Taganito HPAL Nickel Corporation	PLANT OVERVIEW DCS Manual				
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	Area	Common			

HISTORY of REVISION

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CONTENTS

I. General Description

The Plant Overview graphic screen shows instantaneous material balance of the whole plant process operation. The flow rates (mass and volumetric) of different streams in each section are indicated, as well as the current consumption of process chemicals such as limestone, slaked lime and flocculant.

The data indicated in this screen are derived either as present value of corresponding flow indicators and controllers, or automatically calculated as sum or difference of other flow indicators. Additionally the PLANT OVERVIEW screen shows the actual operating speeds of the four GEHO pumps which are directly related to the nickel throughput of the main plant. Refer to ***Annex 1*** for PLANT OVERVIEW SCREEN.

II. Important Monitoring Items

1. Controllers' Description

None

2. Instruments' Description

1) 101WI301: Total Ore Feed

This mass flow indicator monitors the total ore feed to Ore Preparation 101 and 201. This indicator is a totalizer for the ore feed of each line.

101WI301 [t/h] = 101WIC181 [t/h] + 201WIC181 [t/h]

Where:
101WIC181 = ore feed rate to Ore Preparation Train 1
201WIC181 = ore feed rate to Ore Preparation Train 2

(Operating Range: 316.5 – 542.6 t/h; Normal: 425.2 t/h)

2) 101WI304: Total Undersize Ore

This mass flow indicator monitors the total undersize ore (-1.4 mm) that passes through the vibrating screen (101VS01 and 201VS01) of Ore Preparation 101 and 201. This indicator is a totalizer for the computed undersize ore of each line.

Undersize Ore Computation:

$$X = \frac{D_{SD}\ (D\ kg\text{-}D_W)}{D\ (D_{SD}\text{-}D_W)}$$

$$M = (F \times D \times X) / 1000$$

Where:
D = Slurry Density measured with Density Meter, [kg/m3]
Ds_D = Solids Density, [kg/m3] (entered into Complex Loop Parameter 1)
Dw = Water Density, 1000 [kg/m3]
X = Weight % of solid in the slurry
F = Slurry volume flow measured with Flow Meter, [m3/h]

M = Mass flow of solid, [t/h]

For Train 101: Undersize Ore (-1.4mm)
D1 = 101A I181 [kg/m3] – ore slurry density from 101TK01
F1 = 101FI104 [m3/h] – ore slurry flow from 101TK01
M1 = F1 x D1 x (X) / 1000 [t/h]

For Train 201: Undersize Ore (-1.4mm)
D2 = 201A I181 [kg/m3] – ore slurry density from 201TK01
F2 = 201FI104 [m3/h] – ore slurry flow from 201TK01
M2 = F2 x D2 x (X) / 1000 [t/h]

101WI304 = M1 + M2 [t/h]

(Operating Range: 265.4 – 455.0 t/h; Normal: 379.2 t/h)

3) 101WI302: Total Oversize Ore

This mass flow indicator monitors the total oversize ore (+1.4 mm) that is rejected from Ore Preparation 101 and 201. This indicator is a totalizer that computes for the difference of the total ore feed and the total undersize ore to obtain the oversize ore of each line.

101WI302 [t/h] = 101WI301 [t/h] – 101WI304 [t/h]

Where:
101WI302 = ore oversize discharge rate from Ore Preparation Train 1
201WI302 = ore oversize discharge rate from Ore Preparation Train 2

(Operating Range: 32.2 – 55.2 t/h; Normal: 46.0 t/h)

4) 101FI008: Total Flocculant to Ore Preparation

This volumetric flow indicator monitors the total flocculant consumption of the Ore Preparation 101 and 201. This indicator is a totalizer for the flocculant consumption of each line.

