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OPERATING INSTRUCTIONS FOR
WASTE BEER DISTILLATION SYSTEM AT
ANHEUSER BUSCH, INC. PROJECT 773
FAIRFIELD, CALIFORNIA 94533

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OPERATING INSTRUCTIONS FOR WASTE BEER DISTILLATION SYSTEM

1.0 Process General Description (Drawing PP4-0003.01 Sheet 1, PP5-0003-01 Sheet 2.)

Equipment is designated for degassing waste beer, preheating the beer, stripping alcohol from the beer, rectifying the alcohol, and cooling it. Operations are essentially at atmospheric pressure.

1.1 Mass Flow Balance (Drawing PP4-0003-10):

	Composition, %-EtOH	Flow lb/hr	Pressure PSIG	Temper- ature °F
Waste Beer	2%	23,284.7	40 in	150°F
Distillate	95%	476	20 out	86°F
Stripped beer	.02%	22,829	20 out	160°F
Fusel-Oil (1)	-			

(1) To be determined by test

1.2 Utilities Demand:

Connected Horsepower (2) : 27.5 H.P.
 Steam : 5,545 lb/hr, 60 PSIG
 Cooling Water : 900 GPM 85°F (6.24 x 10⁶ BTU/hr)
 Instrument Air : 10 SCFM

(2) Exclusive of waste beer feed pump.

1.3 Process Control and Instrumentation. (Drawing PP4-0003-02 Sheet 1, PP5-0003-02 Sheet 2)

1.3.1 Feed Flow Waste beer flow is measured before preheating by magnetic flow meter, FRC 12-1E. Waste beer is throttled at the elevation of the preheaters, and then rises, flashing, into the degasser, 33-173-4.

1.3.2 Feed Preheat Waste beer is preheated to 10°F below the spent beer temperature by regeneration (33-173-8), and then to 8°F above boiling water temperature by steam preheating (33-173-5).

1.3.3 Degasser Control The degassing effort is controlled by the amount the feed is preheated above the atmospheric boiling point.

A mesh pad in the degasser flash vessel consolidates misted beer. Flash vapor is condensed in the degasser condenser, and the volatiles are vented to the air.

- 1.3.4 Stripper Still Feed All the degassed beer is pumped (33-173-2) to the stripper still (33-173-1) feed point (tray 5 of 28) at 2% by weight alcohol in the beer.
- 1.3.5 Stripper Still Reboil Stripper still reboil steam flow is measured (FRC 12-4 E) at constant pressure (60 PSIG). The steam flow is throttled (FRC 12-4V) to maintain the required flow as set (FRC 12-4 RATIO) in proportion to the waste beer feed rate. A square root extractor (FRC 12-4X) linearizes the steam flow signal to conform to the set point derived from the linear signal of the magnetic flow meter.
- 1.3.6 Stripper Still Reflux Stripper still reflux flow is measured (FRC 12-3-E). The reflux flow is throttled (FRC 12-3V) to maintain the required flow as set (FRC 12-4 ratio) in proportion to the waste beer feed rate. A square root extractor (FRC 12-3X) linearizes the reflux flow signal to conform to the set point derived from the linear signal of the magnetic flow meter.
- 1.3.7 Stripper Still Distillate Condensed stripper distillate is pumped (33-173-23) without throttling to the holding tank.
- 1.3.8 Stripper Bottoms Level The NPSH requirement of the reboiler pump is assured by level controller LIC 12-1. LIC 12-IV is downstream from the regenerative preheater.
- 1.3.9 Interstage Control Balance between the work of the stripper and rectifier is achieved by sensing the inventory level in the holding tank, 33-173-12. The feed rate to the rectifier increases in response to increased levels in the holding tank.
- 1.3.10 Rectifier Bottoms Level The NPSH requirement of the reboiler pump 33-173-18 is assured by a locally mounted level controller, LIC 12-3. Rectifier bottoms are pumped (33-173-16) and throttled (LIC 12-3V) to the holding tank. The holding tank is vented to the rectifier still bottom to prevent flashing of the returned rectifier bottoms when they enter the holding tank.
- 1.3.11 Product Quality The weight of a constant height leg of sample distillate is measured by a differential pressure cell having a reversed pneumatic output; a product of low specific gravity causes a high pneumatic output from the transmitter. The density controller releases final product in accordance with the measured density.
- 1.3.12 Rectifier Reflux The failure of the product to be released from the system because of low quality causes an increase in distillate level. An increase in distillate level (LIC 12-4) results in an increased rectifier reflux (LIC 12-4V) and increases the quality of the overhead vapor.

