

PROCESS OVERVIEW

DO A 021014
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Ethanolamines / Glycol Ethers Consolidated Audit

Process Overview

Process Description (The Ethanolamines process)

Ethanolamines are produced from the liquid phase reaction of Aqueous Ammonia and Ethylene Oxide (EO). There are three main reactions which take place simultaneously to give Monoethanolamine (MEA), Diethanolamine (DEA), and Triethanolamine (TEA) and higher molecular weight compounds.

The product mix can be controlled within certain limits by adjusting the Ammonia/EO feed ratio or by the recycling of finished products (MEA or DEA) back to the reactor system. The aqueous ammonia concentration ranges from 60 to 65 wt% ammonia.

The plant's current capacity is 185 MM lb/yr of Ethanolamines at varying product mixes.

The reaction of EO and aqueous ammonia takes place in a reactor system consisting of an isothermal and adiabatic reactor. After the reactor a mixture of ammonia, water, MEA, DEA, and TEA flows to the ammonia removal system where the excess ammonia is removed, recovered and recycled back to the reactor system.

After the ammonia is removed, the mixture then flows to the water removal system where the water is removed and recycled back to the reactor system.

From the water removal system, a stream of crude mixed ethanolamines (MEA, DEA, TEA, higher) is fed to the purification system, where MEA, DEA, and TEA are purified by vacuum distillation. The purified MEA, DEA, and TEA are then pumped to their respective finished storage tanks.

From storage the finished products are loaded and shipped to the customers via tank trucks, tank cars, barges, ships, or drums.

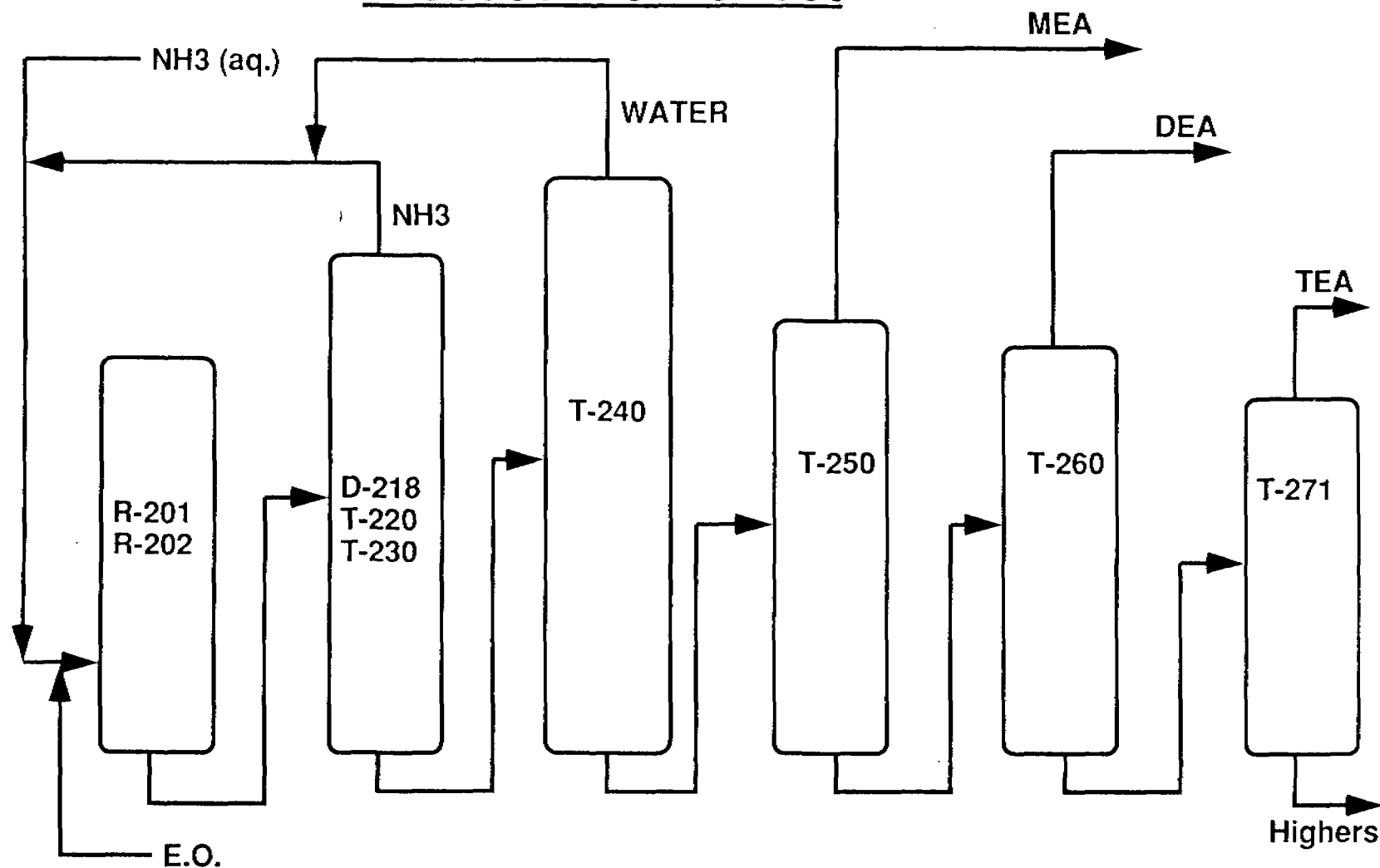
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ETHANOLAMINES / GLYCOL ETHERS

