Stan Mayfield BioRefinery Pilot Plant

The Commission Plan was developed at a high level to provide overall guidance for starting up the pilot plant and commissioning the unit operations, individually and as a continuous process. This Start Up Plan addresses the more detailed approach to the first few weeks of operations.

Phase 1 – Systems start up.

Most all of the plant services are required for the initial start up of the biomass handing front end, including:

1. Electricity
2. Steam (high and low pressure systems)
3. Air
4. Refrigeration system
5. Computer-assisted Control System

In addition, several other unit operations are required to handle materials required by or produced by the pretreatment system including:

1. Process Water
2. Phosphoric acid system
3. CO2 Scrubber
4. Bleach Scrubber (without bleach – only needed for CO2 Scrubber operation)
5. Beer Well
6. Flash Steam Condenser
7. Wastewater System

This plan begins with these systems already having been flushed, pressure tested, and ready for operation. Instrumentation on each system must be calibrated according to Appendix A – Instrument Calibration Log.

The process water, acid system, scrubbers, beer well, and wastewater systems will begin start up by being tested with water as follows:

1. Process Water. The process water system is designed to use service water, distillation bottoms, and condensate. Initially, the system will operate only on service water. The system will be started up by:
    a. Starting up the refrigeration system according to SOP-9210
    b. Start up Process water according to SOP-9505
    c. Fill the process water tank to 80% volume
    d. Set maximum temperature set point to 115 F
2. Acid system. A tote will be filled to 50% volume (~150 gallons) with water will be put in place of the concentrated acid tote in the spill containment

area. The tote will be connected to the Concentrated Acid Metering Pump (PM-8101). The system will be started up by:

a. The Metering Pump will then be tested with water as it feeds the Phosphoric Acid Mix tank using the Flow Control Method in SOP-8110.
b. Once the system is verified to be operating properly to achieve a reasonably accurate ratio of streams from the tote and process water lines under Flow Control Method, the water will be drained from the Mix tank and concentrated acid meter pump and lines.
c. A concentrated Acid tote will be put in place and the process repeated under process conditions using Flow Control Method.
d. The concentration of dilute acid mixture will be verified using SOP-0501.
e. The system will then be ready for process Start Up.

3. Scrubber System. The CO2 Scrubber will be operated normally using process water as it receives vent gases from the flash steam condenser and beer well. The Bleach Scrubber will be operated using process water without bleach unit micro organisms are introduced to the facility. The system will be started up by:
    a. The CO2 Scrubber will be started up using 2 gpm process water feed according to SOP-7210
    b. Water is pumped from the scrubber to the beer well under liquid level control.
    c. The Bleach scrubber will be filled to 80% volume with process water from a tote according to SOP-7211
        i. Placing tote with at least 50 gallons of process water in position of the dilute bleach tote
        ii. Connect the tote to the system according to SOP-7211
4. Beer Well. Process water will be added to the beer well to 25% volume by:
    a. Connecting a hose to HC-4601-01 and pumping water into the tank according to SOP-4600.
5. Wastewater. The wastewater tank will receive water from the Bleach Scrubber and Beer Well (via floor drain). The wastewater tank will be prepared according to SOP-9530
6. Flash Steam Condenser. This condenser will receive flash steam from the blow tank and Sample Cyclone. The condenser uses chilled water to trap vapors which are sent to the floor drain.

The Start Up schedule is given in Appendix B.

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Phase 2 – Hydrolyzer Start Up

The hydrolyzer will be started in four steps according to SOP-2110:

1. Without the use of steam, the system will be run to test instrumentation, controls, motors, and conveyors.
2. Test and calibrate the biomass feed system – Biomass Feed Bin to PreSteam Bin. Bagasse will be fed in order to calibrate the feed rate by collecting biomass off the Steam Bin Transfer Conveyer (SOP-2110 Section 3 & 4).
3. Low pressure and acid concentration operation to introduce steam and acid into the system (SOP-2110 Section 5).
4. Full pressure and low acid concentration to commission the system (SOP-2110 Section 6).

During this start up sequence, all bagasse will be sent to the C6 Storage Bin. The concentration of acid used will be ½ the amount of normal processing. The temperature will be 190 C (374 F).

This sequence is expected to take two weeks.

