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1. MAKE-UP WATER SYSTEM AND EXPANSION AND BLOWDOWN TANKS

Associated P&ID: 1-0101B-A0001, 1-0101B-A0002

Associated NEWPCC Manuals:

Associated DCS HMI Screens: nearea10.G

1.1 Process Description

.1 Potable water (PW) from potable water piping is treated with water softener as it flows into the make-up water tank (B903-MAKU). Two pumps in parallel (B904/905-BP-28/29) draw the PW from the tank and discharge it to the expansion tank to replace lost water.

1.2 Control Description

.1 Local Manual Control Mode:

.1 The Make-up pumps (B904/905-BP-28/29) can be started and stopped by the hand switches B904/905-HS-A.

.2 An alarm will be raised if the Make-up pumps run for longer than 900 seconds.

.2 Remote Manual Control Mode

.1 In REMOTE MANUAL mode the pumps can be started and stopped by the operator by the pop-up faceplate.

.2 An alarm will be raised if the Make-up pumps run for longer than 900 seconds.

.3 Remote Automatic Control Mode

.1 In REMOTE AUTOMATIC mode the pumps are run on a duty cycle, the duty assignment is rotated after the expansion tank level rises above 50%. The duty assignment rotation can be manually overridden by an operator by manually selecting the duty pump through a pop-up faceplate.

.1 In REMOTE AUTOMATIC mode the make-up pumps will only run while the high pressure signal PSH-B908 is normal.

.2 The assigned duty Make-up pump will start when the expansion tank level drops below 45%, the pump will run until the expansion tank level reaches 50%.

.3 If the duty Make-up pump fails while running in REMOTE AUTOMATIC mode, the standby pump will be assigned as duty, start and continue running until 50% level is achieved

.4 An alarm will be raised if the Make-up pump continuous runtime elapses longer than 900 seconds.

.4 Interlocks, Permissives and Control Signals

.1 For to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	B904/905-HS-A (COH)	Hand
Make-Up Pump (B904/905-BP-28/29)	Lock off stop hand switch	B904/905-HS-B (LOS)	Normal

.2 For to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		DA-904/905-MN	Start command
Control Room Panel	Computer/off/hand hand switch	B904/905-HS-A (COH)	Computer
Make-Up Pump (B904/905-BP-28/29)	Lock off stop hand switch	B904/905-HS-B (LOS)	Normal

.3 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Make-Up Pump (B904/905-BP-28/29)	Start command	DA-904/905-MN	Digital Output
Make-Up Pump (B904/905-BP-28/29)	Stop command	DA-904/905-MO	Digital Output
Make-Up Pump (B904/905-BP-28/29)	Run status	DA-904/905-MM	Digital Input
Make-Up Pump (B904/905-BP-28/29)	Computer/hand status	DA-904/905-YS	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Expansion Tank (B907-EXTK)	High tank pressure	DA-B908-PH	Digital Input
Expansion Tank (B907-EXTK)	Low tank pressure	DA-B908-PL	Digital Input
Expansion Tank (B907-EXTK)	Low tank level	DA-B907-LT	Analog Input

.4 HMI Display

Device Description	Status
Make-Up Pump (B904/905-BP-28/29)	Boiler water system malfunction (Normal/Sysmal)
Make-Up Pump (B904/905-BP-28/29)	Duty select (0=Auto/1=BP28/2=BP29)
Make-Up Pump (B904/905-BP-28/29)	Run status
Expansion Tank (B907-EXTK)	Tank level (%)
Expansion Tank (B907-EXTK)	High tank level (Normal/High)
Expansion Tank (B907-EXTK)	Low tank level (Normal/Low)

.5 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Make-Up Pump (B904/905-BP-28/29)	Boiler water system malfunction	Either make-up pump is running (DA-904/905-MM) for 900 seconds or more	Alarm notification
Make-Up Pump (B904/905-BP-28/29)	Make-up pump fault	The make-up pump (B904/905-BP-28/29) is called to start but is not running within 2 seconds of the start command	The other make-up pump Make-Up Pump (B905/904-BP-29/28) is called to start

2. BOILER CIRCULATION PUMPS

Associated P&ID: 1-0101B-A0003, 1-0101B-A0004

Associated NEWPCC Manuals:

Associated DCS HMI Screens:	nearea10.G, nbpp1.G, nboil5.G

2.1 Process Description

.1 Boiler Circulation Pumps

.1 The boiler circulation pumps (B200/100/900/300/400/551/552-BP-30/31/32/33/34/35/36) circulate the hot water from the mixing and expansion tank through the boilers for heating. Manual isolation valves are used to allow for redundant configuration of the circulation pumps as follows:

.1 Boiler 1 can be fed by BP-31 or BP-32

.2 Boiler 2 can be fed by BP-30 or BP-32

.3 Boiler 3 can be fed by BP-33 or BP-32

.4 Boiler 4 can be fed by BP-34 or BP-32

.5 Boiler 5 can be fed by BP-35 or BP-36

The boiler circulation pumps are generally controlled in LOCAL MANAUAL mode to allow to operator to visually confirm the manual valve configuration to prevent short circuiting.

2.2 Control Description

.1 Local Manual Control Mode

.1 The boiler circulation pumps (B200/100/900/300/400/551/552-BP-30/31/32/33/34/35/36) can be started and stopped by the hand switches B200/100/900/300/400/551/552-HS-A-1/2.

Boiler circulation pumps BP-30/31/32/33/34/35/36 have no REMOTE control. The run status is monitored by the PCS.

.2 Interlocks, Permissives and Control Signals

For boiler circulation pumps (B200/100/900/300/400-BP-30/31/32/33/34) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	B200/100/900/300/400-HS-A (COH)	Hand
Boiler Circulation Pump (B200/100/900/300/400-BP-30/31/32/33/34)	Lock off stop hand switch	B200/100/900/300/400-HS-B (LOS)	Normal

.3 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Boiler Circulation Pump (B200/100/900/300/400-BP-30/31/32/33/34)	Run status	DA-B200/100/900/300/400-MM	Digital Input
Boiler 5 Circulation Pump (B551/552-BP-35/36)	Run status	DA-551/552-MM	Digital Input

.4 HMI Display

Device Description	Status
Boiler Circulation Pump (B200/100/900/300/400-BP-30/31/32/33/34)	Run status
Boiler 5 Circulation Pump (B551/552-BP-35/36)	Run status

3. BOILERS 1 AND 2

Associated P&ID: 1-0101B-A0005, 1-0101B-A0006

Associated NEWPCC Manuals:

Associated DCS HMI Screens: nearea10.G, nboil1.G, nboil2.G

3.1 Process Description

Boilers 1 and 2 (B101/201) maintain the hot water supply temperature for sludge and plant heating. Boilers 1 and 2 can be valved and controlled to burn biogas or natural gas; a local switch needs to be operated when alternating between biogas and natural gas. The boilers control the gas supply though the jackshaft (B101/201-JS). The boilers also have a solenoid pilot starter valve (B101/201-SV) and blower (B101/201-FD).

3.2 Control Description

.1 Local Automatic Control Mode

Boilers 1 and 2 each have a local Provox controller which sequence the boiler equipment. In Hand mode the PCS can be bypassed and control the Hot Water temperature to a local jackshaft output .

.2 Remote Control Mode – General

In REMOTE mode, if the Hot Water Supply (HWS) temperature rises above 121°C the jackshaft position control set point will be overridden and set to 0%.

.3 Remote Manual Control Mode

In REMOTE mode the Provox controller receives the jackshaft position control set point from the PCS and a shutdown signal.

In REMOTE MANUAL mode the jackshaft position control set point percentage (Minimum: 15% %, Maximum: 90%) can be manually set by the operator.

The boiler Shutdown signal is generated by the PCS and will be activated if any of the following conditions occur for longer than 2 seconds:

The boiler's Hot Water temperature signal has bad quality.
The boiler's Hot Water flow is less than 25 L/s.
The boiler control panel's signal Fire Enable is not active.

The Shutdown signal is a latched alarm. The latch is reset when the alarm condition has cleared, and the boiler control panel's signal Fire Enable is active. The Shutdown signal cannot be manually activated/reset by the operators.

.4 Remote Automatic Control Mode – Single Boiler Temperature Control

In REMOTE AUTOMATIC mode for a single boiler, the jackshaft position control set point will be modulated to maintain the boiler Hot Water to an operator temperature set point (Minimum: 75ºC; Maximum: 121ºC;).

The boiler Shutdown signal will be activated if any of the following conditions occur for longer than 2 seconds:

The boiler's Hot Water temperature signal has bad quality.
The boiler's How Water flow is less than 25 L/s.
The boiler control panel's signal Fire Enable is not active.

The Shutdown signal is a latched alarm. The latch is reset when the alarm condition has cleared and the boiler control panel's signal Fire Enable is active.

.5 Remote Automatic Cascade Control Mode – Master Temperature Control

In Master Temperature Control mode, the operator can enter in a Plant Master temperature set point (104°C). A PID loop will modulate the plant master demand output percentage to maintain the Hot Water Supply temperature. This output is then scaled linearly between 80 and 160ºC and cascades down as the temperature set point for each individual boiler's PID loop.

The Master Temperature control requires at least 1 or more boiler to be in REMOTE AUTOMATIC CASCADE mode, if no boilers are available in cascade mode the Master Temperature Feedback loop will be set to manual and each boiler will be controlled by its respective set control mode (LOCAL MANUAL, REMOTE MANUAL, or REMOTE AUTOMATIC).

A low temperature alarm is raised if the Hot Water Supply (DA-B500-TT) temperature is 99°C or cooler.

A high temperature alarm is raised if the Hot Water Supply (DA-B500-TT) is 106°C or hotter.

A low temperature alarm is raised if the Hot Water Return (DA-B501-TT) temperature is below 89.5°C

.6 Interlocks, Permissives and Control Signals

For Boiler 1/2 to operate in LOCAL mode:

Equipment	**Device Description**	**Device Tag**	**State**
Local Control Panel	Burner flame relay	B101/201-BSY	Open main gas valve
Local Control Panel	Burner flame relay	B101/201-BSY	Modulate Jackshaft
Local Control Panel	Burner flame relay	B101/201-BSY	Start

For Boiler 1/2 to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		DA-B101/201-TC	Temperature control

.7 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Boiler 1/2	Boiler shutdown	DA-B101/201-BO	Digital Output
Boiler 1/2	Temperature control	DA-B101/201-TC	Analog Output
Boiler 1/2	High fire status	DA-B101/201-BH	Digital Input
Boiler 1/2	Fire enable	DA-B101/201-BS	Digital Input
Boiler 1/2	Computer/hand status	DA-B101/201-HM	Digital Input
Boiler 1/2	Flame failure	DA-B101/201-QA	Digital Input
Boiler 1/2	Fan run status	DA-B120/220-MM	Digital Input
Boiler 1/2	Hot water supply temperature	DA-B101/201-TT	Analog Input
Boiler 1/2	Jackshaft position	DA-B101/201-ZT	Analog Input
Boiler 1/2	Natural gas flow	DA-B104/204-FT	Analog Input
Boiler 1/2	Digester gas flow	DA-B105/205-FT	Analog Input
Boiler 1/2	Hot water return flow	DA-B121/221-FT	Analog Input

.8 HMI Display

Device Description	Status
Boiler 1/2	Boiler control (Provox/Bailey)
Boiler 1/2	Digester gas flow (m^3/h)
Boiler 1/2	Fire enable status (On/Off)
Boiler 1/2	General alarm (Normal/Fail)

Device Description	Status
Boiler 1/2	High fire (No/Yes)
Boiler 1/2	Hot water return flow (L/s)
Boiler 1/2	Hot water supply temperature (°C)
Boiler 1/2	Jackshaft position (%)
Boiler 1/2	Master control mode (Cascade/Manual)
Boiler 1/2	Master temperature control (°C)
Boiler 1/2	Natural gas flow (m^3/h)
Boiler 1/2	Stack temperature (°C)
Boiler System	Plant master control mode (Automatic/?)
Boiler System	Plant master temperature control (°C)

.9 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Boiler 1/2	General Alarm	DA-B101/201-QA in alarm	Alarm notification

4. BOILERS 3 AND 4

Associated P&ID: 1-0101B-A0007, 1-0101B-A0008

Associated NEWPCC Manuals:

Associated DCS HMI Screens: nearea10.G, nboil3.G, nboil4.G

4.1 Process Description

Boilers 3 and 4 (B301/401) maintain the hot water supply temperature for sludge and plant heating. Boiler 3 can be valved and controlled to burn biogas or natural gas, Boiler 4 is only run on natural gas; a local switch needs to be operated when alternating between biogas and natural gas. The boilers control the gas supply though the servo modulated valves (B301/401). The boilers also have a solenoid pilot starter valve (B301/401-SV), a blower damper (B301/401), and blower (B320/420-FD).

4.2 Control Description

.1 Local Automatic Control Mode

Boilers 3 and 4 each have a local Fireye controller which sequence the boiler equipment. In Hand mode the PCS can be bypassed and control the Hot Water temperature to a local set point.

.2 Remote Control Mode – General

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.3 Remote Manual Control Mode

In REMOTE mode the Fireye controller receives the firing rate control set point from the PCS and a shutdown signal.

In REMOTE MANUAL mode the servo position control set point percentage can be manually set by the operator.

The Shutdown signal can be manually sent to the boiler local controller through the Remote E-Stop button on the HMI. The boiler Shutdown signal will also be activated if any of the following conditions occur for longer than 2 seconds:

The boiler's Hot Water temperature signal has bad quality.

The boiler's Hot Water flow is less than 25 L/s.

The boiler control panel's signal Fire Enable is not active.

The Shutdown signal is a latched alarm. The latch is reset when the alarm condition has cleared and the boiler control panel's signal Fire Enable is active.

If the HWS temperature rises above 121°C the servo position control set point will be overridden and set to 0%.

.4 Remote Automatic Control Mode – Single Boiler Temperature Control

In REMOTE AUTOMATIC mode for a single boiler, the servo position control set point will be modulated to maintain the boiler Hot Water to an operator temperature set point (Minimum: 100°C °C; Maximum: 121°C).

If the HWS temperature rises above 121°C the servo position control set point will be overridden and set to 0%.

The boiler Shutdown signal will be activated if any of the following conditions occur for longer than 2 seconds:

The boiler's Hot Water temperature signal has bad quality.

The boiler's How Water flow is less than 25 L/s.
The boiler control panel's signal Fire Enable is not active.

The Shutdown signal is a latched alarm. The latch is reset when the alarm condition has cleared, and the boiler control panel's signal Fire Enable is active.

.5 Remote Automatic Cascade Control Mode – Master Temperature Control

In Master Temperature Control mode, the operator can enter in a Plant Master temperature set point. A PID loop will modulate the plant master demand output percentage to maintain the Hot Water Supply temperature. This output is then scaled linearly between 80 and 160°C and cascades down as the temperature set point for each individual boiler's PID loop.

The Master Temperature control requires at least 1 or more boiler to be in REMOTE AUTOMATIC CASCADE mode, if no boilers are available in cascade mode the Master Temperature Feedback loop will be set to manual.

A low temperature alarm is raised if the Hot Water Supply (DA-B500-TT) temperature is 99°C or cooler.

A high temperature alarm is raised if the Hot Water Supply (DA-B500-TT) is 106°C or hotter.

A low temperature alarm is raised if the Hot Water Return (B501-TT) temperature is below 89.5 C

.6 Interlocks, Permissives and Control Signals

.1 For Boiler 3/4 to operate in LOCAL (MANUAL) mode:

Equipment	**Device Description**	**Device Tag**	**State**
Local Control Panel	Burner flame relay	B301/401-BSY	Open main gas valve
Local Control Panel	Burner flame relay	B301/401-BSY	Modulate Servo
Local Control Panel	Burner flame relay	B301/401-BSY	Start

.2 For Boiler 3/4 to operate in COMPUTER (REMOTE) mode:

Equipment	**Device Description**	**Device Tag**	**State**
PCS		DA-B301/401-TC	Temperature control

.3 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Boiler 3/4	Boiler shutdown	DA-B301/401-BO	Digital Output
Boiler 3/4	Temperature control	DA-B301/401-TC	Analog Output
Boiler 3/4	High fire status	DA-B301/401-BH	Digital Input
Boiler 3/4	Fire enable	DA-B301/401-BS	Digital Input
Boiler 3/4	Computer/hand status	DA-B301/401-HM	Digital Input
Boiler 3/4	Flame failure	DA-B301/401-QA	Digital Input
Boiler 3/4	Fan run status	DA-B320/420-MM	Networked Digital Input
Boiler 3/4	Natural gas valve position	301/401-BMSSTA-06	Networked Analog Input
Boiler 3/4	Digester gas valve position	301/401-BMSSTA-07	Networked Analog Input
Boiler 3/4	Hot water supply temperature	DA-B301/401-TT	Analog Input
Boiler 3/4	Natural gas flow	DA-B304/404/554-FT	Networked Analog Input
Boiler 3/4	Digester gas flow	DA-B305/405-FT	Networked Analog Input
Boiler 3/4	Hot water return flow	DA-B321/421-FT	Analog Input

.4 HMI Display

Device Description	Status
Boiler 3/4	Boiler control (Fireye/Bailey)
Boiler 3/4	Digester gas flow (m^3/h)
Boiler 3/4	Digester gas valve position (%)
Boiler 3/4	Fire enable status (On/Off)
Boiler 3/4	Fuel (Sludge/Natural)
Boiler 3/4	General alarm (Normal/Fail)

Device Description	Status
Boiler 3/4	High fire (No/Yes)
Boiler 3/4	Hot water return flow (L/s)
Boiler 3/4	Hot water supply temperature (°C)
Boiler 3/4	Master control mode (Cascade/Manual)
Boiler 3/4	Master temperature control (°C)
Boiler 3/4	Natural gas flow (m^3/h)
Boiler 3/4	Natural gas valve position (%)
Boiler 3/4	Remote E-Stop
Boiler 3/4	Stack temperature (°C)
Boiler 3/4 Boiler System (BMS)	Blower run status (Off/On)
Boiler 3/4 Boiler System (BMS)	BMS Lockout History (last 10 lockout conditions)
Boiler 3/4 Boiler System (BMS)	Control (On/Off)
Boiler 3/4 Boiler System (BMS)	Digester gas valve (Off/On)
Boiler 3/4 Boiler System (BMS)	Fire enable (Off/On)
Boiler 3/4 Boiler System (BMS)	Firing mode (Local/Remote)
Boiler 3/4 Boiler System (BMS)	General alarm (Alarm/Fail)
Boiler 3/4 Boiler System (BMS)	Limits (Yes/No)
Boiler 3/4 Boiler System (BMS)	Log status (Standby/?)
Boiler 3/4 Boiler System (BMS)	Message (Boiler OFF/?)
Boiler 3/4 Boiler System (BMS)	Mode (Enabled/Disabled)
Boiler 3/4 Boiler System (BMS)	Natural gas valve (Off/On)
Boiler 3/4 Boiler System (BMS)	Timer
Boiler 3/4 Fireye (HW)	Out (%)
Boiler 3/4 Fireye (HW)	Process value (%)
Boiler 3/4 Fireye (HW)	Setpoint (%)
Boiler 3/4 Fireye (HW)	Status (Automatic/Manual)

Device Description	Status
Boiler 3/4 PPC	Air damper position
Boiler 3/4 PPC	Digester gas position (%)
Boiler 3/4 PPC	High fire (No/Yes)
Boiler 3/4 PPC	Manual modulation rate
Boiler 3/4 PPC	Module rate
Boiler 3/4 PPC	Natural gas position (%)
Boiler 3/4 PPC	PPC4000 status (Remote/Local)
Boiler System	Plant master control mode (Automatic/?)
Boiler System	Plant master temperature control (°C)

.5 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Boiler 3/4	General Alarm	DA-B301/401-QA in alarm	Alarm notification

5. BOILER 5

Associated P&ID: 1-0101B-A0009

Associated NEWPCC Manuals:

Associated DCS HMI Screens: nearea10.G, nboil5.G

5.1 Process Description

Boiler 5 is Out of Service and being replaced with different smaller boilers

Boilers 5 (B501) maintains the hot water supply temperature for sludge and plant heating. Boiler 5 burns natural gas. The boilers control the gas burned by modulating the firing rate. The boiler runs blower (B501-FD).

5.2 Control Description

.1 Local Automatic Control Mode

Boiler 5 has a local Autoflame controller which sequence the boiler equipment. In Hand mode the PCS can be bypassed and control the Hot Water temperature to a local set point.

.2 Remote Control Mode – General

In REMOTE mode, if the HWS temperature rises above 125°C the jackshaft position control set point will be overridden and set to 0%.

If the any of the following conditions occur the jackshaft position control set point will maintain it's current value:

Boiler failed signal is active.
Fire Enable signal from boiler is not active.
The boiler Shutdown signal is active.

.3 Remote Manual Control Mode

In REMOTE mode the Autoflame controller receives the firing rate control set point from the PCS and a shutdown signal.

In REMOTE MANUAL mode the firing rate control set point percentage (Minimum: 0%; Maximum: 100%) can be manually set by the operator.

The Shutdown signal cannot be manually sent to the boiler local controller. The boiler Shutdown signal will be activated if any of the following conditions occur for longer than 2 seconds:

The boiler's Hot Water temperature signal has bad quality.

The boiler's Hot Water flow is less than 25 L/s.

The boiler control panel's signal Fire Enable is not active.

The Shutdown signal is a latched alarm. The latch is reset when the alarm condition has cleared and the boiler control panel's signal Fire Enable is active.

.4 Remote Automatic Control Mode – Single Boiler Temperature Control

In REMOTE AUTOMATIC mode, the firing rate control set point will be modulated to maintain the boiler Hot Water to an operator temperature set point (Minimum: 75°C; Maximum: 150°C; Initial: 104°C).

The boiler Shutdown signal will be activated if any of the following conditions occur for longer than 2 seconds:

The boiler's Hot Water temperature signal has bad quality.

The boiler's How Water flow is less than 25 L/s.
The boiler control panel's signal Fire Enable is not active.

The Shutdown signal is a latched alarm. The latch is reset when the alarm condition has cleared, and the boiler control panel's signal Fire Enable is active.

.5 Remote Automatic Control Mode – Master Temperature Control

In Master Temperature Control mode, the operator can enter in a Plant Master temperature set point. A PID loop will modulate the plant master demand output percentage to maintain the Hot Water Supply temperature. This output is then scaled linearly between 80 and 160°C and cascades down as the temperature set point for each individual boiler's PID loop.

The Master Temperature control requires at least 1 or more boiler to be in REMOTE AUTOMATIC CASCADE mode, if no boilers are available in cascade mode the Master Temperature Feedback loop will be set to manual.

A low temperature alarm is raised if the Hot Water Return temperature is below 100 °C, a low-low alarm is raised it the temperature drops below 89.5°C.

A Hydrocarbon analyzer will alarm at 20% LEL. A fault status is monitored for the Hydrocarbon analyzer.

.6 Interlocks, Permissives and Control Signals

For to operate in LOCAL (MANUAL) mode:

Equipment	**Device Description**	**Device Tag**	**State**
Local Control Panel	Local/remote hand switch	HS-4 (L/R)	Local
Local Control Panel	Start hand switch	HS-1 (Start)	Start
Local Control Panel	On/off hand switch	HS-2 (O/O)	On

For to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Local/remote hand switch	HS-4 (L/R)	Remote
PCS		DA-B551-TC	Temperature Control

.7 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Boiler 5	Boiler shutdown	DA-B551-BO	Digital Output
Boiler 5	Temperature control	DA-B551-TC	Analog Output
Boiler 5	Computer/hand status	DA-B550-HM	Digital Input
Boiler 5	Fan run status	DA-B550-MM	Digital Input
Boiler 5	Fire enable	DA-B551-BS	Digital Input
Boiler 5	Flame failure	DA-B551-QA	Digital Input
Boiler 5	Hot water supply temperature	DA-B551-TT	Analog Input
Boiler 5	Jackshaft position	DA-B551-ZT	Analog Input
Boiler 5	Chimney temperature	DA-B552-TT	Analog Input
Boiler 5	Natural gas flow	DA-B554-FT	Analog Input
Boiler 5	Digester gas flow	DA-B555-FT	Analog Input
Boiler 5	Hot water return flow	DA-B571-FT	Analog Input
Boiler 5	20% LEL	DA-B551-LEL	Digital Input
Boiler 5	Gas Detector Fault	DA-B552-QF	Digital Input

.8 HMI Display

Device Description	Status
Boiler 5	Analyzer status (Normal/Fail)
Boiler 5	Boiler control (Autoflame/Baily)
Boiler 5	Boiler master temperature (°C)
Boiler 5	Boiler master temperature control (Automatic/Manual)

Device Description	Status
Boiler 5	Fire enable (On/Off)
Boiler 5	Firing rate (%)
Boiler 5	General alarm (Normal/Fail)
Boiler 5	Hot water return temperature (°C)
Boiler 5	Hot water supply temperature (°C)
Boiler 5	Hydrocarbon 20% LEL alarm (Normal/Alarm)
Boiler 5	Plant master temperature (°C)
Boiler 5	Plant master temperature control (Automatic/Manual)
Boiler 5	Shutdown (Normal/Alarm)
Boiler 5	Stack temperature (°C)

.9 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Boiler 5	General alarm	DA-B551-QA in alarm	Alarm notification
Boiler 5	Hydrocarbon 20% LEL alarm	DA-B551-LEL in alarm	Alarm notification
Boiler 5	HC Analyzer fault	DA-B552-QF in alarm	Alarm notification

6. HOT WATER MIXING TANK

Associated P&ID: 1-0101B-A0010

Associated NEWPCC Manuals:

Associated DCS HMI Screens: nearea10.G

6.1 Process Description

HWS from the boilers flow into the hot water mixing tank. Hot Water Return (HWR) from the following sources flow into the mixing tank:

Dewatering heat and ventilation
Boiler house heat and ventilation
Main building heat and ventilation
Digester heat and ventilation
Digester sludge heat exchangers
Secondary clarifier heat and ventilation.

The hot water mixing tank supplies the hot water distribution pumps with HWS. Excess hot water from the mixing tank is drained to the blowdown tank.

6.2 Control Description

The PCS monitors the main boiler hot water return (DA-B501-TT) and supply (DA-B500-TT) temperatures.

.1 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Hot water mixing tank	Main boiler loop return temperature	DA-B501-TT	Analog Input
Hot water mixing tank	Main boiler loop supply temperature	DA-B500-TT	Analog Input

.2 HMI Display

Device Description	Status
Hot water mixing tank	Main boiler loop return temperature (°C)
Hot water mixing tank	Main boiler loop supply temperature (°C)
Hot water mixing tank	Main boiler loop high supply temperature alarm (Normal/Alarm)
Hot water mixing tank	Main boiler loop low return temperature alarm (Normal/Alarm)

.3 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Hot water mixing tank	Main boiler loop high supply temperature	DA-B500-TT is 108°C or higher	Alarm notification
Hot water mixing tank	Main boiler loop low return temperature	DA-B500-TT is 89.5°C or lower	Alarm notification

7. HOT WATER DISTRIBUTION PUMPS

Associated P&ID:	1-0101B-A0011, 1-0101B-A0012, 1-0101B-A0013, 1-0101B-A0014
Associated NEWPCC Manuals:	
Associated DCS HMI Screens:	ndgabrn.G, nbpp1.G

7.1 Process Description

The hot water distribution pumps draw HWS from the hot water mixing tank.

Boiler HVAC Pumps (B704/705-BP-38/39) discharge the HWS to the boiler house heating and ventilation system.
Digester Sludge Heating Pumps (B706/707-BP-20/21) discharge the HWS to the digester sludge heat exchangers.
Digester HVAC Pumps (B701/702/703-BP-35/36/37) discharge the HWS to the BF20 heat exchanger and the Digesters heating and ventilation system.
Gas Sphere and Waste Gas Burner HVAC Pumps (B708/709-DP-22/23) discharge the HWS to Gas Sphere and Waste Gas Burner heating and ventilation system.
Main Building Distribution Pumps (B712/713-BP-43/44) discharge the HWS to the Main Building heating and ventilation system.
Secondary Distribution Pumps (B710/711-BP-41/42) discharge the HWS to the Secondary Clarifiers and Dewatering Building.

7.2 Control Description

The hot water distribution pumps can be operated in LOCAL (MANUAL) and REMOTE (COMPUTER) modes.

.1 Local Manual Control Mode – Hot Water Distribution Pumps

In LOCAL mode, the hot water distribution pumps are operated using the COMPUTER/OFF/HAND hand switch in the Boiler Control Room Panel (B701/702/703/704/705/706/707/708/709/712/713/710/711-HS-A).

.2 Remote Manual Control Mode – Hot Water Distribution Pumps

The hot water distribution pumps can be started and stopped in REMOTE MANUAL mode from the pop-up faceplate.

To start the hot water distribution pump, a 1 second start pulse is sent to the pump. To stop the hot water distribution pump, a 1 second stop pulse is sent to the pump.

.3 Remote Automatic Control Mode – Hot Water Distribution Pumps

The hot water distribution pumps must be started in MANUAL mode before switching to REMOTE AUTOMATIC.

In REMOTE AUTOMATIC mode, the hot water distribution pumps run continuously once they are manually started.

If the hot water distribution pumps is not running within 2 seconds of receiving a start command from the PCS, the hot water distribution pumps will go into alarm.

.4 Interlocks, Permissives and Control Signals

.1 Boiler HVAC Pumps (B704/705-BP-38/39), Digester Sludge Heating Pumps (B706/707-BP-20/21), Gas Sphere and Waste Gas Burner HVAC Pumps (B708/709-DP-22/23), Main Building Distribution Pumps (B712/713-BP-43/44), Secondary Distribution Pumps (B710/711-BP-41/42) Digester HVAC Pumps (B701/702/703-BP-35/36/37)

For Boiler HVAC Pumps (B704/705-BP-38/39), Digester Sludge Heating Pumps (B706/707-BP-20/21), Gas Sphere and Waste Gas Burner HVAC Pumps (B708/709-DP-22/23), Main Building Distribution Pumps (B712/713-BP-43/44), Digester HVAC Pumps (B701/702/703-BP-35/36/37) and Secondary Distribution Pumps (B710/711-BP-41/42) to operate in LOCAL (MANUAL) mode:

Equipment	**Device Description**	**Device Tag**	**State**
Control Room Panel	Computer/off/hand hand switch	B704/705-HS-A	Hand
		B701/702/703-HS-A	
		B706/707-HS-A	
		B708/709-HS-A	

Equipment	Device Description	Device Tag	State
		B712/713-HS-A	
		B710/711-HS-A	
Boiler HVAC Pump (B704/705-BP-38/39)	Lock off stop hand switch	B704/705-HS-B	Normal
Digester HVAC Pumps (B701/702/703-BP-35/36/37)		B701/702/703-HS-B	
Digester Sludge Heating Pump (B706/707-BP-20/21)		B706/707-HS-B	
Gas Sphere and Waste Gas Burner HVAC Pump (B708/709-DP-22/23)		B708/709-HS-B	
Main Building Distribution Pump (B712/713-BP-43/44)		B712/713-HS-B	
Secondary Distribution Pump (B710/711-BP-41/42)		B710/711-HS-B	

For Boiler HVAC Pumps (B704/705-BP-38/39), Digester Sludge Heating Pumps (B706/707-BP-20/21), Gas Sphere and Waste Gas Burner HVAC Pumps (B708/709-DP-22/23), Main Building Distribution Pumps (B712/713-BP-43/44), Digester HVAC Pumps (B701/702/703-BP-35/36/37) and Secondary Distribution Pumps (B710/711-BP-41/42) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		DA-B704/705-MN	Start command
		DA-B701/702/703	
		DA-B706/707-MN	
		DA-B708/709-MN	
		DA-B712/713-MN	
		DA-B710/711-MN	
Control Room Panel		B704/705-HS-A	

Equipment	Device Description	Device Tag	State
	Computer/off/hand hand switch	B701/702/703-HS-A	Compute r
		B706/707-HS-A	
		B708/709-HS-A	
		B712/713-HS-A	
		B710/711-HS-A	
Boiler HVAC Pump (B704/705-BP-38/39)	Lock off stop hand switch	B704/705-HS-B	Normal
Digester HVAC Pumps (B701/702/703-BP-35/36/37)		B701/702/703-HS-B	
Digester Sludge Heating Pump (B706/707-BP-20/21)		B706/707-HS-B	
Gas Sphere and Waste Gas Burner HVAC Pump (B708/709-DP-22/23)		B708/709-HS-B	
Main Building Distribution Pump (B712/713-BP-43/44)		B712/713-HS-B	
Secondary Distribution Pump (B710/711-BP-41/42)		B710/711-HS-B	

.5 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Boiler HVAC Pump (B704/705-BP-38/39)	Start command	DA-B704/705-MN	Digital Output
Boiler HVAC Pump (B704/705-BP-38/39)	Stop command	DA-B704/705-MO	Digital Output
Digester Sludge Heating Pump (B706/707-BP-20/21)	Start command	DA-B706/707-MN	Digital Output
Digester Sludge Heating Pump (B706/707-BP-20/21)	Stop command	DA-B706/707-MO	Digital Output

Equipment	Signal Description	Signal Tag	Signal Type
Digester HVAC Pump (B701/702/703-BP-35/36/37)	Start command	DA-B701/702/703-MN	Digital Output
Digester HVAC Pump (B701/702/703-BP-35/36/37)	Stop command	DA-B701/702/703-MO	Digital Output
Gas Sphere and Waste Gas Burner HVAC Pump (B708/709-DP-22/23)	Start command	DA-B708/709-MN	Digital Output
Gas Sphere and Waste Gas Burner HVAC Pump (B708/709-DP-22/23)	Stop command	DA-B708/709-MO	Digital Output
Main Building Distribution Pump (B712/713-BP-43/44)	Start command	DA-B712/713-MN	Digital Output
Main Building Distribution Pump (B712/713-BP-43/44)	Stop command	DA-B712/713-MO	Digital Output
Secondary Distribution Pump (B710/711-BP-41/42)	Start command	DA-B710/711-MN	Digital Output
Secondary Distribution Pump (B710/711-BP-41/42)	Stop command	DA-B710/711-MO	Digital Output
Boiler HVAC Pump (B704/705-BP-38/39)	Run status	DA-B704/705-MM	Digital Input
Boiler HVAC Pump (B704/705-BP-38/39)	Computer/hand status	DA-B704/705-YS	Digital Input
Digester Sludge Heating Pump (B706/707-BP-20/21)	Run status	DA-B706/707-MM	Digital Input
Digester Sludge Heating Pump (B706/707-BP-20/21)	Computer/hand status	DA-B706/707-YS	Digital Input
Digester HVAC Pump (B701/702/703-BP-35/36/37)	Run status	DA-B701/702/703-MM	Digital Input
Digester HVAC Pump (B701/702/703-BP-35/36/37)	Computer/hand status	DA-B701/702/703-YS	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Gas Sphere and Waste Gas Burner HVAC Pump (B708/709-DP-22/23)	Run status	DA-B708/709-MM	Digital Input
Gas Sphere and Waste Gas Burner HVAC Pump (B708/709-DP-22/23)	Computer/hand status	DA-B708/709-YS	Digital Input
Main Building Distribution Pump (B712/713-BP-43/44)	Run status	DA-B712/713-MM	Digital Input
Main Building Distribution Pump (B712/713-BP-43/44)	Computer/hand status	DA-B712/713-YS	Digital Input
Secondary Distribution Pump (B710/711-BP-41/42)	Run status	DA-B710/711-MM	Digital Input
Secondary Distribution Pump (B710/711-BP-41/42)	Computer/hand status	DA-B710/711-YS	Digital Input

.6 HMI Display

Device Description	Status
Boiler HVAC Pump (B704/705-BP-38/39)	Run status
Digester Sludge Heating Pump (B706/707-BP-20/21)	Run status
Digester HVAC Pump (B701/702/703-BP-35/36/37)	Run status
Gas Sphere and Waste Gas Burner HVAC Pump (B708/709-DP-22/23)	Run status
Main Building Distribution Pump (B712/713-BP-43/44)	Run status
Secondary Distribution Pump (B710/711-BP-41/42)	Run status

8. SUMP PUMP

Associated P&ID: 1-0101B-A0019

Associated NEWPCC Manuals:

Associated DCS HMI Screens: nearea10.G

8.1 Process Description

Sump pump B910-BP54 discharges the contents of the Boiler Building sump pit to a roof drain.

8.2 Control Description

The PCS monitors the sump level alarm status (DA-B910-LH). The PCS does not monitor or control the sump pump itself.

.1 Interlocks, Permissives and Control Signals

For Sump Pump (B910-BP54) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Sump Pump (B910-BP54)	Level control element	B910-LCE	Start

.2 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Sump Pump (B910-BP54)	High sump level	DA-B910-LH	Digital Input

.3 HMI Display

Device Description	Status
Sump Pump (B910-BP54)	High sump level alarm (Normal/Alarm)

.4 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Sump Pump (B910-BP54)	General alarm	DA-B910-LH in alarm	Alarm notification

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2. DIGESTER BATCH FEED SYSTEM

Associated P&ID:	1-0101D-A0022, 1-0101D-A0023, 1-0101D-A0024, 1-0101D-A0025, 1-0101D-A0026, 1-0101D-A0027
Associated NEWPCC Manuals:	D100 Revised, D300 Revised, D400 Revised, D600 Revised, D700 Revised
Associated DCS HMI Screens:	ndslfd.G, ndd11rl.G, ndd13rl.G, ndd09rl.G, ndd14rl.G, ndd12rl.G, ndd10rl.G, nddata.G, wgaspt3.G, ndgasw.G, digwls.G, ndsltr.G, ndd15gr.G, ndd13gr.G

2.1. Process Description

The Digesters are fed from sludge and scum from the Primary Clarifiers measured through flowmeter P700-FT. PS delivered by trucks from SEWPCC and WEWPCC are unloaded by pumps DP51/52 and measured through flowmeter D700-FT. The sludge and scum flow to the Primary Feed Header.

The Primary Feed Header has actuated feed valves leading to the six digester tanks:

1. Digester 9 is fed through actuated valve D102-HV
2. Digester 10 is fed through actuated valve D104-HV
3. Digester 11 is fed through actuated valve D101-HV
4. Digester 12 is fed through actuated valve D103-HV
5. Digester 13 is fed through actuated valve D105-HV
6. Digester 14 is fed through actuated valve D106-HV

2.2. Control Description

Each Digester feed valves can be controlled in LOCAL or REMOTE mode. In REMOTE mode each Digester feed valve can be controlled in MANUAL or AUTOMATIC mode.

2.2.1. Local Manual Control Mode

In LOCAL mode each digester feed valve is operated through field device panel FDP-1. The feed valve can be opened by the hand switch D102/104/101/103/105/106-HS-F and closed by hand switch D102/104/101/103/105/106-HS-G.

2.2.2. Remote Manual Control Mode

When a feed valve is in REMOTE MANUAL mode the valve position is set to open or closed by the operator.

2.2.3. Remote Automatic Control Mode

When a feed valve is in REMOTE AUTOMATIC mode the valve position is controlled by the Digester Batch Feed System (DBFS). To initiate the DBFS, at least two feed valves need meet the following conditions:

- Be in REMOTE mode
- Be in the closed position
- Associated high level float indicates weir level is not high.

The DBFS can be set by the operator to on or off. When the DBFS is set to on, the digester feed valves in AUTOMATIC mode are sequenced to fill each digester one at a time in rotating order. The digester that is filled first in the rotating order is configurable through an adjustable operator set point.
The digesters are filled in the following order, skipping digesters with feed valves not in automatic:

1. Digester 9 (D102-HV)
2. Digester 10 (D104-HV)
3. Digester 11 (D101-HV)
4. Digester 12 (D103-HV)
5. Digester 13 (D105-HV)
6. Digester 14 (D106-HV)
7. Repeat cycle

A digester will be fed until any of the following conditions are met, at which point the logic will trigger a step to the next digester in the sequence:

- The batch volume operator adjustable set point for the digester is reached (Low limit: $3m^3$; High limit: $300m^3$; Digesters 9 - 12 initially set to $3m^3$, Digesters 13 and 14 initially set to $3.5m^3$) as measured by:
  - For Digester 9 – 14: The sum of the total volumes measured through P700-FT and D700-FT while the respective digester's feed valve is open. If multiple valves are open due to LOCAL or MANUAL control, the flow to the digesters are assumed to be evenly divided across all digesters being fed.
- The operator adjustable batch duration set point is reached (Low limit 2 minutes; High limit 240 minutes; Each digester initially set to 120 minutes) as measured by the elapsed time the digester has been selected as the feeding digester by the DBFS.
- The feed valve is not in REMOTE.
- The respective digester's pressure reading is above 1.5 kPa and below 3.3 kPa. This is a latched alarm that needs to be reset by the operator. The digester will be skipped until the alarm is reset.
- The respective digester's weir high level float is indicating high level. This is a latched alarm that needs to be reset by the operator. The digester will be skipped until the alarm is reset.
- The feed valve has failed to respond in 120 seconds. This is a latched alarm that needs to be reset by the operator. The digester will be skipped until the alarm is reset. There is a batch over feed alarm for each digester that will alarm if it feeds more than 10 m^3 consecutively into one digester

Digester 9 and 13 have an additional condition to trigger the next step in the sequence:

- The total flow to Digester 9 is at least 820m^3
- The total flow to Digester 13 at least 920m^3

The DBFS will be stopped if 5 or more digesters have any of the following conditions:

- The feed valve is not in REMOTE.
- The respective digester's weir high level float is indicating high level. This is a latched alarm that needs to be reset by the operator. The digester will be skipped until the alarm is reset.
- The feed valve has failed to respond in 120 seconds. This is a latched alarm that needs to be reset by the operator. The digester will be skipped until the alarm is reset.

Each digester has an overflow weir that empties into Tank 1. The high-level float switch (D192/194/191/193/195/196-LSH) in the weir box detects high level in the tank.

Digester 11 uses a hydrostatic level transmitter (DB-D137-PT) to measure the level in the digester.

Each digester has a wired pressure monitor (D131/132/133/134/135/136-PT) for the gas pressure. These pressures are for operational control and alarms

Each digester has a wireless gas pressure (DC-D151/152/153/154/155/156-PT) transmitter that is used just for indication, and a dome temperature (DC-D151/152/153/154/155/156-TT) transmitter. The transmitter battery level is monitored (DC-D151/152/153/154/155/156-VT).

Each digester has wireless level transmitter (DC-D161/162/164/165/166-PT) in the vapour space . The signal quality (DC-D161/162/164/165/166-QV), measured in mV, of the vapor space transmitter is monitored through the PCS and displayed to the operators to use in determining the validity of the vapor space pressure reading.

2.2.4. Interlocks and Permissives

2.2.4.1. Digester Feed Valve (D102/104/101/103/105/106-HV)

For Digester Feed Valve (D102/104/101/103/105/106-HV) to open in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/hand hand switch	D102/104/101/103/105/106-HS-A (C/H)	Hand

For Digester Feed Valve (D102/104/101/103/105/106-HV) to operate in REMOTE (COMPUTER/HAND) mode:

Equipment	Device Description	Device Tag	State
PCS		DC-D102/104/101/103/105/106-VD	Open/Close command
Control Room Panel	Computer/hand hand switch	D102/104/101/103/105/106-HS-A (C/H)	Computer

Digester Feed Valve (D102/104/101/103/105/106-HV)	Local/remote hand switch	D102/104/101/103/105/106-HS-A (L/R)	Remote command

2.2.5. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Digester Feed Valve (D102/104/101/103/105/106-HV)	Valve close command	DC-D102/104/101/103/105/106-VB	Digital Output
Digester Feed Valve (D102/104/101/103/105/106-HV)	Valve open command	DC-D102/104/101/103/105/106-VD	Digital Output
Digester Feed Valve (D102/104/101/103/105/106-HV)	Computer/hand status	DC-D102/104/101/103/105/106-YS	Digital Input
Digester Feed Valve (D102/104/101/103/105/106-HV)	Valve close status	DC-D102/104/101/103/105/106-ZB	Digital Input
Digester Feed Valve (D102/104/101/103/105/106-HV)	Valve open status	DC-D102/104/101/103/105/106-ZD	Digital Input
Digester 9/10/11/12/13/14 (D192/194/191/193/195/196)	High level status	DC-D192/194/191/193/195/196-LH	Digital Input
Digester 11	Tank level	DB-D137-PT	Analog Input
Digester AI	Digester pressure	DC-D151/152/153/154/155/156-PT-1/2/3/4/5/6	Analog Input
Digester AI	Digester 9/10/12/13/14 vapor space	DC-D161/162/164/165/166-PV1	Analog Input
Digester AI 2	Digester 11 vapor space	DC-D130-LT	Analog Input
Digester AI	Digester 9/10/12/13/14 signal quality	DC-D161/162/164/165/166-QV1	Analog Input
Digester AI	Transmitter temperature	DC-D151/152/153/154/155/156-TT-1/2/3/4/5/6	Analog Input
Digester AI	Transmitter battery voltage	DC-D151/152/153/154/155/156-VT-1/2/3/4/5/6	Analog Input

2.2.6. HMI Display

Device Description	Status
Digester Feed Valve (D102/104/101/103/105/106-HV)	Reset valve status
Digester Feed Valve (D102/104/101/103/105/106-HV)	Flow rate (L/s)
Digester 9/10/11/12/13/14 (D192/194/191/193/195/196)	Vapour space (ft)

Digester 9/10/12/13/14 (D192/194/191/193/195/196)	Signal quality (mV)
Digester 9/10/11/12/13/14 (D192/194/191/193/195/196)	High level status
Digester 9/10/11/12/13/14 (D192/194/191/193/195/196)	Pressure reading (kPa)
Digester 9/10/11/12/13/14 (D192/194/191/193/195/196)	Pressure status (Normal/High/Low)
Digester 9/10/11/12/13/14 (D192/194/191/193/195/196)	Reset pressure status
Digester 11	Tank Level (ft H2O)
Digester AI	Transmitter temperature
Digester AI	Battery voltage

2.2.7. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Digester 9/10/11/12/13/14 (D192/194/191/193/195/196)	High pressure alarm	DC-D132/134/131-PT in alarm	Associated feed valve closed
Digester 9/10/11/12/13/14 (D192/194/191/193/195/196)	High level alarm	DC-D192/194/191/193/195/196-LH in alarm	Associated feed valve closed
Digester Feed Valve (D102/104/101/103/105/106-HV)	High flow alarm	DB-D112/114/111/113/115/116-FT is greater than 100 L/s	Alarm notification
Digester 9/10/11/12/13/14 (D192/194/191/193/195/196)	High Pressure Common Alarm	D138-PH is equal to or greater than 3.4 kPa	Associated compressor stops

3. PRIMARY SLUDGE RECEIVING

Associated P&ID: 1-0101D-A0019
Associated NEWPCC Manuals: D200 Revised
Associated DCS HMI Screens: nddatat1.G, ndslfd.G, ndpmp.G, nddata.G

3.1. Process Description

Primary Sludge (PS) from SEWPCC and WEWPCC is delivered to the digesters via sludge trucks. Two raw sludge pumps (D703-DP51 and D704-DP52) located in Digester Gallery 5 are used to unload the trucks. PS flows to D703-DP51 via ball valve D703-HV-A, and is pumped to join a common header via ball valve D703-HV-B. Similarly, PS flows to D704-DP52 via ball valve D704-HV-A, and is pumped to join the common header via ball valve D704-HV-B. The PS is pumped to the PS piping, the flow rate is measured by a magnetic flow meter (D700-FT). The PS is discharged to the primary sludge header.

Seal Water (SW) flows to each pump through valved lines. Each pump has a flow gauge for the seal water, however a valved line on either side of the gauge allows SW to bypass the gauge.

3.2. Control Description

The raw sludge pumps (DP51/52-D703/704) may be operated in LOCAL or REMOTE mode.

3.2.1. Local Manual Control Mode

In LOCAL mode, the pump (DP51/52-D703/704) is started and stopped through a local control panel.

3.2.2. Remote Manual Control Mode

In REMOTE mode, pump operation can be stopped, but not started.

The SW flow through the flow gauge is controlled through a solenoid valve interlocked with pump operation. . There must one digester sludge feed valve (D102/104/101/103/105/106-HV) open for DP 51 or DP52 to operate

3.2.3. Interlocks and Permissives

For pumps DP51-D703 and DP52-D704 to operate in LOCAL:

Equipment	Device Description	Device Tag	State
Local Control Panel	On/Off Hand switch	D703/704-HS-A (O/O)	On
Local Control Panel	Reset hand switch	D703/704-HS-C	Normal
Local Control Panel	Lock off stop hand switch	D703/704-HS-B (LOS)	Normal

3.2.4. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Pump (D703/704)	Pump stop command	DC-D703/704-MO	Digital Output
Pump (D703/704)	Pump run status	DC- D703/704-MM	Digital Input
Magnetic Flowmeter (D700)	S/E Sludge flow	DC- D703/704-FT	Analog Input

3.2.5. HMI Display

Device Description	Status
Magnetic Flowmeter (D700)	SEWPCC and WEWPCC Total Flow Interval
Magnetic Flowmeter (D700)	SEWPCC and WEWPCC Total Flow Today
Magnetic Flowmeter (D700)	SEWPCC and WEWPCC Total Flow Previous Day
Magnetic Flowmeter (D700)	Previous Day's Flow
Magnetic Flowmeter (D700)	Current Total Flow
Magnetic Flowmeter (D700)	Digester S&W Sludge Flow
Pump (D703/704)	SEWPCC and WEWPCC Daily Feed Count
Pump (D703/704), Magnetic Flowmeter (D700)	Alarm
Pump (D703/704)	Elapsed Runtime

3.2.6. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Pump (D703/D704)	High flow rate	Flow rate is above setpoint and pump (D703/704) is running	Alarm Notification

4. SLUDGE RECIRCULATION SYSTEM

Associated P&ID:	1-0101D-G-A0028, 1-0101D-A0029, 1-0101D-A0030, 1-0101D-A0031, 1-0101D-A0032, 1-0101D-A0033
Associated NEWPCC Manuals:	D500 Revised
Associated DCS HMI Screens:	nd09rlt1.G, ndd09rl.G, nd10rlt1.G, ndd10rl.G, nd11rlt1.G, ndd11rl.G, nd12rlt1.G, ndd12rl.G, nd13rlt1.G, ndd13rl.G, nd14rlt1.G, ndd14rl.G, nddata.G

4.1. Process Description

Each digester has its own dedicated sludge recirculation system. The DS from the digester is drawn through the recirculation pump (D112-DP9, D114-DP11, D111-DP8, D113-DP10, D115-DP12, D116-DP13). The sludge is heated and sent back to the digester.

The sludge is heated using a heat exchanger with a Hot Water Supply (HWS). A modulating actuated three-way valve controls how much hot water enters the heat exchanger. If the sludge requires heating, the valve is opened more to allow more HWS to the suction of the hot water circulation pump (DP15/17/14/16/18/19). If the sludge is heating too much the three-way valve can be modulated to allow less HWS and reduce the heating rate.

Digester	Sludge Recirculation Pump	Hot Water Circulation Pump	Three-Way HWS Suction Valve
9	D112-DP9	DP15	D112-TV
10	D114-DP11	DP17	D114-TV
11	D111-DP8	DP14	D111-TV
12	D113-DP10	DP16	D113-TV
13	D115-DP12	DP18	D115-TV
14	D116-DP13	DP19	D116-TV

4.2. Control Description

The sludge recirculation pump (D112-DP9, D114-DP11, D111-DP8, D113-DP10, D115-DP12, D116-DP13) and hot water circulation pump (DP15/17/14/16/18/19) are hardwire interlocked to run at the same time. They can be controlled in LOCAL or REMOTE mode as selected by a hand switch (D112/114/111/113/115/116-HS-A).

A three-way modulating actuated valve (D112/114/111/113/115/116-TV) throttles the amount of hot water going to the heat exchanger to control the sludge temperature. The three-way hot water valve (D112/114/111/113/115/116-TV) can be controlled in LOCAL or REMOTE mode.

4.2.1. Local Manual Control Mode – Sludge Recirculation Pump (D112/114/111/113/115/116-DP-9/11/8/10/12/13)

In LOCAL mode the pump pairs are started by placing the hand switch (D112/114/111/113/115/116-HS-A) in hand.

4.2.2. Local Manual Control Mode – Hot Water Valve (D112/114/111/113/115/116-TV)

In LOCAL (HAND) mode, the valve is controlled through a hand control station (D112/114/111/113/115/116-HK). The valve position is controlled using a thumbwheel at the hand control station.

4.2.3. Remote Manual Control Mode – Sludge Recirculation Pump (D112/114/111/113/115/116-DP-9/11/8/10/12/13)

In REMOTE mode, the pump is be operated in MANUAL mode. In REMOTE MANUAL mode, the pump pairs are started and stopped by the operator through the PCS.

4.2.4. Remote Manual Control Mode – Hot Water Valve (D112/114/111/113/115/116-TV)

In REMOTE MANUAL mode the valve position is set by the operator as a percentage.

4.2.5. Remote Automatic Control Mode – Hot Water Valve (D112/114/111/113/115/116-TV)

In REMOTE AUTOMATIC mode the valve position is controlled by a PID loop (K = 10.429; K_p = 3.0; K_I = 0.03; K_D = 0) to maintain the sludge temperature between 36 and 41ºC as measured by D112/114/111/113/115/116-TE.

A high temperature alarm will be raised if the hot water source is above 70ºC as measured by D122/124/121/123/125/126-TE. In REMOTE AUTOMATIC mode, when the high temperature alarm has been raised, the PID response will be slowed to compensate for the higher water temperature.

The pressure and temperature of the DS flowing out of the heat exchanger is monitored in the field using pressure (D112/114/111/113/115/116-PI) and temperature indicators (D112/114/111/113/115/116-TI).

4.2.6. Interlocks and Permissives

For Sludge Recirculation Pump (D112-DP9, D114-DP11, D111-DP8, D113-DP10, D115-DP12, D116-DP13) to operate in LOCAL mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	D112/114/111/113/115/116-HS-A (COH)	Hand
Digester 9/10/11/12/13/14 Sludge Recirculation Pump (D112/114/111/113/115/116)	Lock off stop hand switch	D112/114/111/113/115/116-HS-B (LOS)	Normal

For Sludge Recirculation Pump (D112-DP9, D114-DP11, D111-DP8, D113-DP10, D115-DP12, D116-DP13) to operate in REMOTE mode (COMPUTER):

Equipment	Device Description	Device Tag	State
PCS		DC-D112/114/111/113/115/116-MN	Start Command

Control Room Panel	Computer/off/hand hand switch	D112/114/111/113/115/116-HS-A (COH)	Computer
Digester 9/10/11/12/13/14 Sludge Recirculation Pump (D112/114/111/113/115/116)	Lock off stop hand switch	D112/114/111/113/115/116-HS-B (LOS)	Normal

4.2.7. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Digester 9/10/11/12/13/14 Sludge Recirculation Pump (D112/114/111/113/115/116)	Sludge Recirculation Pump Start Command	DC-D112/114/111/113/115/116-MN	Digital Output
Digester 9/10/11/12/13/14 Sludge Recirculation Pump (D112/114/111/113/115/116)	Sludge Recirculation Pump Stop Command	DC-D112/114/111/113/115/116-MO	Digital Output
Digester 9/10/11/12/13/14 Sludge Recirculation Pump (D112/114/111/113/115/116)	Hot Water Valve Open Command	DC-D112/114/111/113/115/116-VD	Digital Output
Digester 9/10/11/12/13/14 Sludge Recirculation Pump (D112/114/111/113/115/116)	Hot Water Valve Close Command	DC-D112/114/111/113/115/116-VB	Digital Output
Digester 9/10/11/12/13/14 Sludge Recirculation Pump (D112/114/111/113/115/116)	Sludge Recirculation Pump Run Status	DC-D112/114/111/113/115/116-MM	Digital Input
Digester 9/10/11/12/13/14 Sludge Recirculation Pump (D112/114/111/113/115/116)	Sludge Recirculation Pump Computer/Hand Status	DC-D112/114/111/113/115/116-YS	Digital Input
Digester 9/10/11/12/13/14 HWS Circulation Pump (DP15/17/14/16/18/19)	HWS Valve Control Station Status	DC-D112/114/111/113/115/116-YK	Digital Input
Digester 9/10/11/12/13/14 Sludge Recirculation Pump (D112/114/111/113/115/116)	Sludge Temperature	DC-D112/114/111/113/115/116-TT	Analog Input
Digester 9/10/11/12/13/14 HWS Circulation Pump (DP15/17/14/16/18/19)	HWS Valve Position Status	DC-D112/114/111/113/115/116-ZT	Analog Input
Digester 9/10/11/12/13/14 HWS Circulation Pump (DP15/17/14/16/18/19)	HWS Temperature	DC-D122/124/121/123/125/126-TT	Analog Input

4.2.8. HMI Display

Device Description	Status
Digester 9/10/11/12/13/14 Sludge Recirculation Pump (D112/114/111/113/115/116)	Sludge Temperature (°C)
Digester 9/10/11/12/13/14 HWS Circulation Pump (DP15/17/14/16/18/19)	Valve Position (%)
Digester 9/10/11/12/13/14 HWS Circulation Pump (DP15/17/14/16/18/19)	HWS Temperature (°C)

4.2.9. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
D111/112/113/114/115/116-TT	Sludge Temp High	device measures sludge temperature above 41C	Alarm Notice
D111/112/113/114/115/116-TT	Sludge Temp Low	device measures sludge temperature below 36C	Alarm Notice
D121/122/123/124/125/126-TT	Hot water temp low	Hot water temperature below 20C	Alarm Notice

5. DIGESTED SLUDGE TRANSFER PUMPS D301-DP4 & D305-DP5

Associated P&ID: 1-0101D-A0035
Associated NEWPCC Manuals: D800 Revised, D1000 Revised
Associated DCS HMI Screens: ndsltr.G, ndslwd.G, ndoflow.G, ndhold.G

5.1. Process Description

DS flows from the digesters to the digester holding tanks via the Sludge Transfer Header by gravity . The digesters operate with a target solids retention time (SRT) of at least 15 days.

Sludge Transfer Pumps (D301-DP4 and D305-DP5) pump from the digesters to the holding tanks. Manual valve configurations must be set to select the digester pumped from and the holding tank pumped to. The Sludge Transfer Pumps are primarily used to reduce the foam levels in the digesters by pumping sludge that is not flowing by gravity as it should.

The lines leading to the digested sludge transfer header can be rinsed with FW if required.

5.2. Control Description

The Sludge Transfer Pumps (D301-DP4 and D305-DP5) can be controlled in LOCAL (HAND) or REMOTE (COMPUTER) mode.

5.2.1. Local Manual Control Mode

In LOCAL mode the pumps are started and stopped by computer/off/hand hand switch D301/305-HS-A.

5.2.2. Remote Manual Control Mode

In REMOTE mode the pumps are started and stopped manually by the operator.

Seal water is supplied through solenoid valves D301/305-YV that are hardwire interlocked with the pump operation.

5.2.3. Interlocks and Permissives

For Digested sludge transfer pumps (D301-DP4, D305-DP5) to operate in LOCAL mode (HAND):

Equipment	Device Description	Device Tag	State
Control Room Panel	Reset hand switch	D301/305-HS-C (RST)	Normal

Control Room Panel	Computer/off/hand hand switch	D301/305-HS-A	Hand
Digested Sludge Transfer Pumps (D301/305)	Lock of stop hand switch	D301/305-HS-B	Normal

For Digested sludge transfer pumps (D301-DP4, D305-DP5) to operate in REMOTE mode (COMPUTER):

Equipment	Device Description	Device Tag	State
PCS		DB-D301/305-MN	Start Command
Control Room Panel	Reset hand switch	D301/305-HS-C (RST)	Normal
Control Room Panel	Computer/off/hand hand switch	D301/305-HS-A	Computer
Digested Sludge Transfer Pumps (D301/305)	Lock of stop hand switch	D301/305-HS-B	Normal

5.2.4. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Digested Sludge Transfer Pumps (D301/305)	Pump Start Command	DB-D301/305-MN	Digital Output
Digested Sludge Transfer Pumps (D301/305)	Pump Stop Command	DB-D301/305-MO	Digital Output
Digested Sludge Transfer Pumps (D301/305)	Pump Reset Command	DB-D302/306-MX	Digital Output
Digested Sludge Transfer Pumps (D301/305)	Pump Run Status	DB-D301/305-MM	Digital Input
Digested Sludge Transfer Pumps (D301/305)	Pump Computer/Hand Status	DB-D301/305-YS	Digital Input
Discharge Valve (D261/281)	Sludge Valve Open Command	DB-D261/281-VD	Digital Output
Discharge Valve (D261/281)	Sludge Valve Close Command	DB-D261/281-VB	Digital Output
Holding Tank /6/8 (D260/280)	Holding Tank Level	DB-D260/280-LT	Digital Input
Discharge Valve (D261/281)	Sludge Valve Computer/Hand Status	DB-D261/281-YS	Digital Input
Discharge Valve (D261/281)	Sludge Valve Open Status	DB-D261/281-ZD	Digital Input
Discharge Valve (D261/281)	Sludge Valve Closed Status	DB-D261/281-ZB	Digital Input

5.2.5. HMI Display

Device Description	Status
Digested Sludge Transfer Pumps (D301/305)	Pump Run Time
Digested Sludge Transfer Pumps (D301/305)	Pump Reset Status
Digested Sludge Transfer Pumps (D301/305)	Pump Computer/Hand Status
Holding Tank 6/8 (D260/280)	Holding Tank Level (meters)
Holding Tank 6/8 (D260/280)	Holding Tank Level (High/Normal/Low)
Holding Tank 6/8 (D260/280)	Cycle Time (minutes)
Discharge Valve (D261/281)	Discharge Valve Open Status

Discharge Valve (D261/281)	Discharge Valve Computer/Hand Status

6. EMERGENCY OVERFLOW TANK – TANK 1

Associated P&ID: 1-0101D-A0039
Associated NEWPCC Manuals: D900 Revised
Associated DCS HMI Screens: ndoflow.G

6.1. Process Description

The digester tanks overflow into Tank 1.

6.2. Control Description

Tank 1 has a hydrostatic level transmitter (DB-D900-LT) installed to monitor the Tank level. A high alarm is raised when the level rises above 2.5m and a high-high alarm is raised when the level rises above 5m.

6.2.1. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Level sensor (D900)	Tank level	DB-D900-LT	Analog input

6.2.2. HMI Display

Device Description	Status
Level sensor (D900-LT)	Tank level (m)
Level sensor (D900-LT)	Tank level status (Normal/High/Extra High)

6.2.3. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Level sensor (D900-LT)	High tank level	D900-LT measure above 2.5m	Alarm notification
Level sensor (D900-LT)	High-high tank level	D900-LT measure above 5m	Alarm notification

7. SLUDGE MIXING

Associated P&ID: 1-0101D-A0042, 1-0101D-A0043, 1-0101D-A0044, 1-0101D-A0045, 1-0101D-A0046, 1-0101D-A0047
Associated NEWPCC Manuals: D600 Revised
Associated DCS HMI Screens: ndd09gr.G, ndgasw.G

7.1. Process Description

Each digester, excluding Digester 11, has its own gas recirculation compressor. DG is suctioned from the digester vapour space to the compressor as well as to Waste Gas Piping. A sediment and moisture trap filters the DG to the Waste Gas Piping.

The digesters are serviced by the following compressors:

1. Compressor D420-DR2 mixes Digester 9
2. Compressor D430-DR3 mixes Digester 12
3. Compressor D440-DR4 mixes Digester 10
4. Compressor D450-DR5 mixes Digester 13
5. Compressor D460-DR6 mixes Digester 14

The compressor discharges high pressure DG (DGH) to the digester draft tube gas mixers, creating large bubbles that lift and mix the sludge. All five (5) gas compressors should run continuously unless a digester is out of service.

Digester 11 has duty/standby variable speed mixing pumps instead of compressed gas mixing.

7.2. Control Description

The gas recirculation compressors (D420-DR2, D430-DR3, D440-DR4, D450-DR5, D460-DR6) can be controlled in LOCAL or REMOTE mode.

Digester 11 has two parallel variable speed mixing pumps (D375-P and D376-P) each with a discharge isolation valve (Y379XV and Y380XV). The pumps can be controlled in LOCAL or REMOTE (Computer) mode. In REMOTE mode the pumps are controlled by the Digester PLC. The PCS communicates with Digester PLC to provide the operator interface and alarm monitoring. The pumps can be controlled in MANUAL or AUTOMATIC mode.

The mixing pump actuated discharge valves (Y379/380-XV) can be run in LOCAL or REMOTE mode. In REMOTE mode the valves are controlled by the Digester PLC. The PCS communicates with Digester PLC to provide the operator interface and alarm monitoring. The valves can be controlled in MANUAL or AUTOMATIC mode.

7.2.1. Local Manual Control Mode – Gas Recirculation Compressor (D420/430/440/450/460-DR-2/3/4/5/6)

In LOCAL mode the compressors are started and stopped with the respective hand switch (D420/430/440/450/460-HS-A).

7.2.2. Local Manual Control Mode – Mixing Pumps (D375-376-P)

In LOCAL mode the pumps can be started and stopped from the VFD panel. The pump speed can be adjusted from the VFD panel.

7.2.3. Local Automatic Control Mode – Mixing Pumps Discharge Valve (Y379/380-XV)

In LOCAL mode, the valve position is set by the hand switch.

