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FALCON
CONCENTRATORS
GRAVITY
MINERAL
RECOVERY
SYSTEMS

C O N T E N T S

Version 3.0

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INTRODUCTION

I would sincerely like to thank you for taking the time to contact Falcon Concentrators Inc.

Falcon Concentrators Inc. has been conducting business worldwide for over sixteen years in the field of batch and continuous enhanced gravity concentrators. The company not only sells and markets a metallurgically superior and robust product, but is also involved in the design, manufacture, research and development.

Falcon has a complement of staff that is dedicated to assisting the mineral processing industry to achieve gravity separation results unachievable in the past. To date we have achieved excellent results on our installations, yet, we still continue to develop and improve our products with input from our clients in the field.

Within the attached documents you will find the details and descriptions of our enhanced gravity concentrators. Falcon recognized that each gravity concentration circuit is unique and thus offers a line of products that are unequalled in parametric flexibility.

If you have an existing gravity circuit and would like to upgrade or are thinking about a future gravity installation, please contact using the numbers below.

Yours truly,

Falcon Concentrators Inc.

Mark Van Kleek

President and CEO

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FALCON CONCENTRATORS

Designing Technology to Outlast the Life of Your Mine

FALCON AWARDED BIGGEST LARGEST GRAVITY GOLD CIRCUIT IN AUSTRALIAN HISTORY

Four months after the very successful launch of the 1st Falcon SB5200 SE (392 t/h) batch concentrator in January 2003, which was recently commissioned in the third grinding line expansion at Bajo Alumbrera in Argentina, Falcon with representative Western Process Equipment has been awarded the biggest contract in the company's history to supply six Falcon SB5200 SE units to Newcrest's Telfer Copper Gold Project in Western Australia. There are two grinding lines at Telfer and each will comprise of three Falcon SB5200 SE units.

The mining industry has turned a corner with respect to gravity concentration and what makes this order so significant is the following:

- These are the LARGEST gravity concentrators in the world.
- Telfer will be the LARGEST gold mine in Australia.
- This will be the LARGEST gravity circuit in Australia.
- Telfer will be the LARGEST single gold producer in Australia
- The Telfer Mine will put Newcrest in the #1 spot with respect to annual gold production in Australia.

This is a huge endorsement of Falcon's technology and also of the stream where the units are going to be installed. Falcon has been promoting installation of all their grinding circuit units on cyclone feed and Newcrest adopted this after very successful implementation at other mines around the world like Bajo Alumbrera and their own Cadia Hill Mine in New South Wales.

Newcrest already has extensive experience with Falcon technology at both Ridgeway and Cadia Hill Mines in New South Wales and this will bring their fleet of Falcon units to 14.

We are, to say the least, "over the moon" and very proud to announce the award of this contract and know this kind of endorsement is what we at Falcon have been striving for, and many of our friends in the industry have been waiting for.

Yours truly,

Mark Van Kleek

President and CEO

Bajo Alumbrera

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WHY FALCON SB TECHNOLOGY?

1. Falcon is known as the world leader in the recovery of FINE gold from process streams.
2. Falcon has the highest G-force in the industry maximizing the recovery of FINE valuable particles. G-force can be lowered through the touch of a button to treat coarse streams and recover COARSE valuable particles also. This is unique in industry, allowing Falcon machines to be easily tailored to the size of the valuable particles being TARGETED.
3. The lower section of the bowl is rubber lined and can easily be re-lined on site.
4. Falcon's bowls are deeper allowing particles longer time to stratify up the side before entering the collection zone. This is the exact approach used for cyclones – the longer the cone the more efficient the separation.
5. The top or riffle section of the bowl is made of cast and machined stainless steel that is replaced independently of the bowl. The Falcon bowl itself is warranted for the life of the machine, exclusive of the rubber lining. If the machine is properly installed and maintained, the bowl should never have to be replaced. On the other hand, it has been Falcon's experience that the riffle section experiences much less abrasive conditions than the lower portion of the rotor. This means the riffle section needs to be changed out much less frequently than on competing technology where the whole bowl has to be changed even if the wear is confined to the lower portion bowl (See section on warranties and guarantees).
6. Only fluidizing the top third of the bowl allows Falcon to offer the lowest unit water consumption machines on the market today. Falcon units also produce less concentrate per cycle than competing machines of equivalent size.
7. The variable frequency drive and dynamic brake ensure that the machine is only off-line about 30 seconds during each rinse cycle.
8. All electrical components are from international manufacturers, allowing easy access to spare parts from local suppliers.
9. At the base of the bowl there is a rotor baffle or false bottom and impeller that protect the bowl from wear and also improve the efficiency of separation by accelerating the particles up to speed for effective separation to commence.

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FALCON SB - BATCH CONCENTRATOR

Process Description

The **Falcon SB Concentrator** is specifically designed for recovery of free, metallic gold, platinum or silver from hardrock circuits and is also an ideal technology for alluvial gold including secondary recovery from sand and gravel operations. The **Falcon SB** subjects the material being processed to a centrifugal field of up to 200G's which allows recovery of finer native metals than with conventional gravity concentration equipment. Periodically, the high grade concentrate is automatically removed from the rotor during the rinse cycle. When the **Falcon SB** is equipped with the strongly recommended automation package or **AutoPAC**, the rinse cycle time is typically less than 40 seconds per cycle. Optimum operating cycles will range from <1hr to >4hrs. Process equipment is designed for continuous duty yet is attractively priced when compared to competing equipment.

Process Description

Feed is screened at approximately 2 mm depending on the application, introduced as a slurry through the central vertical feed pipe, and accelerated by the impeller. Rapid stratification according to specific gravity occurs as the material is driven up the sloping rubber lined rotor wall (migration zone) under the influence of an immense gravity field. No water is added in this zone. In the retention zone, which is immediately above the migration zone, fluidization water is injected through the rotor wall to create a dilated or fluidized bed. The high specific gravity gold or other target particles become embedded in this zone and are retained here until the machine is stopped and the concentrate is rinsed down through the concentrate discharge ports. A centrally located rinse manifold directs jets of water to thoroughly rinse concentrate from the retention zone after each operating cycle. The rinsing process can normally be accomplished in less than 40 seconds with the AutoPAC which is more fully described below.

AutoPAC

The Programmable Automation Controller or **AutoPAC** is highly recommended on all production units. The **AutoPAC** includes a Mitsubishi programmable variable frequency drive, PLC and dynamic brake to control various operating parameters including acceleration ramp, centrifugal field, deceleration ramp, and power draw. The dynamic brake allows the rinsing cycle to be reduced to as little as 30 seconds off line. **The AutoPAC** allows operation of the **Falcon SB** in a way which optimizes the grade/recovery function for each individual application while at the same time minimizing operator attention. The highest possible concentrate security can be maintained because nobody needs to approach the concentrator while it is operating. The **AutoPAC** is simple to operate as all controls and programmable features are preset upon commissioning.