101FI008 [m^3/h] = 101FIC007 [m^3/h] + 201FIC007 [m^3/h]

Where:
101FIC007 = flocculant feed flowrate to 101TH01
201FIC007 = flocculant feed flowrate to 201TH01

(Operating Range: TBD m^3/h; Normal: TBD m^3/h)

5) 102FI001: Ore Slurry Feed to HPAL 102

This volumetric flow indicator monitors the ore slurry feed going to HPAL 102.
(Operating Range: 237.4 – 407.0 m^3/h; Normal: 339.3 m^3/h)

6) 102FI041: Acid Feed to HPAL 102

This volumetric flow indicator monitors the sulfuric acid feed going to HPAL 102. This indicator is a totalizer for the sulfuric acid feed to 102AC01 Comp.1A and 102AC01 Comp.1B.

102FI041 = 102FI007 [m^3/h] + 102FI039 [m^3/h]

Where:
102FI007 = Sulfuric acid feed to 102AC01 Comp. 1A
102FI039 = Sulfuric acid feed to 102AC01 Comp. 1B

(Operating Range: L = 16 m^3/h, H = 41 m^3/h; Normal: 25.95 ^{3}/h)

7) 102FI004: HP Steam to HPAL 102

This mass flow indicator monitors the high pressure (HP) steam feed going to HPAL 102. (Operating Range: 28.88 – 49.50 t/h; Normal: 41.25 t/h)

8) 102FIC058: HP Air to HPAL 102

This volumetric flow indicator monitors the high pressure (HP) air feed going to HPAL 102.
(Operating Range: To be determined during commissioning Nm^3/h; Normal: To be determined during commissioning Nm^3/h)

9) 102HC421: 102PU07A (GEHO A) Speed

This indicator monitors the operating speed of 102PU07A (GEHOA) of HPAL 102.
(Operating Range: 25 - 100 %; Normal: 50 %)

10) 102HC422: 102PU07B (GEHO B) Speed

This indicator monitors the operating speed of 102PU07B (GEHOB) of HPAL 102.
(Operating Range: 25 - 100 %; Normal: 50 %)

11) 202FI001: Ore Slurry Feed to HPAL 202

This volumetric flow indicator monitors the ore slurry feed going to HPAL 202.
(Operating Range: 237.4 – 407.0 m^3/h; Normal: 339.3 m^3/h)

12) 202FI041: Acid Feed to HPAL 202

This volumetric flow indicator monitors the sulfuric acid feed going to HPAL 202. This indicator is a totalizer for the sulfuric acid feed to 202AC01 Comp.1A and 202AC01 Comp.1B.

202FI041 = 202FI007 [m^3/h] + 202FI039 [m^3/h]

Where:
202FI007 = Sulfuric acid feed to 202AC01 Comp. 1A
202FI039 = Sulfuric acid feed to 202AC01 Comp. 1B

(Operating Range: L = 16 m^3/h, H = 41 m^3/h; Normal: 25.95 ^{3}/h)

13) 202FI004: HP Steam to HPAL 202

This mass flow indicator monitors the high pressure (HP) steam feed going to HPAL 202.
(Operating Range: 28.88 – 49.50 t/h; Normal: 41.25 t/h)

14) 202FIC058: HP Air to HPAL 202

This volumetric flow indicator monitors the high pressure (HP) air feed going to HPAL 202.
(Operating Range: To be determined during commissioning Nm^3/h; Normal: To be determined during commissioning Nm^3/h)

15) 202HC421: 202PU07A (GEHO A) Speed

This indicator monitors the operating speed of 202PU07A (GEHOA) of HPAL 202.
(Operating Range: 25 - 100 %; Normal: 50 %)

16) 202HC422: 202PU07B (GEHO B) Speed

This indicator monitors the operating speed of 202PU07B (GEHOB) of HPAL 202.
(Operating Range: 25 - 100 %; Normal: 50 %)

17) 103FIC026: Limestone Slurry to 103TK12 of PRE-NTRL

This volumetric flow indicator monitors the limestone slurry feed going to 103TK12 of PRE-NTRL which is used for pH adjustment and impurity removal.
(Operating Range: 59.75 – 102.42 m^3/h; Normal: 85.35 m^3/h)