7.2.4. Remote Manual Control Mode – Gas Recirculation Compressor (D420/430/440/450/460-DR-2/3/4/5/6)

In REMOTE mode the recirculation compressors are controlled through the PCS. In REMOTE mode, the compressors are operated in MANUAL mode.

Each compressor has an actuated isolation suction valve that is hardwire interlock to open with the compressor operation. A hardwire interlock will close the suction valve if low pressure is detected by the associated low suction pressure switch (D421/431/441/451/461-PSL). The valve status is required to be open for the compressor to run. The valves are arranged in the following configuration:

1. Valve D425-HV isolates D420-DR2
2. Valve D435-HV isolates D430-DR3
3. Valve D445-HV isolates D440-DR4
4. Valve D455-HV isolates D450-DR5
5. Valve D465-HV isolates D460-DR6

Cooling water for compressors supplied through solenoid valves D420/430/440/450/460-YV that are hardwire interlocked with the compressor operation.

The following signals will fault the compressor and raise an alarm:

1. Cooling water temperature high - D426/436/446/456/468-TH
2. Cooling water flow low - D428/438/448/458/468-PSL
3. Oil level low – D427/437/447/457/567-LL
4. Oil flow low – D429/439/449/459/469-FL
5. Discharge temperature high – D423/433/443/453/463-TH
6. Discharge pressure high – D422/432/442/452/462-PH
7. Suction valve not open – D425/435/445/455/465-ZD
8. Surge Tank pressure abnormal (Below 1 kPa or above 3 kPa) – D502-PT

When any of the compressor's alarms are raised, the compressor is switched into AUTOMATIC mode and shut down. The compressor itself can be REMOTE reset through the PCS (DC-D420/430/440/450/460-MX), but to start-up of the compressor after a low suction pressure alarm requires LOCAL (MANUAL) reset of the suction valve.

The digester vapour space pressure is monitored by D132/134/131/133/135/136-PT and will alarm if the pressure reading goes below 1.5 kPa or above 3.3 kPa.

7.2.5. Remote Manual Control Mode – Mixing Pumps (D375-376-P)

In REMOTE MANUAL mode the pumps are started and stopped by the operator and the speed set point is manually set (Low limit: 0%; High limit: 100%).

7.2.6. Remote Manual Control Mode – Mixing Pumps Discharge Valve (Y379/380-XV)

In REMOTE MANUAL mode the valve position is set by the operator.

7.2.7. Remote Automatic Control Mode – Mixing Pumps (D375-376-P)

In REMOTE AUTOMATIC mode there is a DUTY mode and a CONTINUOUS mode.

In DUTY mode the operator selects a pump to be the duty pump. This pump runs continuously alternating between a high and low speed. Both the high speed and low speed run durations are operator adjustable set points (Low limit: 0.1 Hours; High limit: 100 Hours; Initial value: 0.5 Hours) as well as the high and low speeds (Low limit: 0%; High limit: 100%; Low speed initially: 75%; High speed initially 90%). Permitted pump speeds are 0% and 75% to 100%. To turn the pump off, the speed is set to 0%.

In CONTINUOUS mode the operator selected a pump to be the duty pump. This pump runs continuously at an operator adjustable speed set point (Low limit: 0%; default 75%; High limit: 100%). The continuous mode can be turned on or off to stop the pumps while in REMOTE AUTOMATIC mode.

The mixing pump's discharge valve must be open for the mixing pump to run.

In both AUTOMATIC modes, if the duty pump or valve fails, the standby pump and valve will be started and run as the duty pump.

7.2.8. Remote Automatic Control Mode – Mixing Pumps Discharge Valve (Y379/380-XV)

In REMOTE AUTOMATIC mode the valve opens when the pump is called to start. The valve closes when the pump is stopped.

The PLC has an automatic foam suppression mode which can be turned on and off through the PCS.

Flushing water is added to the common pump discharge header by valves D384-VX1/2. The valves are automatically sequenced to open and flush the recirculation pipe every operation set point interval (Low limit: 0.1 mins; High limit: 120 mins; initial valve: 120 mins). The flushing occurs for an operator set duration (Low limit: 0.2 seconds; High limit: 300 seconds; Initial valve: 60 seconds).

The mixing pump discharge header pressure is measured by D386-PT. The sludge flow is monitored by flowmeter D382-FT. An alarm is raised by the Digester PLC if low flow is measured while a pump is running.

7.2.9. Interlocks and Permissives

7.2.9.1. Gas Recirculation Compressors (D420-DR2, D430-DR3, D440-DR4, D450-DR5, D460-DR6)

For Gas Recirculation Compressor (D420/430/440/450/460) to operate in LOCAL mode:

Equipment	Device Description	Device Tag	State
Suction Valve (D425/435/445/455/465-HV)	Open position switch	D425/435/445/455/465-ZSD	Open
Control Room Panel	Computer/off/hand hand switch	D420/430/440/450/460-HS-A (COH)	Hand command
Gas Compressor (D420/430/440/450/460)	Reset hand switch	D420/430/440/450/460-HS-B (RST)	Normal
Oil Level Switch (D427/437/447/457/467)	Low position switch	D427/437/447/457/467-LSL	Normal

Jacket Temperature (D416/426/436/446/456/466)	High temperature switch	D426/436/446/456/466-TSH	Normal
Cooling Water Pressure Switch (D428/438/448/458/468)	Low pressure switch	D428/438/448/458/468-PSL	Normal Pressure
Pressure Switch (D422/432/442/452/462)	High pressure switch	D422/432/442/452/462-PSH	Normal
Temperature Switch (D423/433/443/453/463)	High temperature switch	D423/433/443/453/463-TSH	Normal
Gas Compressor (D420/430/440/450/460)	Lock off stop hand switch	D420/430/440/450/460-HS-C (LOS)	Normal
Oil Flow Switch D429/439/449/459/469	Flow switch	D429/439/449/459/469-FL	Normal

For Gas Recirculation Compressor (D420/430/440/450/460) to operate in REMOTE (COMPUTER/HAND) mode:

Equipment	**Device Description**	**Device Tag**	**State**
Suction Valve (D425/435/445/455/465)	Open position switch	D425/435/445/455/465-ZSD	Open
PCS		DC- D410/420/430/440/450/460-MN	Start Command
Control Room Panel	Computer/off/hand hand switch	D420/430/440/450/460-HS-A (COH)	Computer
Gas Compressor (D420/430/440/450/460)	Reset hand switch	D420/430/440/450/460-HS-B (RST)	Normal
Oil Level Switch (D427/437/447/457/467)	Low position switch	D427/437/447/457/467-LSL	Normal
Jacket Temperature (D426/436/446/456/466)	High temperature switch	D426/436/446/456/466-TSH	Normal
Cooling Water Pressure Switch (D428/438/448/458/468)	Low pressure switch	D428/438/448/458/468-PSL	Normal Pressure
Pressure Switch (D422/432/442/452/462)	High pressure switch	D422/432/442/452/462-PSH	Normal
Temperature Switch (D423/433/443/453/463)	High temperature switch	D423/433/443/453/463-TSH	Normal
Gas Compressor (D420/430/440/450/460)	Lock off stop hand switch	D420/430/440/450/460-HS-C (LOS)	Normal
Oil Flow Switch D429/439/449/459/469	Flow switch	D429/439/449/459/469-FL	Normal

7.2.9.2. Suction Valve D425/435/445/455/465-HV

For Suction Valve D425/435/445/455/465-HV to open:

Equipment	**Device Description**	**Device Tag**	**State**
Pressure Switch (D/421/431/441/451/461)	Low pressure switch	D421/431/441/451/461-PSL	Normal Pressure

Gas Compressor (D420/430/440/450/460)	Reset hand switch	D420/430/440/450/460-HS	Normal

7.2.10. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Gas Compressor (D420/430/440/450/460)	Compressor Start Command	DC- D420/430/440/450/460-MN	Digital Output
Gas Compressor (D420/430/440/450/460)	Compressor Stop Command	DC- D420/430/440/450/460-MO	Digital Output
Gas Compressor (D420/430/440/450/460)	Compressor Reset Command	DC- D420/430/440/450/460-MX	Digital Output
Gas Compressor (D420/430/440/450/460)	Compressor Run Status	DC- D420/430/440/450/460-MM	Digital Input
Temperature Switch (D423/433/443/453/463)	Compressor Discharge Temperature Status	DC- D423/433/443/453/463-TH	Digital Input
Pressure Switch (D422/432/442/452/462)	Compressor Discharge Pressure Status	DC- D422/432/442/452/462-PH	Digital Input
Pressure Switch (D421/431/441/451/461)	Compressor Suction Low Pressure Status	DC- D421/431/441/451/461-PL	Digital Input
Suction Valve (D425/435/445/455/465)	Valve Position Status	DC- D425/435/445/455/465-ZD	Digital Input
Low Level Switch (D427/437/447/457/467)	Low Oil Level	DC- D427/437/447/457/467-LL	Digital Input
Position Switch (D429/439/449/459/469)	Belt Tension Status	DC- D429/439/449/459/469-ZL	Digital Input
Jacket Temperature (D426/436/446/456/466)	Jacket Temperature	DC- D426/436/446/456/466-TH	Digital Input
Pressure Switch (D428/438/448/458/468)	Cooling Water Flow	DC- D428/438/448/458/468-PL	Digital Input
Mixing Pump (D375/376)	Pressure permissive	DC-D375-PPE	Digital Input
Gas Compressor (D450/460)	Digester West Room Remote Emergency Stop	DC-D399-HS-A	Digital Input
Mixing Pump (D375/376)	High Temperature Status	DC-D375/376-TSH	Digital Input
Mixing Pump (D375/376)	Low flow alarm	DC-D382-FL	Digital Input
Flushing Water Valve (D384-VX1/2)	Automatic status	DC-D384Y-M1/2	Digital Input
Flushing Water Valve (D384-VX1/2)	Open/close status	384-1XAE02/2XAE01	Digital Input
Discharge Valve (Y379/380)	High discharge pressure	DC-D386-PH	Digital Input
Discharge Valve (Y379/380)	Low discharge pressure	DC-D386-PL	Digital Input
Digester 11	Low gas flow alarm	DC-D142-FL	Digital Input

Digester 11	High high foam level alarm	DC-D130-LA	Digital Input
Digester 11	High foam level alarm	DC-D130-LH	Digital Input
Digester 11	VFD communication failure	DC-D375/376-YF	Digital Input
Digester 11	Foam level transmitter failure	DC-D130-QF	Digital Input
Digester 11	Sludge flow meter fault	DC-D382-QF	Digital Input
Digester 11	Gas production	DC-D142-FQ-1	Analog Input
Mixing Pump (D375/376)	Run time hours	DC-D375/376-RTS	Analog Input
Pressure Transmitter (D132/133/134/135/136)	Digester 9/10/11/12/13/14 Pressure	DC- D132/133/134/135/136-PT	Analog Input
Mixing Pump (D375/376)	Discharge header pressure	DC-D386-PT	Analog Input

7.2.11. HMI Display

Device Description	**Status**
Temperature Switch (D423/433/443/453/463)	Discharge Temperature
Pressure Switch (D422/432/442/452/462)	Discharge Pressure
Pressure Switch (D421/431/441/451/461)	Suction Pressure
Pressure Switch (D428/438/448/458/468)	Cooling Water Flow
Jacket Temperature (D426/436/446/456/46)	Jacket Temperature
Low Level Switch (D427/437/447/457/467)	Oil Level
Suction Valve (D425/435/445/455/465)	Valve Position Status
Gas Compressor (D420/430/440/450/460)	Compressor Computer/Hand Status
Digester West Room Remote Emergency Stop (D399)	D450-DR5 and D460-DR6 Remote E-Stop Status (Trip/Normal)
Digester East Room Remote Emergency Stop (D398)	D420-DR2, D330-DR3 and D440-DR4 Remote E-Stop Status (Trip/Normal)
Mixing Pump (D375/376)	Duty pump select
Mixing Pump (D375/376)	Continuous cycle on/off select
Mixing Pump (D375/376)	Continuous cycle speed setting
Mixing Pump (D375/376)	Mixing mode
Mixing Pump (D375/376)	Duty cycle-low speed time (hrs)
Mixing Pump (D375/376)	Duty cycle-high sped time (hrs)
Mixing Pump (D375/376)	Duty cycle-low speed setting (%)
Mixing Pump (D375/376)	Duty cycle-high speed setting (%)
Mixing Pump (D375/376)	Auto foam supply mode active
Mixing Pump (D375/376)	Duty cycle-low speed time left (min)
Mixing Pump (D375/376)	Duty cycle-high speed time left (min)
Flushing Water Valve (D384-VX1/2)	Flushing water off time (min)
Flushing Water Valve (D384-VX1/2)	Flushing water on time (sec)
Mixing Pump (D375/376)	Run hours (hrs)

Mixing Pump (D375/376)	Pressure permissive
Mixing Pump (D375/376)	Sludge mixing current day (m^3)
Digester 11	Gas production current day (m^3)
Mixing Pump (D375/376)	Sludge mixing previous day (m^3)
Digester 11	Gas production previous day (m^3)
Mixing Pump (D375/376)	Sludge flow (m3/hr)
Discharge Valve (Y379/380)	Discharge header pressure (kPa)
Mixing Pump (D375/376)	Sludge flow status (Normal/Low)
Discharge Valve (Y379/380)	Discharge pressure status (Low/Normal/High)
Discharge Valve (Y379/380)	Discharge header valve reset
Discharge Valve (Y379/380)	Discharge header pressure alarm reset
Discharge Valve (Y379/380)	Discharge header low flow alarm reset
Mixing Pump (D375/376)	Mixing pump alarm reset
Flushing Water Valve (D384-VX1/2)	Valve automatic mode status
Flushing Water Valve (D384-VX1/2)	Valve open/close status

7.2.12. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Gas Compressor (D420/430/440/450/460)	Low suction pressure	Low-pressure switch DC-D421/431/441/451/461-PL is active	Compressor is taken out of service and the suction safety shutoff valve is closed
Gas Compressor (D420/430/440/450/460)	High discharge pressure	High-pressure switch DC-D422/432/442/452/462-PH is active	Compressor shuts off
Gas Compressor (D420/430/440/450/460)	High discharge temperature	High-temperature switch DC-D423/433/443/453/463-TH is active	Compressor shuts off
Gas Compressor (D420/430/440/450/460)	High water jacket temperature	High-temperature switch DC-D426/436/446/456/466-TH is active	Compressor shuts off
Gas Compressor (D420/430/440/450/460)	Low oil level	Low-level switch DC-D427/437/447/457/467-LL is active	Compressor shuts off
Gas Compressor (D420/430/440/450/460)	Low water jacket pressure	Low pressure switch is active	Compressor shuts off
Gas Compressor (D420/430/440/450/460)	Low oil flow	Low oil switch DC-D429/439/449/459/469-FL is active	Compressor shuts off
Mixing Pump (D375/376)	Low flow	DC-D382-FL is active	Alarm Notification
Discharge Valve (Y379/380)	High discharge pressure	DC-D386-PH is active	Alarm Notification
Discharge Valve (Y379/380)	Low discharge pressure	DC-D386-PL is active	Alarm Notification
Digester 11	Low gas flow	DC-D142-FL is active	Alarm Notification

Digester 11	High high foam level	DC-D130-LA is active	Alarm Notification
Digester 11	High foam level	DC-D130-LH is active	Alarm Notification
Digester 11	VFD communication failure	DC-D375/376-YF is active	Alarm Notification
Digester 11	Foam level transmitter failure	DC-D130-QF is active	Alarm Notification
Digester 11	Sludge flow meter fault	DC-D382-QF is active	Alarm Notification

8. GAS PIPING

Associated P&ID: 1-0101D-A0052
Associated NEWPCC Manuals: D1200 Revised
Associated DCS HMI Screens: ndboost.G, ndd09gr.G, ndd09rl.G, ndd10rl.G, ndd11gr.G, ndd11rl.G, ndd12rl.G, ndd13gr.G, ndd13rl.G, ndd14rl.G, ndd15gr.G, ndgabrn.G, ndbsetp.G, digwls.G, ndd11mx.G, ndgasw.G

8.1. Process Description

The DG flow rate from each digester is measured separately (D142/144/141/143/145/146-FIT) as the DG enters Waste Gas Piping.
DG from Digesters 9-14 flow to a common header connected to the Gas Surge Tank, Waste Gas Burners, High Pressure Gas Piping Safety Valve and Gas Boosters DR7, DR8, DR,9 and DR10.

8.2. Control Description

The Gas Surge Tank pressure is monitored by PCS. The surge tank pressure status (DCD502-DCD42X/43X/44X/45X) controls the following:

- Cycles the operation of the gas booster compressors (D470-DR7, D480-DR8, D490-DR9, D400-DR10)
- Cycles the operation of the primary digester waste gas burners (D511/521/531)
- LOW pressure status prevents the gas recirculation (D420-DR2, D430-DR3, D440-DR4, D450-DR5, D460-DR6) and booster (D470-DR7, D480-DR8, D490-DR9, D400-DR10) compressors from starting.

8.2.1. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Digester 9	Digester 9 DG flow	DC-D142-FT	Analog Input
Digester 10	Digester 10 DG flow	DC-D144-FT	Analog Input
Digester 11	Digester 11 DG flow	DC-D141-FT	Analog Input
Digester 12	Digester 12 DG flow	DC-D143-FT	Analog Input
Digester 13	Digester 13 DG flow	DB-D145-FT	Analog Input
Digester 14	Digester 14 DG flow	DB-D146-FT	Analog Input
Gas Surge Tank	Surge Tank Pressure	DC-D502-PT	Analog Input

8.2.2. HMI Display

Device Description	Status
Gas Surge Tank	Pressure (kPa)

Gas Surge Tank	Pressure (High/Normal/Low)
Digester 9/10/11/12/13/14	Digester Gas Flow (m^3/h)

8.2.3. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Surge Tank	Pressure alarm	DC-D502-PT above 3 kPa	Software stop sent to compressors.

9. GAS BOOSTER COMPRESSORS AND SPHERE

Associated P&ID: 1-0101D-A0048, 1-0101D-A0049, 1-0101D-A0050, 1-0101D-A0051, 1-0101D-A0055
Associated NEWPCC Manuals: D1500 Revised, D1600 Revised
Associated DCS HMI Screens: ndboost.G, ndgasw.G, nearea7.G

9.1. Process Description

DG from a common header flows through a sediment and moisture trap. DG flows to into the gas booster compressor (D470-DR7, D480-DR8, D490-DR9, and D400-DR10) via a motorized valve (D475/485/495/405-HV). The compressor pressurizes DGH to the Boiler Gas Piping via motorized valves D474,D484, D494 and D404 HV, and to Storage Sphere Gas Piping via normally open hand valves.

Compressor	Intake DG Flowing From	Discharge DGH Flowing To
D470-DR7	Digesters 9-14 Common Booster Suction Header	Boiler Gas Piping
		Storage Sphere Gas Piping
D480-DR8	Digesters 9-14 Common Booster Suction Header	Boiler Gas Piping
		Storage Sphere Gas Piping
D490-DR9	Digesters 9-14 Common Booster Suction Header	Boiler Gas Piping
		Storage Sphere Gas Piping
D400-DR10	Digesters 9-14 Common Suction Header	Boiler Gas Piping
		Storage Sphere Gas Piping

DGH from the booster compressors (D470-DR7, D480-DR8, D490-DR9, D400-DR10) flow to the:

- Gas Storage Sphere
- Common Header
- Boilers

DGH from the booster compressor discharge valves flow into the common header, The DGH flows from the common header to a High Pressure Gas Piping Safety Relief Valve and toBoilers 1-3

DGH flow rate is measured (D901-FT) for the DGH discharged to the boilers.

DGH pressure is measured (D501-PT) for the DGH discharged to the Gas Storage Sphere

9.2. Control Description

Excess DG from the vapour space of the Digesters flows out of each digester, through a flow meter and into the DG low pressure gas system. If the Gas Sphere is not high, It is then pressurized by the booster compressors (D470-DR7, D480-DR8, D490-DR9, D400-DR10) to the gas sphere and the boilers. Each compressor has an actuated suction isolation valve (D475-HV, D485-HV, D495-HV, and D405-HV) and an actuated discharge valve (474-HV, 484-HV, 494-HV, 404-HV) to the boilers.

The gas booster compressors are controlled in LOCAL (MANUAL) mode or REMOTE (COMPUTER) mode. The gas booster compressors are typically run in REMOTE mode.

9.2.1. Local Manual Control Mode – Gas Booster Compressor (D470/480/490/400-DR-7/8/9/10)

In LOCAL (MANUAL) mode, the gas booster compressor can be started (D470/480/490/400-HS-E) and stopped (D470/480/490/400-HS-D) using hand switches on the device.

9.2.2. Remote Automatic Control Mode – Gas Booster Compressor (D470/480/490/400-DR-7/8/9/10)

In REMOTE (COMPUTER) mode the booster compressors are controlled AUTOMATICALLY.

In REMOTE AUTOMATIC the boosters operate in a duty priority; the operator assigns the duty level for each booster compressor. The boosters are sequenced as follows:

1. Duty 1 Booster starts when the Surge Tank pressure rises to 2.05 kPa or the Sphere Tank pressure is below 188 kPa.
2. Duty 2 Booster starts when the Surge Tank pressure further rises to 2.15 kPa or the Sphere Tank pressure is below 186 kPa.
3. Duty 3 Booster starts when the Surge Tank pressure further rises to 2.25 kPa or the Sphere Tank pressure is below 184 kPa.
4. Duty 4 Booster starts when the Surge Tank pressure further rises to 2.35 kPa or the Sphere Tank pressure is below 180 kPa.
5. Duty 4 Booster stops when the Surge Tank pressure drops below 1.6 kPa or the Sphere Tank pressure is above 185 kPa.
6. Duty 3 Booster stops when the Surge Tank pressure drops below 1.5 kPa or the Sphere Tank pressure is above 190 kPa.
7. Duty 2 Booster stops when the Surge Tank pressure drops below 1.4 kPa or the Sphere Tank pressure is above 191.5 kPa.
8. Duty 1 Booster stops when the Surge Tank pressure drops below 1.3 kPa or the Sphere Tank pressure is above 193 kPa.

If the logic dictates that a booster should both start and stop, the booster shall stop or remain off. If a Duty booster is faulted or in local control and is not available, the next priority Duty booster will be started and stopped in its place.

A high-pressure alarm in the Surge Tank shall be raised at 2.95 kPa warning of high pressure.

A high-high-pressure alarm in the Surge Tank shall be raised at 3.2 kPa and will lock out all booster operation.

A low-pressure alarm in the Surge Tank shall be raised at 1.15 kPa and will lock out all booster operation.

A high-pressure alarm in the Sphere shall be raised at 200.00 kPa and will lock out all booster operation.

A low-pressure alarm in the Sphere shall be raised at 83 kPa.

Each booster has the following associated faults:

1. Discharge temperature high – DC-D473/483/493/403-TH
2. Discharge pressure high – DC-D472/482/492/402-PH
3. Suction pressure low – DC-D471/481/491/401-PL
4. Jacket Temperature High – D476/486/496/406-TH
5. Jacket Pressure Low – D478/488/498/408-PL
6. Oil Level Low – D477/487/497/407-LL
7. Belt Tension Low – D479/489/499/409-ZL

If any of the faults trip the associated booster will be shut down and both the suction and discharge valve to the booster will close. The booster will need to receive a reset signal before operating again.

The discharge valve to the boilers will open based on the gas flow to the boilers calculated as the sum of the gas flows across boilers 1 through 5. The discharge valves are sequenced as follows:

1. Duty 1 Booster discharge valve to boilers opens when the flow rises to 850 m^3/hr.
2. Duty 2 Booster discharge valve to boilers opens when the flow rises to 1530 m^3/hr.
3. Duty 3 Booster discharge valve to boilers opens when the flow rises to 2040 m^3/hr.
4. Duty 4 Booster discharge valve to boilers opens when the flow rises to 2550 m^3/hr.
5. Duty 4 Booster discharge valve to boilers closes when the flow falls to 2210 m^3/hr.
6. Duty 3 Booster discharge valve to boilers closes when the flow falls to 1700 m^3/hr.
7. Duty 2 Booster discharge valve to boilers closes when the flow falls to 1190 m^3/hr.
8. Duty 1 Booster discharge valve to boilers closes when the flow falls to 510 m^3/hr.

A booster discharge valve will only open if the associated booster compressor is running; the valve will close if the booster compressor stops running.

9.2.3. Interlocks and Permissives

9.2.3.1. Gas Booster Compressor (D470-DR7, D480-DR8, D490-DR9, D400-DR10)

For Gas Booster Compressor (D470-DR7, D480-DR8, D490-DR9, D400-DR10) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Gas Booster Compressor (D470/480/490/400)	Start Hand Switch	D470/480/490/400-HS-E	Start
Control Room Panel	Off/manual hand switch	D470/480/490/400-HS-B (O/M)	Manual
Control Room Panel	Reset hand switch	D470/480/490/400-HS-C	Normal
Gas Booster Compressor (D470/480/490/400)	Lock off stop hand switch	D470/480/490/400-HS-D (LOS)	Normal

Pressure Switch (D472/482/492/402)	High pressure switch	D472/482/492/402-PSH	Normal
Temperature Switch (D473/483/493/403)	High temperature switch	D473/483/493/403-TSH	Normal
Valve (D475/485/495/405)	Open position switch	D475/485/495/405/ZSD	Open
Jacket Temperature Switch (D476/486/496/406)	High temperature switch	D476/486/496/406-TSH	Normal
Low Oil Level Switch (D477/487/497/407)	Low level switch	D477/487/497/407-LSL	Normal
Pressure Switch (D478/488/498/408)	Low pressure switch	D478/488/498/408-PSL	Normal Pressure
Belt Tension Switch (D479/489/499/409)	Low position switch	D479/489/499/409-ZSL	Normal

For Gas Booster Compressor (D470-DR7, D480-DR8, D490-DR9, D400-DR10) to operate in REMOTE (COMPUTER) mode:

Equipment	**Device Description**	**Device Tag**	**State**
PCS		DC-D470/480/490/400-MN	Start command
Control Room Panel	Computer/off hand switch	D470/480/490/400-HS-A (C/O)	Computer
Control Room Panel	Reset hand switch	D470/480/490/400-HS-C	Normal
Gas Booster Compressor (D470/480/490/400)	Lock off stop hand switch	D470/480/490/400-HS-D (LOS)	Normal
Pressure Switch (D472/482/492/402)	High pressure switch	D472/482/492/402-PSH	Normal
Temperature Switch (D473/483/493/403)	High temperature switch	D473/483/493/403-TSH	Normal
Valve (D475/485/495/405)	Open position switch	D475/485/495/405/ZSD	Open
Jacket Temperature Switch (D476/486/496/406)	High temperature switch	D476/486/496/406-TSH	Normal
Low Oil Level Switch (D477/487/497/407)	Low level switch	D477/487/497/407-LSL	Normal
Pressure Switch (D478/488/498/408)	Low pressure switch	D478/488/498/408-PSL	Normal Pressure
Belt Tension Switch (D479/489/499/409)	Low position switch	D479/489/499/409-ZSL	Normal

9.2.3.2. Motorized Valve D474/484/494/404-HV

For Motorized Valve D474/484/494/404-HV to open:

Equipment	**Device Description**	**Device Tag**	**State**
PCS		DC-D474/484/494/404-VD	Open command
Control Room Panel	Computer/off hand switch	D474/484/494/404-HS-A (C/O)	Computer
Gas Booster Compressor (D470/480/490/400)		D470/480/490/400-MM	Running

9.2.3.3. Motorized Valve D475/485/495/405-HV

For Motorized Valve D475/485/495/405-HV to open:

Equipment	Device Description	Device Tag	State
PCS		DC-D474/484/494/404-VD	Open command
Pressure Switch (D471/481/491/401)	Low pressure switch	D471/481/491/401-PSL	Normal Pressure
Gas Booster Compressor (D470/480/490/400)	Gas Booster Compressor Run Status	D470/480/490/400-MM	Running

9.2.4. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Gas Booster Compressor (D470/480/490/400)	Compressor start command	DC-D470/480/490/400-MN	Digital Output
Gas Booster Compressor (D470/480/490/400)	Compressor stop command	DC-D470/480/490/400-MO	Digital Output
Gas Booster Compressor (D470/480/490/400)	Compressor reset command	DC-D470/480/490/400-MX	Digital Output
Discharge Valve (D474/484/494/404)	Valve open command	DC-D474/484/494/404-VD	Digital Output
Discharge Valve (D474/484/494/404)	Valve close command	DC-D474/484/494/404-VB	Digital Output
Valve (D475/485/495/405)	Valve open command	DC-D475/485/495/405-VD	Digital Output
Valve (D475/485/495/405)	Valve close command	DC-D475/485/495/405-VB	Digital Output
Gas Booster Compressor (D470/480/490/400)	Compressor computer/hand status	DC-D470/480/490/400-YS	Digital Input
Gas Booster Compressor (D470/480/490/400)	Compressor run status	DC-D470/480/490/400-MM	Digital Input
Pressure Switch (D471/481/491/401)	Compressor suction low pressure status	DC-D471/481/491/401-PL	Digital Input
Pressure Switch (D472/482/492/402)	Compressor discharge high pressure status	DC-D472/482/492/402-PH	Digital Input
Temperature Switch (D473/483/493/403)	Compressor discharge high temperature status	DC-D473/483/493/403-TH	Digital Input
Discharge Valve (D474/484/494/404)	Valve computer/hand status	DC-D474/484/494/404-YS	Digital Input
Discharge Valve (D474/484/494/404)	Valve open status	DC-D474/484/494/404-ZD	Digital Input
Discharge Valve (D474/484/494/404)	Valve closed status	DC-D474/484/494/404-ZB	Digital Input
Valve (D475/485/495/405)	Valve open status	DC-D475/485/495/405-ZD	Digital Input

Jacket Temperature Switch (D476/486/496/406)	Jacket high temperature status	D476/486/496/406-TH	Digital Input
Low Oil Level Switch (D477/487/497/407)	Oil low level status	D477/487/497/407-LL	Digital Input
Pressure Switch (D478/488/498/408)	Jacket low pressure status	D478/488/498/408-PL	Digital Input
Belt Tension Switch (D479/489/499/409)	Belt tension status	D479/489/499/409-ZL	Digital Input
Flow Meter (D901)	DGH Flow Rate	DB-B901-FT	Analog Input
Pressure Transmitter (D501)	DGH Pressure Status	DC-D501-PT	Analog Input

9.2.5. HMI Display

Device Description	**Status**
Gas Booster Compressor (D470/480/490/400)	Duty 1 Chosen
Gas Booster Compressor (D470/480/490/400)	Duty 1 Running
Gas Booster Compressor (D470/480/490/400)	Duty 2 Chosen
Gas Booster Compressor (D470/480/490/400)	Duty 2 Running
Gas Booster Compressor (D470/480/490/400)	Duty 3 Chosen
Gas Booster Compressor (D470/480/490/400)	Duty 3 Running
Gas Booster Compressor (D470/480/490/400)	Duty 4 Chosen
Gas Booster Compressor (D470/480/490/400)	Duty 4 Running
Temperature Switch (D473/483/493/403)	Discharge Temperature
Pressure Switch (D472/482/492/402)	Discharge Pressure
Pressure Switch (D471/481/491/401)	Suction Pressure
Pressure Switch (D478/488/498/408)	Jacket Pressure
Jacket Temperature Switch (D476/486/496/406)	Jacket Temperature
Low Oil Level Switch (D477/487/497/407)	Oil Level
Belt Tension Switch (D479/489/499/409)	Belt Tension
Gas Booster Compressor (D470/480/490/400)	Reset
Valve (D475/485/495/405)	Valve Position Status
Valve (D474/484/494/404)	Valve Position Status
Flow Meter (D901)	Gallery 5 Boiler Gas Flow (m^3/h)
Flow Meter (D901)	Boiler System Gas Flow (m^3/h)
Pressure Transmitter (D501)	Gas Sphere Pressure (kPa)
Pressure Transmitter (D501)	Gas Sphere Pressure (High/Normal)

9.2.6. PCS Alarms

Equipment	**Alarm Description**	**Alarm Condition**	**Alarm Response**
Gas Booster Compressor (D470/480/490/400)	Low suction pressure	Low pressure switch DC-D471/481/491/401-PL is active	Compressor is taken out of service
Gas Booster Compressor (D470/480/490/400)	High discharge pressure	High pressure switch DC-D472/482/492/402-PH is active	Compressor is taken out of service

Gas Booster Compressor (D470/480/490/400)	High discharge temperature	High temperature switch DC-D473/483/493/403-TH is active	Compressor is taken out of service
Gas Booster Compressor (D470/480/490/400)	High water jacket temperature	High temperature switch D476/486/496/406-TH is active	Compressor is taken out of service
Gas Booster Compressor (D470/480/490/400)	Low oil level	Low level switch D477/487/497/407-LL is below active	Compressor is taken out of service
Gas Booster Compressor (D470/480/490/400)	Low water jacket pressure	Low pressure switch D478/488/498/408-PL is active	Compressor is taken out of service
Gas Booster Compressor (D470/480/490/400)	Low belt tension	D479/489/499/409-ZL is active	Compressor is taken out of service

10. WASTE GAS BURNERS

Associated P&ID: 1-0101D-A0053, 1-0101D-A0054
Associated NEWPCC Manuals: D1400 Revised
Associated DCS HMI Screens: ndhold.G, ndholdga.G, ndgabrn.G

10.1. Process Description

DG from Waste Gas Piping flows to Waste Gas Burners 1-3 via cylinder operated and pressure control valves, as shown in the table below. When the Surge Tank pressure reaches 2.4 kPa the valve sequence open and DG flows to the burners.

Source	Discharge	Via
Waste Gas Piping	Burner 1	Waste Gas Valve (D512)
		Pressure Control Valve (D562)
	Burner 2	Waste Gas Valve (D522)
		Pressure Control Valve (D562)
	Burner 3	Waste Gas Valve (D532)
		Pressure Control Valve (D561)

10.2. Control Description

The Waste Gas Burners are controlled through a local Burner Control Panel. A hand/off/auto hand switch (D511/521/531/241-HS) on the Burner Control Panel can be used to select HAND or AUTOMATIC modes.

10.2.1. Local Manual Control Mode

In HAND mode, the burner's pilot light is maintained continuously by the Burner Control Panel. The PCS controls the flow of gas to the burner by operating the waste gas valves (D512/522/532). The valves are opened or closed based off of the pressure in the Surge Tank described below.

10.2.2. Remote Automatic Control Mode

In AUTOMATIC mode, the PCS starts a burner by sending a signal to the Burner Control Panel to initiate the pilot light ignition prior to opening the waste gas valves. The PCS stops a burner by closing the waste gas valve and then turning off the pilot light.

The Burners are assigned a duty priority by the operator and sequence as follows:

1. Duty 1 Burner starts when the Surge Tank pressure rises to 2.40 kPa.
2. Duty 2 Burner starts when the Surge Tank pressure rises to 2.50 kPa.
3. Duty 3 Burner starts when the Surge Tank pressure rises to 2.60kPa.
4. Duty 3 Burner stops when the Surge Tank pressure falls to 2.10kPa.
5. Duty 2 Burner stops when the Surge Tank pressure falls to 2.00 kPa.
6. Duty 1 Burner stops when the Surge Tank pressure falls to 1.90 kPa.

In the event of high digester pressure as measured by (DC-D131/132/133/134- PT and DB-D135/136-PT), the Burners are sequenced as follows:

1. Duty 1 Burner starts when any digester reaches a pressure of 3.15 kPa.
    a. This start request signal is cleared once the associated digester pressure falls below 2.9 kPa for 10 seconds.
2. Duty 2 Burner starts when any digester reaches a pressure of 3.25 kPa.
    a. This start request signal is cleared once the associated digester pressure falls below 3.0 kPa for 10 seconds.
3. Duty 3 Burner starts when any digester reaches a pressure of 3.3 kPa.
    a. This start request signal is cleared once the associated digester pressure falls below 3.1 kPa for 10 seconds.

The Burner sequencing from the Surge Tank pressure and the digester pressures are to be run in an OR logic fashion such that start commands from either sequence can start and run the Burners. The Surge Tank low pressure stop commands for a given duty Burner will override the digester pressure Burner starting logic.

If a burner fails, the PCS will close the valves to the failed burner.

A high-pressure switch (D532-PH) indicates when there is high pressure in the waste gas line.

The PCS calculates the total amount of sludge gas wasted (m^3/day) by summing the total gas to the waste system (measured by D141/142/143/145/146-FT) and subtracting the total boiler sludge gas consumption.

The burner building has an upper and lower gas detectors that alarm to the PCS.

10.2.3. Interlocks and Permissives

For Waste Gas Valves (D512/522/532) to operate:

Equipment	Device Description	Device Tag	State
PCS		DC-D511/521/531-BN	Open Command

10.2.4. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Waste Gas Valves (D512/522/532)	Burner Flame Start Command	DC-D511/521/531-BN	Digital Output
Waste Gas Burner 1/2/3 (D511/521/531)	Burner Flame Fault	DC-D511/521/531-BF	Digital Input
Waste Gas Burner 1/2/3 (D511/521/531)	Burner Flame Status	DB-D511/521/531-BM	Digital Input
Waste Gas DH Line	Waste Gas Pressure	DC-D532-PH	Digital Input

10.2.5. HMI Display

Device Description	Status
Waste Gas Burner 1/2/3(D511/521/531/	Flame Status (Normal/Fail)
Waste Gas Burner 1/2/3 (D511/521/531)	Burner Status (On/Off)

10.2.6. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Waste Gas Burner 1/2/3 (D511/521/531)	Waste Gas Burner Pilot Flame Failure	DB-D241-BF in alarm	Change duty selections of burners.

11. GAS DETECTION AND ALARMING

Associated P&ID: 1-0101D-A0061
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nbhvac.G, ndgalms.G, ndhvac3.G, ndhvac2.G, ndhvac5.G, ndhvac6.G, ndgabrn.G, ndegr.G

11.1. Process Description

Gas detectors (D935/936/937/938/939/940/941/942/943/944-GE) measure and transmit (D935/936/937/938/939/940/941/942/943/944-GT) the gas concentration to a gas indicator relay (D935/936/937/938/939/940/941/942/943/944-GIY).

Tag	Location Description	Control Loop	Fan Activated
S-1	Boiler Building	D935	
S-2	Digester Gallery 4 Penthouse	D936	
S-3	Digester Gallery 3 Isolation Chamber	D937	
S-4	Waste Gas Burner 4 Trap Room (Boiler Building)	D938	Exhaust Fan BF-46
S-5	East Gas Room	D939	
S-6	West Gas Room	D940	
S-7	Gas Storage Sphere Trap Room	D941	
S-8	Waste Gas Burner Isolation Chamber	D942	Exhaust Fan DF-31
S-9	Waste Gas Burner Building Main Floor	D943	Exhaust Fan DF-28
S-10	Digester Gallery 4 Drip Trap Room	D944	Exhaust Fan DF-26

11.2. Control Description

The Gas Area Detection Alarms have a warning setpoint and an alarm set point, as shown in the table below. When the gas concentration (% LEL) reaches or exceeds the alarm setpoint, alarms (horn and/or strobe) are triggered at the device location and the alarm condition is sent to PCS. Additionally, select locations have fan(s) which are interlocked to start when the alarm condition is met, as shown in the table below.

When the alarm condition is triggered, Operations staff are dispatched immediately to investigate the site.

Warnings and alarms are reset through the Gas Monitoring Panel in the Digester Control Room. The east electrical room has is own gas monitoring panel.

Location Description	Units	Set Point		Fan Activated
		Warning	Alarm	
Boiler Building	% LEL	10	20	
Digester Gallery 4 Penthouse	% LEL	10	20	DF-15
Digester Gallery 3 Isolation Chamber	% LEL	10	20	DF-10
Waste Gas Burner 4 Trap Room (Boiler Building)	% LEL	10	20	BF-46
East Gas Room	% LEL	10	10	DF-13
West Gas Room	% LEL	10	20	DF-43
Gas Storage Sphere Trap Room	% LEL	10	20	
Waste Gas Burner Isolation Chamber	% LEL	10	20	DF-31
Waste Gas Burner Building Main Floor	% LEL	10	20	DF-28
Digester Gallery 4 Drip Trap Room	% LEL	10	20	DF-26

11.2.1. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Gas Indicator Relay (D935/936/937/938/939/940/941/942/943/944)	Gas Alarm	DB-D935/936/937/938/939/940/941/942/943/944-GA	Digital Input
East Gas Room Sensor (D939-GDC)	Fault	DB-D393-QF	Digital Input
East Gas Room Sensor (D939-GDC)	Sensor In-Maintenance Status	AIT-D939-1/2/3/4/5/6.Maint	Networked Digital Input
East Gas Room Sensor (D939-GDC)	Sensor Fault	AIT-D939-1/2/3/4/5/6.Fault	Networked Digital Input
East Gas Room Sensor (D939-GDC)	Sensor Inhibited	AIT-D939-1/2/3/4/5/6.Inhibited	Networked Digital Input
East Gas Room Sensor (D939-GDC)	Sensor Active	AIT-D939-1/2/3/4/5/6.Active	Networked Digital Input
East Gas Room Sensor (D939-GDC)	Sensor Alarm 1 (High 10%) SP	AIT-D939-1/2/3/4/5/6.AAH_SP	Networked Analog Input
East Gas Room Sensor (D939-GDC)	Sensor Alarm 2 (High High 20%) SP	AIT-D939-1/2/3/4/5/6.AAHH_SP	Networked Analog Input

11.2.2. HMI Display

Device Description	Status
Gas Indicator Relay (D935/936/937/938/939/940/941/942/943/944)	Alarm Status (Normal/High)
Gas Indicator Relay (D935/936/937/938/939/940/941/942/943/944)	Alarm Status (Normal/Alarm)
East Gas Room Sensor (D939-GDC)	Value
East Gas Room Sensor (D939-GDC)	High Alarm SP
East Gas Room Sensor (D939-GDC)	High High Alarm SP
East Gas Room Sensor (D939-GDC)	Under Maintenance
East Gas Room Sensor (D939-GDC)	Faulted Status
East Gas Room Sensor (D939-GDC)	Inhibited
East Gas Room Sensor (D939-GDC)	Active

11.2.3. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Gas Indicator Relay (D935/936/937/938/940/941/942/943/944)	Gas Alarm	DB-D935/938/939/940/941/942/943/944-GA is above 40% LEL	Alarm Notification
Gas Indicator Relay (D936/937)	Gas Alarm	DB-D936/D937-GA is above 10% LEL	Alarm Notification
East Gas Room Sensor (D939-GDC)	Gas Alarm	DB-D939-GA in alarm	Alarm Notification

12. SUMP PUMPS

Associated P&ID: 1-0101D-A0077
Associated NEWPCC Manuals:
Associated DCS HMI Screens: ndhvac1.G, ndhvac2.G, ndhvac3.G

12.1. Process Description

Location	Pump	Discharges To
North End of Digester Gallery 7	D949-DP43	Land Drainage from Roof
	D949-DP44	
Entrance to Pipe Gallery 7	D945-DP47	Rainwater Piping
Entrance to Pipe Gallery 2	D946-DP49	Digester Gallery 1 South
Digester Gallery 6	D948-DP45	Sanitary Sewer in Boilers
	D948-DP46	
Digester Gallery 4	D947-DP48	Sanitary Sewer in Boilers
	D947-DP50	

12.2. Control Description

12.2.1. Local Automatic Control Mode

Each pump controlled in a LOCAL AUTOMATIC mode.

Gallery 7 pumps have a Computer/off/Hand switch that allows for local operation of DP 43 and DP 44

The pump is started by a high-level float switch and shuts down at the low-level switch.

Each sump's high-level switch is monitored by the PCS.

12.2.2. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Digester Gallery 7 NE Sump Pumps (D949)	High level status	DB-D949-LH	Digital Input
Pipe Gallery 7 Entrance Sump Pump (D945)	High level status	DB-D945-LH	Digital Input
Pipe Gallery 2 Entrance Sump Pump (D946)	High level status	DB-D946-LH	Digital Input
Digester Gallery 6 Sump Pumps (D948)	High level status	DB-D948-LH	Digital Input
Digester Gallery 4 Sump Pumps (D947)	High level status	DB-D947-LH	Digital Input

12.2.3. HMI Display

Device Description	Status
Digester Gallery 7 NE Sump Pumps (D949)	Sump Pit Level Status (Normal/High)
Pipe Gallery 7 Entrance Sump Pump (D945)	Sump Pit Level Status (Normal/High)
Pipe Gallery 2 Entrance Sump Pump (D946)	Sump Pit Level Status (Normal/High)
Digester Gallery 6 Sump Pumps (D948)	Sump Pit Level Status (Normal/High)
Digester Gallery 4 Sump Pumps (D947)	Sump Pit Level Status (Normal/High)

12.2.4. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Digester Gallery 7 NE Sump Pumps (D949)	Sump level is high	DB-D949-LH in alarm	Operations and maintenance staff to examine/service the pump
Pipe Gallery 7 Entrance Sump Pump (D945)	Sump level is high	DB-D945-LH in alarm	Operations and maintenance staff to examine/service the pump
Pipe Gallery 2 Entrance Sump Pump (D946)	Sump level is high	DB-D946-LH in alarm	Operations and maintenance staff to examine/service the pump
Digester Gallery 6 Sump Pumps (D948)	Sump level is high	DB-D948-LH in alarm	Operations and maintenance staff to examine/service the pump
Digester Gallery 4 Sump Pumps (D947)	Sump level is high	DB-D947-LH in alarm	Operations and maintenance staff to examine/service the pump

13. MISCELLANEOUS

Associated P&ID: 1-0101D-A0080
Associated NEWPCC Manuals:
Associated DCS HMI Screens: ndhvac2.G, ndoors.G, nearea7.G, ndhvac4.G, ndgalms.G

13.1.1. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Fire Alarm Panel	Fire Alarm Status	DB-D952-XA	Digital Input
West Electrical Room Door (D926)	Digester Electrical Room Door Open Status	DB-D926-XA	Digital Input
Control Room Door (D925)	Digester Control Room Door Open Status	DB-D925-XA	Digital Input
UPS (D960)	Digester UPS Alarm	DC-D960-QA	Digital Input
Instrument Air	Low Pressure	DB-D902-PL	Digital Input

13.1.2. HMI Display

Device Description	Status
West Electrical Room Door (D926)	Door status (Open/Closed)
Control Room Door (D925)	Door status (Open/Closed)
Fire Alarm Panel	Fire alarm status (Normal/Alarm)
Fire Alarm Panel	Fire alarm status (On/Off)
Instrument Air	Low Pressure

13.1.3. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
West Electrical Room Door (D962)	Digester Electrical Room Open Door Alarm	DB-D926-XA in alarm	Alarm Notification
Control Room Door (D925)	Digester Control Room Open Door Alarm	DB-D925-XA in alarm	Alarm Notification
UPS (D960)	Power, battery backup, or component fault	DC-D960-QA in alarm	Check UPS panel
Fire Alarm Panel	Fire alarm (smoke detector or pull station activated)	DB-D952-XA in alarm	Check fire alarm panel in digester control room for specific zone. Call fire department if necessary. Silence alarm and reset if needed.
Instrument Air Low Pressure Switch	Low Instrument Air Pressure	DB-D902-PL	Alarm Notification

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1. INFLUENT FLOW AND SLUICE GATES

Associated P&ID:	1-0101G-A0033
Associated NEWPCC Manuals:	G201 - G210 Revised
Associated DCS HMI Screens:	negrt, negrtbs1, negrtbs2

1.1. Process Description

Raw Sewage (RS) flows by gravity from the discharge chamber in the Main Building into the Influent Header via two influent conduits

The two influent conduits are also connected to the Tank Drain Header via a valved drain line. The valves associated with the drain line are G17E and G17F. The Tank Drain Header flows to the Main Interceptor.

The Influent Header connects to four motor-controlled sluice gates in parallel: G140-SG, G130-SG, G120-SG and G110-SG. RS flows through the sluice gates to climber bar screens located at the front (east) end of the grit tanks.

RS flows into the bar screens as follows:

- RS from Sluice Gate G110-SG flows to Bar Screen 1 (G150-BS)
- RS from Sluice Gate G120-SG flows to Bar Screen 2 (G160-BS)
- RS from Sluice Gate G130-SG flows to Bar Screen 3 (G170-BS)
- RS from Sluice Gate G140-SG flows to Bar Screen 4 (G180-BS)

1.2. Control Description

1.2.1. Local Manual Control Mode

The sluice gates (G110/120/130/140-SG) are controlled in LOCAL mode.

In LOCAL mode the gate position is controlled manually with an OPEN/OFF/CLOSE hand switch (G110/120/130/140-HS-3).

1.2.2. Interlocks, Permissives and Control Signals

For Influent Sluice Gate (G110/120/130/140-SG) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Influent Sluice Gate (G110/120/130/140-SG)	Open/off/close hand switch	G110/120/130/140-HS-3 (OPN/OFF/CLS)	Open, Close
Influent Sluice Gate (G110/120/130/140-SG)	Local/off/remote hand switch	G110/120/130/140-HS-2 (LOR)	Local

1.2.3. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Influent Sluice Gate (G110/120/130/140-SG)	Gate Closed Status	GA-G110/120/130/140-ZB	Digital Input
Influent Sluice Gate (G110/120/130/140-SG)	Gate Open Status	GA-G110/120/130/140-ZD	Digital Input

1.2.4. HMI Display

Device Description	Status
Influent Sluice Gate (G110/120/130/140-SG)	Sluice gate open/closed status

2. BAR SCREENS

Associated P&ID:	1-0101G-A0035
Associated NEWPCC Manuals:	G501 - G503 Revised
Associated DCS HMI Screens:	negrt, negrtbs1, negrtbs2

2.1. Process Description

A motor-controlled rake removes debris from the influent and deposits it onto two Serpentix conveyor belts. Debris from Bar Screen 1 and 2 are sent to conveyor A250-SCON. Debris from Bar Screen 3 and 4 are sent to conveyor A260-SCON. RS flows through the bar screens and proceeds to the grit tanks.

Screened RS flows into the grit tanks as follows:

- RS from Bar Screen 1 (G150-BS) flows to Grit Tank 1
- RS from Bar Screen 2 (G160-BS) flows to Grit Tank 2
- RS from Bar Screen 3 (G170-BS) flows to Grit Tank 3
- RS from Bar Screen 4 (G180-BS) flows to Grit Tank 4

2.2. Control Description

Each bar screen has its own Local Control Panel (150/160/170/180) located near the bar screen. Operation is controlled either LOCALLY using the local control panel or REMOTELY through the PCS.

2.2.1. Local Manual Control Mode

In LOCAL mode, the bar screen is manually controlled using a FORWARD/OFF/REVERSE hand switch (G150/160/170/180-HS-5). Selecting FORWARD turns the bar screen motor on and raises the rake to clear the screen. Selecting OFF turns the bar screen motor off. The bar screens are only operated in REVERSE direction if the bar screen is caught.

2.2.2. Remote Manual Control Mode

In REMOTE MANUAL mode, the operator can manually start and stop the bar screen from a pop-up dialog box.

2.2.3. Remote Automatic Control Mode

In REMOTE AUTOMATIC mode, the PCS sends an operator adjustable periodic signal for the rake to clear the bar screen.

The bar screen rake is called to start when either of the following conditions are met:

- The timer elapses
- The influent level ahead of the bar screen rises past an operator-adjustable high level setpoint.

The timer is adjusted by the operator through the PCS (current value: 20 minutes; maximum value: 60 minutes; minimum value: 0 minutes) . The timer is reset when the bar screen has reached its limit of travel or the influent channel level has raised past the high level setpoint.

The high level setpoint is adjusted as a percentage of the influent channel level (current value: 75%; maximum value: 164.6%; minimum value: 0%) and adapted to a specific height. Currently, the high level setpoint is 75%. High alarm is 80%

The high-level start condition is latched. If the bar screen has reached its end of travel and the influent channel level has fallen below the high level setpoint, level reset cycle count is incremented. Once the count has reached an operated-adjustable cycle count (current value: 2 cycles; maximum value: 60 cycles; minimum value: 0 cycles), the high-level start condition is reset and the bar screen is stopped.

2.2.4. Interlocks, Permissives and Control Signals

For Bar Screen (G150/160/170/180-BS) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Forward/Off/Reverse Hand Switch	G150/160/170/180-HS-5 (FOR)	Forward
Local Control Panel	Local/Off/Remote Hand Switch	G150/160/170/180-HS-2 (LOR)	Local
Local Control Panel	Emergency Stop Hand Switch	G150/160/170/180-HS-3 (E/S)	Normal
Bar Screen (G150/160/170/180-BS)	Torque Switch	G150/160/170/180-OS	Normal

For Bar Screen (G150/160/170/180-BS) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		GA-G150/160/170/180-MN	Start command
Local Control Panel	Local/Off/Remote Hand Switch	G150/160/170/180-HS-2 (LOR)	Remote
Local Control Panel	Emergency Stop Hand Switch	G150/160/170/180-HS-3 (E/S)	Normal
Bar Screen (G150/160/170/180-BS)	Torque Switch	G150/160/170/180-OS	Normal

2.2.5. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Bar Screen (G150/160/170/180-BS)	Stop command	GA-G150/160/170/180-MO	Digital Output
Bar Screen (G150/160/170/180-BS)	Start command	GA-G150/160/170/180-MN	Digital Output
Bar Screen (G150/160/170/180-BS)	Computer/hand status	GA-G150/160/170/180-YS	Digital Input
Bar Screen (G150/160/170/180-BS)	Torque fault	GA-G150/160/170/180-QF	Digital Input
Bar Screen (G150/160/170/180-BS)	Run status	GA-G150/160/170/180-MM	Digital Input
Bar Screen (G150/160/170/180-BS)	Rake end of travel	GA-G150/160/170/180-ZS	Digital Input
Ultra Sonic Level Sensor (G150/160/170/180-LIT)	Influent channel level (0% to 164 %)	GA-G150/160/170/180-LT	Digital Input

2.2.6. HMI Display

Device Description	Status
Bar Screen (G150/160/170/180-BS)	Run status
Bar Screen (G150/160/170/180-BS)	Computer/hand status
Bar Screen (G150/160/170/180-BS)	High torque alarm
Bar Screen (G150/160/170/180-BS)	End of travel (Yes/No)
Bar Screen (G150/160/170/180-BS)	Level reset cycle setpoint (cycles)
Bar Screen (G150/160/170/180-BS)	Level setpoint (%)
Bar Screen (G150/160/170/180-BS)	Cycle time setpoint (minutes)
Ultra Sonic Level Sensor (G150/160/170/180-LIT)	Influent level status (mm)
Ultra Sonic Level Sensor (G150/160/170/180-LIT)	Influent level status (%)

2.2.7. PCS Alarm

Equipment	Alarm Description	Alarm Condition	Alarm Response
Bar Screen (G150/160/170/180-BS)	High Torque Alarm	GA-G150/160/170/180-QF is in alarm	Bar screen(s) taken out of service

3. GRIT TANKS

Associated P&ID: 1-0101G-A0036
Associated NEWPCC Manuals: G201 - G210 Revised
Associated DCS HMI Screens:

3.1. Process Description

In the grit tank, RS is gently agitated with air. The agitation causes the grit to settle out, while the organic matter remains suspended. Once settled, the grit slides down the slope of the tank bottom and into a grit channel in the tank floor. A baffle wall limits the surface velocity of the RS as it flows into the next section of the grit tank.

Each grit tank has a valved drain line that flows to the Tank Drain Header. A flushing water connection is available to the flush the drain line. The flushing water to the drain line is controlled by a manual valve.

On the other side of the baffle wall, RS is vigorously agitated by air to releases odorous gasses from the influent and increase the dissolved oxygen. The grit effluent (GE) leaving the grit tank flows over the effluent weir to the East and West Grit Effluent conduits. Flow through the conduits is limited using stop logs. Waste-activated sludge (WAS) from the Secondary Clarifiers and SBRs is added to the grit effluent channel behind grit tank 4 before the West and East conduits. Valve GV-27A can be used to isolate the WAS line from the GE conduit. The East conduit conveys the GE to the Center Ring in the Primary Clarifiers Building. The West conduit conveys the GE to Primary Clarifiers 4 and 5 as well as the Center Ring.

4. GRIT CONVEYORS AND HOPPERS

Associated P&ID: 1-0101G-A0037
Associated NEWPCC Manuals: G401 - G409 Revised
Associated DCS HMI Screens: negrt, negrtbs1, negrtbs2

4.1. Process Description

Debris from the bar screens (G150/160/170/180-BS) travels down conveyors G250-SCON and G260-SCON, through the hoppers and into a debris bin. Any debris that falls through the conveyor and onto the conveyor pan is rinsed into the grit tanks. The fallen debris from G250-SCON is sent to Grit Tank 2, and the fallen debris from G260-SCON is sent to grit tank 3. Debris is held in the hoppers when the center debris bin is being removed or replaced.

4.2. Control Description

The Serpentix conveyors (G250/260-SCON) may be operated in LOCAL or REMOTE mode. In both modes the PCS tracks each conveyor's run-time.

4.2.1. Local Manual Control Mode – Conveyors (G250/260-SCON)

In LOCAL mode, the conveyor (G250/260-SCON) is started and stopped through a dedicated Local Control Panel (G250/260).

4.2.2. Local Manual Control Mode – Debris Hopper (G250/260)

Each debris hopper gate is open and closed pneumatically by a OPEN/CLOSE hand switch (G250/260-HS-4). The PCS tracks each hopper's time in hours since it was last emptied through the closed position switch status (GA-G250/260-ZB). The grit hoppers are normally left open unless the bin below is being removed or replaced.

4.2.3. Local Manual Control Mode – PW Valve (G250/260-FV)

In LOCAL HAND mode, the PW valve is operated by setting the HAND/OFF/AUTO hand switch in the Local Control Panel (G250/260-HS-4) to HAND. In HAND mode, the PW valve opens and rinses the conveyor pan. In AUTO mode the solenoid is interlocked with the conveyor operation and is opened when the conveyor is started.

4.2.4. Local Automatic Control Mode – PW Valve (G250/260-FV)

In LOCAL AUTOMATIC mode, the PW valve is operated by setting the HAND/OFF/AUTO hand switch in the Local Control Panel (G250/260-HS-4) to AUTOMATIC. In LOCAL AUTOMATIC mode the PW valve is interlocked with the conveyor operation and is opened when the conveyor is started.

4.2.5. Remote Manual Control Mode – Conveyors (G250/260-SCON)

In REMOTE MANUAL mode the conveyor is manually started and stopped from a pop-up dialog box.

4.2.6. Remote Automatic Control Mode – Conveyors (G250/260-SCON)

In REMOTE AUTO mode the conveyor (G250/260-SCON) is started and stopped when either of the associated bar screens are running.

4.2.7. Interlocks, Permissives and Control Signals

For Serpentix Conveyor (G250/260-SCON) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Serpentix Conveyor (G250/260-SCON)	Local/Off/Remote Hand Switch	G250/260-HS-2 (LOR)	Local
Serpentix Conveyor (G250/260-SCON)	Conveyor fault	G250/260-QF	Normal
Serpentix Conveyor (G250/260-SCON)	Lock Off Stop Hand Switch	G250/260-HS-1 (LOS)	Normal

For Serpentix Conveyor (G250/260-SCON) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		GA- G250/260-MN	Start command
Serpentix Conveyor (G250/260-SCON)	Local/Off/Remote Hand Switch	G250/260-HS-2 (LOR)	Remote
Serpentix Conveyor (G250/260-SCON)	Conveyor fault	G250/260-QF	Normal
Serpentix Conveyor (G250/260-SCON)	Lock Off Stop Hand Switch	G250/260-HS-1 (LOS)	Normal

4.2.8. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Serpentix Conveyor (G250/260-SCON)	Conveyor stop command	GA-G250/260-MO	Digital Output
Serpentix Conveyor (G250/260-SCON)	Conveyor start command	GA-G250/260-MN	Digital Output
Serpentix Conveyor (G250/260-SCON)	Conveyor computer/hand status	GA-G250/260-MN	Digital Input
Serpentix Conveyor (G250/260-SCON)	Conveyor fault	GA-G250/260-QF	Digital Input
Serpentix Conveyor (G250/260-SCON)	Conveyor run status	GA-G250/260-MM	Digital Input
Grit Hopper (G250/260)	Hopper closed status	GA-G250/260-ZB	Digital Input

4.2.9. HMI Display

Device Description	Status
Serpentix Conveyor (G250/260-SCON)	Conveyor run status
Serpentix Conveyor (G250/260-SCON)	Conveyor computer/hand status
Serpentix Conveyor (G250/260-SCON)	Conveyor fault
Serpentix Conveyor (G250/260-SCON)	Conveyor run-time
Grit Hopper (G250/260)	Hopper position status
Grit Hopper (G250/260)	Hopper time since last empty (hours)

4.2.10. PCS Alarm

Equipment	Alarm Description	Alarm Condition	Alarm Response
Serpentix Conveyor (G250/260-SCON)	Conveyor fault	GA-G250/260-QF is in fault	Conveyor taken out of service
Grit Hopper (G250/260)	Hopper duration	>24 hours since hopper last emptied	Alarm

5. GRIT MONORAIL AND CLAMSHELL BUCKETS

Associated P&ID: 1-0101G-A0038
Associated NEWPCC Manuals:
Associated DCS HMI Screens:

5.1. Process Description

The grit from the pre-aeration and grit tanks is collected by operations staff manually using two clamshell bucket and monorail systems. One monorail and clamshell bucket services tanks 1 and 2, and the other monorail and clamshell bucket services tanks 3 and 4. Grit is collected daily from the bottom of the grit tank, and grit from the pre-aeration tanks is collected yearly.

5.2. Control Description

The monorail and clamshell buckets are operated manually using a wireless remote.

6. GRIT BLOWERS

Associated P&ID: 1-0101G-A0039
Associated NEWPCC Manuals: G601 - G605 Revised
Associated DCS HMI Screens: negrt, negrtbl

6.1. Process Description

The raw screened sewage in the pre-aeration and grit tanks is agitated using air. The air is drawn from the Intake Plenum on the West Wall by the grit blowers (G505-GB3, G506-GB4, and G508-GB5) located in the West Basement. The tank blowers discharge into a common header. The common header feeds the Primary Clarifier 4 and 5 Influent Channel and the Grit tanks.

The air to the Grit tanks is measured by flowmeters (G516-FT and G518-FT). Flowmeter G516-FT measures the total air flow to Grit tanks 1 and 2 and flowmeter G517-FT measures the total air flow to aeration zone of Grit tanks 1 and 2. Flowmeter G518-FT measures the total air flow tanks 3 and 4 and flowmeter G519-FT measures the total air flow to aeration zone of Grit tanks 3 and 4.

Motorized modulating valves (G517-ZT and G519-ZT) throttle the flow to the Grit aeration zones for each grit tank pair.

6.2. Control Description

The tank blowers (G506-GB4, and G508-GB5) can be controlled in LOCAL or REMOTE mode.

6.2.1. Local Manual Control Mode – Tank Blowers (G506/508-GB-4/5)

In LOCAL mode, the tank blowers are started by setting the COMPUTER/OFF/HAND hand switch to HAND (G506/508-HS-2) in the Grit Control Room

6.2.2. Remote Manual Control Mode – Tank Blowers (G506/508-GB-4/5)

In REMOTE mode the blowers are controlled in MANUAL mode only. In REMOTE MANUAL mode the blowers are manually sequenced on and off.

6.2.3. Remote Automatic Control Mode – Modulating Valves (G517/519)

In REMOTE AUTOMATIC mode, the modulating valve G517 is controlled to maintain the operator adjustable airflow setpoint for Grit tanks 1 and 2 to within a deadband. Similarly, the modulating valve G519 is controlled to maintain the operator adjustable airflow setpoint for Grit tanks 3 and 4 to within a deadband. The feedback airflow is measured by a flowmeter (G517/519-FT).

Grit tanks can be taken in and out of service on the PCS, the air flow set point for a tank pair is multiplied by the number of tanks in service. If neither tank in a pair is in service, the airflow set point is set to zero.

The pre-aeration flow is monitored and tracked. The pre-aeration flow for Grit tanks 1 and 2 is calculated as the flow measured by G517-FT minus the flow measured by G516-FT. The pre-aeration flow for Grit tanks 3 and 4 is calculated as the flow measured by G519-FT minus the flow measured by G518-FT. This flow is manually throttled by the pre-aeration valves.

There are high airflow level alarms for each pair of pre-aeration flow and aeration zone flow.

The common blower header pressure is measured by G515-PT and will alarm for high pressure. The airflow temperature to Grit tanks 1 and 2 (G517-TT) and tanks 3 and 4 (G518-TT) is monitored and alarms for high air temperature.

Each blower has integral bearing thermal sensors (G506/508 IE 1,2,3,4,5) that alarm (G506/508 QF) to the PCS and shut the respective blower down and a discharge high temperature switch (G506/508-TSH) alarms to the PCS and shuts the respective blower down.