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Model SB40

The **SB40** enhanced gravity concentrator is specifically designed for laboratory testwork or very small ore samples. The materials of construction have been carefully selected to minimize the possibility for contamination between samples. The rugged functional design of this unit means that it is perfect for use at home, an exploration site or mineral processing laboratory. The SB40 produces approximately 100 g of concentrate per operating cycle so it is ideal for processing small samples.

Model SB250

The **SB250** enhanced gravity concentrator is ideal for cleaning free native metal (Au, Ag and Pt) concentrates produced by larger Falcon SB's. It can also be used for recovery of free metals from small grinding circuits. The **SB250** can process up to 8 t/h (9 US t/h) of solids per hour yet normally requires 1.8 - 2.7 m^3/h (8 - 12 US gpm) fluidization process water so it can be installed in circuits as small as 50 tons per day without affecting the water balance. Feed should be sized at < 2 mm. A single **SB250** has sufficient capacity to recover the free metals from circuits as large as 200 tons per day. The **SB250** produces less than 6 kg of concentrate per cycle and typical running time is two hours. When controlled by an **AutoPAC**, the **SB250** requires no operator attention and thus it can be installed in a secure environment where access is limited to only authorized personnel.

Model SB750

The **SB750** enhanced gravity concentrator is ideal for recovery of free native metals (Au, Ag and Pt) from grinding circuits. The **SB750** can process up to 47 t/h (52 US t/h) of solids per hour yet normally requires less than 6 - 9 m^3/h (25-40 US gpm) fluidization process water so it can be installed in circuits as small as 200 tons per day without affecting the water balance. Feed is recommended to be finer than 2 mm, although the machine can process particles as course as 6 mm. A single **SB750** has sufficient capacity to recover the free metals from circuits as large as 1600 tons per day. The **SB750** produces less than 18 kg of concentrate per cycle and typical running time is two hours. When controlled by an **AutoPAC**, the **SB750** requires no operator attention and thus it can be installed in a secure environment where access is limited to only authorized personnel.

Model SB1350

The **SB1350** enhanced gravity concentrator is ideal for recovery of free native metals (Au, Ag and Pt) from grinding circuits. The **SB1350** can process up to 114 t/h (126 US t/h) of solids and requires 8 - 15 m^3/h (35 - 65 US gpm) of fluidization process water, so it can be installed in circuits as small as 1000 tons per day without affecting the water balance. Feed is recommended to be finer than 2 mm, although the machine can process particles as course as 6 mm. A single **SB1350** has sufficient capacity to recover the free metals from circuits as large as 3200 tons per day. The **SB1350** produces less than 30 kg of concentrate per cycle and typical running time is two hours. When controlled by an **AutoPAC**, the **SB1350** requires no operator attention and thus it can be installed in a secure environment where access is limited to only authorized personnel.

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Model SB2500

The **SB2500** enhanced gravity concentrator is ideal for recovery of fine free native metals (Au, Ag and Pt) where moderately high production is required. Each **SB2500** can process 206 t/h (226 US t/h) of solids per hour yet requires 15 -24 m^3/h (65 - 105 US gpm) of fluidization water so it can be installed in circuits as small as 1500 tons per day without affecting the water balance. Feed is recommended to be finer than 2 mm, although the machine can process particles as course as 6 mm. A single **SB2500** has sufficient capacity to recover the free metals from circuits as large as 5000 tons per day. **SB2500's** can be simply and inexpensively banked together for applications which require higher throughputs. The **SB2500** produces less than 40 kg of concentrate per cycle and typical running time is two hours. When controlled by an **AutoPAC**, the **SB2500** requires no operator attention and thus it can be installed in a secure environment where access is limited to only authorized personnel.

Model SB5200

The **SB5200** enhanced gravity concentrator is ideal for recovery of fine free native metals (Au, Ag and Pt) where very high production is required. Each **SB5200** can process 392 t/h (433 US t/h) of solids per hour yet requires 30 - 42 m^3/h (150 - 180 US gpm) of fluidization water so it can be installed in circuits as small as 3000 tons per day without affecting the water balance. Feed is recommended to be finer than 2 mm, although the machine can process particles as course as 6 mm. A single **SB5200** has sufficient capacity to recover the free metals from circuits as large as 12500 tons per day. **SB5200's** can be simply and inexpensively banked together for applications which require higher throughput. The **SB5200** produces less than 60 kg of concentrate per cycle and typical running time is two hours. When controlled by an **AutoPAC**, the **SB5200** requires no operator attention and thus it can be installed in a secure environment where access is limited to only authorized personnel.

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ENHANCED GRAVITY CONCENTRATION FOR PRECIOUS METAL RECOVERY

By

Colin Sprake, B. Sc. & Steve McAlister, P. Eng.

Introduction

Enhanced gravity concentration machines have been applied successfully in the following areas of precious metal recovery flowsheets:

1. Primary Grinding Circuits
2. Shaking Table Tailings
3. Pre-Concentration of Leach Feed
4. Flotation Concentrates
    - Flash
    - Conventional

Although great progress has been made, the ability to produce directly smeltable concentrates still remains elusive. Even without this ability, centrifugal concentrators are finding widening applications in precious metal concentration:

1. Primary Grinding Circuits

Enhanced gravity concentration technology has largely replaced jigging as the technology of choice in precious metal grinding circuits worldwide. The benefits of using a centrifugal field to concentrate both coarse and fine gold are well documented but the placement of these machines within grinding circuits is still evolving. Conventional wisdom dictates that the best location for enhanced gravity machines is cyclone underflow on account of the elevated grade found in this stream when compared to cyclone feed or overflow. Plant operating experience at both large and small scale indicates that there are compelling arguments to place ENHANCED GRAVITY MACHINES on cyclone feed instead. At least two new plants, presently in the detailed design stage will incorporate gravity circuits that treat mill discharge or cyclone feed, Teck Cominco's Pogo and Newcrest's Telfer Expansion.

Current Conventional Practice

The current stream of choice for enhanced gravity concentration within grinding circuits is cyclone underflow although recent information indicates a swing toward cyclone feed.

Here are some of the arguments for treating a portion of cyclone underflow:

Elevated Grade

Precious metals become concentrated within grinding circuits. In extreme cases the ratio of grade between cyclone underflow and overflow can be >50. Placing a concentrator on cyclone underflow maximizes the precious metal units that the enhanced gravity concentration equipment sees per unit of feed. For a long time it has been assumed that cyclone underflow will consequently have the highest output of metal.

Slime

Desliming ahead of gravity concentration devices that operate at 1 G or less is a well-proven technique. It has been assumed that providing a deslimed feed to enhanced gravity concentrating machines will also improve stage recovery.

Downstream Processes

In theory, downstream processes such as froth flotation and cyanide leaching will recover all of the free precious metal that escapes from grinding circuits through cyclone overflows. In reality, there are losses from circuit upsets and other causes.

Particle Size Distribution

The thinking is that the size distribution of the target metal will be coarser in cyclone underflow as opposed to cyclone feed and the fine particles in cyclone feed can't be recovered gravimetrically anyway.