The Ethanolamines Process

Process Flow Sheet



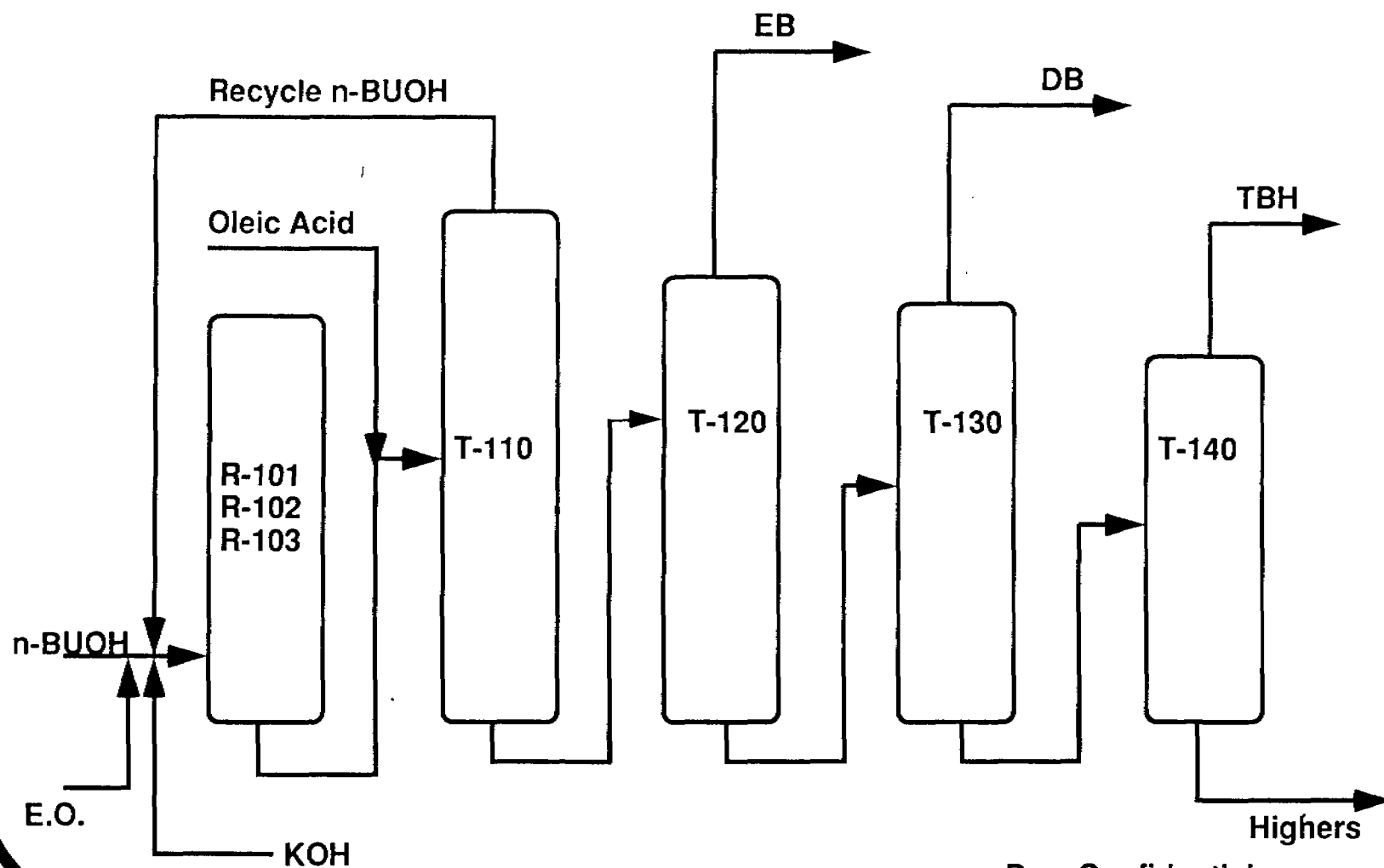
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ETHANOLAMINES / GLYCOL ETHERS