6.2.4. Interlocks, Permissives and Control Signals

For Tank Blowers (G506/508-GB-4/6) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Tank Blower (G506/508-GB-4/5)	Computer/off/hand hand switch	G506/508-HS-2 (COH)	Hand
Tank Blower (G506/508-GB-4/5)	Bearing Temperature Switch	G506/508-TSH	Normal
Local Control Panel	Overcurrent relay	G506/508-IUY	Normal
Tank Blower (G506/508-GB-4/5)	Lock off stop hand switch	G250/260-HS-1 (LOS)	Normal

For Tank Blowers (G506/508-GB-4/6) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		GA-G506/508-MN	Start command
Tank Blower (G506/508-GB-4/5)	Computer/off/hand hand switch	G506/508-HS-2 (COH)	Computer
Tank Blower (G506/508-GB-4/5)	Bearing Temperature Switch	G506/508-TSH	Normal
Local Control Panel	Overcurrent relay	G506/508-IUY	Normal
Tank Blower (G506/508-GB-4/5)	Lock off wstop hand switch	G250/260-HS-1 (LOS)	Normal

6.2.5. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Tank Blower (G506/508-GB-4/5)	Blower stop command	GA-G506/508-MO	Digital Output
Tank Blower (G506/508-GB-4/5)	Blower start command	GA-G506/508-MN	Digital Output
Tank Blower (G506/508-GB-4/5)	Blower computer/hand status	GA-G506/508-YS	Digital Input
Tank Blower (G506/508-GB-4/5)	Blower run status	GA-G506/508-MM	Digital Input
Tank Blower (G506/508-GB-4/5)	Blower fault	GA-G506/508-QF	Digital Input
Aeration Pressure Transmitter (G515-PT)	Aeration pressure	GA-G515-PT	Analog Input
Aeration Temperature Transmitter (G517/519-TT)	Discharge Temperature	GA-517-TT	Analog Input
Grit Tank Total Air Flowmeter (G516/518-FT)	Aeration total air flow	GA-G516/518-FT	Analog Input
Grit Tank Aeration Zone Air Flowmeter (G517/519-FT)	Aeration Zone air flow	GA-G517/519-FT	Analog Input
Aeration Valve (G517/519-ZT)	Valve position command	GA-G517/519-CO	Analog Output
Aeration Valve (G517/519-ZT)	Valve position signal	GA-G517/519-ZT	Analog Input
Aeration Valve (G517/519-ZT)	Computer/hand status	GA-G517/519-YS	Digital Input

6.2.6. HMI Display

Device Description	Status
Tank Blower (G506/508)	Fault
Tank Blower (G506/508)	Run status
Tank Blower (G506/508)	Computer/hand status
Common Header Pressure (G515-PT)	Pressure
Grit Pair Total Flowmeter (G516/518-FT)	Grit Pair Total Airflow
Grit Pair Aeration Zone Flowmeter (G517/519-FT)	Grit Pair Aeration Zone Airflow
Grit Tank (GT1/2/3/4)	Grit Tank In-Service Status
Aeration Valve (G517/519-ZT)	Computer/hand Status
Aeration Valve (G517/519-ZT)	Position (percentage)

6.2.7. PCS Alarm

Equipment	Alarm Description	Alarm Condition	Alarm Response
Tank Blower (G506/508)	Blower fault	GA-G506/508-QF is in fault	Blower taken out of service
Tank Blower (G506/508)	High air pressure	G515-PT is above threshold	Alarm
Grit Aeration Valve (G51/5197-ZT)	High pre-aeration air flow	Pre-aeration airflow is calculated above threshold	Alarm

Grit Aeration Valve (G517/519-ZT)	High aeration air flow	Girt aeration zone airflow is measured above threshold	Alarm

7. TANK FANS

Associated P&ID: 1-0101G-A0041
Associated NEWPCC Manuals: G601 - G605 Revised
Associated DCS HMI Screens: negrt, negrtfn, negrtbl.G

7.1. Process Description

Tank exhaust fans (G608-GF4 and G609-GF4A) draw odorous gases from the underside of the pre-aeration tank covers. The air is then vented up a stack located on the northwest corner of the Pre-Treatment building. On the fan discharge there is a normally-closed pneumatic diaphragm damper (G08-VZ and G609-VZ) that opens when the exhaust fan is running.

An additional tank fan (G610-GF4B) draws odorous gases trapped under the influent channel covers ahead of the sluice gates. The tank fan sends the gases to Grit Tank 2 and Grit Tank 3 to be exhausted by the tank area exhaust fans.

7.2. Control Description

The main exhaust fans (G608-GF4 and G609-GF4A) and tank fan (G610-GF4B) can be controlled in LOCAL at the Field Device Panel (FDP-G) and in REMOTE by the PCS. Each tank fan (G608/609-GF-4/4A) has a discharge pneumatic damper is interlocked with the associated fan operation to open when the fan is energized

7.2.1. Local Manual Control Mode – Main Exhaust Fans (G608/609-GF-4/4A)

In LOCAL mode, the main exhaust fans are started by setting the COMPUTER/OFF/HAND hand switch to HAND (G608/609-HS-2) in the Grit Control Room.

7.2.2. Local Manual Control Mode – Influent Channel Fan (G610-GF4B)

In LOCAL mode, the influent channel fan is started by setting the LOCAL/OFF/REMOTE hand switch (G610-HS-2) in the local control panel.

7.2.3. Remote Manual Control Mode – Main Exhaust Fans (G608/609-GF-4/4A)

In REMOTE MANUAL mode the main exhaust fans are started and stopped by a pop up dialog box.

7.2.4. Remote Manual Control Mode – Influent Channel Fan (G610-GF4B)

In REMOTE MANUAL mode the influent channel fan is started and stopped by a pop up dialog box.

7.2.5. Interlocks, Permissives and Control Signals

7.2.5.1. Main Exhaust Fans (G608/609-GF-4/4A)

For Main Exhaust Fans (G608/609-GF-4/4A) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/Hand hand switch	G608/609-HS-2 (COH)	Hand
Main Exhaust Fan (G608/609-GF-4/4A)	Pressure alarm status	GA-G608/609-PA	Normal
Main Exhaust Fan (G608/609-GF-4/4A)	Lock off stop hand switch	G608/609-HS-1 (LOS)	Normal

For Main Exhaust Fans (G608/609-GF-4/4A) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		GA-G608/609-MN	Start command
Control Room Panel	Computer/Hand hand switch	G608/609-HS-2 (COH)	Computer
Main Exhaust Fan (G608/609-GF-4/4A)	Pressure alarm status	GA-G608/609-PA	Normal
Main Exhaust Fan (G608/609-GF-4/4A)	Lock off stop hand switch	G608/609-HS-1 (LOS)	Normal

7.2.5.2. Influent Channel Fan (G610-GF4B)

For Influent Channel Fan (G610-GF4B) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Local/Off/Remote hand switch	G610-HS-2 (LOR)	Local
Influent Channel Fan (G610-GF4B)	Pressure alarm status	GA-G610-PA	Normal
Influent Channel Fan (G610-GF4B)	Lock Off Stop Hand Switch	G610-HS-1 (LOS)	Normal

For Influent Channel Fan (G610-GF4B) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		GA-G610-MN	Start command
Local Control Panel	Local/Off/Remote hand switch	G610-HS-2 (LOR)	Remote
Influent Channel Fan (G610-GF4B)	Pressure alarm status	GA-G610-PA	Normal
Influent Channel Fan (G610-GF4B)	Lock Off Stop Hand Switch	G610-HS-1 (LOS)	Normal

7.2.6. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Main Exhaust Fan (G608/609-GF-4/4A)	Main Exhaust Fan stop command	GA-G608/609-MO	Digital Output
Main Exhaust Fan (G608/609-GF-4/4A)	Main Exhaust Fan start command	GA-G608/609-MN	Digital Output
Main Exhaust Fan (G608/609-GF-4/4A)	Main Exhaust Fan computer/hand status	GA-G608/609-YS	Digital Input
Main Exhaust Fan (G608/609-GF-4/4A)	Main Exhaust Fan fault (Low air pressure)	GA-G608/609-QF	Digital Input
Main Exhaust Fan (G608/609-GF-4/4A)	Main Exhaust Fan run status	GA-G608/609-MM	Digital Input
Discharge Damper (G608/609)	Damper open status	GA-G608/609-ZD	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Influent Channel Fan (G610-GF4B)	Tank Fan fault	GA-G610-QF	Digital Input
Influent Channel Fan (G610-GF4B)	Tank Fan run status	GA-G610-MM	Digital Input

7.2.7. HMI Display

Device Description	Status
Main Exhaust Fan (G608/609-GF-4/4A)	Fault (Low air pressure)
Main Exhaust Fan (G608/609-GF-4/4A)	Run status
Main Exhaust Fan (G608/609-GF-4/4A)	Computer/hand status
Main Exhaust Fan (G608/609-GF-4/4A)	Discharge damper open
Influent Channel Fan (G610-GF4B)	Fault
Influent Channel Fan (G610-GF4B)	Run status
Influent Channel Fan (G610-GF4B)	Computer/hand status

7.2.8. PCS Alarm

Equipment	Alarm Description	Alarm Condition	Alarm Response
Main Exhaust Fan (G608/609)	Loss of air flow	GA-G608/609-QF is in fault	Main Exhaust Fan taken out of service
Tank Fan (G610)	Loss of air flow	GA-G610-QF is in fault	Tank Fan taken out of service

8. TANK AREA EXHAUST FANS

Associated P&ID: 1-0101G-A0042-001, 1-0101G-A0042-002
Associated NEWPCC Manuals: G201 - G210 Revised
Associated DCS HMI Screens: negrt, negrtfn

8.1. Process Description

Outside air flows into the tank area through four manual dampers (G642/643/644/645) on the East wall. These manual dampers are closed in winter. Air from the tank area is drawn out through the Suction Plenum by five exhaust fans (G611-GF5, G613-GF6, G615-GF7, G612-GF8, and G617-GF9). The air is then vented out the odour control stack. The exhaust fans operate in the same manner as tank exhaust fans G608-GF4 and G609-GF4A.

8.2. Control Description

The tank area exhaust fans (G611/613/615/612/617-GF-5/6/7/8/9) can be controlled in REMOTE by the PCS and in LOCAL at the Field Device Panel (FDP-G) . Each fan has an interlocked normally-closed pneumatic discharge damper (G611/G612/G613/G615/G617-VZ) that opens when the fan is called to start.

A discharge low pressure switch (G611/613/615/612/617-PS) detects fan failure and alarms to the PCS.

8.2.1. Local Manual Control Mode

In LOCAL mode, the main exhaust fans are started by setting the COMPUTER/OFF/HAND hand switch to HAND (G608/609-HS-2) in the Grit Control Room.

8.2.2. Remote Manual Control Mode

In REMOTE mode the fans are controlled in MANUAL. In REMOTE MANUAL the fans are started and stopped manually by a pop-up dialog box.

8.2.3. Interlocks, Permissives and Control Signals

For Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	G611/613/615/612/617-HS-2 (COH)	Hand
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Pressure alarm status	G611/613/615/612/617-PA	Normal
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Lock off stop hand switch	G611/613/615/612/617-HS-1 (LOS)	Normal

For Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		GA-G611/613/615/612/617-MN	Start command
Control Room Panel	Computer/off/hand hand switch	G611/613/615/612/617-HS-2 (COH)	Computer
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Pressure alarm status	G611/613/615/612/617-PA	Normal
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Lock off stop hand switch	G611/613/615/612/617-HS-1 (LOS)	Normal

8.2.4. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Tank Exhaust Fan stop command	GA-G611/G612/G613/G615/G617-MO	Digital Output
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Tank Exhaust Fan start command	GA-G611/G612/G613/G615/G617-MN	Digital Output
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Tank Exhaust Fan computer/hand status	GA-G611/G612/G613/G615/G617-YS	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Tank Exhaust Fan fault	GA-G611/G612/G613/G615/G617-QF	Digital Input
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Tank Exhaust Fan run status	GA-G611/G612/G613/G615/G617-MM	Digital Input
Discharge Damper (G611/G612/G613/G615/G617-VZ)	Damper open status	GA-G611/G612/G613/G615/G617-ZD	Digital Input

8.2.5. HMI Display

Device Description	Status
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Fault
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Run status
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Computer/hand status
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Discharge damper position
East Wall Intake Dampers (G642/643/644/645)	Damper position

8.2.6. PCS Alarm

Equipment	Alarm Description	Alarm Condition	Alarm Response
Tank Area Exhaust Fans (G611/613/615/612/617-GF-5/6/7/8/9)	Loss of air flow	GA- G611/613/615/612/617-QF is in alarm	Exhaust fan taken out of service

9. SUMP PUMPS

Associated P&ID: 1-0101G-A0052
Associated NEWPCC Manuals: Table G109 Revised
Associated DCS HMI Screens: negrt, negrtfn

9.1. Process Description

Sump Pump G504-GP6 pumps water from the East Basement Sump into the Surge Well via Manhole #14.

Sump Pump G507-GP7 pumps water from the Gallery 6 Sump into the Surge Well via the Junction Chamber Manhole.

Sump Pump G510-GP13 pumps water from the Gallery 4 Sump into the Surge Well via the Junction Chamber Manhole.

9.2. Control Description

9.2.1. Local Manual Control Mode

The three pumps are controlled using a level controller. The PCS monitors high sump level alarm (G504/507/510-LAH).

9.2.2. Interlocks, Permissives and Control Signals

For Sump Pumps (G504/507/510-GP-6/7/13) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Sump Pump (G504/507/510)	Level control	G504/507/510-LC (On/Off)	High Level
Sump Pump (G504/507/510)	Lock off stop hand switch	G504/507/510-HS (LOS)	Normal

9.2.3. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Sump Pump (G504/507/510)	High level alarm	GA-G504/507/510-LA	Digital Input

9.2.4. HMI Display

Device Description	Status
Sump Pump (G504/507/510)	High Level

9.2.5. PCS Alarm

Equipment	Alarm Description	Alarm Condition	Alarm Response
Sump Pump (G504/507/510)	High level alarm	GA-G504/507/510-LA is in alarm	Alarm

10. FLUSHING WATER PUMPS

Associated P&ID: 1-0101G-A0054
Associated NEWPCC Manuals: Table G109 Revised
Associated DCS HMI Screens: negrt, negrtfw

10.1. Process Description

The Flushing Water pumps (G502/503-GP-2/3) draw water from the Final Effluent (FE) North and/or South conduit. The pumps discharge FE into a common header, through a strainer.housing and feeds the flushing water system. . Backwash from the strainer housing discharges into the influent header.

10.2. Control Description

10.2.1. Local Manual Control Mode – Flushing Water Pumps (G502/503-GP-2/3)

In LOCAL mode the pumps are operated by setting the COMPUTER/OFF/HAND switch (G502/503-HS-2) to HAND.

10.2.2. Remote Manual Control Mode – Flushing Water Pumps (G502/503-GP-2/3)

In REMOTE MANUAL mode the Flushing Water Pumps are manually sequenced to maintain the flushing water pressure (GA-G650-PT). The pumps are started and stopped from a pop-up dialog box.

10.2.3. Interlocks, Permissives and Control Signals

10.2.3.1. Flushing Water Pumps (G502/503-GP-2/3)

For Flushing Water Pumps (G502/503-GP-2/3) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	G502/503-HS-2 (COH)	Hand
Flushing Water Pump (G502/503)	Low seal water pressure switch	G502/503-PSL	Normal
Flushing Water Pump (G502/503)	Lock off stop hand switch	G502/503-HS-1 (LOS)	Normal

For Flushing Water Pumps (G502/503-GP-2/3) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		GA-G502/503-MN	Start command
Control Room Panel	Computer/off/hand hand switch	G502/503-HS-2 (COH)	Computer
Flushing Water Pump (G502/503)	Low seal water pressure switch	G502/503-PSL	Normal
Flushing Water Pump (G502/503)	Lock off stop hand switch	G502/503-HS-1 (LOS)	Normal

10.2.4. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Flushing Water Pumps (G502/503-GP-2/3)	Start command	GA-G502/503-MO	Digital Output
Flushing Water Pumps (G502/503-GP-2/3)	Stop command	GA-G502/503-MN	Digital Output
Flushing Water Pumps (G502/503-GP-2/3)	Computer/hand status	GA-G502/503-YS	Digital Input
Flushing Water Pumps (G502/503-GP-2/3)	Low seal water pressure alarm	GA-G502/503-PA	Digital Input
Flushing Water Pumps (G502/503-GP-2/3)	Run status	GA-G502/503-MM	Digital Input
Flushing Water	Pressure	GA-G560-PT	Analog Input

10.2.5. HMI Display

Device Description	Status
Flushing Water Pump (G502/503)	Low seal water pressure alarm
Flushing Water Pump (G502/503)	Computer/hand status
Flushing Water Pump (G502/503)	Run status
Flushing Water Pump (G502/503)	Run time (hours)
Grit Flushing Water System	Flushing water pressure (PSIG)

10.2.6. PCS Alarm

Equipment	Alarm Description	Alarm Condition	Alarm Response
Flushing Water Pump (G502/503)	Loss of Seal Water Pressure	GA-G502/503-PA is in alarm	Alarm notification

11. H_2S MONITOR

Associated P&ID: 1-0101G-A0056
Associated NEWPCC Manuals: G901 - G905 Revised
Associated DCS HMI Screens: negrtbs2.G, negrtbs1.G, negrtfn.G, negrthv.G

11.1. Process Description

The H_2S monitoring system (G525-AE, G525-AT, and G525-AIY) measures the H_2S levels in the Grit Building. The analyzer and alarm (G525-AT/AIY) are located in the southwest corner of the building, and the sensor (G525-AE) is located in the pre-aeration and grit tank area. When the H_2S levels exceed 5 ppm, an alarm signal is sent to the control room panel as digital input GA-G525-AA. When the system is in alarm, the PCS sets off the building alarms. Additionally, the signal is sent to alarm beacons in the tank room (G52-AA-2) and above the AIT (G525-AA-1). The alarm is automatically shut off once the H2S concentration drops to 0 ppm.

11.2. Control Description

11.2.1. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
H_2S analyzer (G525-AY)	H_2S PPM	GA-G525-AA	Digital Input
H_2S analyzer (G525-AY)	H_2S PPM	GA-G525-AT	Analog Input

11.2.2. HMI Display

Device Description	Status
H_2S analyzer (G525-AY)	High level alarm
H_2S analyzer (G525-AY)	Concentration (ppm)

11.2.3. PCS Alarm

Equipment	Alarm Description	Alarm Condition	Alarm Response
H_2S monitor (G525-AY)	H_2S high level alarm	GA-G525-AA is in alarm	Alarm notification

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1. PRIMARY CLARIFIERS 1, 2, & 3

Associated P&ID:	1-0101P-A0058, 1-0101P-A0060
Associated NEWPCC Manuals:	P301 - P320 Revised
Associated DCS HMI Screens:	npslp1.G, nearea2.G

1.1. Process Description

Grit effluent (GE) flows from the junction chamber via the east and west conduits to the control chamber inner ring. The GE flows from the control chamber inner ring through three parallel sluice gates (P103-1PM15, P203-2PM16, and P303-1PM17) and into primary clarifiers 1, 2, and 3 as follows:

- GE from sluice gate P103-1PM15 goes to Primary Clarifier 1
- GE from sluice gate P203-2PM16 goes to Primary Clarifier 2
- GE from sluice gate P303-1PM17 goes to Primary Clarifier 3

Primary Effluent (PE) flows out of clarifiers 1, 2, and 3 to the control chamber outer ring.

Each clarifier has its own motorized sludge and scum sweep (P104-1PM1, P204-2PM2, and P304-1PM3) that are typically run in LOCAL MANUAL mode. The sweep pushes the settling sludge into a sludge hopper at the bottom of the tank and skims scum into the walkway channels. The scum is then manually skimmed to the tank's scum trough at the top of the tank. The sludge then travels to sludge valves P102-HV, P202-HV, and P302-HV. Scum goes to scum pumps P901-1PP21 and P905-1PP22.

1.2. Control Description

1.2.1. Local Manual Control Mode - Sludge and Scum Sweep (P104/204/304-1/2/1-PM-1/2/3)

The clarifier sludge and scum sweep motors are controlled through the local control panels (P104/204/304-HS-B), and through the lock/off/stop switch (P104/204/304 HS A) by each motor. Each sludge and scum sweep has a torque switch (P104/204/304 OSH) that senses when the motor is overloaded and causes the sweep to stop and sends the overload alarm (DD-P104/204/304-QF) to the PCS.

In LOCAL MANUAL mode, the sludge and scum sweep is started and stopped using the START or STOP hand switch (P104/204/304-HS-B) at the local control panel located near the sludge and scum sweep motor.

1.2.2. Remote Manual Control Mode - Sludge and Scum Sweep (P104/204/304-1/2/1-PM-1/2/3)

In REMOTE MANUAL mode the sludge and scum sweep can be started and stopped from the pop-up faceplate.

1.2.3. Remote Automatic Control Mode - Sludge and Scum Sweep (P104/204/304-1/2/1-PM-1/2/3)

The sludge and scum sweep (P104/204/304-1/2/1-PM-1/2/3) must be started in MANUAL mode before switching to REMOTE AUTOMATIC.

In REMOTE AUTOMATIC mode, the sludge and scum sweep runs continuously once it is manually started.

1.2.4. Interlocks, Permissives and Control Signals

1.2.4.1. Clarifiers 1, 2, & 3 Primary Influent Sluice Gates (P103/203/303-1/2/1-PM-15/16/17)

For Primary Influent Sluice Gate (P103/203/303-1/2/1-PM-15/16/17) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Primary Influent Sluice Gate (P103/203/303-1/2/1-PM-15/16/17)	Local/off/remote hand switch	P103/203/303-HS-D (LOR)	Local
Primary Influent Sluice Gate (P103/203/303-1/2/1-PM-15/16/17)	Open, close hand switch	P103/203/303-HS-F,G (OPN,CLS)	Open, close
Primary Influent Sluice Gate (P103/203/303-1/2/1-PM-15/16/17)	Open, close torque switch	P103/203/303-OSD,OSB	Normal

Equipment	Device Description	Device Tag	State
Primary Influent Sluice Gate (P103/203/303-1/2/1-PM-15/16/17)	Open, close position switch	P103/203/303-ZSD,ZSB	Not opened, not closed
Primary Influent Sluice Gate (P103/203/303-1/2/1-PM-15/16/17)	Lock off stop hand switch	P103/203/303-HS-E (LOS)	Normal

1.2.4.2. Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)

For Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)	Start hand switch	P104/204/304-HS-B (START)	Start
Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)	High torque switch	P104/204/304-OSH	Normal
Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)	Lock off stop hand switch	P104/204/304-HS-A (LOS)	Normal

For Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		810/820/830-DDE-01	Start command
Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)	Auto /Hand Switch	P104/204/304-HS	Auto
Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)	High torque switch	P104/204/304-OSH	Normal
Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)	Lock off stop hand switch	P104/204/304-HS-A (LOS)	Normal

1.2.5. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Primary Influent Sluice Gate(P103/203/303)	Close command	DD-P103/203/303-VB	Digital Output
Primary Influent Sluice Gate(P103/203/303)	Open command	DD-P103/203/303-VD	Digital Output
Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)	Start command	810/820/830-DDE-01	Digital Output
Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)	Computer/hand status	810/820/830-DDC-02	Digital Input
Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)	Impending overload	810/820/830-DDC-03	Digital Input
Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)	Run status	DD-P104/204/304-MM	Digital Input
Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)	Overload status	DD-P104/204/304-QF	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Sludge and Scum Rake (P104/204/304-1/2/1-PM-1/2/3)	Torque	810/820/830-DDC-05	Analog Input

1.2.6. HMI Display

Device Description	Status
Clarifiers 1, 2, & 3	Clarifier flow enable switch lock
Clarifiers 1, 2, & 3	Total influent flow (ML/day)
Clarifiers 1, 2, & 3	Total primary effluent flow
Sludge and Scum Rake (P104/204/304)	Impending overload status
Sludge and Scum Rake (P104/204/304)	Run status
Sludge and Scum Rake (P104/204/304)	Torque (%)

1.2.7. PCS Alarm

Equipment	Alarm Description	Alarm Condition	Alarm Response
Sludge and Scum Rake (P104/204/304)	High Torque Alarm	DD-P104/204/304-QF is overloaded	Sludge and scum rake taken out of service

2. PRIMARY CLARIFIERS 4 & 5

Associated P&ID: 1-0101P-A0059, 1-0101P-A0061
Associated NEWPCC Manuals:
Associated DCS HMI Screens: npslp2.G, nearea2.G

2.1. Process Description

GE from the West Conduit flows through the Influent Conduit to two parallel sluice gates (P407-2PM18 and P507-1PM19).

GE flows to Primary Clarifier 4 via sluice gate P407-2PM18. The GE flowing to Primary Clarifier 4 is aerated with air from the grit blowers via spargers in the distribution channel after the sluice gate before entering Clarifier 4

The GE flows to Primary Clarifier 5 via sluice gate P507-1PM19 The GE flowing to Primary Clarifier 5 is aerated with air from the grit blowers via spargers in the distribution channel after the sluice gate before entering Clarifier 5

Each distribution channel has two scum control gates:

- Scum control gate SL-1(A) and SL-1(B) is used for cleaning out accumulated scum in the header.
- Scum control gate SL-1(C) and SL-1(D) is used for cleaning out accumulated scum in the header.

From the distribution channels, the GE flows into tanks 4 and 5. The bridge collector (1/2-PM-11/12) scrapes the scum into the tank's scum collector, and sludge into the tank's sludge hoppers. Primary Effluent (PE) flows over the effluent weirs into the PE conduit to the Oxygen Reactors.

2.2. Control Description

2.2.1. Local Control Mode - Bridge Collector (1/2-PM-11/12)

The bridge collector (1/2-PM-11/12) is controlled locally by a PLC. The bridge collector has a drive motor and a scraper hoist operating motor. The controls for the bridge collector are located on the moving bridge. The bridge controls are configured so that FORWARD corresponds to moving towards the East, and REVERSE to the West.

The control loop associated with the bridge collector 1PM11 is P409. The control loop associated with the bridge collector 2PM12 is P509.

2.2.2. Local Manual Control Mode - Primary Influent Sluice Gate (P407/507-1/2-PM-18/19)

The sluice gates are controlled in LOCAL MANUAL mode only. In LOCAL MANUAL mode, the primary influent sluice gates are controlled using the OPEN (P103/303-HS-F) and CLOSE (P103/303-HS-G) hand switches located at the primary influent sluice gates

2.2.3. Interlocks, Permissives and Control Signals

For Primary Influent Sluice Gate (P407/507-1/2-PM-18/19) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Primary Influent Sluice Gate (P407/507-1/2-PM-18/19)	Local/off/remote hand switch	P103/303-HS-D (LOR)	Local
Primary Influent Sluice Gate (P407/507-1/2-PM-18/19)	Open, close hand switch	P103/303-HS-F,G (OPN,CLS)	Open, close
Primary Influent Sluice Gate (P407/507-1/2-PM-18/19)	Open, close torque switch	P103/303-OSD,OSB	Normal
Primary Influent Sluice Gate (P407/507-1/2-PM-18/19)	Open, close position switch	P103/303-ZSD,ZSB	Not opened, not closed
Primary Influent Sluice Gate (P407/507-1/2-PM-18/19)	Lock off stop hand switch	P103/303-HS-E (LOS)	Normal

* = Required for LOCAL MANUAL control from the Primary Clarifiers Control Room only.

2.2.4. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Primary Influent Sluice Gate (P407/507-1/2-PM-18/19)	Close command	DD-P103/303-VB	Digital Output
Primary Influent Sluice Gate (P407/507-1/2-PM-18/19)	Open command	DD-P103/303-VD	Digital Output
Bridge Collector (1/2-PM-11/12)	Bridge power fault	DD-P409/509-QF	Digital Input

2.2.5. HMI Display

Device Description	Status
Bridge Collector (1/2-PM-11/12)	Bridge power status (Normal/Fail)

Bridge Collector (1/2-PM-11/12)	Bridge travel status – Fail if the scum collector doesn't run for 75 minutes

2.2.6. PCS Alarm

Equipment	Alarm Description	Alarm Condition	Alarm Response
Bridge Collector (1/2-PM-11/12)	Bridge power fault	DD-P409/509-QF is in alarm	Alarm notification

3. SLUDGE SYSTEM – CLARIFIERS 1, 2, & 3

Associated P&ID: 1-0101P-A0064, 1-0101P-A0065
Associated NEWPCC Manuals: P401 – P411 Revised
Associated DCS HMI Screens: npslp1.G, nearea2.G

3.1. Process Description

Primary sludge (PS) from the sludge hoppers in clarifiers 1, 2, and 3 flows through the normally-closed sludge removal valves (PV-36A/B/C) as follows:

- Sludge from the clarifier 1 sludge hopper flows through valve PV-36A
- Sludge from the clarifier 2 sludge hopper flows through valve PV-36B
- Sludge from the clarifier 3 sludge hopper flows through valve PV-36C

The PS then flows to the sludge pump suction header via valves PV-37A and PV-37B. The PS is drawn by two sludge pumps, P201-2PP2 and P301-1PP3 and discharged to sludge flow and density metering.

The PS lines from clarifiers 1, 2, and 3 also have valved lines for sludge transfer or tank drainage into the siphon line and then to the Main Building Surge Well.

3.2. Control Description

3.2.1. Local Manual Control Mode - Sludge Removal Valves PV-36A/B/C (P102/202/302-HV)

In LOCAL MANUAL mode, the sludge removal valves must be put to HAND on the Primary Control room panel then are controlled using the OPEN (P102/202/302-HS-D) and CLOSE (P102/202/302-HS-E) hand switches located at the sludge removal valves or the OPEN (P102/202/302-HS-B) and CLOSE (P102/202/302-HS-C) hand switches located at in the Primary Clarifiers control room panel.

3.2.2. Remote Manual Control Mode - Sludge Removal Valves PV-36A/B/C (P102/202/302-HV)

The sludge removal valves can be controlled in REMOTE MANUAL mode when the following conditions are met:

- The Primary Clarifier Batch System (PCBS - See Section 5) is stopped.
- Sludge pump P201-2PP2 or P301-1PP3 has not failed.
- The hand switch is in REMOTE mode

In REMOTE MANUAL mode the sludge removal valves can be opened and closed from the pop-up faceplate.

3.2.3. Remote Automatic Control Mode - Sludge Removal Valves PV-36A/B/C (P102/202/302-HV)

The sludge removal valves will AUTOMATICALLY open when the following conditions are met:

- The valves are called to open by the PCBS
- The valve is in REMOTE mode
- The valves are not in alarm
- The sludge density okay.
  - The sludge density will latch to not okay if the sludge removal valve is open and the sludge density is less than the operator set minimum density percentage (initially 2.8%) while the sludge flow is greater than 5 L/s for longer than 180 seconds.
  - This alarm must be manually reset by an operator.
- At least one sludge pump (P201/301-2/1-PP-2/3) is not in alarm
- The associated clarifier's pumping time has not elapsed (default value: 15 min; maximum value: 100 min; minimum value: 1 min)
- The associated clarifier is not set to be bypassed by the operator.

Once the sludge removal valve has automatically opened, it will be latched open. The valve will close when one of the following conditions are met:

- The valve is called to close by the PCBS.
- The valve has faulted.
- The valve is not in REMOTE mode.

3.2.4. Local Manual Control Mode - Sludge Pump (P201/301-2/1-PP-2/3)

In LOCAL MANUAL mode, the sludge pumps are started using the ON/OFF hand switch (P201/301-HS-H) at the local control panel or at the Primary Clarifiers control room panel by putting pumps to HAND

The sludge pump speed is adjusted using the INCREASE SPEED (P201/301-HS-F) and DECREASE SPEED (P201/301-HS-G) buttons in the local control panel or the INCREASE SPEED (P201/301-HS-C) and DECREASE SPEED (P201/301-HS-D) buttons in the Primary Clarifiers control room panel.

3.2.5. Remote Manual Control Mode - Sludge Pump (P201/301-2/1-PP-2/3)

The sludge pumps can be controlled in REMOTE MANUAL mode if the following conditions are met:

- The PCBS batch is not currently running (See section 5).
- The pump is in REMOTE mode at the local control panel.
- The pump is in REMOTE mode at the Primary Clarifier control room panel.

In REMOTE MANUAL mode the sludge pumps can be started and stopped by the operator from the pop-up faceplate. Does a sludge removal valve from PC1-3 need to be open as well?

The speed can be manually set from a pop-up faceplate or the speed can be controlled in AUTOMATIC mode as described below.

3.2.6. Remote Automatic Control Mode - Sludge Pump (P201/301-2/1-PP-2/3)

The pumps (P201-2PP2 and P301-1PP3) can be set to DUTY or STANDBY mode through the PCS. If the DUTY pump fails, the STANDBY pump will be assigned to DUTY.

In REMOTE AUTOMATIC mode, the duty sludge pump will start automatically if the following conditions are met:

- The pump is called to start from the PCBS (See section 5).
- At least one sludge removal valve (P102/202/302-HV) is open.
- The pump is in REMOTE mode at the local control panel.
- The pump is in REMOTE mode at the Primary Clarifier control room panel.

Once the pump has automatically been started, the pump will be latched to run. The pump will run until it is called to stop by the PCBS.

In REMOTE AUTOMATIC mode the sludge pump speed can be set manually from a pop-up faceplate or can be controlled automatically. When controlled automatically, the pump speed is modulated by a PID loop to maintain the sludge flow measured by P700-FT to the operator set flow (Minimum: 0 m^3/hr; Maximum: 90 m^3/hr; Initial: 81 m^3/hr) while the batch is running. When the batch is not running and the pump speed is controlled automatically, the pump speed is maintained to the last value.

3.2.7. Interlocks, Permissives and Control Signals

3.2.7.1. Sludge Removal Valves PV-36A/B/C (P102/202/302-HV)

For Sludge Removal Valves PV-36A/B/C (P102/202/302-HV) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/hand switch	P102/202/302-HS-A (C/H)	Hand
Control Room Panel	Open, close hand switch	P102/202/302-HS-B,C (OPN,CLS)	Normal
Sludge Removal Valves (P102/202/302-HV)	Open, close hand switch	P102/202/302-HS-D,E (OPN,CLS)	Normal*

* = Required for LOCAL MANUAL control from the Primary Clarifiers Control Room only.

For Sludge Removal Valves (P102/202/302-HV) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/hand switch	P102/202/302-HS-A (C/H)	Computer
PCS		DD-P102/202/302-VD	Open command

3.2.7.2. Sludge Pump (P201/301-2/1-PP-2/3)

For Sludge Pump (P201/301-2/1-PP-2/3) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	P201/301-A (COH)	Hand*
Local Control Panel	Pump local/remote hand switch	P201/301-HS-E (L/R)	Local
Local Control Panel	Pump on/off hand switch	P201/301-HS-H (On/Off)	Start
Control Room Panel	Increase, decrease speed hand switch	P201/301-HS-C,D (IS,DS)	Increase/decrease speed

Equipment	Device Description	Device Tag	State
Local Control Panel	Increase, decrease speed hand switch	P201/301-HS-F,G (IS,DS)	Increase/decrease speed
Local Control Panel	Lock off stop hand switch	P201/301-HS-B (LOS)	Normal

* = Required for LOCAL MANUAL control from the Primary Clarifiers Control Room only.

For Sludge Pump (P201/301-2/1-PP-2/3) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		DD-P201/301-MN	Start command
Control Room Panel	Computer/off/hand hand switch	P201/301-A (COH)	Computer
Local Control Panel	Pump local/remote hand switch	P201/301-HS-E (L/R)	Remote
Local Control Panel	Lock off stop hand switch	P201/301-HS-B (LOS)	Normal

3.2.8. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Sludge Pump (P201/301-2/1-PP-2/3)	Start command	DD-P201/301-MN	Digital Output
Sludge Pump (P201/301-2/1-PP-2/3)	Stop command	DD-P201/301-MO	Digital Output
Sludge Pump (P201/301-2/1-PP-2/3)	Decrease speed command	DD-P201/301-SB	Digital Output
Sludge Pump (P201/301-2/1-PP-2/3)	Increase speed command	DD-P201/301-SD	Digital Output
Sludge Removal Valves (P102/202/302-HV)	Open command	DD-P104/204/304-VD	Digital Output
Sludge Pump (P201/301-2/1-PP-2/3)	Local/remote status	DD-P201/301-HM	Digital Input
Sludge Pump (P201/301-2/1-PP-2/3)	Run status	DD-P201/301-MM	Digital Input
Sludge Pump (P201/301-2/1-PP-2/3)	Fault	DD-P201/301-QF	Digital Input
Sludge Pump (P201/301-2/1-PP-2/3)	Eddy current drive status	DD-P201/301-SM	Digital Input
Sludge Pump (P201/301-2/1-PP-2/3)	Computer/hand status	DD-P201/301-YS	Digital Input
Sludge Removal Valves (P102/202/302-HV)	Open status	DD-P104/204/304-ZD	Digital Input
Sludge Removal Valves (P102/202/302-HV)	Closed status	DD-P104/204/304-ZB	Digital Input
Sludge Removal Valves (P102/202/302-HV)	Computer/hand status	DD-P104/204/304-QF	Digital Input
Sludge Pump (P201/301-2/1-PP-2/3)	Speed status	DD-P201/301-ST	Analog Input

3.2.9. HMI Display

Device Description	Status
Clarifier 1/2/3	Elapsed time (minutes)
Clarifier 1/2/3	Pump time (minutes)
Sludge Pump (P201/301-2/1-PP-2/3)	Duty select (Standby/Duty)
Sludge Pump (P201/301-2/1-PP-2/3)	Flow control
Sludge Pump (P201/301-2/1-PP-2/3)	Flow setpoint
Sludge Pump (P201/301-2/1-PP-2/3)	Run status
Sludge Pump (P201/301-2/1-PP-2/3)	Speed (RPM)
Sludge Removal Valves (P102/202/302-HV)	Computer/hand status
Sludge Removal Valves (P102/202/302-HV)	Open/close status
Sludge Removal Valves (P102/202/302-HV)	Valve density reset

4. SLUDGE SYSTEM – CLARIFIERS 4 & 5

Associated P&ID: 1-0101P-A0066, 1-0101P-A0067, 1-0101P-A0068
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nearea2.G, npslp2.G

4.1. Process Description

Bridge Collector 1PM11 deposits PS into the five sludge hoppers at the end of Tank 4. Bridge Collector 2PM12 deposits PS into the five sludge hoppers at the end of Tank 5.

- PS from Tank 4 Sludge Hopper 1 flows through valve PV-1A
- PS from Tank 4 Sludge Hopper 2 flows through valve PV-1B
- PS from Tank 4 Sludge Hopper 3 flows through valve PV-1C
- PS from Tank 4 Sludge Hopper 4 flows through valve PV-1D
- PS from Tank 4 Sludge Hopper 5 flows through valve PV-1E
- PS from Tank 5 Sludge Hopper 1 flows through valve PV-1F
- PS from Tank 5 Sludge Hopper 2 flows through valve PV-1G
- PS from Tank 5 Sludge Hopper 3 flows through valve PV-1H
- PS from Tank 5 Sludge Hopper 4 flows through valve PV-1J
- PS from Tank 5 Sludge Hopper 5 flows through valve PV-1K

The sludge from the hoppers flow through the sludge removal valves (PV-1A/B/C/D/E/F/G/H/J/K) to pumps P401-1PP1 and P501-2PP4 via valve PV-3A. Pumps P401-1PP1 and P501-2PP4 can draw PS from either tank by configuring valve PV-2A and valve PV-2B. The PS flows through valve PV-4A to sludge flow and density metering.

4.2. Control Description

4.2.1. Local Manual Control Mode - Sludge Removal Valves PV-1A/B/C/D/E/F/G/H/J/K (P402/403/404/405/406/502/503/504/505/506-HV)

In LOCAL MANUAL mode, the sludge removal valves must be put to HAND on the Primary Control room panel then are controlled using the OPEN (P402/403/404/405/406/502/503/504/505/506-HS-C) and CLOSE (P402/403/404/405/406/502/503/504/505/506-HS-D) hand switches located at the sludge removal valves or the OPEN (P402/403/404/405/406/502/503/504/505/506-HS-A) and CLOSE

(P402/403/404/405/406/502/503/504/505/506-HS-B) hand switches located at in the Primary Clarifiers control room panel.

4.2.2. Remote Manual Control Mode - Sludge Removal Valves PV-1A/B/C/D/E/F/G/H/J/K (P402/403/404/405/406/502/503/504/505/506-HV)

The sludge removal valves can be operated in REMOTE MANUAL mode if the following conditions are met:

- The PCBS batch is not running (See section 5).
- At least one sludge pump (P401/501-2/1-PP-1/4) is not in alarm.
- The valve hand switch is in the REMOTE position.

In REMOTE MANUAL mode the valve can be opened and closed by the operator through the pop-up faceplate.

4.2.3. Remote Automatic Control Mode - Sludge Removal Valves PV-1A/B/C/D/E/F/G/H/J/K (P402/403/404/405/406/502/503/504/505/506-HV)

The sludge removal valves will AUTOMATICALLY open when the following conditions are met:

- The valves are called to open by the PCBS
- The valve is in REMOTE mode
- The valves are not in alarm
- The sludge density okay.
  - The sludge density will latch to not okay if the sludge removal valve is open and the sludge density is less than the operator set minimum density percentage (initially 2.8%) while the sludge flow is greater than 5 m^3/hr for longer than 60 seconds.
  - This alarm must be manually reset by an operator.
- At least one sludge pump (P401/501-2/1-PP-1/4) is not in alarm
- The valve's maximum pumping time has not elapsed
  - The valve's maximum pump time is a fraction of the associated clarifier's maximum pump time. The clarifier's maximum pump time is set by the operator (default value: 35 min; maximum value: 100 min; minimum value: 5 min). The operator assigns each valve a ratio value (initially: 1.0), each valve's maximum pumping time is then equal to the clarifiers maximum pump time divided by the sum of all of the associated valve ratio values and multiplied by the respective valve's ratio value.
- The associated clarifier is not set to be bypassed by the operator.

Once the sludge removal valve has automatically opened, it will be latched open. The valve will close when one of the following conditions are met:

- The valve is called to close by the PCBS.
- The valve has faulted.
- The valve is not in REMOTE mode.

(Please see P.C. discrepancy list item #7 regarding REMOTE AUTOMATIC operation of the sludge removal valves)

4.2.4. Local Manual Control Mode - Sludge Pump (P401-2PP1)

In LOCAL MANUAL mode, the sludge pump is started using the ON/OFF hand switch (P401/-HS-H) in the local control panel.

The sludge pump speed is adjusted using the INCREASE SPEED (P401/-HS-F) and DECREASE SPEED (P401/-HS-G) hand switches in the local control panel or the INCREASE SPEED (P401/-HS-C) and DECREASE SPEED (P401/-HS-D) hand switches in the Primary Clarifiers control room panel.

4.2.5. Local Manual Control Mode - Sludge Pump (P501-1PP4)

In LOCAL MANUAL mode, the sludge pump P501/1PP4 is started using its VFD located in the Primary Electrical room. Pump is started through the VFD control panel.The sludge pump speed is adjusted through the VFD control panel as well.

4.2.6. Remote Manual Control Mode - Sludge Pump (P401/501-2/1-PP-1/4)

The sludge pumps can be controlled in REMOTE MANUAL mode if the following conditions are met:

- The PCBS batch is not currently running (See section 5).
- Pump P401-2PP1 is in REMOTE mode at the local control panel.
- Pump P501-1PP4 is in remote on the VFD in Primary Electrical room
- The pump is in REMOTE mode at the Primary Clarifier control room panel.

In REMOTE MANUAL mode the sludge pumps can be started and stopped by the operator from the pop-up faceplate.

The speed can be manually set from a pop-up faceplate or the speed can be controlled in AUTOMATIC mode as described below.

4.2.7. Remote Automatic Control Mode - Sludge Pump (P401/501-2/1-PP-1/4)

The pumps (P401-2PP1 and P501-1PP4) can be set to DUTY or STANDBY mode through the PCS. If the DUTY pump fails, the STANDYBY pump will be assigned to DUTY.

In REMOTE AUTOMATIC mode, the duty sludge pump will start automatically if the following conditions are met:

- The pump is called to start from the PCBS (See section 5).
- At least one clarifier 4 or clarifier 5 associated sludge removal valve is open.
- Pump P401-2PP1 is in REMOTE mode at the local control panel.
- Pump P501-1PP4 is in remote on the VFD in Primary Electrical room
- The pump is in REMOTE mode at the Primary Clarifier control room panel.

Once the pump has automatically been started, the pump will be latched to run. The pump will run until it is called to stop by the PCBS.

In REMOTE AUTOMATIC mode the sludge pump speed can be set manually from a pop-up faceplate or can be controlled automatically. When controlled automatically, the pump speed is modulated by a PID loop to maintain the sludge flow measured by P700-FT to the operator set flow (Minimum: 0 m^3/hr; Maximum: 90 m^3/hr; Initial: 81 m^3/hr) while the batch is running. When the batch is not running and the pump speed is controlled automatically, the pump speed is maintained to the last value.

4.2.8. Interlocks, Permissives and Control Signals

4.2.8.1. Sludge Removal Valves PV-1A/B/C/D/E/F/G/H/J/K (P402/403/404/405/406/502/503/504/505/506-HV)

For Sludge Removal Valves PV-1A/B/C/D/E/F/G/H/J/K (P402/403/404/405/406/502/503/504/505/506-HV) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/hand hand switch	P402/502-HS-A (C/H)	Hand
Control Room Panel	Valve open, close hand switch	P402/403/404/405/406/502/503/504/505/506-HS-B/A/A/A/A/B/A/A/A/A, C/B/B/B/B/C/B/B/B/B(OPN,CLS)	Open, close
For Sludge Removal Valves PV-1A/B/C/D/E/F/G/H/J/K (P402/403/404/405/406/502/503/504/505/506-HV)	Valve open, close hand switch	P402/403/404/405/406/502/503/504/505/506-HS-D/C/C/C/D/C/C/C, E/D/D/D/D/E/D/D/D/D (OPN,CLS)	Open, close

* = Required for LOCAL MANUAL control from the Primary Clarifiers Control Room only.

For Sludge Removal Valves PV-1A/B/C/D/E/F/G/H/J/K (P402/403/404/405/406/502/503/504/505/506-HV) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		DD-P402/403/404/405/406/502/503/504/505/506-VD	Open command
Control Room Panel	Computer/hand hand switch	P402/502-HS-A (C/H)	Computer

4.2.8.2. Sludge Pump (P401-2PP1)

For Sludge Pump (P401-2PP1) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Pump local/remote hand switch	P401-HS-E (L/R)	Local
Local Control Panel	Pump on/off hand switch	P401-HS-H (On/Off)	Start
Control Room Panel	Increase, decrease speed hand switch	P401-HS-C,D (IS,DS)	Increase/decrease speed*
Local Control Panel	Increase, decrease speed hand switch	P401-HS-F,G (IS,DS)	Increase/decrease speed
Local Control Panel	Lock off stop hand switch	P401-HS-B (LOS)	Normal

* = Required for LOCAL MANUAL control from the Primary Clarifiers Control Room only.

For Sludge Pump (P401-2PP1) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		DD-P401-MN	Start command

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	P401-A (COH)	Computer
Local Control Panel	Pump local/remote hand switch	P401-HS-E (L/R)	Remote
Control Room Panel	Increase, decrease speed hand switch	P401-HS-C,D (IS,DS)	Increase/decrease speed
Local Control Panel	Lock off stop hand switch	P401-HS-B (LOS)	Normal

4.2.8.3. Sludge Pump (P501-1PP4)

For Sludge Pump (P501-1PP4) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Lock off stop hand switch	P501-HS-B (LOS)	Normal
VFD	Pump start/stop hand switch	MS-P501 (ON/OFF)	On
VFD	Pump local/remote hand switch	MS-P501 (L/R)	Local
VFD	Increase/decrease speed buttons	MS-P501	Increase/decrease speed

* = Required for LOCAL MANUAL control from the Primary Clarifiers Control Room only.

For Sludge Pump (P501-1PP4) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		DD-P401/501-MN	Start command
Local Control Panel	Lock off stop hand switch	P501-HS-B (LOS)	Normal
VFD	Pump local/remote hand switch	MS-P501 (L/R)	Remote
VFD	Increase/decrease speed buttons	MS-P501	Increase/decrease speed

4.2.9. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Sludge Pump (P401/501-2/1-PP-1/4)	Start command	DD-P401/501-MN	Digital Output
Sludge Pump (P401/501-2/1-PP-1/4)	Stop command	DD-P401/501-MO	Digital Output
Sludge Pump (P401/501-2/1-PP-1/4)	Decrease speed command	DD-P401/501-SB	Digital Output
Sludge Pump (P401/501-2/1-PP-1/4)	Increase speed command	DD-P401/501-SD	Digital Output
Sludge Removal Valves (P402/403/404/405/406/502/503/504/505/506-HV)	Valve open command	DD-P402/403/404/405/406/502/503/504/505/506-VD	Digital Output
Sludge Pump (P401/501-2/1-PP-1/4)	Local/remote status	DD-P401/501-HM	Digital Input
Sludge Pump (P401/501-2/1-PP-1/4)	Run status	DD-P401/501-MM	Digital Input
Sludge Pump (P401/501-2/1-PP-1/4)	Fault	DD-P401/501-QF	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Sludge Pump (P401/501-2/1-PP-1/4)	Eddy current drive status	DD-P401/501-SM	Digital Input
Sludge Pump (P401/501-2/1-PP-1/4)	Computer/hand status	DD-P401/501-YS	Digital Input
Sludge Removal Valves (P402/403/404/405/406/502/503/504/505/506-HV)	Valve closed status	DD-P402/403/404/405/406/502/503/504/505/506-ZB	Digital Input
Sludge Removal Valves (P402/403/404/405/406/502/503/504/505/506-HV)	Valve open status	DD-P402/403/404/405/406/502/503/504/505/506-ZD	Digital Input
Sludge Removal Valves (P402/403/404/405/406/502/503/504/505/506-HV)	Valve computer/hand status	DD-P402-YS	Digital Input
Sludge Pump (P401/501-2/1-PP-1/4)	Speed status	DD-P401/501-ST	Analog Input

4.2.10. HMI Display

Device Description	Status
Clarifier 4/5	Elapsed time (minutes)
Clarifier 4/5	Pump time (minutes)
Sludge Pump (P401/501-2/1-PP-1/4)	Duty select (Standby/Duty)
Sludge Pump (P401/501-2/1-PP-1/4)	Flow control
Sludge Pump (P401/501-2/1-PP-1/4)	Flow setpoint (m^3/hr)
Sludge Pump (P401/501-2/1-PP-1/4)	Run status
Sludge Pump (P401/501-2/1-PP-1/4)	Speed (RPM)
Sludge Removal Valves PV-1A/B/C/D/E/F/G/H/J/K (P402/403/404/405/406/502/503/504/505/506-HV	Open/close status
Sludge Removal Valves PV-1A/B/C/D/E/F/G/H/J/K (P402/403/404/405/406/502/503/504/505/506-HV	Valve density reset
Sludge Removal Valves PV-1A/B/C/D/E/F/G/H/J/K (P402/403/404/405/406/502/503/504/505/506-HV	Valve time ratio

5. PRIMARY CLARIFIERS BATCH SYSTEM (PCBS)

Associated P&ID: 1-0101P-A0069
Associated NEWPCC Manuals:
Associated DCS HMI Screens: npslp1.G, npslp2.G, nearea2.G

5.1. Process Description

The PCBS sequences the periodic transfer of sludge from the Primary Clarifiers to the Digesters. A magnetic flow meter (P700-FE) measures the sludge flow and the sludge density is measured by P701-DX.

5.2. Control Description

The PCBS sequences the equipment in Section 3 and 4 while in REMOTE AUTOMATIC mode.

The PCBS can be turned on and off from a pop-up faceplate.

The PCBS Sequence will only be able to start if the following permissive conditions are all met:

- All primary clarifier sludge removal valves are closed.
- At least one primary clarifier sludge removal valve is in REMOTE mode.
  - The sludge removal valve's associated sludge pump is in REMOTE mode
- At least one sludge pump has not faulted.
- There is no active instrument air alarm.
- The Batch Stop signal is not active (See below).
- At least 1 Digester receiving valve is open and has good signal quality (Digesters 9 – 14).

There are 12 operator adjustable batch start times per day, initially set to start every two hours. The PCBS will start the Batch sequence when the time reaches a batch start time while the PCBS is turned on and the permissive conditions are met.

When the Batch is started, the PCBS will sequence each sludge removal valve to open one at a time. The PCBS will remain on the current step and keep the current valve open until the step trigger (See below) for the valve is activated. Once the step trigger is activated, the PCBS will open the next steps valve and close the current valve. The valves are sequenced in the following order:

- Primary Clarifier 1 (P102-HV)
- Primary Clarifier 2 (P202-HV)
- Primary Clarifier 3 (P302-HV)
- Primary Clarifier 4, Sludge Valve 1 (P402-HV)
- Primary Clarifier 4, Sludge Valve 2 (P403-HV)
- Primary Clarifier 4, Sludge Valve 3 (P404-HV)
- Primary Clarifier 4, Sludge Valve 4 (P405-HV)
- Primary Clarifier 4, Sludge Valve 5 (P406-HV)
- Primary Clarifier 5, Sludge Valve 1 (P502-HV)
- Primary Clarifier 5, Sludge Valve 2 (P503-HV)
- Primary Clarifier 5, Sludge Valve 3 (P504-HV)
- Primary Clarifier 5, Sludge Valve 4 (P505-HV)
- Primary Clarifier 5, Sludge Valve 5 (P506-HV)

When a primary sludge valve is opened, the associated primary sludge pump that has been assigned as the Duty pump will be called to start. If the Duty pump fails, the Standby pump will be assigned as Duty.

The step trigger will be activated for a valve when the valve is being opened by the PCBS and any of the following conditions occur:

- The maximum time for the valve has elapsed.
  - For Primary Clarifiers 1, 2, and 3 this time is directly set by the operator.
  - For Primary Clarifiers 4 and 5 this time is the valve's maximum time as described in Section 4.2.3
- The sludge density is not okay.
  - The sludge density will latch to not okay if the sludge removal valve is open and the sludge density is less than the operator set minimum density percentage (initially 2.8%) while the sludge flow is greater than 5 m^3/hr for longer than 180 seconds for primary clarifiers 1-3 sludge valves and 60 seconds for primary clarifiers 4-5 sludge valves .
  - This alarm must be manually reset by an operator.
- The valve has faulted.
- No associated sludge pumps are available.
- The valve is not in REMOTE mode.
- The operator bypass for the valve is set.

The Batch Stop signal will be active if any of the following conditions occur during the batch:

- All the sludge pumps fail.
- An instrument air alarm occurs.
- 5 seconds after the last step (Primary Clarifier 5, Sludge Valve 5 P506-HV) in the PCBS has completed

The operator can set the Batch Repeat set point to active. When the Batch Repeat signal is active, a new batch sequence will be start upon the completion of the current batch.

5.2.1. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Density Meter (P701)	Primary Raw Sludge Density	DD-P701-DT	Analog Input
Magnetic Flowmeter (P700)	Primary Raw Sludge Flow	DD-P700-FT	Analog Input
Instrument Air (P922/923)	Instrument Air Alarm	DD-P922/923-PA	Digital Input
Instrument Air (P922/923)	Instrument Air Run Status	DD- P922/923-MM	Digital Input

5.2.2. HMI Display

Device Description	Status
PCS	Auto start
PCS	Repeat
PCS	Cycle
PCS	Valve restart
PCS	Finish timeout
PCS	Primary Batch Start 1
PCS	Primary Batch Start 2
PCS	Primary Batch Start 3
PCS	Primary Batch Start 4
PCS	Primary Batch Start 5
PCS	Primary Batch Start 6
PCS	Primary Batch Start 7
PCS	Primary Batch Start 8
PCS	Primary Batch Start 9
PCS	Primary Batch Start 10
PCS	Primary Batch Start 11
PCS	Primary Batch Start 12
PCS	Flow setpoint lock enable switch
Magnetic Flowmeter (P700)	Current sludge flow (m^3/hr)
Density Meter (P701)	Sludge density (%)
Magnetic Flowmeter (P700)	Previous sludge flow (KL)
Magnetic Flowmeter (P700)	Sludge flow today (KL)
Magnetic Flowmeter (P700)	Raw sludge flow (L/s)
Density Meter (P701)	Density trip

6. SCUM REMOVAL SYSTEM – CLARIFIERS 1, 2, & 3

Associated P&ID: 1-0101P-A0070

Associated NEWPCC Manuals: P501 - P508 Revised
Associated DCS HMI Screens: npscum1.G

6.1. Process Description

Scum from the control chamber inner ring flows through an operator controlled sluice gate (P121-1PM121) to the scum system. Scum from Primary Clarifiers 1, 2 and 3 flows into an operator-controlled scum troughs into the scum system and flows towards the scum pumps.

The scum line in the scum room branches into two different lines: one line flows to pump P905-1PP22 via valve PV-10A, and the other line flows to pump P901-1PP21 via valve PV-10B. .

There is a flushing water valve on the inlet to the pumps, valve 1C. There is another flushing water valve on the discharge of PP-22. Both of these flushing water valves are rarely used.

The scum is discharged by scum pumps P905-1PP22 and P901-1PP21 to a common scum line. From the common scum line, the scum is discharged into the sludge line via valve PV-12E to the digester

Flushing water valve 1-A is opened after scumming is completed and flushing water is used to flush out the scum lines. Flushing water 1-A is on a 10 minute timer but is usually opened and closed on the Primary Clarifier control room panel by the operator as needed

6.2. Control Description

6.2.1. Local Manual Control Mode - Scum System Sluice Gate (P121)

The scum system sluice gate is only operated in LOCAL MANUAL mode. The gate's motor is turned on using the START hand switch (P103-HS-1) located at the scum system sluice gate. The sluice gate is raised and lowered using the UP (P103-HS-3) and DOWN (P103-HS-4) hand switches, also located at the scum system sluice gate. The sluice gate leading to the scum system (P121-1PM121) is part of the same control loop as the sluice gate for clarifier 1 (P103-1PM15).

6.2.2. Local Manual Control Mode - FW 1-C/B/A (P902/906/917), suction PV-10B/A (P903/907) and discharge PV-15B/A (P904/908) valves

In LOCAL MANUAL mode, the valves are controlled using the OPEN (P902/906/917-HS-C, P903/907-HS-C, P904/908-HS-C) and CLOSE (P902/906/917-HS-D, P903/907-HS-D, P904/908-HS-D) hand switches located at the sludge removal valves or the OPEN (P902/906/917-HS-A, P903/907-HS-A, P904/908-HS-A) and CLOSE (P902/906/917-HS-B, P903/907-HS-B, P904/908-HS-B) hand switches located at in the Primary Clarifiers control room panel.

6.2.3. Local Manual Control Mode - Scum Removal Pumps P905-1PP22 and P901-1PP21

In LOCAL MANUAL mode, the scum removal pumps (P901/905-1P-21/22) are operated by using the START (P901/905-HS-D) hand switch located at the pump or the START (P901/905-HS-A) and STOP (P901/905-HS-B) hand switches located in the Primary Clarifiers control room panel.

6.2.4. Interlocks, Permissives and Control Signals

6.2.4.1. Scum System Sluice Gate (P121-1PM121)

For Scum System Sluice Gate (P121-1PM121) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Scum System Sluice Gate (P121)	Start hand switch	P103-HS-1 (START)	Start
Scum System Sluice Gate (P121)	Up, down hand switch	P103-HS-3,4 (UP,DOWN)	Raise, lower
Scum System Sluice Gate (P121)	Open, close torque switch	P103-OSD,OSB	Normal
Scum System Sluice Gate (P121)	Open, close position switch	P103-SD/ZSB	Not opened, not closed

6.2.4.2. FW 1-C/B/A (P902/906/917), suction PV-10B/A (P903/907) and discharge PV-15B/A (P904/908) valves

For FW 1-C/B/A (P902/906/917), suction PV-10B/A (P903/907) and discharge PV-15B/A (P904/908) valves to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
FW Valve 1-C/B/A (P902/906/917)	Open, close hand switch	P902/906/917-HS-C,D (OPN, CLS)	Open, close
Suction Valve PV-10B/A (P903/907)		P903/907-HS-C,D (OPN, CLS)	
Discharge Valve PV-15B/A (P904/908)		P904/908-HS-C,D (OPN, CLS)	
Control Room Panel	Open, close hand switch	P902/906/917-HS-A,B (OPN, CLS)	Open, close*
		P903/907-HS-A,B (OPN, CLS)	
		P904/908-HS-A,B (OPN, CLS)	

* = Required for LOCAL MANUAL control from the Primary Clarifiers Control Room only.

6.2.4.3. Scum Removal Pumps P905-1PP22 and P901-1PP21

For Scum Removal Pumps P905-1PP22 and P901-1PP21 to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Start hand switch	P901/905-HS-A (START)	Start*
Scum Removal Pump (P901/905-1P-21/22)	Start hand switch	P901/905-HS-C (START)	Start
Scum Removal Pump (P901/905-1P-21/22)	Lock off stop	P901/905-HS-D (LOS)	Normal

* = Required for LOCAL MANUAL control from the Primary Clarifiers Control Room only.

6.2.5. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
FW Valve 1-C/B/A (P902/906/917)	Closed status	DD-P902/906/917-ZB	Digital Input
FW Valve 1-C/B/A (P902/906/917)	Open status	DD-P902/906/917-ZD	Digital Input
Scum Removal Pump (P901/905-1P-21/22)	Run status	DD-P901/905-MM	Digital Input
Centre Ring H2S Analyzer (P525)	H2S concentration	DD-P525-AT	Analog Input

6.2.6. HMI Display

Device Description	Status
FW Valve 1-C/B/A (P902/906/917)	Open/close status
Scum Removal Pump (P901/905-1P-21/22)	Run status
Centre Ring H2S Analyzer (P525)	H2S concentration (ppm)

7. SCUM REMOVAL SYSTEM – CLARIFIERS 4 & 5

Associated P&ID: 1-0101P-A0071, 1-0101P-A0072
Associated NEWPCC Manuals: P501 - P508 Revised
Associated DCS HMI Screens: npscum2.G, nearea2.G, npslp2.G

7.1. Process Description

Bridge Collector 2PM12 deposits scum onto scum cross collector P508-1PM14 and bridge collector 1PM11 deposits scum onto scum cross collector P408-1PM13. Scum from both scum cross collectors flow into Scum Tank 2. Scum flows out of Scum Tank 2 to scum pumps P909-1PP23 and P913-2PP24. When valve PV-7 is opened, scum from Scum Tank 2 . is recirculated back into Scum Tank 2 by grinder pump P920-2PP30.

Scum from Scum Tank 2 flows via two parallel lines to scum pumps P909-1PP23 and P913-2PP24. Scum is discharged by pumps P909-1PP23 and P913-2PP24 to the digesters.

7.2. Control Description

The motors for the scum cross collectors (P508-1PM14 and P408-1PM13) are started automatically by the bridge collectors, but they can also be run in LOCAL MANUAL mode.

Valve PV-7 is a normally-closed, cylinder-operated valve that may be controlled locally or remotely.

Grinder pump P920-2PP30 is also controlled locally. There is a stop hand switch (P920-HS-B) for each pump in the Control Room Panel, and a lock/off/stop hand switch for each pump (P920-HS-C) at each pump. A solenoid-operated valve controlled by the pump's motor status (P920-MM) adjusts the supply of seal water flowing to the pump.

7.2.1. Local Manual Control Mode - Scum Cross Collector Motor (P408/508-1/2-PM13/14)

7.2.2. The AUTO/MANUAL switch in the Primary Clarifier control room panel must be put to MANUAL. Then In LOCAL MANUAL mode, the scum cross collector (P408/508-1/2-PM13/14) is operated by using the START (P408/508-HS-C) hand switch located at the scum cross collector. Local Manual Control Mode - Grinder Pump P920-2PP30

In LOCAL MANUAL mode, the grinder pump (P920-2PP30) is operated by using the START (P920-HS-A) and STOP (P920-HS-B) hand switches located in the Primary Clarifiers control room panel.

7.2.3. Local Manual Control Mode - Suction Valve PV-7 (P919)

In LOCAL MANUAL mode, the suction valve is controlled using the OPEN (P919-HS-C) and CLOSE (P919-HS-D) hand switches located at the valve or the OPEN (P919-HS-A) and CLOSE (P919-HS-B) hand switches located at in the Primary Clarifiers control room panel.

7.2.4. Local Manual Control Mode - FW 2-D/E/F (P910/914/918), suction PV-6B/A (P911/915) and discharge PV-8B/A (P912/916) valves

In LOCAL MANUAL mode, the valves are controlled using the OPEN (P910/914/918-HS-C, P911/915-HS-C, P912/916-HS-C) and CLOSE (P910/914/918-HS-D, P911/915-HS-D, P912/916-HS-D) hand switches located at the valves or the OPEN (P910/914/918-HS-A, P911/915-HS-A, P912/916-HS-A) and CLOSE (P910/914/918-HS-B, P911/915-HS-B, P912/916-HS-B) hand switches located at in the Primary Clarifiers control room panel.

7.2.5. Local Manual Control Mode - Scum Removal Pumps (P901/905-1P-21/22)

In LOCAL MANUAL mode, the scum removal pumps (P901/905-1P-21/22) are operated by using the START (P901/905-HS-D) hand switch located at the pump or the START (P901/905-HS-A) and STOP (P901/905-HS-B) hand switches located in the Primary Clarifiers control room panel.