In light of development of enhanced gravity concentration devices, the foregoing maxims should be revisited.

Treating Cyclone Feed

There is a trend in plant design toward treating cyclone feed for these reasons:

Lower Capital and Operating Costs

Placing the enhanced gravity concentrators on cyclone feed means that the head against which the cyclone feed pumps must work can be substantially reduced.

For example, the Alumbrera Mine in Argentina lowered their cyclone clusters by 5 meters in 2001 in order to reduce the cyclone feed pump head and associated wear. The original elevation of the cyclones was selected so that a portion of the underflow could flow by gravity to vibrating screens and hence to gravity concentrators. The reduction in cyclone elevation meant that the gravity section could no longer be fed by gravity. The alternatives were to install dedicated pumping capacity or use a spigot from the pressurized cyclone feed distributor to feed a stand alone cyclone mounted over the gravity concentrator feed screens. This system was unreliable and costly to maintain. In mid 2002 a test was conducted by removing the cyclone and feeding cyclone feed onto the screen. This change allowed more material to be fed to the gravity concentrators at a greater size distribution and lower percent solids. The positive effect of this trial was improved gravity gold production and in addition, eliminated costs of maintaining the additional cyclone. The trial has been extended to all four gravity concentrator feed screens.

The down side of the trial is the gravity concentrator tailings are presently introduced to the feed end of the ball mills. At times, Alumbrera's throughput is ball mill limited so putting additional load on this portion of the circuit reduces plant capacity. In order to alleviate this condition, Alumbrera is presently experimenting with 'borrowing' mill discharge by means of a dedicated pump connected to the cyclone feed pump box. The borrowed material is re-introduced to the pump box so there is no effect on mill throughput.

A number of configurations of this concept are presently being evaluated in Alumbrera's recently commissioned third grinding line. If successful, improvements in throughput and grinding efficiency as well as gold recovery will be achieved at Alumbrera.

Stage Metallurgy

Plant experience indicates that higher gold production can be obtained by placing the enhanced gravity concentrators on cyclone feed. Speculation on the reason for the improvement includes:

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Treating the lower pulp density found in cyclone feed streams results in a stage recovery improvement sufficient to overcome the slight reduction in feed grade. The following table illustrates that efficiency improvements do not need to be large to improve overall production from a given circuit. The table indicates that cyclone feed grade is at least 80% of cyclone underflow grade for most grinding situations and can often be over 90%. Even if the CUF/COF ratio is 10 or higher before a gravity circuit is applied to a given circuit, this ratio should be significantly lower when the gravity circuit operates. For example, with a CUF/COF of 4 and circulating load 300%, cyclone feed grade is 81% of the cyclone underflow grade.

Treating cyclone feed with its higher slime content improves the efficiency of enhanced gravity concentration devices. The slime may act as a quasi-heavy medium allowing the high-density precious metal particles to become better separated from the lower density gangue particles. Dr. André Laplante of McGill University has reported that the performance of enhanced gravity concentration machines can be improved by adding silica flour to the incoming pulp. Efficiency improvements have also been noted in the few plants that have switched the source of feed for their gravity circuit from underflow to feed:

Mine Name	Daily Tonnage	Metallurgical Performance		Concentrator Supplier
		Cyclone Underflow	Cyclone Feed	
1. Elvington Gold	~500	38%	74%	Falcon
2. Alumbrera	~100,000	1-2%	4-6%	Concentrator X
3. Orcopampa	~2000	10%	15 – 18%	Concentrator X

These data suggest that cyclone feed-based circuits produce superior results when compared to cyclone underflow.

Here are some operations that have successfully incorporated cyclone feed from the start:

Mine Name	Daily Tonnage	Metallurgical Performance		Concentrator Supplier
		Cyclone Underflow	Cyclone Feed	
1. Antapite	~350	Not tried	85%*	Falcon
2. Akka	Unknown	Not tried	78%	Falcon
3. Lepanto	~2000	Not tried	40%	Falcon

*Before Table losses-ILR being installed.

Fine Particles

With concentrating fields up to 300 G's now available, particles that were previously thought to be unrecoverable gravimetrically are being recovered at more and more plants. Treating cyclone underflow means that many fine particles do not ever go through the gravity concentration circuit. With cyclone feed, there is at least a possibility that some of these fines will be recovered. Where gravity recovery is deemed to be very important, the entire mill discharge can be treated to maximize metal production by gravity.

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2. Shaking Table Tailings

Enhanced gravity concentration machines recover gold that is easily lost on shaking tables. For this reason, batch-type centrifugal concentrators are seeing growing use as a scavenger for tables. Cadia reported a 20% increase in gravity gold production after installing a Falcon on table tailings. The scavenger concentrate must be re-tabled.

3. Pre-Concentrating Leach Feed

Where a cyclone overflow or leach feed stream contains a slow-leaching dense mineral such as electrum or even free gold, it is possible to concentrate it using enhanced gravity concentration technology. The Falcon Concentrators Inc. Model "C" concentrator, for example, consumes little or no process water and can be set to produce virtually any desired mass pull to a concentrate or dense fraction. In addition, this fraction is highly dewatered as well as deslimed.

The concentrate is put into the first tank of the leach train where all of the cyanide is added. Residence time and cyanide concentration are increased for this material without requiring more cyanide or tanks. The tailings are introduced further down the train, as they require less cyanide concentration and less residence time. The sketch below shows the concept:

This technique was used successfully at Echo Bay's Kettle River Mine. The operators reported an increase in production of approximately 3,000 ounces per year while maintaining cyanide consumption at pre-preconcentration levels. Daily throughput was approximately 2,000 Tons.

4. Flotation Concentrates

Flash Flotation

Newcrest Mining of Australia first introduced the use of enhanced gravity concentration to treat flash flotation concentrate at the 50,000 tpd Cadia Mine in Australia in 1997. Flash flotation concentrate is treated with a Falcon Concentrator and the resulting gravity concentrate is upgraded for smelting on a shaking table. Table tailings are scavenged with a second smaller Falcon. The performance of this circuit was the subject of a Paper by Robert Dunne of Newcrest and André Laplante at the 2002 CMP meeting. The circuit produces upwards of 40,000 ounces per annum.

Conventional Flotation

Flotation concentrates of copper are being successfully treated with Falcon Concentrators for removal of fine, free gold. The benefits to operators that have installed Falcon's for this duty enjoy these benefits:

Faster Payment

If the gold recovered from the copper concentrate is smelted into doré at site and then shipped to a refinery, for example, payment can be almost immediate.

Higher Payment

Gold shipped as doré will attract almost 100% of the current spot price for the contained gold whereas gold contained in concentrate attracts less, typically by 3-5%. Depending on the character of the ore, payback may be very rapid.

