

IN LINE PRESSURE JIG (GEKKOS) STARTS THE MODERNISATION PLAN AT THE SAN RAFAEL PLANT.

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ABSTRACT:

The San Rafael tin mine of MINSUR SA situated high in the Peruvian Andes at 4,500m has been in operation for over 30 years in various levels of production and is treating 75,000T/month of ore at 5%Sn and today its production represents 14% of world's tin production. Mine reserves are extensive at present production levels.

During 2002 a Pilot IPJ2400 was installed at the plant to investigate the metallurgical performance of the IPJ jig on several streams within the plant.

In late 2002 based on the results of the pilot plant, a decision was taken to install two IPJ2400 units on the feed to the plant with the aim to eliminate the liberated cassiterite from reporting to primary grinding and thus reduce the generation of fines which are difficult to recover in latter stages of the process. The operation of the jig is simple and has a reduced water consumption and permits the first steps in the modernisation of the existing plant. The new GEKKOS circuit will be controlled through a PLC.

The new circuit was commissioned in October 2003.

Other streams are still under investigation and GEKKO IPJ technology promises to radically change the plant of San Rafael in its metallurgical performance.

KEYWORDS:

Gravity concentration, Cassiterite, InLine Pressure Jig, tin, ragging.

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Introduction :

The San Rafael tin mine of MINSUR SA is situated high in the Peruvian Andes at 4,500m and has been in operation for the last 30 years in various levels of production and is currently treating 75,000T/month of ore at around 5%Sn and today its production represents 14% of world's tin production. The company has its own smelter with AUSMELT technology situated strategically on the Pacific Ocean .

Background :

The concentrator is undergoing a modernisation program with a view to improvements in concentrate quality, increased recoveries and lower operating costs and in 2002 a pilot GEKKOS IPJ2400 was acquired to test this Australian technology on various streams within the plant .

Based on the promising results on the crushed feed of 100% passing 14mm to the plant a decision was reached to install two IPJ 2400's (In Line Pressure Jig's) with an aim to reduce the liberated or nearly liberated cassiterite from reporting to primary grinding and thus reduce the generation of fines which are difficult to recover in latter stages of the process and are in fact eliminated prior to the tin flotation circuit in the form of slimes in the desliming step.

The new circuit was commissioned in October 2003.

The Circuit:

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Crushed ore at 100% passing 14mm is fed from the Fine ore bin at 109.5 T/hour and a loop through the PLC additions water to make up a 50% pulp. This pulp is then fed by gravity to a rotating distributor which has four exits of which two feed the two installed GEKKOS IPJ2400's and the other two feed two horizontal vibrating screens on the GEKKOS tails. The feed of either one of the GEKKOS can be bypassed to its corresponding screen if the GEKKOS is under maintenance or whatever circuit failure (shown in Figure 4). The tails from the GEKKOS normally report to the screen where the coarse fraction at >4mm reports to a Rod Mill for size reduction and liberation and the <4mm fraction goes to a conventional jigging circuit .

The concentrate from each GEKKO is then treated in a small vibrating screen with an opening of 2mm where two concentrates are produced (as shown in figure 5). The coarse fraction , >2mm, about 2T/hour with a grade of 45-50%Sn and the fine fraction with a flow of about 5T/hour with a grade of 12-15%Sn . The higher grade concentrate reports to a upgrade circuit consisting of grinding of this coarse concentrate, spirals and a regrind of unliberated tails followed by a sulphide flotation to reduce the impurities according to smelter specifications. The lower grade concentrate reports to a secondary jigging circuit. Final shipping grade from the gravity circuit is 63%Sn. Figure 3 shows the Gekkos IPJ circuit.

Control & Automation:

The circuit consists of four loops of control through a ControlLogixPLC from ALLEN BRADLEY which communicates with a PC in the engineering station and a Panel View (Allen Bradley 600) for operator access . The communication is through ControlNet.

The first loop controls the water addition to the GEKKO feed in function of the belt balance on the main feed plant of the <14mm crushed feed.

