Process Safety Issues

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RP-751 LPG Treater Safety

a) Operational issues in the unit may allow significant quantities of HF into the defluorinator and/or KOH treater.

The heat of reaction in the defluorinator may be high enough to cause vessel damage and potential loss of containment due to excessive vessel wall temperature. Product vaporization can increase pressure at a rate or amount that exceeds the equipment design and relief valve capacity of the KOH treater.

Therefore, safety instrumented systems and procedures **shall** be established to minimize this significant hazard including documentation pertaining to the development of scenarios related to HF intrusion into the treater system.

A safety instrumented system to stop the flow to the treaters upon indications of significant HF entering **shall** be installed. Procedures should be in place to clear piping and/or upstream equipment of HF before reintroducing feed to the treatment system; see Annex J for information on how these systems may be designed.

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RP-751 LPG Treater Safety

For sites designed to operate with propane defluorinator, operation of the solid KOH treaters on the propane system **shall not** be allowed without at least one active defluorinator treater in operation.

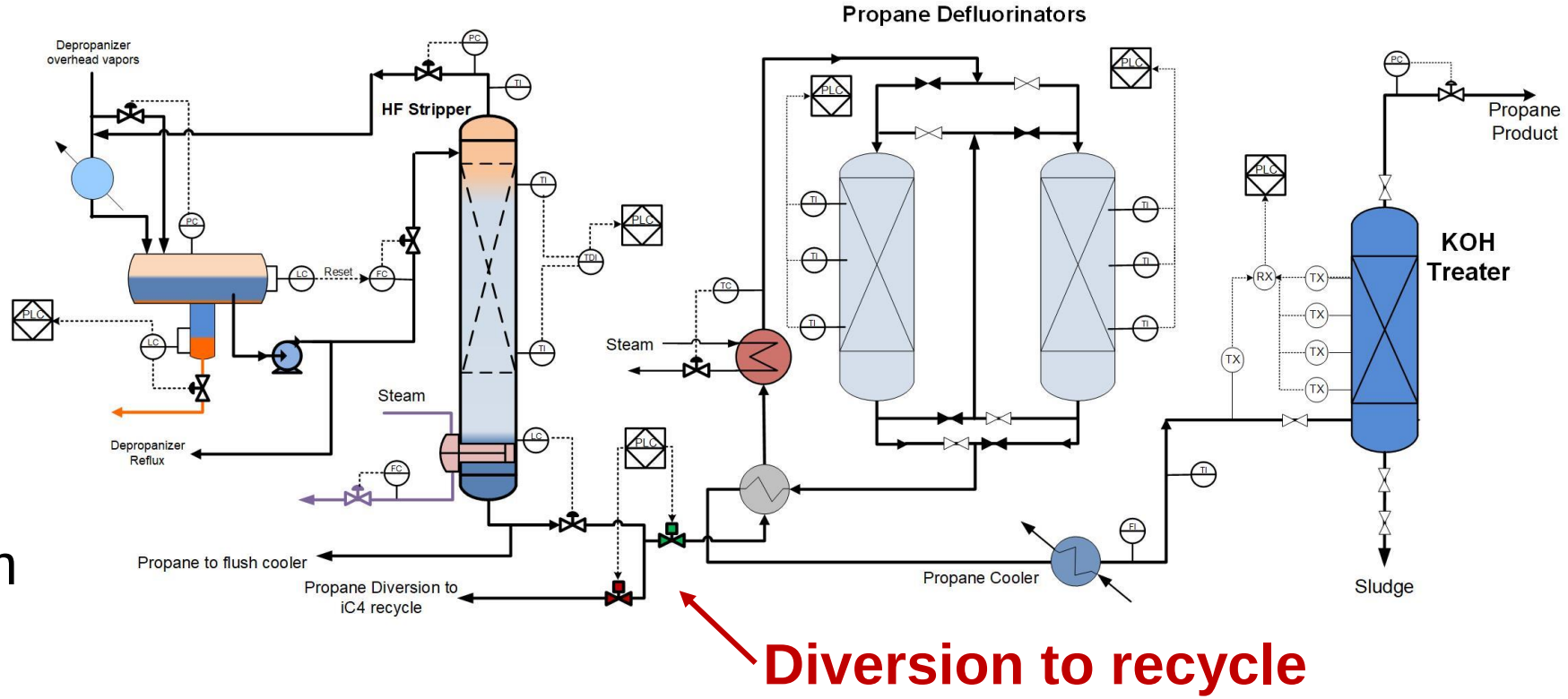
Fluoride testing should be done on the LPG leaving the primary defluorinator, to monitor the condition of the primary defluorinator.