7.2.6. Local Automatic Control Mode - Scum Cross Collector Motor (P408/508-1/2-PM13/14)

The motors for the scum cross collectors (P508-1PM14 and P408-1PM13) will automatically start when the bridge collector reaches and tilts the microswitch when travelling to the east end of the clarifier.

7.2.7. Interlocks, Permissives and Control Signals

7.2.7.1. Scum Cross Collector Motor (P408-1PM13, P508-2PM14)

For Scum Cross Collector Motor (P408-1PM13, P508-2PM14) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Bridge Collector (P408/P508)	Position limit switch	P408/P508-ZS	Start
Control room Panel	Auto/Hand switch	P408/P508-HS-A (A/M)	Hand
Scum Cross Collector (P408/508)	Start hand switch	P408/P508-HS-C (START)	Manual
Scum Cross Collector (P408/508)	Lock of stop hand switch	P408/P508-HS-B (LOS)	Normal

For Scum Cross Collector Motor (P408-1PM13, P508-2PM14) to operate in LOCAL (AUTOMATIC) mode:

Equipment	Device Description	Device Tag	State
Bridge Collector (P408/P508)	Position limit switch	P408/P508-ZS	Bridge collector at east end
Control Room Panel	Automatic/manual hand switch	P408/P508-HS-A (A/M)	Automatic
Scum Cross Collector (P408/508)	Lock of stop hand switch	P408/P508-HS-B (LOS)	Normal

7.2.7.2. Grinder Pump P920-2PP30

For Grinder Pump P920-2PP30 to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Start hand switch	P920-HS-A (START)	Start*
Grinder Pump (P920-2PP30)	Lock off stop	P920-HS-C (LOS)	Normal

* = Required for LOCAL MANUAL control from the Primary Clarifiers Control Room only.

7.2.7.3. Suction Valve PV-7 (P919)

For Suction Valve PV-7 (P919) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Suction Valve PV-7 (P919)	Open, close hand switch	P919-HS-A,B (OPN, CLS)	Open, close
Control Room Panel	Open, close hand switch	P919-HS-C,D (OPN, CLS)	Open, close *

* = Required for LOCAL MANUAL control from the Primary Clarifiers Control Room only.

7.2.7.4. FW 2-D/E/F (P910/914/918), suction PV-6B/A (P911/915) and discharge PV-8B/A (P912/916) valves

For FW valves 2-D/E/F (P910/914/918), suction valves PV-6B/A (P911/915) and discharge valves PV-8B/A (P912/916) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
FW Valve 2-D/E/F(P910/914/918)	Open, close hand switch	P910/914/918-HS-C,D (OPN, CLS)	Open, close
Suction Valve PV-6B/A (P911/915)		P911/915-HS-C,D (OPN, CLS)	
Discharge Valve PV-8B/A (P912/916)		P912/916-HS-C,D (OPN, CLS)	
Control Room Panel	Open, close hand switch	P910/914/918-HS-A,B (OPN, CLS)	Open, close*
		P911/915-HS-A,B (OPN, CLS)	
		P912/916-HS-A,B (OPN, CLS)	

* = Required for LOCAL MANUAL control from the Primary Clarifiers Control Room only.

7.2.7.5. Scum Removal Pumps P909-1PP23 and P913-2PP24

For Scum Removal Pumps P909-1PP23 and P913-2PP24 to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Start hand switch	P901/905-HS-A (START)	Start*
Scum Removal Pump (P909/913-1/2-P-23/24)	Start hand switch	P901/905-HS-C (START)	Start
Scum Removal Pump (P909/913-1/2-P-23/24)	Lock off stop	P901/905-HS-D (LOS)	Normal

* = Required for LOCAL MANUAL control from the Primary Clarifiers Control Room only.

7.2.8. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
FW Valve 2-D/E/F(P910/914/918)	Computer/hand status	DD-P408/508-HM	Digital Input
FW Valve 2-D/E/F(P910/914/918)	Run status	DD-P408/508-MM	Digital Input
Grinder Pump (P920-2PP30)	Run status	DD-P920-MM	Digital Input
Scum Cross Collector (P408/508)	Computer/hand status	DD-P408/508-HM	Digital Input
Scum Cross Collector (P408/508)	Run status	DD-P408/508-MM	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Scum Removal Pump (P909/913)	Run status	DD-P909/913-MM	Digital Input

7.2.9. HMI Display

Device Description	Status
FW Valve 2-D/E/F(P910/914/918)	Open/close status
Grinder Pump (P920-2PP30)	Run status
Scum Cross Collector (P408/508)	Run status
Scum Removal Pump (P920-2PP30)	Run status

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1. REACTOR PRIMARY EFFLUENT (PE) FLOW

Associated P&ID:	1-0101R-A0091, 1-0101R-A0092, 1-0101R-A0093
Associated NEWPCC Manuals:	R401 - R406 Revised
Associated DCS HMI Screens:	nerpe.G, nertr1.G, nertr2.G, nertr3.G

1.1 Process Description

Primary Effluent (PE) from the Primary Clarifiers building flows through a conduit and into the reactor tanks (1A/1B/2A/2B/3A/3B). The depth (AA-R302-LT), temperature (AA-R300-TT), and PE LEL (AA-R301-AIT) of the PE flowing through the conduit is measured in the Secondary Clarifiers building by the double doors leading to the Reactor Deck.

From the conduit, PE flow is diverted through six separate lines, one to each reactor tank. Flow to each tank is measured using a magnetic flowmeter (R310/320/330/340/350/360-FE) and controlled by a butterfly valve (R310/320/330/340/350/360-FV).

1.2 Control Description

1.2.1 Local Manual Control Mode

The modulating actuated PE valve can be controlled in LOCAL (MANUAL) mode or REMOTE (COMPUTER) mode. The mode is selected using the COMPUTER/HAND (R310/320/330/340/350/360-HS-1) at the local control station located near the PE valve. If local control is selected, the operator uses a thumbwheel to control air pressure to open/close the valve. There is also LOCAL/REMOTE (R310/320/330/340/350/360-HS-2) hand switches in the Reactor control room panel.

In LOCAL (MANUAL) mode, the PE valve is open and closed using hand switches (R310/320/330/340/350/360-HS-3/4) in the control room panel.

1.2.2 Remote Manual Control Mode

In REMOTE MANUAL mode the PE valve position can be set manually by the operator from the pop-up faceplate.

1.2.3 Remote Automatic Control Mode

In COMPUTER AUTOMATIC mode, the total flow control set point is controlled through a PID loop to maintain the PE level set point.

The total desired PE flow (302AAA01) is determined through a PID loop based on the level measured (R302-LT) in the PE conduit. The operator sets the desired level percentage in the PE conduit and the PID loop modulates the total desired PE flow control output to maintain this level percentage. If all PE valves are in manual control, the total desired PE flow control output is equal to the sum of the PE flows to each reactor.

The total desired PE flow is distributed across each in service reactor based on the operator input PE flow ratio setpoint (Minimum: 0; Maximum: 100; Initially 1A/B: 80; Initially 2A/B, 3A/B: 60). The PCS uses a

weighted average of the total desired PE flow using the PE ratios as weights in the average to determine the PE flow setpoint for each reactor.

Each PE valve position is modulated to through a PID loop to control the flow to its reactor to the PE flow setpoint. If the current flow is greater than the setpoint, the PCS will send a close command (AA-R310/320/330/340/350/360-VB) to decrease the valve position. If the current flow is less than the setpoint, the PCS will send an open command (AA-R310/320/330/340/350/360-VD) to increase the valve position.

In Remote mode, the PE valves should not fully open or close or they will jam, so there are minimum and maximum open/close positions in percent. They are 10% and 90% respectively.

1.2.4 **Interlocks, Permissives and Control Signals**

For PE valves (R310/320/330/340/350/360-FV) to operate in LOCAL (MANUAL) mode:

Equipment	**Device Description**	**Device Tag**	**State**
Control Room Panel	Open/close hand switch	R310/320/330/340/350/360-HS-3/4	Open/close
Control Room Panel	Computer/hand hand switch	R310/320/330/340/350/360-HS-2	Hand
PE Valve local station	Local/remote hand switch	R310/320/330/340/350/360-HS-1	Local

For PE valves (R310/320/330/340/350/360-FV) to operate in COMPUTER (REMOTE) mode:

Equipment	**Device Description**	**Device Tag**	**State**
PCS		AA-R310/320/330/340/350/360-VD/DB	Open/close command
Control Room Panel	Computer/hand hand switch	R310/320/330/340/350/360-HS-2	Computer
PE Valve local panel	Local/Remote hand switch	R310/320/330/340/350/360-HS-1	Remote

1.2.5 **Inputs and Outputs**

Equipment	**Signal Description**	**Signal Tag**	**Signal Type**
PE Valve (R310/320/330/340/350/360-FV)	Valve close command	AA-R310/320/330/340/350/360-VB	Digital Output
PE Valve (R310/320/330/340/350/360-FV)	Valve open command	AA-R310/320/330/340/350/360-VD	Digital Output
PE Valve (R310/320/330/340/350/360-FV)	Valve computer/hand status	AA-R310/320/330/340/350/360-YS	Digital Input
PE Conduit	PE temperature	AA-R300-TT	Analog Input
PE Conduit	PE LEL	AA-R301-AIT	Analog Input
PE Conduit	PE level	AA-R302-LT	Analog Input

Equipment	Signal Description	Signal Tag	Signal Type
PE Magnetic Flowmeter (R310/320/330/340/350/360-FE)	Reactor 1A/1B/2A/2B/3A/3B PE flow	AA-R310/320/330/340/350/360-FT	Analog Input
PE Valve (R310/320/330/340/350/360-FV)	Valve position status	AA-R310/320/330/340/350/360-ZT	Analog Input

1.2.6 **HMI Display**

Device Description	Status
PE Magnetic Flowmeter (R310/320/330/340/350/360-FE)	PE flow (ML/day)
PE Valve (R310/320/330/340/350/360-FV)	Computer/hand status
PE Valve (R310/320/330/340/350/360-FV)	Open/close status
PE Valve (R310/320/330/340/350/360-FV)	Position (%)
Reactor Train 1A/1B/2A/2B/3A/3B	PE level (%)
Reactor Train 1A/1B/2A/2B/3A/3B	PE ratio
Reactor Train 1A/1B/2A/2B/3A/3B	PE setpoint
Reactor Train 1A/1B/2A/2B/3A/3B	PE temperature (°C)
Reactor Train 1A/1B/2A/2B/3A/3B	Sum of PE ratio setpoint
Reactor System	PE level (%)
Reactor System	PE level alarm
Reactor System	Total PE flow

1.2.7 **PCS Alarms**

Equipment	Alarm Description	Alarm Condition	Alarm Response
Reactor System	PE Level Alarm	R302-LIT-1A is 68% or above	Alarm notification

2. REACTOR RETURN ACTIVATED SLUDGE (RAS) FLOW

Associated P&ID: 1-0101R-A0094, 1-0101R-A0095, 1-0101R-A00946
Associated NEWPCC Manuals: R501 - R504 Revised
Associated DCS HMI Screens: nerpe.G, nertr1.G, nertr2.G, nertr3.G

2.1 Process Description

Return activated sludge (RAS) is drawn from the secondary clarifiers and pumped to the reactors.

The flow of RAS through each train can be diverted to another train using the manual isolation valves:
- Isolation valve S801 connects reactor trains 1 and 3 (Monitored by limit switchesS801-ZB/ZD)
- Isolation valve S802 connects reactor trains 1 and 2 (Monitored by limit switchesS802-ZB/ZD)
- Isolation valve S803 connects reactor trains 2 and 3 (Monitored by limit switchesS803-ZB/ZD)

The flow of RAS to each tank is monitored using a magnetic flowmeter (R810/815/820/825/830/835-FE) and controlled by an actuated modulating valve (R810/815/820/825/830/835-FV).

2.2 Control Description

2.2.1 Local Manual Control Mode

The RAS valve can be controlled in LOCAL (MANUAL) mode or REMOTE (COMPUTER) mode. The mode is selected using the COMPUTER/HAND (R810/815/820/825/830/835-HS-2) and LOCAL/REMOTE (R810/815/820/825/830/835-HS-1) at local control station near the RAS valves. If local is selected the operator uses a thumbwheel to control air pressure to open/close valve. There is also hand switches in the Secondary Clarifiers control room panel.

In LOCAL (MANUAL) mode, the RAS valve is open and closed using push buttons (R810/815/820/825/830/835-HS-3/4) in the control room panel.

2.2.2 Remote Manual Control Mode

In REMOTE MANUAL mode the valve position can be set by the pop-up faceplate, the DCS will control the valve position to the operator set open percentage through a PID feedback based on the valve position.

The valve position is controlled through a PID loop to maintain the operator set percentage through the modulating open (BC- R810/815/820/825/830/835-VD) and modulating close (BC-R810/815/820/825/830/835-VB) commands.

2.2.3 Remote Automatic Casacade Control Mode

A RAS valve will operate in REMOTE AUTOMATIC Cascade mode if:
- The RAS train is in service
- The cross-isolation valves are closed

IN REMOTE AUTOMATIC Cascade mode, the tank's RAS flow set point is determined by the total RAS flow control output for the Reactor. The operator sets the desired train's total RAS flow. The total RAS flow control output is then modulated through a PID loop to maintain the measured flow. The total RAS flow control output value is then evenly distributed across the tanks with RAS valves in REMOTE AUTOMATIC Cascade mode for a given reactor.

In REMOTE AUTOMATIC Cascade mode, each RAS valve modulates through PID control to maintain the flow to the associated tank to the tank's RAS flow set point.

In REMOTE AUTO Cascade mode, A RAS valve will be automatically switched into REMOTE MANUAL if:
- One of the cross-isolation valves are open
- The valve is removed from REMOTE mode
- The paired reactor tank (A/B) RAS valve is put into manual
- The associated RAS flowmeter has bad quality.

2.2.4 Interlocks, Permissives and Control Signals

For RAS (R810/815/820/825/830/835-FV) valves to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Open/close hand switch	R810/815/820/825/830/835-HS-3/4	Open/close
Control Room Panel	Computer/hand hand switch	R810/815/820/825/830/835-HS-2	Hand
RAS valve local panel	Local/Remote hand switch	R810/815/820/825/830/835-HS-1	Local

For RAS valves (R810/815/820/825/830/835-FV) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		BC-R810/815/820/825/830/835-VD/DB	Open/close command
Control Room Panel	Computer/hand hand switch	R810/815/820/825/830/835-HS-2	Computer
RAS valve local panel	Local/Remote hand switch	R810/815/820/825/830/835-HS-1	Remote
Cross-tie valve limit switch	Cross-tie valve limit switch	S801/802/803-HV	Closed

2.2.5 **Inputs and Outputs**

Equipment	Signal Description	Signal Tag	Signal Type
RAS Valve (R810/815/820/825/830/835-FV)	Valve close command	BC-R810/815/820/825/830/835-VB	Digital Output
RAS Valve (R810/815/820/825/830/835-FV)	Valve open command	BC-R810/815/820/825/830/835-VD	Digital Output
RAS Valve (R810/815/820/825/830/835-FV)	Valve computer/hand status	BC-R810/815/820/825/830/835-YS	Digital Input
RAS Flowmeter (R810/815/820/825/830/835-FE)	Reactor 1A/1B/2A/2B/3A/3B RAS flow	BC-R810/815/820/825/830/835-FT	Analog Input
RAS Valve (R810/815/820/825/830/835-FV)	Valve position status	BC-R810/815/820/825/830/835-ZT	Analog Input

2.2.6 **HMI Display**

Device Description	Status
RAS Flowmeter (R810/815/820/825/830/835-FE)	RAS flow (ML/day)
RAS Valve (R810/815/820/825/830/835-FV)	Computer/hand status
RAS Valve (R810/815/820/825/830/835-FV)	Open/close status
RAS Valve (R810/815/820/825/830/835-FV)	Position (%)
Reactor Train 1A/1B/2A/2B/3A/3B	RAS ratio
Reactor Train 1A/1B/2A/2B/3A/3B	RAS setpoint

Device Description	Status
Reactor Train 1A/1B/2A/2B/3A/3B	RAS temperature (°C)
Reactor Train 1A/1B/2A/2B/3A/3B	Sum of RAS ratio setpoint
Reactor System	Total RAS flow (ML/day)
Reactor System	Total reactor RAS flow (ML/day)
Isolation Valve (S801/802/803-HV)	Open/close status
Reactor Train 1/2/3	Operator MLSS setpoint (mg/L)

3. REACTORS

Associated P&ID:	1-0101R-A0100, 1-0101R-A0101, 1-0101R-A0102, 1-0101R-A0103, 1-0101R-A0104, 1-0101R-A0105, 1-0101R-A0106, 1-0101R-A0107, 1-0101R-A0108
Associated NEWPCC Manuals:	R101 - R106 Revised, R601 - R610 Not Revised, R701 - R707 Revised
Associated DCS HMI Screens:	nertr1.G, nertr2.G, nertr3.G

3.1 Process Description

The reactor system has three reactor trains, each of with two separate tanks. Each tank has four compartments (stages). Oxygen (O2), PE, and RAS enter the tank through the first stage compartment. The O2, PE, and RAS flows through each stage via interstage wall openings. Each stage has a dedicated mixer (R201/202/203/204-MXR-1/4/5/8-1A, R211/212/213/214-MXR-1/4/5/8-1B, R221/222/223/224-MXR-9/12/13/16-2A, R231/232/233/234-MXR-10/11/14/15-2B, R241/242/243/244-MXR-17/20/21/24-3A, R251/252/253/254-MXR-18/19/22/23-3B) that operates continuously to mix the PE and RAS together to create mixed liquor (ML), disperse the O2 throughout the ML, and maintain the solids in suspension. At the end of the fourth stage compartment is an effluent trough. The ML flows through the effluent troughs to the secondary clarifiers via the ML junction chamber. Reactor train 1 feeds clarifiers 1-10; reactor train 2 feeds clarifiers 11-18; and reactor train 3 feeds clarifiers 19-26.

High purity O2 is piped from the Cryogenic Plant to the Reactor Building Valve Room, where it is diverted through six pipes, one to each reactor tank. The O2 flow to each reactor is measured using an orifice plate (R100/110/120/130/140/150-FE) and controlled by a valve (R100/110/120/130/140/150-PCV). In the reactor tank, the O2 flows through each stage via interstage wall openings. This is achieved by maintaining a constant pressure in the first stage of the reactor tank. The first stage pressure signal is sent to the oxygen valve controller, which modulates the valve position to maintain constant pressure.

3.2 Control Description

3.2.1 Local Manual Control Mode - Mixers

The mixers (R201/202/203/204-MXR-1/4/5/8-1A, R211/212/213/214-MXR-2/3/6/7-1B, R221/222/223/224-MXR-9/12/13/16-2A, R231/232/233/234-MXR-10/11/14/15-2B, R241/242/243/244-MXR-17/20/21/24-3A, R251/252/253/254-MXR-18/19/22/23-3B) can be controlled in LOCAL (MANUAL) mode or REMOTE (COMPUTER) mode. The mode is selected using the COMPUTER/OFF/HAND hand switch (R201/202/203/204/211/212/213/214/221/222/223/224/231/232/233/234/241/242/243/244/251/252/253/254-HS-2) in the control room panel.

In LOCAL (MANUAL) mode, each mixer is individually operated by setting the COMPUTER/OFF/HAND hand switch to HAND.

3.2.2 **Remote Manual Control Mode – Mixers**

In REMOTE MANUAL mode the mixers can be started and stopped manually from the pop-up faceplate.

3.2.3 **Remote Automatic Control Mode - Mixers**

In REMOTE AUTOMATIC mode, the tank mixers for a train are started when the operator presses the "GROUP START" button on the HMI. For each reactor train (1/2/3), the mixers in REMOTE AUTOMATIC mode are group started in the following sequence, with a 5 second delay between each step:

Sequence Step	Tank	Mixer	Mixer Tag
1	A	1	R201/221/241-MXR-1/9/17-1A/2A/3A
2	A	2	R202/222/242-MXR-4/12/20-1A/2A/3A
3	A	3	R203/223/243-MXR-5/13/21-1A/2A/3A
4	A	4	R204/224/244-MXR-8/16/24-1A/2A/3A
5	B	1	R211/231/251-MXR-2/10/18-1B/2B/3B
6	B	2	R212/232/252-MXR-3/11/19-1B/2B/3B
7	B	3	R213/233/253-MXR-6/14/22-1B/2B/3B
8	B	4	R214/234/254-MXR-7/15/23-1B/2B/3B

After the last step, the mixers will stay on until the stop sequence is initiated. The mixer will go into alarm if the mixer has not started/stopped within 50 seconds of the PCS sending a start/stop command to the mixer.

With the mixers in REMOTE AUTOMATIC mode, the mixers will run continuously once the mixers has been started (Automatically or Manually).

The mixers will shut down when the operator stops the "GROUP START" button. The mixers will shut down following the same sequencing as the start up sequence, with 5 seconds between each step.

If the Hydrocarbon concentration in the vapour space a reactor tank has met or surpassed 50% LEL for 5 seconds or more, the mixers associated with the reactor tank's train will automatically shut down.

3.2.4 **Local Manual Control Mode – Oxygen Valves**

The oxygen valves (R100/110/120/130/140/150-PCV) can be controlled in LOCAL mode or REMOTE mode. The mode is selected using the LOCAL/REMOTE (R100/110/120/130/140/150-HS-1) hand switch in the local control panel

3.2.5 **Remote Manual Control Mode – Oxygen Valves**

In REMOTE MANUAL mode the operator can set the oxygen valve position percentage through the pop-up faceplate. A PID loop will modulate to maintain this position.

The valve will be automatically close in REMOTE MANUAL mode if either condition occur:

- The associated stage 2 pressure rises above 5 In H20 (R100/110/120/130/140/150-PIT-2)
    - This condition will latch until the pressure drops below 4.8 In H20.

- The associated train (tank A or B) hydrocarbon level rises above 25% LEL
- The train's associated purge blower is running.

3.2.6 Remote Automatic Control Mode – Oxygen Valves

In REMOTE AUTOMATIC mode, the oxygen valve is modulated to maintain the stage 1 operator pressure set point (3.0 in H20) (R100/110/120/130/140/150-PIT-1) and adjusts the valve position using a PID loop.

The valve will be automatically close in REMOTE AUTOMATIC mode if either condition occur:

- The associated stage 2 pressure rises above 5 In H20 (R100/110/120/130/140/150-PIT-2)
  - This condition will latch until the pressure drops below 4.8 In H20.
- The associated train (tank A or B) hydrocarbon level rises above 25% LEL.
- The train's associated purge blower is running.

3.2.7 Interlocks, Permissives and Control Signals

3.2.7.1 Reactor Tank1A/1B/2A/2B/3A/3B Mixers 1/2/3/4 (R201/202/203/204/211/212/213/214/221/222/223/224/231/232/233/234/241/242/243/244/251/252/253/254-MXR-1/4/5/8/2/3/6/7/9/12/13/16/10/11/14/15/17/20/21/24/18/19/22/23-1A/1B/2A/2B/3A/3B)

For Reactor Tank 1A/1B/2A/2B/3A/3B Mixers 1/2/3/4 (R201/202/203/204-MXR-1/4/5/8-1A, R211/212/213/214-MXR-2/3/6/7-1B, R221/222/223/224-MXR-9/12/13/16-2A, R231/232/233/234-MXR-10/11/14/15-2B, R241/242/243/244-MXR-17/20/21/24-3A, R251/252/253/254-MXR-18/19/22/23-3B) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	R201/202/203/204-HS-2 (COH)	Hand
		R211/212/213/214-HS-2 (COH)	
		R221/222/223/224-HS-2 (COH)	
		R231/232/233/234-HS-2 (COH)	
		R241/242/243/244-HS-2 (COH)	
		R251/252/253/254-HS-2 (COH)	
Reactor Tank 1A Mixer 1/2/3/4 (R201/202/203/204-MXR-1/4/5/8-1A)	Lock off stop	R201/202/203/204-HS-1 (LOS)	Normal
Reactor Tank 1B Mixer 1/2/3/4 (R211/212/213/214-MXR-2/3/6/7-1B)		R211/212/213/214-HS-1 (LOS)	
Reactor Tank 2A Mixer 1/2/3/4 (R221/222/223/224-MXR-9/12/13/16-2A)		R221/222/223/224-HS-1 (LOS)	
Reactor Tank 2B Mixer 1/2/3/4 (R231/232/233/234-MXR-10/11/14/15-2B)		R231/232/233/234-HS-1 (LOS)	
Reactor Tank 3A Mixer 1/2/3/4 (R241/242/243/244-MXR-17/20/21/24-3A)		R241/242/243/244-HS-1 (LOS)	

Equipment	Device Description	Device Tag	State
Reactor Tank 3B Mixer 1/2/3/4 (R251/252/253/254-MXR-10/11/14/15-3B)		R251/252/253/254-HS-1 (LOS)	

For Reactor Tank 1A/1B/2A/2B/3A/3B Mixers 1/2/3/4 (R201/202/203/204-MXR-1/4/5/8-1A, R211/212/213/214-MXR-1/4/5/8-1B, R221/222/223/224-MXR-9/12/13/16-2A, R231/232/233/234-MXR-10/11/14/15-2B, R241/242/243/244-MXR-17/20/21/24-3A, R251/252/253/254-MXR-18/19/22/23-3B) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		AA-R201/202/203/204-MN	Start command
		AA-R211/212/213/214-MN	
		AB-R221/222/223/224-MN	
		AB-R231/232/233/234-MN	
		AB-R241/242/243/244-MN	
		AB-R251/252/253/254-MN	
Control Room Panel	Computer/off/hand hand switch	R201/202/203/204-HS-2 (COH)	Computer
		R211/212/213/214-HS-2 (COH)	
		R221/222/223/224-HS-2 (COH)	
		R231/232/233/234-HS-2 (COH)	
		R241/242/243/244-HS-2 (COH)	
		R251/252/253/254-HS-2 (COH)	
Reactor Tank 1A Mixer 1/2/3/4 (R201/202/203/204-MXR-1/4/5/8-1A)	Lock off stop	R201/202/203/204-HS-1 (LOS)	Normal
Reactor Tank 1B Mixer 1/2/3/4 (R211/212/213/214-MXR-1/4/5/8-1B)		R211/212/213/214-HS-1 (LOS)	
Reactor Tank 2A Mixer 1/2/3/4 (R221/222/223/224-MXR-9/12/13/16-2A)		R221/222/223/224-HS-1 (LOS)	
Reactor Tank 2B Mixer 1/2/3/4 (R231/232/233/234-MXR-10/11/14/15-2B)		R231/232/233/234-HS-1 (LOS)	
Reactor Tank 3A Mixer 1/2/3/4 (R241/242/243/244-MXR-17/20/21/24-3A)		R241/242/243/244-HS-1 (LOS)	
Reactor Tank 3B Mixer 1/2/3/4 (R251/252/253/254-MXR-10/11/14/15-3B)		R251/252/253/254-HS-1 (LOS)	

3.2.7.2 Oxygen Valves (R100/110/120/130/140/150-PCV)

For oxygen valve (R100/110/120/130/140/150-PCV) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Oxygen Valve (R100/110/120/130/140/150-PCV)	Valve controller	R100/110/120/130/140/150-XV	Open/Close
Control Room Panel	Local/Remote hand switch	R100/110/120/130/140/150-HS-1 (L/R)	Local
Reactor Tank 1A/1B/2A/2B/3A/3B	High Pressure Switch	R100/110/120/130/140/150-PSH	Normal

For oxygen valves (R100/110/120/130/140/150-PCV) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		AA-R100/110-HS-VD/DB	Open/close command
		AB-R120/130/140/150-VD/DB	
Oxygen Valve (R100/110/120/130/140/150-PCV)	Valve controller	R100/110/120/130/140/150-XV	Open/Close
Control Room Panel	Local/Remote hand switch	R100/110/120/130/140/150-HS-1 (L/R)	Local
Reactor Tank 1A/1B/2A/2B/3A/3B	High Pressure Switch	R100/110/120/130/140/150-PSH	Normal

3.2.8 **Inputs and Outputs**

Equipment	Signal Description	Signal Tag	Signal Type
Oxygen Valve (R100/110-PCV)	Valve open command	AA-R100/110-VD	Digital Output
Oxygen Valve (R120/130/140/150-PCV)	Valve close command	AB-R120/130/140/150-VB	Digital Output
Oxygen Valve (R120/130/140/150-PCV)	Valve open command	AB-R120/130/140/150-VD	Digital Output
Reactor Tank 1A Mixer 1/2/3/4 (R201/202/203/204-MXR-1/4/5/8-1A)	Mixer start command	AA-R201/202/203/204-MN	Digital Output
Reactor Tank 1A Mixer 1/2/3/4 (R201/202/203/204-MXR-1/4/5/8-1A)	Mixer stop command	AA-R201/202/203/204-MO	Digital Output
Reactor Tank 1B Mixer 1/2/3/4 (R211/212/213/214-MXR-1/4/5/8-1B)	Mixer start command	AA-R211/212/213/214-MN	Digital Output
Reactor Tank 1B Mixer 1/2/3/4 (R211/212/213/214-MXR-1/4/5/8-1B)	Mixer stop command	AA-R211/212/213/214-MO	Digital Output
Reactor Tank 2A Mixer 1/2/3/4 (R221/222/223/224-MXR-9/12/13/16-2A)	Mixer start command	AB-R221/222/223/224-MN	Digital Output
Reactor Tank 2A Mixer 1/2/3/4 (R221/222/223/224-MXR-9/12/13/16-2A)	Mixer stop command	AB-R221/222/223/224-MO	Digital Output

Equipment	Signal Description	Signal Tag	Signal Type
Reactor Tank 2B Mixer 1/2/3/4 (R231/232/233/234-MXR-10/11/14/15-2B)	Mixer start command	AB-R231/232/233/234-MN	Digital Output
Reactor Tank 2B Mixer 1/2/3/4 (R231/232/233/234-MXR-10/11/14/15-2B)	Mixer stop command	AB-R231/232/233/234-MO	Digital Output
Reactor Tank 3A Mixer 1/2/3/4 (R241/242/243/244-MXR-17/20/21/24-3A)	Mixer start command	AB-R241/242/243/244-MN	Digital Output
Reactor Tank 3A Mixer 1/2/3/4 (R241/242/243/244-MXR-17/20/21/24-3A)	Mixer stop command	AB-R241/242/243/244-MO	Digital Output
Reactor Tank 3B Mixer 1/2/3/4 (R251/252/253/254-MXR-10/11/14/15-3B)	Mixer stop command	AB-R251/252/253/254-MO	Digital Output
Reactor Tank 3B Mixer 1/2/3/4 (R251/252/253/254-MXR-18/19/22/23-3B)	Mixer start command	AB-R251/252/253/254-MN	Digital Output
Oxygen Valve (R100/110-PCV)	Valve close command	AA-R100/110-VB	Digital Output
Oxygen Valve (R100/110-PCV)	Valve computer/hand status	AA-R100/110-YS	Digital Input
Oxygen Valve (R120/130/140/150-PCV)	Valve computer/hand status	AB-R120/130/140/150-YS	Digital Input
Reactor Tank 1A Mixer 1/2/3/4 (R201/202/203/204-MXR-1/4/5/8-1A)	Mixer run status	AA-R201/202/203/204-MM	Digital Input
Reactor Tank 1A Mixer 1/2/3/4 (R201/202/203/204-MXR-1/4/5/8-1A)	Mixer computer/hand status	AA-R201/202/203/204-YS	Digital Input
Reactor Tank 1A/1B	First high-pressure alarm	AA-R100/110-PA	Digital Input
Reactor Tank 1A/1B	Second high-pressure alarm pressure	AA-R100/110-PH	Digital Input
Reactor Tank 1B Mixer 1/2/3/4 (R211/212/213/214-MXR-1/4/5/8-1B)	Mixer run status	AA-R211/212/213/214-MM	Digital Input
Reactor Tank 1B Mixer 1/2/3/4 (R211/212/213/214-MXR-1/4/5/8-1B)	Mixer computer/hand status	AA-R211/212/213/214-YS	Digital Input
Reactor Tank 2A Mixer 1/2/3/4 (R221/222/223/224-MXR-9/12/13/16-2A)	Mixer run status	AB-R221/222/223/224-MM	Digital Input
Reactor Tank 2A Mixer 1/2/3/4 (R221/222/223/224-MXR-9/12/13/16-2A)	Mixer computer/hand status	AB-R221/222/223/224-YS	Digital Input
Reactor Tank 2A/2B/3A/3B	First high-pressure alarm	AB-R120/130/140/150-PA	Digital Input
Reactor Tank 2A/2B/3A/3B	Second high-pressure alarm pressure	AB-R120/130/140/150-PH	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Reactor Tank 2B Mixer 1/2/3/4 (R231/232/233/234-MXR-10/11/14/15-2B)	Mixer run status	AB-R231/232/233/234-MM	Digital Input
Reactor Tank 2B Mixer 1/2/3/4 (R231/232/233/234-MXR-10/11/14/15-2B)	Mixer computer/hand status	AB-R231/232/233/234-YS	Digital Input
Reactor Tank 3A Mixer 1/2/3/4 (R241/242/243/244-MXR-17/20/21/24-3A)	Mixer run status	AB-R241/242/243/244-MM	Digital Input
Reactor Tank 3A Mixer 1/2/3/4 (R241/242/243/244-MXR-17/20/21/24-3A)	Mixer computer/hand status	AB-R241/242/243/244-YS	Digital Input
Reactor Tank 3B Mixer 1/2/3/4 (R251/252/253/254-MXR-18/19/22/23-3B)	Mixer run status	AB-R251/252/253/254-MM	Digital Input
Reactor Tank 3B Mixer 1/2/3/4 (R251/252/253/254-MXR-18/19/22/23-3B)	Mixer computer/hand status	AB-R251/252/253/254-YS	Digital Input
Reactor Train 1/2/3	Mixed liquor high level	BA-S841/842/843-LH	Digital Input
Cryogenic Plant	Oxygen purity	AA-R161-AT	Analog Input
Cryogenic Plant	Oxygen flow rate	AB-R160-FT	Analog Input
Oxygen Flowmeter (R100/110-FE)	Reactor 1A/1B oxygen flow	AA-R100/110-FT	Analog Input
Oxygen Flowmeter (R120/130/140/150-FE)	Reactor 2A/2B/3A/3B oxygen flow	AB-R120/130/140/150-FT	Analog Input
Oxygen Valve (R100/110-PCV)	Valve position status	AA-R100/110-ZT	Analog Input
Oxygen Valve (R120/130/140/150-PCV)	Valve position status	AB-R120/130/140/150-ZT	Analog Input
Reactor Tank 1A/1B	Stage 1 tank pressure	AA-R100/110-PIT-1A/1B	Analog Input
Reactor Tank 2A/2B/3A/3B	Stage 1 tank pressure	AB-R120/130/140/150-PIT-2A/2B/3A/3B	Analog Input

3.2.9 **HMI Display**

Device Description	Status
Reactor Tank 1A/1B/2A/2B/3A/3B	Oxygen purity (%)
Reactor Tank 1A/1B/2A/2B/3A/3B	Hydrocarbon level (%LEL)
Reactor Tank 1A/1B/2A/2B/3A/3B	Stage 1 hydrostatic pressure
Reactor Tank 1A/1B/2A/2B/3A/3B	Stage 2 hydrostatic pressure
Reactor Tank 1A/1B/2A/2B/3A/3B	Mixer computer/hand status
Reactor Tank 1A/1B/2A/2B/3A/3B	Mixer run status
Reactor Tank 1A/1B/2A/2B/3A/3B	Hydrocarbon level alarm
Reactor Tank 1A/1B/2A/2B/3A/3B	Mixer group start

Device Description	Status
Reactor Tank 1A/1B/2A/2B/3A/3B	Reactor pressure (IN/W)
Reactor Tank 1A/1B/2A/2B/3A/3B	Suspended solids
Cryogenic Plant	Oxygen purity (%)
Cryogenic Plant	Total standard oxygen flow (KSCFH)
Oxygen Flowmeter (R120/130/140/150-FE)	Oxygen flow (ML/day)
Oxygen Valve (R120/130/140/150-PCV)	Computer/hand status
Oxygen Valve (R120/130/140/150-PCV)	Open/close status
Oxygen Valve (R120/130/140/150-PCV)	Position (%)
Reactor Train 1A/1B/2A/2B/3A/3B	Corrected oxygen flow (m^3/hr)
Reactor Train 1A/1B/2A/2B/3A/3B	Oxygen flow current day (m^3)
Reactor Train 1A/1B/2A/2B/3A/3B	Oxygen flow previous day (m^3)
Reactor System	Total oxygen flow (m^3)
Reactor System	Total oxygen use current day (m^3/day)
Reactor System	Total oxygen use previous day (m^3/day)

3.2.10 **PCS Alarms**

Equipment	Alarm Description	Alarm Condition	Alarm Response
Reactor Tank 2A/2B/3A/3B	First high-pressure alarm	AB-R120/130/140/150-PA in alarm	Alarm notification
Reactor Tank 2A/2B/3A/3B	Second high-pressure alarm pressure	AB-R120/130/140/150-PH in alarm	Alarm notification
Reactor Tank 1A/1B	First high-pressure alarm	AA-R100/110-PA in alarm	Alarm notification
Reactor Tank 1A/1B	Second high-pressure alarm pressure	AA-R100/110-PH in alarm	Alarm notification

4. HYDROCARBON GAS DETECTION AND ALARMING

Associated P&ID: 1-0101R-A0110, 1-0101R-A0111, 1-0101R-A0112
Associated NEWPCC Manuals: R801 - R809 Not Revised
Associated DCS HMI Screens: nearea3.G, nerdata.G,

4.1 Process Description

The PE and RAS could possibly contain flammable hydrocarbons (HC) that vaporize within the reactor tanks. The HC content in the reactor tank is continuously monitored to prevent a fire or explosion from occurring. The HC gas detectors will alarm at 25% LEL and 50% LEL HC concentrations. At 25% LEL, the oxygen valves are closed and the air purge blower is started. At 50% LEL, the mixers for the associated reactor tank will shut down.

4.2 Control Description

4.2.1 **Local Manual Control Mode**

The air purge blower can be operated in HAND or ANALYZER mode. To operate the blower in HAND mode, the HAND/ANALYZER hand switch in the control room panel is set to HAND.

4.2.2 **Local Automatic Control Mode**

In ANALYZER mode, the HC analyzer will AUTOMATICALLY turn the air purge blower on when the HC level has reached 25% LEL.

The PCS monitors the air purge blower computer/hand (AA-R240-YS, AB-R250/260-YS) and run statuses (AA-R240-MM, AB-R250/260-MM) but does not control the blower itself.

4.2.3 **Interlocks, Permissives, and Control Signals**

4.2.3.1 Air Purge Blower (R240/250/260-PB-2/4/6-1A/2A/3A)

For Air Purge Blower (R240/250/260-PB-2/4/6-1A/2A/3A) to operate in HAND mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Hand/Analyzer hand switch	R240/250/260-HS-2	Hand
Air Purge Blower (R240/250/260-PB-2/4/6-1A/2A/3A)	Lock of stop hand switch	R240/250/260-HS-1	Normal

For Air Purge Blower (R240/250/260-PB-2/4/6-1A/2A/3A) to operate in ANALYZER (AUTOMATIC) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Hand/Analyzer hand switch	R240/250/260-HS-2	Analyzer
Air Purge Blower (R240/250/260-PB-2/4/6-1A/2A/3A)	Lock of stop hand switch	R240/250/260-HS-1	Normal

4.2.4 **Inputs and Outputs**

Equipment	Signal Description	Signal Tag	Signal Type
Air Purge Blower (R240-PB-2-1A)	Blower run status	AA-R240-MM	Digital Input
Air Purge Blower (R250/260-PB-4/6-2A/3A)	Blower run status	AB-R250/260-MM	Digital Input
Air Purge Blower (R240-PB-2-1A)	Blower computer/hand status	AA-R240-YS	Digital Input
Air Purge Blower (R250/260-PB-4/6-2A/3A)	Blower computer/hand status	AB-R250/260-YS	Digital Input
Reactor Gas Detection System	Hydrocarbon calibration status	AA-R280-AU	Digital Input
Reactor Gas Detection System	Common analyzer fault	AA-R290-AU	Digital Input
Reactor Train 1A/1B	25% LEL hydrocarbon alarm	AA-R100/110-AA	Digital Input
Reactor Train 1A/1B	50% LEL hydrocarbon alarm	AA-R100/110-AH	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Reactor Train 2A/2B/3A/3B	25% LEL hydrocarbon alarm	AB-R120/130/140/150-AA	Digital Input
Reactor Train 2A/2B/3A/3B	50% LEL hydrocarbon alarm	AB-R120/130/140/150-AH	Digital Input
Reactor Tank 1A/1B	Stage 1 hydrocarbon level	AA-R102/112/-AT-1A/1B	Analog Input
Reactor Tank 2A/2B/3A/3B	Stage 1 hydrocarbon level	AB-R132/142/152-AT-2A/2B/3A/3B	Analog Input

4.2.5 **HMI Display**

Device Description	Status
Reactor Train 1A/1B/2A/2B/3A/3B	25% LEL alarm (Normal/Alarm)
Reactor Train 1A/1B/2A/2B/3A/3B	50% LEL alarm (Normal/Alarm)

4.2.6 **PCS Alarms**

Equipment	Alarm Description	Alarm Condition	Alarm Response
Reactor Tank 1A/1B	High hydrocarbon level	AA-R102/112/-AT-1A/1B is above 25% LEL	Alarm notification
Reactor Tank 2A/2B/3A/3B	High hydrocarbon level	AB-R132/142/152-AT-2A/2B/3A/3B is above 25% LEL	Alarm notification

5. OXYGEN GAS DETECTION AND REGULATION

Associated P&ID: 1-0101R-A0110, 1-0101R-A0111, 1-0101R-A0112
Associated NEWPCC Manuals: XXXX - XXXX Revised
Associated DCS HMI Screens: nearea3.G, nerdata.G,

5.1 Process Description

The stage 4 O2 purity for each reactor tank is continuously monitored. The vent valve will open more to decrease the O2 purity, and close more to increase the O2 purity.

5.2 Control Description

5.2.1 **Local Manual Control Mode**

The vent valve (R105/R115/125/135/145/155-FV) can be controlled in LOCAL (MANUAL) mode or REMOTE (COMPUTER) mode. The mode is selected using the COMPUTER/HAND hand switch (R310/320/330/340/350/360-HS-2) in the control room panel.

In LOCAL (MANUAL) mode, the vent valve is open and closed using a hand switch (R105/R115/125/135/145/155-HS-2) in the control room panel.

5.2.2 **Remote Manual Control Mode**

In REMOTE MANUAL mode the vent valve position can be set by the operator on the pop-up faceplate.

5.2.3 **Remote Automatic Control Mode**

In REMOTE AUTOMATIC mode, the stage 4 oxygen purity (AA-R107/117-AIT-1A/1B, AB-R127/137/147/157-AIT-2A/2B/3A/3B) is controlled to the operator-adjustable setpoint (50% O2) using a PID loop.

5.2.4 **Interlocks, Permissives, and Control Signals**

5.2.4.1 Reactor Tank 1A/1B/2A/2B/3A/3B Vent Valve (R105/R115/125/135/145/155-FV)

For Reactor Tank 1A/1B/2A/2B/3A/3B Vent Valve (R105/R115/125/135/145/155-FV) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Open/close hand switch	R105/R115/125/135/145/155-HS-2 (O/C)	Open/close
Control Room Panel	Computer/hand hand switch	R105/R115/125/135/145/155-HS-1 (C/H)	Hand

For Reactor Tank 1A/1B/2A/2B/3A/3B Vent Valve (R105/R115/125/135/145/155-FV) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/hand hand switch	R105/R115/125/135/145/155-HS-1 (C/H)	Computer
PCS		AA-R105/115-VD/VB	Open/close command
		AB-R125/135/145/155-VD/VB	

5.2.5 **Inputs and Outputs**

Equipment	Signal Description	Signal Tag	Signal Type
Reactor Tank 1A/1B Vent Valve (R105/R115-FV)	Valve close command	AA-R105/115-VB	Digital Output
Reactor Tank 1A/1B Vent Valve (R105/R115-FV)	Valve open command	AA-R105/115-VD	Digital Output
Reactor Tank 2A/2B/3A/3B Vent Valve (R125/135/145/155-FV)	Valve close command	AB-R125/135/145/155-VB	Digital Output
Reactor Tank 2A/2B/3A/3B Vent Valve (R125/135/145/155-FV)	Valve open command	AB-R125/135/145/155-VD	Digital Output
Reactor Tank 1A/1B Vent Valve (R105/R115-FV)	Valve computer/hand status	AA-R105/115-YS	Digital Input
Reactor Tank 2A/2B/3A/3B Vent Valve (R125/135/145/155-FV)	Valve computer/hand status	AB-R125/135/145/155-YS	Digital Input
Reactor Tank 1A/1B	Stage 4 oxygen purity	AA-R107/117-AIT-1A/1B	Analog Input
Reactor Tank 1A/1B Vent Valve (R105/R115-FV)	Valve position	AA-R105/115-ZT	Analog Input

Equipment	Signal Description	Signal Tag	Signal Type
Reactor Tank 2A/2B/3A/3B	Stage 4 oxygen purity	AB-R127/137/147/157-AIT-2A/2B/3A/3B	Analog Input
Reactor Tank 2A/2B/3A/3B Vent Valve (R105/R115-FV)	Valve position	AB-R125/135/145/155-ZT	Analog Input

5.2.6 **HMI Display**

Device Description	Status
Reactor Tank 1A/1B/2A/2B/3A/3B Vent Valve (R105/R115/125/135/145/155-FV)	Valve position (%)
Reactor Tank 1A/1B/2A/2B/3A/3B Vent Valve (R105/R115/125/135/145/155-FV)	Vent purity (%)

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1. SECONDARY CLARIFIERS TRAIN 1 COLLECTORS

Associated P&ID:	1-0101S-A0122, 1-0101S-A0123, 1-0101S-A0124, 1-0101S-A0125, 1-0101S-A0126
Associated NEWPCC Manuals:	
Associated DCS HMI Screens:	nearea5.G, nstrn1.G, nsras1.G

1.1. Process Description

Mixed liquor (ML) enters the Train 1 secondary clarifiers (clarifiers 1-10) via Mixed Liquor Channel 1. Each clarifier has its own motorized scum collector (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10) that pushes the settling sludge into a sludge hopper at the bottom of the tank and skims scum (SC) into the clarifier's scum trough at the top of the tank.

1.2. Control Description

The scum collectors can be operated in LOCAL (MANUAL) and REMOTE (COMPUTER) modes.

1.2.1. Local Manual Control Mode

In LOCAL mode, the scum collectors are operated using the COMPUTER/OFF/HAND hand switch in the Secondary Clarifiers Control Room Panel (S731/732/33/734/735/736/737/738/739/740-HS-1).

1.2.2. Remote Manual Control Mode

The scum collectors can be started and stopped in REMOTE MANUAL mode from the pop-up faceplate.

To start the scum collector, a 3 second start pulse is sent to the drive. To stop the scum collector, a 3 second stop pulse is sent to the drive.

1.2.3. Remote Automatic Control Mode

The scum collectors must be started in MANUAL mode before switching to REMOTE AUTOMATIC.

In REMOTE AUTOMATIC mode, the scum collectors run continuously once they are manually started.

If the scum collector is not running within 2 seconds of receiving a start command from the PCS, the scum collector will go into alarm.

The PCS will call the scum collector to STOP in REMOTE AUTOMATIC mode if the scum collector has faulted (BA- S731/732/733/734/735/736/737/738/739/740-QF) .

1.2.4. Interlocks, Permissives and Control Signals

For Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	S731/732/733/734/735/736/737/738/739/740-HS-1 (COH)	Hand
Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10)	Overload switch	S731/732/733/734/735/736/737/738/739/740-OSH	Normal
Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10)	Lock off stop switch	S731/732/733/734/735/736/737/738/739/740-HS-2 (LOS)	Normal

For Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		BA-S731/732/733/734/735/736/737/738/739/740-MN	Start command
Control Room Panel	Computer/off/hand hand switch	S731/732/733/734/735/736/737/738/739/740-HS-1 (COH)	Computer
Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10)	Overload switch	S731/732/733/734/735/736/737/738/739/740-OSH	Normal
Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10)	Lock off stop switch	S731/732/733/734/735/736/737/738/739/740-HS-2 (LOS)	Normal

1.2.5. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10)	Start command	BA-S731/732/733/734/735/736/737/738/739/740-MN	Digital Output
Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10)	Stop command	BA-S731/732/733/734/735/736/737/738/739/740-MO	Digital Output
Mixed Liquor Channel 1	High level status	BA-S843-LH	Digital Input
Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10)	Run status	BA-S731/732/733/734/735/736/737/738/739/740-MM	Digital Input
Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10)	Fault status	BA-S731/732/733/734/735/736/737/738/739/740-QF	Digital Input
Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10)	Computer/hand status	BA-S731/732/733/734/735/736/737/738/739/740-YS	Digital Input
Train 1	WAS flow	BA-S943-FT	Analog Input

1.2.6. HMI Display

Device Description	Status
Mixed Liquor Channel 1	Level status (Normal/High)
Mixed Liquor Channel 1	Mixed liquor flow (ML/day)
Secondary Clarifiers Train 1	Final effluent flow (ML/day)
Secondary Clarifiers Train 1	RAS current day (ML)
Secondary Clarifiers Train 1	RAS previous day (ML)
Secondary Clarifiers Train 1	Total RAS flow (ML/day)
Secondary Clarifiers Train 1	Total WAS flow (L/s)
Secondary Clarifiers Train 1	WAS current day (kL)
Secondary Clarifiers Train 1	WAS previous day (kL)

Device Description	Status
Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10)	Fault status (Normal/Fail)
Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10)	Run status

1.2.7. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Mixed Liquor Channel 1	High level alarm	BA-S843-LH in alarm	Alarm notification
Train 1 Scum Collectors (S731/732/733/734/735/736/737/738/739/740-SC-1/2/3/4/5/6/7/8/9/10)	Fault	BA-S731/732/733/734/735/736/737/738/739/740-QF in alarm	Alarm notification

2. SECONDARY CLARIFIERS TRAINS 2 AND 3 COLLECTORS

Associated P&ID: 1-0101S-A0127, 1-0101S-A0128, 1-0101S-A0129, 1-0101S-A0130, 1-0101S-A0132, 1-0101S-A0133, 1-0101S-A0134, 1-0101S-A0135

Associated NEWPCC Manuals:
Associated DCS HMI Screens: nearea5.G, nstrn2.G, nsras2.G

2.1. Process Description

Mixed liquor (ML) enters the Train 2 secondary clarifiers (clarifiers 11-18) through Mixed Liquor Channel 2 and Train 3 secondary clarifiers (clarifiers 19-26) through Mixed Liquor Channel 3. Each train has four travelling bridges:

- S701-SC-11 services clarifiers 11 and 12 in train 2
- S702-SC-12 services clarifiers 13 and 14 in train 2
- S703-SC-13 services clarifiers 15 and 16 in train 2
- S704-SC-14 services clarifiers 17 and 18 in train 2
- S705-SC-15 services clarifiers 19 and 20 in train 3
- S706-SC-16 services clarifiers 21 and 22 in train 3
- S707-SC-17 services clarifiers 23 and 24 in train 3
- S708-SC-18 services clarifiers 25 and 26 in train 3

The bridges travel from one side of the tank to the other, skimming the scum and siphoning the sludge out of the tank. The scum is deposited into a scum trough at the end of the tank where it is flushed into the scum tank system. The bridge position is tracked based on elapsed running time since reaching the end limit switch.

Each scum trough has a Flushing Water (FW) valve (S468/469/478/479/488/489/498/499-HV) that controls the flow of water to the trough.

2.2. Control Description

2.2.1. Local Manual Control Mode – Train 2, 3 Scum Collector (S701/702/703/704-SC-11/12/13/14, S705/706/707/708-SC-15/16/17/18)

The traverse motor, scum blade hoist, and two vacuum pumps that are part of each scum collector system are controlled and sequenced through the dedicated bridge collector PLC for each secondary clarifier in Train 2 and 3.

In LOCAL mode, the scum collector system is started and stopped through a COMPUTER/OFF/HAND hand switch in the Secondary Clarifiers Control Room Panel (S701/702/703/704/705/706/707/708-HS-1).

2.2.2. Local Automatic Control Mode – Train 2, 3 Scum Collector (S701/702/703/704-SC-11/12/13/14, S705/706/707/708-SC-15/16/17/18)

In LOCAL AUTOMATIC mode the scum collection system is controlled and sequenced by the bridge collector PLC.

Each Bridge has a control panel that has an Auto/Manual switch. If switch put to manual, operator can control all functions of the bridge locally from this panel

2.2.3. Remote Manual Control Mode – Train 2, 3 Scum Collector (S701/702/703/704-SC-11/12/13/14, S705/706/707/708-SC-15/16/17/18)

The scum collector systems can be started and stopped in REMOTE MANUAL mode from the pop-up faceplate.

To start the scum collector system, a 3 second start pulse is sent to the drive. To stop the scum collector, a 3 second stop pulse is sent to the drive.

2.2.4. Remote Automatic Control Mode – Train 2,3 Scum Collector (S701/702/703/704-SC-11/12/13/14, S705/706/707/708-SC-15/16/17/18)

The scum collectors must be started in MANUAL mode before switching to REMOTE AUTOMATIC.

In REMOTE AUTOMATIC mode, the scum collector system is run continuously once it has been manually started.

The PCS monitors the status (BC-S701/702/703/704-MM, BD-S705/706/707/708-MM) of the scum collector system. The PCS also monitors the following networked status points:

- Bridge position
- Bridge loss of siphon – Side 1
- Bridge loss of siphon – Side 2
- Bridge previous day loss of siphon total – Side 1
- Bridge previous day loss of siphon total – Side 2
- Bridge auto status
- Bridge manual status
- Bridge E-Stop status
- Bridge valve A open
- Bridge valve B open

- Bridge drain valve open
- Bridge forward status
- Bridge reverse status
- Bridge vacuum pump 1 run status
- Bridge vacuum pump 2 run status
- Bridge 1 non-critical alarm
- Bridge 1 critical alarm

If the scum collector contactor is not closed within 3 seconds of receiving a start command from the PCS, the scum collector will go into alarm.

The PCS will call the scum collector to STOP in REMOTE AUTOMATIC mode if the scum collector has faulted (BC-S701/702/703/704-QF, BD-S705/706/707/708-QF).

2.2.5. Local Manual Mode – FW Valve (S468/469/478/479/488/489/498/499-HV)

The FW valves can be controlled in LOCAL (MANUAL) or REMOTE (COMPUTER) mode. The mode is selected using a LOCAL/REMOTE hand switch in the mixed liquor gallery (S468/469/478/479/488/489/498/499-HS-1).

In LOCAL mode, the FW valve is MANUALLY operated using an OPEN/CLOSE hand switch in the mixed liquor gallery (S468/469/478/479/488/489/498/499-HS-2).

2.2.6. Remote Manual Control Mode – FW Valve (S468/469/478/479/488/489/498/499-HV)

In REMOTE MANUAL mode the FW can be manually opened and closed through the pop-up faceplate.

To open the valve, the PCS sends a 3 second pulse open signal. To close the valve, the PCS sends a 3 second pulse close signal.

2.2.7. Remote Automatic Mode – FW Valve (S468/469/478/479/488/489/498/499-HV)

In REMOTE mode, the FW valves AUTOMATICALLY open once the collector bridge has reached the scum trough. The PCS monitors the end of travel signal (BB-S468/469/478/479/488/489/498/499-ZB) from the limit switch at the end of the clarifier (S468/469/478/479/488/489/498/499-ZSB) and sends an open command to the FW valve (BB-S468/469/478/479/488/489/498/499-VD) if the limit switch detects the collector bridge for 60 seconds or more. The FW valves have an operator-set flushing time (minimum setpoint: 0 seconds; maximum setpoint: 120 seconds; current setpoint: 45 seconds). Once the flushing time has elapsed, the PCS will send a close command (BB- S468/469/478/479/488/489/498/499-VB) to the FW valve.

2.2.8. Interlocks, Permissives and Control Signals

2.2.8.1. Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)

For Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	S701/702/703/704/ 705/706/707/708-HS (COH)	Hand

Equipment	Device Description	Device Tag	State
Bridge control panel	Auto/Manual switch	S701/702/703/704/ 705/706/707/708-HS	Manual

For Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		BC-S701/702/703/704-MN	Start command
		BD-S705/706/707/708-MN	
Control Room Panel	Computer/off/hand hand switch	S701/702/703/704/ 705/706/707/708-HS (COH)	Computer
Bridge Control Panel	Auto/Manual switch	S701/702/703/704/ 705/706/707/708-HS	Auto

2.2.8.2. FW Valve (S468/469/478/479/488/489/498/499-HV)

For FW Valve (S468/469/478/479/488/489/498/499-HV) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
FW Valve (S468/469/478/479/488/ 489/498/499-HV)	Local/remote hand switch	S468/469/478/479/488/489/ 498/499-HS-1 (L/R)	Local
FW Valve (S468/469/478/479/488/ 489/498/499-HV)	Open/close hand switch	S468/469/478/479/488/489/ 498/499-HS-2 (O/C)	Open/close

For FW Valve (S468/469/478/479/488/489/498/499-HV) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		BB-S468/469/478/479/488/489/498/499-VD/VB	Open/close command
FW Valve (S468/469/478/479/488/ 489/498/499-HV)	Local/remote hand switch	S468/469/478/479/488/489/498/499-HS-1	Remote

2.2.9. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
FW Valve (S468/469/478/479/488/489/498/499-HV)	Close command	BB-S468/469/478/479/488/489/498/499-VB	Digital Output
FW Valve (S468/469/478/479/488/489/498/499-HV)	Open command	BB-S468/469/478/479/488/489/498/499-VD	Digital Output
Train 2 Scum Collector (S701/702/703/704-SC11/12/13/14)	Start command	BC-S701/702/703/704-MN	Digital Output

Equipment	Signal Description	Signal Tag	Signal Type
Train 2 Scum Collector (S701/702/703/704-SC11/12/13/14)	Stop command	BC-S701/702/703/704-MO	Digital Output
Train 3 Scum Collector (S705/706/707/708-SC-15/16/17/18)	Start command	BD-S705/706/707/708-MN	Digital Output
Train 3 Scum Collector (S705/706/707/708-SC-15/16/17/18)	Stop command	BD-S705/706/707/708-MO	Digital Output
Bridge Travel Limit Switch (S468/469/478/479/488/489/498/499-ZSB)	Bridge positioned at SC channel	BB-S468/469/478/479/488/489/498/499-ZB	Digital Input
Clarifier 11/12/13/14/15/16/17/18	High tank level	BC-S711/712/713/714/715/716/717/718-LH	Digital Input
FW Valve (S468/469/478/479/488/489/498/499-HV)	Computer/hand status	BB-S468/469/478/479/488/489/498/499-YS	Digital Input
Train 2 Scum Collector (S701/702/703/704-SC11/12/13/14)	Run status	BC-S701/702/703/704-MM	Digital Input
Train 2 Scum Collector (S701/702/703/704-SC11/12/13/14)	Drive warning	BC-S701/702/703/704-QA	Digital Input
Train 2 Scum Collector (S701/702/703/704-SC11/12/13/14)	Drive fault	BC-S701/702/703/704-QF	Digital Input
Train 2 Scum Collector (S701/702/703/704-SC11/12/13/14)	Computer/hand status	BC-S701/702/703/704-YS	Digital Input
Train 3 Scum Collector (S705/706/707/708-SC-15/16/17/18)	Run status	BD-S705/706/707/708-MM	Digital Input
Train 3 Scum Collector (S705/706/707/708-SC-15/16/17/18)	Drive warning	BD-S705/706/707/708-QA	Digital Input
Train 3 Scum Collector (S705/706/707/708-SC-15/16/17/18)	Drive fault	BD-S705/706/707/708-QF	Digital Input
Train 3 Scum Collector (S705/706/707/708-SC-15/16/17/18)	Computer/hand status	BD-S705/706/707/708-YS	Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge Position	Bridge_01/02/03/04/0-5/06/07/08.Brdg_Pos_Cntr	Networked Analog Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Side 1 siphon loss	Bridge_01/02/03/04/0-5/06/07/08.T1LossSiphon	Networked Analog Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Side 2 siphon loss	Bridge_01/02/03/04/0-5/06/07/08.T2LossSiphon	Networked Analog Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Side 1 previous day siphon loss	Bridge_01/02/03/04/0-5/06/07/08.T1PrevDayTot	Networked Analog Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Side 2 previous day siphon loss	Bridge_01/02/03/04/0-5/06/07/08.T2PrevDayTot	Networked Analog Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Hoist Low limit switch	Bridge_01/02/03/04/0-5/06/07/08.HoistDownLimSw	Networked Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Hoist High limit switch	Bridge_01/02/03/04/0-5/06/07/08.HoistUpLimSw	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Hoist beyond limit switch	Bridge_01/02/03/04/0-5/06/07/08.HoistOvrTrvl	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge Forward limit switch	Bridge_01/02/03/04/0-5/06/07/08.BrigFwrdLimSw	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge Forward travel beyond limit switch	Bridge_01/02/03/04/0-5/06/07/08.BrigFwrdOvrTrvlLimSw	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge Program 1	Bridge_01/02/03/04/0-5/06/07/08.Prgm1	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge Program 2	Bridge_01/02/03/04/0-5/06/07/08.Prgm2	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge Program 3	Bridge_01/02/03/04/0-5/06/07/08.Prgm3	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge in auto	Bridge_01/02/03/04/0-5/06/07/08.Auto	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge Tank 1 prime switch	Bridge_01/02/03/04/0-5/06/07/08.Tank1PrimeSw	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge Tank 2 prime switch	Bridge_01/02/03/04/0-5/06/07/08.Tank2PrimeSw	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge Drive Torque Switch	Bridge_01/02/03/04/0-5/06/07/08.EuroDriveTorqueTrip	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge motor overload	Bridge_01/02/03/04/0-5/06/07/08.BrdgMotorOL	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Hoist motor overload	Bridge_01/02/03/04/0-5/06/07/08.HoistMotorOL	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Vacuum Pump 1 overload	Bridge_01/02/03/04/0-5/06/07/08.VacP1OL	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Vacuum Pump 2 overload	Bridge_01/02/03/04/0-5/06/07/08.VacP2OL	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Vacuum Receive Tank High Level	Bridge_01/02/03/04/0-5/06/07/08.VacRcvrTankHiLvl	Networked Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge E-Stop	Bridge_01/02/03/04/0-5/06/07/08.E_Stop	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Valve A Open	Bridge_01/02/03/04/0-5/06/07/08.VV1AOpened	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Valve B Open	Bridge_01/02/03/04/0-5/06/07/08.VV1BOpened	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Drain Valve	Bridge_01/02/03/04/0-5/06/07/08.DVOpened	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	PV1A Closed	Bridge_01/02/03/04/0-5/06/07/08.PV1AClosedLimSw	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	PV1B Closed	Bridge_01/02/03/04/0-5/06/07/08.PV1BClosedLimSw	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge manual status	Bridge_01/02/03/04/0-5/06/07/08.ManualMode	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Valve A Closed	Bridge_01/02/03/04/0-5/06/07/08.VV1AClosed	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Valve B Closed	Bridge_01/02/03/04/0-5/06/07/08.VV1BClosed	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Drain Valve Closed	Bridge_01/02/03/04/0-5/06/07/08.DVClosed	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge Forward Status	Bridge_01/02/03/04/0-5/06/07/08.BrdgFwdStatus	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge Reverse Status	Bridge_01/02/03/04/0-5/06/07/08.BrdgRevStatus	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Vacuum pump 1 run status	Bridge_01/02/03/04/0-5/06/07/08.VacP1Running	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Vacuum pump 2 run status	Bridge_01/02/03/04/0-5/06/07/08.VacP2Running	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Non-critical alarm	Bridge_01/02/03/04/0-5/06/07/08.NonCriticalAlarm	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Critical Alarm	Bridge_01/02/03/04/0-5/06/07/08.CriticalAlarm	Networked Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Tank 1 Fail	Bridge_01/02/03/04/0-5/06/07/08.AutoSegFail T1	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Tank 2 Fail	Bridge_01/02/03/04/0-5/06/07/08.AutoSegFail T2	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Valve A Fail	Bridge_01/02/03/04/0-5/06/07/08.VV1A_Failed	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Valve B Fail	Bridge_01/02/03/04/0-5/06/07/08.VV1B_Failed	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Drain Valve Fail	Bridge_01/02/03/04/0-5/06/07/08.DV_Failed	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge PV1A Fail to Close	Bridge_01/02/03/04/0-5/06/07/08.PV1A_Failed_To_Close	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	Bridge PV1B Fail to Close	Bridge_01/02/03/04/0-5/06/07/08.PV1B_Failed_To_Close	Networked Digital Input
Train 2/3 Scum Collector (S701/702/703/704-SC11/12/13/14) / (S701/702/703/704-SC11/12/13/14)	High sludge level	BD-S719/720/721/722/723/724/725/726-LH	Digital Input
Mixed Liquor Channel 2/3	High level alarm	BA-S842/841-LH	Digital Input

2.2.10. HMI Display

Device Description	Status
Mixed Liquor Channel 2/3	Level status (Normal/High)
FW Valve (S468/469/478/479/488/489/498/499-HV)	Trough flush time (seconds)
Mixed Liquor Channel 2/3	Mixed liquor flow (ML/day)
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Bridge status (Normal/Fail)
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Fault status
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Forward/reverse status
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Manual/automatic status
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Run status
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Tank 1 siphon loss incidents current day
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Tank 1 siphon loss incidents previous day
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Tank 2 siphon loss incidents current day

Device Description	Status
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Tank 2 siphon loss incidents previous day
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Travel status (Normal/Fail)
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Trough flush time (seconds)
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Vacuum Pump 1 run status
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Vacuum Pump 2 run status
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Valve DV-1 open status
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Valve VV-1A open status
Train 2,3 Scum Collector (S701/702/703/704-SC11/12/13/14, S705/706/707/708-SC-15/16/17/18)	Valve VV-1B open status
Secondary Clarifiers Train 2/3	Final effluent flow (ML/day)
Secondary Clarifiers Train 2/3	RAS current day (ML)
Secondary Clarifiers Train 2/3	RAS previous day (ML)
Secondary Clarifiers Train 2/3	Total RAS flow (ML/day)
Secondary Clarifiers Train 2/3	Total WAS flow (L/s)
Secondary Clarifiers Train 2/3	WAS current day (kL)
Secondary Clarifiers Train 2/3	WAS previous day (kL)

2.2.11. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Mixed Liquor Channel 3	High level alarm	BA-S841-LH in alarm	Alarm notification
Mixed Liquor Channel 2	High level alarm	BA-S842-LH in alarm	Alarm notification
Train 2 Scum Collector (S701/702/703/704-SC11/12/13/14)	Fault	BC-S701/702/703/704-QA in alarm	Alarm notification
Train 3 Scum Collector (S705/706/707/708-SC-15/16/17/18)	Fault	BD-S705/706/707/708-QA in alarm	Alarm notification

3. SECONDARY CLARIFIERS RETURN ACTIVATED SLUDGE (RAS) TRAIN 1

Associated P&ID: 1-0101S-A0140, 1-0101S-A0141, 1-0101S-A0142, 1-0101S-A0143, 1-0101S-A0144
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nsrasd.G, nsras1.G, nsdata.G

3.1. Process Description

Train 1 has 10 return activated sludge (RAS) pumps, one for each clarifier in the train:

- S901-RAP-1 services clarifier 1
- S902-RAP-2 services clarifier 2
- S903-RAP-3 services clarifier 3
- S904-RAP-4 services clarifier 4
- S905-RAP-5 services clarifier 5
- S906-RAP-6 services clarifier 6
- S907-RAP-7 services clarifier 7
- S908-RAP-8 services clarifier 8
- S909-RAP-9 services clarifier 9
- S910-RAP-10 services clarifier 10

The RAS pumps draw RAS from their associated clarifier and discharge it to RAS Header 1.