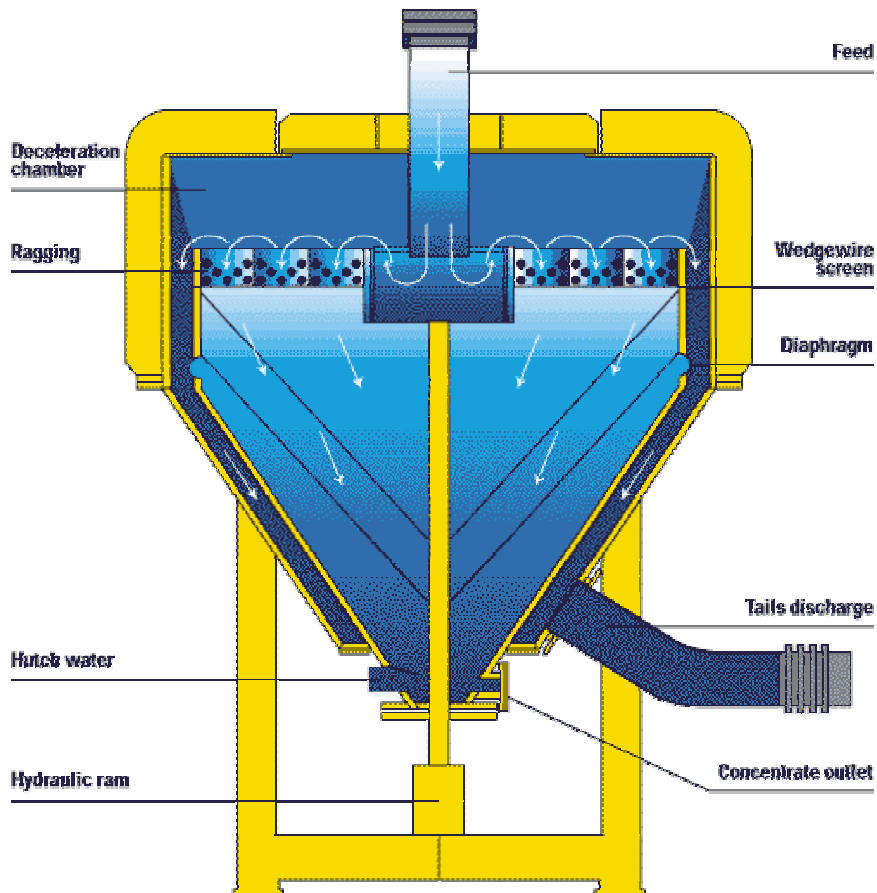
The second loop consists of an ultrasonic sensor measuring the pulp level within the GEKKOS and controlling the Muscle Valve on the tailings product to adjust the pulp level within the IPJ2400.

The third loop controls the density to the Rod Mill which is treating the >4mm fraction from the GEKKO tails.

All process variables and IPJ2400 operating parameters can be adjusted from the Operators panel view. Figure 6 shows one of the views available from the operators station.

InLine Pressure Jig (IPJ) Theory of Operation:

The IPJ is unique in its design and use of jigging concepts. The unit combines a circular bed with a moveable sieve action. The screen is pulsed vertically by a hydraulically driven shaft. Length of stroke and speed of up and down stroke can be varied to suit the application. Screen aperture, ragging dimension and ragging material can also be altered for the application. An overview is shown in Figure 1 below.



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Figure 1: IPJ Cross Sectional View Showing Overview.

Separation of valuable minerals from gangue particles occurs based on relative density as well as particle size and shape. High specific gravity particles are drawn into the concentrate hutch during the suction stroke of the bed and are continuously discharged. The lighter gangue is discharged over the tailboard to the outer cone. Both concentrates and tailings are discharged. Figure 7 shows a view of the the IPJ2400's with the feed pipe.

Operating Parameters of the Two IPJ2400's:

Both IPJ2400 are operating with a stroke of 25mm and a pulsation frequency of 70ppm . The inlet water to each hutch is 50m³/hour and the internal wedge wire screen has an opening of 16mm and a ragging bed of 19mm steel balls covers about 95% of the area allowing flexibility of the formed bed for large heavy particles to report to the concentrate hutch. The down stroke velocity of the stroke is set at 4 (on a scale of 1 to 10). Figure 2 shows the view depicted by the control system.

