MIDWEST VANADIUM PTY LTDLTD

WINDIMURRA VANADIUM PROJECT
AREA 30 - DESILICATION CONTROL PHILOSOPHY

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CONTENTS

9.6 Desilication Filter - Includes Vendor PID

1.0 PROCESS DESCRIPTION

Reference P&ID: (6033-30-J-1001, 6033-30-J-1002, 6033-30-J-1003, 6033-30-J-1004)

1.1 Desilication Precipitation

Concentrated pregnant liquor, at a concentration of approximately 100 grams per litre V_2O_5 equivalent, is pumped to the dirty pregnant liquor tank (30TNK510) from Area 19 off-gas scrubbing system. The purpose of the new dirty pregnant liquor tank is to provide surge capacity to the desilication area of the plant.

The concentrated liquor is pumped (30PPC509 A) to the first of a series of two agitated desilication precipitation tanks (30TNK501, 502) via the desilication feed cooler (30HEX501). As the desilication process requires the addition of concentrated sulphuric acid for pH modification, a significant amount of heat is generated across the process. The purpose of the feed cooler is to reduce the temperature of the concentrated feed liquor, such that the exiting desilication slurry has a temperature below the maximum operating temperature of the filter press.

Aluminium sulphate is added to the tanks to precipitate out dissolved silica. The slightly alkali pH (ph 8.3) of the desilication liquor causes excess alum to precipitate out as a solid hydroxide. If the pH of the liquor is too high then the silica and aluminium may redissolve as soluble hydroxide complexes. For this reason sulphuric acid is added to maintain pH such that excess alum is consumed and that soluble hydroxides are not allowed to form. The basic reactions that govern precipitation are given below.

$$2SiO_{2(aq)} + Al_2(SO_4)_{3(aq)} + 8NaOH_{(aq)} \rightarrow Na_2O.Al_2O_3.2SiO_2.2H_2O.3Na_2SO_{4(s)} + 2H_2O_{(l)}$$

$$Al_2(SO_4)_{3(aq)} + 6NaOH_{(aq)} \rightarrow 2Al(OH)_{3(s)} + 3Na_2SO_{4(aq)}$$

$$2NaOH_{(aq)} + H_2SO_{4(aq)} \rightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$$

All reagents and liquor are added in the first desilication tank due to the large residence time. The liquor is then fed to the second desilication tank by a launder that exits the top of the first tank and feeds to the well agitated zone of the second tank. This modified launder is used to ensure that short circuiting of liquor is minimised. Each tank has a capacity of 90 m³, which represents a residence time of approximately 7 hours each.

1.2 Desilication Filtration

The ensuing slurry from the last precipitation tank gravity feeds the agitated desilication filter feed tank (30TNK503). The slurry is pumped (30PPC501 A) on a batch basis to the desilication filter press (30FTP501), with an area of 600 m^2.

Although not currently installed, the desilication facility allows for the future installation of a pre-coat system should this be deemed necessary during operation. The pre-coat system is designed to coat the filter cloth with a pre-coat of

diatomaceous earth to avoid very fine silicate solids from washing through the filter and to prevent the occurrence of blinding of the filter cloth due to precipitate growth within the cloth.

Raw water is used as the filter wash water. The wash water tank (30TNK504) has a capacity of 10 m³, which is enough for over 12 hours of operation. Wash water from the tank is pumped (30PPC502) to the filter as required during the batch filter cycle.

The solid material produced from the filter press is dumped into a cake bunker (30BKR501). The resulting stockpile of alumina silicates is transferred to the calcine dump (25DAM501) via a truck or trailer. The concentrated pregnant solution containing the valuable vanadium is collected from the filter press and pumped to the agitated, clear pregnant liquor storage tank (30TNK506). This tank has a capacity of 320 m³, which holds enough solution for over 24 hours of production. The solution is continuously pumped (30PPC504 A) from the tank to the pregnant liquor cooler (35HEX501) before AMV production and precipitation.

1.3 Aluminium Sulphate

Aluminium sulphate is required to precipitate out all of the silica associated with the concentrated pregnant liquor produced from leaching. Aluminium sulphate arrives on site via a road tanker and is offloaded (30PPC508) into a single storage tank (30TNK508). The storage tank holds 56 m³, which is more than 8 days consumption at the average demand. The solution is pumped (30PPC506 A/B) to the desilication tanks at the required dosage rate.

A sump pump (30PPS503) is located in the storage area to direct any aluminium sulphate spillage to the desilication tanks.

Safety showers (30SHS505, 506) are located in the offloading and storage areas for the reagent.

1.4 Sulphuric Acid

Sulphuric acid is used to control pH for silicate precipitation. The sulphuric acid solution is received on site from a road tanker. The solution is offloaded (30PPC507) into the sulphuric acid storage tank (30TNK507). The storage tank holds 83 m³, which is enough capacity for over 6 days consumption by the plant at average demand. The liquor is pumped (30PPC505 A/B) to the desilication tanks at the required dosage rate.

A sump pump (30PPS502) is located in the storage area to direct any sulphuric acid spillage to the desilication tanks.

Safety showers (30SHS503, 504) are located in the offloading and storage areas for the reagent.

2.0 CONTROL PHILOSOPHY

2.1 Desilication Precipitation

The desilication precipitation circuit consists of the Dirty Pregnant Liquor Tank (30TNK510) and Agitator (30AGT506), Discharge Pump (30PPC509A), Desilication Feed Cooler (30HEX501), Desilication Tanks (30TNK501/502) and Agitators (30AGT501/502) and Desilication Filter Feed Tank (30TNK503) and Agitator (30AGT503).

2.1.1 Dirty Pregnant Liquor Tank (30TNK510)

Concentrated liquor is pumped from the kiln off-gas system (19PPC501A/B) to the dirty pregnant liquor tank (30TNK510). The tank is mechanically agitated (30AGT506) to ensure solids suspension and is equipped with continuous level indication (LIC305106). The tank is equipped with a variable speed discharge pump (30PPC509A) to feed dirty preg solution to the desilication stage.

2.1.2 Dirty Pregnant Liquor Discharge Pump (30PPC509)

The dirty preg tank discharge pump is variable speed (SC305106A). The speed of the pump is controlled (FIC305111) to an operator input flow rate set point. Alternatively, the speed of the pump can be controlled to maintain a constant level (LIC305106) in the dirty preg tank (30TNK510). Due to the large size of the dirty preg tank, it is envisaged that the preferred method of control will be flow control.

The dirty preg tank discharge pump (30PPC509A) is a group start through the OIS. The group start opens the suction valve (HV305107) and then starts the pump provided the valve open status switch (ZSO305107) is energised. The suction valve is fail closed and fitted with proximity switches to indicate valve position. The proximity switches are interlocked to the operation of the pump.

The discharge pumps feed the desilication tanks via the desilication feed cooler (30HEX501). A magnetic flow meter fitted to the pump discharge pipe line provides an instantaneous (FIC305111) and totalised (FQ305111) readout of volumetric flow. Together with the operator input for the silica content of the dirty preg solution and the output from the flow meter, an algorithm in the DCS calculates the flow rate of aluminium sulphate required and this becomes the set point for the aluminium sulphate controller (FIC305105).

Provision has been made in design for the installation of a standby pump should this be deemed necessary.

2.1.3 Desilication Feed Cooler (30HEX501)

The desilication feed cooler (30HEX501) is a counter current spiral type heat exchanger.

The dirty preg solution and cooling water discharge from the heat exchanger are equipped with temperature indication (TI305104, TI305102). A differential pressure transmitter (PDT305123) measures the pressure drop across the heat exchanger and alarms (PDAH305123) at a high pressure drop to indicate to the operator that the heat exchanger may be blocked.

The temperature of the cooled dirty preg is measured (TE305103) and a temperature controller (TIC305103) controls the operation of the cooling water supply control valve (TCV30103) to maintain the operator input set point.

2.1.4 Desilication Tanks

Two desilication tanks (30TNK501/502) are provided. The tanks are mechanically agitated (30AGT501/502), rubber lined and fully enclosed. The slurry flow between the tanks occurs by gravity via fully enclosed launders.

The first desilication tank (30TNK501) is equipped with pH measurement (AI305113) to control the addition of concentrated sulphuric acid to maintain pH 8.3.

Desilication product from the second tank gravitates to the filter feed tank (30TNK503).

2.1.5 Sulphuric Acid Addition

Concentrated sulphuric acid at 98% H_2SO_4 is provided to the desilication area in a pressurised pipe line for addition to the first desilication tank. A pH meter (AE305113) is mounted in the first tank to measure the pH of the desilication slurry and control (AIC305113) the addition of sulphuric acid via the acid control valve (ACV305113).

