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I. General Description

This graphics screen shows tabulations of calculated values which are used as monitoring items for the operation of the Plant. Calculated values involve in the operations are mostly flow totalizers, differential pressure (PDI), average temperature and differential temperature (TDI) and others such as calculated density and heating rate. Refer to ***Annex 1*** for MISCELLANEOUS CALCULATION screen.

For the purpose and availability of calculated values, refer to the items corresponding manuals.

This screen has a shortcut link button to Graphics Overview for easy access to other screens.

II. Important Monitoring Items

1. Controllers' Description

None

2. Instruments' Description

1) 101FI008: Ore Thickener Total Flocculant Flowrate

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 101TH01 and 201TH01.

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

Where:
101FIC007 – Flocculant flowrate to 101TH01
201FIC007 – Flocculant flowrate to 201TH01

(Operating Range: 3.50 – 11.23 m^3/h; Normal: 6.3 m^3/h)

2) 101/201XI001: 101TH01 Density

This density indicator monitors the calculated density of 101/201TH01 slurry which is based on manually measured height of water phase (Hw). This indicator is calculated using the following equation:

$$101/201XI001\ [kg/m^3] = \frac{(101/201PIC001\ [kPag] \times 1000) - (Dw\ [kg/m3] \times g\ [m/s^2] \times Hw\ [m])}{(g\ [m/s^2] \times Hs\ [m])}$$

Where:
101/201PIC001 – Bed pressure of 101/201TH01
Dw – Density of water, 1000kg/m3
g – Acceleration due to gravity, 9.8 m/s2
Hw – Height of water phase
Hs – Height of solid/slurry phase

Refer to ***TNH-201-103 (2) ORE SLURRY THICKENING DCS Manual*** for the discussion of the complex loop calculation for 101/201XI001.
(Operating Range: 1390 - 1450 kg/m^3; Normal: 1400 kg/m^3)

3) 102LI001B: 102TK01 and 202TK01 Total Volume

This indicator is a totalizer of the individual volume of 102TK01 and 202TK01. This indicator is calculated using the following equation:

102LI001B [m^3] = 102LI001A + 202LI001A [m^3]

Where:
102LI001A – Volume of slurry in 102TK01
202LI001A – Volume of slurry in 202TK01

(Operating Range: 634 – 3592 m^3; Normal: 2113 m^3)

4) 102/202FI002: Feed Slurry Flowrate to 102HX02

This flow indicator is an electromagnetic type that monitors the flow rate of ore slurry to 102/202HX02.
(Operating Range: 238 - 408 m^3/h; Normal: 340 m^3/h)

5) 102/202FI038: Water Feed Flowrate to 102SR01

This flow indicator is an electromagnetic type that monitors the flow rate of clarified water to 102/202SR01.
(Operating Range: To be determined during commissioning m^3/h; Normal: To be determined during commissioning m^3/h)

6) 102/202FI041: Total Acid Flowrate

This volumetric flow indicator monitors the sulfuric acid feed going to HPAL 102/202. This indicator is a totalizer for the sulfuric acid feed to 102/202AC01 Comp.1A and 102/202AC01 Comp.1B.

102/202FI041 [m^3/h] = 102/202FI007 + 102/202FI039 [m^3/h]

Where:
102/202FI007 – Sulfuric Acid flowrate to 102/202AC01 Comp. 01A
102/202FI039 – Sulfuric Acid flowrate to 102/202AC01 Comp. 01B

(Operating Range: 18.2 – 31.2 m^3/h; Normal: 26.0 m^3/h)

7) 102/202FI070: 102/202PU07A Calculated Flowrate

This calculated flow indicator monitors the HPAL feed slurry flow rate from 102/202PU07A to 102/202AC01. This indicator is calculated using the following equation:

102/202FI070 [m^3/h] = 102/202SI001 [rpm] x K [m^3/h-rpm]

Where:
K = 6.642 m^3/h-rpm
102/202AI001 – Speed indication of the 102/202PU07A (GEHO A)

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

8) 102/202FI071: 102/202PU07B Calculated Flowrate

This calculated flow indicator monitors the HPAL feed slurry flow rate from 102/202PU07B to 102/202AC01. This indicator is calculated using the following equation:

102/202FI071 [m^3/h] = 102/202SI002 [rpm] x K [m^3/h-rpm]