1.3.13 Cooling Water Control Each of the condensers is fitted with a temperature indicating controller to regulate the condensate temperature (TIC 12-3, -4, -5) by throttling the supply of cooling tower water. The flow rates and pressure drops published for the condensers were based on a temperature rise of 14°F (from 85°F to 99°F) of the cooling water.

1.4 Equipment Access and Surveillance

1.4.1 Direct Reading Instruments The following process conditions are monitored by logging of direct reading instruments during a commissioning run and compared to locate the cause of off-range operation.

1.4.1.1 Heat Exchanger pressure and temperature in and out (Fouling or plugging).

1.4.1.2 Distillation temperature and quality profile (during commissioning).

1.4.1.3 Reboiler pumps discharge pressure and temperature.

1.4.1.4 Cooling water temperature and pressure.

1.4.1.5 Level gauges for vessels having controlled liquid levels.

1.4.2 Equipment Access Sample valves are designated for measuring product quality during initial commissioning. Block valves and drain valves for service to pump seals are designated. Valves in high-proof sections of the plant are subject to internal revenue regulations regarding protection of tax revenue.

The need of connections for supply of boil-out cleaning liquids and for their removal is recognized. The 39" stripper still (33-173-1) is fitted with access manways at 3 points. The 22" rectifier still (33-173-13) is fitted with an 8" handhole below the bottom tray. Alternate feed points are available on the stripper still to optimize the still's performance over a range of feed beer strengths. An auxiliary product stream may be established from the 50th, 52nd or 54th trays of the rectifier still (33-173-13) to prevent the concentration of fusel oils. Service ladders are fitted to the 39" stripper still, and interconnecting service platforms at three levels are fitted to both stills.

2.0 Start-Up Instructions

2.1 Utilities check Assure that the following utilities are on stream and ready for use: Steam - Cooling Water - Electrical Gear - Compressed Air - Waste Beer. Inspect pump seal water flow.

- 2.2 Valve Line-Up Assure proper valve line-up for waste beer line, stripped beer line, distillate line. During the start-up, stripped beer should be returned to the waste beer tank, pending establishment of equilibrium in the stripper still trays.
- 2.3 Start Cooling Water Start cooling water supply to condensers and final distillate cooler. If water savers stop water flow, a preempt signal to the cooling water valves will have to be injected during the start-up.
- 2.4 Start Re-Boiler Recirculating Pumps It is presumed that the still bottoms are filled so that the level shows in the glass.
- 2.5 Start Steam Condensate Pump It is presumed that the steam condensate receiver shows a level in the glass.
- 2.6 Start Stripper Re-Boiler Steam With controller FRC 12-4 on manual gradually increase controller output until steam valve opens. Allow condensate to drain from the steam line. When the steam line is dry feed steam to the re-boiler by setting the steam throttle valve at a 6 PSIG position, or as experience dictates. When the still bottoms rise to the boiling point steam will rise in the column and drive out the air. Do not exceed 13 PSIG pressure at the still bottom while air is being expelled from the still.
- 2.7 Start Stripper Condenser Transfer Pump Running this pump assures that the stripper condenser will not be drowned while attention is diverted to other parts of the start-up.
- 2.8 Start Stripper Reflux Pump When the stripper condensers start to receive vapors as evidenced by a rise in TI-12-47 the stripper reflux valve may be opened 20% of its stroke by applying a manual signal to the valve from controller FRC 12-3.
- 2.8 Start Stripper Bottoms Pump Put LIC 12-1 on automatic. Observe level glass at bottom of stripper column, level should be sufficient to satisfy re-boiler recirculating pump.
- 2.9 Start Waste Beer Feed Pump When steam reaches stripper condenser as shown on TI-12-47, start waste beer feed pump. With flow controller FRC 12-1 on automatic and set point at "0" start waste beer feed pump. Gradually increase set point of controller to 10 GPM or 20% of normal flow.
- 2.10 Start feed Preheater With TRC 12-1 on manual gradually crack steam valve. When steam pipe is dry gradually open steam valve to 10% of stroke. When feed temperature reaches 212°F put controller on automatic.
- 2.11 Put Stripper Still on Automatic Adjust manual signals to stripper reboil steam valve and stripper reflux valve until process set pointers are lined with set pointer on controllers, FRC 12-3 and FRC 12-4. Put controllers on automatic.
- 2.12 Start Rectifier Feed Pump and Rectifier Bottoms Pump With the set points of LIC 12-2 and LIC 12-3 in their normal process condition and automatic, start referred pumps. Observe that the