A flow meter fitted to sulphuric acid pipe line provides an instantaneous (FI305101) and totalised (FQ305101) readout of volumetric flow.

2.1.6 Aluminium Sulphate Addition

Aluminium sulphate solution at 42% $Al_2(SO_4)_3$ is provided to the desilication area in a pressurised pipe line for addition to the first desilication tank (30TNK501).

The addition rate of aluminium sulphate is dependent on the concentration of soluble silica in the dirty preg solution. Routine sampling and analysis of the dirty preg solution is carried out by operations personnel to determine the soluble silica concentration in the dirty preg solution, and this value is an input at the OIS. Together with the desilication feed flow rate, an algorithm in the DCS calculates the flow rate of aluminium sulphate required and this is the set point for the aluminium sulphate controller (FIC305105).

The aluminium sulphate flow rate controller (FIC305105) controls the operation of the flow control valve (FCV305105) to maintain the required flow rate of aluminium sulphate.

2.2 Desilication Filtration

The Latham International 2000mm Membrane Filter Press runs in batch operation. Consequently much of the control surrounding the filter press is the sequencing of various stages of each batch cycle. The sequences are broken into 10 separate stages and are discussed in greater detail in the start up / shut down section. Reference to specific equipment configuration is also made in the start up / shut down section. Information provided in this control philosophy is adapted from vendor document P07-026 "*OPERATING & MAINTENACE INSTRUCTIONS FOR MODEL 2000x2000mm, 7 BAR, FULLY MECHANISED FILTER PRESS, HAVING 92/120 CHAMBERS x30MM CAKE, MULTIPLE PLATE SHAKER & CLOTH WASHING MACHINE*". This adaption is provided for information purposes only, the vendor document should be used as the official control philosophy regarding the filter press.

2.2.1 Closing Filter Press

The filtration cycle begins with the filter open. Before the cycle can continue the filter must be secured closed.

The AUTO ON switch must be selected on the on the panel door to give the signal to the DCS. When the press is securely closed the "PRESS CLOSED" light will illuminate on the control panel door.

Refer to section 8.6.1 for full sequence

2.2.2 Pre Coating of Filter Press (Future)

2.2.3 Feeding of Filter Press

The press must be closed to the correct pressure and sustaining before feed commences.

The filter press is fed from Desilication Filter Feed Tank (30TNK503) via a variable speed (SC305122) pump (30PPC501A). The pump feeds the filter at a constant pressure (PIC305122) for 180 minutes.

The filtrate from the filter is measured for turbidity (AE305217) and is recirculated to the Desilication Filter feed tank until the filtrate turbidity drops below a defined level and is directed to the clear preg tank (30TNK506).

Feed must be complete before progressing to further stages to prevent damage to membranes.

Refer to section 8.6.3 for full sequence

2.2.4 Squeezing

Plant air is fed to the filter to inflate membranes in the filter to a specified pressure of no more than 10 bar, the line is fitted with pressure indication (PI305419) and

High and Low alarms (PAH/PAL305419) to protect and allow detection of faults or leaks in the membranes.

The squeezing pressure applied by the membranes must be maintained until the deflate sequence.

Refer to section 8.6.4 for full sequence

2.2.5 Cake Washing

The filter cake is washed with raw water to recover vanadium holding liquor that is also present.

The filter wash water is delivered from the desilication wash water tank (30TNK504) and a fixed pump that delivers pressurised water for 15 minutes.

Refer to section 8.6.5 for full sequence

2.2.6 Cake Air Blowing

The filter cake is blown with plant air at approximately 5 bar, for 3 minutes to dry the cake allowing for easier discharge from the filter.

Refer to section 8.6.6 for full sequence

2.2.7 Core Blow

The core is blown with plant air at approximately 5 bar, for 2 minutes to remove residual liquid that would otherwise remain in the core. The liquid removed in this step reports to the core drain rather than the filtrate line.

Refer to section 8.6.7 for full sequence

2.2.8 Deflate

The membranes are deflated to a set pressure (PI305419). A status signal is displayed when preliminary deflation is complete, the membranes then will be deflated for a further 60 seconds.

Refer to section 8.6.8 for full sequence

2.2.9 Opening

The opening of the press takes place via the hydraulic system and is achieved when the open-to-open proximity switch (ZS305472) is activated.

With the hydraulic system running and the press open the cake discharge may proceed.

Refer to section 8.6.9 for full sequence

2.2.10 Cake Discharge

The filter cake is discharged from the press using mechanical shakers.

Each set of plates is shaken individually for a maximum of 45 seconds. The cycle is complete after the shift carriage end stop switch (ZS305408) is activated and the final set of plates is shaken.

This completes a full cycle of the filter press.

Refer to section 8.6.10 for full sequence

2.2.11 Cloth Washing (1 x week)

The cloth washing cycle is initiated from the local control box on the filter press by switching to “OFF” after cake discharge and pressing the “CLOTH WASH” button on the junction box. The cloth washing process requires approximately 42m3 of water and is consequently only performed on a weekly basis.

To ensure plates are in the correct positions, the press is closed then opened before washing begins.

Each batch of plates is washed in two passes of the spray arm. The cycle is complete when the shifter carriage end stop switch (ZS305408) is activated and the final batch of plates has been washed and stacked and all equipment turned off and de energised.

Refer to section 8.6.11 for full sequence

2.2.12 Additional Information

The filter press is continually monitored by the DCS for fault conditions as listed below as well as standard motor failures and should be displayed on clients screen. Further faults conditions may be added or deleted at programme factory acceptance trials or site

a) At any time during the plate moving or washing cycle it is possible to select manual on the control panel. This will transfer the control to the pendant located on the filter press and the operator/maintenance staff can operate the unit at the press.

b) Loss of oil level in hydraulic unit should stop all operations and present alarm condition.

c) All valve movements to be monitored for open close position

d) Motor running to be monitored

e) Feed time exceeded.

f) Press failed to open in allocated time

g) Pressure in filter press to be monitored via transducer in feed line

h) During closing monitor time to pressure switch 1 if time set in DCS is exceeded alarm and stop closing

i) During closing monitor time to pressure switch 2 if time set in DCS is exceeded alarm and stop closing

j) During closing monitor time to sustain on pressure switch 2 if time set in DCS is exceeded alarm and stop closing

k) Monitor membrane pressure switch on inflate and deflate cycles

l) Check air is available for membrane squeeze if not alarm

m) Check air is available for core blow if not alarm

2.3 Sulphuric Acid Storage and Dosing

Concentrated Sulphuric Acid is delivered to site in road train tankers. On arrival, the road tanker driver reports to the central control room (CCR) operator to obtain authorisation to enter the plant area. A concrete apron is provided at the unloading facility and any spillage is collected in the sulphuric acid spillage pump (30PPS502).

The unloading facility includes an unloading pump (30PPC507). A local control panel is provided at the unloading facility to give the driver a local high level alarm, local “start loading” button and display of storage tank high high level alarm (LAH305302A).

Although unloading is locally initiated by the driver, the local control panel is not operable until authorisation has been provided from the CCR, including confirmation that an earth has been successfully achieved between delivery chassis and loading pipeline. Plant communication shall be initiated by the driver to the CCR operator if loading valve is still inhibited.

The sulphuric acid is pumped (30PPC507) from the road tanker to the sulphuric acid storage tank (30TNK507). The storage tank is equipped with level indication (LI305301) alarmed at high (LAH305301) and low level (LAL305301). The tank is equipped with a high high switch (LSHH305302) that, when triggered, activates a siren (SIR305303) and inhibits the offloading pump (30PPC507).

Located outside the bund is local control panel for the operation of the acid dosing pumps and isolation valves. Duty and standby acid dosing pumps are provided (30PPC505A/B). The duty standby arrangement is break before make, meaning that one pump will stop before the other starts, this is to reduce the possibility of fluid surging, especially due to the hazardous nature of sulphuric acid. The operator must open the suction valve (HV305305, HV305306) to the selected pump before the pump can be started. The suction valves are fail closed and fitted with proximity switches to indicate valve position. The proximity switches are interlocked to the operation of the respective pump.

The sulphuric acid feed pump discharge is fitted with a bleed line incorporating a restrictive orifice plate (RO305340) to prevent the damage to the pump should the pump be accidentally dead-headed.