18) 203FIC026: Limestone Slurry to 203TK12 of PRE-NTRL

This volumetric flow indicator monitors the limestone slurry feed going to 203TK12 of PRE-NTRL which is used for pH adjustment and impurity removal.
(Operating Range: 59.75 – 102.42 m^3/h; Normal: 85.35 m^3/h)

19) 103FIC001: CCD4 Feed Slurry

This volumetric flow indicator monitors the PRE-NTRL slurry going to CCD4 of the CCD circuit.
(Operating Range: 632.7 – 1084.6 m^3/h; Normal: 903.8 m^3/h)

20) 103FIC020: Barren Liquor

This volumetric flow indicator monitors the SULFURIZATION (MS) barren liquor that is fed to CCD9 of the CCD circuit to be used as wash water.
(Operating Range: 793.0 – 1359.4 m^3/h; Normal: 1132.8 m^3/h)

21) 103FI068: Total CCD Flocculant

This volumetric flow indicator monitors the total flocculant consumption of the CCD circuit. This indicator is a totalizer for the flocculant consumption of the six thickeners in CCD.

103FI068 = 103FIC014 + 103FIC015 + 103FIC016 + 103FIC017 + 103FIC018 + 103FIC019 [m^3/h]

Where:
- 103FIC014 – Flocculant flow controller to 103TH04
- 103FIC015 – Flocculant flow controller to 103TH05
- 103FIC016 – Flocculant flow controller to 103TH06
- 103FIC017 – Flocculant flow controller to 103TH07
- 103FIC018 – Flocculant flow controller to 103TH08
- 103FIC019 – Flocculant flow controller to 103TH09

(Operating Range: To be determined during commissioning m^3/h; Normal: 40.5 m^3/h)

22) 104FIC004: NTRL Thickener Underflow

This volumetric flow indicator monitors the NTRL thickener underflow slurry that is recycled back to CCD6 of the CCD circuit.
(Operating Range: 240.2 – 412.3 m^3/h; Normal: 343.6 m^3/h)

23) 103FIC003: CCD4 Thickener Overflow Solution

This volumetric flow indicator monitors the CCD4 overflow solution going to NTRL.
(Operating Range: 1055.4 – 1809.2 m^3/h; Normal: 1507.7 m^3/h)

24) 103FIC009: CCD9 Thickener Underflow Slurry

This volumetric flow indicator monitors the CCD9 underflow slurry discharged to FNTRL for treatment and disposal.
(Operating Range: 488.3 – 829.9 m^3/h; Normal: 697.6 m^3/h)

25) 103FIC021: NTRL Seed

This volumetric flow indicator monitors the CCD5 underflow slurry that is fed to NTRL as seed for impurity precipitation.
(Operating Range: 96.0 – 164.6 m^3/h; Normal: 137.2 m^3/h)

26) 104FIC006: NTRL Pregnant Liquor

This volumetric flow indicator monitors the NTRL pregnant liquor fed to ZINC REMOVAL (De-Zn) circuit.
(Operating Range: L = 873 m^3/h, H = 1662 m^3/h; Normal: 1385.1 m^3/h)

27) 104FIC050: Limestone Slurry to NTRL

This volumetric flow indicator monitors the limestone slurry feed going to NTRL which is used for pH adjustment and impurity removal.
(Operating Range: 57.3 – 98.2 m^3/h; Normal: 81.8 m^3/h)

28) 104FIC007: NTRL Thickener Flocculant

This volumetric flow indicator monitors the flocculant consumption of NTRL thickener.
(Operating Range: 18.6 – 31.8 m^3/h; Normal: 26.5 m^3/h)

29) 105FI042: Total H2S Gas to De-Zn

This volumetric flow indicator monitors the total H2S gas injection to the De-Zn reactors. This indicator is a totalizer for the H2S gas injection of De-Zn reactor 1 and 2.