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Better Measurability

Operations that ship gold in base metal concentrate usually face an ongoing dispute with the receiving smelter over gold content, with the smelter usually coming out on top. Removing the Falcon-recoverable free gold before shipment makes it much more homogeneous and thus easier to sample accurately for payment purposes. In one case that came to Falcon's attention, the size of the discrepancy between what the Mine thought it was sending and what the smelter was willing to pay for amounted to more than 1,000,000 USD.

Better Global Gold Recovery

If the Falcon Concentrator is installed to treat the rougher copper concentrate or within the regrind circuit as opposed to the final product, there is a possibility that overall recovery can be increased by reducing losses to cleaner tailings. This can only be assessed with a plant-scale installation.

Here are some operations that are either using or considering enhanced gravity concentration of gold from copper concentrates:

Mine Name	Location	Approximate Daily Throughput (000's of tonnes)
Lepanto	Philippines	2
Troilus	Canada	15
Philex	Philippines	18
Cadia	Australia	50
Alumbrera	Argentina	100
Freeport	Indonesia	250

Conclusions & The Future

Even though gravity concentration is man's oldest and possibly simplest mineral dressing technique (other than hand picking), experience has shown there is a lot to be learned about enhanced gravity concentration.

For more than a hundred years, enhanced gravity concentration of precious metals has been the goal of many an equipment developer, but most successful commercial applications have appeared only recently, say within the last 15 years or so. Enhanced gravity concentration is here to stay and will see expanded use as the equipment gets better, and more importantly, better understood. As is the trend in other aspects of mineral processing, unit capacity will increase as well as the degree of automation and process control.

As environmental regulations and permitting requirements become more stringent, enhanced gravity concentration may become the only economically viable technology for some ore deposits.

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FALCON CONCENTRATORS

Designing Technology to Outlast the Life of Your Mine

5 MAJOR ITEMS TO CONSIDER BEFORE YOU PURCHASE A CENTRIFUGAL GRAVITY CONCENTRATOR

1. There are many reasons why the Falcon you purchase will outlast the life of your mine.

Falcon's equipment is fabricated from plate steel of various thicknesses to yield a **product life of 20 years** e.g. on the SB5200 steel plate of 13mm is used for the launders. Falcon has also ensured that all wetted parts are manufactured from long life plastics, stainless steel or steel that is rubber lined.

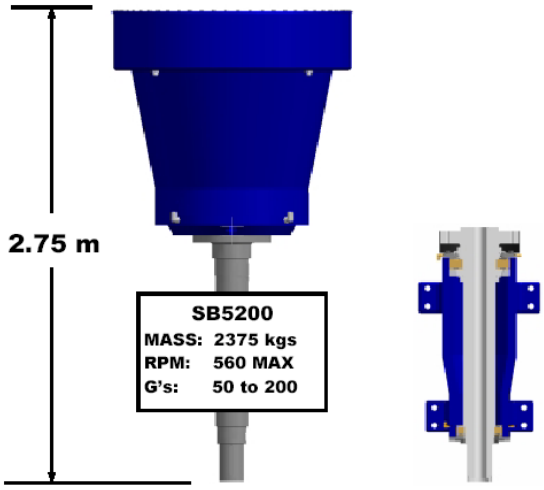
Falcon has worked closely with a few local industrial painters to find the best processes available to produce a painted product that is **capable of handling marine conditions**, which are considered to be more severe that what is expected on many metallurgical plants.

Falcon's units are therefore not the lightest units available in the marketplace today, and with all our other unparalleled guarantees that we have to offer, I am sure you agree that this is most certainly a strong reason why incorporating Falcon into your plant makes a lot of economic sense.

2. Unparalleled 20,000 hour bearing guarantee at 200 times the force of gravity.

Falcon, with specific engineering consultation involving **FAG** and **SKF**, developed a new **cartridge bearing design**, which was introduced in 1997. This design uses high quality 4-point spherical bearings to support the load of the rotor bowl and cylindrical roller bearing for alignment. Some of the advantages of this new feature for both the 'SB' and the 'C' lines of machines are:

- Bearing life **guaranteed for 20,000 hours** at 200G's
- Bearings are completely **protected against slurry ingress** and/or other contamination
- High guiding precision for **top speed suitability**
- **Quick change-out** of complete bearing cartridge assembly (if one in spares)
- **Centralized lubrication system**



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3. With the use of variable G-force you can adjust settings to maximize recovery of coarse and fine gold at the touch of a button.

Falcon Concentrators Inc. first began using **variable frequency drives** (VFD's) in both batch and continuous type machines in 1989. Now, all credible researchers in the field acknowledge that centrifugal field is an important parameter to **optimize metallurgical performance**, particularly as the target mineral becomes finer.

Mineral Processors now routinely use VFD's because of their obvious benefit in the area of process control. What is less well known is that there are other important benefits of VFD's that make them an essential component of every enhanced gravity concentration installation:

Rapid Cycling

VFD/Dynamic Brakes allow the concentrators to spend more time on line concentrating and less time performing non-productive rinsing. If we compare two concentrators cycling every 30 minutes:

	CONCENTRATOR	
	FALCON	**X**
CONCENTRATING CYCLES PER HOUR	2	2
RINSING TIME PER CONCENTRATING CYCLE	1.5 Minutes	4.5 Minutes
OFF LINE TIME PER HOUR	3.0 Minutes	9.0 Minutes
OFF LINE TIME PER YEAR (BASED ON 8000 HOURS)	400 HOURS	1200 HOURS

This *seemingly* small difference in rinsing time means that the Falcon Concentrator will be **on line for almost 2 months more** than Concentrator X after only a year of operation. This fact alone justifies the small premium for VFD's.

Longer Drive Component Life

Starting across-the-line reduces the life of electric motors, sheaves, belts and bearings. In addition, working on the drive train of gravity concentrators is extremely difficult under the best of circumstances. This fact alone means that speed changes are very unlikely to occur in most plants. In keeping with Falcon's policy of 'bulletproofing' all components including cartridges for bearings and **bowls guaranteed for the life of the machine**, Falcon strongly recommends the use of VFD's to increase the life of third party drive train components. This makes for extremely long service intervals on the drive trains of Falcon Concentrators.

Economically Optimum Centrifugal Field

The economic optimum speed for the Falcon Concentrators may not be the metallurgical optimum when all costs are considered. For example, it may be determined that the metallurgical optimum consumes too much electricity or wear parts. VFD's mean **easy speed adjustments** to the **economic optimum**.

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4. Never buy another concentrator bowl from Falcon.