Sites should include the potential for inadvertent bypassing of the defluorinators or similar events that would allow liquid HF to be sent directly to the KOH treater when assessing the instrumentation needs of KOH treater protection systems.

Although prior incidents occurred on unit start-up, sites should consider other transient operations where this may occur.

HF Stripper and C3 Treaters

- Safeguards to prevent HF in propane downstream of HF stripper:



Level alarm on Receiver acid boot
Differential temperature alarm on HF Stripper
Bed temperature alarms on propane defluorinators
No bypass on propane defluorinators
Temperature differential shutdown on propane KOH treater

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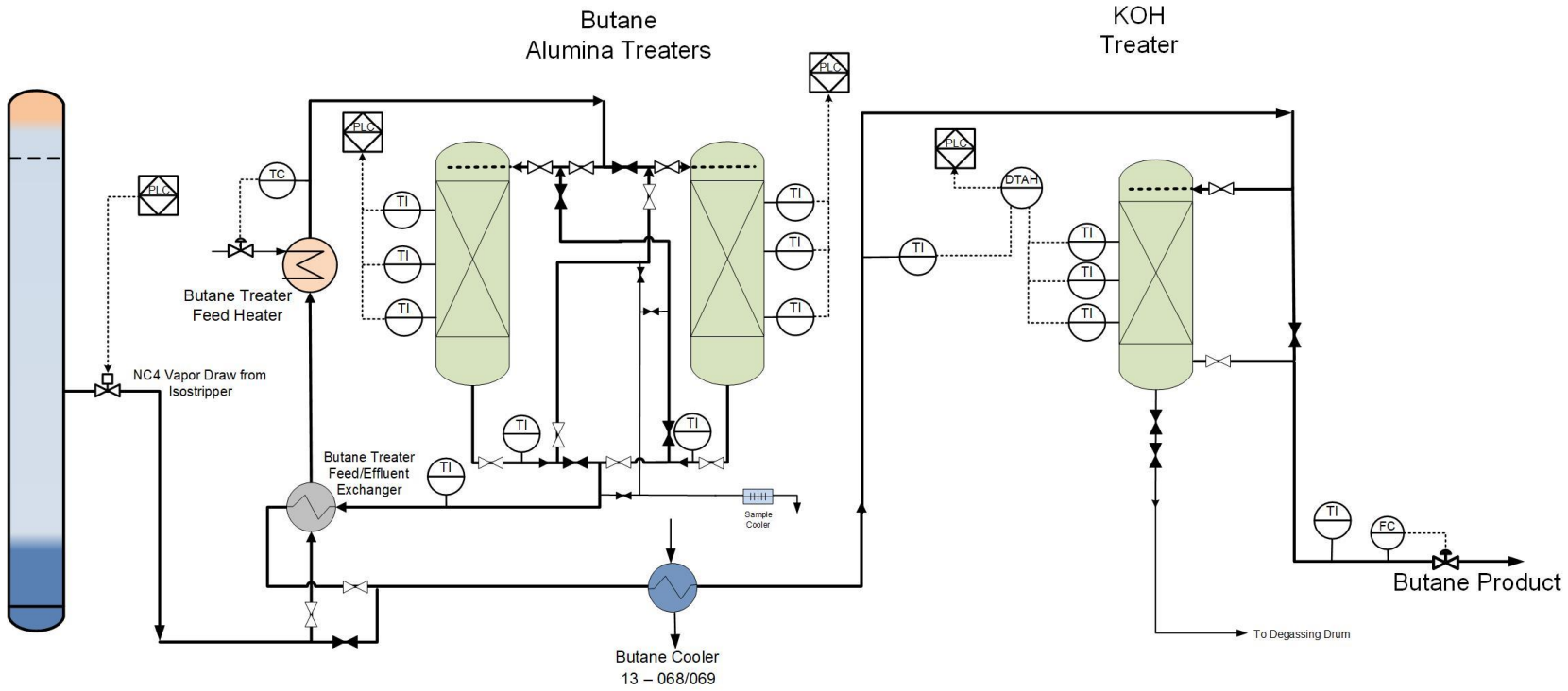
Butane Treaters