The Glycol Ethers Process

Process Flow Sheet - EB Series



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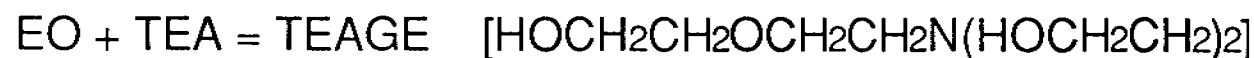
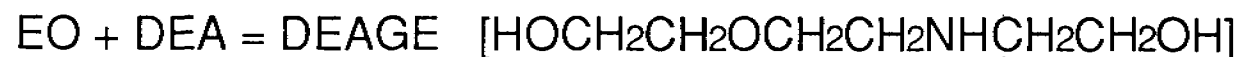
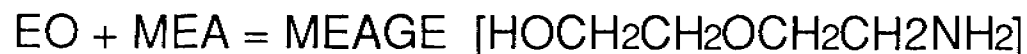
The Ethanolamines Process

Process Chemistry

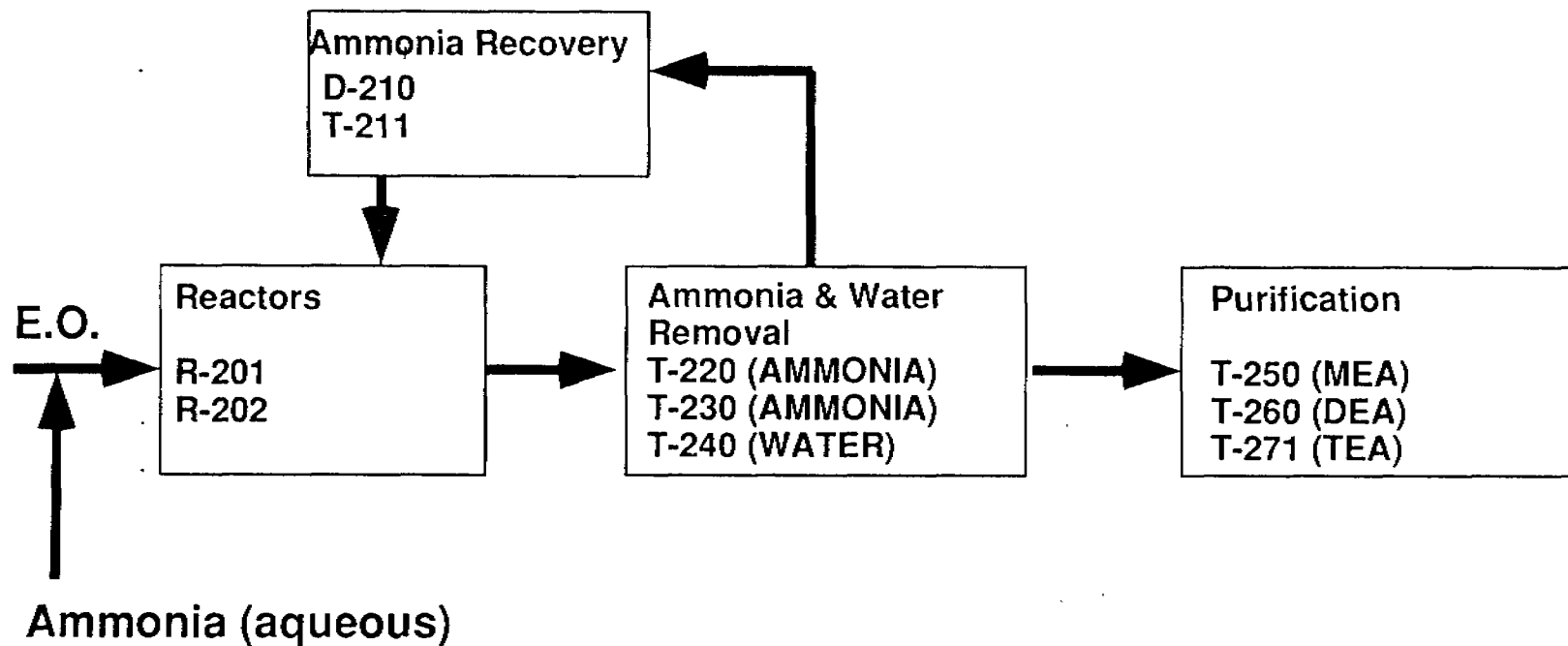
DESIRED REACTIONS



UNDESIRED REACTIONS

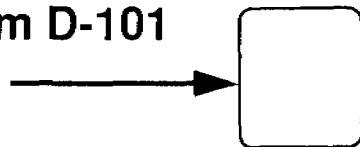


The Ethanolamines Process



The Ethanolamines Process (Reactor System)

From D-101



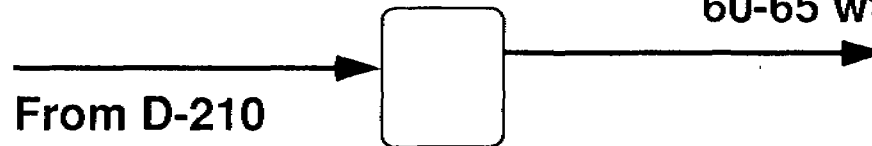
To R-201 (E.O.)

P-201 A/B (E.O. Feed Pumps)

Sundyne Vertical Centrifugal
19,200 lbs/hr @ 2100 ft Head
75 hp 3500 rpm motor
Gearbox 14,700 rpm

To R-201 (Aq. NH₃)
60-65 wt% NH₃

From D-210



P-212 A/B (Aqueous NH₃ Feed Pumps)

