

Commentary

Control

- 1 - Loop controls liquid level in E-303, by manipulating the liquified starch feed flowrate via CV-5. This is performed by PDT-306 sending a signal to LIC-306. PDE-306 measures pressure difference between liquid and overhead vapour space in this control loop.
- 2-Loop controls pressure by manipulating low pressure steam flowrate in exhaust gas line leading to chimney via CV-6. This control loop and relevant stream exist in addition to other pressure relief devices in the system.
- 3-Loop controls pH in E-303, by manipulating CV-7 and CV-8. MIR-307 linearises the pH measurement made by MIT-307 by taking the antilog of the measurement. The converted signal is then sent to MIC-307, the output of which is split. In the case that pH drops below the set point of 5, CV-8 is opened.
- 4-Loop controls temperature of liquid phase in E-303 by manipulating cooling water flowrate via CV-9. Cascade control is employed in this case in order to minimise lag time between disturbances in cooling water flowrate and temperature correction in E-303.
- 5-Loop controls the composition of glucose in E-303 by manipulating agitator speed. CE-310 and CE-311 measure glucose composition at two different positions in E-303. CY-312 compares the measurements and sends a signal to CC-312, the output of which acts to adjust agitator power by manipulating the current supplied to it.

Trips

- 6 -Low level trip to E-304.
In addition, high and low pressure, level, temperature and pH alarms are shown on the P&ID, which in case of an emergency, would trigger operator action.
A FULL area 3 trip would automatically trigger an emergency shutdown.

Emergency Shutdown Actions

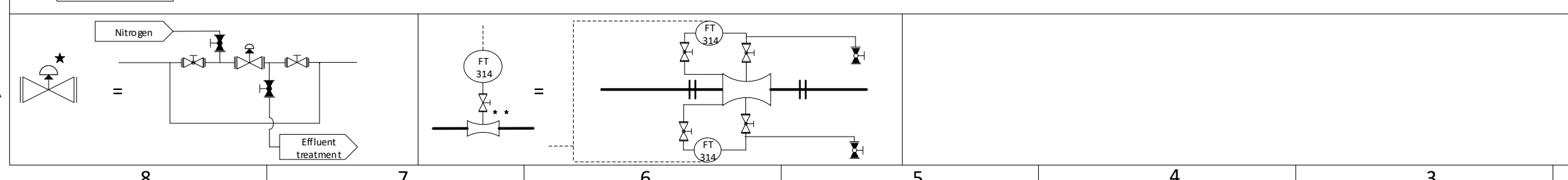
- CV-5 shuts
- CV-6 opens fully
- CV-7 & CV-8 shut
- CV-9 shuts
- E-304 no action. Continues unless low level trip in note 6 is active

General

- 7 -Not actual layout of internal cooling coils in E-303. The helical cooling coil entrance to the reactor is on the opposite bottom end to the one shown on the P&ID.
- 8 -A sparger for LPS at 131 °C, is positioned at the bottom of the reactor. This is not shown on the P&ID since it's purpose is to steam and therefore sterilise all the ports and walls of the reactor prior to each charge of feed.
- 9 -Small pipe section connected to E-303, consisting of a drainage valve and manual isolation valve, VLV-315. It permits E-303 inventory samples to be extracted for laboratory analysis
- 10 - FT-314 and TW-314 measure the pressure difference and liquid temperature, respectively. These readings are fed to MIR-314 which analyses and converts them to flowrate (Glucose solution outlet flowrate).
- 11 - MIR-313 performs the same analysis and conversion as MIR-314 in note 10, but in this scenario the measured flowrate is that of the Liquefied starch feed.

850 - OV - 2 - xxx - CS
Nominal diameter (mm) – Material Contained – Area – Unique line number – Pipe material

Material Key:
NaOH = Sodium hydroxide
H₂SO₄ = Sulfuric acid
CS = Carbon Steel
AS=Aqueous slurry
GS = Glucose solution
Fg = Fiberglass



Area 3- Saccharification reactor

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