The sulphuric acid storage area is equipped with a sump pump (30PPS502). The sump is alarmed at high level (LAH305309) to inform the operator the there has been a spillage of sulphuric acid in the bund. The operator must start (HS305309) the pump from the local control panel. The dirty preg tank discharge pump also interlocks with the sulphuric acid addition such that the sump cannot operate unless the dirty preg tank discharge pump is also operating

Two combination deluge and eye wash safety showers (30SHS503, 504) have been provided, one located outside the bund near the unloading facility and the other inside the bund.

2.4 Aluminium Sulphate Storage and Dosing

Aluminium sulphate liquid is delivered to site in road train tankers. On arrival, the road tanker driver reports to the central control room (CCR) operator to obtain authorisation to enter the plant area. A concrete apron is provided at the unloading facility and any spillage is collected and hosed into the aluminium sulphate spillage pump (30PPS503).

The unloading facility includes an unloading pump (30PPC508). A local control panel is provided at the unloading facility to give the driver a local high level alarm (LAH305321), local “start loading” button and display of storage tank high high level alarm (LAHH305322A). Although unloading is locally initiated by the driver, the local control panel is not operable until authorisation has been provided from the CCR, including confirmation that an earth has been successfully achieved between delivery chassis and loading pipeline. Plant communication shall be initiated by the driver to the CCR operator if loading valve is still inhibited.

The aluminium sulphate is pumped (30PPC508) from the road tanker to the aluminium sulphate storage tank (30TNK508). The storage tank is equipped with level indication (LI305321) alarmed at high (LAH305321) and low level (LAL305321). The tank is equipped with a high high switch (LSHH305322) that, when triggered, activates a siren (SIR305323) and inhibits the offloading pump (30PPC508).

A duty and standby aluminium sulphate dosing pump is provided (30PPC506A/B). The duty / standby arrangement is in a make before break configuration, this means that the standby pump will start up before the duty pump is stopped. This configuration is used to ensure there is a constant flow of Alum to the desilication circuit. The duty dosing pump (30PPC506A) is initiated as a group start. The group start opens the suction and discharge valves (HV305325, HV305327) simultaneously and then starts the pump provided the valve open status switches are energised. The suction and discharge valves are fail closed and fitted with proximity switches to indicate valve position. The proximity switches are interlocked to the operation of the respective pump.

A flow meter fitted to aluminium sulphate feed pump discharge pipe line provides an instantaneous (FIC305105) and totalised (FQ305105) readout of volumetric flow.

The pump discharge is fitted with a bleed line incorporating a restrictive orifice plate (RO305324) to prevent the damage to the pump should the pump be accidentally dead headed.

The aluminium sulphate storage area is equipped with a sump pump (30PPS503). The pump automatically operates on detection of a high level (LSH305329) and stops at a low level (LSL305329).

Two combination deluge and eye wash safety showers (30SHS505, 506) have been provided, one located outside the bund near the unloading facility and the other inside the bund.

3.0 EQUIPMENT

The following are the drives in this area:

NOTE: for trends letters indicate the following trends

R = Running status
I = Amps
MO = Motor output (for VSD and reversible drives)

Drive Name	No.1 Desilication Tank Agitator
Equipment Number	30AGT501
Drive Type	DOL
P&ID Number	6033-30-J-1001
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, Slow
Process Interlocks	Will trip 30PPC509A/B when stopped

Drive Name	No.2 Desilication Tank Agitator
Equipment Number	30AGT502
Drive Type	DOL
P&ID Number	6033-30-J-1001
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, Slow
Process Interlocks	Will trip 30PPC509A/B when stopped

Drive Name	Desilication Filter Feed Tank Agitator
Equipment Number	30AGT503
Drive Type	DOL
P&ID Number	6033-30-J-1001
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, Slow
Process Interlocks	Will trip 30PPC509A/B when stopped

Drive Name	Precoat Tank Agitator (FUTURE)
Equipment Number	30AGT504
Drive Type	DOL
P&ID Number	6033-30-J-1002
Modes	Auto or Manual
Alarms	Standard Drive
Trend	Nil
Process Interlocks	Nil

Drive Name	Dirty Preg Tank Agitator
Equipment Number	30AGT506
Drive Type	DOL
P&ID Number	6033-30-J-1001
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, Slow
Process Interlocks	Nil

Drive Name	Desilication Filter Press Hydraulic Pump
Equipment Number	30FTP501
Drive Type	DOL
P&ID Number	6033-30-J-1002
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, Slow
Process Interlocks	Nil

Drive Name	Desilication Filter Feed Pump
Equipment Number	30PPC501A
Drive Type	VSD
P&ID Number	6033-30-J-1001
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, MO, Slow
Process Interlocks	Nil

Drive Name	Standby Desilication Filter Feed Pump (FUTURE)
Equipment Number	30PPC501B
Drive Type	VSD
P&ID Number	6033-30-J-1001
Modes	Auto or Manual
Alarms	Standard Drive
Trend	Nil
Process Interlocks	Nil

Drive Name	Desilication Wash Water Pump
Equipment Number	30PPC502
Drive Type	DOL
P&ID Number	6033-30-J-1002
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, Slow
Process Interlocks	Nil

Drive Name	Precoat Pump (Future)
Equipment Number	30PPC503
Drive Type	DOL
P&ID Number	6033-30-J-1002
Modes	Auto or Manual
Alarms	Standard Drive
Trend	Nil
Process Interlocks	Nil

Drive Name	Precipitation Feed Pump
Equipment Number	30PPC504A
Drive Type	VSD
P&ID Number	6033-30-J-1002
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, MO, Slow
Process Interlocks	Nil

Drive Name	Standby Precipitation Feed Pump (FUTURE)
Equipment Number	30PPC504B
Drive Type	VSD
P&ID Number	6033-30-J-1002
Modes	Auto or Manual
Alarms	Standard Drive
Trend	Nil
Process Interlocks	Nil

Drive Name	Sulphuric Acid Feed Pump (A / B)
Equipment Number	30PPC505A/B
Drive Type	DOL
P&ID Number	6033-30-J-1003
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, Slow
Process Interlocks	Nil

Drive Name	Aluminium Sulphate Feed Pump (A / B)
Equipment Number	30PPC506A/B
Drive Type	DOL
P&ID Number	6033-30-J-1003
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, Slow
Process Interlocks	Nil

Drive Name	Sulphuric Acid Offloading Pump
Equipment Number	30PPC507
Drive Type	DOL
P&ID Number	6033-30-J-1003
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, Slow
Process Interlocks	Nil

Drive Name	Aluminium Sulphate Offloading Pump
Equipment Number	30PPC508
Drive Type	DOL
P&ID Number	6033-30-J-1003
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, Slow
Process Interlocks	Nil

Drive Name	Dirty Preg Tank Discharge Pump
Equipment Number	30PPC509A
Drive Type	VSD
P&ID Number	6033-30-J-1001
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, MO, Slow
Process Interlocks	Nil

Drive Name	Standby Dirty Preg Tank Discharge Pump (FUTURE)
Equipment Number	30PPC509B
Drive Type	VSD
P&ID Number	6033-30-J-1001
Modes	Auto or Manual
Alarms	Standard Drive
Trend	Nil
Process Interlocks	Nil

Drive Name	Desilication Cloth Wash Pump
Equipment Number	30PPC510
Drive Type	DOL
P&ID Number	6033-30-J-1002
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, I, Slow
Process Interlocks	Nil

Drive Name	Desilication Spillage Pump
Equipment Number	30PPS501
Drive Type	DOL
P&ID Number	6033-30-J-1002
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, Slow
Process Interlocks	Nil

Drive Name	Sulphuric Acid Spillage Pump
Equipment Number	30PPS502
Drive Type	DOL
P&ID Number	6033-30-J-1003
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, Slow
Process Interlocks	Nil

Drive Name	Aluminium Sulphate Spillage Pump
Equipment Number	30PPS503
Drive Type	DOL
P&ID Number	6033-30-J-1003
Modes	Auto or Manual
Alarms	Standard Drive
Trend	R, Slow
Process Interlocks	Nil

4.0 INSTRUMENTS

4.1 Analogue Indicators

The following are the analogue indicators in this area:

Indicator Name	Filter Press Discharge Turbidity meter			
Indicator Number	AI-30-5217			
P&ID Number	6033-30-J-1002			
Indicator Type	Field Indicator			
Range	0 - 100 ppm			
Normal	N/A			
Alarms	HH	H	L	LL
Values	90	80		
Priorities	Urgent	Control		
Process Interlocks	AAH opens AV305217A and Closes AV305217B If AAH not active AV305217A is Closed and AV305217B is Open			
Trend	Fast			
Extras	Nil			
Cascaded Loop	Nil			