3.2. Control Description

3.2.1. Local Manual Control Mode

The RAS pumps can be operated in LOCAL (MANUAL) and REMOTE (COMPUTER) modes.

The RAS pumps has hardwired interlocks and will automatically shut down if the seal water pressure is low (S901/902/903/904/905/906/907/908/909/910-PSL) or if the pump overheats (S901/902/903/904/905/906/907/908/909/910-TSH).

In LOCAL MANUAL mode, the RAS pump is started by switching the COMPUTER/OFF/HAND hand switch (S901/902/903/904/905/906/907/908/909/910-HS-7) to HAND. The speed of the pump is changed MANUALLY using the INCREASE/DECREASE hand switch S901/902/903/904/905/906/907/908/909/910-HS-8/9) in the Secondary Clarifiers control room panel, the pump speed can be verified on the VFD in the electrical room .

3.2.2. Remote Manual Control Mode

The RAS pumps can be manually started and stopped from the pop-up faceplate.

To start the pump, a 3 second start pulse signal is sent to the drive. To stop the pump, a 3 second stop pulse signal is sent to the drive.

The RAS pump speed can be manually set through the pop-up faceplate or can be controlled by the REMOTE AUTOMATIC speed control as described in the REMOTE AUTOMATIC section below.

3.2.3. Remote Automatic Control Mode

The RAS pumps must be started in MANUAL mode before switching to REMOTE AUTOMATIC. In REMOTE AUTOMATIC mode the RAS pumps run continuously.

If the RAS pump is not running within 7 seconds of receiving a start command from the PCS, the pump will go into alarm.

The RAS pump speed in REMOTE AUTOMATIC Mode is automatically set to the initial value of 50% for the first 11 seconds. After the 11 seconds have elapsed, the RAS pump speed is controlled through PID feedback to maintain the RAS flow to the RAS flow set point for the respective clarifier.

The RAS flow set point for each clarifier is calculated as a weighted average of the total RAS flow set point for Train 1 using the operator adjustable ratio set point for each Train 1 clarifier as the weights in the average.

The total RAS flow set point has two modes of operation:

- RAS/PE model
  - In the RAS/PE model, the total RAS flow set point for Train 1 is based on a percentage of the Train 1 Primary Effluent (PE) flow to the Reactors. The operator can input the percentage set point (minimum: 0%; maximum 100%; initial 30%).
- Manual mode
  - In Manual mode, the operator sets the total RAS flow set point for train 1 in ML/D.

The operator can set a minimum total RAS flow set point for Train 1.

The PCS will call the RAS pump to STOP in REMOTE AUTOMATIC mode if the RAS pump has faulted (BA-S901/902/903/904/905/906/907/908/909/910-QF).

3.2.4. Interlocks, Permissives and Control Signals

For RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	S901/902/903/904/905/906/907/908/909/910-HS-7 (COH)	Hand
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Lock off stop switch	S901/902/903/904/905/906/907/908/909/910-HS-1 (LOS)	Normal
Control Room Panel	Increase/decrease speed hand switch	S901/902/903/904/905/906/907/908/909/910-HS-8/9 (INC/DEC)	Increase /decrease speed
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Low pressure switch	S901/902/903/904/905/906/907/908/909/910-PSL	Normal
Local Control Panel	High temperature switch	S901/902/903/904/905/906/907/908/909/910-TSH	Normal
Local Control Panel	Reset hand switch	S901/902/903/904/905/906/907/908/909/910-HS-2 (RST)	Normal

For RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		BA-S901/902/903/904/905/906/907/908/909/910-MN	Start command

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	S901/902/903/904/905/906/907/908/909/910-HS-7 (COH)	Computer
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Lock off stop switch	S901/902/903/904/905/906/907/908/909/910-HS-1 (LOS)	Normal
PCS		BA-S901/902/903/904/905/906/907/908/909/910-SD/SB	Increase /decrease speed command
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Low pressure switch	S901/902/903/904/905/906/907/908/909/910-PSL	Normal
Local Control Panel	High temperature switch	S901/902/903/904/905/906/907/908/909/910-TSH	Normal
Local Control Panel	Reset hand switch	S901/902/903/904/905/906/907/908/909/910-HS-2 (RST)	Normal

3.2.5. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Start command	BA-S901/902/903/904/905/906/907/908/909/910-MN	Digital Output
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Stop command	BA-S901/902/903/904/905/906/907/908/909/910-MO	Digital Output
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Decrease speed command	BA-S901/902/903/904/905/906/907/908/909/910-SB	Digital Output
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Increase speed command	BA-S901/902/903/904/905/906/907/908/909/910-SD	Digital Output
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Run status	BA-S901/902/903/904/905/906/907/908/909/910-MM	Digital Input
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Fault	BA-S901/902/903/904/905/906/907/908/909/910-QF	Digital Input
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Computer/hand status	BA-S901/902/903/904/905/906/907/908/909/910-YS	Digital Input
Magnetic Flowmeter (S901/902/903/904/905/906/907/908/909/910-FE)	Clarifier 1/2/3/4/5/6/7/8/9/10 RAS flow	BA-S901/902/903/904/905/906/907/908/909/910-FT	Analog Input

Equipment	Signal Description	Signal Tag	Signal Type
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Speed	BA-S901/902/903/904/905/906/907/908/909/910-ST	Analog Input

3.2.6. HMI Display

Device Description	Status
Clarifier 1/2/3/4/5/6/7/8/9/10	RAS ratio
Clarifier 1/2/3/4/5/6/7/8/9/10	RAS ratio setpoint
Magnetic Flowmeter (S901/902/903/904/905/906/907/908/909/910-FE)	RAS flow (L/s)
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Computer/hand status
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Run status
RAS Pump (S901/902/903/904/905/906/907/908/909/910-RAP-1/2/3/4/5/6/7/8/9/10)	Speed (RPM)
Secondary Clarifiers RAS Train 1	Total RAS flow (ML/day)
Secondary Clarifiers RAS Train 1	RAS/PE model active (Yes/No)
Secondary Clarifiers RAS Train 1	Clarifier solids model active (yes/No)
Secondary Clarifiers RAS Train 1	RAS/PE model operator/lab RAS ratio (%)
Secondary Clarifiers RAS Train 1	RAS/PE model actual RAS to PE ratio (%)
Secondary Clarifiers RAS Train 1	RAS/PE model sludge setpoint (ML/day)
Secondary Clarifiers RAS Train 1	Total PE flow (ML/day)
Secondary Clarifiers RAS Train 1	Minimum calculated RAS setpoint
Secondary Clarifiers RAS Train 1	Operator flow model active (Yes/No)
Secondary Clarifiers RAS Train 1	Operator flow model sludge setpoint (ML/day)
Secondary Clarifiers RAS Train 1	Clarifier solids model operator/lab setpoint (mg/L)
Secondary Clarifiers RAS Train 1	Clarifier solids model sludge setpoint (ML/day)
Secondary Clarifiers RAS Train 1	Current day RAS volume (ML)
Secondary Clarifiers RAS Train 1	Previous day RAS volume (ML)
Secondary Clarifiers RAS Train 1	Total RAS flow to reactors (ML/day)
Secondary Clarifiers RAS Train 1	RAS flow to reactor 1A (ML/day)
Secondary Clarifiers RAS Train 1	RAS flow to reactor 1B (ML/day)
Secondary Clarifiers RAS Train 1	PE flow to reactor 1A (ML/day)
Secondary Clarifiers RAS Train 1	PE flow to reactor 1B (ML/day)
Secondary Clarifiers RAS Train 1	Current day PE volume discharged to reactor 1A (ML)
Secondary Clarifiers RAS Train 1	Current day PE volume discharged to reactor 1B (ML)
Secondary Clarifiers RAS Train 1	Previous day PE volume discharged to reactor 1A (ML)
Secondary Clarifiers RAS Train 1	Previous day PE volume discharged to reactor 1B (ML)

4. SECONDARY CLARIFIERS RETURN ACTIVATED SLUDGE (RAS) TRAINS 2 AND 3

Associated P&ID: 1-0101S-A0145, 1-0101S-A0146, 1-0101S-A0147, 1-0101S-A0148, 1-0101S-A0149, 1-0101S-A0150, 1-0101S-A0151, 1-0101S-A0152
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nsras2.G, nsras3.G, nsrasd.G

4.1. Process Description

RAS from the clarifiers is siphoned into the RAS tanks. From the RAS tanks, the RAS is pumped to the RAS headers, as outlined in the following table.

Train	Clarifier	RAS Tank	RAS Pump	RAS Header
2	11	1	S911-RAP-11	2
2	12	2	S912-RAP-12	2
2	13	3	S913-RAP-13	2
2	14	4	S914-RAP-14	2
2	15	5	S915-RAP-15	2
2	16	6	S916-RAP-16	2
2	17	7	S917-RAP-17	2
2	18	8	S918-RAP-18	2
3	19	9	S919-RAP-19	3
3	20	10	S920-RAP-20	3
3	21	11	S921-RAP-21	3
3	22	12	S922-RAP-22	3
3	23	13	S923-RAP-23	3
3	24	14	S924-RAP-24	3
3	25	15	S925-RAP-25	3
3	26	16	S926-RAP-26	3

4.2. Control Description

4.2.1. Local Manual Control Mode

The RAS pumps can be operated in LOCAL (MANUAL) and REMOTE (COMPUTER) modes.

The RAS pumps there are hardwired interlocks that will automatically shut down if the seal water pressure is low (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-PSL) or if the pump overheats (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-TSH).

In LOCAL MANUAL mode, the RAS pump is started by switching the COMPUTER/OFF/HAND hand switch (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-HS-7) to HAND. The speed of the pump is changed MANUALLY using the INCREASE/DECREASE hand switch (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-HS-8/9) in the Secondary Clarifiers control room panel.

4.2.2. Remote Manual Control Mode

The RAS pumps can be manually started and stopped from the pop-up faceplate.

To start the pump, a 3 second start pulse signal is sent to the drive. To stop the pump, a 3 second stop pulse signal is sent to the drive.

The RAS pump speed can be manually set through the pop-up faceplate or can be controlled by the REMOTE AUTOMATIC speed control as described in the REMOTE AUTOMATIC section below.

4.2.3. Remote Automatic Control Mode

The RAS pumps must be started in MANUAL mode before switching to REMOTE AUTOMATIC.

In REMOTE AUTOMATIC mode the RAS pumps run continuously once manually started. The RAS pump will turn off if either of the following conditions occur:

- The pump has a fail signal
- The RAS tank level goes below the minimum tank set point. (minimum: 0m; maximum: 5m; initial: 4.5m)

If the RAS pump is not running within 7 seconds of receiving a start command from the PCS, the pump will go into alarm.

The RAS pump speed in REMOTE AUTOMATIC Mode is automatically set to the initial value of 50% for the first 11 seconds. After the 11 seconds have elapsed, the RAS pump speed is controlled through PID feedback to maintain the RAS flow to the RAS flow set point for the respective clarifier.

The RAS flow set point for each clarifier is calculated as a weighted average of the total RAS flow set point for the respective Train using the operator adjustable ratio set point for each clarifier as the weights in the average.

The total RAS flow set point has two modes of operation:

- RAS/PE model
  - In the RAS/PE model, the total RAS flow set point for the Train is based on a percentage of the Train Primary Effluent (PE) flow to the Reactors. The operator can input the percentage set point (minimum: 0%; maximum 100%; initial 30%).
- Manual mode
  - In Manual mode, the operator sets the total RAS flow set point for the Train in ML/D.

The operator can set a minimum total RAS flow set point for each Train.

4.2.4. Interlocks, Permissives and Control Signals

For RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-1/2/3/4/5/6/7/8/9/10) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-HS-7 (COH)	Hand
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/92	Lock off stop switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-HS-1 (LOS)	Normal

Equipment	Device Description	Device Tag	State
4/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)			
Control Room Panel	Increase/decrease speed hand switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-HS-8/9 (INC/DEC)	Increase /decrease speed
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Low pressure switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-PSL	Normal
Local Control Panel	High temperature switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-TSH	Normal
Local Control Panel	Reset hand switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-HS-2 (RST)	Normal
Control Room Panel	Low level switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-LSL	Normal

For RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		BC-S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-MN	Start command
Control Room Panel	Computer/off/hand hand switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-HS-7 (COH)	Computer
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Lock off stop switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-HS-1 (LOS)	Normal
PCS		BC-S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-SD/SB	Increase /decrease speed command
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-	Low pressure switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-PSL	Normal

Equipment	Device Description	Device Tag	State
11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)			
Local Control Panel	High temperature switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-TSH	Normal
Local Control Panel	Reset hand switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-HS-2 (RST)	Normal
Control Room Panel	Low level switch	S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-LSL	Normal

4.2.5. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Start command	BC-S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-MN	Digital Output
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Stop command	BC-S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-MO	Digital Output
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Decrease speed command	BC-S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-SB	Digital Output
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Increase speed command	BC-S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-SD	Digital Output
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Run status	BC-S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-MM	Digital Input
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Fault	BC-S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-QF	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Computer/hand status	BC-S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-YS	Digital Input
Magnetic Flowmeter (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-FE)	Clarifier 11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26 RAS flow	BC-S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-FT	Analog Input
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Speed	BC-S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-ST	Analog Input
RAS Tank (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926)	RAS level	BC-S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-LT	Analog Input

4.2.6. HMI Display

Device Description	Status
Clarifier 11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26	RAS ratio
Clarifier 11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26	RAS ratio setpoint
Magnetic Flowmeter (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-FE)	RAS flow (L/s)
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Computer/hand status
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Run status
RAS Pump (S911/912/913/914/915/916/917/918/920/921/922/923/924/925/926-RAP-11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26)	Speed (RPM)
Secondary Clarifiers RAS Train 2/3	Total RAS flow (ML/day)

Device Description	Status
Secondary Clarifiers RAS Train 2	RAS to SBR (L/s)
Secondary Clarifiers RAS Train 2/3	Total RAS flow (ML/day)
Secondary Clarifiers RAS Train 2/3	RAS/PE model active (Yes/No)
Secondary Clarifiers RAS Train 2/3	Clarifier solids model active (yes/No)
Secondary Clarifiers RAS Train 2/3	RAS/PE model operator/lab RAS ratio (%)
Secondary Clarifiers RAS Train 2/3	RAS/PE model actual RAS to PE ratio (%)
Secondary Clarifiers RAS Train 2/3	RAS/PE model sludge setpoint (ML/day)
Secondary Clarifiers RAS Train 2/3	RAS flow
Secondary Clarifiers RAS Train 2/3	PE flow
Secondary Clarifiers RAS Train 2/3	Minimum calculated RAS setpoint
Secondary Clarifiers RAS Train 2/3	Operator flow model active (Yes/No)
Secondary Clarifiers RAS Train 2/3	Operator flow model sludge setpoint (ML/day)
Secondary Clarifiers RAS Train 2/3	Clarifier solids model operator/lab setpoint (mg/L)
Secondary Clarifiers RAS Train 2/3	Clarifier solids model sludge setpoint (ML/day)
Secondary Clarifiers RAS Train 2/3	Current day RAS volume (ML)
Secondary Clarifiers RAS Train 2/3	Previous day RAS volume (ML)
Secondary Clarifiers RAS Train 2/3	Total RAS flow to reactors (ML/day)
Secondary Clarifiers RAS Train 2/3	RAS flow to reactor 2A/3A (ML/day)
Secondary Clarifiers RAS Train 2/3	RAS flow to reactor 2B/3B (ML/day)
Secondary Clarifiers RAS Train 2/3	PE flow to reactor 2A/3A (ML/day)
Secondary Clarifiers RAS Train 2/3	PE flow to reactor 2B/3B (ML/day)
Secondary Clarifiers RAS Train 2/3	Current day PE volume discharged to reactor 2A/3A (ML)
Secondary Clarifiers RAS Train 2/3	Current day PE volume discharged to reactor 2B/3B (ML)
Secondary Clarifiers RAS Train 2/3	Previous day PE volume discharged to reactor 2A/3A (ML)
Secondary Clarifiers RAS Train 2/3	Previous day PE volume discharged to reactor 2B/3B (ML)

5. SECONDARY CLARIFIERS WASTE ACTIVATED SLUDGE (WAS) SYSTEM

Associated P&ID: 1-0101S-A0155
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nawasp.G

5.1. Process Description

The WAS pumps suction RAS off the RAS headers and discharge to a common WAS header to the Grit Effluent. Each train has a dedicated WAS suction valve and flowmeter. The WAS pumps can service the following trains based on manual valve positioning:

- WAP1 can suction from Train 1 or Train 3.
- WAP2 can suction from Train 2.
- WAP3 can suction from Train 3.
- WAP4 can suction from Train 1 or Train 2.

Secondary Clarifier WAS pumping is paused when the SBR wasting pumps are running.

The suction valve and Train combinations are as follows:

- S943-HV-1 is associated with Train 1
- S942-HV-2 is associated with Train 2

- S941-HV-3 is associated with Train 3

5.2. Control Description

5.2.1. Local Manual Control Mode – WAS Suction Valve (S943/942/941-HV-1/2/3)

The WAS suction valves can be operated in LOCAL (MANUAL) and REMOTE (COMPUTER) modes.

In LOCAL MANUAL mode, the valve is opened by switching the COMPUTER/HAND hand switch (S943/942/941-HS-1) to HAND.

5.2.2. Remote Manual Control Mode – WAS Suction Valve (S943/942/941-HV-1/2/3)

In REMOTE MANUAL mode the WAS suction valves can be opened and closed from the pop-up faceplate.

To open the valve, a 3 second open pulse signal will be sent to the controller. To close the valve, a 3 second close pulse signal will be sent to the controller.

5.2.3. Remote Automatic Control Mode – WAS Suction Valve (S943/942/941-HV-1/2/3)

In REMOTE AUTOMATIC mode, the PCS monitors the open (BA-S943/942/941-ZD) and closed (BA-S943/942/941-ZB) statuses of the valve. If the valve is open, the PCS will continue to keep the valve open. If the valve is closed, the PCS will keep the valve closed.

5.2.4. Local Manual Control Mode – WAS Pump (S951/952/953/954-WAP-1/2/3/4)

The WAS pumps can be operated in LOCAL (MANUAL) and REMOTE (COMPUTER) modes.

The WAS pumps have a hardwired interlock and will automatically shut down if the seal water pressure is low (S951/952/953/954-PSL) or if the pump overheats (S951/952/953/954-TSH).

In LOCAL MANUAL mode, the WAS pump is started by switching the COMPUTER/OFF/HAND hand switch (S951/952/953/954-HS-7) to HAND. The speed of the pump is changed MANUALLY using the INCREASE/DECREASE hand switch (S951/952/953/954-HS-8/9) in the Secondary Clarifiers control room panel.

5.2.5. Remote Manual Control Mode – WAS Pump (S951/952/953/954-WAP-1/2/3/4

A WAS pump can be controlled in REMOTE MANUAL control mode if the following conditions are met:

- A Train is manually valved (indicated by operator set input) to feed the pump and the associated suction valve is open.
- The hand switch is the REMOTE position.

If the above conditions are not met, the pump will be switched to REMOTE AUTOMATIC mode.

In REMOTE MANUAL mode the WAS pump can be started and stopped from the pop-up faceplate.

To start the WAS pump, a 3 second pulse start signal will be sent to the pump drive. To stop the pump a 3 second stop pulse will be sent to the pump drive.

The WAS speed can be set manually or can be set to follow the automatic speed control as described by below in the REMOTE AUTOMATIC section.

5.2.6. Remote Automatic Control Mode – WAS Pump (S951/952/953/954-WAP-1/2/3/4)

The WAS pump (S951/952/953/954-WAP-1/2/3/4) will AUTOMATICALLY start in REMOTE AUTOMATIC mode if all the following conditions are met:

- A Train is manually valved (indicated by operator set input) to feed the pump and the associated suction valve is open.
- The SBR is not wasting

If the WAS pump is not running within 10 seconds of receiving a start command from the PCS, the pump will go into alarm.

The WAS pump speed in REMOTE AUTOMATIC Mode is automatically set to the initial value of 70 % for the first 3 minutes. After the 3 minutes have elapsed, the RAS pump speed is controlled through PID feedback to maintain the WAS flow to the WAS flow set point for the respective train. The WAS flow for each train is set based on the operator selected model, the options are:

- Manual
  - The train flow set point is manually set by the operator (minimum: 0L/s; maximum: 51 L/s; initial: 10L/s)
- SRT
  - The train flow set point is based on the SRT calculation with the operator set retention time (minimum 0 days; maximum: 100 days; initial 3.45 days). The operator entered WAS and MLSS suspended solids concentration as measured from the lab samples is used as the concentration in the SRT calculation.

5.2.7. Interlocks, Permissives and Control Signals

5.2.7.1. WAS Suction Valve (S943/942/941-HV-1/2/3)

For WAS Suction Valve (S943/942/941-HV-1/2/3) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/hand hand switch	S943/942/941-HS-1	Hand

For WAS Suction Valve (S943/942/941-HV-1/2/3) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		BA-S943/942/941-VD/VB	Open/close command
Control Room Panel	Computer/hand hand switch	S943/942/941-HS-1	Computer

5.2.7.2. WAS Pump (S951/952/953/954-WAP-1/2/3/4)

For WAS Pump (S951/952/953/954-WAP-1/2/3/4) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	S951/952/953/954-HS-7 (COH)	Hand
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Lock off stop switch	S951/952/953/954-HS-1 (LOS)	Normal
Control Room Panel	Increase/decrease speed hand switch	S951/952/953/954-HS-8/9 (INC/DEC)	Increase /decrease speed
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Low pressure switch	S951/952/953/954-PSL	Normal
Local Control Panel	High temperature switch	S951/952/953/954-TSH	Normal
Local Control Panel	Reset hand switch	S951/952/953/954-HS-2 (RST)	Normal

For WAS Pump (S951/952/953/954-WAP-1/2/3/4) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		BA-S951/952/953/954-MN	Start command
Control Room Panel	Computer/off/hand hand switch	S951/952/953/954-HS-7 (COH)	Computer
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Lock off stop switch	S951/952/953/954-HS-1 (LOS)	Normal
PCS		BA-S951/952/953/954-SD/SB	Increase /decrease speed command
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Low pressure switch	S951/952/953/954-PSL	Normal
Local Control Panel	High temperature switch	S951/952/953/954-TSH	Normal
Local Control Panel	Reset hand switch	S951/952/953/954-HS-2 (RST)	Normal

5.2.8. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
WAS Suction Valve (S943/942/941-HV-1/2/3)	Open command	BA-S943/942/941-VD	Digital Output
WAS Suction Valve (S943/942/941-HV-1/2/3)	Close command	BA-S943/942/941-VB	Digital Output
WAS Suction Valve (S943/942/941-HV-1/2/3)	Open status	BA-S943/942/941-ZD	Digital Input
WAS Suction Valve (S943/942/941-HV-1/2/3)	Closed status	BA-S943/942/941-ZB	Digital Input
WAS Suction Valve (S943/942/941-HV-1/2/3)	Computer/hand status	BA-S943/942/941-YS	Digital Input
WAS Magnetic Flowmeter (S941/942/943-FE)	WAS header 1/2/3 flow	BA-S943/942/941-FT	Analog Input

Equipment	Signal Description	Signal Tag	Signal Type
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Start command	BA-S951/952/953/954-MN	Digital Output
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Stop command	BA-S951/952/953/954-MO	Digital Output
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Decrease speed command	BA-S951/952/953/954-SB	Digital Output
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Increase speed command	BA-S951/952/953/954-SD	Digital Output
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Run status	BA-S951/952/953/954-MM	Digital Input
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Fault	BA-S951/952/953/954-QF	Digital Input
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Computer/hand status	BA-S951/952/953/954-YS	Digital Input
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Speed	BA-S951/952/953/954-ST	Analog Input

5.2.9. HMI Display

Device Description	Status
Secondary Clarifiers WAS System	Main bypass control enable
Secondary Clarifiers WAS System	SBR 1 WAS pump bypass enable
Secondary Clarifiers WAS System	SBR 2 WAS pump bypass enable
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Bypass enable
Secondary Clarifiers RAS Train 1/2/3	Current day total WAS flow (kL)
Secondary Clarifiers RAS Train 1/2/3	Previous day total WAS flow (kL)
WAS Magnetic Flowmeter (S941/942/943-FE)	Train 3/2/1 WAS flow (L/s)
WAS Suction Valve (S943/942/941-HV-1/2/3)	Open/closed status
WAS Suction Valve (S943/942/941-HV-1/2/3)	Computer/hand status
Secondary Clarifiers RAS Train 1	WAS pump select (Four/One)
Secondary Clarifiers RAS Train 2	WAS pump select (Two/Four)
Secondary Clarifiers RAS Train 3	WAS pump select (One/Three)
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Manual/automatic status
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Run status
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	Speed (RPM)
WAS Pump (S951/952/953/954-WAP-1/2/3/4)	RAS suspended solids lab result (mg/L)
Secondary Clarifiers RAS Train 1/2/3	Minimum flow setpoint (L/s)
Secondary Clarifiers RAS Train 1/2/3	WAS minimum setpoint alarm
Secondary Clarifiers RAS Train 1/2/3	SRT model selected
Secondary Clarifiers RAS Train 1/2/3	SRT operator setpoint (days)
Secondary Clarifiers RAS Train 1/2/3	SRT calculated days
Secondary Clarifiers RAS Train 1/2/3	SRT model WAS setpoint (L/s)
Secondary Clarifiers RAS Train 1/2/3	Current day WAS mass (kg)
Secondary Clarifiers RAS Train 1/2/3	Previous day WAS mass (kg)

6. SCUM REMOVAL SYSTEM

Associated P&ID:	1-0101S-A0159, 1-0101S-A0160, 1-0101S-A0161, 1-0101S-A0162, 1-0101S-A0163, 1-0101S-A0164, 1-0101S-A0165, 1-0101S-A0166, 1-0101S-A0167
Associated NEWPCC Manuals:	
Associated DCS HMI Screens:	nsscm1.G,

6.1. Process Description

Scum from the secondary clarifiers is held in scum tanks and serviced by scum pumping systems:

- Scum system 1 services clarifiers 1 and 2
- Scum system 2 services clarifiers 3 and 4
- Scum system 3 services clarifiers 5 and 6
- Scum system 4 services clarifiers 7 and 8
- Scum system 5 services clarifiers 9 and 10
- Scum system 6 services clarifiers 11 though 14
- Scum system 7 services clarifiers 15 through 18
- Scum system 8 services clarifiers 19 through 22
- Scum system 9 services clarifiers 23 through 26

Each scum system is comprised of a scum holding tank, a recirculation valve, a discharge valve, a scum pump, and a flushing water valve.

Scum is discharged to a common scum header and ties into the WAS discharge header.

6.2. Control Description

6.2.1. Local Manual Control Mode – Scum Recirculation Valve (S414/424/434/444/454/464/474/484/494)

The Scum recirculation valve can be controlled manually from the local control hand switches S414/424/434/444/454-HS-1/2.

6.2.2. Remote Manual Control Mode – Scum Recirculation Valve (S414/424/434/444/454/464/474/484/494)

The Scum recirculation valve can be controlled in REMOTE MANUAL mode through the pop-up faceplate when the hand switch is in the REMOTE position.

A 5-second pulse open signal is sent to the controller to open the valve. A 5 second pulse close signal is sent to the controller to close the valve.

6.2.3. Remote Automatic Control Mode – Scum Recirculation Valve (S414/424/434/444/454/464/474/484/494)

The Scum recirculation valve is sequenced in REMOTE AUTOMATIC mode by the automatic Scum System described below.

6.2.4. Local Manual Control Mode – Scum Discharge Valve (S413/423/433/443/453/463/473/483/493)

The Scum discharge valve can be controlled manually from the local control hand switches S413/423/433/443/453-HS-1/2.

6.2.5. Remote Manual Control Mode – Scum Discharge Valve (S413/423/433/443/453/463/473/483/493)

The Scum discharge valve can be controlled in REMOTE MANUAL mode through the pop-up faceplate when the hand switch is in the REMOTE position.

A 5-second pulse open signal is sent to the controller to open the valve. A 5 second pulse close signal is sent to the controller to close the valve.

6.2.6. Remote Automatic Control Mode – Scum Discharge Valve (S413/423/433/443/453/463/473/483/493)

The Scum discharge valve is sequenced in REMOTE AUTOMATIC mode by the automatic Scum System described below.

6.2.7. Local Manual Control Mode – Scum Pump (S411/421/431/441/451/461/471/481/491)

The Scum pump can be started and stopped manually from the local control hand switches S411/421/431/441/451-HS-1/2.

6.2.8. Remote Manual Control Mode – Scum Pump (S411/421/431/441/451/461/471/481/491)

The Scum pump can be controlled in REMOTE MANUAL mode through the pop-up faceplate when the hand switch is in the REMOTE position, the scum pump has not faulted, and the discharge pressure is normal (S-S411/421/431/441/451-PSH).

A 5-second pulse start signal is sent to the controller to start the pump. A 5 second pulse stop signal is sent to the controller to stop the pump.

6.2.9. Remote Automatic Control Mode – Scum Pump (S411/421/431/441/451/461/471/481/491)

The Scum pump is sequenced in REMOTE AUTOMATIC mode by the automatic Scum System described below.

6.2.10. Local Manual Control Mode – Scum Flushing Valve (S415/425/435/445/455/465/475/485/495)

The Scum flushing valve can be controlled manually from the local control hand switches S415/425/435/445/455-HS-1/2.

6.2.11. Remote Manual Control Mode – Scum Flushing Valve (S415/425/435/445/455/465/475/485/495)

The Scum flushing valve can be controlled in REMOTE MANUAL mode through the pop-up faceplate when the hand switch is in the REMOTE position.

A 5-second pulse open signal is sent to the controller to open the valve. A 5 second pulse close signal is sent to the controller to close the valve.

6.2.12. Remote Automatic Control Mode – Scum Flushing Valve (S415/425/435/445/455/465/475/485/495)

The Scum flushing valve is sequenced in REMOTE AUTOMATIC mode by the automatic Scum System described below.

6.2.13. Automatic Scum System

The scum system control is run as two independent groups: one sequence controls scum tanks 1 through 5, and the other sequence controls scum tanks 6 through 9. For each group, the sequence is initialized when the following conditions are both met for any scum tank within the group:

- The scum tank level is above the operator set start level (minimum: 0m; maximum: 3.1m; initial: 1.2m).
- The scum tank is in service (described below)

Once the Automatic Scum System sequence is initialized, each scum tank in the group is called to start one at a time (Operation describe below in Automatic Individual Scum Tank Sequence). The following scum tank does not start until the previous scum tank is finished its sequence. A sequence is considered finished when the STOP signal is active (described in below section) for the respective tank.

For group 1, the scum tanks are sequenced in the following order:

- Scum Tank 5
- Scum Tank 4
- Scum Tank 3
- Scum Tank 2
- Scum Tank 1

For group 2, the scum tanks are sequenced in the following order:

- Scum Tank 9
- Scum Tank 8
- Scum Tank 7
- Scum Tank 6

Once the last tank in a group has finished its sequence, the Automatic Scum System sequence for that group is reset.

A scum tank is in service if the following conditions occur for the associated equipment:

- The scum pump is in REMOTE AUTOMATIC mode and has not faulted.
- The scum pump discharge pressure is not high.
- The discharge valve is in REMOTE AUTOMATIC and has not faulted.
- The recirculation valve is in REMOTE AUTOMATIC and has not faulted.
- The flushing valve is in REMOTE AUTOMATIC and has not faulted.

A scum tank can be manually set to not in service.

6.2.14. Automatic Individual Scum Tank Sequence

The Automatic Individual Scum Tank Sequence can be initiated manually by the operator through the pop-up face plate or automatically by the Automatic Scum System (described above).

The Automatic Individual Scum Tank Sequence will not start if the scum tank is not in service, as described above.

The STOP signal occurs, and the sequence will end if any of the following conditions are ever all met:

- The scum tank is not in service (As described above).
- The scum tank is being sequenced to start and the Automatic Individual Scum Tank Sequence Step is not in Step 0 (The Ready Step).
- Step 7 of the sequence is reached (last step)
- Any of the following conditions occur:
    - The discharge valve does not change its position status within 20 seconds of receiving an open or close command
    - The recirculation valve does not change its position status within 20 seconds of receiving an open or close command
    - The flushing valve does not change its position status within 20 seconds of receiving an open or close command
    - The scum pump does not change its run status within 20 seconds of receiving a start or stop command

Once initiated, the Automatic Individual Scum Tank Sequence is as follows:

- Step 0 (Ready Step):
    - Equipment control signals:
        - Recirculation Valve: Closed
        - Pump: Off
        - Discharge Valve: Closed
        - Flushing Valve: Closed
    - Trigger to next step (All required for 3 seconds):
        - The scum tank is selected to start (Manually or Automatically)
        - The STOP signal is not active
        - The scum tank level is above the operator-set low level (current value: 0.5 meters; maximum value: 3.1 meters; minimum value: 0 meters)
- Step 1:
    - Equipment control signals:
        - Recirculation Valve: Open
        - Pump: Off
        - Discharge Valve: Closed
        - Flushing Valve: Closed
    - Trigger to next step:
        - Recirculation valve status is open.
- Step 2:
    - Equipment control signals:
        - Recirculation Valve: Open
        - Pump: On
        - Discharge Valve: Closed
        - Flushing Valve: Closed
    - Trigger to next step:
        - Operator set recirculation time has elapsed (minimum: 0 minutes; maximum: 100 minutes; initial: 2 minutes) while pump run status is On.
- Step 3:
    - Equipment control signals:
        - Recirculation Valve: Open

        - Pump: On
        - Discharge Valve: Open
        - Flushing Valve: Closed
    - Trigger to next step:
        - Discharge valve status is open.
- Step 4:
    - Equipment control signals:
        - Recirculation Valve: Closed
        - Pump: On
        - Discharge Valve: Open
        - Flushing Valve: Closed
    - Trigger to next step:
        - Scum tank level below operator set low level (current value: 0.5 meters; maximum value: 3.1 meters; minimum value: 0 meters)
- Step 5:
    - Equipment control signals:
        - Recirculation Valve: Closed
        - Pump: Off
        - Discharge Valve: Open
        - Flushing Valve: Open
    - Trigger to next step:
        - Operator set flushing time has elapsed (minimum: 0 minutes; maximum: 100 minutes; initial: 2 minutes).
- Step 6:
    - Equipment control signals:
        - Recirculation Valve: Closed
        - Pump: On
        - Discharge Valve: Open
        - Flushing Valve: Closed
    - Trigger to next step:
        - Scum tank level below operator set low level (current value: 0.5 meters; maximum value: 3.1 meters; minimum value: 0 meters).
- Step 7:
    - Equipment control signals:
        - Recirculation Valve: Closed
        - Pump: Off
        - Discharge Valve: Closed
        - Flushing Valve: Closed
    - STOP signal is activated
    - Trigger to next step:
        - STOP Signal immediately activated and automatically reset to Step 0 (Ready Step)

6.2.15. Interlocks, Permissives and Control Signals

6.2.15.1. Recirculating (S414/424/434/444/454-HV, S464/474/484/494-HV), Discharge (S413/423/433/443/453-HV, S463/473/483/493-HV) and FW (S415/425/435/445/455-HV, S465/475/485/495-HV) Valves

For recirculating (S414/424/434/444/454-HV, S464/474/484/494-HV), discharge (S413/423/433/443/453-HV, S463/473/483/493-HV) and FW (S415/425/435/445/455-HV, S465/475/485/495-HV) valves to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/hand hand switch	S414/424/434/444/454-HS-1 (C/H)	Hand
		S464/474/484/494-HS-1 (C/H)	
		S413/423/433/443/453-HS-1 (C/H)	
		S463/473/483/493-HS-1 (C/H)	
		S415/425/435/445/455-HS-1 (C/H)	
		S465/475/485/495-HS-1 (C/H)	
Control Room Panel	Open/close hand switch	S414/424/434/444/454-HS-2,3 (OPN,CLS)	Open/close
		S464/474/484/494-HS-2,3 (OPN,CLS)	
		S413/423/433/443/453-HS-2,3 (OPN,CLS)	
		S463/473/483/493-HS-2,3 (OPN,CLS)	
		S415/425/435/445/455-HS-2,3 (OPN,CLS)	
		S465/475/485/495-HS-2,3 (OPN,CLS)	

For recirculating (S414/424/434/444/454-HV, S464/474/484/494-HV), discharge (S413/423/433/443/453-HV, S463/473/483/493-HV) and FW (S415/425/435/445/455-HV, S465/475/485/495-HV) valves to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/hand hand switch	S414/424/434/444/454-HS-1 (C/H)	Computer
		S464/474/484/494-HS-1 (C/H)	
		S413/423/433/443/453-HS-1 (C/H)	
		S463/473/483/493-HS-1 (C/H)	
		S415/425/435/445/455-HS-1 (C/H)	
		S465/475/485/495-HS-1 (C/H)	
PCS		BD-S414/424/434/444/454-VD/VB	Open/close command
		BB-S464/474/484/494-VD/VB	
		BD-S413/423/433/443/453-VD/VB	
		BB-S463/473/483/493-VD/VB	
		BD-S415/425/435/445/455-VD/VB	
		BB-S465/475/485/495-VD/VB	

6.2.15.2. Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5, S461/471/481/491-SP-6/7/8/9)

For Scum pump (S411/421/431/441/451-SP-1/2/3/4/5, S461/471/481/491-SP-6/7/8/9) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/hand hand switch	S411/421/431/441/451-HS-2 (C/H)	Hand
		S461/471/481/491-HS-2 (C/H)	
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	Lock off stop hand switch	S411/421/431/441/451-HS-1 (LOS)	Normal
Scum Pump (S461/471/481/491-SP-6/7/8/9)		S461/471/481/491-HS-1 (LOS)	
Control Room Panel	Scum tank 1/2/3/4/5/6/7/8/9 low level switch	S416/426/436/446/456/466/476/486/496-LSL	Normal
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	Seal water low pressure switch	S411/421/431/441/451-PSL	Normal
Scum Pump (S461/471/481/491-SP-6/7/8/9)		S461/471/481/491-PSL	
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	High discharge pressure switch	S411/421/431/441/451-PSH	Normal
Scum Pump (S461/471/481/491-SP-6/7/8/9)		S461/471/481/491-PSH	

For Scum pump (S411/421/431/441/451-SP-1/2/3/4/5, S461/471/481/491-SP-6/7/8/9) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		BD-S411/421/431/441/451-MN	Start command
		BB-S461/471/481/491-MN	
Control Room Panel	Computer/hand hand switch	S411/421/431/441/451-HS-2 (C/H)	Computer
		S461/471/481/491-HS-2 (C/H)	
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	Lock off stop hand switch	S411/421/431/441/451-HS-1 (LOS)	Normal
Scum Pump (S461/471/481/491-SP-6/7/8/9)		S461/471/481/491-HS-1 (LOS)	
Control Room Panel	Scum tank 1/2/3/4/5/6/7/8/9 low level switch	S416/426/436/446/456/466/476/486/496-LSL	Normal
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	Seal water low pressure switch	S411/421/431/441/451-PSL	Normal
Scum Pump (S461/471/481/491-SP-6/7/8/9)		S461/471/481/491-PSL	
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	High discharge pressure switch	S411/421/431/441/451-PSH	Normal
Scum Pump (S461/471/481/491-SP-6/7/8/9)		S461/471/481/491-PSH	

6.2.16. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Discharge Valve (S413/423/433/443/453-HV)	Open command	BD-S413/423/433/443/453-VD	Digital Output
Discharge Valve (S463/473/483/493-HV)	Open command	BB-S463/473/483/493-VD	Digital Output
FW Valve (S415/425/435/445/455-HV)	Open command	BD-S415/425/435/445/455-VD	Digital Output
FW Valve (S465/475/485/495-HV)	Open command	BB-S465/475/485/495-VD	Digital Output
Recirculating Valve (S414/424/434/444/454-HV)	Open command	BD-S414/424/434/444/454-VD	Digital Output
Recirculating Valve (S464/474/484/494-HV)	Open command	BB-S464/474/484/494-VD	Digital Output
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	Start command	BD-S411/421/431/441/451-MN	Digital Output
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	Stop command	BD-S411/421/431/441/451-MO	Digital Output
Scum Pump (S461/471/481/491-SP-6/7/8/9)	Start command	BB-S461/471/481/491-MN	Digital Output
Scum Pump (S461/471/481/491-SP-6/7/8/9)	Stop command	BB-S461/471/481/491-MO	Digital Output
Discharge Valve (S413/423/433/443/453-HV)	Close command	BD-S413/423/433/443/453-VB	Digital Input
Discharge Valve (S413/423/433/443/453-HV)	Computer/hand status	BD-S413/423/433/443/453-YS	Digital Input
Discharge Valve (S413/423/433/443/453-HV)	Closed status	BD-S413/423/433/443/453-ZB	Digital Input
Discharge Valve (S413/423/433/443/453-HV)	Open status	BD-S413/423/433/443/453-ZD	Digital Input
Discharge Valve (S463/473/483/493-HV)	Close command	BB-S463/473/483/493-VB	Digital Input
Discharge Valve (S463/473/483/493-HV)	Computer/hand status	BB-S463/473/483/493-YS	Digital Input
Discharge Valve (S463/473/483/493-HV)	Closed status	BB-S463/473/483/493-ZB	Digital Input
Discharge Valve (S463/473/483/493-HV)	Open status	BB-S463/473/483/493-ZD	Digital Input
FW Valve (S415/425/435/445/455-HV)	Close command	BD-S415/425/435/445/455-VB	Digital Input
FW Valve (S415/425/435/445/455-HV)	Computer/hand status	BD-S415/425/435/445/455-YS	Digital Input
FW Valve (S465/475/485/495-HV)	Close command	BB-S465/475/485/495-VB	Digital Input
FW Valve (S465/475/485/495-HV)	Computer/hand status	BB-S465/475/485/495-YS	Digital Input
Recirculating Valve (S414/424/434/444/454-HV)	Close command	BD-S414/424/434/444/454-VB	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Recirculating Valve (S414/424/434/444/454-HV)	Computer/hand status	BD-S414/424/434/444/454-YS	Digital Input
Recirculating Valve (S414/424/434/444/454-HV)	Closed status	BD-S414/424/434/444/454-ZB	Digital Input
Recirculating Valve (S414/424/434/444/454-HV)	Open status	BD-S414/424/434/444/454-ZD	Digital Input
Recirculating Valve (S464/474/484/494-HV)	Close command	BB-S464/474/484/494-VB	Digital Input
Recirculating Valve (S464/474/484/494-HV)	Computer/hand status	BB-S464/474/484/494-YS	Digital Input
Recirculating Valve (S464/474/484/494-HV)	Closed status	BB-S464/474/484/494-ZB	Digital Input
Recirculating Valve (S464/474/484/494-HV)	Open status	BB-S464/474/484/494-ZD	Digital Input
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	Run status	BD-S411/421/431/441/451-MM	Digital Input
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	High discharge pressure	BD-S411/421/431/441/451-PH	Digital Input
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	Fault status	BD-S411/421/431/441/451-QF	Digital Input
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	Computer/hand status	BD-S411/421/431/441/451-YS	Digital Input
Scum Pump (S461/471/481/491-SP-6/7/8/9)	Run status	BB-S461/471/481/491-MM	Digital Input
Scum Pump (S461/471/481/491-SP-6/7/8/9)	High discharge pressure	BB-S461/471/481/491-PH	Digital Input
Scum Pump (S461/471/481/491-SP-6/7/8/9)	Fault status	BB-S461/471/481/491-QF	Digital Input
Scum Pump (S461/471/481/491-SP-6/7/8/9)	Computer/hand status	BB-S461/471/481/491-YS	Digital Input
Scum Tank 1/2/3/4/5	Scum level	BD-S416/426/436/446/456-LT	Analog Input
Scum Tank 6/7/8/9	Scum level	BB-S466/476/486/496-LT	Analog Input

6.2.17. HMI Display

Device Description	Status
Discharge Valve (S463/473/483/493-HV)	Open/closed status
FW Valve (S465/475/485/495-HV)	Open/closed status
Recirculating Valve (S464/474/484/494-HV)	Open/closed status
Scum Pump (S411/421/431/441/451/461/471/481/491-SP-1/2/3/4/5/6/7/8/9)	Fault status
Scum Pump (S411/421/431/441/451/461/471/481/491-SP-1/2/3/4/5/6/7/8/9)	Run status
Scum System 1/2/3/4/5/6/7/8/9	Elapsed flush time (min)

Device Description	Status
Scum System 1/2/3/4/5/6/7/8/9	Elapsed recirculation time (min)
Scum System 1/2/3/4/5/6/7/8/9	Flush time (min)
Scum System 1/2/3/4/5/6/7/8/9	Hours since last run
Scum System 1/2/3/4/5/6/7/8/9	Maximum tank level setpoint (metres)
Scum System 1/2/3/4/5/6/7/8/9	Minimum tank level setpoint (metres)
Scum System 1/2/3/4/5/6/7/8/9	Recirculation time (min)
Scum System 1/2/3/4/5/6/7/8/9	Return to service (Enable)

6.2.18. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Scum Pump (S411/421/431/441/451-SP-1/2/3/4/5)	Pump fault	BD- S411/421/431/441/451-QF	Scum system is taken out of service
Scum Pump (S461/471/481/491-SP-6/7/8/9)	Pump fault	BB- S461/471/481/491-QF	Scum system is taken out of service

7. AIR BLOWERS AND INSTRUMENT AIR

Associated P&ID: 1-0101S-A0169
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nseq.G

7.1. Process Description

The air blowers aerate the RAS channels in Secondary Clarifiers 11-26 to maintain an even RAS mixture.

7.2. Control Description

7.2.1. Local Manual Control Mode

The air blowers can be operated in LOCAL MANUAL mode with hand switches S634/635-HS-1/2.

7.2.2. Remote Manual Control Mode

In REMOTE MANUAL the operator can MANUALLY call a blower to start through a pop-up faceplate.

To start a blower a 3 second pulse start signal is sent to the controller. To stop a blower, a 3 second stop pulse is sent to the controller.

7.2.3. Remote Automatic Control Mode

In REMOTE AUTOMATIC mode the blowers are controlled in duty/standby. The duty assignment is rotated every day if both blowers are in REMOTE mode and have not faulted. The duty assignment and rotation can be overridden by the operator.

There is a 24-hour schedule, each hour can be set to ON or OFF. If the current hour is set to ON, the duty blower will be called to start. If the standby blower will turn on if either of the following conditions occur:

- The duty blower has faulted for 20 seconds or more.
- The duty pump has failed to start within 2 minutes.

The following table shows the current automatic air blower schedule.

Shift	**Automatic Air Blower Schedule (Hour)**							
A	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	ON	ON	ON	ON	ON	ON	OFF	OFF
B	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
C	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
	OFF	ON	ON	ON	OFF	ON	OFF	ON

The instrument air compressor run status is monitored. If a compressor is running for longer than 10 minutes, an alarm will be raised. An alarm will also be raised if there is low pressure detected in the instrument air line.

7.2.4. Interlocks, Permissives and Control Signals

For Air Blower (S634/635-AB-1/2) to operate in LOCAL (MANUAL) mode:

Equipment	**Device Description**	**Device Tag**	**State**
Control Room Panel	Computer/off/hand hand switch	S634/635-HS-2 (COH)	Hand
Control Room Panel	High current switch	S634/635-ISH	Normal
Control Room Panel	Reset switch	S634/635-HS-3 (RST)	Normal
MCC-1A/2A	Overload relay	S634/635-UY	Normal

For Air Blower (S634/635-AB-1/2) to operate in COMPUTER (REMOTE) mode:

Equipment	**Device Description**	**Device Tag**	**State**
PCS		BC-S634/635-MN	Start command
Control Room Panel	Computer/off/hand hand switch	S634/635-HS-2 (COH)	Computer
Control Room Panel	High current switch	S634/635-ISH	Normal
Control Room Panel	Reset switch	S634/635-HS-3 (RST)	Normal
MCC-1A/2A	Overload relay	S634/635-UY	Normal

7.2.5. Inputs and Outputs

Equipment	**Signal Description**	**Signal Tag**	**Signal Type**
Air Blower (S634/635-AB-1/2)	Start command	BC-S634/635-MN	Digital Output
Air Blower (S634/635-AB-1/2)	Stop command	BC-S634/635-MO	Digital Output
Air Blower (S634/635-AB-1/2)	Computer/hand status	BC-S634/635-YS	Digital Input
Air Blower (S634/635-AB-1/2)	Run status	BC-S634/635-MM	Digital Input
Air Blower (S634/635-AB-1/2)	Fault	BC-S634/635-QF	Digital Input

7.2.6. HMI Display

Device Description	**Status**
Air Blower (S634/635-AB-1/2)	Rotation status

Device Description	Status
Air Blower (S634/635-AB-1/2)	Auto rotation lead (Yes/No)
Air Blower (S634/635-AB-1/2)	Current lead (Yes/No)
Air Blower (S634/635-AB-1/2)	Elapsed off time (hrs)
Air Blower (S634/635-AB-1/2)	Run status
Air Blower (S634/635-AB-1/2)	Fault status
Air Blower (S634/635-AB-1/2)	Computer/hand status
Air Blower (S634/635-AB-1/2)	Shift enable (A/B/C)
Air Blower (S634/635-AB-1/2)	Hour enable (On/Off)

7.2.7. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Air Blower (S634/635-AB-1/2)	Fault	BC-S634/635-QF in alarm	Alarm notification

8. FAN HOUSE

Associated P&ID: 1-0101S-A0176, 1-0101S-A0177, 1-0101S-A0178, 1-0101S-A0179, 1-0101S-A0180, 1-0101S-A0181, 1-0101S-A0182
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nsfanh.G, nshvac.G

8.1. Process Description

The fan house fans suction air from the secondary clarifier process area and discharges it to the secondary clarifier odour stack.

8.2. Control Description

8.2.1. Local Manual Control Mode

The odour control fans (S617/618/619/620/621-FN-1/2/3/4/5) and their associated inlet vanes (S617/618/619/620/621-VZ-1) and discharge dampers (S617/618/619/620/621-VZ-2) are controlled through a PLC.

The odour control fan (S617/618/619/620/621-FN-1/2/3/4/5) is controlled through the COMPUTER/OFF/HAND switch
In LOCAL MANUAL mode, the odour control fan (S617/618/619/620/621-FN-1/2/3/4/5) is started by switching the COMPUTER/OFF/HAND hand switch (S617/618/619/620/621-HS-2) to HAND.

8.2.2. Local Automatic Control Mode

The Fan House PLC controls the fans in the odour control fans. The Fan House PLC communicates with the PCS to facilitate REMOTE control from the operator HMIs.

8.2.3. Remote Manual Control Mode

The odour control fans can be started and stopped in manual control mode through the pop-up faceplate.

REMOTE MANUAL control is not permitted when the fan has a fail signal and the fan with switch to automatic control.

8.2.4. Interlocks, Permissives and Control Signals

For Odour Control Fan (S617/618/619/620/621-FN-1/2/3/4/5) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Computer/off/hand hand switch	S617/618/619/620/621-HS-2 (COH)	Hand
Secondary Clarifiers PLC		S617/618/619/620/621-MN	Start command
Local Control Panel	Overload Relay	S617/618/619/620/621-UY	Normal
Odour Control Fan (S617/618/619/620/621-FN-1/2/3/4/5)	Lock off stop hand switch	S617/618/619/620/621-HS-1 (LOS)	Normal

For Odour Control Fan (S617/618/619/620/621-FN-1/2/3/4/5) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		BC-S617/618/619/620/621-MN	Start command
Local Control Panel	Computer/off/hand hand switch	S617/618/619/620/621-HS-2 (COH)	Computer
Secondary Clarifiers PLC		S617/618/619/620/621-MN	Start command
Local Control Panel	Overload Relay	S617/618/619/620/621-UY	Normal
Odour Control Fan (S617/618/619/620/621-FN-1/2/3/4/5)	Lock off stop hand switch	S617/618/619/620/621-HS-1 (LOS)	Normal

8.2.5. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Odour Control Fan (S617/618/619/620/621-FN-1/2/3/4/5)	Computer/hand status	BC-S617/618/619/620/621-YS	Digital Input
Odour Control Fan (S617/618/619/620/621-FN-1/2/3/4/5)	Start command	BC-S617/618/619/620/621-MN	Digital Output
Secondary Clarifiers PLC	Exhaust fan 1/2/3/4/5 fault	BC-S617/618/619/620/621-QF	Digital Input
Odour Control Fan (S617/618/619/620/621-FN-1/2/3/4/5)	Run status	BC-S617/618/619/620/621-MM	Digital Input
Fan House	High temperature	BD-S521-TH	Digital Input
Fan House Exhaust Fan (S615/616-AF-33/34)	Run status	BD-S615/616-MM	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Fan House Exhaust Fan (S615/616-AF-33/34)	Fault	BD-S616-QF	Digital Input
Fan House	Air plenum high pressure differential	BC-S538-PS	Digital Input

8.2.6. HMI Display

Device Description	Status
Odour Control Fan (S617/618/619/620/621-FN-1/2/3/4/5)	Run status
Odour Control Fan (S617/618/619/620/621-FN-1/2/3/4/5)	Computer/hand status
Odour Control Fan (S617/618/619/620/621-FN-1/2/3/4/5)	Discharge damper open/close status
Odour Control Fan (S617/618/619/620/621-FN-1/2/3/4/5)	Inlet damper open/close status
Balancing Dampers (S675/676/677/678-VZ)	Summer/winter status
Clarifier Dampers (S666/667/668669/670/671/672-VZ-1/2/3/4/5/6/7)	Summer/winter status

8.2.7. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Odour Control Fan (S617/618/619/620/621-FN-1/2/3/4/5)	Fault status	BC-S617/618/619/620/621-QF in alarm	Alarm notification
Fan House	Differential pressure alarm	BC-S538-PS	Alarm notification

9. SECONDARY WASTE ACTIVATED SLUDGE (WAS) AND FINAL EFFLUENT SAMPLERS

Associated P&ID:
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nsampler.G

9.1. Process Description

The Secondary WAS Samplers (S534) include 4 samplers , one for each WAS pump. The samplers are located in the RAS gallery at the WAS pumps.
The Secondary Final Effluent Sampler (U539) is located in the UV building prior to disinfection.

9.2. Control Description

9.2.1. Local Manual Control Mode – Secondary Final Effluent Sampler (U539)

A sample can be taken manually with hand switch U539-HS.

9.2.2. Remote Manual Control Mode – Secondary Final Effluent Sampler (U539)

In REMOTE MANUAL mode, a sample can be taken while the sample is in REMOTE mode and has not faulted. The sampler ON/OFF control is manually operated through the pop-up faceplate.

9.2.3. Remote Automatic Control Mode – Secondary Final Effluent Sampler (U539)

In REMOTE AUTOMATIC mode, the PCS sends a start command (UA-U539-MN) to the secondary final effluent sampler (U539) for every operator set volume (minimum: 0.25 ML; maximum: 4ML; initial: 1.25 ML) of secondary final effluent that is transferred to UV Disinfection if the sample is in REMOTE mode and has no fail signal.

The secondary final effluent volume that is transferred to UV Disinfection is calculated from the PE flow for each train minus the WAS flow for each train with a 3-minute time delay. This calculation is paused if no UV pumps are running.

The current and previous day sample counts and attempts are stored and displayed.

9.2.4. Local Manual Control Mode – Secondary WAS Sampler (S534)

A sample can be taken manually with hand switch for each WAS pump sampler S534-HS.

9.2.5. Remote Manual Control Mode – Secondary WAS Sampler (S534)

In REMOTE MANUAL mode, a sample can be taken while the sampler is in REMOTE mode and has not faulted. The sampler ON/OFF control is manually operated through the pop-up faceplate.

9.2.6. Remote Automatic Mode – Secondary WAS Sampler (S534)

In REMOTE AUTOMATIC mode, the PCS sends a start command (UA-U534-MN) to the secondary WAS samplers (U534) for 15 seconds every operator set duration (maximum: 60 minutes; minimum: 0.6 minutes; initial: 15 minutes) if the samplers are in REMOTE and the samplers have no associated fail signal.

The current and previous day sample counts and attempts are stored and displayed and is multiplied by the amount of samplers online, usually 3.

9.2.7. Interlocks, Permissives and Control Signals

9.2.7.1. Secondary Final Effluent Sampler (U539)

For Secondary Final Effluent Sampler (U539) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		UA-U539-MN	Start command

9.2.7.2. Secondary WAS Sampler (S534)

For Secondary WAS Sampler (S534) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		UA-U534-MN	Start command

9.2.8. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Secondary Final Effluent Sampler (U539)	Start command	UA-U539-MN	Digital Output
Secondary WAS Sampler (S534)	Start command	BB-S534-AN	Digital Output
Secondary Final Effluent Sampler (U539)	Run status	UA-U539-MM	Digital Input
Secondary Final Effluent Sampler (U539)	Fault	UA-U539-UF	Digital Input
Secondary Final Effluent Sampler (U539)	Computer/hand status	UA-U539-YS	Digital Input
Secondary WAS Sampler (S534)	Fault status	BB-S534-AF	Digital Input
Secondary WAS Sampler (S534)	Run status	BB-S534-AM	Digital Input
Secondary WAS Sampler (S534)	Computer/hand status	BB-S534-YS	Digital Input

9.2.9. HMI Display

Device Description	Status
Secondary WAS Sampler (S534)	Fault status (Normal/Fail)
Secondary WAS Sampler (S534)	Computer/hand status
Secondary WAS Sampler (S534)	Samples tried previous day
Secondary WAS Sampler (S534)	Samples tried current day
Secondary WAS Sampler (S534)	Samples sampled previous day
Secondary WAS Sampler (S534)	Samples sampled current day
Secondary Final Effluent Sampler (U539)	Fault status (Normal/Fail)
Secondary Final Effluent Sampler (U539)	Computer/hand status
Secondary Final Effluent Sampler (U539)	Samples tried previous day
Secondary Final Effluent Sampler (U539)	Samples tried current day
Secondary Final Effluent Sampler (U539)	Samples sampled previous day
Secondary Final Effluent Sampler (U539)	Samples sampled current day

9.2.10. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Secondary WAS Sampler (S534)	Fault	BB-S534-AF in alarm	Alarm notification
Secondary Final Effluent Sampler (U539)	Fault	UA-U539-UF in alarm	Alarm notification

10. PE SAMPLER

Associated P&ID: 1-0101S-A0121
Associated NEWPCC Manuals:

Associated DCS HMI Screens: nsampler.G, nerpe.G

10.1. Process Description

The PE sampler is used to sample the PE flowing to the reactors. A sample is taken every 1 ML.

10.2. Control Description

10.2.1. Local Manual Control Mode

The sampler (S530) can be operated in LOCAL (MANUAL) or REMOTE (COMPUTER) modes. The mode is changed using the HAND/AUTOMATIC hand switch (S530-HS) on the sampler. A sample can be manually set to be taken.

10.2.2. Local Automatic Control Mode

In LOCAL AUTOMATIC mode, the sampler is scheduled to run using a time controller (S530-KC).

10.2.3. Remote Manual Control Mode

In REMOTE MANAUL mode, the operator can set the sampler to take a sample through the pop-up faceplate when the sampler is in REMOTE mode and the sampler has not faulted.

10.2.4. Remote Automatic Control Mode

In REMOTE AUTOMATIC mode, the PCS will send a start command to the sampler for every 1 ML of PE sent to the reactors if the is in REMOTE mode and not faulted. The sample is taken for 2 seconds. The PCS keeps track of the number of samples taken and tried for the current and previous days.

10.2.5. Interlocks, Permissives and Control Signals

For PE Sampler (S530) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
PE Sampler (S530)	Hand/automatic hand switch	S530-HS (H/A)	Hand
PE Sampler (S530)	Time controller	S530-KC	Start

For PE Sampler (S530) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PE Sampler (S530)	Hand/automatic hand switch	S530-HS (H/A)	Computer
PE Sampler (S530)		BB-S530-AN	Start command

10.2.6. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
PE Sampler (S530)	Start command	BB-S530-AN	Digital Output
PE Sampler (S530)	Fault	BB-S530-AF	Digital Input
PE Sampler (S530)	Run status	BB-S530-AM	Digital Input
PE Sampler (S530)	Computer/hand status	BB-S530-YS	Digital Input

10.2.7. HMI Display

Device Description	Status
PE Sampler (S530)	Fault status (Normal/Fail)
PE Sampler (S530)	Computer/hand status
PE Sampler (S530)	Number of samples tried previous day
PE Sampler (S530)	Number of samples taken previous day
PE Sampler (S530)	Number of samples tried current day
PE Sampler (S530)	Number of samples taken current day
PE Sampler (S530)	Sampling frequency (ML)

10.2.8. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
PE Sampler (S530)	Sampler fault	BB-S530-AF in alarm	Alarm notification

11. SUMP PUMPS

Associated P&ID: 1-0101S-A0200
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nshvac.G

11.1. Process Description

The sump pumps operate in the following areas:

- Pump S643-SMP1 discharges the contents of the sump pit in the scum gallery near clarifier 15 to clarifier 15
- Pump S644-SMP2 discharges the contents of the sump pit in the scum gallery near clarifier 23 to clarifier 23
- Pump S674-SMP3 discharges the contents of the sump pit in the fan house basement to mixed liquor conduit 3
- Pumps S650-AP22 and S651-AP23 discharges the contents of the sump pit in the RAS gallery to the primary effluent conduits

11.2. Control Description

11.2.1. Local Automatic Control Mode - Sump Pump (S643/644/674-SMP-1/2/3)

The pump is turned on and off AUTOMATICALLY based on the sump pit level by a level control element (S643/644/674-LCE).

11.2.2. Local Automatic Mode - Sump Pumps S650-AP22 and S651-AP23

Sump Pumps S650-AP22 and S651-AP23 can only operate in LOCAL AUTOMATIC mode.

A level control element (S650-LCE) monitors the sump it level. The output of the level control element controls the mechanical alternator that starts and stops the individual pumps.