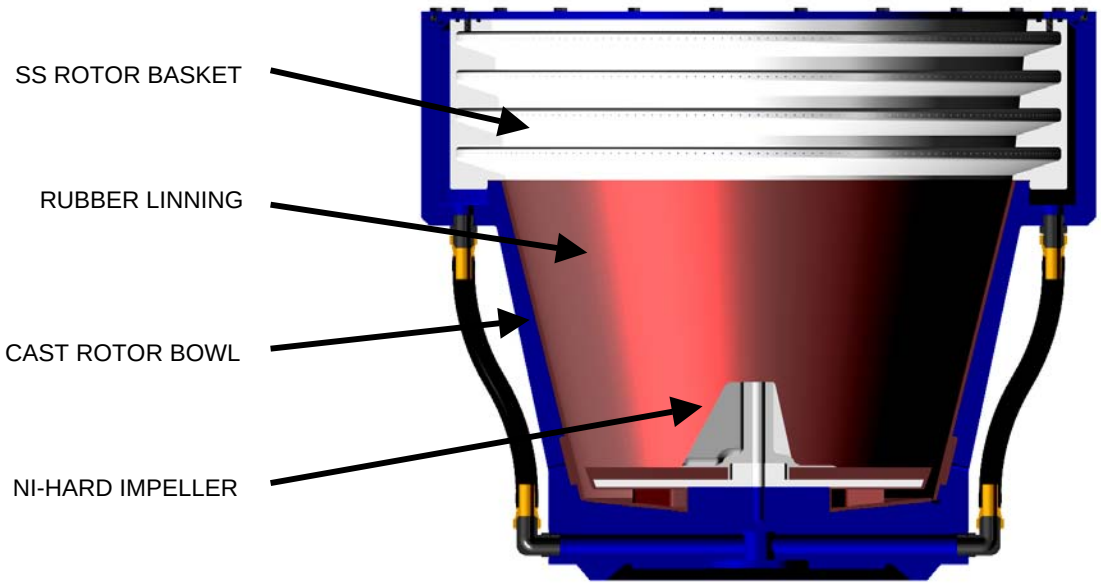
Falcon Concentrator Rotor Bowls are specifically designed to be user maintained and are **Guaranteed For The Life Of The Machine.**

For example, the lower section of a production Model SB Rotor Bowl is a heavy ductile iron casting which is rubber lined like a quality slurry pump. The rubber lining can easily be repaired or replaced on site by the customer or nominated contractor with minimal down time. There is **no need to purchase or stock expensive replacement bowls** from Falcon and with proper rubber maintenance the bowl will never wear out.

The heavy Rotor Bowl casting also serves as a dampening flywheel to minimize inherent vibrations caused by feed slurry unbalance, as the feed material is a small fraction of the rotation mass. Bearings and machine life are extended.

The SB Rotor also incorporates a stainless steel Rotor Basket as well as an inexpensive sacrificial Ni-Hard Impeller that is **easily replaced with one bolt**.

The **Impeller extends the life of the rubber lining and Basket** by bringing the feed slurry up to rotational speed instead of relying on friction and wear between the Bowl or Basket.



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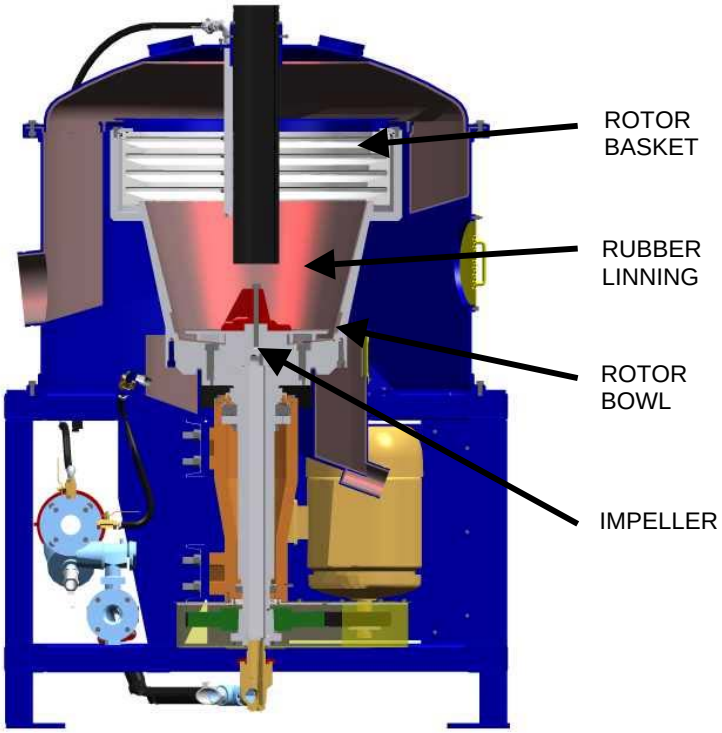

5. Do you have the time and money to spend drilling out hundreds or thousands of small elutriation holes every month?

Falcon units have been designed to have **elutriation holes that are very short in length, bevelled and radial** to minimize the chances of plugging by coarse material, ground mill steel or scale.

Falcon prides itself in this design feature and to give you an example of a site that operates both Falcon and our competitor's machines. The Falcon elutriation apertures are cleaned out every 3,500 hours compared to 500 hours on competing equipment. When you work out the time and money spent there is a **substantial saving in installing Falcon on your plant.**

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FALCON C - CONTINUOUS CONCENTRATORS

Process Overview

The **Falcon Concentrator** is specifically designed for concentration of fine heavy particles. The material being processed is subjected to a centrifugal field of up to 300G's. Efficient concentration of particles finer than 20 microns has been achieved even on low specific gravity ash particles in the coal industry. An additional benefit of the process is that the heavy fraction or underflow is partially dewatered and effectively deslimed. Ultra-fine particles contained in the feed report more or less in proportion to the water and since the underflow has very high pulp density, only a small fraction of the slimes report to this stream. The process is fully continuous and thus appropriate for applications where it is necessary to recover more than a fraction of a percentage of the feed weight as concentrate.

Typical installation sites include:

- Scavenging FINE gold and sulphides from leach of flotation tailing
- Pre-concentrating before the leach to maximize leach performance
- Scavenging FINE tantalum and tin from plant tailing
- Removing ash and sulphides from coal
- Scavenging FINE iron ore from LIMS tailings
- Pre-concentrating of old tailing dumps
- Pre-concentrating and desliming heavy mineral deposits
- Pre-concentrating before flotation or leach removing light undesirables

If you have a stream with minerals and metals that have a higher density than the host rock, you should have a test done to see if it can be pre-concentrated or scavenged. Reducing the size of the required down stream equipment or increasing plant recovery from final tailings, adds to the bottom line. **Falcon Concentrators** are best suited to applications which require separation of a relatively small amount of fine heavy material from a relatively large amount of lighter gangue. Weight recovery to concentrate can be as high as 40% at full feed rate and even higher with lower feed rates.

The proportion of the feed which reports to the underflow or heavy fraction is controlled by **Falcon**'s patented metering system. By integrating on stream analysis with the underflow metering system, **Falcon Concentrators** can react to changing plant conditions in real time. Optimum metallurgical performance can be maintained with little or no operator input.

The **Falcon Concentrator** consumes no water during processing and consists of a single moving part.

Process Description

Feed is screened at approximately 1mm depending on the application and is introduced as a slurry through a central vertical feed pipe and is accelerated by an impeller. Rapid stratification according to specific gravity occurs as the material is driven up the sloping rubber lined rotor wall (migration zone) under the influence of an immense gravity field. The size of the field is varied by changing the rate of revolution of the rotor with a variable frequency drive.