- Safeguards to prevent HF in butane to KOH treater:



- Bed temperature alarms on Butane defluorinators
- Do not bypass on defluorinators
- Temperature differential shutdown on KOH treater

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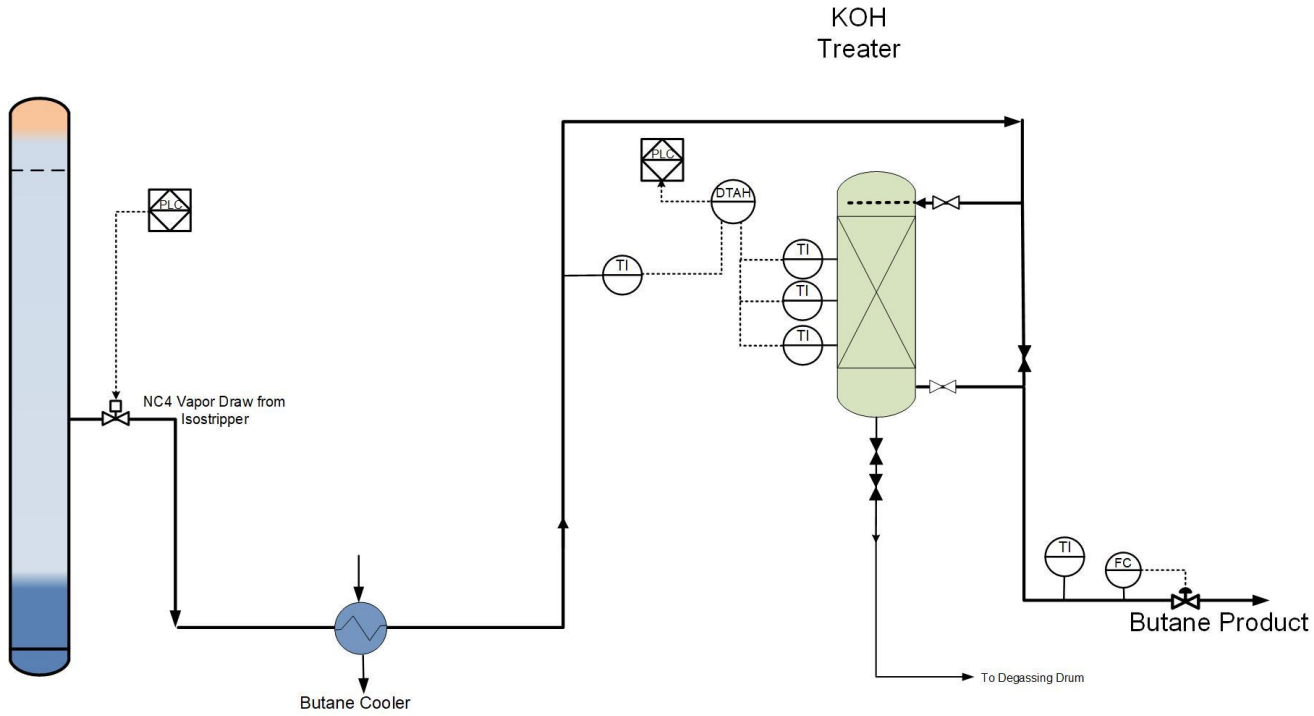
Butane Treaters

- Safeguards to prevent HF in butane to KOH treater:



- Temperature differential shutdown on KOH treater
- Shutdown on fractionator furnace trip