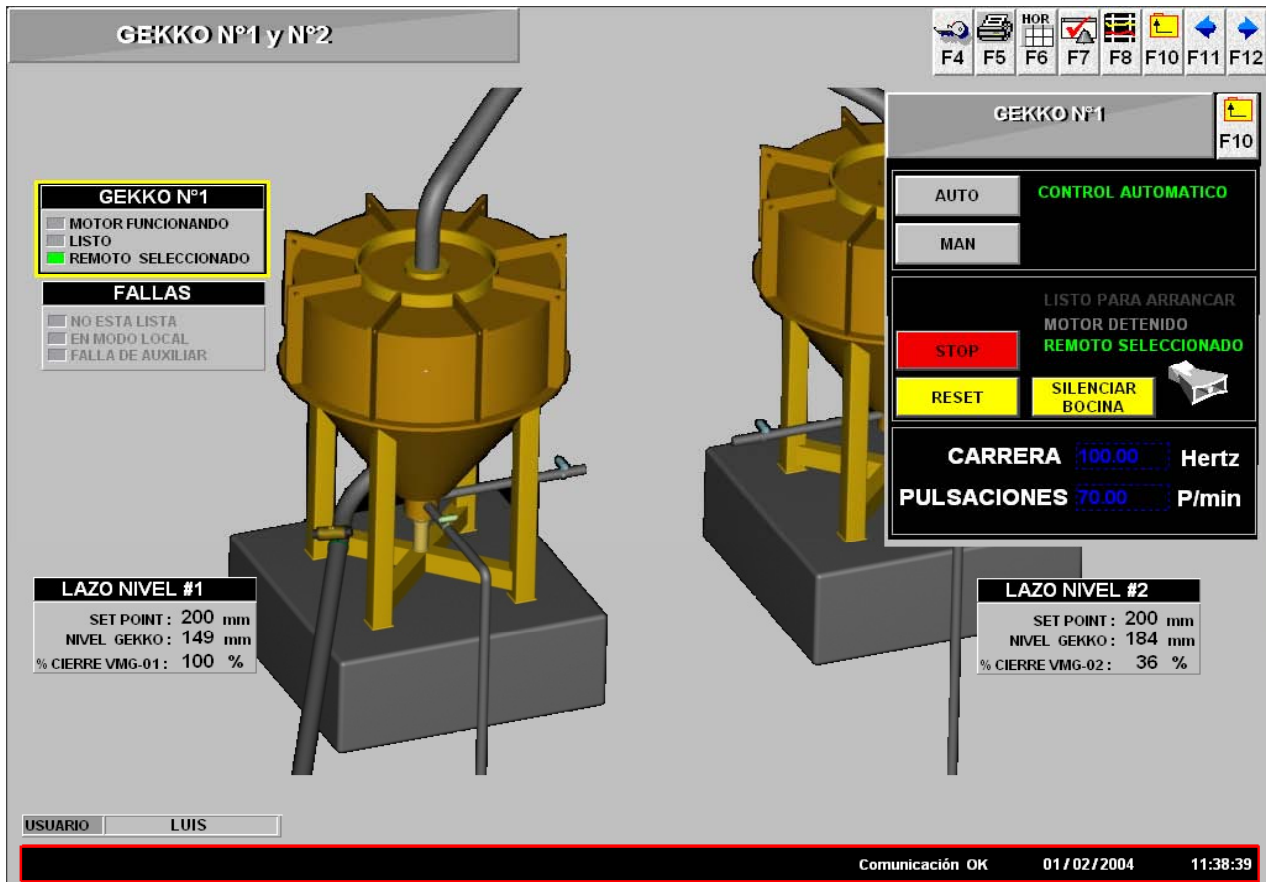


Figure 2: Operator Console - IPJ 2400 Operating Parameters.

Metallurgical Performance:

The high grade concentrate (>2mm) from both GEKKOS produced from the Sizatex concentrate screen is expelled from the main part of the circuit direct to the final upgrade section. This has resulted in the generation of less tin slimes in the Rod Mill and plant recovery has increased by +1% from 90.6 % to 91.6%. Table 1 shows the mass and metallurgical balance around the Gekkos IPJ circuit.

	T/hour	%Sn	Distribution %Sn
Feed to the GEKKO Circuit 100% <14mm	115.0	5.00	100.0
Feed to GEKKO 01- IPJ2400	57.5	5.00	50.0
Feed to GEKKO 02- IPJ2400	57.5	5.00	50.0
Concentrate Gekko 01 & Gekko 02	7.0	23.5	28.6
Tails GEKKO 01(Feed to Sisetec 4mm Screen)	54.0	3.8	35.7
Tails GEKKO 02(Feed to SIZETEC 4mm Screen)	54.0	3.8	35.7
Oversize to SIZETEC 01 & 02 (Feed to Rod Mill)	54.0	3.6	33.8
Undersize of SIZETEC 01 & 02 (Partial feed to Secondary Jigging)	54.0	4.0	37.6
Feed to SIZETEC 2mm Screen (concentrate GEKKO 01 & 02)	7.0	23.5	28.6
Oversize from SIZETEC 2mm Screen (Conc. High Grade)	2.0	50.0	17.4
Undersize from SIZETEC 2mm Screen (Conc. Low Grade)	5.0	12.9	11.2
Feed to ROD Mill (9.5' x 13')	54.0	3.6	33.8
Feed to Secondary Jigging	108.0	3.8	71.4