11.2.3. Interlocks, Permissives and Control Signals

11.2.3.1. Sump Pump (S643/644/674-SMP-1/2/3)

:

Equipment	Device Description	Device Tag	State

For Sump Pump (S643/644/674-SMP-1/2/3) to operate in LOCAL (AUTOMATIC) mode:

Equipment	Device Description	Device Tag	State
Sump Pump (S643/644/674-SMP-1/2/3)	Level control element	S643/644/674-LCE	On

11.2.3.2. Sump Pumps S650-AP22 and S651-AP23

For Sump Pumps S650-AP22 and S651-AP23 to operate in LOCAL (AUTOMATIC) mode:

Equipment	Device Description	Device Tag	State
Sump Pumps (S650-AP22)	Level control element	S650-LCE	On
Sump Pump (S650/651-AP-22/23)	Lock/off/stop	S650/651-HS (LOS)	Normal

11.2.4. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Sump Pump	Pump fault	BC-643/644/650/674-QF	Digital Input

11.2.5. HMI Display

Device Description	Status
Sump Pump (S643/644/674-SMP-1/2/3)	Fault status
Sump Pump (S650/651-AP-22/23)	Fault status

11.2.6. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Sump Pump (S643/644/674-SMP-1/2/3)	Fault	BC-643/644/674-QF in alarm	Alarm notification
Sump Pump (S650/651-AP-22/23)	Fault	BC-650-QF in alarm	Alarm notification

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1. UV PUMPS

Associated P&ID:	1-0101U-P0004-001-02, 1-0101U-P0006-001-02
Associated NEWPCC Manuals:	
Associated DCS HMI Screens:	nupump.G, uvpump.G

1.1. Process Description

Secondary Effluent (SE) from the secondary clarifiers flows to the UV pump influent well. The UV pumps (U010/020/030/040/050-P-1/2/3/4/5) pump the SE in the influent well to the pump discharge channel. From the pump discharge channel, the SE flows into the UV distribution chamber.

SE can overflow directly to the UV effluent channel via a bypass weir in the UV pump influent well.

1.2. Control Description

1.2.1. Local Manual Control Mode

The UV Pumps (U010/020/030/040/050-P-1/2/3/4/5) can be started and stopped manually by the local hand switches on local deck panel (U010/020/030/040/050-HS-1/2) or from the VFD.

The UV Pumps speeds can be manually set at the VFD.

1.2.2. Remote Manual Control Mode

The UV Pumps can be started in REMOTE MANUAL mode from the pop-up faceplate. The pumps can be started and stopped manually when the following conditions are met:

- The pump is in REMOTE mode and not faulted.
- The pump is not currently running in emergency pump mode.
- The UV influent well level is above 225.82m.
- The UV pump system is not running in recovery mode.
- The pump is not currently being stopped by the cascade control mode.

If the above conditions are not met while running in REMOTE MANUAL, the pump will be automatically switched over to REMOTE AUTOMATIC mode.

In REMOTE MANUAL mode the UV Pump speed can be set manually to a speed percentage or the speed can be set to be controlled through the REMOTE AUTOMATIC cascade control logic, as described in the following section.

1.2.3. Remote Automatic Control Mode –Cascade Control

In REMOTE AUTOMATIC mode the pump is started based on the cascade control logic. The cascade control logic sequences the next UV pump to start when either of the following conditions are met:

- Condition 1; All of the following occur:
  - The UV influent well level is 0.05m or more below the operator tuneable set point (Minimum: 226.12; Maximum: 226.62; Initial: 226.37).
  - None of the UV Pumps are currently running in cascade mode.
  - The UV Channel flow is not within 5ML/d of the operator set maximum capacity (Minimum: 100 ML/d; Maximum: 160 ML/d; Initial: 142 ML/d).
- Condition 2; All of the following occur for 3 minutes:
  - The UV influent well level target set point is above 98%

- All pumps called to start in cascade mode have not successfully started.
- The UV Channel flow is not within 5ML/d of the operator set maximum capacity (Minimum: 100 ML/d; Maximum: 160 ML/d; Initial: 142 ML/d).

When the cascade automatic control logic requires a pump to start, the pump that has been idle for the longest time and meets the following conditions will be started:

- The pump is not faulted and does not have an active alarm.
- The pump is in REMOTE AUTO mode.
- The speed control is set to REMOTE AUTO mode.
- The pump is currently off.

A pump will be called to stop if any of the following conditions occur:

- The UV influent well level is below 225.82m.
- The UV pumping system is in recovery mode.
- The cascade logic has requested the pump to stop.
- The pump has faulted or is switched to LOCAL control.
- The pump stops running.

The cascade control logic will sequence a pump to stop if any of the following conditions are met:

- Condition 1; All of the following conditions are met for 3 minutes:
  - The UV influent well level target set point is below 50%.
  - There is at least 1 or more pump(s) running in cascade mode.
  - All pumps called to stop in cascade mode so far have not successfully stopped.
- Condition 2; All of the following conditions are met for 10 minutes:
  - The UV influent well target level set point is below:
    - 65% if 2 pumps are running in cascade mode.
    - 73% if 3 pumps are running in cascade mode.
    - 79% if 4 pumps are running in cascade mode.
    - 80% if 5 pumps are running in cascade mode.
  - All pumps called to stop in cascade mode so far have not successfully stopped.
- Condition 3; All of the following conditions are met for 10 minutes:
  - 2 or more pumps are running in cascade mode.
  - The Secondary Clarifiers total effluent flow is greater than 50 ML/d and below 82 ML/d (delayed 3 minutes).
- Condition 4; All of the following conditions are met for 10 minutes:
  - 3 or more pumps are running in cascade mode.
  - The Secondary Clarifiers total effluent flow is greater than 82 ML/d and below 164 ML/d (delayed 3 minutes).

When the cascade control logic requires a pump to stop, the pump with the longest current run time that is currently running in cascade control mode will be stopped.

Emergency start mode occurs while the following conditions are met:

- The UV influent well level is above 226.82m.
- The system is not in recovery mode.

Recovery mode is entered when either:

- Both UV influent level transmitters (U005-LT-1/2) have bad quality.
- All pumps have faulted.

Recovery mode switches the pump speed control to cascade mode. Recovery mode is exited once the faults that caused recovery mode have cleared and an operator set duration (Minimum: 0 minutes; Maximum: 60 minutes; Initial: 0.2 minutes) has elapsed.

The UV influent level measurement used for the speed and sequencing logic in REMOTE AUTO mode is the combination of the level readings from U005-LT-1 and U005-LT-2. These readings are combined into a weighted average based on operator set weights. If any signal quality becomes bad, it is removed from the weighted average. If the signals deviate from each other greater than an operator set deviation limit (Minimum: 0m; Maximum: 0.5; Initial: 0.2m)

1.2.4. Remote Automatic Control Mode – Pump Speed Control

In REMOTE AUTO mode, the pump speed is limited by the operator set UV channel maximum capacity. The pump speeds are controlled based on the operating mode:

- In manual speed operating mode, a PID loop maintains the pump speed to the target set speed.
- In cascade speed operating mode, the pump speed is modulated based on a PID loop to the UV influent well target level.
- In emergency start mode or recovery mode, the pump speed is modulated based on a PID loop to reach the operator set UV channel maximum flow capacity.

1.2.5. Interlocks, Permissives and Control Signals

For Influent Pump (U010/020/030/040/050-P-1/2/3/4/5) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Computer/off/hand hand switch	U010/020/030/040/050-HS-2 (COH)	Hand
Local Control Panel	Leak sensor	U010/020/030/040/050-AY	Normal
Local Control Panel	Lock off stop switch	U010/020/030/040/050-HS-1 (LOS)	Normal

For Influent Pump (U010/020/030/040/050-P-1/2/3/4/5) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Computer/off/hand hand switch	U010/020/030/040/050-HS-2 (COH)	Computer
Local Control Panel	Leak switch	U010/020/030/040/050-AY	Normal
Local Control Panel	Lock off stop switch	U010/020/030/040/050-HS-1 (LOS)	Normal
Local Control Panel	Fault Status	UA-U010/020/030/040/050-UF	Normal
PCS		UA-U010/020/030/040/050-MN	Start command
PCS		UA-U010/020/030/040/050-SC	Speed command

1.2.6. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Pump start command	UA-U010/020/030/040/050-MN	Digital Output
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Pump speed command	UA-U010/020/030/040/050-SC	Analog Output
Influent Wetwell Sensor 0 (U005-LE)	Loss of echo	UA-U005-LF	Digital Input
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Pump computer/hand status	UA-U010/020/030/040/050-YS	Digital Input
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Pump fault status	UA-U010/020/030/040/050-MF	Digital Input
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Pump run status	UA-U010/020/030/040/050-MM	Digital Input
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Pump current	UA-U010/020/030/040/050-IIT	Analog Input
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Pump speed	UA-U010/020/030/040/050-SIT	Analog Input
Influent Wetwell Level Sensor 0/1 (U005-LE/LT)	Wetwell level	UA-U005-LT-0/1	Analog Input

1.2.7. HMI Display

Device Description	Status
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Continuous run time (hrs)
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Next cascade start (yes/no)
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Next cascade stop (yes/no)
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Pump idle hours (hrs)
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Pump run status
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Pump speed (%)
Influent Wetwell	Wet well level (meters)
Influent Wetwell	Wet well level deviation limit
Influent Wetwell	Wet well level set point
Influent Wetwell Sensor 0/1 (U005-LE/LT)	Level reading confidence
Influent Wetwell Sensor 0/1 (U005-LE/LT)	Wet well level (meters)

1.2.8. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Influent Pump (U010/020/030/040/050-P-1/2/3/4/5)	Pump fault	UA-U010/020/030/040/050-MF in alarm	Pump is taken out of service

2. UV BANKS

Associated P&ID: 1-0101U-P0007-001-03, 1-0101U-P0008-001-02, 1-0101U-P0009-001-02, 1-0101U-P0010-001-03
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nuvprocess1.G, UVSETTINGS.G

2.1. Process Description

There are three UV channels, each with two sets of UV banks (U110/120/210/220/310/320). The channels can be rotated in and out of service. Flow to each channel is adjusted by the effluent weir gate and can be stopped using stop logs.

SE from the UV distribution chamber flows through the UV channel in service to the UV effluent channel. As the SE flows through the UV banks, it is irradiated by the UV bulbs.

Each bank is equipped with a wiper that cleans effluent off the bulbs.

2.2. Control Description

2.2.1. Local Manual Control Mode

In LOCAL MANUAL mode the UV banks can be controlled from the hand switch U110/120/210/220/310/320-HS-1.

The wiper can be manually controlled with the hand switches U110/120/210/220/310/320-HS-2/3.

2.2.2. Local Automatic Control Mode

The UV Banks are completely sequenced from the local UV PLC.

2.2.3. Remote Manual Control Mode

The PCS will be integrated with the UV PLC to allow for interfacing the status values and setting the operator adjustable settings.

2.2.4. Interlocks, Permissives and Control Signals

2.2.4.1. <u>UV Bank 1A/1B/2A/2B/3A/3B (U110/120/210/220/310/320)</u>

For UV Bank 1A/1B/2A/2B/3A/3B (U110/120/210/220/310/320) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
UV Bank 1A/1B/2A/2B/3A/3B Power Distribution Centre	Computer/off/hand switch	U110/120/210/220/310/320-HS-1 (BANK COH)	Hand

For UV Bank 1A/1B/2A/2B/3A/3B (U110/120/210/220/310/320) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
UV Bank 1A/1B/2A/2B/3A/3B Power Distribution Centre	Computer/off/hand switch	U110/120/210/220/310/320-HS-1 (BANK COH)	Computer

UV Wiper 1A/1B/2A/2B/3A/3B (U110/120/210/220/310/320)

For UV Wiper 1A/1B/2A/2B/3A/3B (U110/120/210/220/310/320) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
UV Bank 1A/1B/2A/2B/3A/3B Power Distribution Centre	Computer/off/hand switch	U110/120/210/220/310/320-HS-2 (WIPER COH)	Hand
UV Bank 1A/1B/2A/2B/3A/3B Power Distribution Centre	Sequence/retract/extend hand switch	U110/120/210/220/310/320-HS-2 (WIPER SEQ/RETR/EXT)	Retract/extend

For UV Wiper 1A/1B/2A/2B/3A/3B (U110/120/210/220/310/320) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
UV Bank 1A/1B/2A/2B/3A/3B Power Distribution Centre	Computer/off/hand switch	U110/120/210/220/310/320-HS-2 (WIPER COH)	Computer
UV Bank 1A/1B/2A/2B/3A/3B Power Distribution Centre	Sequence/retract/extend hand switch	U110/120/210/220/310/320-HS-2 (WIPER SEQ/RETR/EXT)	Sequence

UV Channel 1/2/3 Weir Gate (U102/202/302)

For UV Channel 1/2/3 Weir Gate (U102/202/302) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
UV Channel 1/2/3 Weir Gate (U102/202/302)	Local/remote hand switch	U102/202/302-HS-1 (L/R)	Local
UV Channel 1/2/3 Weir Gate (U102/202/302)	Open/close hand switch	U102/202/302-HS-2/3 (OPEN/CLOSE)	Open/Close

For UV Channel 1/2/3 Weir Gate (U102/202/302) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
UV Channel 1/2/3 Weir Gate (U102/202/302)	Local/remote hand switch	U102/202/302-HS-1 (L/R)	Remote
Trojan UV PLC		U102/202/302-ZC	Position command

2.2.5. Trojan UV PLC Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
PCS	Minor alarm	U070-UA-1	Digital Output
PCS	Major alarm	U070-UA-2	Digital Output
PCS	Critical alarm	U070-UA-3	Digital Output
PCS	UV bank on/off status	U110/120/210/220/310/320-YM	MODBUS Digital Output
UV Channel 1/2/3 Weir Gate (U102/202/302)	Position control	U102/202/302-ZC	Analog Output
UV Distribution Channel Level Sensor (U170-FE)	Level sensor	U060-LT	MODBUS Digital Input
UV Channel 1/2/3 Weir Gate (U102/202/302)	Computer/hand status	U102/202/302-YS	Digital Input
UV Channel 1/2/3 Weir Gate (U102/202/302)	Closed status	U102/202/302-ZSB	Digital Input
UV Channel 1/2/3 Weir Gate (U102/202/302)	Open status	U102/202/302-ZSD	Digital Input
UV Distribution Chamber Level Sensor (U060-FE)	Level sensor fault	U060-QF	MODBUS Digital Input
UV Channel 1/2/3 Level Sensor (U170/270/370-FE)	UV effluent flow rate	U170/270/370-FT	Analog Input
UV Channel 1/2/3 Weir Gate (U102/202/302)	Position status	U102/202/302-ZT	Analog Input
UV Bank 1A/1B/2A/2B/3A/3B (U110/120/210/220/310/320)	UV intensity	U110/121/211/221/311/321-AT	Analog Input
UV Distribution Chamber Flow Sensor (U060-FE)	Discharge channel level/flow	U060-FT	Analog Input

2.2.6. PCS Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Trojan UV PLC	Minor alarm	UA-U070-1	MODBUS Digital Input
Trojan UV PLC	Major alarm	UA-U070-2	MODBUS Digital Input
Trojan UV PLC	Critical alarm	UA-U070-3	MODBUS Digital Input
Trojan UV PLC	UV bank on/off status	UA-U110/120/210/220/310/320-YM	MODBUS Digital Input

2.2.7. HMI Display

Device Description	Status
UV Bank 1A/1B/2A/2B/3A/3B	Advance “time off” timers
UV Bank 1A/1B/2A/2B/3A/3B	Bank cycles setpoint
UV Bank 1A/1B/2A/2B/3A/3B	Bank health (Healthy/Not Healthy)
UV Bank 1A/1B/2A/2B/3A/3B	Bank major fault
UV Bank 1A/1B/2A/2B/3A/3B	Bank requested

Device Description	Status
UV Bank 1A/1B/2A/2B/3A/3B	Communication board EPROM write buttons
UV Bank 1A/1B/2A/2B/3A/3B	Control mode (Remote/Local, Auto/Hand/Off)
UV Bank 1A/1B/2A/2B/3A/3B	Cycle
UV Bank 1A/1B/2A/2B/3A/3B	Dampen timer (s)
UV Bank 1A/1B/2A/2B/3A/3B	Duty (Lead/Lag)
UV Bank 1A/1B/2A/2B/3A/3B	Flow limit for wiping exceeded status
UV Bank 1A/1B/2A/2B/3A/3B	Initiate wiper sequence
UV Bank 1A/1B/2A/2B/3A/3B	Lamp (hrs)
UV Bank 1A/1B/2A/2B/3A/3B	Lamp hours setpoint
UV Bank 1A/1B/2A/2B/3A/3B	Low water shutdown level
UV Bank 1A/1B/2A/2B/3A/3B	Module 1/2/3/4/5/6/7 manual enabled
UV Bank 1A/1B/2A/2B/3A/3B	Module 1/2/3/4/5/6/7 reset
UV Bank 1A/1B/2A/2B/3A/3B	Module 1/2/3/4/5/6/7 wiper enabled
UV Bank 1A/1B/2A/2B/3A/3B	Multiple bank failure
UV Bank 1A/1B/2A/2B/3A/3B	Next wiper sequence (Days, Hrs, Min)
UV Bank 1A/1B/2A/2B/3A/3B	Off timer (s)
UV Bank 1A/1B/2A/2B/3A/3B	On/Off status
UV Bank 1A/1B/2A/2B/3A/3B	Peak hours (hrs)
UV Bank 1A/1B/2A/2B/3A/3B	Peak hours in 24hrs (hrs)
UV Bank 1A/1B/2A/2B/3A/3B	Power (%)
UV Bank 1A/1B/2A/2B/3A/3B	Requested
UV Bank 1A/1B/2A/2B/3A/3B	Restart timer (s)
UV Bank 1A/1B/2A/2B/3A/3B	Runtime (hrs)
UV Bank 1A/1B/2A/2B/3A/3B	Sequence number
UV Bank 1A/1B/2A/2B/3A/3B	Status (Okay/Warming)
UV Bank 1A/1B/2A/2B/3A/3B	Warming seconds left (s)
UV Bank 1A/1B/2A/2B/3A/3B	Warmup timer (s)
UV Bank 1A/1B/2A/2B/3A/3B	Wiper low pressure reset
UV Bank 1A/1B/2A/2B/3A/3B	Wiper pressure status
UV Bank 1A/1B/2A/2B/3A/3B	Wiper remote/local status
UV Bank 1A/1B/2A/2B/3A/3B	Wiper run status (Idle)
UV Bank 1A/1B/2A/2B/3A/3B	Wiper sequence reset
UV Bank 1A/1B/2A/2B/3A/3B	Wiper sequence status (In-progress)
UV Channel 1/2/3	Bias setpoint
UV Channel 1/2/3	Channel enable
UV Channel 1/2/3	Control output deadband setpoint (mm)
UV Channel 1/2/3	Derivative (Td) setpoint
UV Channel 1/2/3	Differential gain setpoint
UV Channel 1/2/3	Fixed weir position setpoint (%)
UV Channel 1/2/3	Full scale water level setpoint (mm)
UV Channel 1/2/3	Integral (Ti) setpoint
UV Channel 1/2/3	Lead bank
UV Channel 1/2/3	Low scale water level setpoint (mm)
UV Channel 1/2/3	Not enough banks available
UV Channel 1/2/3	Proportional band (Kp) setpoint
UV Channel 1/2/3	Retention flow (ML/day)
UV Channel 1/2/3	Retention time (s)
UV Channel 1/2/3	Rotate lead bank

Device Description	Status
UV Channel 1/2/3	Start modulation flow setpoint (ML/day)
UV Channel 1/2/3	UV Dose (mJ/cm^2)
UV Channel 1/2/3	Water depth (Okay)
UV Channel 1/2/3	Weir failed to move delay setpoint (s)
UV Channel 1/2/3	Weir failed to move setpoint (%)
UV Channel 1/2/3 Weir Gate (U102/202/302)	Automatic position setpoint (%)
UV Channel 1/2/3 Weir Gate (U102/202/302)	Control mode (Auto /Manual)
UV Channel 1/2/3 Weir Gate (U102/202/302)	Manual position setpoint (%)
UV Channel 1/2/3 Weir Gate (U102/202/302)	Position (%)
UV Channel 1/2/3 Weir Gate (U102/202/302)	Water level (mm)
UV Channel 1/2/3 Weir Gate (U102/202/302)	Water level setpoint (mm)
UV Distribution Chamber Flow Sensor (U060-FE)	UV feed channel flow (Normal/Alarm)
UV Distribution Chamber Flow Sensor (U060-FE)	UV flow/channel (ML/day)
UV System	“UVT out of range” high limit setpoint (%)
UV System	“UVT out of range” low limit setpoint (%)
UV System	20mA flowmeter setpoint (ML/day)
UV System	Bank rotation timer setpoint (days)
UV System	Bank sorting enable
UV System	Bank time off delay setpoint (min)
UV System	Bank time off in disabled channel delay setpoint (s)
UV System	Calculated average intensity (mW/cm^2)
UV System	Critical alarm delay setpoint (s)
UV System	Dampen timer setpoint (s)
UV System	Designed dose (mJ/cm^2)
UV System	Designed dose setpoint (mJ/cm^2)
UV System	Entered UV transmittance (%)
UV System	Flow default value setpoint (ML/day)
UV System	Flow filter sample rate setpoint (s)
UV System	Flow filtering factor setpoint
UV System	Flow limit for wiping setpoint (%)
UV System	Low flow alarm delay setpoint (ML/day)
UV System	Low flow alarm setpoint (ML/day)
UV System	Major alarm delay setpoint (min)
UV System	Max lamp output at EOL setpoint (%)
UV System	Maximum capacity flow per channel (ML/day)
UV System	Maximum capacity flow per channel status (Normal/Alarm)
UV System	Minor alarm delay (min)
UV System	Minor/major/critical alarm status (Normal/Alarm)
UV System	Multiple lamp failure setpoint
UV System	Multiple lamp faults enable
UV System	Number of channels enabled
UV System	Off timer setpoint (s)
UV System	Online status
UV System	Restart timer setpoint (s)
UV System	Rotate UV bank countdown (Days, Hrs, Min)
UV System	System recovered (Yes/No)

Device Description	Status
UV System	System retention time (s)
UV System	System UV dose (mJ/s)
UV System	Total effluent flow (ML/day)
UV System	Trending timer reset setpoint (min)
UV System	UV dose alarm offset setpoint (%)
UV System	UV transmittance (%)
UV System	UVT communication board enable
UV System	UVT filter sample rate setpoint (s)
UV System	UVT filtering factor setpoint
UV System	Warmup timer setpoint (s)
UV System	Wiper sequence timer setpoint (hrs)

2.2.8. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Trojan UV PLC	Minor alarm	UA-U070-1 in alarm	Alarm notification
Trojan UV PLC	Major alarm	UA-U070-2 in alarm	Alarm notification
Trojan UV PLC	Critical alarm	UA-U070-3 in alarm	Alarm notification
UV Distribution Chamber Flow Sensor (U060-FE)	Low flow	U060 flow is less than 13 ML/day	Alarm notification

2.2.9. Trojan System Alarm Lookup Table

Minor Alarm	Major Alarm	Critical Alarm
Low flow	Level sensor fault	Low UV dose
PLC battery fault	Low water level	Flowmeter fault
Memory card battery fault	Weir gate not in remote	Cooling low pressure
Lamp fault	Weir gate failed to move	Not enough channels for disinfection
Ballast fault	Channel hydraulic limit exceeded	
End of lamp life warning	Multiple ballast fault	
Module communication fault	Multiple lamp fault	
Fan fault	Bank communication fault	
	Bank power loss fault	
	Wiper not in remote	
	Cooling high pressure	
	Wiper high pressure	
	Wiper low pressure	
	Bank not in remote	

3. UV BYPASS

Associated P&ID: 1-0101U-P0004-001-02
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nupump.G, uvpump.G

3.1. Process Description

The following process lines bypass UV and flow directly to outfall:

- Secondary Effluent (SE) from the secondary clarifiers via sluice gate YG-12B.
- Primary effluent (PE) from the Primary Clarifiers
- Raw sewage (RS) from the RS discharge well

3.2. Control Description

3.2.1. Local Manual Control Mode

The SE bypass sluice gate can be controlled in LOCAL MANUAL mode with the hand switch YG-12B-HS-1.

3.2.2. Remote Manual Control Mode

In REMOTE MANUAL mode, the SE bypass sluice gate position can be manually set by the operator from the pop-up faceplate.

3.2.3. Remote Automatic Control Mode

In REMOTE AUTO mode, the SE bypass sluice gate opens automatically when either of the following conditions occur:

- All UV pumps are off and the UV influent level is higher than 226.82 for 5 seconds or longer.
- Both UV influent well level transmitters have failed.

On the PCS The SE bypass gate will ask an operator to close in manual mode then place back automatic mode when the above conditions have cleared for 5 seconds.

3.2.4. Interlocks, Permissives and Control Signals

For Sluice Gate (YG-12B) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Sluice Gate (YG-12B)	Computer/off/hand hand switch	U002-HS-1 (COH)	Hand
Sluice Gate (YG-12B)	Open/Close hand switch	U002-HS-3/3	Open/Close

For Sluice Gate (YG-12B) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
Sluice Gate (YG-12B)	Computer/off/hand hand switch	U002-HS-1 (COH)	Computer
PCS		GA-U002-VD/VB	Open/Close command

3.2.5. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Sluice Gate (YG-12B)	Gate close command	GA-U002-VB	Digital Output
Sluice Gate (YG-12B)	Gate open command	GA-U002-VD	Digital Output
Sluice Gate (YG-12B)	Gate closed status	GA-U002-ZSB	Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Sluice Gate (YG-12B)	Gate computer/hand status	GA-U002-YS	Digital Input
Sluice Gate (YG-12B)	Gate open status	GA-U002-ZSD	Digital Input

3.2.6. HMI Display

Device Description	Status
Sluice Gate (YG-12B)	Gate computer/hand status
Sluice Gate (YG-12B)	Gate open status

4. UV FINAL EFFLUENT SAMPLER

Associated P&ID:
Associated NEWPCC Manuals:
Associated DCS HMI Screens: uvpump.G, nearea11.G, nsampler.G

4.1. Process Description

The UV Effluent sample pump circulates the plant effluent to the sampler. A sample is taken every 1 ML.

4.2. Control Description

4.2.1. Local Manual Control Mode

The UV Effluent sample pump (U537-P) can be controlled in LOCAL MANUAL mode with the hand switches (U537-HS-1/2).

The UV Effluent sampler (U538) can be operated locally from hand switches U538-HS-1/2.

4.2.2. Remote Manual Control Mode

The UV Effluent sample pump (U537-P) can be started and stopped in REMOTE MANUAL mode from the pop-up faceplate. The pump can be controlled manually when the pump is in REMOTE mode and the pump is not in alarm.

A UV Effluent sample can be taken manually from the pop-up faceplate when the sampler is in REMOTE mode and the sampler has not faulted.

4.2.3. Remote Automatic Control Mode

The UV Effluent sample pump (U537-P) runs continuously in REMOTE AUTO mode while there is no pump alarm.

The pump will alarm if the pump has faulted or if there is no detected discharge flow (from the internal flow switch) while the pump is running. The alarm can be reset from the PCS.

In REMOTE AUTO mode the sampler (U538) will take a 1 second sample when the U537-P flow is normal every operator adjustable plant raw influent volume (Minimum: 0.25 ML; Maximum: 4.0 ML; Initial: 1.0 ML) as measured by the sum of M110/120/130/140/150/160-FT delayed 5 minutes. The sample count and sample attempt count are recorded for the current and previous day.

4.2.4. Interlocks, Permissives and Control Signals

UV Final Effluent Circulation Pump (U537)

For UV Final Effluent Circulation Pump (U537) to operate in LOCAL (HAND) mode:

Equipment	Device Description	Device Tag	State
UV Final Effluent Circulation Pump (U537)		U537-HS-1/2	Hand

For UV Final Effluent Circulation Pump (U537) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
UV Final Effluent Circulation Pump (U537)		U537-HS	Computer
PCS		UA-U537-MN	Start command

UV Final Effluent Sampler (U538)

For UV Final Effluent Sampler (U538) to operate in LOCAL (HAND) mode:

Equipment	Device Description	Device Tag	State
UV Final Effluent Sampler (U538)		U538-HS-1/2	Hand

For UV Final Effluent Sampler (U538) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
UV Final Effluent Sampler (U538)		U538-HS	Computer
PCS		UA-U538-MN	Start command

4.2.5. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
UV Final Effluent Circulation Pump (U537)	Start command	UA-U537-MN	MODBUS Digital Output
UV Final Effluent Sampler (U538)	Start command	UA-U538-MN	MODBUS Digital Output
UV Final Effluent Circulation Pump (U537)	Low flow status	UA-U537-FSL	MODBUS Digital Input
UV Final Effluent Circulation Pump (U537)	Fault	UA-U537-UF	MODBUS Digital Input
UV Final Effluent Circulation Pump (U537)	Run status	UA-U537-MM	MODBUS Digital Input
UV Final Effluent Circulation Pump (U537)	Computer/hand status	UA-U537-YS	MODBUS Digital Input
UV Final Effluent Sampler (U538)	Fault	UA-U538-UF	MODBUS Digital Input
UV Final Effluent Sampler (U538)	Run status	UA-U538-MM	MODBUS Digital Input
UV Final Effluent Sampler (U538)	Computer/hand status	UA-U538-YS	MODBUS

Equipment	Signal Description	Signal Tag	Signal Type
			Digital Input

4.2.6. HMI Display

Device Description	Status
UV Final Effluent Circulation Pump (U537)	Alarm reset
UV Final Effluent Circulation Pump (U537)	Run status
UV Final Effluent Sampler (U538)	Computer/hand status
UV Final Effluent Sampler (U538)	Normal/fail status
UV Final Effluent Sampler (U538)	Number of samples taken
UV Final Effluent Sampler (U538)	Number of samples taken previous day
UV Final Effluent Sampler (U538)	Number of samples tried
UV Final Effluent Sampler (U538)	Number of samples tried previous day
UV Final Effluent Sampler (U538)	Run status
UV Final Effluent Sampler (U538)	Sampling frequency (ML)

4.2.7. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
UV Final Effluent Sampler (U538)	Sampler fault	U538-MF in alarm	Alarm notification

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1. DIGESTED SLUDGE HOLDING TANKS 6 AND 8

Associated P&ID:	1-0101W-A0289, 1-0101W-A0290
Associated NEWPCC Manuals:	DW201 – DW214
Associated DCS HMI Screens:	nearea9.G, ndhold.G, ndoflow.G, ndsltr.G, ndslwd.G, nwsltr.G, nearea7.G

1.1 Process Description

There are four digested sludge holding tanks, numbered 5 through 8. Holding tanks 6 and 8 are currently in commission. Holding tanks 5 and 7 are decommissioned and not able to be put into service, the graphics for tanks 5 and 7 will not be included in the PCS.

Holding tanks 6 and 8 are connected to the digesters via a valved feed line (W320/340-HV). The valves are pneumatically controlled. The valves are manually operated; the in-service holding tank feed valve is set to the open position.

Holding tanks 6 and 8 have a sludge circulation system to keep the sludge evenly mixed for the centrifuges. Pump W368-CP2 circulates the DS of the in-service holding tank. The suction valves (W321/341-HV) and discharge valves (W322/342-HV) control which holding tank is circulated.

DS from the Transfer Pumps Recirculation Valve (W381-HV) and thin sludge (TS) from the Thin Sludge Header flow into the in service holding tank.

Transfer pumps (D350/360-DSP) pump DS from holding tanks 6 and 8 through suction valves (D271/281-HV) to the centrifuge sludge pumps.

The level in the tank is measured using pressure differential transmitters (D270/280-LIT) and monitored by the PCS.

1.2 Control Description

The feed valves (W320/340-HV) are pneumatically operated; each feed valves has a computer/hand switch in local panel FDP-W4 to select LOCAL (HAND) or REMOTE (COMPUTER) operation.

1.2.1 Local Manual Control Mode

In LOCAL mode, an operator can manually open or close each feed valve (W320/340-HV) through FDP-W4. The valve position is monitored through the PCS.

1.2.2 Remote Manual Control Mode

In REMOTE mode, the feed valves are operated in MANUAL mode. The operator can open and close the valves from a popup faceplate.

1.2.3 Interlocks, Permissives, and Control Signals

For Digester Feed Valves (W320/340-HV) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		WA-W320/340-VD	Open command
Digester Feed Valve (W320/340-HV)	Computer/Hand hand switch	WA-W320/340-HS-1	Computer

1.2.4 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Digester Feed Valve (W320/340-HV)	Open command	WA-W320/340-VD	Digital Output
Digester Feed Valve (W320/340-HV)	Close command	WA-W320/340-VB	Digital Output
Digester Feed Valve (W320/340-HV)	Computer/hand status	WA-W320/340-YS	Digital Input
Digester Feed Valve (W320/340-HV)	Valve open status	WA-W320/340-ZD	Digital Input
Digester Feed Valve (W320/340-HV)	Valve closed status	WA-W320/340-ZB	Digital Input
Holding Tank 6/8 (D270/280)	Holding Tank level	DB-D270/280-LT	Digital Input

1.2.5 HMI Display

Device Description	Status
Digester Feed Valve (W320/340-HV)	Open/closed status
Digester Feed Valve (W320/340-HV)	Computer/hand status

Holding Tank 6/8 (D270/280)	Holding Tank level (metres)

1.2.6 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Holding Tank 6/8 (D270/280)	High Level	DB-D270/280-LT above 5 meters	Shuts feeding valve

2. HOLDING TANK CIRCULATION PUMPS

Associated P&ID: 1-0101W-A0290, 1-0101W-A0291
Associated NEWPCC Manuals: DW201 – DW214
Associated DCS HMI Screens: nwsltr.G, nearea9.G

2.1 Process Description

DS within the Digested Sludge Holding Tanks settles into different layers, affecting polymer demand, cake quality and centrate quality. To avoid this, DS from the tanks is continuously circulated to keep the solids evenly mixed and light grit in suspension.

The system is comprised of:
- Two constant-speed axial flow circulation pumps, W357-CP1 and W368-CP2
- A suction valve (W321/341-HV) for each tank
- A discharge valve (W322/342-HV) for each tank
- Manual pump isolation valve WKGD for the discharge piping
- Manual pump isolation valve WKGS for the suction piping

Circulation pump W368-CP2 mixes the DS from holding tanks 6 and 8. Circulation pump W357-CP1 is able to be manually valved and operated to service holding tanks 6 and 8. Each pump will only service one holding tank at a time. If one of the circulation pumps needs to be serviced, valves (WKGD and WKGS) may be used isolate the pump.

For any tank undergoing DS circulation, both the suction (W321/341-HV) and the discharge valves (W322/342-HV) need to be open for proper circulation.

2.2 Control Description

These valves can be controlled in LOCAL or REMOTE mode. In both LOCAL and REMOTE mode the valves are controlled in MANUAL mode.

2.2.1 Local Manual Control Mode – Suction/Discharge Valves

Each Holding Tank has a suction (W321/341-HV) and discharge (W322/342-HV) valves to the circulation pump. In LOCAL MANUAL mode the valve position is controlled through the switch W321/322/341/342-HS-1.

2.2.2 Remote Manual Control Mode – Suction/Discharge Valves

In REMOTE MANUAL mode the valve position is manually set by the operator from the pop-up faceplate.

2.2.3 Local Manual Control Mode – Circulation Pumps

Each circulation pump is controlled through a computer/off/hand switch at FDP-W4. The pump is operated in LOCAL MANUAL mode when the switch is set to OFF or HAND.

2.2.4 Remote Manual Control Mode – Circulation Pumps

The pump is operated in REMOTE mode when the computer/off/hand switch at FDP-W4 switch is set to COMPUTER. In REMOTE MANUAL mode the circulation pump can be started and stopped from the pop-up faceplate.

In REMOTE MANUAL mode the pump can only start if both of the following conditions are all met:

- Seal water is present; and
- Either:
    - Both circulation suction and discharge valves for Tank 6 are open; or
    - Both circulation suction and discharge valves for Tank 8 are open.

2.2.5 Interlocks, Permissives, and Control Signals

2.2.5.1 Circulation Pumps (W357-CP1 and W368-CP2)

For Circulation Pumps (W357-CP1 and W368-CP2) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		WA-W357/368-MN	Start Command
Control Room Panel	Computer/off/hand hand switch	W357/368-HS-1	Computer
Control Room Panel	Low pressure alarm	W357/368-PAL	Normal
Circulation Pumps (W357/368)	Lock off stop hand switch	W357/368-HS-2	Normal
Circulation Pump Discharge/Suction Valve (W321/322/341/342-HV)	Discharge/Suction valve pair open	W321/322/341/342-HV	Pair is open

2.2.5.2 Circulation Pump Discharge and Suction Valves (W322/342-HV and W321/341-HV)

For Circulation Pump Discharge Valves (W322/342-HV), and Suction Valves (W321/341-HV) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		WA-W322/342-VD	Open command
		WA-W321/341-VD	
Circulation Pump Discharge Valve (W322/342-HV)	Computer/Hand hand switch	W322/342-HS-1	Computer
Circulation Pump Suction Valve (W321/341-HV)		WA-W321/341-HS-1	

2.2.6 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Circulation Pumps (W357/368)	Start Command	WA-W357/368-MN	Digital Output
Circulation Pumps (W357/368)	Stop Command	WA-W357/368-MO	Digital Output
Circulation Pump Discharge Valve (W322/342-HV)	Open command	WA-W322/342-VD	Digital Output
Circulation Pump Suction Valve (W321/341-HV)	Open command	WA-W321/341-VD	Digital Output
Circulation Pump Discharge Valve (W322/342-HV)	Close command	WA-W322/342-VB	Digital Output
Circulation Pump Suction Valve (W321/341-HV)	Close command	WA-W321/341-VB	Digital Output
Circulation Pumps (W357/368)	Low Pressure Alarm	WA-W357/368-PA	Digital Input
Circulation Pumps (W357/368)	Run status	WA-W357/368-MM	Digital Input
Circulation Pumps (W357/368)	Computer/hand status	WA-W357/368-YS	Digital Input
Circulation Pump Discharge Valve (W322/342-HV)	Computer/hand status	WA-W322/342-YS	Digital Input
Circulation Pump Suction Valve (W321/341-HV)	Computer/hand status	WA-W321/341-YS	Digital Input
Circulation Pump Discharge Valve (W322/342-HV)	Valve open status	WA-W322/342-ZD	Digital Input
Circulation Pump Suction Valve (W321/341-HV)	Valve open status	WA-W321/341-ZD	Digital Input
Circulation Pump Discharge Valve (W322/342-HV)	Valve closed status	WA-W322/342-ZB	Digital Input
Circulation Pump Suction Valve (W321/341-HV)	Valve closed status	WA-W321/341-ZB	Digital Input

2.2.7 HMI Display

Device Description	Status
Circulation Pumps (W357/368)	Seal Water Pressure Alarm (Normal/Alarm)
Circulation Pumps (W357/368)	Computer/Hand status
Circulation Pumps (W357/368)	Run status (On/Off)
Circulation Pump Suction Valve (W321/341-HV)	Open/closed status
Circulation Pump Suction Valve (W321/341-HV)	Computer/hand status

2.2.8 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Circulation Pumps (W357/368)	Seal Water Pressure Alarm	WA-W357/368-PA is in alarm	Circulation pump taken out of service

3. DIGESTED SLUDGE TRANSFER PUMPS

Associated P&ID: 1-0101W-A0292
Associated NEWPCC Manuals: DW201 – DW214
Associated DCS HMI Screens: nwsltr.G, nearea9.G, nsampler.G

3.1 Process Description

The digested sludge is transferred to the Dewatering building by two constant-speed centrifugal pumps (W350/360-DSP) through suction valves (D271/281-HV).

The discharge recirculation valve (W381-HV) is opened when the transfer pump is running, a manual hand valve is throttled to control the pressure to the Dewatering building. The discharge pressure, temperature, and density are monitored. Flushing water can be manually added thin the sludge density.

3.2 Control Description

3.2.1 Local Manual Control Mode – Digested Sludge Transfer Valves

The transfer valves (D271/281-HV) can be controlled in LOCAL MANUAL mode via the computer/hand switch (D271/281-HS-1) and open/close switch (D271/281-HS-2/3).

3.2.2 Remote Manual Control Mode – Digested Sludge Transfer Valves

In REMOTE MANUAL mode the transfer valves (D271/281-HV) are set to open or closed by the pop-up faceplate.

3.2.3 Local Manual Control Mode – Digested Sludge Transfer Pumps

The transfer pumps (W350/360-DSP) are controlled through a computer/off/hand switch (W350/360-HS-1) at FDP-W4. The pump is operated in LOCAL MANUAL mode when the switch is set to OFF or HAND.

3.2.4 Remote Manual Control Mode – Digested Sludge Transfer Pumps

The pump is operated REMOTELY by the PCS when W350/360-HS-1 is set to COMPUTER. In REMOTE MANUAL mode the pump is started and stopped manually by the operator via the pop-up faceplate. For the transfer pumps to run in REMOTE MANUAL mode, any transfer valve (D271/281-HV) must be in the open position.

3.2.5 Local Manual Control Mode – Digested Sludge Recirculation Valve

Valve W381-HV is pneumatically controlled, in LOCAL (MANUAL) mode, the valve is opened and closed using hand switches in the dewatering control room panel (W381-HS-1).

3.2.6 Remote Manual Control Mode – Digested Sludge Recirculation Valve

In REMOTE MANUAL mode the open/close valve position is set manually by the pop-up faceplate.

3.2.7 Remote Manual Control Mode – Digested Sludge Sampler

In REMOTE MANUAL mode the sampler (W533) is started and stopped manually by the operator via the pop-up faceplate. The sampler will be inhibited from running if the fault signal is active or the sampler is not in REMOTE mode.

3.2.8 Remote Automatic Control Mode – Digested Sludge Sampler

In REMOTE AUTOMATIC mode the sampler will run for 30 seconds every operator adjustable period (Minimum: 0.6 minutes; Maximum: 60 minutes; Initial: 15 minutes). The sampler will be inhibited from running if the fault signal is active or the sampler is not in REMOTE mode.

3.2.9 General Monitoring

The transfer pump discharge sludge temperature (W101-TT), pressure (W101-PT), and density (W101-DT) are monitored by the PCS.

3.2.10 Interlocks, Permissives, and Control Signals

3.2.10.1 Digested Sludge Transfer Pumps (W350/360-DSP)

For Digested Sludge Transfer Pumps (W350/360-DSP) to operate in LOCAL mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Computer/off/hand hand switch	W350/360-HS-1	Hand
Digested Sludge Transfer Pumps (W350/360-DSP)	Lock off stop switch	W350/360-HS-2	Normal

For Digested Sludge Transfer Pumps (W350/360-DSP) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		WA-W350/360-MN	Start Command
Control Room Panel	Computer/off/hand hand switch	W350/360-HS-1	Computer
Digested Sludge Transfer Pumps (W350/360-DSP)	Lock off stop switch	W350/360-HS-2	Normal
Control Room Panel	Low pressure alarm	W350/360-PAL	Normal

3.2.10.2 Digested Sludge Transfer Valves (D271/281-HV)

For Digested Sludge Transfer Valve (D271/281-HV) to operate in LOCAL mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Open hand switch	D271/281-HS-2	Open
Digester Control Room Panel	Computer/hand hand switch	D271/281-HS-1	Hand

For Digested Sludge Transfer Valve (D271/281-HV) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		DA-D271/381-VD	Open Command
Digester Control Room Panel	Computer/off/hand hand switch	D271/281-HS-1	Computer

3.2.10.3 Digested Sludge Recirculation Valve (W381-HV)

For Digested Sludge Recirculation Valve (W381-HV) to operate in LOCAL mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Open hand switch	W381-HS-2	Open
Control Room Panel	Computer/hand hand switch	W381-HS-1	Hand

For Digested Sludge Recirculation Valve (W381-HV) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		WA-W381-VD	Open Command
Control Room Panel	Computer/off/hand hand switch	W381-HS-1	Computer

3.2.11 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Digested Sludge Transfer Pumps (W350/360-DSP)	Start command	WA-W350/360-MN	Digital Output
Digested Sludge Transfer Pumps (W350/360-DSP)	Stop command	WA-W350/360-MO	Digital Output
Sludge Transfer Valve (W381-HV)	Open command	WA-W381-VD	Digital Output
Sludge Transfer Valve (W381-HV)	Close command	WA-W381-VB	Digital Output
Digested Sludge Sampler (W533)	Cycle command	WB-W533-AN	Digital Output
Digested Sludge Transfer Pumps (W350/360-DSP)	Computer/hand status	WA-W350/360-YS	Digital Input
Digested Sludge Transfer Pumps (W350/360-DSP)	Run status	WA-W350/360-MM	Digital Input
Digested Sludge Transfer Pumps (W350/360-DSP)	Seal water low pressure alarm	WA-W350/360-PA	Digital Input
Sludge Transfer Valve (W381-HV)	Open status	WA-W381-ZD	Digital Input
Sludge Transfer Valve (W381-HV)	Closed status	WA-W381-ZB	Digital Input
Sludge Transfer Valve (W381-HV)	Computer/hand status	WA-W381-YS	Digital Input
Digested Sludge Sampler (W533)	Computer/hand status	WB-W533-YS	Digital Input
Digested Sludge Sampler (W533)	Fault	WB-W533-AF	Digital Input
Digested Sludge Sampler (W533)	Run status	WB-W533-AM	Digital Input
Sludge Feed Temperature (W101)	Sludge temperature	WA-W101-TT	Analog Input
Sludge Feed Pressure (W101)	Sludge pressure	WA-W101-PT	Analog Input
Sludge Feed Density (W101)	Sludge Density	WA-W101-DT	Analog Input

3.2.12 HMI Display

Device Description	Status
Digested Sludge Sampler (W533)	Fault status (Normal/Fail)
Digested Sludge Sampler (W533)	Computer/hand status
Digested Sludge Sampler (W533)	Previous day – tried
Digested Sludge Sampler (W533)	Previous day – sampled
Digested Sludge Sampler (W533)	Current day – tried

Digested Sludge Sampler (W533)	Current day – sampled
Digested Sludge Sampler (W533)	Frequency (minutes)
Sludge Feed Temperature (W101)	Sludge Temperature (°C)
Sludge Feed Pressure (W101)	Sludge pressure (kPa)
Sludge Feed Density (W101)	Sludge Density (% TS)
Digested Sludge Transfer Pumps (W350/360-DSP)	Seal water pressure (Normal/Low)
Digested Sludge Transfer Pumps (W350/360-DSP)	Fault status (Normal/Fail)
Digested Sludge Transfer Pumps (W350/360-DSP)	Computer/hand status
Digested Sludge Transfer Pumps (W350/360-DSP)	Run status
Sludge Transfer Valve (W381-HV)	Open status
Sludge Transfer Valve (W381-HV)	Computer/hand status

3.2.13 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Digested Sludge Sampler (W533)	Sampler fault	WB-W533-AF in alarm	Alarm notification
Digested Sludge Transfer Pumps (W350/360-DSP)	Pump fault	Pump fault	Alarm notification
Digested Sludge Transfer Pumps (W350/360-DSP)	Seal water low pressure alarm	WA-W350/360-PA in alarm	Pump taken out of service.

4. SLUDGE FEED PUMPING SYSTEM

Associated P&ID:	1-0101W-A0293, 1-0101W-A0294, 1-0101W-A0295, 1-0101W-A0296, 1-0101W-A0297, 1-0101W-A0298, 1-0101W-A0305, 1-0101W-A0306, 1-0101W-A0307
Associated NEWPCC Manuals:	DW301 – DW305
Associated DCS HMI Screens:	nearea9.G, nwcnt1.G, nwcnt1md.G, nwcnt2.G, nwcnt2md.G, nwcnt3.G, nwcnt3md.G, nwcnt4.G, nwcnt4md.G, nwcnt5.G, nwcnt5md.G, nwcnt6.G, nwcnt6md.G, nwsumry.G

4.1 Process Description

Sludge is pumped to the centrifuges by the sludge feed pumps:

- W110-SFP pumps sludge to centrifuge 1
- W120-SFP pumps sludge to centrifuge 2
- W130-SFP pumps sludge to centrifuge 3
- W140-SFP pumps sludge to centrifuge 4
- W150-SFP pumps sludge to centrifuge 5
- W160-SFP pumps sludge to centrifuge 6

The speed of the feed pumps is adjustable to ensure the centrifuges receive the steady flow of sludge required to produce consistent sludge cakes.

Each sludge feed pump has a dedicated magnetic flowmeter and automatic sludge feed valve to monitor and control the flow of sludge to the centrifuge:

- Sludge flow from W110-SFP is measured by flowmeter W012-FE and regulated by valve W010-HV
- Sludge flow from W120-SFP is measured by flowmeter W022-FE and regulated by valve W020-HV

- Sludge flow from W130-SFP is measured by flowmeter W032-FE and regulated by valve W030-HV
- Sludge flow from W140-SFP is measured by flowmeter W042-FE and regulated by valve W040-HV
- Sludge flow from W150-SFP is measured by flowmeter W052-FE and regulated by valve W050-HV
- Sludge flow from W160-SFP is measured by flowmeter W062-FE and regulated by valve W060-HV

4.2 Control Description

Each sludge feed valve (W010/020/030/040/050/060-HV) is pneumatically controlled and can be operated in LOCAL (MANUAL) or REMOTE (COMPUTER) mode.

4.2.1 Local Manual Control Mode – Sludge Valve

In LOCAL MANUAL mode, the valve is opened and closed using hand switches (W010/020/030/040/050-HS-1/2).

4.2.2 Remote Manual Control Mode – Sludge Valve

In REMOTE MANUAL mode, the Centrifuge sludge feed valve position can be set manually from the pop-up faceplate. The sludge feed valve will not open if the associated Centrifuge's flushing water valve is open. The sludge feed valve will close immediately if the associated Centrifuge's flushing water valve is open.

4.2.3 Remote Automatic Control Mode – Sludge Valve

In REMOTE mode, the sludge feed valve will open AUTOMATICALLY if all of the following conditions are met:

- The associated cake pump is running.
- The associated Centrifuge is in REMOTE.
- The associated Centrifuge's flushing water valve is closed.
- The associated cake pump has not faulted.
- The associated cake hopper level is below 2.65 meters.
- The associated Centrifuge is running in low speed (delta) mode and the speed has reached 2480 RPM. This is a latched state that will remain acceptable until the Centrifuge Stop signal is received.

The sludge feed valve will not open if the associated Centrifuge's flushing water valve is open. The sludge feed valve will close immediately if the associated Centrifuge's flushing water valve is open.

4.2.4 Local Manual Control Mode – Sludge Feed Pump

Each sludge feed pump (W110/120/130/140/150/160-SFP) is controlled through a local/remote button (W110/120/130/140/150/160-HS-2) on an VFD controller at local control panel FDP-W3 in the Electrical Room. The pump is operated in LOCAL mode when the button is pressed to "LOC" and green diamond button is pressed to start pump. The speed of the pump is controlled by the up/down buttons

4.2.5 Remote Manual Control Mode – Sludge Feed Pump

The pump is operated through the PCS in REMOTE mode when the controller button is set to REMOTE . In REMOTE MANUAL mode the sludge feed pump is started from the pop-up faceplate.

The sludge feed pumps require the following conditions to be true to start the pump. The pump will automatically stop while running if any condition are not met:

- The Holding Tank transfer pump discharge pressure is above 10 kPa.
- The associated Centrifuge is running in low speed (delta).
- The associated Cake pump is not faulted.
- The discharge sludge feed valve is open.
- The associated cake agitator is running.
- The associated cake hopper is below 2.65 meters.

Speed control is available in REMOTE MANUAL mode and is controlled using the REMOTE AUTOMATIC speed control described below.

4.2.6 Remote Automatic Control Mode – Sludge Feed Pump
In REMOTE mode, the sludge feed pump speed is AUTOMATICALLY modulated through the PCS. The PCS adjusts the pump speed based on the flowrate measured by the magnetic flowmeter (W012/122/032/042/052/062-FE) to maintain an operator-adjusted setpoint controlled by a PID loop .

The sludge feed pump speed output is set to the minimum speed 10% if any of the following conditions occur:

- The polymer flow is greater than 0.1 g/s and the associated Centrifuge is not running in low speed (delta) mode
- The pump is removed from REMOTE mode or the pump running status reads stopped.
- The associated Centrifuge has been in alarm for longer than 30 seconds. The Centrifuge is considered in alarm if any of the following conditions are met:
  - The Centrifuge bearing high temperature switch has tripped (W801/821/841/861/881/901-TA)
  - The Centrifuge backdrive bearing temperature switch has tripped. (W804/824/844/864/884/904-TA)
  - The Centrifuge vibration switch has tripped and the Centrifuge has been running for longer than 160 seconds for centrifuges 4 and 5, and 120 seconds for the remaining centrifuges . (W805/825/845/865/885/905-XA)
  -
  - The Centrifuge stop signal is active (see Remote Automatic Control Mode – Centrifuge for signal conditions)

4.2.6 Interlocks, Permissives, and Control Signals

4.2.6.1 Sludge Feed Pumps (W110/120/130/140/150/160-SFP)

For sludge feed pump (W110/120/130/140/150/160-SFP) to operate in LOCAL mode:

Equipment	Device Description	Device Tag	State
Local VFD Control Panel	Start button	W110/120/130/140/150/160-HS (START)	Start
Local VFD Control Panel	Local/Remote button	W110/120/130/140/150/160-HS	Local
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Seal water pressure	W110/120/130/140/150/160-PSL	Normal
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Pump discharge pressure	W110/120/130/140/150/160-PSH	Normal

Local Control Panel	VFD Fault	W110/120/130/140/150/160-MF	Normal
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Lock off stop hand switch	W110/120/130/140/150/160-HS-1	Normal
Local Control Panel	Speed control	W110/120/130/140/150/160-HS-7 (SC)	Speed set*
Local Control Panel	VFD bypass	W110/120/130/140/150/160-HS-4 (COB)	Speed control bypassed*

** Only one of these conditions is necessary for operation*

For sludge feed pump (W110/120/130/140/150/160-SFP) to operate in REMOTE mode:

Equipment	**Device Description**	**Device Tag**	**State**
PCS		WA-W110/120/130/140/150/160-MN	Start command
Local VFD Control Panel	Local/Remote button	W110/120/130/140/150/160-HS	Remote
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Seal water pressure	W110/120/130/140/150/160-PSL	Normal
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Pump discharge pressure	W110/120/130/140/150/160-PSH	Normal
Local Control Panel	VFD Fault	W110/120/130/140/150/160-MF	Normal
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Lock off stop hand switch	W110/120/130/140/150/160-HS-1	Normal
Local Control Panel	Speed control	WA-W110/120/130/140/150/160-SC	Speed command

4.2.6.2 Sludge Feed Valves (W010/020/030/040/050-HV)

For sludge feed valve (W010/020/030/040/050-HV) to operate in LOCAL mode:

Equipment	**Device Description**	**Device Tag**	**State**
Control Room Panel	Open hand switch	W010/020/030/040/050-HS-2 (OPN)	Open
Control Room Panel	Computer/hand hand switch	W010/020/030/040/050-HS-1 (C/H)	Hand

For sludge feed valve (W010/020/030/040/050-HV) to operate in REMOTE mode:

Equipment	**Device Description**	**Device Tag**	**State**
PCS		WA-W010/020/030/040/050-VD	Open command
Control Room Panel	Computer/hand hand switch	W010/020/030/040/050-HS-1 (C/H)	Computer

4.2.7 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Sludge feed pump start command	WA-W110/120/130/140/150/160-MN	Digital Output
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Sludge feed pump stop command	WA-W110/120/130/140/150/160-MO	Digital Output
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Sludge feed pump speed command	WA-W110/120/130/140/150/160-SC	Digital Output
Sludge Feed Valve (W010/020/030/040/050-HV)	Sludge feed valve open command	WA-W010/020/030/040/050-VD	Digital Output
Sludge Feed Valve (W010/020/030/040/050-HV)	Sludge feed valve close command	WA-W010/020/030/040/050-VB	Digital Output
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Sludge feed pump computer/hand status	WA-W110/120/130/140/150/160-YS	Digital Input
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Sludge feed pump fault status	WA-W110/120/130/140/150/160-QF	Digital Input
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Sludge feed pump run status	WA-W110/120/130/140/150/160-MM	Digital Input
Sludge Feed Valve (W010/020/030/040/050-HV)	Sludge feed valve computer/hand status	WA-W010/020/030/040/050-YS	Digital Input
Sludge Feed Valve (W010/020/030/040/050-HV)	Sludge feed valve open status	WA-W010/020/030/040/050-ZD	Digital Input
Sludge Feed Valve (W010/020/030/040/050-HV)	Sludge feed valve closed status	WA-W010/020/030/040/050-ZB	Digital Input
Magnetic Flowmeter (W012/122/032/042/052/062-FE)	Sludge feed flowrate	WA-W012/122/032/042/052/062-FT	Analog Input
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Sludge feed pump speed status	WA-W110/120/130/140/150/160-ST	Analog Input

4.2.8 HMI Display

Device Description	Status
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Run status
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Speed
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Computer/hand status
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Fault status
Magnetic Flowmeter (W012/122/032/042/052/062-FE)	Sludge flow (L/s)
Sludge Feed Valve (W010/020/030/040/050-HV)	Open/closed status
Sludge Feed Valve (W010/020/030/040/050-HV)	Computer/hand status

4.2.9 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Sludge Feed Pump (W110/120/130/140/150/160-SFP)	Sludge feed fault	WA-W110/120/130/140/150/160-QF in alarm	Centrifuge system 1/2/3/4/5/6 taken out of service

5. DRY POLYMER BATCHING SYSTEM

Associated P&ID: 1-0101W-A0299, 1-0101W-A0301
Associated NEWPCC Manuals: DW501 - DW509
Associated DCS HMI Screens: nwpol1.G, nwpol2.G

5.1 Process Description

There are two polymer systems, comprised of the following:

Polymer System 1	Polymer System 2
Dry Polymer Bin W210	Dry Polymer Bin W220
Screw Feeder W210-PSF	Screw Feeder W220-PSF
Pneumatic Blower W212-POB	Pneumatic Blower W222-POB
Mix and Age Tank W230	Mix and Age Tank W240
Rapid Fill Valve W234-FV	Rapid Fill Valve W244-FV
Jetwet PW Valve W233-FV	Jetwet PW Valve W243-FV
Mixer W230-POM	Mixer W240-POM
Mixing Tank Valve W232-HV	Mixing Tank Valve W242-HV
Feed Tank 1 (W250)	Feed Tank 2 (W260)
Feed Pump Valve W250-HV	Feed Pump Valve W260-HV

Dry polymer is manually unloaded into the dry polymer bins (W210/220) using a monorail crane.
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The polymer batch system has two cycles:

1. Dry feed (35 minutes – operator adjustable time)
2. Mix and age (60 minutes – operator adjustable time)

During the dry feed cycle, the rapid fill valve (W234/244-FV) for the mix and age tank (W230/240) opens and the pneumatic blower (W212/222-POB) is started. Once the mix and age tank is half-filled, the rapid fill valve is closed and the screw feeder (W210/220-PSF) and mixer (230/240-POM) are started. The dry polymer in the storage bin (W210/220) is fed to the pneumatic blower by the screw feeder, and the polymer is blown to the jetwet head. Potable water (PW) enters the jetwet head via a valved line (W233/243-FV). The dry polymer is watered by the jetwet head and deposited into the mix and age tank until the screw feeder (dry feed) time has elapsed. The screw feeder then shuts off. The rapid fill valve is reopened and PW flows into the tank until the tank is filled. Once filled, the rapid fill, Jetwet solenoid and blower shut down, the mixer continues to run and the mix and age begins

During the mix and age cycle, the polymer solution is mixed for the entire duration of the cycle. Once the cycle is finished, the mixer (230/240-POM) stops and the mixing tank valve will open, allowing the polymer solution to flow into the feed tank. If the feed tank is full, the polymer will remain in the mix and age tank until there is space available in the feed tank, at a level of 0.25 meters.

The polymer flows from the feed tank (W250/260) to the polymer feed pumps via a valved line (W250/260-HV).

5.2 Control Description

5.2.1 Remote Manual Control Mode – Polymer Batch Feed Valve

In REMOTE MANUAL the feed valve position is set by the operator via the pop-up faceplate. This mode of control is used when a single batch train is in operation.

5.2.2 Remote Manual Control Mode – Polymer Batch Feed Valve

In REMOTE AUTOMATIC the feed valve for a batch system's opens automatically when either:

- The associated batch system's feed tank level is greater than the alternate batch systems feed tank level and the alternate feed valve is not open.
- The alternate batch system's tank level drops below 0.25 meters.

The polymer feed valve will close automatically when either:

- The batch system's associated feed tank level has dropped below 0.25 meters for 30 seconds; or
- The alternate batch system's feed valve has opened or 2 seconds.

5.2.3 Remote Automatic Control Mode – Dry Polymer Batch Sequence

The Dry Polymer Batch Sequence (DPBS) is used to make polymer automatically. For the DPBS to run the following associated equipment must have no faults:

- Blower
- Jetwet soleniod
- Screw
- Agitator
- Mixing tank valve
- Water pressure

The batch can be reset or paused by the operator at any time during the batch sequence.

Step 1 begins when all the following conditions are met:

- The associated mix and age tank low level signal has persisted for 180 seconds or longer.
- The associated system selection is on the Dry Polymer system.
- The associated DPBS is AUTO.
- The above equipment has not been in fault for 10 seconds or longer.
    - If a piece of equipment has faulted for longer than 10 seconds, the batch system is paused and will not move on to the next steps until the fault is cleared and the batch is resumed by the operator.
- The polymer batch system is ready (Step 6)

- The mix and age tank is not high (for at least 5 seconds) and the aging elapsed timer is has still not reached 200 minutes.

In Step1, the following associated equipment is started:

- Blower

Step 2 begins when all of the following conditions are met:

- The above equipment has not been in fault for 10 seconds or longer.
- The Blower is running.
- The Blower discharge pressure is normal.

In Step 2, the following associated equipment is started/kept running:

- Blower
- JetWet solenoid
- Rapid Fill valve is opened

Step 3 begins when the follow conditions have been met:

- The above equipment has not been in fault for 10 seconds or longer.
- The Blower discharge pressure is normal.
- The mixing tank level is below mid-tank level.
- The JetWet pressure is normal or the PCS has sent an open command to the Rapid Fill Valve.

In Step 3 the following associated equipment is started/kept running:

- Blower
- JetWet solenoid
- Screw
- Agitator
- Rapid Fill valve is closed

Step 4 begins after Step 3 has run for 35 minutes (Operator adjustable).

In Step 4, the following associated equipment is started/kept running:

- Blower
- JetWet soleniod
- Rapid Fill Valve is opened
- Agitator

In Step 4, the Screw is stopped.

Step 5 begins when the following conditions have been met:

- The above equipment has not been in fault for 10 seconds or longer.
- The mixing tank is full as measured by the mixing tank high level valve (for more than 5 seconds)
- The Agitator is running.

In Step 5, the following associated equipment is started/kept running:

- The Rapid Fill Valve and Jetwet soleniod is closed, blower shuts off
- Agitator

Step 5 is complete after it has run for 60 minutes (operator adjustable). The completion of Step 5 triggers Step 6.

Step 6 is an indicator that the polymer batch is ready and allows the mixing tank release valve to open. In REMOTE AUTOMATIC, the mixing tank release valve is opened when all of the following conditions are met:

- The associated polymer feed tank level is below 0.25 meters; and
- The associated dry polymer batch process is in the ready step (step 6)

The batch mode can be set to automatic, one more batch, or off. In automatic, new batches are produced as the mix and age tank is emptied. In one more batch mode, another batch is sequences when the mix and age tank is emptied. After the next batch is complete the batch mode is automatically switched to off. In off mode the batch sequence is not started.

5.2.4 Local Manual Control Mode – General

The monorail crane is equipped with LOCAL MANUAL control. The crane is operated using a remote with STOP, UP, DOWN, EAST, and WEST hand switches.

The dust collector is operated MANUALLY using a ON/OFF switch (W224-HS2).