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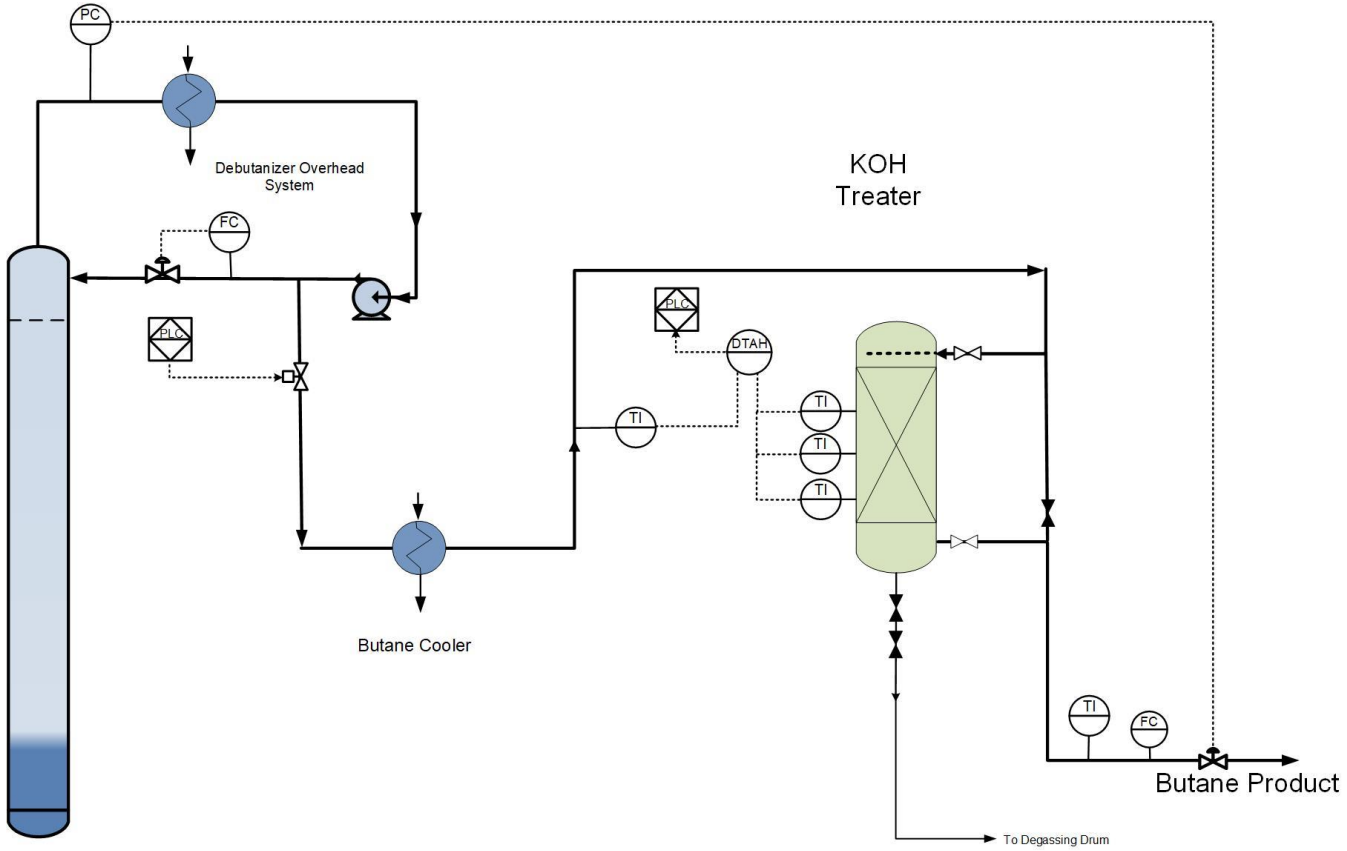
Debutanizer OVHD KOH Treater

- Safeguards to prevent HF in butane to KOH treater:



- Temperature differential shutdown on KOH treater
- How to clear butane system of HF after incident?