105FI042 = 105FIC002 + 105FIC003 [Nm3/h]

Where:
105FIC002 – fresh H2S gas flow to 105TK01
105FIC003 – fresh H2S gas flow to 105TK02/03

(Operating Range: To be determined during commissioning Nm^3/h; Normal: To be determined during commissioning Nm^3/h)

30) 105FI406: Zn Free Pregnant Liquor

This volumetric flow indicator monitors the total Zn-free pregnant liquor fed into the De-Zn polishing filters. This indicator is a totalizer for the Zn-free pregnant liquor pumped by the seven polishing filter feed pumps.

105FI406 = 105FIC006 + 105FIC007 + 105FIC206 + 105FIC207 + 105FIC306 + 105FIC307 + 105FIC106 [m3/h]

Where:
105FIC006 – 105PU01A to 105FT01A flow controller
105FIC007 – 105PU01B to 105FT01B flow controller
105FIC206 – 105PU01C to 105FT01C flow controller
105FIC207 – 105PU01D to 105FT01D flow controller
105FIC306 – 105PU01E to 105FT01E flow controller
105FIC307 – 105PU01F to 105FT01F flow controller
105FIC106 – 105PU01G flow controller

(Operating Range: 1008.6 – 1723.0 m^3/h; Normal: 1440.8 m^3/h)

31) 106FIC002A: MS Feed from Flowmeter A

This volumetric flow indicator monitors the MS feed solution from De-Zn going to the MS reactors through 106FIC002A. During operation only one flowmeter for MS feed is used, either 106FIC002A or 106FIC002B.
(Operating Range: LL = 800 m^3/h, L = 908 m^3/h, HH = 1730 m^3/h; Normal: 1440.8 m^3/h)

32) 106FIC002B: MS Feed from Flowmeter B

This volumetric flow indicator monitors the MS feed solution from De-Zn going to the MS reactors through 106FIC002B. During operation only one flowmeter for MS feed is used, either 106FIC002A or 106FIC002B.
(Operating Range: LL = 800 m^3/h, L = 908 m^3/h, HH = 1730 m^3/h; Normal: 1440.8 m^3/h)

33) 106FI043: Total H2S Gas to MS

This volumetric flow indicator monitors the total H2S gas injection to the MS reactors. This indicator is a totalizer for the H2S gas injection of MS reactor 1, 2, 3 and 4.

106FI043 = 106FIC001 + 106FIC231 + 106FIC231 + 106FIC911 [Nm3/h]

Where:
106FIC001 – fresh H2S gas flow controller to 106VE01
106FIC231 – fresh H2S gas flow controller to 106VE02
106FIC097 – fresh H2S gas flow controller to 106VE03
106FIC911 – fresh H2S gas flow controller to 106VE04

(Operating Range: To be determined during commissioning Nm^3/h; Normal: To be determined during commissioning Nm^3/h)

34) 106FIC007: MS Thickener Flocculant

This volumetric flow indicator monitors the flocculant consumption of MS thickener.
(Operating Range: 0.28 – 0.48 m^3/h; Normal: 0.40 m^3/h)

35) 106FI020: Acid Feed to H2S Destruction

This volumetric flow indicator monitors the sulfuric acid feed to H2S Destruction (106TK14) to maintain the pH of the barren liquor/ supernatant to an optimum range for efficient slurry washing in the CCD circuit.
(Operating Range: HH = 1.48 m^3/h; Normal: To be determined during commissioning m^3/h)

36) 106FI106: Barren Liquor Discharge to FNTRL

This volumetric flow indicator monitors the barren liquor discharged to FNTRL for treatment and disposal.
(Operating Range: 43.7 – 74.9 m^3/h; Normal: 62.4 m^3/h)

37) 108FIC001: Limestone Slurry to FNTRL

This volumetric flow indicator monitors the limestone slurry feed going to FNTRL which is used for neutralization of waste acid and precipitation of heavy metals.
(Operating Range: 43.4 – 82.9 m^3/h; Normal: 69.1 m^3/h)

38) 112FI014: Slaked Lime Slurry to FNTRL

This volumetric flow indicator monitors the slaked lime slurry feed going to FNTRL which is used for neutralization of waste acid and precipitation of heavy metals. This indicator is a totalizer that computes for the difference of the slaked lime feed to FNTRL and the unused slaked lime from FNTRL to slaked lime tank.

