

1. Procedure summary

The purpose of this SOP is to describe the decanter and harvested algae storage system and their operations.

Related Procedures

TA Basket Strainer Replacement	CB-02-004-007
Maintenance of Decanter	CB-02-006-001
Decanter Harvest Monitoring	CB-02-006-003
Decanter Troubleshooting	CB-02-006-004
Transfer Slurry for Transport	CB-02-007-003

Procedure impacts and concerns

Safety	The decanter works reliably, provided that is operated and looked after in accordance with our operating instructions. Shutdown the decanter immediately when unusual noises, vibrations or overheating occur. Wear ear protection in the decanter processing area.
Quality	A process interruption due to decanter downtime will have a negative impact on culture health.
Delivery	All pumps need to be operated wet to prevent any damage.
Environmental	Algae material spilled in the decanter area will be recorded and cleaned up as soon as possible.
Cost	Failure to monitor decanter operation properly and/or transfer the target product volume of thickened algae may result in insufficient harvest and result in product losses.
Compliance	Failure to monitor decanter equipment can lead to a large amount of product that is not efficiently processed (too high of a moisture content) and/or large amounts of Centrate that would have to be sent to the evaporation pond.

Responsibilities and owners

Document Owner	Manage content and distribution	Timothy Langer
Process Owner	Responsible for content and process validation	Rebecca White
Site Manager	Responsible for implementation and conformance	Rebecca White

2. Process

Process description

The decanter and its associated equipment move thickened algae from the DAF and further dewater the algae product using centrifugal forces and a mechanical scroll to preferentially separate water from algae.

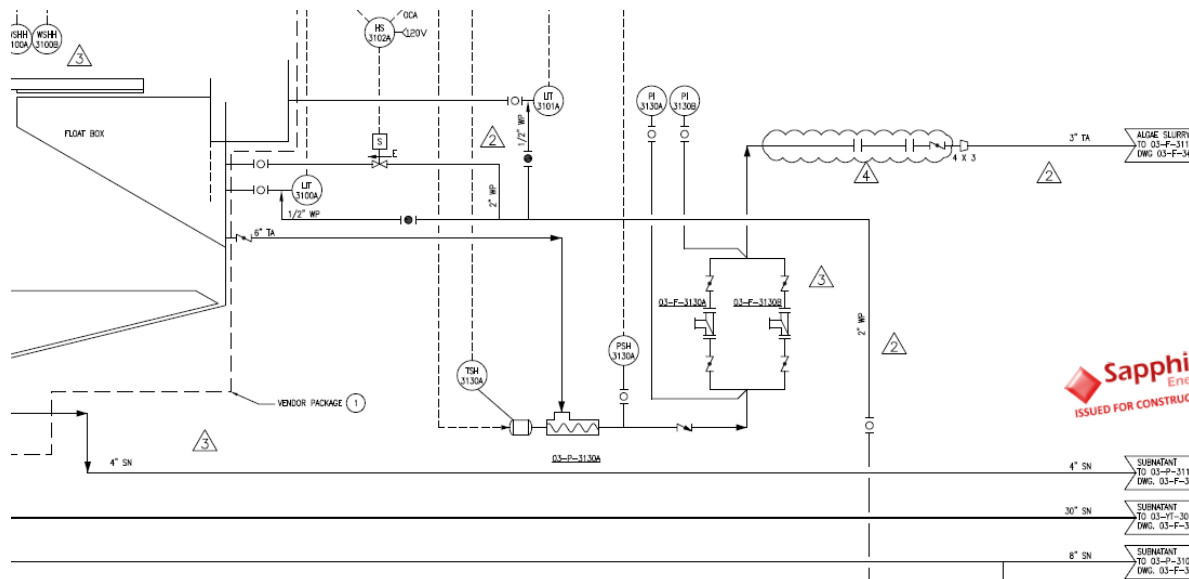
The DAF float box is emptied by a progressive cavity pump and to the decanter.

Concentrated algae from the decanter fall's from the decanter and into a hopper feeding a progressive cavity pump. This pump moves algae into an external transfer tank. Algae in the tank may be mixed and circulated using the under tank progressive cavity pump. This pump also serves to empty and transfer the tank contents to a waiting tanker truck.

Clarified process water from the decanter may be returned to the SN system upstream of the SN lift station

pump at the chemical injection location. Alternatively, clarified process water may be discharged to the building process floor drain for pumping to the evaporation ponds.