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Appendix A – Start Up Schedule

SYSTEM	ACTIVITY	9-Apr							16-Apr							23-Apr							30-Apr						
		M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
Electricity	System energized	X																											
Steam Boiler	Powered up	X																											
Air Compressor	Powered Up	X																											
Refrigeration System	Powered up	X																											
Potable Water	System ready	X																											
HoneyWell System	Loop Check	X	X	X	X	X																							
HoneyWell System	Calibration								X	X	X	X	X																
Process Water	Instr. Calib.								X	X																			
	Fill with water										X																		
	Temp. Cntrl Test.										X																		
CO2 Scrubber	Instr. Calib.										X	X																	
	Level Cntrl Test												X																
Bleach Scrubber	Instr. Calib.										X	X																	
	Level Cntrl Test												X																
Beer Well	Instr. Calib.												X																
	Add water to 25%															X													
Wastewater Tank	Instr. Calib.												X																
	Add water to 25%																												
Flash Steam Condenser	Instr. Calib.												X																
Biomass Handling	Feed system															X													
	Presteam Bin - Inst. Calib															X													
	Presteam Bin start																X												
Hydrolyzer	Inst. Calib															X													
	Phase 1 Start																	X											
	Phase 2 Start																		X	X									
	Phase 3 Start																												
	Phase 4 Start																												
Acid Mix System	Instr. Calib.															X	X												
	Metering Pump Calib.																	X											
	Flow Cntrl. Test																	X											
	AG-8101 test																	X											
	Transfer Pump																		X										
Acid Hold System	Instr. Calib.															X	X												
	AG-8102 Test																	X											
	PM-8103 Test																	X											
	PM-8104 test																	X											
Dil Acid System	Acid Tote																	X											
	Dilute Acid Mixture																		X	X									
	Fill Dil. Acid Hold Tank																			X									

Appendix B – Instrument Calibration Log

System	Unit	Device	Value	Instrument	Range
Refrigeration System	Cooling Water Heat Exchanger	HP-9202	Temp Inlet		40 - 45 F
			Temp Outlet		80 - 90 F
			Pressure Inlet		0 - ?? lbs
Process Water System	Process Water Tank	TS-9501	Liquid Level		0 - 100%
	Process Water Pump	PC-9501	Flow rate		0 - 100 gpm
	Process Water Cooler	HP-9501	Temperature		100 - 120 F
Acid System	Conc. Acid Metering Pump	PM-8101	Flow rate		0 - 6 gpm
	Process Water		Flow rate		0 - 100 gpm
	Dilute Acid Mix Tank	TS-8101	Liquid Level		0 - 100%
			Weight		0 - 6600 lbs
	Dilute Acid Transfer Pump	PM-8102	Flow rate		0 - 6 gpm
	Dilute Phos. Acid Hold Tank	TS-8102	Liquid Level		0 - 100%
			Conductivity		0 - ??
	Dilute Phos. Acid Metering Pump	PM-8103	Flow rate		0 - 60 gph
		PM-8104			0 - 16 gph
Beer Well	Beer well	TS-4601	Liquid Level		0 - 100%
	Beer Stripper Feed Pump	PC-4601	Pressure Outlet		0 - ?? Lbs
			Temp Outlet		??
			Flow Rate		0 - 5 gpm
Wastewater	Wastewater Tank	TS-9502	Liquid Level		0 - 100%
	Wastewater Pump	PC-9502	Pressure Outlet		0 - ?? Lbs
			Flow Rate		0 - 20 gpm
Bleach Scrubber	Scrubber	SC-7203	Liquid Level		0 - 100%
			Pressure - Top		0 - ?? Lbs
			Pressure - Mid		0 - ?? Lbs
			Pressure - Bottom		0 - ?? Lbs
	Scrubber Pump	PC-7203	Flow rate		0 - 2.2 gpm
			Pressure - Outlet		0 - ?? Lbs
CO2 Scrubber	Process water		Flow rate		0 - 3 gpm
	Scrubber	SC-7201	Liquid Level		0 - 100 %
			Temp		??
			Pressure - Top		??
			Pressure - Mid		??
			Pressure - Bottom		??
	Scrubber Fan	FA-7201	Pressure Inlet		0 - ?? Lbs
			Pressure outlet		0 - ?? Lbs
	Scrubber Pump	PC-7201	Pressure Outlet		0 - ?? Lbs
Flash Steam Condenser	Chilled Water		Pressure - Inlet		0 - ?? Lbs
			Pressure - outlet		
		HS-2201			