Where:
K = 6.642 m^3/h-rpm
102/202AI001 – Speed indication of the 102/202PU07B (GEHO B)

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

9) 102/202PDI051: LT Heater Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 102/202PU32AB discharge pressure and 102/202HX01 pressure or 102/202VE03 pressure (whichever is selected in 102/202HX01 Selector Switch). This indicator is calculated using the following equation:

102/202PDI051 [kPa] = 102/202PI001 [kPag] – 102/202PI002 [kPag]
or
102/202PDI051 [kPa] = 102/202PI001 [kPag] – 102/202PI021 [kPag]

Where:
102/202PI001 – Discharge pressure of 102/202PU31/32AB
102/202PI002 – 102/202HX01 (LT) pressure indicator
102/202PI021 – 102/202VE03 (LP) pressure indicator

(Operating Range: HH = 500 kPa; Normal: 50 kPa)

10) 102/202PDI052: MT Heater Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 102/202PU03AB discharge pressure and 102/202HX02 pressure or 102/202VE02 pressure (whichever is selected in 102/202HX02 Vent Control Selector Switch). This indicator is calculated using the following equation:

102PDI052 [kPa] = 102/202PI003 [kPag] – 102/202PIC004 [kPag]
or
102/202PDI052 [kPa] = 102/202PI003 [kPag] – 102/202PIC019 [kPag]

Where:
102/202PI003 – Discharge pressure of 102/202PU02/03AB
102/202PIC004 – 102/202HX02 (MT) pressure indicator
102/202PIC019 – 102/202VE02 (MP) pressure indicator

(Operating Range: HH = 500 kPa; Normal: 90 kPa)

11) 102/202PDI055: HT Heater Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 102/202PU06AB discharge pressure and 102/202HX03 pressure or 102/202VE01 pressure (whichever is selected in 102/202HX03 Vent Control Selector Switch). This indicator is calculated using the following equation:

102/202PDI055 [kPa] = 102/202PI005 [kPag] – 102/202PIC006 [kPag]
or
102/202PDI055 [kPa] = 102/202PI005 [kPag] – 102/202PIC017 [kPag]

Where:
102/202PI005 – Discharge pressure of 102/202PU04/05/06AB
102/202PIC006 – 102/202HX03 (HT) pressure indicator
102/202PIC017 – 102/202VE01 (HP) pressure indicator

(Operating Range: HH = 500 kPa; Normal: 50 kPa)

12) 102/202PDI090: LT Heater – LP Flash Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 102/202VE03 pressure and 102/202HX01 pressure. This indicator is calculated using the following equation:

102/202PDI090 [kPa] = 102/202PI021 [kPag] – 102/202PI002 [kPag]

Where:
102/202PI021 – 102/202VE03 (LP) pressure indicator
102/202PI002 – 102/202HX01 (LT) pressure indicator

(Operating Range: H = 100 kPa; Normal: To be determined during commissioning kPa)

13) 102/202PDI091: MT Heater – MP Flash Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 102/202VE02 pressure and 102/202HX02 pressure. This indicator is calculated using the following equation:

102/202PDI091 [kPa] = 102/202PIC019 [kPag] – 102/202PIC004 [kPag]

Where:
102/202PI019 – 102/202VE02 (MP) pressure indicator
102/202PIC004 – 102/202HX02 (MT) pressure indicator

(Operating Range: H = 100 kPa; Normal: To be determined during commissioning kPa)

14) 102/202PDI092: HT Heater – HP Flash Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 102/202VE01 pressure and 102/202HX03 pressure. This indicator is calculated using the following equation:

102/202PDI092 [kPa] = 102/202PIC017 [kPag] – 102/202PIC006 [kPag]

Where:
102/202PI017 – 102/202VE01 (HP) pressure indicator
102/202PIC006 – 102/202HX03 (HT) pressure indicator

(Operating Range: H = 100 kPa; Normal: To be determined during commissioning kPa)

15) 102/202PDI057A: 102/202PT010/023 (AC COMP. 1A) Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 102/202PI023 (102PU10AB discharge pressure to 102AC01 COMP. 1A) and 102/202PI010 (102/202AC01 vent pressure). This indicator is calculated using the following equation:

102/202PDI057A [kPa] = 102/202PI023 [kPag] – 102/202PI010 [kPag]

Where:
102/202PI023 – 102/202AC01 Comp. 1A acid feed pressure indicator
102/202PI010 - 102/202AC01 pressure indicator