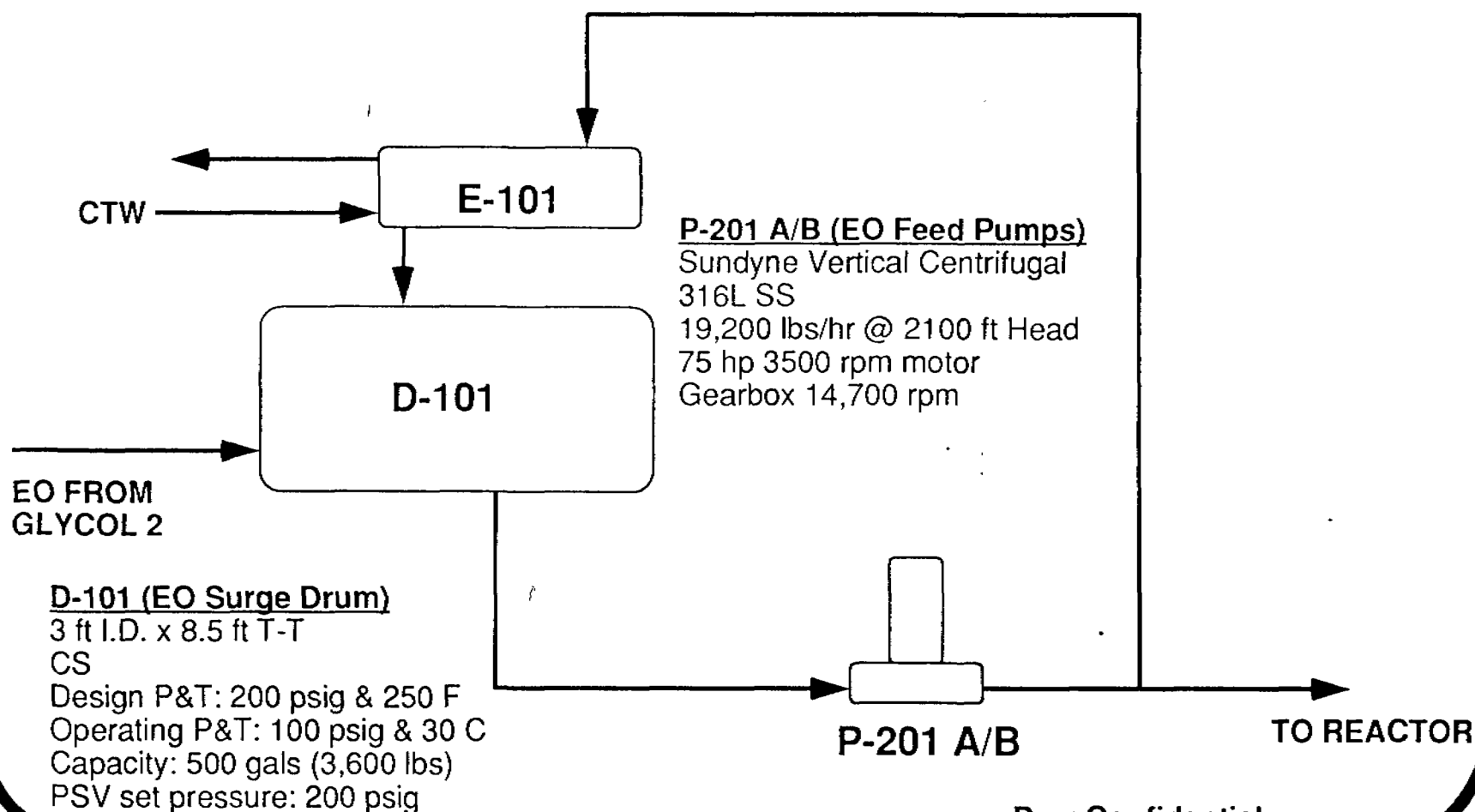
Sundyne Vertical Centrifugal
54,000 lbs/hr @ 2100 ft Head
200 hp 3500 rpm motor
Gearbox 14,700 rpm