5.2.5 Interlocks, Permissives, and Control Signals

5.2.5.1 Polymer Screw Feeders (W210/W220-PSF)

For Polymer Screw Feeders (W210/W220-PSF) to operate in REMOTE mode:

Equipment	Device Description	Device Tag	State
PCS		WA-W210/220-MN	Start Command
Polymer Screw Feeder (W210/W220-PSF)	Lock off stop hand switch	W210/220-HS-1	Normal

5.2.5.2 Pneumatic Blowers (W212/222-POB)

For Pneumatic Blowers (W212/222-POB) to operate in REMOTE mode:

Equipment	Device Description	Device Tag	State
PCS		WA-W212/222-MN	Start Command
Pneumatic Blower (W212/222-POB)	Lock off stop hand switch	W212/222-HS-1	Normal

5.2.6 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Feed Pump Valve (W250/260-HV)	Open Command	WA-W250/260-VD	Digital Output
Jetwet PW Valve (W233/243-FV)	Open Command	WA-W233/243-VD	Digital Output
Mixer (W230/240-POM)	Start Command	WA-W230/240-MN	Digital Output
Mixing Tank Valve (W232/242-HV)	Open Command	WA-W232/242-VD	Digital Output
Pneumatic Blower (W212/222-POB)	Start Command	WA-W212/222-MN	Digital Output

Polymer Screw Feeder (W210/W220-PSF)	Start Command	WA-W210/220-MN	Digital Output
Rapid Fill Valve (W234/244-FV)	Open Command	WA-234/244-VD	Digital Output
Feed Pump Valve (W250/260-HV)	Open status	WA-W250/260-ZD	Digital Input
Feed Pump Valve (W250/260-HV)	Closed status	WA-W250/260-ZB	Digital Input
Feed Tank 1/2 (W250/260)	Low tank level	WA-W250/260-LL	Digital Input
Jetwet PW Valve (W233/243-FV)	Discharge pressure	WA-W233/243-PL	Digital Input
Mix & Age Tank 1/2 (W230/240)	High high tank level alarm	WA-W235/245-LA	Digital Input
Mix & Age Tank 1/2 (W230/240)	High tank level	WA-W235/245-LH	Digital Input
Mix & Age Tank 1/2 (W230/240)	Mid tank level	WA-W235/245-LX	Digital Input
Mix & Age Tank 1/2 (W230/240)	Low tank level	WA-W235/245-LL	Digital Input
Mixer (W230/240-POM)	Run status	WA-W230/240-MM	Digital Input
Mixing Tank Valve (W232/242-HV)	Open status	WA-W232/242-ZD	Digital Input
Mixing Tank Valve (W232/242-HV)	Closed status	WA-W232/242-ZB	Digital Input
Pneumatic Blower (W212/222-POB)	Run status	WA-W212/222-MM	Digital Input
Pneumatic Blower (W212/222-POB)	Discharge pressure	WA-W212/222-PL	Digital Input
Polymer Screw Feeder (W210/W220-PSF)	Run status	WA-W210/220-MM	Digital Input
Potable Water Piping	Pressure status	WA-W270-PC	Digital Input
Dry Polymer Storage Tank (W210/220)	Low level alarm	WA-W214/224-LA	Analog Input
Feed Tank 1/2 (W250/260)	Tank level status	WA-W250/260-LT	Analog Input

5.2.7 HMI Display

Device Description	**Status**
Dry Polymer Storage Tank (W210/220)	Dry polymer storage tank level (Normal/Low)
Feed Pump Valve (W250/260-HV)	Feed valve open/closed status
Feed Tank 1/2 (W250/260)	Feed tank level (m)
Feed Tank 1/2 (W250/260)	Feed tank level (Low)
Jetwet PW Valve (W233/243-FV)	Jetwet pressure (Normal/Low)
Jetwet PW Valve (W233/243-FV)	Jetwet PW valve open/closed status
Mix & Age Tank 1/2 (W230/240)	Mix and age set time (min)
Mix & Age Tank 1/2 (W230/240)	Mix & age tank level
Mix & Age Tank 1/2 (W230/240)	Mix & age tank high level alarm
Mixer (W230/240-POM)	Mix and age run time (min)
Mixer (W230/240-POM)	Mixer run status
Mixing Tank Valve (W232/242-HV)	Mixing tank valve open/closed status
Pneumatic Blower (W212/222-POB)	Pneumatic blower run status
Pneumatic Blower (W212/222-POB)	Pneumatic blower pressure (Normal/Low)
Polymer Screw Feeder (W210/W220-PSF)	Screw feeder run status
Polymer system 1/2	System status (Normal/Alarm)
Polymer system 1/2	System status (Auto/One)
Polymer system 1/2	System selection (Dry/Liquid)
Polymer system 1/2	System control (On/Hold)
Polymer system 1/2	Batch reset (Reset/Run)
Polymer system 1/2	Dry batch status
Polymer system 1/2	Dry feed set time (min)
Polymer system 1/2	Dry feed run time (min)

Polymer system 1/2	Polymer concentration (%V)
Potable Water Piping	Potable water pressure
Rapid Fill Valve (W234/244-FV)	Rapid fill valve open/closed status

5.2.8 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Polymer system 1/2	General alarm	WA-W215/225-QF in alarm	Alarm notification
Mix & Age Tank 1/2 (W230/240)	Tank high level alarm	WA-W235/245-LA in alarm	Alarm notification
Dry Polymer Storage Tank (W210/220)	Tank low level alarm	WA-W214/224-LA in alarm	Storage tank is refilled

6. POLYMER FEED PUMPS

Associated P&ID: 1-0101W-A0302, 1-0101W-A0303, 1-0101W-A0304
Associated NEWPCC Manuals: DW501 - DW509
Associated DCS HMI Screens: nwcnt1.G, nwcnt1md.G, nwcnt2.G, nwcnt2md.G, nwcnt3.G, nwcnt3md.G, nwcnt4.G, nwcnt4md.G, nwcnt5.G, nwcnt5md.G, nwcnt6.G, nwcnt6md.G, nwsumry.G

6.1 Process Description

Polymer flows into a common suction header from Feed Tank 1 via valve W250-HV and Feed Tank 2 via valve W260-HV. The suction hearer has an isolation valve to allow both Polymer systems to run with system 1 only feeding centrifuges 1, 2, and 3 as well as system 2 only feeding centrifuges 4, 5, and 6. From the suction header, the polymer is pumped by the polymer feed pumps (W111/121/131/141/151/161-POF) through an inline mixer and into the centrifuges.

Each centrifuge has a dedicated polymer feed pump:
- Polymer feed pump W111-POF services Centrifuge 1
- Polymer feed pump W121-POF services Centrifuge 2
- Polymer feed pump W131-POF services Centrifuge 3
- Polymer feed pump W141-POF services Centrifuge 4
- Polymer feed pump W151-POF services Centrifuge 5
- Polymer feed pump W161-POF services Centrifuge 6

6.2 Control Description

6.2.1 Local Manual Control Mode

Each polymer feed pump is controlled through a computer/off/hand switch (W111/121/131/141/151/161-HS-2) at FDP- W5 in electrical room. The pump is operated in LOCAL (MANUAL) mode when the switch is set to OFF or HAND. Setting W111/121/131/141/151/161-HS-2 to the HAND position allows for MANUAL speed control using the pump's potentiometer (W111/121/131/141/151/161-HC). The pump can be set to run at a constant speed by setting the COMPUTER/OFF/BYPASS hand switch (W111/121/131/141/151/161-HS) to BYPASS. In BYPASS mode, the pump will run at full speed.

6.2.2 Remote Manual Control Mode

The pump is operated REMOTELY by the PCS when W111/121/131/141/151/161-HS-2 is set to COMPUTER. The pumps will only operate when either polymer feed tank valve is open and the feed tank level is not below 0.25 meters for 30 seconds.

The polymer pumps are started manually via the pop-up faceplate and the speed can be set manually or controlled by the below automatic speed control logic.

6.2.3 Remote Automatic Control Mode

The polymer pumps cannot be automatically started, the pumps need to be started manually. The pumps will only operate when either polymer feed tank valve is open and the feed tank level is not below 0.25 meters for 30 seconds. The pumps can be switched to Remote Automatic and run when the tank valve and level conditions are met.

The polymer pumps will stop in REMOTE AUTOMATIC if any of the following conditions occur:

- The associated cake pump is not running.
- The associated Centrifuge is not is remote.
- The associated Centrifuge is running in low speed (delta) mode and the speed has reached 2480 RPM. This is a latched state that will remain acceptable until the Centrifuge Stop signal is received.
- The cake pump has faulted.
- Cake hopper level is above 2.65 meters.
- No polymer tanks meet these requirements:
    - The polymer feed tank valve is open
    - The feed tank level is below 0.25 meters for 30 second

The polymer pump speed can be controlled by one of two automatic control strategies, DOSAGE or RATIO mode.

In DOSAGE mode, the operator sets a constant polymer dosage (Minimum = 0 g/s; Maximum = 5 g/s; Initial = 1.59 g/s) for the sludge entering the centrifuge. The pump speed modulates to supply this amount.

In RATIO mode the polymer pump speed is controlled to be flow paced to the digested sludge flow (Minimum = 0 g/ kg; Maximum = 20 g/kg; initial = 6.5 g/kg).

Ratio mode feedback formula:
P1 = Polymer Flow * (10 * Polymer Concentration)
D1 = 1000 / (Digested Sludge Flow to Centrifuge * (10 * Transfer Digested Sludge Density))
Process Value = P1 / D1

Polymer feed pump PID parameters:
Minimum speed = 10%
Maximum speed = 100%

The polymer concentration used in the polymer pump control is manually input by the operator (Min = 0.00%; Maximum = 0.50%).

6.2.4 Interlocks, Permissives, and Control Signals

For Polymer Feed Pump (W111/121/131/141/151/161-POF) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Computer/hand hand switch	W111/121/131/141/151/161-HS-2 (COH)	Hand
Local Control Panel	Under/over voltage breaker trip overload	W111/121/131/141/151/161-MF	Normal
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Lock off stop hand switch	W111/121/131/141/151/161-HS-1	Normal
Local Control Panel	Speed control	W111/121/131/141/151/161-HC	Speed set*
Local Control Panel	VFD bypass	W111/121/131/141/151/161-HS-4 (COB)	Speed control bypassed*

** Only one of these conditions is necessary for operation*

For Polymer Feed Pump (W111/121/131/141/151/161-POF) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		WA-W111/121/131/141/151/161-MN	Start command
Local Control Panel	Computer/hand hand switch	W111/121/131/141/151/161-HS-2 (COH)	Computer
PCS		WA- W111/121/131/141/151/161-SC	Speed set
Local Control Panel	Under/over voltage breaker trip overload	W111/121/131/141/151/161-MF	Normal
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Lock off stop hand switch	W111/121/131/141/151/161-HS-1	Normal

6.2.5 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Start command	WA-W111/121/131/141/151/161-MN	Digital Output
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Stop command	WA-W111/121/131/141/151/161-MO	Digital Output
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Speed control	WA- W111/121/131/141/151/161-SC	Analog Output
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Run status	WA-W111/121/131/141/151/161-MM	Digital Input
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Computer/hand status	WA-W111/121/131/141/151/161-YS	Digital Input
Polymer Feed Pump (W111/121/131/141/151/161-POF)	High discharge pressure alarm	WA-W111/121/131/141/151/161-QF	Digital Input
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Speed	WA-W111/121/131/141/151/161-ST	Analog Input

Magnetic Flowmeter (W013/023/033/043/053/063-FE)	Discharge flow rate	WA-W013/023/033/043/053/063-FT	Analog Input

6.2.6 HMI Display

Device Description	Status
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Pump run status
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Pump computer/hand status
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Dosage mode off/on status
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Polymer flow setpoint (g/s)
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Polymer flow process value (g/s)
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Ratio mode off/on status
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Polymer mass setpoint (kg/T)
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Polymer mass process value (kg/T)
Polymer Feed Pump (W111/121/131/141/151/161-POF)	Polymer mass setpoint as flowrate (g/s)
Magnetic Flowmeter (W013/023/033/043/053/063-FE)	Polymer flowrate (L/s)
Magnetic Flowmeter (W013/023/033/043/053/063-FE)	Polymer flowrate (Normal/Low)

6.2.7 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Magnetic Flowmeter (W013/023/033/043/053/063-FE)	Low polymer flow	Polymer flow below 0.2 L/S while Centrifuge is on	Alarm Notification

7. CENTRIFUGE SYSTEM

Associated P&ID: 1-0101W-A0305, 1-0101W-A0306, 1-0101W-A0307, 1-0101W-A0308, 1-0101W-A0309, 1-0101W-A0310, 1-0101W-A0311, 1-0101W-A0312, 1-0101W-A0313
Associated NEWPCC Manuals: DW401 – DW415
Associated DCS HMI Screens: nwcnt1.G, nwcnt1md.G, nwcnt2.G, nwcnt2md.G, nwcnt3.G, nwcnt3md.G, nwcnt4.G, nwcnt4md.G, nwcnt5.G, nwcnt5md.G, nwcnt6.G, nwcnt6md.G, nwsumry.G

7.1 Process Description

Each centrifuge has its own dedicated equipment:

Centrifuge		Main Drive Motor	Back Drive Motor	Oil Lube Pump	Flushing Water Valve	Cake Hopper
#	Tag					
1	W112-CE	W112-MCE	W113-BD	W114-LOP	W011-HV	W018
2	W122-CE	W122-MCE	W123-BD	W124-LOP	W021-HV	W028
3	W132-CE	W132-MCE	W133-BD	W134-LOP	W031-HV	W038
4	W142-CE	W142-MCE	W143-BD	W144-LOP	W041-HV	W048
5	W152-CE	W152-MCE	W153-BD	W154-LOP	W051-HV	W058
6	W162-CE	W162-MCE	W163-BD	W164-LOP	W061-HV	W068

The main drive motor (W112/122/132/142/152/162-MCE) is used to spin the centrifuge bowl. The back-drive motor (W113/123/133/143/153/163-BD) operates the centrifuge's screw conveyor. Due to the vibration caused by the centrifugal process, the centrifuges are supported by bearings and spring vibration isolators. Each centrifuge has an oil lube pump (W114/124/134/144/154/164-LOP) to lubricate the centrifuge's bearings.

Polymer and sludge flows from the polymer (W111/121/131/141/151/161-POF) and sludge (W110/120/130/140/150/160-SFP) feed pumps through a stationary feed pipe that extends into the hollow shaft of the centrifuge's rotating screw conveyor. Flushing water may be added via a valved line (W011/021/031/041/051/061-HV) to clean the centrifuge. The sludge exits the conveyor shaft through ports and pools in the rotating bowl of the centrifuge.

The sludge solids are spun out and settle on the bowl wall. The screw conveyor pushes the sludge solids across the centrifuge and up the beaching incline to the outlet ports, depositing the sludge solids in the cake hopper (W018/028/038/048/058/068). The moisture content of the cake is determined by the screw conveyor speed.

The remaining centrate drains back into the centrifuge bowl's pool. Excess centrate is discharged via weirs in the bowl end.

7.2 Control Description

7.2.1 Local Manual Control Mode – Flushing Water Valves

The flushing water valves (W011/021/031/041/051/061-HV) can operate in LOCAL MANUAL mode. In MANUAL mode, the valve can be opened (W011/021/031/041/051/061-HS-2) or closed (W011/021/031/041/051/061-HS-3) using hand switches in the Dewatering control room panel.

7.2.2 Local Automatic Control Mode – Flushing Water Valves

In LOCAL AUTOMATIC mode, the valve position is controlled through the Centrifuge PLC. The position of each flushing water valve is monitored through the PCS.

7.2.3 Remote Automatic Control Mode – Centrifuge Sequence

The centrifuge system is controlled REMOTELY through the PCS. The PCS communicates with the centrifuge system equipment through the Centrifuge PLC.

The following conditions are all required for the Centrifuge AUTOMATIC START signal:

- Any sludge transfer pumps (W350/360-DSP) is running (WA-W350/360-MM) or in COMPUTER mode (WA-W350/360-YS)
- The centrifuge is in COMPUTER mode (WB-W895-YC)
- Any polymer feed valve is open (WA-W250/260-ZD) and the feed tank level is not low (WA-W252/262-LT)
-
-
- The centrifuge has not faulted

When the Centrifuge is called to START in AUTOMATIC mode the following occurs:

- The oil cooler is started.

- The oil cooler will remain on until 15 seconds after the Centrifuge is stopped or the Centrifuge stop signal is received.
- Once the oil cooler has been running for 15 seconds, the Centrifuge main motor drive starts.
  - The main motor drive will run until one of the following conditions is met:
    - The Centrifuge is stopped
    - The oil cooler stops running.
    - The Centrifuge alarm input is triggered.
- Once the oil cooler has been running for 15 seconds, the general back drive alarms are reset.

The Centrifuge AUTOMATIC STOP signal occurs when the operator sets the Centrifuge to stop.

When the Centrifuge is called to STOP in AUTOMATIC mode the following occurs:

- The associated sludge cake pump is stopped
  - The speed control is tracked by the PCS 30 seconds after the centrifuge call to stop
  - The speed control is transferred to MANUAL 30 seconds after the centrifuge call to stop
- The associated polymer pump is stopped
  - The speed control is tracked by the PCS 30 seconds after the centrifuge call to stop
- The back drive motor speed control is tracked by the PCS 20 seconds after the centrifuge call to stop
- The back drive motor speed control is transferred to MANUAL 20 seconds after the centrifuge call to stop
- The oil cooler has run its preset duration.

7.2.4 Remote Automatic Control Mode – Centrifuge Main Drive Motor (W112/122/132/142/152/162-MCE)

The main drive motor has a wye-delta starter. The PCS sends a START command (WB-W112/122/132/142/152/162-MN) to the Centrifuge PLC. The Centrifuge PLC then sends separate signals to the 1M, 2M, and S contactors. To start the main drive motor, the PLC will close the 1M and 2M contactors. Once the motor has reached 80% speed, the S contactor closes and the 2M contactor opens, supplying the motor with the voltage required to run at full speed. The main drive motor will automatically stop if the overload relay trips (W112/122/132/142/152/162-UY).

7.2.5 Remote Automatic Control Mode – Centrifuge Back Drive Motor (W113/123/133/143/153/163-BD)

The PCS receives the current speed of the back drive motor from the PLC and uses a PID loop to maintain the back drive motor at constant speed. (Minimum speed = 0 RPM, Maximum speed = 2350 RPM). The centrifuge back drive motor control is switched to constant torque when the speed torque station is in cascade mode . The PCS receives the current torque of the back drive motor from the PLC and uses a PID loop to maintain the back drive motor at constant torque. (Minimum speed = 0 N-m, Maximum speed = 160 N-m).

7.2.6 Interlocks, Permissives, and Control Signals

7.2.6.1 Flushing Water Valve (W011/021/031/041/051/061-HV)

For Flushing Water Valve (W011/021/031/041/051/061-HV) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Control Room Panel	Open hand switch	W011/021/031/041/051/061-HS-2 (OPN)	Open
Control Room Panel	Computer/hand hand switch	W011/021/031/041/051/061-HS-1 (C/H)	Hand

For Flushing Water Valve (W011/021/031/041/051/061-HV) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
Centrifuge PLC		W011/021/031/041/051/061-VD	Open command
Control Room Panel	Computer/hand hand switch	W011/021/031/041/051/061-HS-1 (C/H)	Computer

7.2.6.2 Main Drive Motor (W112/122/132/142/152/162-MCE)

For Main Drive Motor (W112/122/132/142/152/162-MCE) to operate:

Equipment	Device Description	Device Tag	State
PCS		WB-W112/122/132/142/152/162-MN	Start command
Centrifuge PLC		W112/122/132/142/152/162-MN-1	1M contactor (wye & delta) start command
Centrifuge PLC		W112/122/132/142/152/162-MN-2	2M contactor (delta) start command
Centrifuge PLC		W112/122/132/142/152/162-MN-3	S contactor (wye) start command
Main Drive Motor (W112/122/132/142/152/162-MCE)	Lock off stop hand switch	W112/122/132/142/152/162-HS-1 (LOS)	Normal

7.2.6.3 Back Drive Motor (W113/123/133/143/153/163-BD)

For Back Drive Motor (W113/123/133/143/153/163-BD) to operate:

Equipment	Device Description	Device Tag	State
Centrifuge PLC		W113/123/133/143/153/163-MN	Start command
Centrifuge PLC		W113/123/133/143/153/163-SC	Speed command
Back Drive Motor (W113/123/133/143/153/163-BD)	Lock off stop hand switch	W113/123/133/143/153/163-HS-1 (LOS)	Normal

7.2.6.4 Oil Lube Pump (W114/124/134/144/154/164-LOP)

For Oil Lube Pump (W114/124/134/144/154/164-LOP) to operate:

Equipment	Device Description	Device Tag	State
PCS		WB-W114/124/134/144/154/164-MN	Start command

Centrifuge PLC		W114/124/134/144/154/164-MN	Start command

7.2.7 Inputs and Outputs

7.2.7.1 Centrifuge PLC Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
PCS	Right bearing temperature	W801/821/841/861/881/901-TA	Digital Output
PCS	Left bearing temperature	W804/824/844/864/884/904-TA	Digital Output
PCS	Centrifuge vibration	W805/825/845/865/885/905-XI	Digital Output
PCS	Back drive motor high torque alarm	W113/123/133/143/153/163-OAH	Digital Output
PCS	Back drive motor run status	W113/123/133/143/153/163-MM	Digital Output
PCS	System computer/local status	W815/835/855/875/895/915-HC	Digital Output
PCS	CIP Forward	W816/836/856/876/896/916-XX	Digital Output
PCS	CIP Reverse	W817/837/857/877/897/916-XX	Digital Output
Main Drive Motor (W112/122/132/142/152/162-MCE)	1M contactor (wye & delta) start command	W112/122/132/142/152/162-MN-1	Digital Output
Main Drive Motor (W112/122/132/142/152/162-MCE)	2M contactor (delta) start command	W112/122/132/142/152/162-MN-2	Digital Output
Main Drive Motor (W112/122/132/142/152/162-MCE)	S contactor (wye) start command	W112/122/132/142/152/162-MN-3	Digital Output
Horn, PCS	Common alarm	W811/831/851/871/891/911-QA	Digital Output
Flushing Water Valve (W011/021/031/041/051/061-HV)	Open command	W011/021/031/041/051/061-VD	Digital Output
Oil Lube Pump (W114/124/134/144/154/164-LOP)	Oil lube pump start command	W114/124/134/144/154/164-MN	Digital Output
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor start command	W113/123/133/143/153/163-MN	Serial Output
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor stop command	W113/123/133/143/153/163-MO	Serial Output
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor speed command	W113/123/133/143/153/163-SC	Serial Output
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor alarm	W113/123/133/143/153/163-QX	Serial Output
PCS	Alarm reset command	W811/831/851/871/891/911-QX	Digital Input
PCS	Alarm silence command	W811/831/851/871/891/911-QS	Digital Input
PCS	Main drive motor start command	W112/122/132/142/152/162-MN	Digital Input

PCS	Main drive motor stop command	W112/122/132/142/152/162-MO	Digital Input
PCS	Back drive motor increase speed command	W113/123/133/143/153/163-SD	Digital Input
PCS	Back drive motor decrease speed command	W113/123/133/143/153/163-SB	Digital Input
PCS	Oil lube pump start command	W114/124/134/144/154/164-MN	Digital Input
PCS	Oil lube pump stop command	W114/124/134/144/154/164-MO	Digital Input
Main Drive Motor (W112/122/132/142/152/162-MCE)	High current alarm	W112/122/132/142/152/162-UA	Digital Input
Main Drive Motor (W112/122/132/142/152/162-MCE)	1M contactor (wye & delta) run status	W112/122/132/142/152/162-MM-1	Digital Input
Main Drive Motor (W112/122/132/142/152/162-MCE)	2M contactor (delta) run status	W112/122/132/142/152/162-MM-2	Digital Input
Main Drive Motor (W112/122/132/142/152/162-MCE)	S contactor (wye) run status	W112/122/132/142/152/162-MM-3	Digital Input
Oil Lube Pump (W114/124/134/144/154/164-LOP)	Oil lube pump run status	W114/124/134/144/154/164-MM	Digital Input
Oil Lube Pump (W114/124/134/144/154/164-LOP)	Oil lube pump overload alarm	W114/124/134/144/154/164-IA	Digital Input
Oil Lube Pump (W114/124/134/144/154/164-LOP)	Oil lube pump flow switch	W114/124/134/144/154/164-FS	Digital Input
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Centrifuge bowl speed	W806/826/846/866/886/906-SI	Analog Input
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Centrifuge vibration	W805/825/845/865/885/905-XI	Analog Input
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Bearing temperature	W804/824/844/864/884/904-TI	Analog Input
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Bearing temperature	W801/821/841/861/881/901-TI	Analog Input
Main Drive Motor (W112/122/132/142/152/162-MCE)	Motor high temperature alarm	W803/823/843/863/883/903-TAH	Analog Input
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor run status	W113/123/133/143/153/163-MM	Serial Input
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor speed	W113/123/133/143/153/163-SI	Serial Input
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor fault	W113/123/133/143/153/163-QA	Serial Input
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor torque	W113/123/133/143/153/163-OI	Serial Input

7.2.7.2 PCS Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Centrifuge PLC	Alarm reset command	WB-W811/831/851/871/891/911-QX	Digital Output
Centrifuge PLC	Alarm silence command	WB-W811/831/851/871/891/911-QS	Digital Output
Centrifuge PLC	Main drive motor start command	WB-W112/122/132/142/152/162-MN	Digital Output
Centrifuge PLC	Main drive motor stop command	WB-W112/122/132/142/152/162-MO	Digital Output
Centrifuge PLC	Back drive motor increase speed command	WB-W113/123/133/143/153/163-SD	Digital Output
Centrifuge PLC	Back drive motor decrease speed command	WB-W113/123/133/143/153/163-SB	Digital Output
Centrifuge PLC	Oil lube pump start command	WB-W114/124/134/144/154/164-MN	Digital Output
Centrifuge PLC	Oil lube pump stop command	WB-W114/124/134/144/154/164-MO	Digital Output
Centrifuge PLC	Right bearing temperature	WB-W801/821/841/861/881/901-TA	Digital Input
Centrifuge PLC	Left bearing temperature	WB-W804/824/844/864/884/904-TA	Digital Input
Centrifuge PLC	Centrifuge vibration	WB-W805/825/845/865/885/905-XA	Digital Input
Centrifuge PLC	Back drive motor high torque alarm	WB-W112/122/132/142/152/162-OA	Digital Input
Centrifuge PLC	Back drive motor run status	WB-W111/121/131/141/151/161-MM	Digital Input
Centrifuge PLC	System computer/local status	WB-W815/835/855/875/895/915-HC	Digital Input
Centrifuge PLC	Clean In Place Forward	WB-W816/836/856/876/896/916-XX	Digital Input
Centrifuge PLC	Clean In Place Reverse	WB-W817/837/857/877/897/916-XX	Digital Input
Main Drive Motor (W112/122/132/142/152/162-MCE)	Main drive motor wye (start) status	WB-W112/122/132/142/152/162-MX	Digital Input
Main Drive Motor (W112/122/132/142/152/162-MCE)	Main drive motor delta (run) status	WB-W112/122/132/142/152/162-MM	Digital Input
Oil Lube Pump (W114/124/134/144/154/164-LOP)	Oil lube pump run status	WB-W114/124/134/144/154/164-MM	Digital Input
Flushing Water Valve (W011/021/031/041/051/061-HV)	Valve open status	WB-W011/021/031/041/051/061-ZD	Digital Input

Flushing Water Valve (W011/021/031/041/051/061-HV)	Valve closed status	WB-W011/021/031/041/051/061-ZB	Digital Input
Flushing Water Valve (W011/021/031/041/051/061-HV)	Valve computer/hand status	WB-W011/021/031/041/051/061-YS	Digital Input
Main Drive Motor (W112/122/132/142/152/162-MCE)	Main drive motor current	WB-W112/122/132/142/152/162-IT	Analog Input
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor speed (RPM)	WB-W113/123/133/143/153/163-ST	Analog Input
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor torque	WB-W113/123/133/143/153/163-OI	Analog Input
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Centrifuge bowl speed	WB-W806/826/846/866/886/906-ST	Analog Input

7.2.8 HMI Display

Device Description	**Status**
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor speed (RPM)
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor torque (Nm)
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor torque (Normal/High)
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Centrifuge bowl run status
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Centrifuge reset
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Centrifuge vibration (mils)
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Centrifuge vibration (Normal/High)
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Right bearing temperature (°C)
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Right bearing temperature (Normal/High)
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Left bearing temperature (°C)
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Left bearing temperature (Normal/High)
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Centrifuge speed (RPM)
Centrifuge system 1/2/3/4/5/6	Centrifuge auto/hand status
Centrifuge system 1/2/3/4/5/6	CIP On/Off status
Centrifuge system 1/2/3/4/5/6	General reset
Centrifuge system 1/2/3/4/5/6	General status (Normal/Alarm)
Centrifuge system 1/2/3/4/5/6	Acknowledge horn (Reset)
Centrifuge system 1/2/3/4/5/6	Last grease hours (hrs)
Centrifuge system 1/2/3/4/5/6	Grease status (Normal)
Centrifuge system 1/2/3/4/5/6	Hours run (hrs)
Centrifuge system 1/2/3/4/5/6	Hours since last start (hrs)
Centrifuge system 1/2/3/4/5/6	CIP status (hrs)
Centrifuge system 1/2/3/4/5/6	CIP run hours (hrs)
Centrifuge system 1/2/3/4/5/6	CIP direction (Forwards/Reverse)
Centrifuge system 1/2/3/4/5/6	Total run hours (hrs)
Flushing Water Valve (W011/021/031/041/051/061-HV)	Flushing water valve status (Open/Closed)
Main Drive Motor (W112/122/132/142/152/162-MCE)	Main drive start (wye) status

Main Drive Motor (W112/122/132/142/152/162-MCE)	Main drive run (delta) status
Main Drive Motor (W112/122/132/142/152/162-MCE)	Motor DE bearing temperature
Main Drive Motor (W112/122/132/142/152/162-MCE)	Motor ODE bearing temperature
Main Drive Motor (W112/122/132/142/152/162-MCE)	Motor winding 1 temperature
Main Drive Motor (W112/122/132/142/152/162-MCE)	Motor winding 2 temperature
Main Drive Motor (W112/122/132/142/152/162-MCE)	Motor current draw (Amp)
Oil Lube Pump (W114/124/134/144/154/164-LOP)	Oil lube pump run status
Oil Lube Pump (W114/124/134/144/154/164-LOP)	Oil lube pump overload alarm

7.2.9 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Oil Lube Pump (W114/124/134/144/154/164-LOP)	Oil lube pump overload alarm	811/821/831/841/851/861-WBE-45 in alarm	Centrifuge system taken out of service
Centrifuge system 1/2/3/4/5/6	General alarm	116/126/136/146/156/166-WSP-19 in alarm	Centrifuge system taken out of service
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Right bearing high temperature alarm	WB-W801/821/841/861/881/901-TA in alarm	Centrifuge system taken out of service
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Left bearing high temperature alarm	WB-W804/824/844/864/884/904-TA in alarm	Centrifuge system taken out of service
Centrifuge 1/2/3/4/5/6 (W112/122/132/142/152/162-CE)	Centrifuge high vibration alarm	WB-W805/825/845/865/885/905-XA in alarm	Centrifuge system taken out of service
Back Drive Motor (W113/123/133/143/153/163-BD)	Back drive motor high torque alarm	WB-W112/122/132/142/152/162-OA in alarm	Centrifuge system taken out of service

8. SLUDGE CAKE SYSTEM

Associated P&ID: 1-0101D-A0315, 1-0101D-A0316, 1-0101D-A0317, 1-0101D-A0318, 1-0101D-A0319, 1-0101D-A0320
Associated NEWPCC Manuals: XXXX - XXXX Revised
Associated DCS HMI Screens: 1-0101W-A0308, 1-0101W-A0309, 1-0101W-A0310, 1-0101W-A0311, 1-0101W-A0312, 1-0101W-A0313

8.1 Process Description

Dewatered sludge from the centrifuges is deposited into the sludge cake hoppers. The sludge cake hopper agitator (W017/027/037/047/057/067-CA) directs the dewatered sludge towards the inlet of the sludge cake pump.

The sludge cake pump discharge is composed of thin sludge cake (TS) and thick sludge cake (CS). The TS is pumped through a valved line (W015/025/035/045/055/065-HV) to the Thin Sludge Header. From the header, the TS returns to holding tanks 6 and 8. The CS is pumped through a valved line (W016/026/036/046/056/066-HV) to the Cake Supply Header and transferred to the cake storage bins.

Sludge cake pumps 1, 3, and 5 discharge CS to the east cake storage bins, and sludge cake pumps 2, 4, and 6 discharge CS to the west cake storage bins.

The sludge cake pump has a hydraulic power pack with a main drive motor (W115/125/135/145/155/165-CAP, swash plate drive (W116/126/136/146/156/166-SWP), and oil reservoir. The hydraulic power pack is supplied with oil from the reservoir. The hydraulic powerpack pushes the oil to the cake pump. From the cake pump, the oil is discharged to the reservoir, where it is recirculated by a pump (W118/128/138/148/158/168-CCM) and fan-cooled (W117/127/137/147/157/167-AOC) .

8.2 Control Description

8.2.1 Local Manual Control Mode-Hopper Agitator

The cake hopper agitator can be controlled from a local control station W017/027/037/047/057/067-HS-3

8.2.2 Remote Automatic Control Mode – Hopper Agitator

The hopper agitator starts if the cake pump is running (WB-115/125/135/145/155/165-MM) and will stop is the cake pump stops.

8.2.3 Remote Automatic Control Mode – Cake Pump

The start signal is latched. The latch is reset if any of the following conditions are met:

- The main drive motor (see below) is not running for 30 seconds or more
- The PERM START (see below) signal is LOW for 30 seconds or more
- All of these three conditions are met:
  - The main drive motor is in COMPUTER (REMOTE) mode
  - The associated Centrifuge is requested to stop
  - The associated Cake Hopper level is less than 0.53999m for 30 seconds or more?

The main drive motor start signal occurs if the following conditions are met:

- The main drive motor is running or the PERM START (see below) signal is HIGH
- Either the associated thin sludge valve or thick sludge valve is open
- The associated centrifuge has not faulted
- Any of the cake storage bins have capacity and the valve is open
  - Sludge cake systems 1, 3, and 5 check the east storage bins and valves
  - Sludge cake systems 2, 4, and 6 check the east storage bins and valves

The PERM START signal occurs if the following conditions are met:

- Either the associated thin sludge valve or cake sludge valve is open
- Any of the cake storage bins valves is open
  - Sludge cake systems 1, 3, and 5 check the east storage bin valves
  - Sludge cake systems 2, 4, and 6 check the east storage bin valves

  The associated Centrifuge is running in low speed (delta) mode and the speed has reached 2480 RPM

The swash plate drive (W116/126/136/146/156/166-SWP) is controlled by the Sludge Cake System PLC. The PLC receives increase speed, decrease speed, and automatic/manual signals from the PCS. In REMOTE MANUAL mode, the PCS does not adjust the speed.

8.2.4 Remote Automatic Control Mode – Swash Plate Drive

In REMOTE AUTOMATIC mode, the swash plate runs to maintain a level in the hopper (Initial value: 10 strokes per minute; Low limit: 0 strokes per minute; High limit: 20 strokes per minute). The PCS compares the speed setpoint with the current speed of the swash plate drive. The PCS will send an increase or decrease speed signal (unit: percent per second) to the PLC if the difference between the setpoint and current speed is greater than the deadband limit of 0.5.

8.2.5 Remote Manual Control Mode – Cake Pump Discharge Thin Valve

The thin valve discharges the sludge to the holding tanks. In REMOTE MANUAL mode the thin valve (W016/026/036/046/056/066) position can be set by the pop-up faceplate.

8.2.6 Remote Automatic Control Mode – Cake Pump Discharge Thin Valve

The thin valve with open in AUTOMATIC REMOTE mode if any of the following occurs:

- The associated centrifuge backdrive control mode is in cascade and the differential torque targeting set point is either:
    - Above 20 Nm for longer than 30s
    - Below -15 Nm for longer than 30s
- The associated centrifuge is in either forward or reverse Clean in Place.
- The Sludge Cake Storage bins levels and valves are not okay (see below) for the Centrifuge's associated bins
    - Centrifuges 1, 3, 5 feed the East bins
    - Centrifuges 2, 4, 6 feed the West bins
- The associated cake pump has failed.

The Sludge Cake Storage bins and levels are okay for a side (West or East) if any of the Bins meet the following criteria on the respective side:

- The feed valve is for the respective side is open and both:
    - The bin weight is below 175 tonnes
    - The bin weight on the respective side is less than 105 tonnes, as calculated as the bin total weight proportional to the levels measures on each side.
        - Example for West side level: Bin weight x [level_west/(level_west+level_east)] < 105

The thin valve will automatically close when the associated thick valve opens.

8.2.7 Remote Manual Control Mode – Cake Pump Discharge Thick Valve

The thick valve discharges the sludge cake to the Sludge Cake Storage bins. In REMOTE MANUAL mode the thin valve (W015/025/035/045/055/065) position can be set by the pop-up faceplate.

8.2.8 Remote Automatic Control Mode – Cake Pump Discharge Thick Valve

The thick valve opens automatically in REMOTE AUTOMATIC mode if all of the conditions are met:

- The associated cake pump is running
- The associated centrifuge is running in Delta mode
- The associated centrifuge is running in automatic mode
- The discharge sludge feed flowmeter is measuring greater than 5 L/s.

The Sludge Cake Storage bins and levels are okay for a side (West or East) if any of the Bins meet the following criteria on the respective side:

- The feed valve is for the respective side is open and both:
  - The bin weight is below 175 tonnes
  - The bin weight on the respective side is less than 105 tonnes as calculated as the bin total weight proportional to the levels measures on each side.
    - Example for West side level: Bin weight x [level_west/(level_west+level_east)] < 105

Once the thick valve opens, it is latched open. The thick valve will close if any of the following conditions are met:

- The respective thin sludge valve is opened
- The associated centrifuge backdrive control mode is in cascade and the differential torque targeting set point is either:
  - Above 20 Nm for longer than 30s
  - Below -15 Nm for longer than 30s

8.2.9 Local Manual Control Mode – General

The oil circulation pump (W118/128/138/148/158/168-CCM) and fan (W117/127/137/147/157/167-AOC) are both controlled through HAND/OFF/AUTOMATIC switches (W118/128/138/148/158/168-HS-2 and W117/127/137/147/157/167-HS-2). In LOCAL MANUAL mode, the pump and fan are turned on by setting their respective H/O/A hand switch to HAND.

8.2.10 Local Automatic Control Mode – General

When the switch is set to AUTOMATIC, the pump and fan are interlocked to run with the main drive motor (LOCAL AUTOMATIC mode).

8.2.11 Interlocks, Permissives, and Control Signals

8.2.11.1 Hopper Agitator (W017/027/037/047/057/067-CA)

For Hopper Agitator (W017/027/037/047/057/067-CA) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Hopper Agitator (W017/027/037/047/057/067-CA)	Computer/hand hand switch	W017/027/037/047/057/067-HS-3 (C/H)	Hand
Hopper Agitator (W017/027/037/047/057/067-CA)	Forward/off/reverse hand switch	W017/027/037/047/057/067-HS-4 (FOR)	Forward/ Reverse
Hopper Agitator (W017/027/037/047/057/067-CA)	Lock off stop switch	W017/027/037/047/057/067-HS-1 (LOS)	Normal

For Hopper Agitator (W017/027/037/047/057/067-CA) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		WB-W017/027/037/047/057/067-MN-1	Start permit
PLC		W017/027/037/047/057/067-MN-2	Start command

Hopper Agitator (W017/027/037/047/057/067-CA)	Computer/hand hand switch	W017/027/037/047/057/067-HS-3 (C/H)	Computer
Hopper Agitator (W017/027/037/047/057/067-CA)	Forward/off/reverse hand switch	W017/027/037/047/057/067-HS-4 (FOR)	Forward/ Reverse
Hopper Agitator (W017/027/037/047/057/067-CA)	Lock off stop switch	W017/027/037/047/057/067-HS-1 (LOS)	Normal

8.2.11.2 Main Drive Motor (W115/125/135/145/155/165-CAP)

For Main Drive Motor (W115/125/135/145/155/165-CAP) to operate in LOCAL (MANUAL) mode:

Equipment	**Device Description**	**Device Tag**	**State**
Local Control Panel	Start hand switch	W115/125/135/145/155/165-HS-6 (START)	Start
Local Control Panel	Local/remote hand switch	W115/125/135/145/155/165-HS-5 (L/R)	Local
Main Drive Motor (W115/125/135/145/155/165-CAP)	Lock off stop hand switch	W115/125/135/145/155/165-HS-1 (LOS)	Normal

For Main Drive Motor (W115/125/135/145/155/165-CAP) to operate in REMOTE (COMPUTER) mode:

Equipment	**Device Description**	**Device Tag**	**State**
PCS		WB-W115/125/135/145/155/165-MN	Start command
PLC		W115/125/135/145/155/165-MN-1	Start command
Main Drive Motor (W115/125/135/145/155/165-CAP)	Lock off stop hand switch	W115/125/135/145/155/165-HS-1 (LOS)	Normal

8.2.11.3 Swash Plate Drive (W116/126/136/146/156/166-SWP)

For Swash Plate Drive (W116/126/136/146/156/166-SWP) to operate in LOCAL (MANUAL) mode:

Equipment	**Device Description**	**Device Tag**	**State**
Swash Plate Drive (W116/126/136/146/156/166-SWP)	High position switch	W116/126/136/146/156/166-ZSH	Position†
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Low position switch	W116/126/136/146/156/166-ZSL	Position‡

† *Interlock in increase speed control loop*
‡ *Interlock in decrease speed control loop*

For Swash Plate Drive (W116/126/136/146/156/166-SWP) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PLC		W116/126/136/146/156/166-MX-2	Increase speed command*
PLC		W116/126/136/146/156/166-MX-1	Decrease speed*
Swash Plate Drive (W116/126/136/146/156/166-SWP)	High position switch	W116/126/136/146/156/166-ZSH	Position†
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Low position switch	W116/126/136/146/156/166-ZSL	Position‡

* *Only one of these conditions is necessary for operation*
† *Interlock in increase speed control loop*
‡ *Interlock in decrease speed control loop*

8.2.11.4 Oil Circulation Pump (W118/128/138/148/158/168-CCM)

For Oil Circulation Pump (W118/128/138/148/158/168-CCM) to operate in HAND mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Hand/off/automatic hand switch	W118/128/138/148/158/168-HS-2	Hand
Oil Circulation Pump (W118/128/138/148/158/168-CCM)	Lock off stop hand switch	W118/128/138/148/158/168-HS-1	Normal

For Oil Circulation Pump (W118/128/138/148/158/168-CCM) to operate in AUTOMATIC mode:

Equipment	Device Description	Device Tag	State
Main Drive Motor (W115/125/135/145/155/165-CAP)	Main drive motor run status	W115/125/135/145/155/165-MM	On
Local Control Panel	Hand/off/automatic hand switch	W118/128/138/148/158/168-HS-2	Automatic
Oil Circulation Pump (W118/128/138/148/158/168-CCM)	Lock off stop hand switch	W118/128/138/148/158/168-HS-1	Normal

8.2.11.5 Oil Circulation Fan (W117/127/137/147/157/167-AOC)

For Oil Circulation Fan (W117/127/137/147/157/167-AOC) to operate in HAND mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Hand/off/automatic hand switch	W117/127/137/147/157/167-HS-2	Hand
Oil Circulation Fan (W117/127/137/147/157/167-AOC)	Lock off stop hand switch	W117/127/137/147/157/167-HS-1	Normal

For Oil Circulation Fan (W117/127/137/147/157/167-AOC) to operate in AUTOMATIC mode:

Equipment	Device Description	Device Tag	State
Main Drive Motor (W115/125/135/145/155/165-CAP)	Main drive motor run status	W115/125/135/145/155/165-MM	On
Local Control Panel	Hand/off/automatic hand switch	W117/127/137/147/157/167-HS-2	Automatic
Oil Circulation Fan (W117/127/137/147/157/167-AOC)	Lock off stop hand switch	W117/127/137/147/157/167-HS-1	Normal

8.2.12 Inputs and Outputs

8.2.12.1 PLC Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Hopper Agitator (W017/027/037/047/057/067-CA)	Agitator start command	W017/027/037/047/057/067-MN-2	Digital Output
Main Drive Motor (W115/125/135/145/155/165-CAP)	Motor start command	W115/125/135/145/155/165-MN-1	Digital Output
PCS	Main drive motor fault	W115/125/135/145/155/165-QF	Digital Output
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Load/Bypass	W116/126/136/146/156/166-XD	Digital Output
Cake Pump	Cake pump discharge high pressure alarm	W115/125/135/145/155/165-PAH-3	Digital Input
Hopper Agitator (W017/027/037/047/057/067-CA)	Agitator run status	W017/027/037/047/057/067-MM	Digital Input
Hydraulic Powerpack (W115/125/135/145/155/165)	Oil reservoir level	W115/125/135/145/155/165-LAL	Digital Input
Hydraulic Powerpack (W115/125/135/145/155/165)	Dirty oil filter alarm	W115/125/135/145/155/165-PAH-1	Digital Input
Hydraulic Powerpack (W115/125/135/145/155/165)	High pressure alarm	W115/125/135/145/155/165-PAH-2	Digital Input
Hydraulic Powerpack (W115/125/135/145/155/165)	Oil reservoir high temperature alarm	W115/125/135/145/155/165-TAH-2	Digital Input
Main Drive Motor (W115/125/135/145/155/165-CAP)	Hand control status	W115/125/135/145/155/165-HC-1	Digital Input
Main Drive Motor (W115/125/135/145/155/165-CAP)	Reset	W115/125/135/145/155/165-HY	Digital Input
Main Drive Motor (W115/125/135/145/155/165-CAP)	Motor run status	W115/125/135/145/155/165-MM-1	Digital Input
Main Drive Motor (W115/125/135/145/155/165-CAP)	High temperature alarm	W115/125/135/145/155/165-TAH-1	Digital Input
PCS	Agitator start permit	W017/027/037/047/057/067-MN-1	Digital Input
PCS	Main drive motor start command	W115/125/135/145/155/165-MN	Digital Input

Swash Plate Drive (W116/126/136/146/156/166-SWP)	Hand control status	W116/126/136/146/156/166-HC-1	Digital Input
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Decrease speed	W116/126/136/146/156/166-MX-1	Digital Input
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Increase speed	W116/126/136/146/156/166-MX-2	Digital Input
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Load/Bypass	W116/126/136/146/156/166-XD	Digital Input
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Load/Bypass 1	W116/126/136/146/156/166-XD-1	Digital Input
Sludge Cake Hopper (W018/028/038/048/058/068)	Hopper level	W018/028/038/048/058/068-LI	Analog Input
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Speed	W116/126/136/146/156/166-SI	Analog Input
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Speed setpoint	W116/126/136/146/156/166-SX	Analog Input

8.2.12.2 PCS Inputs and Outputs

Equipment	**Signal Description**	**Signal Tag**	**Signal Type**
Cake Sludge Valve (W015/025/035/045/055/065-HV)	Cake sludge valve close command	WB-W015/025/035/045/055/065-VB	Digital Output
Cake Sludge Valve (W015/025/035/045/055/065-HV)	Cake sludge valve open command	WB-W015/025/035/045/055/065-VD	Digital Output
PLC	Agitator start permit	WB-W017/027/037/047/057/067-MN	Digital Output
PLC	Main drive motor start command	WB-W115/125/135/145/155/165-MN	Digital Output
PLC	Main drive motor stop command	WB-W115/125/135/145/155/165-MO	Digital Output
Thin Sludge Valve (W016/026/036/046/056/066-HV)	Thin sludge valve close command	WB-W016/026/036/046/056/066-VB	Digital Output
Thin Sludge Valve (W016/026/036/046/056/066-HV)	Thin sludge valve open command	WB-W016/026/036/046/056/066-VD	Digital Output
Cake Sludge Valve (W015/025/035/045/055/065-HV)	Cake sludge valve computer/hand status	WB-W015/025/035/045/055/065-YS	Digital Input
Cake Sludge Valve (W015/025/035/045/055/065-HV)	Cake sludge valve closed status	WB-W015/025/035/045/055/065-ZB	Digital Input
Cake Sludge Valve (W015/025/035/045/055/065-HV)	Cake sludge valve open status	WB-W015/025/035/045/055/065-ZD	Digital Input
Hopper Agitator (W017/027/037/047/057/067-CA)	Agitator run status	WB-W017/027/037/047/057/067-MM	Digital Input
Main Drive Motor (W115/125/135/145/155/165-CAP)	Main drive motor run status	WB-W115/125/135/145/155/165-MM	Digital Input
Main Drive Motor (W115/125/135/145/155/165-CAP)	Main drive motor computer/hand status	WB-W115/125/135/145/155/165-YS	Digital Input

PLC	Main drive motor fault	WB-W115/125/135/145/155/165-QF	Digital Input
Thin Sludge Valve (W016/026/036/046/056/066-HV)	Thin sludge valve computer/hand status	WB-W016/026/036/046/056/066-YS	Digital Input
Thin Sludge Valve (W016/026/036/046/056/066-HV)	Thin sludge valve closed status	WB-W016/026/036/046/056/066-ZB	Digital Input
Thin Sludge Valve (W016/026/036/046/056/066-HV)	Thin sludge valve open status	WB-W016/026/036/046/056/066-ZD	Digital Input
Sludge Cake Hopper (W018/028/038/048/058/068)	Hopper level	WB-W018/028/038/048/058/068-LT	Analog Input
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Speed	WB-W116/126/136/146/156/166-ST	Analog Input

8.2.13 HMI Display

Device Description	Status
Cake Sludge Valve (W015/025/035/045/055/065-HV)	Thick sludge valve computer/hand status
Cake Sludge Valve (W015/025/035/045/055/065-HV)	Thick sludge valve open/closed status
Hydraulic Powerpack (W115/125/135/145/155/165)	Clogged oil filter alarm (Normal/Alarm)
Hydraulic Powerpack (W115/125/135/145/155/165)	Discharge pressure alarm (Normal/Alarm)
Hydraulic Powerpack (W115/125/135/145/155/165)	Oil pressure alarm (Normal/Alarm)
Hydraulic Powerpack (W115/125/135/145/155/165)	Oil temperature alarm (Normal/Alarm)
Hydraulic Powerpack (W115/125/135/145/155/165)	Schwing powerpack hydraulic pressure (PSI)
Main Drive Motor (W115/125/135/145/155/165-CAP)	Motor temperature alarm (Normal/Alarm)
Main Drive Motor (W115/125/135/145/155/165-CAP)	Schwing powerpack run status (On/Off)
Sludge Cake System 1/2/3/4/5/6	General alarm (Normal/Alarm)
Sludge Cake System 1/2/3/4/5/6	Major alarm (Normal/Alarm)
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Schwing powerpack load/bypass status
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Swash plate automatic/manual status
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Swash plate process value (Sk/m)
Swash Plate Drive (W116/126/136/146/156/166-SWP)	Swash plate setpoint (Sk/m)
Thin Sludge Valve (W016/026/036/046/056/066-HV)	Thin sludge valve computer/hand status
Thin Sludge Valve (W016/026/036/046/056/066-HV)	Thin sludge valve open/closed status

8.2.14 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Sludge Cake System 1/2/3/4/5/6	Major alarm	156WSP18 in alarm	Sludge Cake System taken out of service
Hydraulic Powerpack (W115/125/135/145/155/165)	Oil pressure	156WSP11 in alarm	Sludge Cake System taken out of service
Hydraulic Powerpack (W115/125/135/145/155/165)	Oil temperature	156WSP14 in alarm	Sludge Cake System taken out of service
Hydraulic Powerpack (W115/125/135/145/155/165)	Oil level	156WSP15 in alarm	Sludge Cake System taken out of service

Main Drive Motor (W115/125/135/145/155/165-CAP)	Motor temperature	156WSP16 in alarm	Sludge Cake System taken out of service
Hydraulic Powerpack (W115/125/135/145/155/165)	Discharge pressure	156WSP12 in alarm	Sludge Cake System taken out of service
Hydraulic Powerpack (W115/125/135/145/155/165)	Clogged oil filter	156WSP13 in alarm	Sludge Cake System taken out of service
Sludge Cake System 1/2/3/4/5/6	General alarm	156WSP19 in alarm	Sludge Cake System taken out of service
Sludge Cake System 1/2/3/4/5/6	High hopper level	WB-W018/028/038/048/058/068-LT is greater than 2.65m	Alarm Notrification

9. SLUDGE CAKE STORAGE

Associated P&ID: 1-0101D-A0321, 1-0101D-A0322, 1-0101D-A0323, 1-0101D-A0324, 1-0101D-A0325
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nearea9.G, asbin1lc.G, asbin2lc.G, asbin3lc.G

9.1 Process Description

The three sludge cake storage bins are partitioned into east and west sections. The transfer of CS to each bin partition is controlled using the sludge cake storage valves:

- Storage valve W410-HV controls CS transfer to Sludge Cake Storage Bin 1 East
- Storage valve W420-HV controls CS transfer to Sludge Cake Storage Bin 1 West
- Storage valve W430-HV controls CS transfer to Sludge Cake Storage Bin 2 East
- Storage valve W440-HV controls CS transfer to Sludge Cake Storage Bin 2 West
- Storage valve W450-HV controls CS transfer to Sludge Cake Storage Bin 3 East
- Storage valve W460-HV controls CS transfer to Sludge Cake Storage Bin 3 West

Sludge cake pumps 1, 3, and 5 pump CS through a common header to sludge cake storage valves W420-HV, W440-HV, W460-HV. Sludge cake pumps 2, 4, and 6 pump CS through a common header to sludge cake storage valves W410-HV, W430-HV, W450-HV.

Each bin partition has its own discharge system. Each discharge system is equipped with two augers (W412/422/432/442/452/462-SCA and W417/427/437/447/457/467-SCA) that deposit the CS onto the loadout truck via four chutes.

9.2 Control Description

The Autoloading PLC controls and sequences the Sludge Storage bins for filling and discharging. The PCS interfaces with the Autoloading PLC to interlock the Centrifuges with the bins and to allow the operator to monitor and control the bin states.

Each bin has a Fill Mode state. The fill mode can be set to:

- Online: the bin feed valves will automatically sequence to allow for filling the bin
- Offline: the bin feed valves will not automatically sequence

Each bin East and West side has a Discharge Mode. Discharge Modes can be set to:

- Online: This bin will be automatically sequenced to be discharged in turn with the other bins.
- Offline: This bin will not automatically discharge sludge

At any given time, each bin can only be in one of the following states:

- Idle: The bin is not filling or discharging.
- Fill: The bin is currently being filled.
- West Discharge: The bin is currently discharging the West side.
- East Discharge: The bin is currently discharge the East side.
- Out of Service: The bin is not automatically sequencing.

9.2.1 Local Manual Control Mode – Sludge Cake Storage Valves (W410/420/430/440/450/460-HV)

The sludge cake storage valves are operated in LOCAL and REMOTE modes. In LOCAL MANUAL mode, the valves are opened (W410/420/430/440/450/460-HS-2) and closed (W410/420/430/440/450/460-HS-3) using hand switches in the local control panel.

9.2.2 Local Manual Control Mode – Discharge Chute Valve 1/2/3/4 (W413/423/433/443/453/463-HV, 414/424/434/444/454/464-HV, 415/425/435/445/455/465-HV, 416/426/436/446/456/466-HV)

Truck must be under proper bin and chutes lowered before opening discharge valves. Associated truck bay emergency stop must be pulled out.Discharge chute valves 1, 2, 3 and 4 are operated in LOCAL and REMOTE modes. In LOCAL MANUAL mode at the panel, , the valves are operated using OPEN/CLOSE hand switch (W413/423/433/443/453/463-HS-2, 414/424/434/444/454/464-HS-2, 415/425/435/445/455/465-HS-2, and 416/426/436/446/456/466-HS-2)

9.2.3 Local Automatic Control Mode – Sludge Cake Storage Valves (W410/420/430/440/450/460-HV)

In LOCAL mode, the valves are operated through the Autoloading Upgrade PLC. The PCS tests the field inputs of the valve and will send either an automatic or manual command signal to the PLC based on the result.

9.2.4 Local Automatic Control Mode – Discharge Augers (W412/422/432/442/452/462/417/427/437/447/457/467-SCA)

The discharge augers are controlled through the Autoloading Upgrade PLC. The PCS receives the auger SCA.Running_Input and SCA.Manual_Command_Mode signals from the PLC. If the auger is in MANUAL mode and the auger is running, a MANUAL START signal is returned to the PLC. If the auger is not running, a MANUAL STOP signal is returned. The auger device driver in the PCS checks if the auger is in AUTOMATIC or MANUAL mode and returns the result to the PLC.

The PCS holds a memory of the discharge auger in-service status (W412/422/432/442/452/462/417/427/437/447/457/467_SCA.InService). The memory is updated every 5 seconds and provides the PLC feedback of the discharge auger in-service status (W412/422/432/442/452/462/417/427/437/447/457/467_SCA.InService_PB). If the discharge auger in-service signal from the PLC is HIGH, the PCS will return the memory of the in-service status to the PLC. If the signal is LOW, the PCS will return the memory of the in-service status to the PLC inverted.

9.2.5 Local Automatic Control Mode – Discharge Chute Valve 1/2/3/4 (W413/423/433/443/453/463-HV, 414/424/434/444/454/464-HV, 415/425/435/445/455/465-HV, 416/426/436/446/456/466-HV)

In LOCAL AUTOMATIC mode, the valves are operated through the Autoloading Upgrade PLC. The PCS tests the field inputs of the valve and will send either an automatic or manual command signal to the PLC based on the result.

9.2.6 Remote Manual Control Mode– Sludge Cake Storage Valves (W410/420/430/440/450/460-HV)

In REMOTE MANUAL mode, the PCS can send a manual mode signal to the PLC to open or close the valve.

9.2.7 Remote Manual Control Mode – Discharge Chute Valve 1/2/3/4 (W413/423/433/443/453/463-HV, 414/424/434/444/454/464-HV, 415/425/435/445/455/465-HV, 416/426/436/446/456/466-HV)

In REMOTE MANUAL mode, the PCS will send a manual control signal to the PLC to control the valve.

9.2.8 Interlocks, Permissives, and Control Signals

9.2.8.1 Sludge Cake Storage Valves (W410/420/430/440/450/460-HV)

For Sludge Cake Storage Valves (W410/420/430/440/450/460-HV) to operate in LOCAL (HAND) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel		W410/420/430/440/450/460-HS-2	Open
Local Control Panel	Hand/off/remote hand switch	W410/420/430/440/450/460-HS-1	Hand

For Sludge Cake Storage Valves (W410/420/430/440/450/460-HV) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PLC		W1A/2A/3A-410/430/450-HC	Open command
		W1B/2B/3B-420/440/460-HC	
Local Control Panel	Hand/off/remote hand switch	W410/420/430/440/450/460-HS-1	Remote

9.2.8.2 Discharge Augers (W412/422/432/442/452/462/417/427/437/447/457/467-SCA)

For Discharge Auger 1 (W412/422/432/442/452/462-SCA) and Discharge Auger 2 (W417/427/437/447/457/467-SCA) to operate in LOCAL (HAND) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Hand/off/remote hand switch	W412/422/432/442/452/462-HS-2 (HOR)	Hand
		W417/427/437/447/457/467-HS-2 (HOR)	

Discharge Auger 1 (W412/422/432/442/452/462-SCA)	Lock off stop hand switch	W412/422/432/442/452/462-HS (LOS)	Normal
Discharge Auger 2 (W417/427/437/447/457/467-SCA)		W417/427/437/447/457/467-HS (LOS)	

For Discharge Auger 1 (W412/422/432/442/452/462-SCA) and Discharge Auger 2 (W417/427/437/447/457/467-SCA) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PLC		W1A/2A/3A-W412/432/452-MN	Start command
		W1A/2A/3A-W417/437/457-MN	
		W1B/2B/3B-W422/442/462-MN	
		W1B/2B/3B-W427/447/467-MN	
Local Control Panel	Hand/off/remote hand switch	W412/422/432/442/452/462-HS-2 (HOR)	Remote
		W417/427/437/447/457/467-HS-2 (HOR)	
Discharge Auger 1 (W412/422/432/442/452/462-SCA)	Lock off stop hand switch	W412/422/432/442/452/462-HS (LOS)	Normal
Discharge Auger 2 (W417/427/437/447/457/467-SCA)		W417/427/437/447/457/467-HS (LOS)	

9.2.8.3 Discharge Chute Valve 1/2/3/4 (W413/423/433/443/453/463-HV, 414/424/434/444/454/464-HV, 415/425/435/445/455/465-HV, 416/426/436/446/456/466-HV)

For Discharge Chute 1 (W413/423/433/443/453/463-HV), 2 (W414/424/434/444/454/464-HV), 3 (W415/425/435/445/455/465-HV), and 4 (W416/426/436/446/456/466-HV) Valves to operate in LOCAL (HAND) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Open/close hand switch	W413/423/433/443/453/463-HS-2 (OPN/CLS)	Open
		W414/424/434/444/454/464-HS-2 (OPN/CLS)	
		W415/425/435/445/455/465-HS-2 (OPN/CLS)	
		W416/426/436/446/456/466-HS-2 (OPN/CLS)	
Local Control Panel	Local/remote hand switch	W413/423/433/443/453/463-HS-1 (L/R)	Local

For Discharge Chute 1 (W413/423/433/443/453/463-HV), 2 (W414/424/434/444/454/464-HV), 3 (W415/425/435/445/455/465-HV), and 4 (W416/426/436/446/456/466-HV) Valves to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PLC	Open/close hand switch	W1A/2A/3A-W413/433/453-HC	Open
		W1B/2B/3B-W423/443/463-HC	
		W1A/2A/3A-W414/434/454-HC	
		W1B/2B/3B-W424/444/464-HC	
		W1A/2A/3A-W415/435/455-HC	

		W1B/2B/3B-W425/446/465-HC	
		W1A/2A/3A-W416/436/456-HC	
		W1B/2B/3B-W426/446/466-HC	
Local Control Panel	Local/remote hand switch	W413/423/433/443/453/463-HS-1 (L/R)	Remote

9.2.9 Inputs and Outputs

9.2.9.1 PLC Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
East Discharge Auger 1 (W422/442/462-SCA)	East auger 1 start command	W1B/2B/3B-W422/442/462-MN	Digital Output
East Discharge Auger 2 (W427/447/467-SCA)	East auger 2 start command	W1B/2B/3B-W427/447/467-MN	Digital Output
East Discharge Chute 1 (W423/443/463)	East chute 1 open command	W1B/2B/3B-W423/443/463-HC	Digital Output
East Discharge Chute 2 (W424/444/464)	East chute 2 open command	W1B/2B/3B-W424/444/464-HC	Digital Output
East Discharge Chute 3 (W425/445/465)	East chute 3 open command	W1B/2B/3B-W425/446/465-HC	Digital Output
East Discharge Chute 4 (W426/446/466)	East chute 4 open command	W1B/2B/3B-W426/446/466-HC	Digital Output
Sludge Cake Storage Valves (W410/430/450-HV)	Storage valve open command	W1A/2A/3A-410/430/450-HC	Digital Output
Sludge Cake Storage Valves (W420/440/460-HV)	Storage valve open command	W1B/2B/3B-420/440/460-HC	Digital Output
West Discharge Auger 2 (W417/437/457-SCA)	West auger 2 start command	W1A/2A/3A-W417/437/457-MN	Digital Output
West Discharge Chute 1 (W413/433/453)	West chute 1 open command	W1A/2A/3A-W413/433/453-HC	Digital Output
West Discharge Chute 2 (W414/434/454)	West chute 2 open command	W1A/2A/3A-W414/434/454-HC	Digital Output
West Discharge Chute 3 (W415/435/455)	West chute 3 open command	W1A/2A/3A-W415/435/455-HC	Digital Output
West Discharge Chute 4 (W416/436/456)	West chute 4 open command	W1A/2A/3A-W416/436/456-HC	Digital Output
West Storage Bin Discharge Auger 1 (W412/432/452-SCA)	West auger 1 start command	W1A/2A/3A-W412/432/452-MN	Digital Output
Discharge System	Emergency stop	WOM-W409-US	Digital Input
East Discharge Auger 1 (W422/442/462-SCA)	East auger 1 hand/remote status	W1B/2B/3B-W422/442/462-HS	Digital Input
East Discharge Auger 1 (W422/442/462-SCA)	East auger 1 run status	W1B/2B/3B-W422/442/462-MM	Digital Input
East Discharge Auger 2 (W427/447/467-SCA)	East auger 2 hand/remote status	W1B/2B/3B-W427/447/467-HS	Digital Input
East Discharge Auger 2 (W427/447/467-SCA)	East auger 2 run status	W1B/2B/3B-W427/447/467-MM	Digital Input

East Discharge Chute 1 (W423/443/463)	East chute 1 closed status	W1B/2B/3B-W423/443/463-ZB	Digital Input
East Discharge Chute 1 (W423/443/463)	East chute 1 open status	W1B/2B/3B-W423/443/463-ZD	Digital Input
East Discharge Chute 2 (W424/444/464)	East chute 2 closed status	W1B/2B/3B-W424/444/464-ZB	Digital Input
East Discharge Chute 2 (W424/444/464)	East chute 2 open status	W1B/2B/3B-W424/444/464-ZD	Digital Input
East Discharge Chute 3 (W425/445/465)	East chute 3 closed status	W1B/2B/3B-W425/446/465-ZB	Digital Input
East Discharge Chute 3 (W425/445/465)	East chute 3 open status	W1B/2B/3B-W425/446/465-ZD	Digital Input
East Discharge Chute 4 (W426/446/466)	East chute 4 closed status	W1B/2B/3B-W426/446/466-ZB	Digital Input
East Discharge Chute 4 (W426/446/466)	East chute 4 open status	W1B/2B/3B-W426/446/466-ZD	Digital Input
East Discharge System 1/2/3	Truck proximity switch	W1B/2B/3B-W420/440/460-US	Digital Input
East Discharge System 1/2/3	System stop	W1B/2B/3B-W423/443/463-US	Digital Input
Sludge Cake Storage Valves (W410/430/450-HV)	Storage valve closed status	W1A/2A/3A-410/430/450-ZB	Digital Input
Sludge Cake Storage Valves (W410/430/450-HV)	Storage valve open status	W1A/2A/3A-410/430/450-ZD	Digital Input
Sludge Cake Storage Valves (W420/440/460-HV)	Storage valve closed status	W1B/2B/3B-420/440/460-ZB	Digital Input
Sludge Cake Storage Valves (W420/440/460-HV)	Storage valve open	W1B/2B/3B-420/440/460-ZD	Digital Input
West Discharge Auger 1 (W412/432/452-SCA)	West auger 1 hand/remote status	W1A/2A/3A-W412/432/452-HS	Digital Input
West Discharge Auger 1 (W412/432/452-SCA)	West auger 1 run status	W1A/2A/3A-W412/432/452-MM	Digital Input
West Discharge Auger 2 (W417/437/457-SCA)	West auger 2 hand/remote status	W1A/2A/3A-W417/437/457-HS	Digital Input
West Discharge Auger 2 (W417/437/457-SCA)	West auger 2 run status	W1A/2A/3A-W417/437/457-MM	Digital Input
West Discharge Chute 1 (W413/433/453)	West chute 1 closed status	W1A/2A/3A-W413/433/453-ZB	Digital Input
West Discharge Chute 1 (W413/433/453)	West chute 1 open status	W1A/2A/3A-W413/433/453-ZD	Digital Input
West Discharge Chute 2 (W414/434/454)	West chute 2 closed status	W1A/2A/3A-W414/434/454-ZB	Digital Input
West Discharge Chute 2 (W414/434/454)	West chute 2 open status	W1A/2A/3A-W414/434/454-ZD	Digital Input
West Discharge Chute 3 (W415/435/455)	West chute 3 closed status	W1A/2A/3A-W415/435/455-ZB	Digital Input
West Discharge Chute 3 (W415/435/455)	West chute 3 open status	W1A/2A/3A-W415/435/455-ZD	Digital Input
West Discharge Chute 4 (W416/436/456)	West chute 4 closed status	W1A/2A/3A-W416/436/456-ZB	Digital Input
West Discharge Chute 4 (W416/436/456)	West chute 4 open status	W1A/2A/3A-W416/436/456-ZD	Digital Input

West Discharge System 1/2/3	Truck proximity switch	W1B/2B/3B-W410/430/450-US	Digital Input
West Discharge System 1/2/3	System stop	W1B/2B/3B-W413/433/453-US	Digital Input
Sludge Cake East Storage Bins 1E/2E/3E	East storage bin level	W1B/2B/3B-W421/441/461-LT	Analog Input
Sludge Cake East Storage Bins 1E/2E/3E	East storage bin weight	W1B/2B/3B-W481/482/483-WT	Analog Input
Sludge Cake West Storage Bins 1W/2W/3W	West storage bin level	W1A/2A/3A-W411/431/451-LT	Analog Input
Sludge Cake West Storage Bins 1W/2W/3W	West storage bin weight	W1A/2A/3A-W481/482/483-WT	Analog Input

9.2.9.2 PCS Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Sludge Cake Storage Valves (W410/420/430/440/450/460-HV)	Storage valve closed status	WB-W410/420/430/440/450/460-ZB	Digital Input
Sludge Cake Storage Valves (W410/420/430/440/450/460-HV)	Storage valve open status	WB-W410/420/430/440/450/460-ZD	Digital Input
Sludge Cake Storage Bins 1W/1E/2W/2E/3W/3E	Storage bin level	WB-W411/421/431/41/451/461-LT	Analog Input
Sludge Cake Storage Bins 1/2/3	Storage bin weight	WB-W481/482/483-WT	Analog Input
Sludge Cake Storage System	General alarm	WB-W480-QF	Digital Input
Sludge Cake Storage System	Silence alarm	WB-W480-QS	Digital Output

9.2.9.3 Network Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Sludge Cake Storage Bins 1/2/3	Bin weight	XX-W481/482/483-WT1	Serial Input

9.2.10 HMI Display

Device Description	Status
Discharge Augers (W412/422/432/442/452/462/417/427/437/447/457/467-SCA)	Auger alarm reset
Discharge Augers (W412/422/432/442/452/462/417/427/437/447/457/467-SCA)	Auger in manual mode
Discharge Augers (W412/422/432/442/452/462/417/427/437/447/457/467-SCA)	Auger in service
Discharge Augers (W412/422/432/442/452/462/417/427/437/447/457/467-SCA)	Auger in service (Yes/No)

Discharge Chute Valves (W413/423/433/443/453/463/414/424/434/444/454/464/ 415/425/435/445/455/465/416/426/436/446/456/466-HV)	Valve alarm reset
Discharge Chute Valves (W413/423/433/443/453/463/414/424/434/444/454/464/ 415/425/435/445/455/465/416/426/436/446/456/466-HV)	Valve computer/hand status
Discharge Chute Valves (W413/423/433/443/453/463/414/424/434/444/454/464/ 415/425/435/445/455/465/416/426/436/446/456/466-HV)	Valve in service (Yes/No)
Discharge Chute Valves (W413/423/433/443/453/463/414/424/434/444/454/464/ 415/425/435/445/455/465/416/426/436/446/456/466-HV)	Valve open status
Level Transmitter (W411/421/431/41/451/461-LIT)	Level transmitter in service
Level Transmitter (W411/421/431/41/451/461-LIT)	Tank level (m)
Sludge Cake Storage Bins 1/2/3	Bin mode (idle/fill/west discharge/east discharge/out of service)
Sludge Cake Storage Bins 1/2/3	Fill mode status (online/offline)
Sludge Cake Storage Bins 1/2/3	Odd/even storage bins trip status
Sludge Cake Storage System	Emergency stop status
Sludge Cake Storage System	General alarm reset
Sludge Cake Storage Valves (W410/420/430/440/450/460-HV)	Valve alarm reset
Sludge Cake Storage Valves (W410/420/430/440/450/460-HV)	Valve computer/hand status
Sludge Cake Storage Valves (W410/420/430/440/450/460-HV)	Valve in service (Yes/No)
Sludge Cake Storage Valves (W410/420/430/440/450/460-HV)	Valve open status
Weight Transmitter (W481/482/483-WIT)	Storage bin weight (kg)
Weight Transmitter (W481/482/483-WIT)	Weight transmitter in service
West/East Discharge System 1/2/3	Discharge status (online/offline)
West/East Discharge System 1/2/3	Hopper dispensed weight (kg)
West/East Discharge System 1/2/3	Hopper required weight (kg)
West/East Discharge System 1/2/3	Next discharge status

9.2.11 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Sludge Cake Storage	General Alarm	WB-W480-QF in Alarm	Alarm notification

10. SLUDGE CAKE LOADOUT

Associated P&ID: 1-0101W-A0326
Associated NEWPCC Manuals:
Associated DCS HMI Screens:

10.1 Process Description

The sludge cake loadout is comprised of an east bay and a west bay. Each bay has an “In” door and an “Out” door:

- West Bay In (W510-TD)
- West Bay Out (W520-TD)
- East Bay In (W511-TD)
- East Bay Out (W521-TD)

Vehicles request access to the loadout area using a truck pedestal (W400) complete with truck sensor, card reader, and ASCII display. Each overhead door has a truck sensor (W510/511/520/521-ZS) and each truck bay has a weight indicator (W407/408-WI).