Indicator Name	Sulphuric acid addition line			
Indicator Number	FI-30-5101			
P&ID Number	6033-30-J-1001			
Indicator Type	Field Indicator			
Range	0 - 2 m3/hr			
Normal	0.9			
Alarms	HH	H	L	LL
Values	1.86	1.72	0.25	0.1
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Nil			
Trend	Slow			
Extras	Phase - Liquid / SG - 1.89			
Cascaded Loop	Nil			

Indicator Name	Filter Press Filtrate line			
Indicator Number	FI-30-5220			
P&ID Number	6033-30-J-1002			
Indicator Type	Field Indicator			
Range	0 - 40 m3/hr			
Normal	33			
Alarms	HH	H	L	LL
Values	35	34	8	4
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Nil			
Trend	Slow			
Extras	Phase - Liquid / SG - 1.1			
Cascaded Loop	Nil			

Indicator Name	30-AGT-501 Motor Current Indicator			
Indicator Number	II-30-5124			
P&ID Number	6033-30-J-1001			
Indicator Type	Field Indicator			
Range	0 – 10 Amps			
Normal	N/A			
Alarms	HH	H	L	LL
Values	7.6	7.2	2.4	2
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	IALL will trip 30AGT501 when activated for 60s			
Trend	Slow			
Extras	Nil			
Cascaded Loop	Nil			

Indicator Name	30-AGT-502 Motor Current Indicator			
Indicator Number	II-30-5125			
P&ID Number	6033-30-J-1001			
Indicator Type	Field Indicator			
Range	0 – 10 Amps			
Normal	N/A			
Alarms	HH	H	L	LL
Values	7.6	7.2	2.4	2
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	IALL will trip 30AGT502 when activated for 60s			
Trend	Slow			
Extras	Nil			
Cascaded Loop	Nil			

Indicator Name	30-AGT-503 Motor Current Indicator			
Indicator Number	II-30-5126			
P&ID Number	6033-30-J-1001			
Indicator Type	Field Indicator			
Range	0 – 10 Amps			
Normal	N/A			
Alarms	HH	H	L	LL
Values	7.6	7.2	2.4	2
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	IALL will trip 30AGT503 when activated for 60s			
Trend	Slow			
Extras	Nil			
Cascaded Loop	Nil			

Indicator Name	30-AGT-506 Motor Current Indicator			
Indicator Number	II-30-5126			
P&ID Number	6033-30-J-1001			
Indicator Type	Field Indicator			
Range	0 – 20 Amps			
Normal	N/A			
Alarms	HH	H	L	LL
Values	15.2	14.5	5	4
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	IALL will trip 30AGT503 when activated for 60s			
Trend	Slow			
Extras	Nil			
Cascaded Loop	Nil			

Indicator Name	Desilication Filter feed Tank			
Indicator Number	LI-30-5118			
P&ID Number	6033-30-J-1001			
Indicator Type	Field Indicator			
Range	0 - 100 %			
Normal	60			
Alarms	HH	H	L	LL
Values	90	80	20	10
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	LALL will trip 30PPC501A when activated LAHH will trip 30PPC509A when activated			
Trend	Slow			
Extras	Phase - Slurry / SG - 1.12			
Cascaded Loop	Nil			

Indicator Name	Desilication Wash Water Tank			
Indicator Number	LI-30-5212			
P&ID Number	6033-30-J-1002			
Indicator Type	Field Indicator			
Range	0 - 100 %			
Normal	60			
Alarms	HH	H	L	LL
Values	90	80	20	10
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	LALL will trip 30PPC502 when activated			
Trend	Slow			
Extras	Phase - Liquid / SG - 1			
Cascaded Loop	Nil			

Indicator Name	Sulphuric Acid Storage Tank			
Indicator Number	LI-30-5301			
P&ID Number	6033-30-J-1003			
Indicator Type	Field Indicator			
Range	0 - 100 %			
Normal	60			
Alarms	HH	H	L	LL
Values	90	80	20	10
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	LALL will trip 30PPC505A/B when activated LAH will activate LAH305302A on local panel when activated LAHH will trip 30PPC507			
Trend	Slow			
Extras	Phase - Liquid / SG - 1.89			
Cascaded Loop	Nil			

Indicator Name	Aluminium Sulphate Storage Tank			
Indicator Number	LI-30-5321			
P&ID Number	6033-30-J-1003			
Indicator Type	Field Indicator			
Range	0 - 100 %			
Normal	60			
Alarms	HH	H	L	LL
Values	90	80	20	10
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	LALL will trip 30PPC506A/B when activated LAH will activate LAH305321A on local panel when activated LAHH will trip 30PPC507 and sound SIR305323 when activated			
Trend	Slow			
Extras	Phase - Liquid / SG - 1.56			
Cascaded Loop	Nil			

Indicator Name	Desilication Feed Cooler			
Indicator Number	PDI-30-5123			
P&ID Number	6033-30-J-1001			
Indicator Type	Field Indicator			
Range	0 - 65 kPag			
Normal	50			
Alarms	HH	H	L	LL
Values	60	55	20	15
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Nil			
Trend	Slow			
Extras	Phase - Slurry			
Cascaded Loop	Nil			

Indicator Name	Desilication Cloth Water Filter			
Indicator Number	PDI-30-5209			
P&ID Number	6033-30-J-1002			
Indicator Type	Field Indicator			
Range	0 - 30 kPag			
Normal	20			
Alarms	HH	H	L	LL
Values	27	25	15	10
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Nil			
Trend	Slow			
Extras	Phase - Liquid			
Cascaded Loop	Nil			

Indicator Name	Desilication Wash Water Pump			
Indicator Number	PI-30-5213			
P&ID Number	6033-30-J-1002			
Indicator Type	Field Indicator			
Range	0 - 1120 kPag			
Normal	800			
Alarms	HH	H	L	LL
Values	1000	900	500	100
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	PALL and PAHH will cause 305PPC502 to trip when activated			
Trend	Slow			
Extras	Phase - Liquid			
Cascaded Loop	Nil			

Indicator Name	Precipitation Feed Pump			
Indicator Number	PI-30-5223			
P&ID Number	6033-30-J-1002			
Indicator Type	Field Indicator			
Range	0 - 150 kPag			
Normal	100			
Alarms	HH	H	L	LL
Values	135	120	80	50
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	PAHH will cause 305PPC504A to trip when activated			
Trend	Slow			
Extras	Phase - Liquid			
Cascaded Loop	Nil			

Indicator Name	Cooling Water Return			
Indicator Number	TI-30-5102			
P&ID Number	6033-30-J-1001			
Indicator Type	Field Indicator			
Range	0 - 80 deg C			
Normal	55			
Alarms	HH	H	L	LL
Values	70	65	20	15
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Nil			
Trend	Slow			
Extras	Phase - Liquid			
Cascaded Loop	Nil			

Indicator Name	Desilication Cooler Inlet			
Indicator Number	TI-30-5104			
P&ID Number	6033-30-J-1001			
Indicator Type	Field Indicator			
Range	0 - 100 deg C			
Normal	90			
Alarms	HH	H	L	LL
Values	100	97	20	10
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Nil			
Trend	Slow			
Extras	Phase - Slurry / SG - 1.2			
Cascaded Loop	Nil			

Indicator Name	Desilication Filter Feed Tank			
Indicator Number	TI-30-5120			
P&ID Number	6033-30-J-1001			
Indicator Type	Field Indicator			
Range	0 - 100 deg C			
Normal	85			
Alarms	HH	H	L	LL
Values	90	87	20	10
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	TAHH will trip 30PPC501A when activated			
Trend	Slow			
Extras	Phase - Slurry / SG - 1.2			
Cascaded Loop	Nil			

4.2 Status Indicators

The Following are the status Switches within the area.