The concentrated heavy fraction is withdrawn continuously through a series of ports distributed evenly around the circumference of the rotor. Coarse adjustments to the rate of concentrate production are made by changing the orifices in the ports. Once the appropriate orifice size is determined for the range of concentrate productions required by the application, fine adjustments are achieved by changing the rotor speed. Concentrate production is proportional to the centrifugal field applied. The pulp density of the heavy fraction is very high, often in excess of 80% solids, depending on the characteristics of the material being processed.

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Concentrate is extruded through tungsten carbide orifices and deposited in an annular launder which is provided with two opposing discharge points. Two points are required to provide sufficient slope to allow the high pulp density underflow to flow by gravity away from the machine. The lighter solid fraction and most of the associated process water flow upward and are discharged into a circular launder and ultimately conducted away from the machine. Process equipment is designed for continuous duty and easy servicing and maintenance.

AutoPAC

The Programmable Automation Controller or **AutoPAC** is strongly recommended for all production units. The **AutoPAC** includes a Mitsubishi programmable variable frequency drive and dynamic brake to control various operating parameters including acceleration ramp, centrifugal field, deceleration ramp, and power draw. The splash proof VFD cabinet also houses a keypad and screen, which are used to control the operation of the underflow metering system. The dynamic brake allows the rotor to come to a stop rapidly in the event of a malfunction. **The AutoPAC** can also be connected to an on stream analysis system which allows the **Falcon Concentrator** to maintain optimum metallurgical performance while operating conditions change. The **AutoPAC** is simple to operate as all controls and programmable features are preset upon commissioning.

Model C400

The **C400** enhanced gravity concentrator is designed for pilot plant work and production applications in the 1–4.5 t/h (1-5 US t/h) range. The **C400** is small enough to be used in a laboratory yet large enough to accurately predict the performance of larger machines. Since no process water is required, closed circuit testing can be performed in which the tailings and concentrates are re-combined in an agitated tank and re-introduced as fresh feed. Parameters such as feed rate, pulp density, centrifugal field, and weight recovery to concentrate can all be adjusted while the unit is running, making process optimization rapid and inexpensive. Feed to the unit must be screened at 1.0 mm (16 mesh).

Model C1000

The **C1000** enhanced gravity concentrator is designed for large scale pilot plant work, primary recovery, and as a cleaner for larger units. Treating 5 - 27 t/h (5.5-30 US t/h) the **C1000** requires no process water and little operator attention. Feed to the unit must be screened at 1.0 mm (16 mesh).

Model C2000

The **C2000** enhanced gravity concentrator is designed for moderate tonnage. Each **C2000** can process up to 60 t/h (66 US t/h) of solids per hour. These machines make ideal cleaners for the larger Model C4000's or as roughers in smaller applications. Feed to the unit must be screened at 1.4 mm (14 mesh).

Model C4000

The **C4000** enhanced gravity concentrator is designed for large tonnage. Each **C4000** can process up to 100 t/h (110 US t/h) of solids per hour but can be simply and inexpensively banked with other **C4000**'s for applications which require higher throughputs. Feed to the unit must be screened at 1.4 mm (14 mesh).

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RECENT TEST WORK AT FALCON

Falcon has recently completed detailed test work campaigns for the following international clients:

- Newcrest Mining – Copper/Gold
- C.V.R.D. – Copper/Gold
- P.T. Freeport – Copper/gold
- Inmet Mining – Copper/Gold
- MIM, BHP and RTZ – Copper/Gold
- Newmont Mining - Gold
- Barrick Corporation – Gold
- Kinross Corporation – Gold
- AngloGold Company – Gold
- Buenaventura – Gold
- Kemira – Gypsum
- Minsur Tin
- Comsur Tin
- Collingwood Tin
- Sons of Gwalia - Tantalum
- Tantalum Corporation of Canada

On the next few pages are test results from various parts of gold and copper gold circuits to demonstrate what can be achieved using Falcon's technology. Names of clients have been removed from the data for appropriate reasons.

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GRAVITY CONCENTRATION TEST REPORT

Client: xxx
Test: GSB1
Sample: Leach Feed

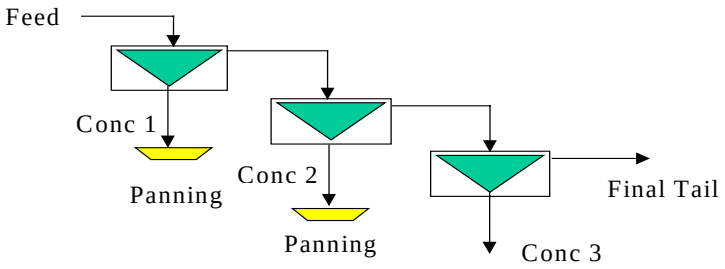
Date: 13-Jan-03
Project: 0200301
02-057

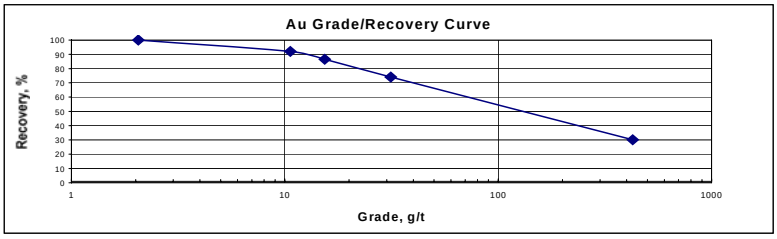
Objective: Attempt to pre-concentrate leach feed with Falcon SB40

Products	Weight (g)	(%)	Assay Au, g/t	Distribution (%) Au
Pan Concentrate 1	2.89	0.1	427	30.1
Pan Tail 1	94	4.7	19.2	43.9
SB40 Concentrate 1	**97**	**4.8**	**31.4**	**74.1**
Pan Concentrate 2	2.03	0.1	129	6.38
Pan Tail 2	132	6.6	1.90	6.12
SB40 Concentrate 2	**134**	**6.7**	**3.82**	**12.5**
SB40 Concentrate 1 + 2	**230**	**11.6**	**15.4**	**86.5**
SB40 Concentrate 3	124	6.2	1.80	5.46
Total SB40 Concentrate	**355**	**17.8**	**10.6**	**92.0**
SB40 Tails	1,638	82.2	0.20	8.00
Calculated Head	**1,992**	**100.0**	**2.06**	**100.0**

Three-pass Falcon SB40 Test Flowchart

Test Conditions					
Pulp density	Bowl	ck water pressure		Speed	
20%	28°	0.5 psi		80 Hz	300 G





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GRAVITY CONCENTRATION TEST REPORT

Client:	XXX	**Date:**	11-Dec-02
Test No:	SB40C1- 200301	**PRA Project No:**	200301
Sample:	Leach Feed	**Falcon Reference:**	02-054

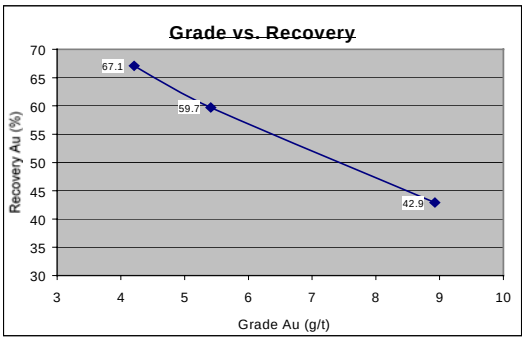
Objective: To simulate a Falcon C Concentrator to recover Au, producing a mass yield vs. recovery curve that will indicate a range where metallurgical recovery vs. this mass yield is optimum. This can be reliably scaled up in the production circuit using larger production machines.