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Acid Runaway

- Safeguards to prevent acid runaway:
  - Minimize contaminants in the feed
  - Maintain adequate reactor conditions (I/O ratio, Temperature, Acid/Hydrocarbon ratio)
  - Monitor acid strength (online analyzer)
  - Maintain proper acid regeneration
  - Have large enough acid regeneration system to handle upsets
  - Recognize signs of insipient runaway
  - Provide IOW limits

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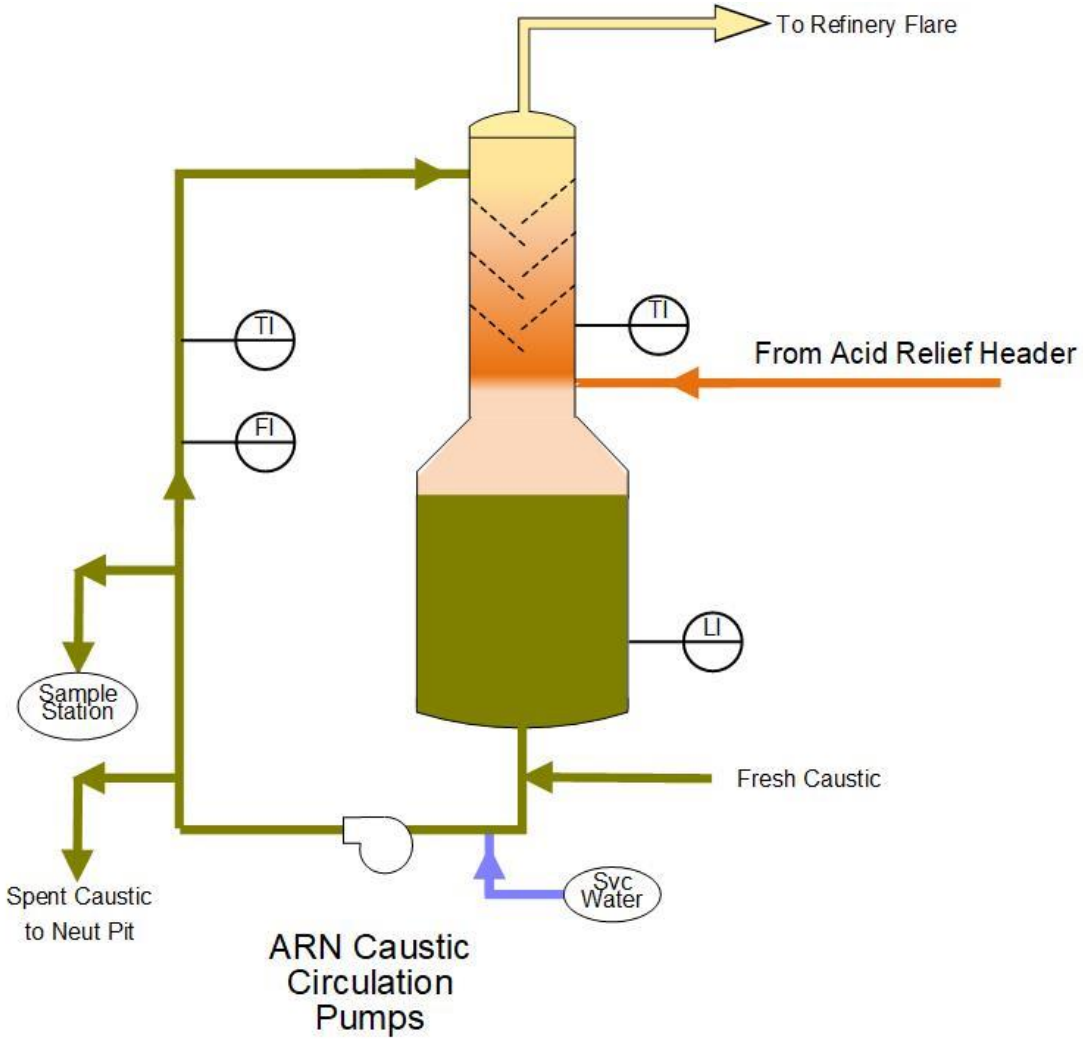
Fractionator Feed Line Failure

- Factors contributing to feed line failure:
  - Acid carryover
  - Operating too hot (above 160 deg F)
  - Inadequate inspection
    - Inspect all components
  - Operating not hot enough
    - Preheating the feed just enough to concentrate the HF/water droplets