NOTE: A generic description of status indicators is provided in the generic control philosophy. Status indicators listed below vary from the generic description

Status Name	Acid Storage Tank Hi Hi Level
Status Number	LSHH-30-5302
States	1 = Healthy, 0= LAHH
Process Interlocks	LSHH will trip 30PPC507 when activated
Indication	LAHH-30-5302 and SIR-30-5303
Extras	Provides Redundancy for LI305301

Status Name	Alum Storage Tank Hi Hi Level
Status Number	LSHH-30-5322
States	1 = Healthy, 0= LAHH
Process Interlocks	LSHH will trip 30PPC508 when activated
Indication	LAHH-30-5322 and SIR-30-5323
Extras	Provides Redundancy for LI305321

Status Name	Dirty Preg Tank Discharge Pump Selection
Status Number	HS-30-5106
States	1 = 30PPC509B (Future), 0= 30PPC509A
Process Interlocks	Will send Start/Stop signal and controller outputs to selected pump
Indication	HS-30-5106 and selection to be visible on DCS
Extras	Control Room operator to be able to select from DCS 30PPC509B does not exist but requires allowance for future installation

Status Name	Desilication Filter Feed Pump Selection
Status Number	HS-30-5122
States	1 = 30PPC501B (Future), 0= 30PPC501A
Process Interlocks	Will send Start/Stop signal and controller outputs to selected pump
Indication	HS-30-5106 and selection to be visible on DCS
Extras	Control Room operator to be able to select from DCS 30PPC501B does not exist but requires allowance for future installation

Status Name	Precipitation Feed Pump Selection and Mode of Operation
Status Number	HS-30-5218
States	Input 1 = LIC305218, 0= FIC355106 Output 1 = 30PPC504B (Future), 0= 30PPC504A
Process Interlocks	Will send Start/Stop signal and controller outputs to selected pump
Indication	HS-30-5106 and selection to be visible on DCS
Extras	Control Room operator to be able to select from DCS 30PPC504B does not exist but requires allowance for future installation

5.0 AUTOMATIC VALVES

5.1 ON/OFF Service

The following are the actuated (On / Off) valves in this area:

Valve Name	Dirty Preg Tank discharge
Valve Number	HV-305107
Valve Modes	Auto or Manual
P&ID Number	6033-30-J-1001
Process Interlocks	Will trip 30PPC509A when closed
Fail Position	Closed
Indication	Open, Closed
Extras	Nil

Valve Name	Desil Filter feed tank discharge
Valve Number	HV-305121
Valve Modes	Auto or Manual
P&ID Number	6033-30-J-1001
Process Interlocks	Will trip 30PPC501A when closed
Fail Position	Closed
Indication	Open, Closed
Extras	Nil

Valve Name	Desil Slurry dump to sump
Valve Number	HV-305210
Valve Modes	Auto or Manual
P&ID Number	6033-30-J-1002
Process Interlocks	Nil
Fail Position	Closed
Indication	Open, Closed
Extras	Nil

Valve Name	Dirty filtrate return valve
Valve Number	AV-305217A
Valve Modes	Auto or Manual
P&ID Number	6033-30-J-1002
Process Interlocks	AV-305217B will open when AV-305217A is closed
Fail Position	Open
Indication	Open, Closed
Extras	Nil

Valve Name	Clean filtrate receival valve
Valve Number	AV-305217B
Valve Modes	Auto or Manual
P&ID Number	6033-30-J-1002
Process Interlocks	AV-305217A will open when AV-305217B is closed
Fail Position	Closed
Indication	Open, Closed
Extras	Nil

Valve Name	H_2SO_4 feed pump B suction valve
Valve Number	HV-305305
Valve Modes	Auto or Manual
P&ID Number	6033-30-J-1003
Process Interlocks	Will trip 30PPC505B when closed
Fail Position	Closed
Indication	Open, Closed
Extras	Nil

Valve Name	H_2SO_4 feed pump A suction valve
Valve Number	HV-305306
Valve Modes	Auto or Manual
P&ID Number	6033-30-J-1003
Process Interlocks	Will trip 30PPC505A when closed
Fail Position	Closed
Indication	Open, Closed
Extras	Nil

Valve Name	Aluminium Sulphate feed pump A suction line
Valve Number	HV-305325
Valve Modes	Auto or Manual
P&ID Number	6033-30-J-1003
Process Interlocks	Will trip 30PPC506B when closed
Fail Position	Closed
Indication	Open, Closed
Extras	Nil

Valve Name	Aluminium Sulphate feed pump B suction line
Valve Number	HV-305326
Valve Modes	Auto or Manual
P&ID Number	6033-30-J-1003
Process Interlocks	Will trip 30PPC506A when closed
Fail Position	Closed
Indication	Open, Closed
Extras	Nil

Valve Name	Aluminium Sulphate feed pump B discharge line
Valve Number	HV-305327
Valve Modes	Auto or Manual
P&ID Number	6033-30-J-1003
Process Interlocks	Will trip 30PPC506B when closed
Fail Position	Closed
Indication	Open, Closed
Extras	Nil

Valve Name	Aluminium Sulphate feed pump A Discharge
Valve Number	HV-305328
Valve Modes	Auto or Manual
P&ID Number	6033-30-J-1003
Process Interlocks	Will trip 30PPC506A when closed
Fail Position	Closed
Indication	Open, Closed
Extras	Nil

6.0 CONTROL LOOPS

The following are the Control Loops in this area:

Loop Name	Desilication pH Control			
Loop Input	AI-30-5113			
P&ID Number	6033-30-J-1001			
Loop Type	STD PID Loop			
Modes	Auto & Manual			
Range	1 - 14 pH			
Normal	8.3			
Alarms	HH	H	L	LL
Values	9.5	9	7	6
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Set to manual & Output to 0% when 30PPC509A/B stopped			
Trend	PV, SP & OP, Slow			
Loop Output	0 - 100 %	ACV-30-5113		
Action	Reverse			
Loop Tuning	Slow (Process Lag)			
Extras	Nil			
Cascaded Loop	Nil			

Loop Name	Desilication Alum Addition			
Loop Input	FI-30-5105			
P&ID Number	6033-30-J-1001			
Loop Type	STD PID Loop			
Modes	Auto, Manual & Cascade			
Range	0 - 1.7 m3/hr			
Normal	0.75			
Alarms	HH	H	L	LL
Values	1.53	1.36	0.34	0.17
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Nil			
Trend	PV, SP & OP, Fast			
Loop Output	0 - 100 %	FCV-30-5105		
Action	Direct			
Loop Tuning	Fast (Process Critical)			
Extras	Cascade Setpoint from FY305111			
Cascaded Loop	Nil			

Loop Name	Desilication circuit feed controller			
Loop Input	FI-30-5111			
P&ID Number	6033-30-J-1001			
Loop Type	STD PID Loop			
Modes	Auto & Manual			
Range	0 - 22.4 m3/hr			
Normal	14			
Alarms	HH	H	L	LL
Values	20.16	17.92	4.48	2.24
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Nil			
Trend	PV, SP & OP, Slow			
Loop Output	0 - 100 %	HS-30-5106, SC-30-5106A		
Action	Direct			
Loop Tuning	Slow			
Extras	Provides data to FY305111 HS allows choice between LIC305106 and FIC305111			
Cascaded Loop	Nil			

Loop Name	30-TNK-510 Level Controller			
Loop Input	LI-30-5106			
P&ID Number	6033-30-J-1001			
Loop Type	STD PID Loop			
Modes	Auto & Manual			
Range	0 - 100 %			
Normal	60			
Alarms	HH	H	L	LL
Values	90	80	20	10
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Nil			
Trend	PV, SP & OP, Slow			
Loop Output	0 - 100 %	HS-30-5106, SC-30-5106A		
Action	Reverse			
Loop Tuning	Slow			
Extras	HS allows choice between LIC305106 and FIC305111			
Cascaded Loop	Nil			

Loop Name	Clear Preg Tank Level Control			
Loop Input	LI-30-5218			
P&ID Number	6033-30-J-1002			
Loop Type	STD PID Loop			
Modes	Auto & Manual			
Range	0 - 100 %			
Normal	60			
Alarms	HH	H	L	LL
Values	90	80	20	10
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Nil			
Trend	PV, SP & OP, Slow			
Loop Output	0 - 100 %	HS-30-5218, SC-30-5218A		
Action	Reverse			
Loop Tuning	Slow			
Extras	HS allows choice between LIC305218 and FIC355106			
Cascaded Loop	Nil			

Loop Name	Filter Press Feed Pressure control			
Loop Input	PI-30-5122			
P&ID Number	6033-30-J-1001			
Loop Type	STD PID Loop			
Modes	Auto & Manual			
Range	0 - 800 kPag			
Normal	200			
Alarms	HH	H	L	LL
Values	720	640	160	80
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Nil			
Trend	PV, SP & OP, Moderate			
Loop Output	0 - 100 %	HS-30-5122, SC-30-5122A		
Action	Direct			
Loop Tuning	Moderate			
Extras	Nil			
Cascaded Loop	Nil			