Process diagram: Work Instruction



NOTE: Do not run the TA feed pump for 30 minutes without feed or damage will occur to the pump.

Figure 1: Illustrates the process systems from the DAF to the decanter. Thickened algae accumulate in the DAF float box by the continuous process of flocculation and air floatation. As the algae rises in the DAF, a thickened cake is formed on the water surface. Rotating blades on the surface of the DAF push and skim the cake to the float box where it overflows into the float box. There is a level transmitter in the float box to tell the PLC when there is material present in the float box for transferring to the decanter. There is no intermediate accumulation between the DAF and decanter so the float box must be used in intermediate process supply buffer for the decanter.

The decanter thickened algae feed pump should not be run dry or premature wear of the stator insert will occur. The thickened algae (TA) feed pump can be kept wet by pacing the DAF cake generation at or slightly above the operating rate of the TA pump. Process water may be introduced into the float box by actuating the flush solenoid on the 2" WP line feeding the float box. This flush line may be used to prime the TA line to the decanter, flush the line and push out material at the end of a DAF/decanter run. The volume of the 3" TA line between the DAF and decanter is approximately 75 US gal.

Downstream of the TA pump is a pair of basket strainers with approximately 1 mm sized openings. These basket strainers are designed to be operated in an A-B fashion and not in parallel. When the pressure drop across a strainer exceeds the change point, the operating A strainer must be taken out of service and the B strainer put into service. A nearby utility station can be used to flush basket strainer contents.

NOTE: When left hand side gauge reaches 80 psi change strainer.

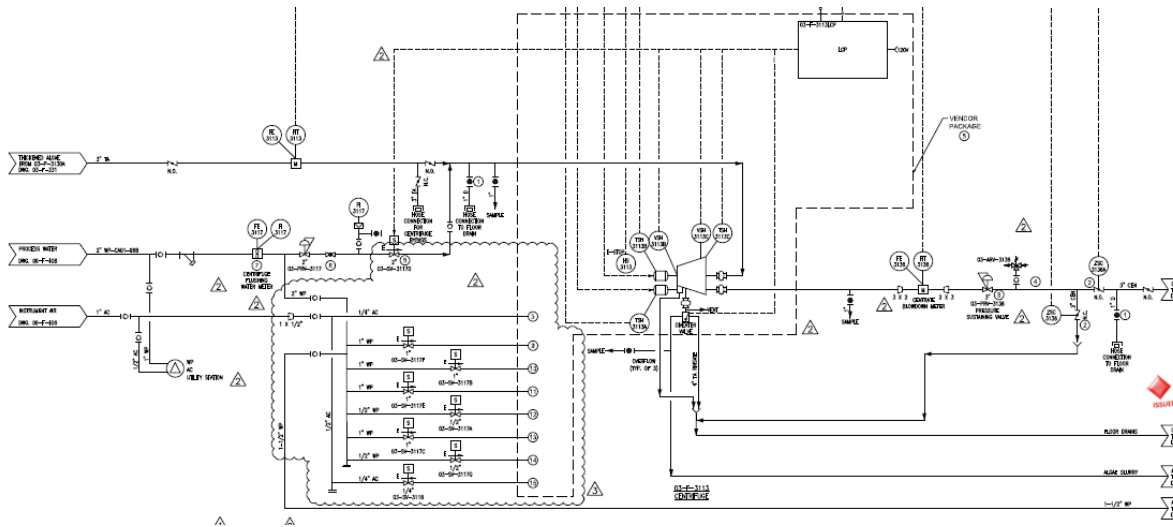


Figure 2: illustrates the process lines into and out of the decanter. In addition to the main-line process flows of TA, CEN and Algae Slurry, the decanter has connections for flush water and compressed air for lubrication and operation of the VariPond system. Several of these systems drain to the process floor drain.

The solids are discharged into the discharge chute where there is a manual diverter gate. This gate switches between directing flow to the process floor drain and the algae slurry transfer pump to storage. When the diverter gate is open, close attention needs to be paid to the viscosity of the product. This will ensure quality product is been sent to the storage tank.