(Operating Range: L = 80 kPa; Normal: To be determined during commissioning kPa)

16) 102/202PDI057B: 102/202PT010/037 (AC COMP. 1B) Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 102/202PI037 (102PU10AB discharge pressure to 102AC01 COMP. 1B) and 102/202PI010 (102/202AC01 vent pressure). This indicator is calculated using the following equation:

102/202PDI057B [kPa] = 102/202PI037 [kPag] – 102/202PI010 [kPag]

Where:
102/202PI037 – 102/202AC01 Comp. 1B acid feed pressure indicator
102/202PI010 - 102/202AC01 pressure indicator

(Operating Range: L = 80 kPa; Normal: To be determined during commissioning kPa)

17) 102/202PDI078: HP Air Injection Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 102/202PI033 (HP Air pressure to 102AC01) and 102/202PI010 (102/202AC01 vent pressure). This indicator is calculated using the following equation:

102/202PDI078 [kPa] = 102/202PI033 [kPag] – 102/202PI010 [kPag]

Where:
102/202PI033 – HP Air to 102/202AC01 pressure indicator
102/202PI010 – 102/202AC01 pressure indicator

(Operating Range: To be determined during commissioning kPa; Normal: To be determined during commissioning kPa)

18) 102/202PDIC056: 102/202PY007/PT010 Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 102/202PI010 (102/202AC01 vent pressure) and 102/202PY007 (saturated steam pressure in 102/202AC01). This indicator is calculated using the following equation:

102/202PDIC056 = 102/202PI010 – 102/202PY007

Where:
102/202PI010 – 102/202AC01 pressure indicator
102/202PY007 – 102/202AC01 saturated steam pressure

(Operating Range: 400 – 600 kPa; Normal: 500 kPa)

19) 102/202TY030: 102/202TI006 – 102/202 Autoclave Average Temperature

This calculated temperature indicator measures the average temperature inside 102/202AC01. This indicator is calculated using the following equation:

$$102/202TY030\ [^{o}C] = (102/202TI006\ [^{o}C] + 102/202TI007\ [^{o}C] + 102/202TI008\ [^{o}C] + 102/202TI009\ [^{o}C] + 102/202TI010\ [^{o}C] + 102/202TI011\ [^{o}C] + 102/202TI012\ [^{o}C]) / 7$$

Where:
102/202TI006 – 102/202AC01 Comp. 1 temperature indicator
102/202TI007 – 102/202AC01 Comp. 2 temperature indicator
102/202TI008 – 102/202AC01 Comp. 3 temperature indicator
102/202TI009 – 102/202AC01 Comp. 4 temperature indicator
102/202TI010 – 102/202AC01 Comp. 5 temperature indicator
102/202TI011 – 102/202AC01 Comp. 6 temperature indicator
102/202TI012 – 102/202AC01 Comp. 7 temperature indicator

(Operating Range: LL = 270 ^{o}C; Normal: To be determined during commissioning ^{o}C)

20) 102/202TDY006: 102/202AC01 COMP. #1 Heating Rate

This calculated heating rate indicator measures the change in temperature per unit time inside 102/202AC01 Comp. #1. This indicator is calculated using the following equation:

$$102/202TDY006\ [^{o}C/h] = \frac{(102/202TI006_{Newest}\ [^{o}C] - 102/202TI006_{Oldest}\ [^{o}C])}{X\ [min]} \times 60[min/h]$$

Where:
102/202TI006 – 102/202AC01 Comp.1 temperature indicator

(Operating Range: -25 ^{o}C/h to 25 ^{o}C/h; Normal: 0 ^{o}C/h)

21) 102/202TDY007: 102/202AC01 COMP. #2 Heating Rate

This calculated heating rate indicator measures the change in temperature per unit time inside 102/202AC01 Comp. #2. This indicator is calculated using the following equation:

$$102/202TDY007\ [^{o}C/h\ ] = \frac{(102/202TI007_{Newest}\ [^{o}C\ ] - 102/202TI007_{Oldest}\ [^{o}C\ ])}{X\ [min]} \times 60\ [min/h]$$

Where:
102/202TI007 – 102/202AC01 Comp.2 temperature indicator

(Operating Range: -25 ^{o}C/h to 25 ^{o}C/h; Normal: 0 ^{o}C/h)