Loop Name	Desilication Feed Cooler Outlet temperature control			
Loop Input	TI-30-5103			
P&ID Number	6033-30-J-1001			
Loop Type	STD PID Loop			
Modes	Auto & Manual			
Range	0 - 95 deg C			
Normal	55			
Alarms	HH	H	L	LL
Values	85.5	76	19	9.5
Priorities	Urgent	Control	Control	Urgent
Process Interlocks	Nil			
Trend	PV, SP & OP, Slow			
Loop Output	0 - 100 %	TCV-30-5103		
Action	Reverse			
Loop Tuning	Slow			
Extras	Nil			
Cascaded Loop	Nil			

7.0 CALCULATION BLOCKS

The following are the Calculation Blocks with in this area:

Calculation Name	Alum Dosing Calculation
Calculation Number	FY305111
Inputs	• Preg Liquor Flow (***F***) = FIC305111 (m^3/h) • Alum to silica ratio (***R***) = Metallurgist Input (Default = 2.847) • Alum excess ratio (***X***) = Metallurgist Input (Default = 1.33) • Soluble silica strength (***Si***) = Operator Input (Default = 4 g/L) • Alum solution strength (***Alum***) = Metallurgist Input (Default = 0.4 %w/w) • Alum solution density (***SGAlum***) = Metallurgist Input (Default = 1.2 t/m^3) • Correction Factor (α) = Metallurgist Input (Default = 1)
Outputs	Required Alum Flow (A) = Setpoint for FIC305105 (m^3/h)
Calculation	$(A) = \frac{(\alpha)*(X)*(R)*(F)*(Si)}{1000*(SGAlum)*(Alum)}$
Range	0 – 2.5 m^3/h
Mode	Active when FIC305105 is in CASCADE MODE (default operation mode)
Extras	Nil

8.0 FUNCTIONAL PREREQUISITES

Should there be an insufficient supply of dilute dirty preg solution or insufficient storage capacity in the clear preg tank, the operation of the Area described in this Section requires the following areas of the plant to be operational:

Area	System	Associated Drawing	Associated Control Philosophy
19	Off Gas	6033-19-J-1002	6033-G-00-F-006
35	AMV Prod.	6033-35-J-1001	6033-G-00-F-010

If sufficient storage capacity is available in the clear preg tank and sufficient feed for the area is available in the dirty preg tank, then no requisites apply.

9.0 STARTUP/SHUTDOWN SEQUENCES

9.1 Sulphuric Acid Distribution

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1		Various	Plant services	OPERATING
2			Drives in sequence	HEALTHY
3	LALL305301	30TNK507	Sulphuric acid dosing tank low low level	NOT ENERGISED
4		30PPS502	Sulphuric acid spillage pump	HEALTHY

Note – Although stated as sequences, these are manual sequences and will not be automated

Start Sequence – duty pump

Prerequisite	Step No.	Description
	1	Ensure manual suction, discharge and double block and bleed valves for the selected pump are OPEN
	2	Ensure Drain valves for selected pump are CLOSED
Steps 1 and 2	3	OPEN actuated valve on selected pumps suction line from Hand switch at local panel
Step 3	4	START Sulphuric acid feed pump in AUTO

Stop Sequence

Prerequisite	Step No.	Description
	1	STOP sulphuric acid feed pump
Step 1	2	CLOSE actuated valve on selected pumps suction line from Hand switch at local panel

Changer Over to Standby Sulphuric Acid Pump Sequence

Prerequisite	Step No.	Description
	1	Ensure manual suction, discharge and double block and bleed valves for the standby pump are OPEN
	2	Ensure Drain valves for the standby pump are CLOSED
Steps 1 and 2	3	OPEN actuated valve on the stand by pump's suction line from Hand switch at local panel
Step 3	4	STOP Duty Sulphuric acid feed pump
Step 4	5	START Standby Sulphuric acid feed pump in AUTO
Step 5	6	CLOSE actuated valve on the now stopped pump's suction line from Hand switch at local panel

9.2 Aluminium Sulphate Distribution

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1		Various	Plant services	OPERATING
2			Drives in sequence	HEALTHY
3	LALL305321	30TNK508	Aluminium sulphate tank low low level	NOT ENERGISED
4		30PPS503	Aluminium sulphate spillage pump	HEALTHY

Note – Although stated as sequences, the Start and Stop sequences are manual sequences and will not be automated

Start Sequence

Prerequisite	Step No.	Description
	1	Ensure manual suction and discharge valves for the selected pump are OPEN
	2	Ensure Drain valves for selected pump are CLOSED
Steps 1 and 2	3	OPEN actuated valve on selected pumps suction an discharge lines
Step 3	4	START Aluminium Sulphate feed pump in AUTO

Stop Sequence

Prerequisite	Step No.	Description
	1	STOP Aluminium Sulphate feed pump
Step 1	2	CLOSE actuated valves on selected pumps suction line and discharge lines

Changer Over to Standby Aluminium Sulphate Pump Sequence

Prerequisite	Step No.	Description
	1	OPEN actuated valves on standby pump's suction and discharge lines
Step 1	2	START standby Aluminium Sulphate feed pump in AUTO
Step 2	3	STOP Duty Aluminium Sulphate feed pump
Step 3	4	CLOSE actuated valves on Duty pump's suction line and discharge lines

9.3 Desilication Precipitation

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1		Various	Plant services	OPERATING
2			Drives in sequence	HEALTHY
3		Various	Sulphuric dosing system	OPERATING
4		Various	Aluminium sulphate system	OPERATING
5	PDT305123	30HEX501	Desilication feed cooler differential pressure	NOT LATCHED
6	LAH305118	30TNK503	Desilication filter feed tank	NOT ENERGISED

Start Sequence

Prerequisite	Step No.	Description
	1	Fill Dirty Preg Tank to 30% Level (LIC305106)
Step 1	2	START Dirty Preg Tank Agitator (30AGT506) in AUTO
	3	SET feed cooler temperature controller (TIC305103) to AUTO at 50 C
	4	SET Desilication tank 1 pH control (AIC305113) to AUTO at pH 8.3
	5	INPUT soluble SiO_2 concentration into Alum flow algorithm (FY305111)
	6	INPUT Alum reagent concentration into Alum flow algorithm (FY305111)
	7	Set Alum Flow control (FIC305105) loop to AUTO
Steps 2 – 7	8	OPEN Dirty Preg tank discharge valve (HV305107)
Step 8	9	START Dirty Preg Tank Discharge pump (30PPC509A) in AUTO (LIC305106) at 50% Level
Step 9	10	Operator to confirm No.1 Desilication tank level above agitator
Step 10	11	START No.1 Desilication Tank Agitator (30AGT501) in AUTO
Step 11	12	Operator to confirm No.2 Desilication tank level above agitator
Step 12	13	START No.2 Desilication Tank Agitator (30AGT502) in AUTO
Step 13	14	Operator to confirm Desilication Filter Feed tank level above agitator
Step 14	15	START Desilication Filter Feed tank Agitator (30AGT503) in AUTO

Stop Sequence

Prerequisite	Step No.	Description
	1	STOP Dirty Preg tank discharge pump (30PPC509A)
Step 1	2	CLOSE Dirty Preg tank discharge valve (HV305107)
Step 2	3	SET pH control (AIC305113) to MANUAL with sulphuric flow at 0
Step 3	4	SET Alum addition control (AIC305105) to MANUAL with Alum flow at 0

9.4 Sulphuric Acid Unloading

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1		Various	Plant services	OPERATING
2			Drives in sequence	HEALTHY
3			CCR authorisation - Sulphuric acid storage tank level of sufficient capacity	AUTHORISED
4		30PPS502	Sulphuric acid spillage pump	HEALTHY
5		30SHS503, 30SHS504	Safety showers operational	HEALTHY
6			Truck to be earthed	CONNECTED

Note – driver includes the driver and the supervising operator.
– Although stated as sequences, these are all manual sequences and will not be automated

Start Sequence

Prerequisite	Step No.	Description
	1	Driver to connect truck to unloading point
	2	Driver to confirm pump suction and discharge drain valves are CLOSED
Steps 1 and 2	3	OPEN Unloading pump suction valve
	4	OPEN Unloading pump discharge valve
Steps 3 and 4	5	START Sulphuric Acid Offloading Pump (30PPC507) via Start button on Local Panel (HS305302A)

Stop Sequence

Prerequisite	Step No.	Description
	1	STOP Sulphuric acid offloading pump via Stop button on Local Panel (HS305302B)
Step 1	2	OPEN pump suction and discharge drain valves
Step 2	3	Allow line to Drain
Step 3	4	CLOSE Unloading pump Discharge Valve
Step 4	5	CLOSE Unloading pump Suction Valve
Step 5	6	Driver to disconnect truck from unloading point
Step 6	7	Driver to disconnect Truck from earthing
Step 7	8	Operator to confirm to CCR that unloading is complete