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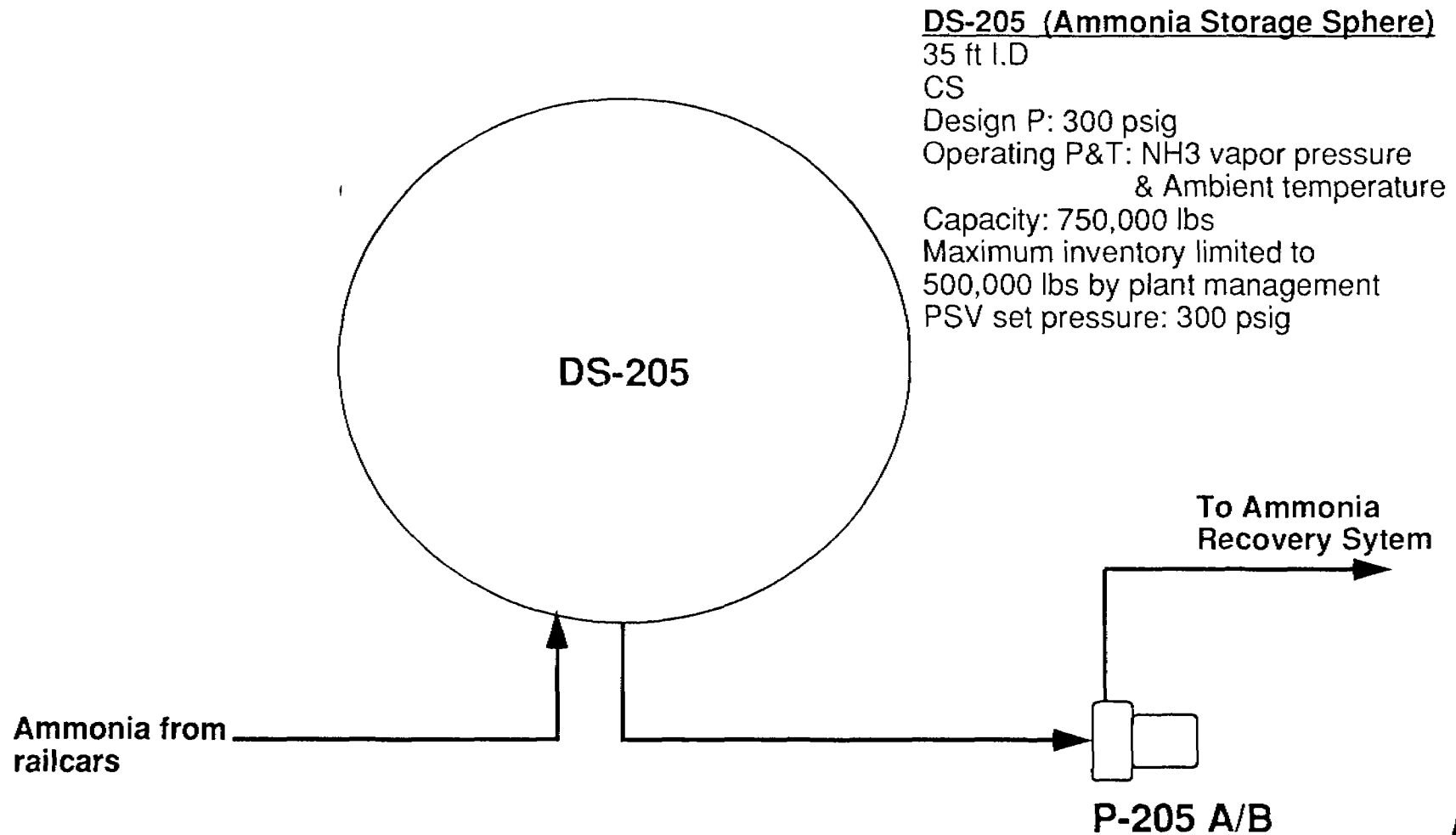
The Ethanolamines Process

