

220098 - SYSTEM OPERATION

To: Plasticizer Foremen

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Interorganization Correspondence

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Subject: BUTYL RECOVERY SYSTEM

1. Verify all valve positions listed in Safe Job Procedure MPE-4. This is essential to proper system operation.
2. The purpose of the butyl system is to return dry butyl to the reactor to speed up the reaction. Allowing wet butyl to return to the reactor will slow down the reaction because the reactor will have to boil off the free water again.

System Operations

After the catalyst addition to the reactor, the reaction proceeds very rapidly. During this initial 30 minutes, the butanol vaporized is returned directly to the reactor. After the Butyl Recycle Timer (K59) has timed out, the flow of strip butyl will be diverted to the Butanol Surge Tank (V728) instead of directly back to the reactor.

The water separated and collected in the Reactor Separator (T75) is fed to the Water Surge Tank (V729) on a level basis. That is, all of the water from the first part of the reaction will go to V729 unless the level is above a set percentage of level (50%), in which case, it is dumped to the Multi-Products Ester Sump.

The wet Butyl Alcohol collected in V728 is sent through a Distillation Column (T71) where the water is stripped out. The dry Butanol is collected in the bottom of the column. High pressure steam is used to keep the Butanol at its boiling point (117° C) in the bottom of T71. As level builds, Level Control XCV308 will send this dry Butanol to V728 if the level is low or back to the reactor if level is high (above 30%). The water stripped from the Butanol is sent out of the top of T71 to the Azeotrope Condensers HE306 A and B. The liquid is cooled to 30° C and sent to the Azeotropic Separator (T76). Further separation of the Butanol and water takes place here. The Azeotrope Level Indicator (LIC270), usually set for 55%, allows water to flow to V729 and the alcohol to V728. The entire system should operate at 1 psig, controlled at the Azeotropic Separator (T76).

The water from (T76) the Azeotropic Separator and from the Reactor Separator (T75) is collected in V729. This water contains approximately 6-12% Butyl Alcohol. It is necessary for economic and environmental considerations to strip out this alcohol. A second Distillation Column (T70) is utilized to strip the Butanol from the water. The water-alcohol mix collected in 729 is pumped at a preset flow (4.5 gpm) to the Water Column (T70). Live steam is fed to the bottom of the column to control the overhead temperature of 102° C. These overhead vapors are mixed with the overhead vapors from the Butyl Column and sent to the Azeotrope Condenser and Separator. The water is, thus, stripped of the alcohol and sent to the Multi-Products Ester Sump based on the Level Controller of V729. A level over 50% will send water to the sump, then, divert flow back to 729 at a 40% level. Low level (10%) in 729 caused water from column to recycle to 729.

Controls

Butanol Side

A. V728 level (LIC 684).

This percent of level in the Butanol Surge Tank should be set for 30%, although the level may wander from 5% to 60%.

B. Butanol feed to T71 (FCV 281).

This is the feed rate into the Butyl Stripper Column. This can be controlled in two methods. On LOCAL -- the Operator controls the feed rate. On REMOTE -- the pressure differential across the Butyl Column will control the feed rate. Currently, we operate the system on LOCAL. The Operator should adjust the flow to do three things:

- (1) Lower the level in V728.
- (2) Maintain a constant Δp across the Butyl Column. The level in 728 should be 20-30% and the Δp should be 30 mm to 50 mm. A feed rate of 20-25 gpm should accomplish this.
- (3) Maintain 117° C in the column bottoms. Feed rate may have to be lowered if achieving this is not possible.

C. Butanol Column level (LCV 305).

This should be set to maintain a 50% level. LCV 305 should show a positive percent open to show that dry Butanol is being returned to the reactor.

D. Butanol Column bottom temperature (TIC 309).

This controls the amount of steam being sent to the reboiler. The setting should be 117° C. If maintaining this temperature is impossible, the Operator must cut back the feed rate until this temperature can be maintained. (Check all valving prior to changing operation of system.)

E. Butanol Column pressure (Δ P-PDI 314).

This gauge measures the pressure drop across the Butanol Column. This indicator can be used to control the feed rate into the column. It should, normally, run 30 to 50 mm. If it runs too high (above 90 mm), this would indicate that the column is flooded and the water is not being removed efficiently.

F. Azeotropic Separator (LCV 270).

This level controls the interface level between the water and the Butanol. As the azeotrope separates, the water will sink and the alcohol will float. The level controller will open up as the water layer rises, allowing water to recycle back to V729. The dried alcohol will overflow to V728 and, hence, back to the reactor.

Water Side

A. Water Surge Tank level (LIC 301).

This level controller either recirculates the water back to V729 or dumps the water to the Multi-Products Ester Sump based on a level priority. Above 40% level will dump to the sump. Below 10% will recirculate back to V729.

B. Feed rate to Water Column (FIC 293).

This controller determines the amount of feed going into the water stripper column T70. It should be set at 4.5 gpm; however, this may have to be lowered to achieve other operating conditions.

C. Water Column bottom level (LCV 683).

This controller determines the level of the "pool" of water in the base of the column. Level in the pool should be set at 10%; above this, the valve will open and return water to 729 or to the sump based on LIC 301. A high level here would indicate flooding of the column or a malfunction of valves or piping.

D. Water Column temperature (TCV 301).

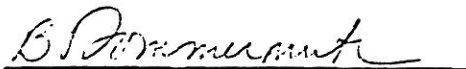
This controller maintains a temperature slightly above the boiling point of water (102° C) by allowing live steam to flow to the column. Low temperatures here would indicate flooding of the column or improper steam valving.

E. Water Column pressure differential (PDI 296).

This monitors the pressure differential across the water column. The Δp should be maintained between 0 and 40 mm. Lowering the feed rate will lower the Δp .

General

It is most important to note that any distillation system operates best and most smoothly when the various control points are maintained at "steady state" conditions. Therefore, the operation of these systems is best obtained by changing only one variable in the system; i. e., the feed rates to the columns. Changes should be small in size and done slowly so as not to shock the system. Also, the amount and quality of the wet Butanol will change as each cook progresses. Adjustments will have to be made to compensate for changing feed stocks.


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