22) 102/202TDY008: 102/202AC01 COMP. #3 Heating Rate

This calculated heating rate indicator measures the change in temperature per unit time inside 102/202AC01 Comp. #3. This indicator is calculated using the following equation:

$$102/202TDY008\ [^{o}C/h\ ] = \frac{(102/202TI008_{Newest}\ [^{o}C\ ] - 102/202TI008_{Oldest}\ [^{o}C\ ])}{X\ [min]} \times 60\ [min\ /h]$$

Where:
102/202TI008 – 102/202AC01 Comp.3 temperature indicator

(Operating Range: -25 ^{o}C/h to 25 ^{o}C/h; Normal: 0 ^{o}C/h)

23) 102/202TDY009: 102/202AC01 COMP. #4 Heating Rate

This calculated heating rate indicator measures the change in temperature per unit time inside 102/202AC01 Comp. #4. This indicator is calculated using the following equation:

$$102/202TDY009\ [^{o}C/h\ ] = \frac{(102/202TI009_{Newest}\ [^{o}C\ ] - 102/202TI009_{Oldest}\ [^{o}C\ ])}{X\ [min]} \times 60\ [min/h]$$

Where:
102/202TI009 – 102/202AC01 Comp.4 temperature indicator

(Operating Range: -25 ^{o}C/h to 25 ^{o}C/h; Normal: 0 ^{o}C/h)

24) 102/202TDY010: 102/202AC01 COMP. #5 Heating Rate

This calculated heating rate indicator measures the change in temperature per unit time inside 102/202AC01 Comp. #5. This indicator is calculated using the following equation:

$$102/202TDY010\ [^{o}C\ /h] = \frac{(102/202TI010_{Newest}\ [^{o}C\ ] - 102/202TI010_{Oldest}\ [^{o}C\ ])}{X\ [min]} \times 60\ [min/h]$$

Where:
102/202TI010 – 102/202AC01 Comp.5 temperature indicator

(Operating Range: -25 ^{o}C/h to 25 ^{o}C/h; Normal: 0 ^{o}C/h)

25) 102/202TDY011: 102/202AC01 COMP. #6 Heating Rate

This calculated heating rate indicator measures the change in temperature per unit time inside 102/202AC01 Comp. #6. This indicator is calculated using the following equation:

$$102/202TDY011\ [^{o}C/h] = \frac{(102/202TI011_{Newest}\ [^{o}C] - 102/202TI011_{Oldest}\ [^{o}C])}{X\ [min]} \times 60\ [min/h]$$

Where:
102/202TI011 – 102/202AC01 Comp.6 temperature indicator

(Operating Range: -25 ^{o}C/h to 25 ^{o}C/h; Normal: 0 ^{o}C/h)

26) 102/202TDY012: 102/202AC01 COMP. #7 Heating Rate

This calculated heating rate indicator measures the change in temperature per unit time inside 102/202AC01 Comp. #7. This indicator is calculated using the following equation:

$$102/202TDY012\ [^{o}C/h] = \frac{(102/202TI012_{Newest}\ [^{o}C] - 102/202TI012_{Oldest}\ [^{o}C])}{X\ [min]} \times 60\ [min/h]$$

Where:
102/202TI012 – 102/202AC01 Comp.7 temperature indicator

(Operating Range: -25 ^{o}C/h to 25 ^{o}C/h; Normal: 0 ^{o}C/h)

27) 102/202TDI026: 102/202AC01 Skin Temperature Difference

This calculated temperature difference indicator measures the skin temperature difference at 102/202AC01 Comp. #1 and 102/202AC01 Comp. #2. This indicator is calculated using the following equation:

$$102/202TDI026\ [^{o}C] = 102/202TI013\ [^{o}C] - 102/202TI014\ [^{o}C]$$

Where:
102/202TI013 – 102/202AC01 Comp.1 skin temperature indicator
102/202TI014 – 102/202AC01 Comp.7 skin temperature indicator

(Operating Range: -25 ^{o}C to 25 ^{o}C; Normal: 0 ^{o}C)

28) 102/202TDI027: LT Heater Approach Temperature

This calculated temperature difference indicator measures the temperature difference of steam going in 102/202HX01 and heated slurry going out of 102/202HX01. This indicator is calculated using the following equation:

102/202TDI027 [^{o}C] = 102/202TI102 [^{o}C] – 102/202TI101 [^{o}C]