Process steps

2.3.1 Decanter Set-up

2.3.1.1 Check the following valves are in the positions listed prior to decanter start-up:

- Open the TA Supply (TA-V210)
- Close the Decanter by-pass (TA-V212)
- Open the Decanter feed (TA-V211)
- Close the SN return (CEN-V103)
- If transferring to the SN return line, open CEN-V105)
- Open the breather vent (CEN-V101)
- If transferring Centrate to the lift station, open CEN-V102
- Close the Subnatant sample valve (SN-V104)
- Open the decanter water supply valve (WP-V502)
- Open the water transfer valve (WP-V520)
- Open the water transfer to solenoid valve (WP-V503)
- Open the water line to the pressure indicator (WP-V521)
- Open the decanter flush water valve (WP-V524)
- Close the thickened algae feed sample port (TA-V213)
- Open the spray ball to the hopper valve (WP-V516)
- Close the hopper inlet valve (WP-V517)
- Close the diverter gate valve (WP-V519)
- Close the hopper sample port (WP-V520)
- Close the water flush valve (WP-V518)
- Close the decanter product sample port (AS-V911)

NOTE: Refer to
Decanter P&ID for
valve Harvest Area
valve numbers and
locations.

Open the transfer to algae storage tank (AS-V910)
Close the decanter product transfer valve to the drain (AS-V912)
Close the thickened algae sample valve (TA-V214)
Close the Centrate sample valve (CEN-V100)
Verify 50 psi at the Centrate back pressure valve
Verify required oil level at decanter

- 2.3.1.2 Record TA feed totalizer and the Centrate totalizer
- 2.3.1.3 Make sure Centrifuge control panel power is ON in the MCC building
- 2.3.2.3 Verify E-stop is pulled out
- 2.3.2.4 Verify diverter gate switch is placed in Remote
- 2.3.2.5 Verify Algae Slurry Chute pump (09-P-9059) is in Program Mode at the HMI
- 2.3.2.6 Press "Centrifuge Start" button at the decanter control panel in decanter building
- 2.3.2.7 Verify decanter is ramping up to Set-point (4000 RPM) Then drop to (3000 RPM)
- 2.3.2.8 Verify "Centrifuge Ready for Feed" when decanter reaches Set-point
- 2.3.2.9 Verify TA pump (03-P-3130A) is placed in Program Mode at the HMI
- 2.3.2.10 Verify float box has collected product, prior to pressing "Process Start"
- 2.3.2.11 Press "Process Start" at the decanter control panel
- 2.3.2.12 Adjust back pressure valve to clear Centrate (50-70 psi)
- 2.3.2.13 Adjust TA feed pump flow rate to increase solids collected in product
- 2.3.2.14 Adjust Varipond manually during the run (0-2 bar)
- 2.3.2.15 Check flow meters and flow rates on decanter control panel to verify operations

2.3.2 Shutdown

- 2.3.2.1 Run rinse water from the DAF float box to the decanter for approximately 15 min
To clean out lines if not By-passing.
- 2.3.2.2 Press "Process Stop" button at the decanter control panel
- 2.3.2.3 Press "Flush & Shutdown" button to start CIP cycle (10 CIP's recommended)
- 2.3.2.4 Close diverter gate
- 2.3.3.5 Verify all CIP cycles are completed

2.3.3 Emergency Shutdown – All Equipment OFF Immediately

- 2.3.3.1 An emergency shutdown is issued when the E-Stop push button is activated
- 2.3.3.2 The E-Stop will remove power from the Bowl and Scroll VFDs

2.3.4 Algae Load Out Pump Operation

- 2.3.4.1 Verify Algae Load-out Pump (09-P-9061) switch is in Auto in the MCC building
- 2.3.4.2 Verify E-Stop is pulled at Algae Load-out Pump
- 2.3.4.1 Operate the Algae Load-out Pump by pressing the Start or Stop button (See
Transfer Slurry for Transport procedure CB-02-006-002)

3. Required documents

Input documents

Harvest Record
Truck Manifest

<Input document
number>

Output documents

Harvest Record

<Output document

Truck Manifest
MSDS for algae material

number>

4. Document control**Revision history**

R0 – Initial Release – Dave Marsh	February 28, 2012
R1 – Updated Procedure – Marcos Delgado	August 16, 2012
R3- Updated Procedure- Leo Willis	January 6,2 2015

Document approval**Document reviewers**<Last reviewed
date><Last reviewed
date>**5. Risk analysis**

<Risk name>

<Mitigation plan>

<Owner> <RPN
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