10.2 Control Description

10.2.1 Local Manual Control Mode

Each door can be operated in LOCAL MANUAL mode or LOCAL AUTOMATIC mode. In LOCAL MANUAL mode, the doors are raised and lowered using open and close hand switches in the local panel.

10.2.2 Local Automatic Control Mode

In LOCAL AUTOMATIC mode, the doors are controlled by a PLC. Each door will instantly reverse/open if the door obstruction switch is tripped. Each door will AUTOMATICALLY close after the timer (W510/511/520/521-KY) has elapsed if there are no obstructions, regardless of the mode of operation.

10.2.3 Interlocks, Permissives, and Control Signals

For Overhead Door (W510/511/520/521-TD) to operate in LOCAL MANUAL mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Open hand switch	W510/511/520/521-HS-1	Open*
Local Control Panel	Close hand switch	W510/511/520/521-HS-2	Close*
Overhead Door (W510/511/520/521-TD)	Hoist chain interlock	W510/511/520/521-HSS	Normal
Overhead Door (W510/511/520/521-TD)	Stop hand switch	W510/511/520/521-HS-3	Normal
Overhead Door (W510/511/520/521-TD)	Open position switch	W510/511/520/521-ZSD	Not open†
Overhead Door (W510/511/520/521-TD)	Close position switch	W510/511/520/521-ZSB-2	Not closed‡

* *Only one of these conditions is necessary for operation*
† *Door cannot open if already fully opened.*
‡ *Door cannot close if already fully closed.*

For Overhead Door (W510/511/520/521-TD) to operate in LOCAL AUTOMATIC mode:

Equipment	Device Description	Device Tag	State
PLC		WOM-W510/511/520/521-ZCD	Open*

PLC		WOM-W510/511/520/521-ZCB	Close*
Overhead Door (W510/511/520/521-TD)	Hoist chain interlock	W510/511/520/521-HSS	Normal
Overhead Door (W510/511/520/521-TD)	Stop hand switch	W510/511/520/521-HS-3	Normal
Overhead Door (W510/511/520/521-TD)	Open position switch	W510/511/520/521-ZSD	Not open†
Overhead Door (W510/511/520/521-TD)	Close position switch	W510/511/520/521-ZSB-2	Not closed‡

* *Only one of these conditions is necessary for operation*
† *Door cannot open if already fully opened.*
‡ *Door cannot close if already fully closed.*

10.2.4 Inputs and Outputs

10.2.4.1 PLC Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Overhead Door (W510/511/520/521-TD)	Door open command	WOM-W510/511/520/521-ZCD	Digital Output
Overhead Door (W510/511/520/521-TD)	Door close command	WOM-W510/511/520/521-ZCB	Digital Output
Truck sensor (W510/511/520/521-ZS)	Truck position status	WOM-W510/511/520/521-ZS	Digital Input
Truck pedestal (W400)	Truck position status	WOM-W400-ZS	Digital Input

10.2.4.2 Network Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Shipping Room Printer (W404)	Print command	XX-W404-UC	Serial Output
Truck Bay Weight Indicator	Weight status	XX-W407/408-WY	Serial Output
Truck pedestal (W400)	Door close command	XX-W400-UC	Serial Output
Shipping Room Keypad (W405)	User input	XX-W405-UT	Serial Input
Truck pedestal (W400)	Card reader	XX-W400-UX	Serial Input

11. CENTRIFUGE BUILDING EXHAUST FANS

Associated P&ID: 1-0101W-A0335
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nwhvac1.G

11.1 Process Description

Air from the main and second floors of the centrifuge building are exhausted by fans W641/651-FN to an air handling unit (W611-AHU) and into the truck bay . The Truck Bay and Hauled Liquid Waste Facility are exhausted by W612.

11.2 Control Description

11.2.1 Local Manual Control Mode

The air in the receiving manhole is exhausted by fan W612-FN in the Dewatering Building. The exhaust fan has two speeds, low and high. The fan can be controlled locally with hand switches W612-HS-1/2.

The exhaust fans are started and stopped MANUALLY using hand switches (W641/651-HS-2) in the Dewatering Control Room. The exhaust fan discharge damper (W641/651-VZ-1) are interlocked to open before the fan starts.

The dampers controlling return airflow to the air handling units (W641-VZ-2/3) are always closed.

11.2.2 Remote Manual Control Mode

In MANUAL mode the fan is started and stopped by the operator through the PCS.

11.2.3 Remote Automatic Control Mode

In AUTOMATIC mode the exhaust fan will run continuously in high speed mode.

The return damper (W612-VB) is always open.

11.2.4 Interlocks, Permissives, and Control Signals

11.2.4.1 Exhaust Fans (W641/651-FN)

For exhaust fans (W641/651-FN) to operate:

Equipment	Device Description	Device Tag	State
Control Room Panel	On/off hand switch	W641/651-HS-2 (O/O)	On
Exhaust Fans (W641/651-FN)	Damper open position switch	W641/651-ZSD	Open
Exhaust Fans (W641/651-FN)	Lock off stop hand switch	W641/651-HS-1	Normal

11.2.4.2 AHU Supply Dampers (W641-VZ-2/3)

For AHU supply dampers (W641-VZ-2/3) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Hand control	W641-HC	Open

For AHU supply dampers (W641-VZ-2/3) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		WB-W641-VD	Open command

11.2.5 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
AHU Supply Dampers (W641-VZ-2/3)	Open command	WB-W641-VD	Digital output
Exhaust Fans (W641/651-FN)	Fan fault	WB-W641/651-QF	Digital Input
Exhaust Fans (W641/651-FN)	Fan run status	WB-W641/651-MM	Digital Input
CO Detectors (W601/602-AA)	Gas detected	W601/602-AA	Digital Input

11.2.6 HMI Display

Device Description	Status
Exhaust Fans (W641/651-FN)	Fan run status
Exhaust Fans (W641/651-FN)	Fan fault status (Normal/Alarm)
CO Detectors (W601/602-AA)	Gas Detection (Normal/Alarm)

11.2.7 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Exhaust Fans (W641/651-FN)	Fan failure	WB-W641/651-QF in alarm	Fan taken out of service.

12. FERRIC CHLORIDE UNLOADING

Associated P&ID:
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nwpld.G,

12.1 Process Description

The ferric chloride (FC) used for phosphorus removal is delivered by railcar and truck. When delivered by railcar, compressed air is used to unload the FC. The compressed air is sent to the railcar via a 3-way air purge valve (W695). In both the railcar and truck delivery scenarios, the FC is discharged to the storage tanks (W710/720).

Each storage tank has an inlet valve (W705/706) and an outlet valve. The FC exiting the tank flows to the FC dosing pumps suction.

FC from the railcar spill collection, the FC dosing pump skid, and the storage tank drain and overflow lines all discharge to a sump pit. The sump pit drains to the sewer.

The carbon monoxide levels are monitored in the FC unloading and storage areas (WC-W792/798-GH).

12.2 Control Description

12.2.1 Local Manual Control Mode – Air Purge Valve (W695)

The air purge valve (W695) is operated in HAND or COMPUTER mode. In HAND mode the valve is controlled by W695-HS.

12.2.2 Local Manual Control Mode – Tank Inlet Valves (W705/706) and Outlet Valves (W715/725)

The tank inlet and outlet valves are operated in HAND and COMPUTER mode. In HAND mode the valves are controlled with W705/706/715/725-HS-1.

12.2.3 Remote Manual Control Mode – Air Purge Valve (W695)

In COMPUTER mode, the valve is operated through the PCS. In COMPUTER mode, the valve is MANUALLY opened when either:

- These three conditions occur:
  - The air purge valve is in COMPUTER mode
  - The air pressure reading is NORMAL
  - The UNLOAD RAILCAR request occurs.

In COMPUTER mode, the valve will AUTOMATICALLY open when:

- The air purge valve is in COMPUTER and AUTOMATIC mode
- The air pressure reading is NORMAL
- The UNLOAD RAILCAR request occurs
- The following conditions are met for either tank (W710/720):
  - The tank's inlet valve (W705/706) is fully opened
  - There is storage available for the tank

12.2.4 Remote Manual Control Mode – Tank Inlet Valves (W705/706) and Outlet Valves (W715/725)

In REMOTE mode, the valves are controlled through the PCS.

In REMOTE MANUAL mode, the inlet/outlet valve is MANUALLY opened when either:

- These three conditions occur:
  - Storage is available in the associated tank
  - The valve is in COMPUTER mode
  - The unload status of the air purge valve is NORMAL

12.2.5 Remote Automatic Control Mode – Ferric Chloride Unloading

FC unloading is operated REMOTELY through the PCS. The unloaded volume and flow rate is measured for the railcar unloading. A totalizer pulse signal (WC-W701-FQ) from the flow meter (W701-FE) is used to increment an up/down counter to calculate the total unloaded volume.

The PCS generates individual READY, UNLOAD, STOP, and OVERRIDE RESET signals for the truck and the railcar. The STORAGE UNAVAILABLE and UNLOADING STOP signals are common to both unloading scenarios.

The tank STORAGE UNAVAILABLE signal occurs when any of the following conditions are met:

- The tank's storage is locked out. Storage lockout occurs when:
  - The tank's inlet valve is not in COMPUTER or AUTOMATIC mode, and
  - The tank's inlet valve is not fully closed
- The tank's associated level sensors all have poor signal quality
- The tank is full.

The STORAGE AVAILABLE signal is the complement of the STORAGE UNAVAILABLE signal.

UNLOADING STOP is requested when any of the following conditions are met:

- Storage is unavailable for both tanks
- UNLOADING EMERGENCY STOP is requested:
  - Either the railcar, truck, or storage area unload statuses are in alarm
- Either inlet valve are in alarm

The UNLOAD RAILCAR READY signal occurs when:

- Railcar unloading is permitted
  - The sum of the spare capacity between the two tanks is 5.25 meters or greater. A tank's spare capacity is zeroed out if the tank's STORAGE UNAVAILABLE signal is HIGH.
- The truck is not unloading and UNLOADING STOP is not requested
- None of the following conditions occur:
  - Railcar unloading is not permitted
    - The sum of the spare capacity between the two tanks less than 5.25 meters.
  - The truck is unloading
  - UNLOADING STOP is requested
  - RAILCAR OVERRIDE RESET is requested

The UNLOAD RAILCAR request occurs when:

- UNLOAD RAILCAR READY signal occurs
- UNLOAD RAILCAR START signal occurs

The UNLOAD RAILCAR request is reset when any of the following conditions are met:

- The railcar might be empty
- High pressure shutdown occurs
  - The pressure switch reading is HIGH for 5 seconds or more while the railcar is unloading
- UNLOADING STOP is requested

The STOP UNLOADING RAILCAR is requested when:

- The railcar is currently unloading
- Any of the following conditions occur
  - The railcar might be empty:
    - The flow rate is less than 0.5 L/s for 300 seconds or more, or
    - The pressure is at least 40 kPa less than the peak air pressure value for 300 seconds or more within the first 900 seconds of unloading.
  - High pressure shutdown occurs
  - UNLOADING STOP is requested

RAILCAR OVERRIDE RESET is requested when the following conditions are met:

- The railcar is not permitted
- Either of the following conditions occur:
  - The UNLOAD RAILCAR READY signal is HIGH for an hour (3600 seconds) or more
  - The UNLOAD START PULSE is HIGH
    - The UNLOAD RAILCAR or the UNLOAD TRUCK request is HIGH for 2 seconds or more

The UNLOAD TRUCK READY signal occurs when

- Truck unloading is permitted
  - The sum of the spare capacity between the two tanks is 5.25 meters or greater. A tank's spare capacity is zeroed out when the tank's STORAGE UNAVAILABLE occurs.
- The railcar is not unloading and UNLOADING STOP is not requested

- None of the following conditions occur:
  - Truck unloading is not permitted
    - The sum of the spare capacity between the two tanks less than 5.25 meters.
  - The railcar is unloading
  - UNLOADING STOP is requested
  - TRUCK OVERRIDE RESET is requested

The UNLOAD TRUCK request occurs when:
- UNLOAD TRUCK READY signal occurs
- UNLOAD TRUCK START signal occurs

The UNLOAD TRUCK request is reset when any of the following conditions are met:
-
- UNLOADING STOP is requested

The STOP UNLOADING TRUCK is requested when:
- The railcar is currently unloading
- Any of the following conditions occur
  - :
    - The flow rate is less than 0.5 L/s for 90 seconds or more after 60 seconds of unloading
  - UNLOADING STOP is requested

TRUCK OVERRIDE RESET is requested when the following conditions are met:
- The truck is not permitted
- Either of the following conditions occur:
  - The UNLOAD TRUCK READY signal is HIGH for an hour (3600 seconds) or more
  - The UNLOAD START PULSE is HIGH

12.2.6 Remote Automatic Control Mode – Tank Inlet Valves (W705/706) and Outlet Valves (W715/725)

In REMOTE AUTOMATIC mode, the inlet/outlet valve will AUTOMATICALLY open when:
- The valve is in COMPUTER and AUTOMATIC mode
- The air pressure reading is NORMAL
- The UNLOAD RAILCAR request occurs
- The following conditions are met for either tank (W710/720):
  - The valve (W705/706) is fully opened
  - There is storage available for the tank

The valve will go into alarm if:
- An open/close command has been sent to the valve
- The valve is not fully opened/closed within 20 seconds.

12.2.7 Interlocks, Permissives, and Control Signals

12.2.7.1 Air Purge Valve (W695)

For Air Purge Valve (W695) to operate in LOCAL (HAND) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Open/close/remote hand switch	W695-HS	Open*

Local Control Panel	Open/close/remote hand switch	W695-HS	Close*
Air Purge Valve (W695)	High pressure switch	W695-PSH	Normal
Local Control Panel	Emergency stop	W696-HS-2	Normal
Local Panel	Emergency stop	W696-HS-3	Normal

* *Only one of these conditions is necessary for operation*

For Air Purge Valve (W695) to operate in REMOTE mode:

Equipment	**Device Description**	**Device Tag**	**State**
PCS	Open/close/remote hand switch	WC-W695-VD	Open command
Local Control Panel	Open/close/remote hand switch	W695-HS	Remote
Air Purge Valve (W695)	High pressure switch	W695-PSH	Normal
Local Control Panel	Emergency stop	W696-HS-2	Normal
Local Panel	Emergency stop	W696-HS-3	Normal

* *Only one of these conditions is necessary for operation*

12.2.7.2 Tank Inlet Valves (W705/706) and Outlet Valves (W715/725)

For Tank Inlet Valves (W705/706) and Outlet Valves (W715/725) to operate in LOCAL (HAND) mode:

Equipment	**Device Description**	**Device Tag**	**State**
C Local Switch	Local/off/remote hand switch	W705/706/715/725-HS-1	Local
Local Switch	Open hand switch	W705/706/715/725-HS-2	Open*
Local Switch	Close hand switch	W705/706/715/725-HS-3	Close*

* *Only one of these conditions is necessary for operation*

For Tank Inlet Valves (W705/706) and Outlet Valves (W715/725) to operate in REMOTE (COMPUTER) mode:

Equipment	**Device Description**	**Device Tag**	**State**
P Building Panel	Local/off/remote hand switch	W705/706/715/725-HS-1	Remote
PCS		WC-W705/706/715/725-VD	Open command*
PCS		WC-W705/706/715/725-VB	Close command*

* *Only one of these conditions is necessary for operation*

12.2.8 Inputs and Outputs

Equipment	**Signal Description**	**Signal Tag**	**Signal Type**
Air Purge Valve (W695)	Air purge valve open command	WC-W695-VD	Digital Output
Inlet valve (W705/706)	Inlet valve close command	WC-W705/706-VB	Digital Output
Inlet valve (W705/706)	Inlet valve open command	WC-W705/706-VD	Digital Output
Outlet valve (W715/725)	Outlet valve close command	WC-W715/725-VB	Digital Output

Outlet valve (W715/725)	Outlet valve open command	WC-W715/725-VD	Digital Output
Air Purge Valve (W695)	Air purge valve high pressure alarm	WC-W695-PAH	Digital Input
Air Purge Valve (W695)	Air purge valve computer/hand status	WC-W695-YS	Digital Input
CO Monitor (W792/798)	CO alarm	WC-W792/798-GH	Digital Input
East/West Rail Shelter Door (W703)	Door open status	WC-W703-ZS-3/4	Digital Input
Eyewash Stations (W702)	Unloading room eyewash in use status	WC-W702-FS-1	Digital Input
Eyewash Stations (W702)	Storage room eyewash in use status	WC-W702-FS-2	Digital Input
Flow meter (W701)	Chemical unload totalizer pulse	WC-W701-FQ	Digital Input
Inlet valve (W705/706)	Inlet computer/hand status	WC-W705/706-YS	Digital Input
Inlet valve (W705/706)	Inlet valve close status	WC-W705/706-ZSB	Digital Input
Inlet valve (W705/706)	Inlet valve open status	WC-W705/706-ZSD	Digital Input
Outlet valve (W715/725)	Outlet valve close status	WC-W715/725-ZSB	Digital Input
Outlet valve (W715/725)	Outlet valve open status	WC-W715/725-ZSD	Digital Input
Railcar (W696)	Railcar start unload	WC-W696-HS-1	Digital Input
Railcar (W696)	Railcar emergency stop	WC-W696-HS-2	Digital Input
Storage tank (W710/720)	Storage tanks emergency stop	WC-W696-HS-4	Digital Input
Storage tank (W710/720)	Sensor 0 fault	WC-W710/720-LF	Digital Input
Sump Pit (W731)	Sump pit level high alarm	WC-W731-LH	Digital Input
Truck (W697)	Truck start unload	WC-W697-HS-1	Digital Input
Truck (W697)	Truck emergency stop	WC-W697-HS-2	Digital Input
Storage Room Motion Detectors (W704)	Motion detected status	WC-W704-ZS-1	Digital Input
Unloading Room Motion Detectors (W703)	Motion detected status	WC-W703-ZS-1	Digital Input
Air Purge Valve (W695)	Air purge valve chemical unloading pressure	WC-W695-PIT	Analog Input
Flow meter (W701)	Chemical unload flow rate	WC-W701-FT	Analog Input
Storage tank (W710/720)	Sensor 0 tank level	WC-W710/720-LT-1	Analog Input
Storage tank (W710/720)	Sensor 1 tank level	WC-W710/720-LT-2	Analog Input

12.2.9 HMI Display

Device Description	**Status**
Railcar (W696)	Railcar unload ready
Railcar (W696)	Railcar unload status
Air Purge Valve (W695)	Air purge valve open/close status
Air Purge Valve (W695)	Air purge valve computer/hand status
Air Purge Valve (W695)	Unloading pressure high alarm
Air Purge Valve (W695)	Compressed air pressure (kPa)
Flow meter (W701)	Unloaded volume (m^3)
Flow meter (W701)	Chemical unload flow rate (L/s)

Eyewash Stations (W702)	Storage room eyewash in use
Eyewash Stations (W702)	Unload room eyewash in use
Truck (W697)	Truck unload ready
Truck (W697)	Truck unload status
Sump Pit (W731)	Sump pit level high alarm
Inlet valve (W705/706)	Storage tank inlet valve open/close status
Inlet valve (W705/706)	Storage tank inlet valve computer/hand status
Storage tank (W710/720)	Storage tank level (m)
Storage tank (W710/720)	Remaining dosing chemical capacity (days)
Storage tank (W710/720)	Ferric chloride tank level < 75%
Outlet valve (W715/725)	Storage tank outlet valve open/close status
Outlet valve (W715/725)	Storage tank outlet valve computer/hand status
Storage tank (W710/720)	Unloading tank duty/standby status
Storage tank (W710/720)	Tank level sensor 0 level (m)
Storage tank (W710/720)	Tank level sensor 1 level (m)
Ferric Chloride Dosing Skid (W700)	Pump dosing alarm reset

12.2.10 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Air Purge Valve (W695)	High unloading pressure	WC-W695-PAH is in alarm	Railcar unloading is stopped
Sump Pit (W731)	High sump pit level	WC-W731-LH is in alarm	Alarm notification

13. FERRIC CHLORIDE DOSING PUMPS

Associated P&ID:
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nwpds.G

13.1 Process Description

The phosphorus removal chemical dosing has three injection points:
1. Primary Sludge (Injection Point 1)
2. Digested Sludge (Injection Point 2)
3. Centrate (Injection Point 3)

Each dosing pump (W740/750/760) is capable of pumping FC from the storage tanks (W710/720) to each injection point by manually opening valves in the field.

13.2 Control Description

13.2.1 Local Manual Control Mode

The ferric chloride dosing pumps are part of a vendor-supplied dosing skid. Each dosing pump has its own variable frequency drive (VFD). Each dosing pump has speed indication, speed control, start/stop, run, fault, and automatic signals. The dosing pump discharge is monitored for flow rate and high pressure. The dosing pumps are operated in LOCAL (HAND) mode and REMOTE (COMPUTER) mode.

In LOCAL mode, the dosing pumps are controlled through their associated VFD control panel. Setting W740/750/760-HS-1 to HAND will start the pump in LOCAL (HAND) mode. The speed is adjusted using the speed control, W740/750/760-SC.

13.2.2 Remote Automatic Control Mode

In REMOTE AUTOMATIC mode, the dosing pumps are operated through PCS. Setting W740/750/760-HS-1 to COMPUTER will give the PCS control of the pump. The operator can change which injection point each feed pump serves, as well as the dosing set points.

In COMPUTER mode, the PCS will send a START command (WC-W740/750/760-MN) to the dosing pump if:

- A CASCADE START is requested or the START command is still HIGH
- None of the following conditions occur:
  - STOP is requested
  - CASCADE STOP is requested
  - EMERGENCY STOP is requested
  - The pump has failed or is in HAND mode
  - Storage tanks W710 and W720 are not feeding the pumps for 10 seconds or more.
  - High pressure alarm
  - The pump is running and the discharge flow feedback from the pump is less than 10 L/Hr
  - TROUBLE SHUTOFF is requested:
    - The flowmeter reading has poor signal quality, and
    - The pump is running in COMPUTER mode

CASCADE START is requested for a pump when the following conditions are met:

- .
- The pump is currently OFF
- The pump is in service
- The pump is in COMPUTER AUTOMATIC mode
- The pump is not in alarm

The conditions are evaluated for each injection point.

CASCADE STOP is requested for a pump when the following conditions are met:

-
- The pump is currently ON
- The pump is in COMPUTER mode

The conditions are evaluated for each injection point.

The pump will go into alarm if:

- The pump is in COMPUTER mode
- A START command has been sent to the pump
- The pump is not running within 35 seconds.

13.2.3 Interlocks, Permissives, and Control Signals

For dosing pump (W740/750/760) to operate in LOCAL (HAND) mode:

Equipment	Device Description	Device Tag	State
VFD control panel (W740/750/760)	Computer/off/hand hand switch	W740/750/760-HS-1	Hand
VFD control panel (W740/750/760)	Lock off stop hand switch	W740/750/760-HS-2	Normal

For dosing pump (W740/750/760) to operate in REMOTE (COMPUTER) mode:

Equipment	Device Description	Device Tag	State
PCS		WC-W740/750/760-MN	Start command
PCS		WC-W740/750/760-SC	Speed control
VFD control panel (W740/750/760)	Computer/off/hand hand switch	W740/750/760-HS-1	Computer
VFD control panel (W740/750/760)	Lock off stop hand switch	W740/750/760-HS-2	Normal

13.2.4 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Dosing Pump (W740/750/760)	Start command	WC-W740/750/760-MN	Digital Output
Dosing Pump (W740/750/760)	Speed control command	WC-W740/750/760-SC	Analog Output
Dosing Pump (W740/750/760)	Flow totalizer pulse	WC-W740/750/760-FQ	Digital Input
Dosing Pump (W740/750/760)	Fault status	WC-W740/750/760-MF	Digital Input
Dosing Pump (W740/750/760)	Run status	WC-W740/750/760-MM	Digital Input
Dosing Pump (W740/750/760)	High pressure alarm	WC-W740/750/760-PAH	Digital Input
Dosing Pump (W740/750/760)	Computer/hand status	WC-W740/750/760-YS	Digital Input
Dosing Pump (W740/750/760)	Flow rate	WC-W740/750/760-FT	Analog Input
Dosing Pump (W740/750/760)	Speed status	WC-W740/750/760-ST	Analog Input

13.2.5 HMI Display

Device Description	Status
Dosing Pump (W740/750/760)	In service status (Yes/No)
Dosing Pump (W740/750/760)	Dosing injection point 1 (Yes/No)
Dosing Pump (W740/750/760)	Dosing injection point 2 (Yes/No)
Dosing Pump (W740/750/760)	Dosing injection point 3 (Yes/No)
Dosing Pump (W740/750/760)	Idle time (hrs)
Dosing Pump (W740/750/760)	Run time (hrs)
Dosing Pump (W740/750/760)	Next cascade start (Yes/No)
Dosing Pump (W740/750/760)	Next cascade stop (Yes/No)
Dosing Pump (W740/750/760)	Flow rate (L/hr)
Dosing Pump (W740/750/760)	Speed (RPM)
Dosing Pump (W740/750/760)	High pressure trapped (Normal/Alarm)
Dosing Pump (W740/750/760)	Total run time (hrs)
Injection Point 1/2/3	Injection point dosing set point (L/hr)
Injection Point 1/2/3	Injection point dosing rate (L/hr)
Injection Point 1/2/3	Total dosing rate (L/hr)
Ferric Chloride Dosing Skid (W700)	Pump dosing alarm reset

13.2.6 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Dosing Pump (W740/750/760)	High pressure	WC-W740/750/760-PAH in alarm	Dosing pump taken out of service
Dosing Pump (W740/750/760)	Pump fault	WC-W740/750/760-MF in alarm	Dosing pump taken out of service

14. MISCELLANEOUS SYSTEMS

Associated P&ID: 1-0101W-A0340
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nwhvac1.G

14.1 Process Description

A pump (W663) draws water from the supply well and pumps it to the Centrifuge Building cooling coils. The water returns from the Centrifuge Building and flows into the recharge well. The suppy well is located in the north east corner of the Dewatering Building.and the return well is located east of the dewatering facility near Main Street

Two sump pumps (W530/540-SMP) pump the contents of the Dewatering Building sump pit to the main interceptor.

14.2 Control Description

14.2.1 Local Manual Control Mode

The supply well pump (W663) is controlled in LOCAL MANUAL mode by a hand switch (W663-HS-2) in the Dewatering Control Room panel.

14.2.2 Local Automatic Control Mode

The sump pumps will start AUTOMATICALLY based on the sump pit level. . The sump pumps will shut off once the sump pit level is low.

14.2.3 Interlocks, Permissives, and Control Signals

14.2.3.1 Supply Well Pump (W663)

For supply well pump (W663) to operate:

Equipment	Device Description	Device Tag	State
Control Room Panel	On/Off hand switch	W663-HS-2 (O/O)	On
Supply Well Pump (W663)	Discharge pressure control	W663-PC	Normal
Supply Well Pump (W663)	Lock of stop hand switch	W663-HS-1 (LOS)	Normal

14.2.3.2 Sump Pumps (W530/540-SMP)

For sump pumps (W530/540-SMP) to operate:

Equipment	Device Description	Device Tag	State
	Sump pit high level float switch	W530-LH	Start
Sump Pumps (W530/540-SMP)	Lock of stop hand switch	W530/540-HS-1 (LOS)	Normal

14.2.4 Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Supply Well Pump (W663)	Pump fail	WB-W663-FA	Digital Input
Supply Well Pump (W663)	Pump run status	WB-W663-MM	Digital Input
Sump Pumps (W530/540-SMP)	High level alarm	WB-W530-LA	Digital Input
Instrument Air Dryer (W682-QF)	Fail alarm	WB- W682-QF	Digital Input

14.2.5 HMI Display

Device Description	Status
Supply Well Pump (W663)	Supply well pump run status
Supply Well Pump (W663)	Supply well pump normal/alarm status
Sump Pumps (W530/540-SMP)	Sump level (normal/alarm)
Instrument Air Dryer (W682-QF)	Status (normal/alarm)

14.2.6 PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Supply Well Pump (W663)	Supply pump fail	WB-W663-FA in alarm	Alarm notification
Sump Pumps (W530/540-SMP)	Sump pit high level alarm	WB-W530-LA in alarm	Alarm notification
Instrument Air Dryer (W682-QF)	Status (normal/alarm)	W682-QF in alarm	Alarm notification

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1. SEPTAGE LANES 1, 2, 3, AND 4 – HAULED WASTEWATER

Associated P&ID:	1-0101Y-A001-001
Associated NEWPCC Manuals:	
Associated DCS HMI Screens:	nsepl1.G, nsepl2.G, nsepl3.G

1.1. Process Description

Hauled wastewater is dumped into the receiving manholes through Lanes 1, 2, 3, or 4. Lane 4 is typically used for Leachate, described in Section 2. An access control system allows for automatic entry and tracking by the truck drivers.

There are two modes of operation, Normally Closed mode and Normally Open mode.

In Normally Closed mode, the received wastewater drains to a holding tank to sample for hydrocarbons. If no hydrocarbons are detected, the wastewater is released into the facility main interceptor. If hydrocarbons are detected, the tank discharge valve will remain shut, and the access system will keep the truck in position. The truck operator will be required to suck out the contaminated wastewater from the holding tank.

The Hauled Liquid Waste lanes can be operated in Normally Open mode, which allows the dumped wastewater to flow through the holding tank with the valve open. The valve then closes when hydrocarbons are detected.

A flowmeter measures the volume of each load. After the load is complete, flushing water is injected at three locations through a time-controlled sequence. Scheduled large flushes occur overnight to prevent build-up.

1.2. Control Description

1.2.1. Local Manual Control Mode

Drain valve Y211/221/231/241-XV can be manually controlled by the attached hand switch (Y211/221/231/241-HS-2).

Flush valves Y781/784/791/794, Y782/785/792/795, and Y783/786/792/796 can be controlled manually by the attached hand switch (Y781/782/783/791/792/793/784/785/786-HS-2)

1.2.2. Local Automatic Control Mode

The operation and sequencing of the Hauled Liquid Waste lanes are controlled by PLC. One PLC controls lanes 1 and 2, and a separate PLC controls lanes 3 and 4. This functionality will be integrated into the PCS.

1.2.3. Remote Manual Control Mode

Commands can be sent to the PLC to change the state of the equipment.

The Drain Valves (Y211/221/231/241-XV) can be set to open or closed in REMOTE MANUAL mode from the pop-up faceplate.

The Flushing Valves (Y781/784/791/794, Y782/785/792/795, and Y783/786/792/796) positions can be set by the operator from the pop-up faceplate in REMOTE MANUAL mode.

The Entrance Control Gates (Y800/810/830/840) can be set to open or closed in REMOTE MANUAL mode from the operator pop-up faceplate.

The Exit Control Gates (Y805/815/835/845) can be set to open or closed in REMOTE MANUAL mode from the operator pop-up faceplate.

The default Local Automatic Control and Normally Open Local control can be changed in REMOTE AUTOMATIC mode.

The following equipment can be put in and out of service:

- Entrance Gate (Y800/810/830/840)
- Exit Gate (Y805/815/835/845)
- Sampler (Y910/920/930/940)
- Drain Valve (Y211/221/231/241-XV)
- Flushing Valves (Y781/784/791/794, Y782/785/792/795, and Y783/786/792/796)

A large flush sequence can manually be requested by the operators, the request can also be cancelled. The operator can set the overnight large flush to be bypassed.

Each flushing valve has an operator set open limit percentage for manual and automatic operation.

The operator can silence general alarms through a button. Similarly, the operator can silence LEL alarms with a separate button.

In REMOTE MANUAL mode the operator can reset the status of a lane to unoccupied.

1.2.4. Remote Automatic Control Mode

There is no REMOTE AUTOMATIC mode for the Hauled Liquid Waste Equipment. When the equipment is set to AUTOMATIC mode from the workstation, the equipment operates in LOCAL AUTOMATIC mode through the local PLC.

1.2.5. Interlocks, Permissives and Control Signals

1.2.5.1. FW Valve (Y781/782/783/791/792/793/784/785/786)

For FW Valve (Y781/782/783/791/792/793/784/785/786) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
FW Valve (Y781/782/783/791/792/793/784/785/786)	Local/remote hand switch	Y781/782/783/791/792/793/784/785/786-HS-1 (L/R)	Local
FW Valve (Y781/782/783/791/792/793/784/785/786)	Open/close hand switch	Y781/782/783/791/792/793/784/785/786-HS-2 (O/C)	Open/Close

For FW Valve (Y781/782/783/791/792/793/784/785/786) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		Y781/782/783/791/792/793/784/785/786_Open/Close_Mode_PB	Open/Close command
PLC		Y781/782/783/791/792/793/784/785/786-VD/VB	Open/Close
FW Valve (Y781/782/783/791/792/793/784/785/786)	Local/remote hand switch	Y781/782/783/791/792/793/784/785/786-HS-1 (L/R)	Remote

1.2.5.2. Drain Valve (Y211/221/231-XV)

For Drain Valve (Y211/221/231-XV) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Drain Valve (Y211/221/231-XV)	Local/remote hand switch	Y211/221/231-HS-1 (L/R)	Local
Drain Valve (Y211/221/231-XV)	Open/close hand switch	Y211/221/231-HS-2 (O/C)	Open/Close

For Drain Valve (Y211/221/231-XV) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		Y211/221/231_Open/Close_Mode_PB	Open/Close command
PLC		YX211/221/231-VD/VB	Open/Close
Drain Valve (Y211/221/231-XV)	Local/remote hand switch	Y211/221/231-HS-1 (L/R)	Remote

1.2.5.3. Entrance Gate (Y800/810/830) and Exit Gate (Y805/815/835)

For Entrance Gate (Y800/810/830) or Exit Gate (Y805/815/835) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		Y800/810/830/805/815/835_Gate_Open_Mode_PB	Open command
PLC		Y800/810/830/805/815/835-ZCD	Open

1.2.6. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Entrance Gate (Y800/810/830)	Open command	Y800/810/830_Gate_Open_Mode_PB	Networked Digital Output
Exit Gate (Y805/815/835)	Open command	Y805/815/835_Gate_Open_Mode_PB	Networked Digital Output
FW Valve (Y781/782/783/791/792/793/784/785/786)	Open command	Y781/782/783/791/792/793/784/785/786_Valve_Open_Mode_PB	Networked Digital Output
FW Valve (Y781/782/783/791/792/793/784/785/786)	Close command	Y781/782/783/791/792/793/784/785/786_Valve_Close_Mode_PB	Networked Digital Output
Drain Valve (Y211/221/231-XV)	Open command	Y211/221/231_Valve_Close_Mode_PB	Networked Digital Output
Drain Valve (Y211/221/231-XV)	Close command	Y211/221/231_Valve_Open_Mode_PB	Networked Digital Output
Building 1	High sump level alarm	560-YAE-01	Networked Digital Input
Building 1/2	Flood alarm	YA-Y700/702-FA	Networked Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Building 2	High sump level alarm	YA-Y650-LH	Networked Digital Input
Entrance Gate (Y800/810/830)	Manual status	YA-Y800/810/830-MD	Networked Digital Input
Entrance Gate (Y800/810/830)	Proximity status	YA-Y800/810/830-PXS	Networked Digital Input
Entrance Gate (Y800/810/830)	Fault	YA-Y800/810/830-QF	Networked Digital Input
Entrance Gate (Y800/810/830)	In service status	YA-Y800/810/830-SE	Networked Digital Input
Exit Gate (Y805/815/835)	Manual status	YA-Y805/815/835-MD	Networked Digital Input
Exit Gate (Y805/815/835)	Proximity status	YA-Y805/815/835-PXS	Networked Digital Input
Exit Gate (Y805/815/835)	Fault	YA-Y805/815/835-QF	Networked Digital Input
Exit Gate (Y805/815/835)	In service status	YA-Y805/815/835-SE	Networked Digital Input
Flow Meter (Y113/123/153)	Fault	YA-Y113/123/153-LL	Networked Digital Input
FW Valve (Y781/782/783/791/792/793/784/785/786)	Automatic status	YA-Y781/782/783/791/792/793/784/785/786-AM	Networked Digital Input
FW Valve (Y781/782/783/791/792/793/784/785/786)	Manual status	YA-Y781/782/783/791/792/793/784/785/786-MD	Networked Digital Input
FW Valve (Y781/782/783/791/792/793/784/785/786)	Remote status	YA-Y781/782/783/791/792/793/784/785/786-RS	Networked Digital Input
FW Valve (Y781/782/783/791/792/793/784/785/786)	In service status	YA-Y781/782/783/791/792/793/784/785/786-SE	Networked Digital Input
FW Valve (Y781/782/783/791/792/793/784/785/786)	Fail to close alarm	Y781/782/783/791/792/793/784/785/786_Valve_Fail_To_Close_Alm	Networked Digital Input
FW Valve (Y781/782/783/791/792/793/784/785/786)	Fail to open alarm	Y781/782/783/791/792/793/784/785/786_Valve_Fail_To_Open_Alm	Networked Digital Input
FW Valve (Y781/782/783/791/792/793/784/785/786)	Open status	Y781/782/783/791/792/793/784/785/786_Valve_Open_Status	Networked Digital Input
FW Valve (Y781/782/783/791/792/793/784/785/786)	Closed status	Y781/782/783/791/792/793/784/785/786_Valve_Close_Status	Networked Digital Input
Lane 1/2/3	Lockdown status	YA-Y800/810/830-LD	Networked Digital Input
Lane 1/2/3	Lock out status	YA-Y850-L1L/L2L/M5L	Networked Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Sampler (Y910/920/930)	Sampler E-Stop	YA-Y910/920/930-XS	Networked Digital Input
Drain Valve (Y211/221/231-XV)	Fail to close alarm	Y211/221/231_Valve_Fail_To_Close_Alm	Networked Digital Input
Drain Valve (Y211/221/231-XV)	Fail to open alarm	Y211/221/231_Valve_Fail_To_Open_Alm	Networked Digital Input
Drain Valve (Y211/221/231-XV)	Open status	Y211/221/231_Valve_Open_Status	Networked Digital Input
Drain Valve (Y211/221/231-XV)	Closed status	Y211/221/231_Valve_Close_Status	Networked Digital Input
Flow Meter (Y113/123/153)	Wastewater flow	YA-Y113/123/153-FT	Networked Analog Input
FW Valve (Y781/782/783/791/792/793/784/785/786)	Position	YA-Y781/782/783/791/792/793/784/785/786-PS	Networked Analog input
Holding Tank 1/2/3 (Y111/121/131)	Tank Level	YA-Y111/121/131-LT	Networked Analog Input
Lane 1/2/3	Third full	111/121/131-YAY-02	Networked Analog Input
Valve (211/221-XV)	Actuator position	YA-Y211/221-PS	Networked Analog input
Valve (211/221-XV)	Actuator torque	YA-Y211/221-TS	Networked Analog input

1.2.7. HMI Display

Device Description	Status
Building 1/1/2	Flood alarm (Normal/Alarm)
Building 1/1/2	High sump level alarm (Normal/Alarm)
Entrance Gate (Y800/810/830)	Automatic/Manual status
Entrance Gate (Y800/810/830)	Fault status (Normal/Fail)
Entrance Gate (Y800/810/830)	In service status
Entrance Gate (Y800/810/830)	Proximity status
Exit Gate (Y805/815/835)	Automatic/Manual status
Exit Gate (Y805/815/835)	Fault status (Normal/Fail)
Exit Gate (Y805/815/835)	In service status
Exit Gate (Y805/815/835)	Proximity status
Flow Meter (Y113/123/153)	Flow meter fault (Normal/Fail)
FW Valve (Y781/782/783/791/792/793/784/785/786)	AUTOMATIC mode open limit setpoint (%)
FW Valve (Y781/782/783/791/792/793/784/785/786)	Automatic/manual status
FW Valve (Y781/782/783/791/792/793/784/785/786)	In service status
FW Valve (Y781/782/783/791/792/793/784/785/786)	Local/remote status
FW Valve (Y781/782/783/791/792/793/784/785/786)	MANUAL mode open limit setpoint (%)

Device Description	Status
FW Valve (Y781/782/783/791/792/793/784/785/786)	Position (%)
Holding Tank 1/2/3 (Y111/121/131)	High level alarm (Normal/Alarm)
Holding Tank 1/2/3 (Y111/121/131)	Level transfer fail (Normal/Fail)
Holding Tank 1/2/3 (Y111/121/131)	Tank level (m)
Lane 1/2/3	Third full (m)
Lane 1/2/3	Cancel large flush
Lane 1/2/3	Cancel occupied status
Lane 1/2/3	General alarm reset
Lane 1/2/3	Hauled liquid waste flow (L/s)
Lane 1/2/3	Hauled waste mode selected (Yes/No)
Lane 1/2/3	Large flush requested
Lane 1/2/3	Large flush run status
Lane 1/2/3	Leachate mode selected (Yes/No)
Lane 1/2/3	Lock out status
Lane 1/2/3	Lockdown status
Lane 1/2/3	Operating state (Normally Closed/Normally Open)
Lane 1/2/3	Request large flush
Lane 1/2/3	Status (Bad Quality/Lane Open/Accepted/Occupied/Cleaning/Lockout/Lane Closed)
Drain Valve (Y211/221/231-XV)	Automatic/Manual status
Drain Valve (Y211/221/231-XV)	In service status
Valve (211/221-XV)	Position (%)
Valve (211/221-XV)	Torque (Nm)

1.2.8. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Holding Tank 1/2/3 (Y111/121/131)	High tank level	YA-Y111/121/131-LT above 2.0m	Alarm notification
Holding Tank 1/2/3 (Y111/121/131)	Low tank level	YA-Y111/121/131-LT below 0.2m	Alarm notification

2. SEPTAGE LANE 4 - LEACHATE

Associated P&ID:
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nsepl4.G

2.1. Process Description

Lane 4 can accept Hauled Wastewater or Leachate. The lane is typically operated in leachate mode. When operating in Hauled Wastewater mode, the lane is operated as described in Section 1. The mode of operation is dependant upon the truck operator code entered into the gate access system.

Leachate is dumped through a discharge hose to the Leachate Sampling Building. The Leachate then flows by gravity directly into the main interceptor sewer. An automatic sampler takes a series of samples from the load and stores them for testing. The flowmeter (FE-X151) records the total volume of each load. An alarm will be raised if the truck operator dumps to load into the manhole while in Leachate mode.

There is a single manual flushing valve in the Leachate drain line upstream of the flowmeter.

2.2. Control Description

2.2.1. Local Automatic Control Mode

The operation and sequencing of the Leachate lane is controlled by the Leachate PLC. This functionality will be integrated into the PCS.

2.2.2. Remote Manual Control Mode

The following equipment can be put in and out of service:

- Leachate Sampler (X950)

In REMOTE MANUAL mode the operator can change the occupied status of a lane.

2.2.3. Remote Automatic Control Mode

There is no REMOTE AUTOMATIC mode for the Leachate Equipment. When the equipment is set to AUTOMATIC mode from the workstation, the equipment operates in LOCAL AUTOMATIC mode.

2.2.4. Interlocks, Permissives and Control Signals

2.2.4.1. FW Valve (Y794/795/796)

For FW Valve (Y794/795/796) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
FW Valve (Y794/795/796)	Local/remote hand switch	Y794/795/796-HS-1 (L/R)	Local
FW Valve (Y794/795/796)	Open/close hand switch	Y794/795/796-HS-2 (O/C)	Open/Close

For FW Valve (Y794/795/796) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		Y794/795/796_Open/Close_Mode_PB	Open/Close command
PLC		Y794/795/796-VD/VB	Open/Close
FW Valve (Y794/795/796)	Local/remote hand switch	Y794/795/796-HS-1 (L/R)	Remote

2.2.4.2. Valve (Y241-XV)

For Valve (Y241-XV) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Valve (Y241-XV)	Local/remote hand switch	Y241-HS-1 (L/R)	Local
Valve (Y241-XV)	Open/close hand switch	Y241-HS-2 (O/C)	Open/Close

For Valve (Y241-XV) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		Y241_Open/Close_Mode_PB	Open/Close command
PLC		Y211/221/231-VD/VB	Open/Close
Valve (Y241-XV)	Local/remote hand switch	Y241-HS-1 (L/R)	Remote

2.2.4.3. Entrance Gate (Y840) and Exit Gate (Y845)

For Entrance Gate (Y840) or Exit Gate (Y845) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		Y840/805/815/835_Gate_Open_Mode_PB	Open command
PLC		Y840/805/815/835-ZCD	Open

2.2.5. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Entrance Gate (Y840)	Open command	Y840_Gate_Open_Mode_PB	Networked Digital Output
Exit Gate (Y845)	Open command	Y845_Gate_Open_Mode_PB	Networked Digital Output
FW Valve (Y794/795/796)	Open command	Y794/795/796_Valve_Open_Mode_PB	Networked Digital Output
FW Valve (Y794/795/796)	Close command	Y794/795/796_Valve_Close_Mode_PB	Networked Digital Output
Valve (Y241-XV)	Open command	Y241_Valve_Open_Mode_PB	Networked Digital Output
Valve (Y241-XV)	Close command	Y241_Valve_Close_Mode_PB	Networked Digital Output
Building 2	High sump level alarm	YA-Y650-LH	Networked Digital Input
Building 2	Flood alarm	YA-Y702-FA	Networked Digital Input
Entrance Gate (Y840)	Manual status	YA-Y840-MD	Networked Digital Input
Entrance Gate (Y840)	Proximity status	YA-Y840-PXS	Networked Digital Input
Entrance Gate (Y840)	Fault	YA-Y840-QF	Networked Digital Input

Equipment	Signal Description	Signal Tag	Signal Type
Entrance Gate (Y840)	In service status	YA-Y840-SE	Networked Digital Input
Exit Gate (Y845)	Manual status	YA-Y845-MD	Networked Digital Input
Exit Gate (Y845)	Proximity status	YA-Y845-PXS	Networked Digital Input
Exit Gate (Y845)	Fault	YA-Y845-QF	Networked Digital Input
Exit Gate (Y845)	In service status	YA-Y845-SE	Networked Digital Input
Flow Meter (Y163)	Fault	YA-Y163-LL	Networked Digital Input
FW Valve (Y794/795/796)	Automatic status	YA-Y794/795/796-AM	Networked Digital Input
FW Valve (Y794/795/796)	Manual status	YA-Y794/795/796-MD	Networked Digital Input
FW Valve (Y794/795/796)	Remote status	YA-Y794/795/796-RS	Networked Digital Input
FW Valve (Y794/795/796)	In service status	YA-Y794/795/796-SE	Networked Digital Input
FW Valve (Y794/795/796)	Fail to close alarm	Y794/795/796_Valve_Fail_To_Close_Alm	Networked Digital Input
FW Valve (Y794/795/796)	Fail to open alarm	Y794/795/796_Valve_Fail_To_Open_Alm	Networked Digital Input
FW Valve (Y794/795/796)	Open status	Y794/795/796_Valve_Open_Status	Networked Digital Input
FW Valve (Y794/795/796)	Closed status	Y794/795/796_Valve_Close_Status	Networked Digital Input
Lane 4	Lockdown status	YA-Y840-LD	Networked Digital Input
Lane 4	Lock out status	YA-Y850-M4L	Networked Digital Input
Sampler (Y940)	Sampler E-Stop	YA-Y940-XS	Networked Digital Input
Flow Meter (Y163)	Wastewater flow	YA-Y163-FT	Networked Analog Input
FW Valve (Y794/795/796)	Position	YA-Y794/795/796-PS	Networked Analog input
Holding Tank 4 (Y141)	Leachate influent flow	XA-X151-FS	Networked Analog Input
Holding Tank 4 (Y141)	Leachate influent volume	XA-X151-TOT	Networked Analog Input
Holding Tank 4 (Y141)	Tank Level	YA-Y141-LT	Networked Analog Input
Lane 4	Third full	141-YAY-02	Networked Analog Input

2.2.6. HMI Display

Device Description	Status
Building 2	Flood alarm (Normal/Alarm)
Building 2	High sump level alarm (Normal/Alarm)
Entrance Gate (Y840)	Automatic/Manual status
Entrance Gate (Y840)	Fault status (Normal/Fail)
Entrance Gate (Y840)	In service status
Entrance Gate (Y840)	Proximity status
Exit Gate (Y845)	Automatic/Manual status
Exit Gate (Y845)	Fault status (Normal/Fail)
Exit Gate (Y845)	In service status
Exit Gate (Y845)	Proximity status
Flow Meter (Y163)	Flow meter fault (Normal/Fail)
FW Valve (Y794/795/796)	AUTOMATIC mode open limit setpoint (%)
FW Valve (Y794/795/796)	Automatic/manual status
FW Valve (Y794/795/796)	In service status
FW Valve (Y794/795/796)	Local/remote status
FW Valve (Y794/795/796)	MANUAL mode open limit setpoint (%)
FW Valve (Y794/795/796)	Position (%)
Holding Tank 4 (Y141)	High level alarm (Normal/Alarm)
Holding Tank 4 (Y141)	Level transfer fail (Normal/Fail)
Holding Tank 4 (Y141)	Tank level (m)
Lane 4	Third full (m)
Lane 4	Cancel large flush
Lane 4	Cancel occupied status
Lane 4	General alarm reset
Lane 4	Hauled waste mode selected (Yes/No)
Lane 4	Large flush requested
Lane 4	Large flush run status
Lane 4	Leachate mode selected (Yes/No)
Lane 4	Lock out status
Lane 4	Lockdown status
Lane 4	Operating state (Normally Open/Normally Closed)
Lane 4	Request large flush
Lane 4	Status (Bad Quality/Lane Open/Accepted/Occupied/Cleaning/Lockout/Lane Closed)
Lane 4 Hauled Liquid Waste System	Hauled liquid waste flow (L/s)
Lane 4 Leachate System	Leachate flow (L/s)
Lane 4 Leachate System	Total leachate volume (M3)
Sampler (Y940)	In service status
Sampler (Y940)	Sampler E-Stop
Valve (Y241-XV)	Automatic/Manual status
Valve (Y241-XV)	In service status
Valve (Y241-XV)	In service status

2.2.7. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Holding Tank 4 (Y141)	High tank level	YA-Y141-LT above 2.0m	Alarm notification
Holding Tank 4 (Y141)	Low tank level	YA-Y141-LT below 0.2m	Alarm notification

3. GAS DETECTION AND MONITORING

Associated P&ID:
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nsepl1.G, nsepl2.G, nsepl3.G, nsepl4.G

3.1. Process Description

Each lane has a hydrocarbon (HC) sensor (Y112/122/133/143) that detects the HC levels in the lane's holding tank.

Each Hauled Wastewater Building has an ambient H2S analyzer (Y900/901). The H2S analyzer will generate a warning when the H2S levels rise above 5ppm. The H2S analyzer will go into alarm when the level rises above 10ppm. The warnings and alarms are cleared once the H2S level falls below 2.5ppm for 1 hour.

Each Hauled Wastewater Building has a CO (HWWCOAL/ B2SMKAL) and smoke detector (HWWSMKAL/ B2SMKAL) which will alarm upon detection of CO and smoke.

3.2. Control Description

The PCS monitors and displays the gas warnings and alarms for each lane.

3.2.1. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Building 1	CO alarm	HWWCOAL	Networked Digital Input
Building 1	Smoke alarm	HWWSMKAL	Networked Digital Input
Building 1	High H2S alarm	YA-Y900-H2S	Networked Digital Input
Building 1	H2S warning	YA-Y900-H2SW	Networked Digital Input
Building 2	CO alarm	B2COAL	Networked Digital Input
Building 2	Smoke alarm	B2SMKAL	Networked Digital Input
Building 2	High H2S alarm	YA-Y901-H2S	Networked Digital Input

Building 2	H2S warning	YA-Y907-H2SW	Networked Digital Input
Lane 1/2 Hydrocarbon Sensor (Y112/122)	High hydrocarbon alarm	YA-Y112/122-HAL	Networked Digital Input
Lane 1/2 Hydrocarbon Sensor (Y112/122)	High high hydrocarbon alarm	YA-Y112/122-HHAL	Networked Digital Input
Lane 3 Hydrocarbon Sensor (Y133)	High high hydrocarbon alarm	133-YAY-01	Networked Digital Input
Lane 3 Hydrocarbon Sensor (Y133)	High hydrocarbon alarm	133-YAY-02	Networked Digital Input
Lane 4 Hauled Liquid Waste Hydrocarbon Sensor (Y143)	High high hydrocarbon alarm	143-YAY-01	Networked Digital Input
Lane 4 Hauled Liquid Waste Hydrocarbon Sensor (Y143)	High hydrocarbon alarm	143-YAY-02	Networked Digital Input
Building 1	H2S level	YA-Y900-VAL	Networked Analog Input
Building 2	H2S level	901-YAE-01	Networked Analog Input
Lane 1/2 Hydrocarbon Sensor (Y112/122)	% LEL	YA-Y112/122-AT	Networked Analog Input
Lane 3 Hydrocarbon Sensor (Y133)	% LEL	YA-Y133-HCS	Networked Analog Input
Lane 4 Hauled Liquid Waste Hydrocarbon Sensor (Y143)	% LEL	YA-Y143-HCS	Networked Analog Input
Lane 4 Leachate H2S Sensor (X951)	H2S ppm	XA-X951-H2S	Networked Analog Input
Lane 4 Leachate Hydrocarbon Sensor (X952)	LEL ppm	XA-X952-HC	Networked Analog Input

3.2.2. HMI Display

Device Description	**Status**
Building 1/2	CO alarm (Normal/Alarm)
Building 1/2	H2S High (Normal/Alarm)
Building 1/2	H2S Warning (Normal/Alarm)
Building 1/2	Smoke alarm (Normal/Alarm)
Lane 1/2/3/4	H2S Level (ppm)
Lane 1/2/3/4	High high hydrocarbon concentration alarm (Normal/Alarm)
Lane 1/2/3/4	High hydrocarbon concentration alarm (Normal/Alarm)
Lane 1/2/3/4	LEL % > 25%
Lane 1/2/3/4	LEL (%)
Lane 1/2/3/4	Silence LEL alarm
Lane 4 Leachate System	H2S (ppm)
Lane 4 Leachate System	LEL (ppm)

3.2.3. PCS Alarms

Equipment	Alarm Description	Alarm Condition	Alarm Response
Building 1/2	CO alarm	HWWCOAL/B2COAL in alarm	Alarm Notification
Building 1/2	H2S High	YA-Y900/901-H2S in alarm	Alarm Notification
Building 1/2	H2S Warning	YA-Y900/907-H2SW in alarm	Alarm Notification
Building 1/2	Smoke alarm	HWWSMKAL/B2SMKAL in alarm	Alarm Notification
Lane 1/2 Hydrocarbon Sensor (Y112/122)	High high hydrocarbon concentration alarm	YA-Y112/122-HHAL in alarm	Alarm Notification
Lane 1/2 Hydrocarbon Sensor (Y112/122)	High hydrocarbon concentration alarm	YA-Y112/122-HAL in alarm	Alarm Notification
Lane 3 Hydrocarbon Sensor (Y133)	High high hydrocarbon concentration alarm	133-YAY-02 in alarm	Alarm Notification
Lane 3 Hydrocarbon Sensor (Y133)	High hydrocarbon concentration alarm	133-YAY-01 in alarm	Alarm Notification
Lane 4 Hauled Liquid Waste Hydrocarbon Sensor (Y143)	High high hydrocarbon concentration alarm	143-YAY-02 in alarm	Alarm Notification
Lane 4 Hauled Liquid Waste Hydrocarbon Sensor (Y143)	High hydrocarbon concentration alarm	143-YAY-01 in alarm	Alarm Notification

4. WASTE HAULING SAMPLERS

Associated P&ID:
Associated NEWPCC Manuals:
Associated DCS HMI Screens: nwhs.G

4.1. Process Description

Each lane has an automatic sampler (Y910/920/930/940/950). During the discharge period, the automatic samplers take raw sewage (RS) samples downstream of the lane's manhole and store them in the attached refrigerator.

The samplers can collect a daily composite sample or an individual sample.

4.2. Control Description

The PCS monitors the sampler's in-service, e-stop, full carousel, last dump position, and operating mode statuses. The PCS will send a 5 second pulse back to the PLC (YA-Y910/920/930/940/950-SE) when the sampler changes its in service status.

4.2.1. Interlocks, Permissives and Control Signals

For Sampler (Y910/920/930/940/950) to operate in LOCAL (MANUAL) mode:

Equipment	Device Description	Device Tag	State
Local Control Panel	Hand/off/automatic hand switch	Y910/920/930/940/950-HS-1 (HOA)	Hand
Local Control Panel	Int/com hand switch	Y910/920/930/940/950-HS-2 (INT/COM)	Int
Local Control Panel	Eject hand switch	Y910/920/930/940/950-HS-3 (Eject)	Normal

For Sampler (Y910/920/930/940/950) to operate in COMPUTER (REMOTE) mode:

Equipment	Device Description	Device Tag	State
PCS		YA-Y910/920/930/940/950-SE	In service
PLC		Y910/920/930/940/950-AN	Start
Local Control Panel	Hand/off/automatic hand switch	Y910/920/930/940/950-HS-1 (HOA)	Automatic
Local Control Panel	Int/com hand switch	Y910/920/930/940/950-HS-2 (INT/COM)	Com
Local Control Panel	Eject hand switch	Y910/920/930/940/950-HS-3 (Eject)	Normal

4.2.2. Inputs and Outputs

Equipment	Signal Description	Signal Tag	Signal Type
Sampler (Y910/920/930/940/950)	In service	YA-Y910/920/930/940/950-SE	Networked Digital Output
Sampler (Y910/920/930/940/950)	Sampler E-Stop status	YA-Y910/920/930/940/950-XS	Networked Digital Input
Sampler (Y910/920/930/940/950)	Sampler carousel full	YA-Y910/920/930/940/950-EB	Networked Digital Input
Sampler (Y910/920/930/940/950)	Run status	YA-Y910/920/930/940/950-MM	Networked Digital Input
Sampler (Y910/920/930/940/950)	Off mode status	YA-Y910/920/930/940/950-OM	Networked Digital Input
Sampler (Y910/920/930/940/950)	Last dump position	YA-Y910/920/930/940/950-PT	Networked Digital Input
Sampler (Y910/920/930/940/950)	Auto mode status	YA-Y910/920/930/940/950-SAM	Networked Digital Input
Sampler (Y910/920/930/940/950)	Hand mode status	YA-Y910/920/930/940/950-SHM	Networked Digital Input

4.2.3. HMI Display

Device Description	Status
Sampler (Y910/920/930/940/950)	In service status
Sampler (Y910/920/930/940/950)	Sampler E-Stop
Sampler (Y910/920/930/940/950)	Sampler Carousel Full
Sampler (Y910/920/930/940/950)	Last dump position

Device Description	Status
Sampler (Y910/920/930/940/950)	Off mode status
Sampler (Y910/920/930/940/950)	Hand mode status
Sampler (Y910/920/930/940/950)	Auto mode status