Where:
102/202TI102 – 102/202VE03 (LP) vent temperature indicator
102/202TI101 – 102/202HX01 (LT) slurry temperature indicator

(Operating Range: To be determined during commissioning ^{o}C; Normal: 6 ^{o}C)

29) 102/202TDI028: MT Heater Approach Temperature

This calculated temperature difference indicator measures the temperature difference of steam going in 102/202HX02 and heated slurry going out of 102/202HX02. This indicator is calculated using the following equation:

102/202TDI027 [^{o}C] = 102/202TI104 [^{o}C] – 102/202TI103 [^{o}C]

Where:
102/202TI104 – 102/202VE02 (MP) vent temperature indicator
102/202TI103 – 102/202HX02 (MT) slurry temperature indicator

(Operating Range: To be determined during commissioning ^{o}C; Normal: 8 ^{o}C)

30) 102/202TDI029: HT Heater Approach Temperature

This calculated temperature difference indicator measures the temperature difference of steam going in 102/202HX03 and heated slurry going out of 102/202HX03. This indicator is calculated using the following equation:

102/202TDI027 [^{o}C] = 102/202TI106 [^{o}C] – 102/202TI105 [^{o}C]

Where:
102/202TI106 – 102/202VE01 (HP) vent temperature indicator
102/202TI105 – 102/202HX03 (HT) slurry temperature indicator

(Operating Range: To be determined during commissioning ^{o}C; Normal: 8 ^{o}C)

31) 103FI500: CCD Input Total Flowrate

This volumetric flow indicator monitors the total flow input of materials into the CCD circuit. This indicator is a totalizer of the pregnant liquor flow from PNTRL, barren liquor flow from MS, total flocculant flow and NTRL underflow slurry. This indicator is calculated using the following equation:

103FI500 [m^3/h] = 103FIC001 [m^3/h] + 103FIC020 [m^3/h] + 103FI068 [m^3/h] + 104FIC004 [m^3/h]

Where:
103FIC001 – CCD feed slurry input controller
103FIC020 – Barren liquor flow controller
103FI068 – Total flocculant flow indicator
104FIC004 – NTRL underflow slurry indicator

(Operating Range: 1550.0 – 2657.2 m^3/h; Normal: 2214.3 m^3/h)

32) 103FI501: CCD Output Total Flowrate

This volumetric flow indicator monitors the total flow output of materials from the CCD circuit. This indicator is a totalizer of the pregnant liquor flow from CCD-4, CCD-9 underflow slurry to FNTRL and CCD-5 underflow seed slurry to NTRL. This indicator is calculated using the following equation:

103FI501 [m^3/h] = 103FIC003 [m^3/h] + 103FIC021 [m^3/h] + 103FIC009 [m^3/h]

Where:
103FIC003 – NTRL input solution flow controller
103FIC021 – NTRL seed flow controller
103FIC009 – CCD9 underflow flow controller

(Operating Range: 1639.8 – 2811.0 m^3/h; Normal: 2342.5 m^3/h)

33) 104FI002: Coagulant Flowrate to 104TK02

This flow indicator is an electromagnetic type that monitors the flow rate of coagulant to 104TK02.

(Operating Range: L = 0.55 m^3/h; Normal: To be determined during commissioning m^3/h)

34) 104FIC006: Pregnant Liquor Flowrate to 105TK01

This flow indicator is an electromagnetic type that monitors the flow rate of pregnant liquor to 105TK01.

(Operating Range: 969.6 – 1662.1 m^3/h; Normal: 1385.1 m^3/h)

35) 104FI201: 104VP01AB- Coagulant Flowrate

This volumetric flow indicator monitors the flow of coagulant form 104VP01AB less the dilution water. This indicator is calculated using the following equation:

104FI201 [m^3/h] = 104FI002 [m^3/h] - 104FI001 [m^3/h]

Where:
104FI002 – Water and coagulant flowrate to 104TK02
104FI001 – Dilution water flowrate to 104VP01AB

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

36) 106FI043: Fresh H2S Gas Flowrate to MS

This volumetric flow indicator monitors the total fresh H2S gas flow to the MS reactors. This indicator is a totalizer of H2S gas flow to 106VE01, 106VE02, 106VE03 and 106VE04.