9.5 Aluminium Sulphate Unloading

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1		Various	Plant services	OPERATING
2			Drives in sequence	HEALTHY
3			CCR authorisation - Aluminium sulphate storage tank level of sufficient capacity	AUTHORISED
4		30PPS503	Aluminium sulphate spillage pump	HEALTHY
5		30SHS505, 30SHS506	Safety showers operational	HEALTHY
6			Truck to be earthed	CONNECTED

Note – driver includes the driver and the supervising operator
– Although stated as sequences, these are all manual sequences and will not be automated

Start Sequence

Prerequisite	Step No.	Description
	1	Driver to connect truck to unloading point
	2	Driver to confirm pump suction and discharge drain valves are CLOSED
Steps 1 and 2	3	OPEN Unloading pump suction valve
	4	OPEN Unloading pump discharge valve
Steps 3 and 4	5	START Aluminium Sulphate Offloading Pump (30PPC508) via Start button on Local Panel (HS305321A)

Stop Sequence

Prerequisite	Step No.	Description
	1	STOP Aluminium Sulphate offloading pump via Stop button on Local Panel (HS305321B)
Step 1	2	OPEN pump suction and discharge drain valves
Step 2	3	Allow line to Drain
Step 3	4	CLOSE Unloading pump Discharge Valve
Step 4	5	CLOSE Unloading pump Suction Valve
Step 5	6	Driver to disconnect truck from unloading point
Step 6	7	Driver to disconnect Truck from earthing
Step 7	8	Operator to confirm to CCR that unloading is complete

9.6 Desilication Filter - Includes Vendor PID

Information provided in this control philosophy is an interpretation of the vendor document P07-026 "*OPERATING & MAINTENACE INSTRUCTIONS FOR MODEL 2000x2000mm, 7 BAR, FULLY MECHANISED FILTER PRESS, HAVING 92/120 CHAMBERS x30MM CAKE, MULTIPLE PLATE SHAKER & CLOTH WASHING MACHINE*". This interpretation is provided for information purposes only, the vendor document should be used as the official control philosophy regarding the filter press.

Operation of the Latham International 2000mm Membrane Filter Press is a batch process and consists of 10 distinct sequences.

- Closing Filter Press
- Feeding
- Squeezing
- Cake Washing
- Cake Air Blowing
- Core Blow
- Deflate
- Opening Cake Discharge
- Cloth Washing

9.6.1 Closing

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1		Various	Plant services	OPERATING
2			Drives in sequence	HEALTHY
3		PX305410	Feed valve	CLOSED
4		PX305414	Core drain valve	OPEN
5		PX305412	Pre-coat isolation valve	OPEN
6		PX305413	Pre-coat isolation valve	OPEN
7		PX305417	Filtrate isolation valve	OPEN
8		PX305415	Pre-coat return valve	CLOSED
9		PX305416	Filtrate/wash/air blow return valve	OPEN
10		PX305418	Wash water in valve	CLOSED
11		PX305419	Air in valve	CLOSED
12		PX305420	Core blow valve	CLOSED
13		PX305421	Membrane inflate valve	CLOSED
14		PX305422	Membrane vent valve	CLOSED
15		ZS305411	Plate moving equipment on parked limit switch	ACTIVATED
16		PT305419	Membrane Pressure Transducer at setting 1	ACHIEVED
17		ZS305432	Oil level switch must be made in hydraulic tank	ACTIVATED
18		ZS305472	Press follower must be on open switch	ACTIVATED
19		ZS305403	Washing machine must be on parked limit switch	ACTIVATED
20			Safety valid light must be illuminated on junction box	HEALTHY

Sequence

Prerequisite	Step No.	Description
	1	Press AUTO Switch on Panel Door
Step 1	2	Confirm Hydraulic power pack motor start
Step 2 + 3 min	3	ENERGISE Low Pressure Dump (Solenoid C)
	4	ENERGISE Bomb Door Raise (Solenoid G)
	5	DE ENERGISE Bomb Door Raise (Solenoid G)
Steps 3-5 + 40s	6	ENERGISE Close (Solenoid B)
	7	High Pressure Dump (Solenoid E)
	8	ENERGISE Confirm Safety Curtains Status is HEALTHY
Steps 6-8 + PT305429 is in Setting 1	9	DE ENERGISE Close (Solenoid B)
	10	DE ENERGISE Low Pressure Dump (Solenoid C)
Steps 9 and 10	11	DE ENERGISE High Pressure Dump (Solenoid E)

+ PT305429 is in Setting 2		
Step 11	12	Sustain Pressure

9.6.2 Feeding

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1		30FTP501	Filter Closed	CLOSED

Sequence

Prerequisite	Step No.	Description
	1	OPEN Feed valve (FV305410)
	2	CLOSE Core drain valve (FV305414)
	3	OPEN Pre-coat isolation valve (FV305412)
	4	OPEN Pre-coat isolation valve (FV305413)
	5	OPEN Filtrate isolation valve (FV305417)
	6	CLOSE Pre-coat return valve (FV305415)
	7	OPEN Filtrate/wash/air blow return valve (FV305416)
	8	CLOSE Wash water in valve (FV305418)
	9	CLOSE Air in valve (FV305419)
	10	CLOSE Core blow valve (FV305420)
	11	CLOSE Membrane inflate valve (FV305421)
	12	OPEN Membrane vent valve (FV305422)
Steps 1 - 12	13	SET Filter feed time in DCS
Step 13	14	OPEN desilication filter feed tank discharge valve (HV305121)
Step 14	15	START Desilication filter feed pump (30PPC501) in AUTO
Step 15	16	Begin Squeezing Sequence

9.6.3 Squeezing

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1			Feed Sequence complete	ACHIEVED

Sequence

Prerequisite	Step No.	Description
Filter feed time has elapsed	1	STOP Desilication filter feed pump (30PPC501)
	2	CLOSE desilication filter feed tank discharge valve (HV305121)
	3	CLOSE Feed valve (FV305410)
	4	CLOSE Membrane vent valve (FV305422)
	5	OPEN Membrane inflate valve (FV305421)
Steps 1-5	6	Confirm PT305419 is in setting 1
Step 6	7	Begin Cake Wash Sequence

9.6.4 Cake Washing

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1			Squeeze Sequence complete	ACHIEVED

Sequence

Prerequisite	Step No.	Description
	1	CLOSE Filtrate Isolation valve (FV305417)
	2	OPEN Wash Water valve (FV305418)
	3	SET wash time in DCS
Steps 1- 3	4	START Desilication Wash Water Pump (30PPC502) in AUTO
Step 4 + wash water time elapsed	5	STOP Wash Water pump (30PPC502)
Step 5	6	Begin Cake Air Blow Sequence

9.6.5 Cake Air Blowing

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1			Cake Washing Sequence complete	ACHIEVED

Sequence

Prerequisite	Step No.	Description
	1	SET Cake Air Blow time in DCS
	2	CLOSE Wash Water valve (FV305418)
Steps 1 and 2	3	OPEN Air Valve (FV305419)
Step 3 + cake air blow time elapsed	4	CLOSE Air valve (FV305419)
Step 4	5	Begin Core Blow Sequence

9.6.6 Core Blow

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1			Cake Air Blow Sequence Complete	ACHIEVED

Sequence

Prerequisite	Step No.	Description
	1	Set Core Blow Time in DCS
	2	CLOSE Air Blow valve (FV305419)
	3	OPEN Filtrate isolation valve (FV305417)
	4	OPEN Core Drain Valve (FV305414)
Steps 1 - 4	5	OPEN Core Blow Valve (FV305420)
Step 5 + Core blow time elapsed	6	CLOSE Core Blow Valve (FV305420)
Step 6	7	Begin Deflate Sequence

9.6.7 Deflate

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1			Core Blow Sequence Complete	ACHIEVED

Sequence

Prerequisite	Step No.	Description
	1	OPEN Filtrate / Wash / Air blow return valve (FV305416)
	2	CLOSE Membrane Inflate valve (FV305421)
Step 1 and 2	3	OPEN Membrane Vent valve (FV305422)
Step 3 + PT305419 is in Setting 1	4	CLOSE PS/3 membranes deflated switch
Step 4 + 1min	5	Begin Opening Sequence