112FI014 = 112FI012 – 112FI013 [m^3/h]

Where:
112FI012 – 112PU01AB slaked lime slurry discharge flow rate
112FI011 – Slaked lime slurry return to 102TK01

(Operating Range: 36.0 – 61.7 m^3/h; Normal: 51.4 m^3/h)

39) 705FI688: Coal Ash Slurry to FNTRL

This volumetric flow indicator monitors the coal ash slurry discharged to FNTRL which is used to help in neutralization of waste acid and precipitation of heavy metals.
(Operating Range: To be determined during commissioning m^3/h; Normal: To be determined during commissioning m^3/h)

40) 108FI015: Supernatant to FNTRL

This volumetric flow indicator monitors the supernatant going to FNTRL which is used as additional dilution water for the FNTRL operation.
(Operating Range: To be determined during commissioning m^3/h; Normal: To be determined during commissioning m^3/h)

41) 524FI008: Effluent Discharge

This volumetric flow indicator monitors the effluent discharge from FNTRL going to TAILINGS DAM for settling of tailings and cooling and recovery of supernatant.
(Operating Range: 630.7 – 1081.2 m^3/h; Normal: 901 m^3/h)

42) 524AI001: Supernatant pH Analyzer

This pH analyzer indicator monitors the supernatant pH stored in the decant water return pond (524PD01).
(Operating Range: LL = 6.5, HH = 8.8; Normal: 7.0)

43) 524FI001: Supernatant Discharge to Sea

This volumetric flow indicator monitors the supernatant discharged to the Sea.
(Operating Range: 327.8 – 562.0 m^3/h; Normal: 468.3 m^3/h)

44) 524FI002: Supernatant Recycle to Plant

This volumetric flow indicator monitors the supernatant recycled back to the Plant.
(Operating Range: To be determined during commissioning m^3/h; Normal: To be determined during commissioning m^3/h)

45) 111FIC006: Supernatant to Limestone Preparation

This volumetric flow indicator monitors the supernatant going to Limestone Preparation Area which is used as dilution water for wet grinding in the limestone ball mill for the production of limestone slurry.
(Operating Range: To be determined during commissioning m^3/h; Normal: To be determined during commissioning m^3/h)

46) 112FI001: Supernatant to Slaked Lime Preparation (VSLC Scope)

This volumetric flow indicator monitors the supernatant going to Slaked Lime Preparation Area which is used for dilution of quick lime (CaO) to produce slaked lime.
(Operating Range: To be determined during commissioning m^3/h; Normal: To be determined during commissioning m^3/h)

47) 114FI004: Total Flocculant

This volumetric flow indicator monitors the total flocculant consumption of all the thickeners in the Plant. This indicator is a totalizer for the flocculant consumption of the Ore Preparation thickeners, CCD thickeners, NTRL thickener and MS thickener.

114FI004 = 101FI008 + 103FI068 + 104FIC007 + 106FIC007 [m^3/h]

Where:
- 101FI008 – Total flocculant flow to Ore Prep. 101/201
- 103FI068 – Total flocculant flow to CCD circuit
- 104FIC007 – Flocculant flow controller to 104TH01
- 106FIC007 – Flocculant flow controller to 106TH01

(Operating Range: 56.1 – 96.1 m^3/h; Normal: 80.1 m^3/h)

48) 416FI001: Total Acid Feed

This volumetric flow indicator monitors the total sulfuric acid consumption of the Plant.
(Operating Range: 36.3 – 62.3 m^3/h; Normal: 51.9 m^3/h)

3. Motors

None

4. Actuated Valves

None

5. Switches

None

III. Interlocks/Controls

None

IV. Control Sequences

None

V. Alarms

None

VI. DCS Emergency Shutdown

None

VII. Trend Graphs Grouping

None

Annex 1: PLANT OVERVIEW DCS Graphics