106FI043 [Nm^3/h] = 106FIC001 [Nm^3/h] + 106FIC231 [Nm^3/h] + 106FIC097 [Nm^3/h] + 106FIC911 [Nm^3/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: 2138 Nm^3/h)

37) 106FQ033: Fresh H2S Gas Volume to MS

This indicator monitors the total amount/volume of fresh H2S gas to the MS reactors. This indicator is a totalizer of H2S gas volume to 106VE01, 106VE02, 106VE03 and 106VE04.

106FQ033 [Nm^3] = 106FQ001 [Nm^3] + 106FQ231 [Nm^3] + 106FQ097 [Nm^3] + 106FQ911 [Nm^3]

Where:
106FIC001 – amount of fresh H2S gas injected to 106VE01
106FIC231 – amount of fresh H2S gas injected to 106VE02
106FIC097 – amount of fresh H2S gas injected to 106VE03
106FIC911 – amount of fresh H2S gas injected to 106VE04

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

38) 106PDI100: 106VE01-106VE02 Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 106VE01 pressure and 106VE02 pressure. This indicator is calculated using the following equation:

106PDI100 [kPa] = 106PI002 [kPag] – 106PI003 [kPag]

Where:
106PI002 – 106VE01 pressure indicator
106PI003 – 106VE02 pressure indicator

(Operating Range: To be determined during commissioning kPa; Normal: 15 kPa)

39) 106PDI101: 106VE02-106VE03 Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 106VE02 pressure and 106VE03 pressure. This indicator is calculated using the following equation:

106PDI101 [kPa] = 106PI003 [kPag] – 106PI004 [kPag]

Where:
106PI003 – 106VE02 pressure indicator
106PI004 – 106VE03 pressure indicator

(Operating Range: To be determined during commissioning kPa; Normal: 15 kPa)

40) 106PDI102: 106VE03-106VE04 Differential Pressure

This calculated differential pressure indicator measures the pressure difference of 106VE03 pressure and 106VE04 pressure. This indicator is calculated using the following equation:

106PDI101 [kPa] = 106PI004 [kPag] – 106PIC005 [kPag]

Where:
106PI004 – 106VE03 pressure indicator
106PIC005 – 106VE04 pressure controller

(Operating Range: To be determined during commissioning kPa; Normal: 15 kPa)

41) 108FI202: 108PU02/03/04/05AB Total Flowrate

This calculated flow indicator measures the total flow rate of effluent slurry from FNTRL to Tailings Dam and 106TK14. This indicator is calculated using the following equation:

108FI202 [m^3/h] = 524FI008 [m^3/h] + 108FI007 [m^3/h]

Where:
524FI008 – Process tailings slurry flow rate to tailing dam (524DM01)
108FI007 – Process tailings slurry flow rate to H2S Destruction Tank (106TK14)

(Operating Range: 630.7 – 1081.2 m^3/h; Normal: 901 m^3/h)

42) 112FI014: Slaked Lime Flowrate to FNTRL

This calculated flow indicator measures the flow rate of slaked lime to FNTRL. This indicator is calculated using the following equation:

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

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

(Operating Range: To be determined during commissioning m^3/h; Normal: 51.4 m^3/h)

43) 114FI004: Total Flocculant Flowrate

This calculated flow indicator measures the total flow rate of flocculant to the Plant. This indicator is a totalizer of the total flocculant flow to Ore Prep. 101/201, total flocculant flow to CCD circuit, flocculant flow to NTRL and flocculant flow to MS. This indicator is calculated using the following equation:

114FI004 [m^3/h] = 101FI008 [m^3/h] + 103FI068 [m^3/h] + 104FIC007 [m^3/h] + 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: To be determined during commissioning m^3/h; Normal: 80.1 m^3/h)

44) 103FI068: CCD Total Flocculant Flowrate

This calculated flow indicator measures the total flow rate of flocculant to the CCD thickeners. This indicator is a totalizer for the flocculant consumption of 103TH04/05/06/07/08/09. This indicator is calculated using the following equation:

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

3. Motors

None

4. Actuated Valves

None

5. Switches

None

III. Interlocks/Controls

None

IV. Control Sequences

None

V. Alarms

None

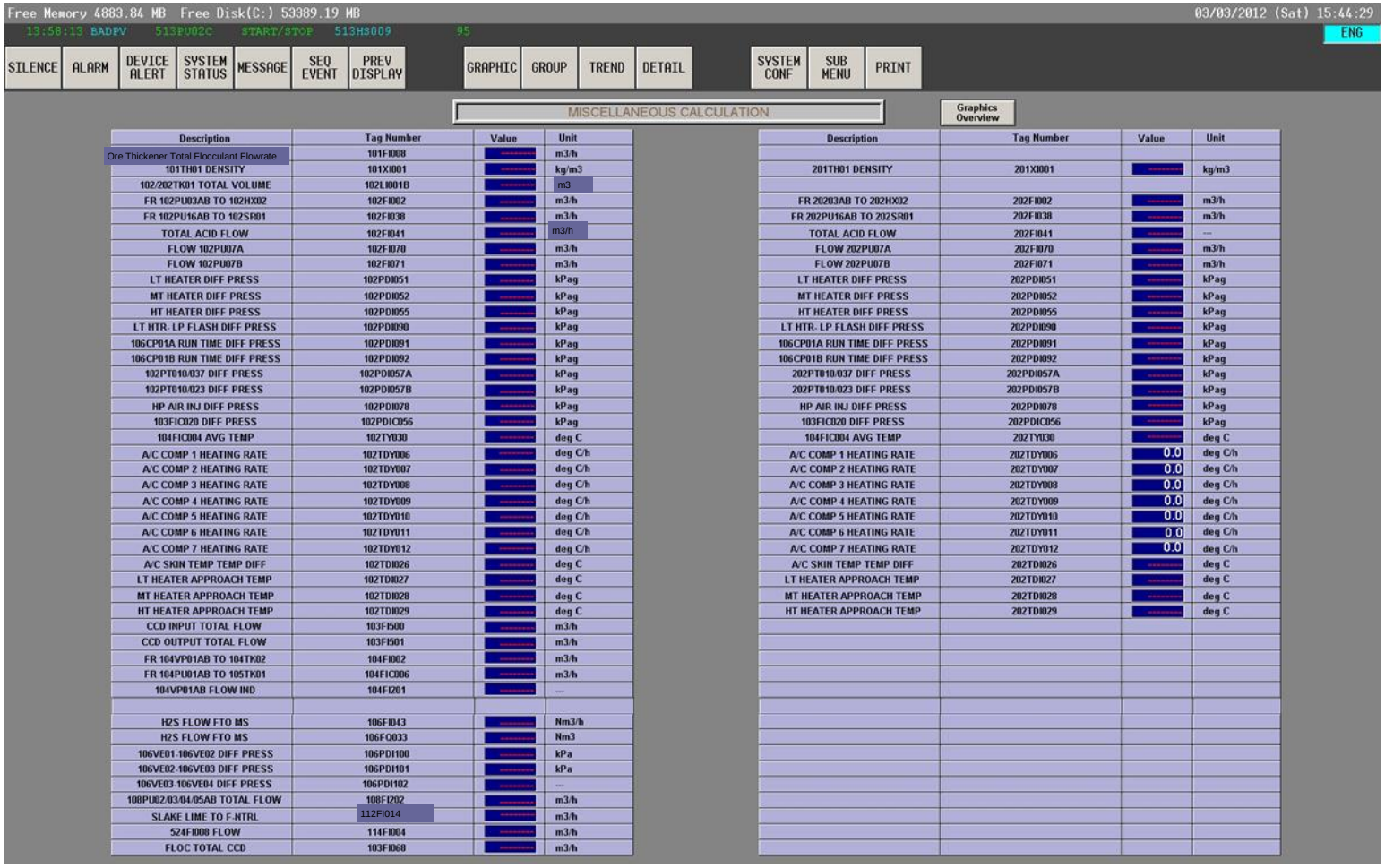
VI. DCS Emergency Shutdown

None

VII. Trend Graphs Grouping

None

Annex 1: MISCELLANEOUS CALCULATION DCS Graphics



Description	Tag Number	Value	Unit
Ore Thickener Total Flocculant Flowrate	101FI008		m3/h
101TH01 DENSITY	101XI001		kg/m3
102/202TK01 TOTAL VOLUME	102LI001B		m3
FR 102PU03AB TO 102HX02	102FI002		m3/h
FR 102PU16AB TO 102SR01	102FI038		m3/h
TOTAL ACID FLOW	102FI041		m3/h
FLOW 102PU07A	102FI070		m3/h
FLOW 102PU07B	102FI071		m3/h
LT HEATER DIFF PRESS	102PDI051		kPag
MT HEATER DIFF PRESS	102PDI052		kPag
HT HEATER DIFF PRESS	102PDI055		kPag
LT HTR- LP FLASH DIFF PRESS	102PDI090		kPag
106CP01A RUN TIME DIFF PRESS	102PDI091		kPag
106CP01B RUN TIME DIFF PRESS	102PDI092		kPag
102PT010/037 DIFF PRESS	102PDI057A		kPag
102PT010/023 DIFF PRESS	102PDI057B		kPag
HP AIR INJ DIFF PRESS	102PDI078		kPag
103FIC020 DIFF PRESS	102PDIC056		kPag
104FIC004 AVG TEMP	102TY030		deg C
A/C COMP 1 HEATING RATE	102TDY006		deg C/h
A/C COMP 2 HEATING RATE	102TDY007		deg C/h
A/C COMP 3 HEATING RATE	102TDY008		deg C/h
A/C COMP 4 HEATING RATE	102TDY009		deg C/h
A/C COMP 5 HEATING RATE	102TDY010		deg C/h
A/C COMP 6 HEATING RATE	102TDY011		deg C/h
A/C COMP 7 HEATING RATE	102TDY012		deg C/h
A/C SKIN TEMP TEMP DIFF	102TDI026		deg C
LT HEATER APPROACH TEMP	102TDI027		deg C
MT HEATER APPROACH TEMP	102TDI028		deg C
HT HEATER APPROACH TEMP	102TDI029		deg C
CCD INPUT TOTAL FLOW	103FI500		m3/h