rectifier bottoms level is high enough in SG 12-2 to satisfy the NPSH requirement of the rectifier reboiler pump (33-173-18). Do not start stripper reboil steam until the bottoms level shows in SG 12-2, indicating that the bottom trays of the still are not drowned.

- 2.13 Start Rectifier Reboil Steam with controller FRC 12-2 on manual crack steam valve and remove condensate from steam line. When steam line is dry gradually open valve to 20% of stroke by applying 6 PSIG signal to valve, or as experience indicates as air is expelled from column by rising vapors steam rate may gradually be increased until the process flow matches the set point position established by the low level relay or the ratio signal from FE2 to FRC 12-2 XI. When set pointer and process pointer are aligned put controller FRC 12-2 on automatic.
- 2.14 Start Rectifier Reflux Pump With controller LIC 12-4 on automatic and controller DIC 12-1 on manual and closed start rectifier reflux pump. Pump should start before vapor reaches condenser as indicated by TI 12-53 so condenser will not be drowned.
- 2.15 Put Water Savers on Automatic If water savers have been pre-empted by manual air signal to cooling water throttle valves put controllers on automatic.
- 2.16 Put DRC 12-1 on Automatic Observe process flows and temperatures. When stripper vapor is at 183.5°F (TI 12-47) and rectifier vapor is at 172°F (TI 12-53) design conditions have been established in stripper still and rectifier still. Gradually increase feed rate set point to 45 GPM for 2% Ethyl Alcohol feed beer. Divert stripper bottoms flow from waste beer feed tank to evaporator feed tank.
- 3.0 Shut-Down
- 3.1 Reduce Feed and Preheat Gradually reduce feed controller set point to "0" and reduce feed preheater set point to "0". Observe set pointers on FRC 12-3 and 12-4, reducing stripper reflux and stripper reboil as feed rate decreases.
- 3.2 Stop Stripped Beer Flow to Evaporator Supply Tank Return stripper still bottoms to waste beer feed tank.
- 3.3 Stop Rectifier Reboil Steam With manual air regulator on controller FRC 12-2 at minimum position switch controller from automatic to manual. Rectifier reboil steam valve will close.
- 3.4 Stop Rectifier Feed With manual air pressure regulator of LIC 12-2 in minimum position switch regulator to manual. Rectifier feed valve will close.
- 3.5 Stop Rectifier Reflux Stop pump PC 005 (equipment 33-173-5). Rectifier reflux will stop.

- 3.6 Stop Rectifier Bottoms Pump Stop PC 009 (Equipment 33-173-16).
- 3.7 Stop Reboiler Pump and Steam Condensate Pump Stop pumps PC 002 (33-173-10) PC 004 (33-173-18) and P 10 (33-173-7).
- 3.8 Stop Cooling Water Close cooling water stop valves on 3 condensers and one product cooler.