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Table 1: Mass and Metallurgical Balance of the Gekkos IPJ Circuit

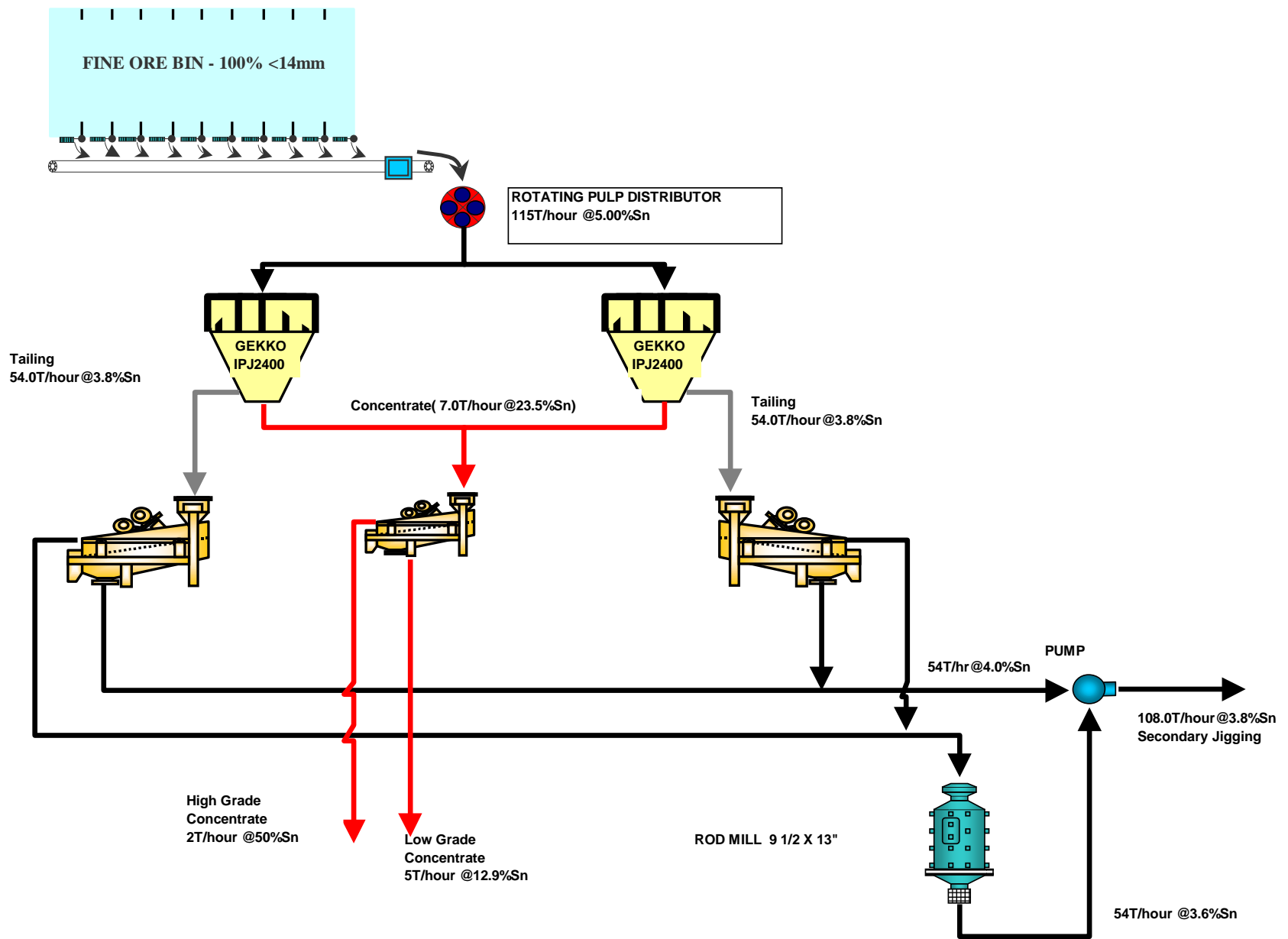


Figure 3: Gekkos IPJ Circuit.



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Figure 4: Feed (100%<14mm) Belt Showing The By-pass Option.