CCD OUTPUT TOTAL FLOW	103FI501		m3/h
FR 104VP01AB TO 104TK02	104FI002		m3/h
FR 104PU01AB TO 105TK01	104FIC006		m3/h
104VP01AB FLOW IND	104FI201		---
H2S FLOW FTO MS	106FI043		Nm3/h
H2S FLOW FTO MS	106FQ033		Nm3
106VE01-106VE02 DIFF PRESS	106PDI100		kPa
106VE02-106VE03 DIFF PRESS	106PDI101		kPa
106VE03-106VE04 DIFF PRESS	106PDI102		---
108PU02/03/04/05AB TOTAL FLOW	108FI202		m3/h
SLAKE LIME TO F-NTRL	112FI014		m3/h
524FI008 FLOW	114FI004		m3/h
FLOC TOTAL CCD	103FI068		m3/h

Description	Tag Number	Value	Unit
201TH01 DENSITY	201XI001		kg/m3
FR 202PU03AB TO 202HX02	202FI002		m3/h
FR 202PU16AB TO 202SR01	202FI038		m3/h
TOTAL ACID FLOW	202FI041		---
FLOW 202PU07A	202FI070		m3/h
FLOW 202PU07B	202FI071		m3/h
LT HEATER DIFF PRESS	202PDI051		kPag
MT HEATER DIFF PRESS	202PDI052		kPag
HT HEATER DIFF PRESS	202PDI055		kPag
LT HTR- LP FLASH DIFF PRESS	202PDI090		kPag
106CP01A RUN TIME DIFF PRESS	202PDI091		kPag
106CP01B RUN TIME DIFF PRESS	202PDI092		kPag
202PT010/037 DIFF PRESS	202PDI057A		kPag
202PT010/023 DIFF PRESS	202PDI057B		kPag
HP AIR INJ DIFF PRESS	202PDI078		kPag
103FIC020 DIFF PRESS	202PDIC056		kPag
104FIC004 AVG TEMP	202TY030		deg C
A/C COMP 1 HEATING RATE	202TDY006	0.0	deg C/h
A/C COMP 2 HEATING RATE	202TDY007	0.0	deg C/h
A/C COMP 3 HEATING RATE	202TDY008	0.0	deg C/h
A/C COMP 4 HEATING RATE	202TDY009	0.0	deg C/h
A/C COMP 5 HEATING RATE	202TDY010	0.0	deg C/h
A/C COMP 6 HEATING RATE	202TDY011	0.0	deg C/h
A/C COMP 7 HEATING RATE	202TDY012	0.0	deg C/h
A/C SKIN TEMP TEMP DIFF	202TDI026		deg C
LT HEATER APPROACH TEMP	202TDI027		deg C
MT HEATER APPROACH TEMP	202TDI028		deg C
HT HEATER APPROACH TEMP	202TDI029		deg C