9.6.8 Opening

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1			Deflate Sequence Complete	ACHIEVED
2	ZS30541		Plate Moving Equipment Park Switch	ACTIVATED
3	PT305419		Membrane Pressure Transducer at setting 1	ACHIEVED
4	ZS305432		Oil Level Switch	ACTIVATED
5	ZS305403		Washing machine parked limit switch	ACTIVATED
6			Safety Light on Junction Box	ACTIVE

Sequence

Prerequisite	Step No.	Description
	1	ENERGISE solenoid D (SV305431)
Step 1	2	CONFIRM Hydraulic power pack motor start
	3	Energise Solenoid C (SV305435) for low pressure dump
	4	ENERGISE Solenoid F (SV305425A) for bomb door lower
Steps 2-4 + 40s	5	DE ENERGISE Solenoid F (SV305425A) for bomb door lower
Step 5	6	ENERGISE Solenoid A (SV305430A) for Press open
Step 6 + Filter Press Open switch (ZS305472) activated	7	Begin Cake Discharge sequence

9.6.9 Cake Discharging

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1			Filter Press Open	OPEN
2	SV305435		Low Pressure Dump (Solenoid C)	ENERGISED

Sequence

Prerequisite	Step No.	Description
	1	Set shake time in DCS (<45s)
Step 1	2	ENERGISE Solenoid K (SV305438) for Shake
Step 2 + shake time elapsed	3	DE ENERGISE Solenoid K (SV305438) for Shake
Step 3	4	ENERGISE Solenoid L (SV305439) Latch Cylinders Hold
	5	ENERGISE Solenoid H (SV3054436A) for Plate mechanism reverse
Steps 4 and 5 + Shifter reverse proximity switch (SV3054) activated	6	DE ENERGISE Solenoid L (SV305439) Latch Cylinders Hold
	7	DE ENERGISE Solenoid H (SV3054436A) for Plate mechanism reverse
Steps 6 and 7	8	ENERGISE Solenoid J (SV3054436B) Plate mechanism forward
Step 8 + shifter forward switch activated (ZS305406)	9	ENERGISE Solenoid K (SV305438) for Shake
Step 9 + shake time elapsed	10	DE ENERGISE Solenoid K (SV305438) for Shake
Step 10	11	Repeat Steps 2 - 10 until all batches have been shaken and shifter carriage end stop activated
Step 11	12	ENERGISE Solenoid K (SV305438) for Shake of last batch of plates
Step 12 + shake time elapsed	13	DE ENERGISE Solenoid K (SV305438) for Shake
Step 13	14	ENERGISE Solenoid H (SV305436A) for Plate mechanism reverse
Step 14 + Shifter carriage end stop proximity switch (ZS305417)	15	DE ENERGISE all solenoids
Step 15	16	STOP Hydraulic power pack motor

9.6.10

9.6.11 Cloth Washing

The following are the sequences in this area:

Prerequisites

No.	TAG No.	Equip. No.	Description	Status
1		Various	Plant services	OPERATING
2			Drives in sequence	HEALTHY
3		PX305410	Feed valve	CLOSED
4		PX305414	Core drain valve	OPEN
5		PX305412	Pre-coat isolation valve	OPEN
6		PX305413	Pre-coat isolation valve	OPEN
7		PX305417	Filtrate isolation valve	OPEN
8		PX305415	Pre-coat return valve	CLOSED
9		PX305416	Filtrate/wash/air blow return valve	OPEN
10		PX305418	Wash water in valve	CLOSED
11		PX305419	Air in valve	CLOSED
12		PX305420	Core blow valve	CLOSED
13		PX305421	Membrane inflate valve	CLOSED
14		PX305422	Membrane vent valve	OPEN
15		ZS305411	Plate moving equipment on parked limit switch	ACTIVATED
16		ZS305432	Oil level switch must be made in hydraulic tank	ACTIVATED
17		ZS305403	Washing machine must be on parked limit switch	ACTIVATED
18			Safety valid light must be illuminated on junction box	HEALTHY

Sequence

Prerequisite	Step No.	Description
	1	ACTIVATE WASH on control panel Door
	2	Confirm Hydraulic power pack motor start
Steps 1 and 2	3	ENERGISE Solenoid C(SV305435) for Low Pressure Dump
Step 3	4	ENERGISE Solenoid G (SV305425B) for Bomb door raise
Step 4 + 40s	5	DE ENERGISE Solenoid G (SV305425B) Bomb door raise
Step 5	6	ENERGISE Solenoid B (SV305430B) for Close
Step 6	7	ENERGISE Solenoid E (SV305434) for High pressure dump
Step 7 + Press open switch (ZS305410) is not activated + PT305429 is in	8	STOP Hydraulic motor

setting 1		
Step 8	9	ENERGISE Solenoid D (SV305431) for Decompress closing cylinder
Step 9 + 30 s	10	DE ENERGISE Solenoid D (SV305431) for Decompress closing cylinder
Step 10	11	START Press Power Pack motor
Step 11	12	ENERGISE Solenoid C (SV305435) for Low Pressure Dump
Step 12	13	ENERGISE Solenoid A (SV305430A) for Press open
Step 13	14	CONFIRM Bomb Doors open
Step 14 + Filter press open proximity switch (ZS305472) is activated	15	CONFIRM Washing machine carriage start position is located on wash carriage end stop (ZS305408 is activated)
Step 15	16	ENERGISE Solenoid Q (SV305442B) Wash index motor forward
Step 16 + Wash index proximity switch (ZS305404) is activated	17	DE ENERGISE Solenoid Q (SV305442B) Wash index motor forward
Step 17	18	START wash pump in recirculation
Step 18	19	ENERGISE Solenoid N (SV305440B) Wash Arm Lower
	20	ENERGISE Solenoid S (SV305441) Slow down valve
Steps 19 and 20 + Wash Start Switch (ZS305402) is activated	21	DE ENERGISE Solenoid N (SV305440B) Wash Arm Lower
	22	DE ENERGISE Solenoid S (SV305441) Slow down valve
	23	CLOSE bypass valve (FV305428) from cloth wash to stop recirculation
	24	ENERGISE Solenoid N (SV305440B) Wash Arm Lower
Step 24 + Wash reverse proximity switch (ZS305401) is activated	25	DE ENERGISE Solenoid N (SV305440B) Wash Arm Lower
Step 25	26	ENERGISE Solenoid M (SV305440A) Wash Arm Raise
Step 26 + Wash Start Switch (ZS305402) is activated	27	DE ENERGISE Solenoid M (SV305440A) Wash Arm Raise
Step 27	28	OPEN bypass valve (PX305428) from cloth wash to start recirculation
Step 28	29	ENERGISE Solenoid M (SV305440A) Wash Arm Raise
	30	ENERGISE Solenoid S (SV305441) Slow down valve
Steps 29 and 30 + Wash arm parked switch (ZS305402) is activated	31	DE ENERGISE Solenoid M (SV305440A) Wash Arm Raise

	32	ENERGISE Solenoid S (SV305441) Slow down valve
Steps 31 and 32	33	Repeat Steps 17-32 until all plates in first batch have been washed and washing carriage reaches wash reverse proximity switch (ZS305401)
Step 33	34	DE ENERGISE Solenoid Q (SV305442B) Wash index motor forward
Step 34	35	ENERGISE Solenoid P (SV305442A) Wash index motor reverse
Step 35 + Wash index proximity switch (ZS305404) is activated	36	DE ENERGISE Solenoid P (SV305442A) Wash index motor reverse
Step 36	37	ENERGISE Solenoid L (SV305439) Latch cylinders hold
Step 37	38	ENERGISE Solenoid H (SV305436A) Plate mechanism reverse
Step 38 + Shifter reverse proximity switch (ZS305407) is activated	39	DE ENERGISE Solenoid L (SV305439) Latch cylinders hold
	40	DE ENERGISE Solenoid H (SV305436A) Plate mechanism reverse
Steps 39 and 40	41	ENERGISE Solenoid J (SV305436B) Plate mechanism forward
Step 41 + Shifter forward proximity switch (ZS305406) is activated	42	DE ENERGISE Solenoid J (SV305436B) Plate mechanism forward
Step 42	43	Continue process for each set of plates by repeating Steps 14-36 until shifter carriage end stop switch is activated (ZS305408)
Step 43 + shifter carriage end stop switch (ZS305408) is activated	44	DE ENERGISE Solenoid J (SV305436B) Plate mechanism forward
Step 44	45	Repeat Steps 18- 41 to wash last batch of plates
Step 45 + Wash index proximity switch (ZS305408) is activated	46	STOP Wash pump
Step 46	47	DE ENERGISE All Solenoids
Step 47	48	STOP hydraulic motor