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Figure 5: +2mm Concentrate(50%Sn) Flowing Across the Sisetec Concentrate Screen.

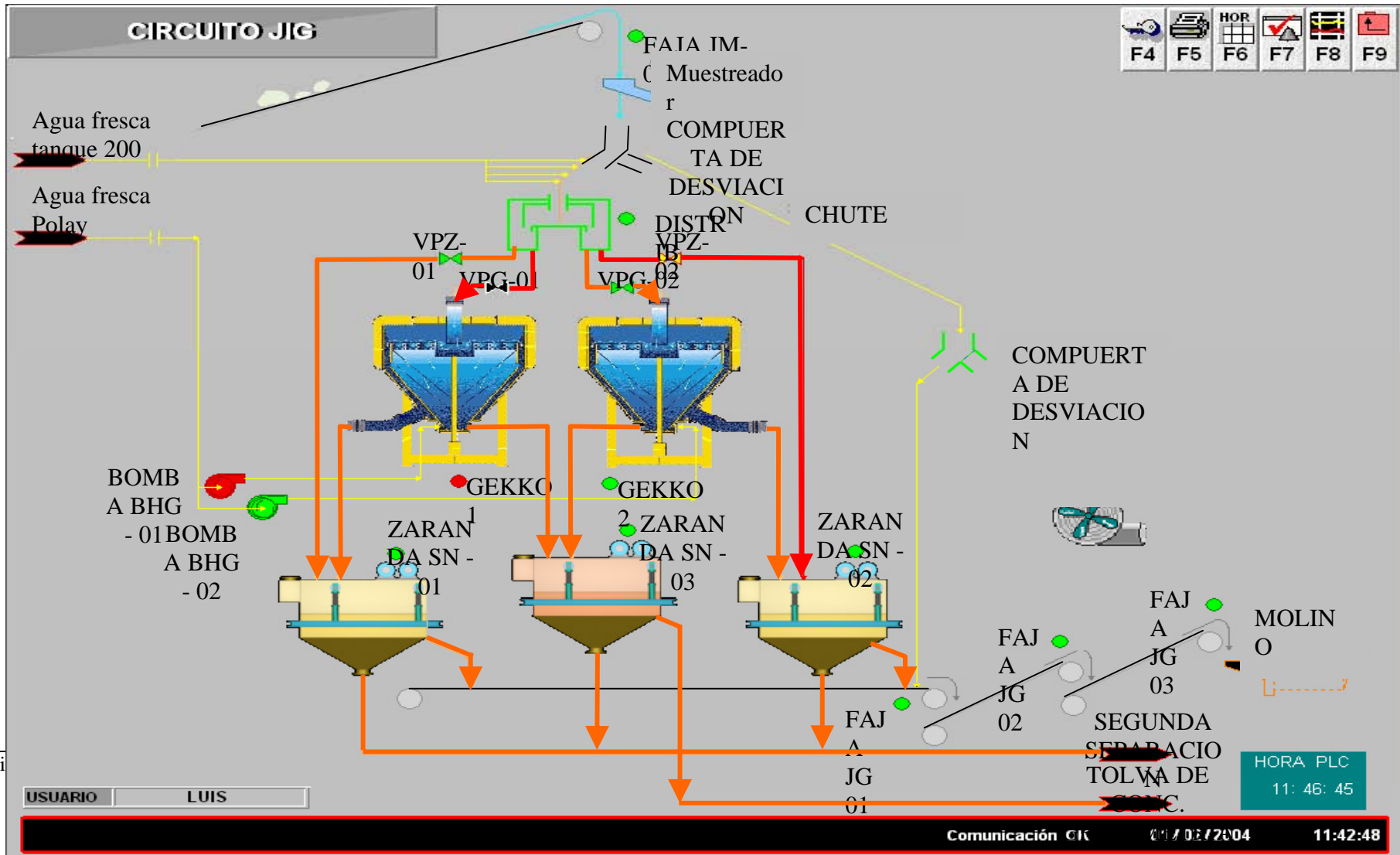


Figure 6: Operator Console - One of the 10 Screens on the Allen Bradley Panel View 600.



Page 12 **Figure 7: View of Gekko IPJ2400 Lid Platform Showing the Feed Pipes from the Rotating Distributor.**

References:

Heins, R. Et Al, "Successful Applications Of The InLine Pressure Jig With Particular Reference To The Recovery Of Gold and Diamonds", SAIMM Gravity Conference, January 2003.