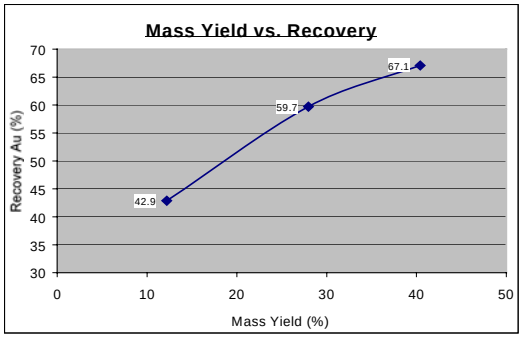
Process: Using a laboratory scale SB40 the feed sample is run through collecting mass yield 1. The remainder of the sample (lights) is run through again collecting mass yield 2. This is repeated as many times as necessary to achieve the desired mass yield. The Grade vs. Recovery and Mass Yield vs. Recovery will help determine whether a Falcon SB or a Falcon C machine is required. See last sheet in workbook for more detail.

Conditions:

Sample Feed Mass	+/-	1000	grams
Individual Concentrate Mass Yield	+/-	100	grams
Mass Yield / Sample Feed Mass	+/-	10	%
Desired Combined Total Mass Yield		30	%
Number of Mass Yields Required to Achieve Combined Total		3	
Feed Pulp Density		20	% solids
Fluidization Water Pressure		0.5	psi
Fluidization Water Flow		n/a	l/m
Centrifugal Force		300	G's

Summary:





Feed Grade	2.53

Application (type of machine)	Mass Yield	Recovery % Au	Conc. Grade (g/t)	Tailings Grade (g/t)
Falcon SB	0.2	12.1	189.00	6.50
Falcon Continuous	12.2	42.9	8.92	1.65
Falcon Continuous	28.0	59.7	5.41	1.42
Falcon Continuous	40.4	67.1	4.21	1.40

Recommendations:

A 'C' machine pulling a +/- 20% mass yield will achieve >50% Au recovery.
An 'SB' machine will achieve >12% Au recovery in a very low mass yield.

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GRAVITY CONCENTRATION TEST REPORT

Client: XXX
Test: GSB3
Sample: Circulating Load

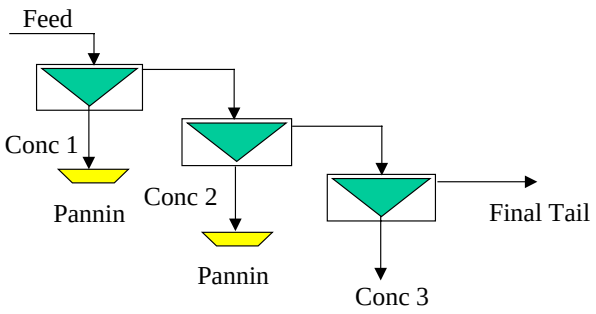
Date: 21-Feb-02
Project: 0200301
Falcon no: 02-008

Objective: To simulate Falcon continuous concentrator to recover gold on the -0.5mm material

Products	Weight (g)	Weight (%)	Assay Au, g/t	Distribution (%) Au
Pan Concentrate 1	3.71	0.4	340	31.3
Pan Tail 1	110	11.0	4.43	12.1
SB40 Concentrate 1	**113**	**11.4**	**15.4**	**43.4**
Pan Concentrate 2	2.78	0.3	109	7.5
Pan Tail 2	104	10.4	13.6	35.1
SB40 Concentrate 2	**106**	**10.7**	**16.1**	**42.6**
SB40 Concentrate 1 + 2	**220**	**22.1**	**15.7**	**86.0**
SB40 Concentrate 3	102	10.3	1.47	3.7
Total SB40 Concentrate	**322**	**32.3**	**11.2**	**89.8**
SB40 Tails	674	67.7	0.61	10.2
Calculated Head	**997**	**100.0**	**4.04**	**100.0**

Three-pass Falcon SB40 Test Flowchart

Test Conditions				
Pulp density	Bowl	Back water pressure	Speed	
20%	14°	1.0 psi	80 Hz	300 G



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GRAVITY CONCENTRATION TEST REPORT

Client: XXX
Test: GSB1
Sample: Final Copper Concentrate

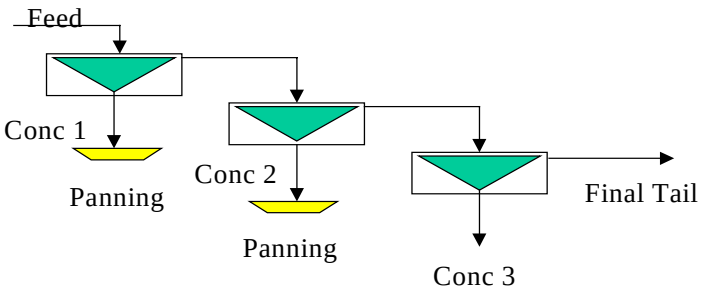
Date: 15-May-01
Project: 0100301
Falcon: 01-061

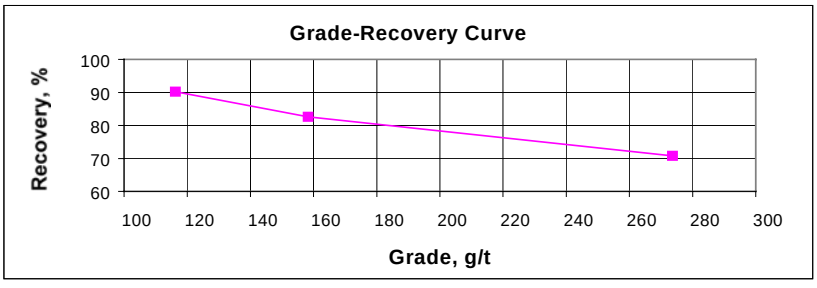
Objective: To similate a continuous Falcon Concentrator to recover Au by gravity using Falcon SB40 concentrator.