Acid Relief Neutralizer (Relief Gas Scrubber)

Operational issues:

- Freezing caustic (auto-refrigeration)
- Operating too hot – high heat of reaction
- Spent caustic (NaOH or KOH)
- Salting (NaF laydown)
- High caustic strength (dehydration)



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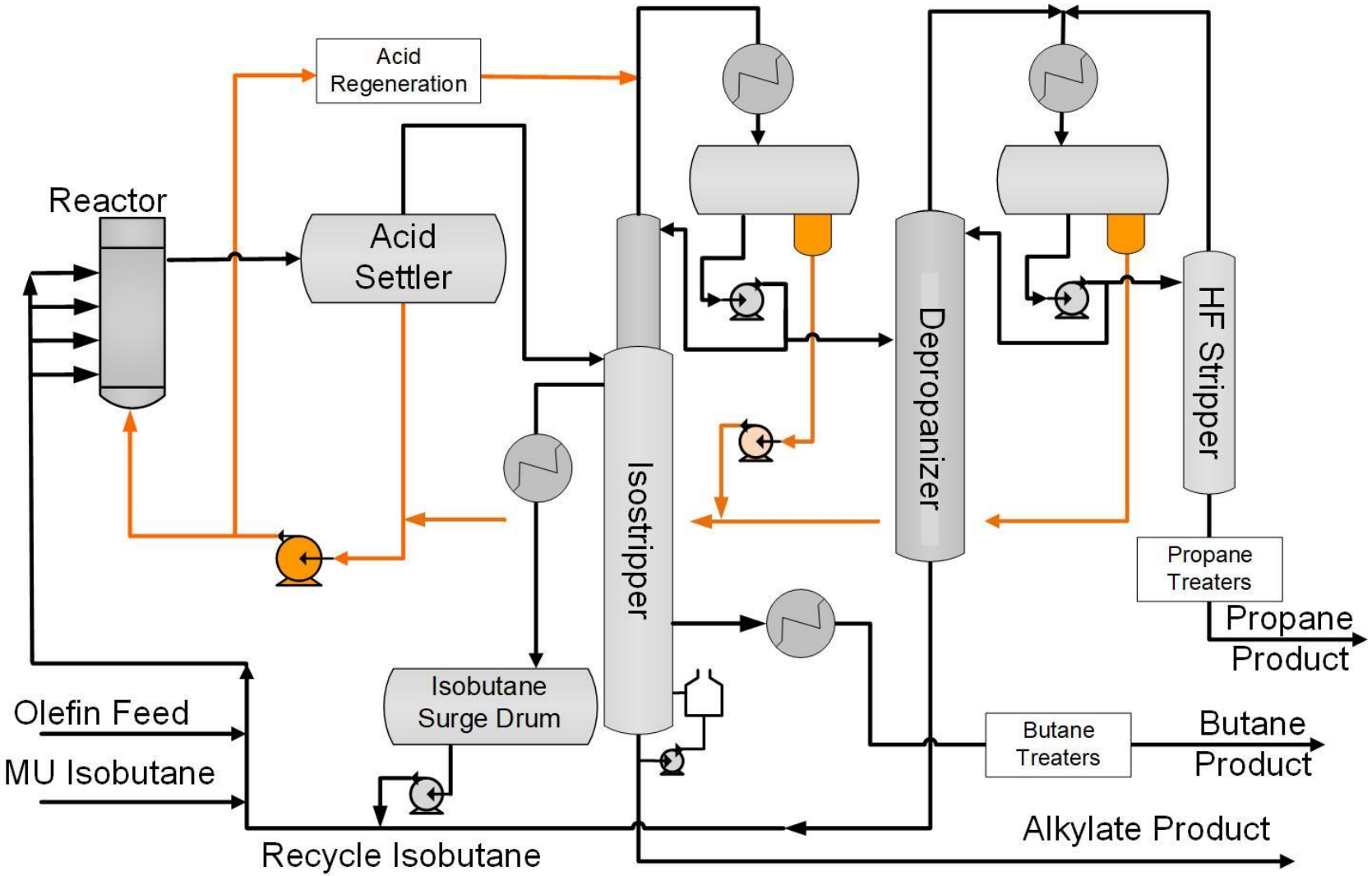
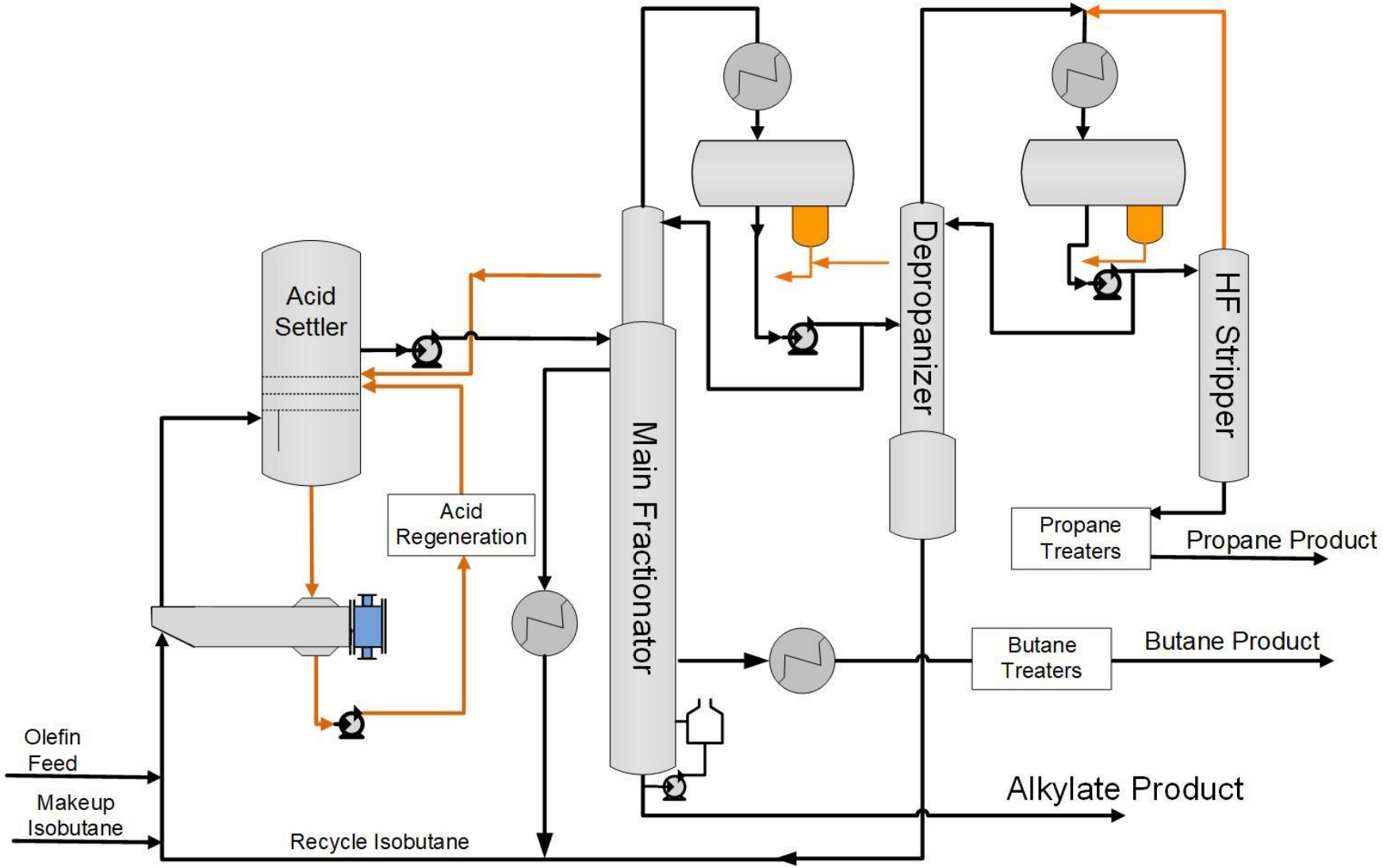
Simple Process Flow



Simple Process Flow



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