Products	Weight (g)	Weight (%)	Assay (g/t) Au	Distribution (%) Au
Pan Concentrate 1	7.06	0.7	2,455	19.5
Pan Tail 1	222	22.2	204	51.2
SB40 Concentrate 1	**229**	**23.0**	**274**	**70.8**
Pan Concentrate 2	4.90	0.5	188	1.0
Pan Tail 2	229	22.9	41.8	10.8
SB40 Concentrate 2	**234**	**23.4**	**44.9**	**11.8**
SB40 Concentrate 1 + 2	**463**	**46.3**	**158**	**82.6**
SB40 Concentrate 3	226	22.6	30.0	7.6
Total SB40 Concentrate	**688**	**68.9**	**116**	**90.2**
SB40 Tails	311	31.1	27.9	9.8
Calculated Head	**999**	**100.0**	**88.7**	**100.0**

Three-pass Falcon SB-4 Test Flowchart

Test Conditions				
Pulp density	Bowl	Back water pressure	Speed	
20%	14°	0.5 psi	80 Hz	300 G





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FALCON'S ENVIRONMENTALLY FRIENDLY PROCESSES

The option of Gravity-only circuits should be considered for Greenfield projects before leaching or flotation is added. Falcon has now commissioned three of these circuits in Russia, the CIS and Mongolia with Metso Minerals. The information concerning two of the circuits is as follows:

Susuman – Vetrenskoe Gold Plant

This plant is located in Magadan Russia and was commissioned in May 2002. The majority of the gold is less than 45 microns. The circuit comprises of a Falcon SB750 treating the entire mill discharge and two Falcon continuous units in series on cyclone overflow. The concentrates produced by the batch and continuous concentrators are tabled on separate tables because of the difference in size distribution.

Laboratory results indicated that a recovery of around 80% could be achieved from the circuit. Today, the recovery is over 80% and improving as the circuit is optimized.

Mongol Gazar Gold Plant

This plant is located in the Gobi desert in Mongolia, close to the border with China. There is very little coarse gold in the ore with the majority being below 75 microns. This plant has a Falcon SB750 treating the entire ball mill discharge and another two SB750's in series on cyclone overflow. As with the Susuman circuit there will be two tables installed to treat concentrate produced from the grinding circuit and cyclone overflow.

Falcon designed the above plant flowsheets after extensive testwork campaigns using a Falcon SB40 laboratory machine. Metso Minerals out of Sweden completed the engineering.

SCALE-UP FROM LABORATORY FALCON SB40 TO PLANT OPERATIONS

Client or Site	Falcon SB40 Recovery	Achieved Plant Recovery
1. Cadia Hill – SB	18%	15 – 19%
2. Troilus – SB	15%	13 – 15%
3. Gold Corp. – SB	13%	13%
4. Akka Gold – SB	80%	78 – 83%
5. Antapite – SB	25%	30 – 40%
6. Minsur – SB	Strong correlation through many tests	
7. Echo Bay - C	14%	12 – 15%
8. Susuman – SB and C	80%	83%
9. Elvington	69 – 76%	74%

The above samples of results all indicate very consistent scale-up for both Falcon product lines. The Cadia Hill example is documented in a paper co-authored by Mr. R. Dunne and Dr. A. Leplante that was presented at the Canadian Mineral Processors Conference in Ottawa in 2002.

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ARGENTINA	Mill Ore	Gold	SB
AUSTRALIA	Newcrest Mining	Gold	SB
	Sons of Gwalia	Tantalum	C
	Diametric Resources Ltd.	Gold	SB
	Legend Mining Ltd.	Gold / Silver	SB
	AMMTEC	Lab	SB, C
	University of Queensland (J.K. Center)	Lab	SB
	Lakefield OreTest	Lab	SB
BELGIUM	University De Liege	Lab	SB
BRAZIL	CVRD	Gold	SB
	Equiprom Metallurgical Engineering Corp.	Lab	SB, C
CANADA	Tantalum Mining Corp.	Tantalum	C
	Inmet Mining Corporation	Gold	SB
	TVX Gold Inc.	Gold	SB
	Claude Resources	Gold	SB
	Centre de Recherches Minerales	Lab	SB, C
	Evis House Inc.	Lab	SB, C
	Lakefield Research Limited	Lab	SB
	Process Research Associates	Lab	SB
CHILE	Silver Eagle Mining	Gold / Silver	C
CHINA	Wadam Industries	Lab	SB
COSTA RICA	Arvada Tres Amigos	Gold	SB, C
ECUADOR	Eminza	Gold	C
GHANA	Abosso Goldfields Ltd.	Gold	SB
	H. S. Resources	Gold	SB
GUYANA	Garraway Resources Ltd.	Gold	SB
	Crescent Mining	Gold	SB
INDONESIA	Consolidated Silver Tusk	Gold	SB
KAZAKHSTAN	Kazzinc	Gold / Zinc	SB
KOREA	Bu Yeo Material	Gold	SB
KYRGYZSTAN	Dzamgyr	Gold	SB, C
MALAYSIA	Specific Resources	Gold	SB

	MALI	S.T.O.M.	Gold	SB
	MONGOLIA	Mongolia Gold Resources Ltd.	Gold	SB, C
	MOROCCO	ONA Corporation	Gold	SB
	PERU	Minsur	Tin	C
		Buena Ventura	Gold	SB
		Marsa Mining Corporation	Gold	SB
	PHILLIPINES	Lepanto Consolidated Mining	Gold	SB
		Philex Mining Corp.	Gold	SB
		Sunshine Fields Corp.	Gold	SB
		Hexat Mining	Gold	SB
		JB Management	Gold	SB
	ROMANIA	Agrom International	Lab	SB
	RUSSIA	Norilsk Nickel	PGM's	SB, C
		Svedala Systems A.B.	Gold	SB, C
		Mikhailovsky GOK	Iron	C
		Polimetal	Gold,	SB, C
		CETCO Metallurgical Laboratory	Chromite	SB
		Central Core Exporting	Lab	SB
		TzNigri	Lab	SB
	SIERRA LEONE	Branch Energy	Gold	SB
	SOUTH AFRICA	Anglo American Corp.	Gold	SB
		Harmony Gold Company	Gold	SB
		Mintek	Lab	SB, C
		Lakefield	Lab	SB
		Manhattan	Lab	SB
		Multotec Process equipment	Lab	SB
	SPAIN	Rio Narcea	Lab	SB
	TANZANIA	Umico Limited	Gold	SB
	USA	Echo Bay Minerals	Gold	C
		Rio Tinto (R.T.Z.) Corp.	Gold	SB
		Teichert Aggregates	Gold	SB
		Montezuma Aggregates	Gold	SB
		Southern Illinois University	Lab	SB, C
		University of Minnesota	Lab	C
		Hazen Research	Lab	SB
		University of Kentucky	Lab	SB
	ZIMBABWE	Lonrho Zimbabwe Limited (several mines)	Gold	SB
		Zimbabwe Government (Elvington)	Gold	SB
		Indarama Mines Ltd.	Gold	SB
		Delta Gold Company	Gold	SB
		Casmyn Mining Zimbabwe Ltd.	Gold	SB
		Antech Laboratories	Lab	SB

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