Process Flow Sheet



The Ethanolamines Process

Process Flow Sheet

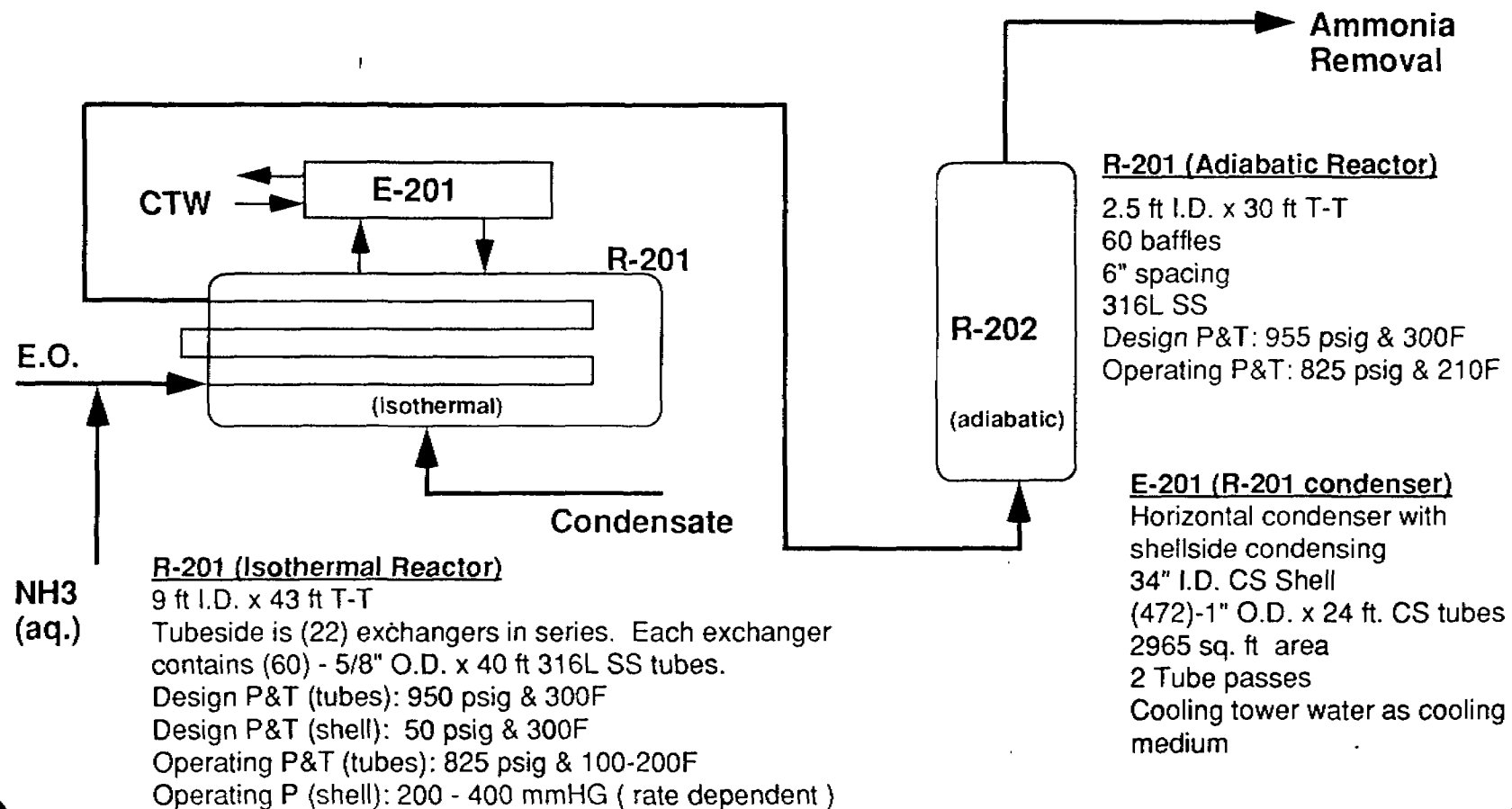


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The Ethanolamines Process

(Reactor System)

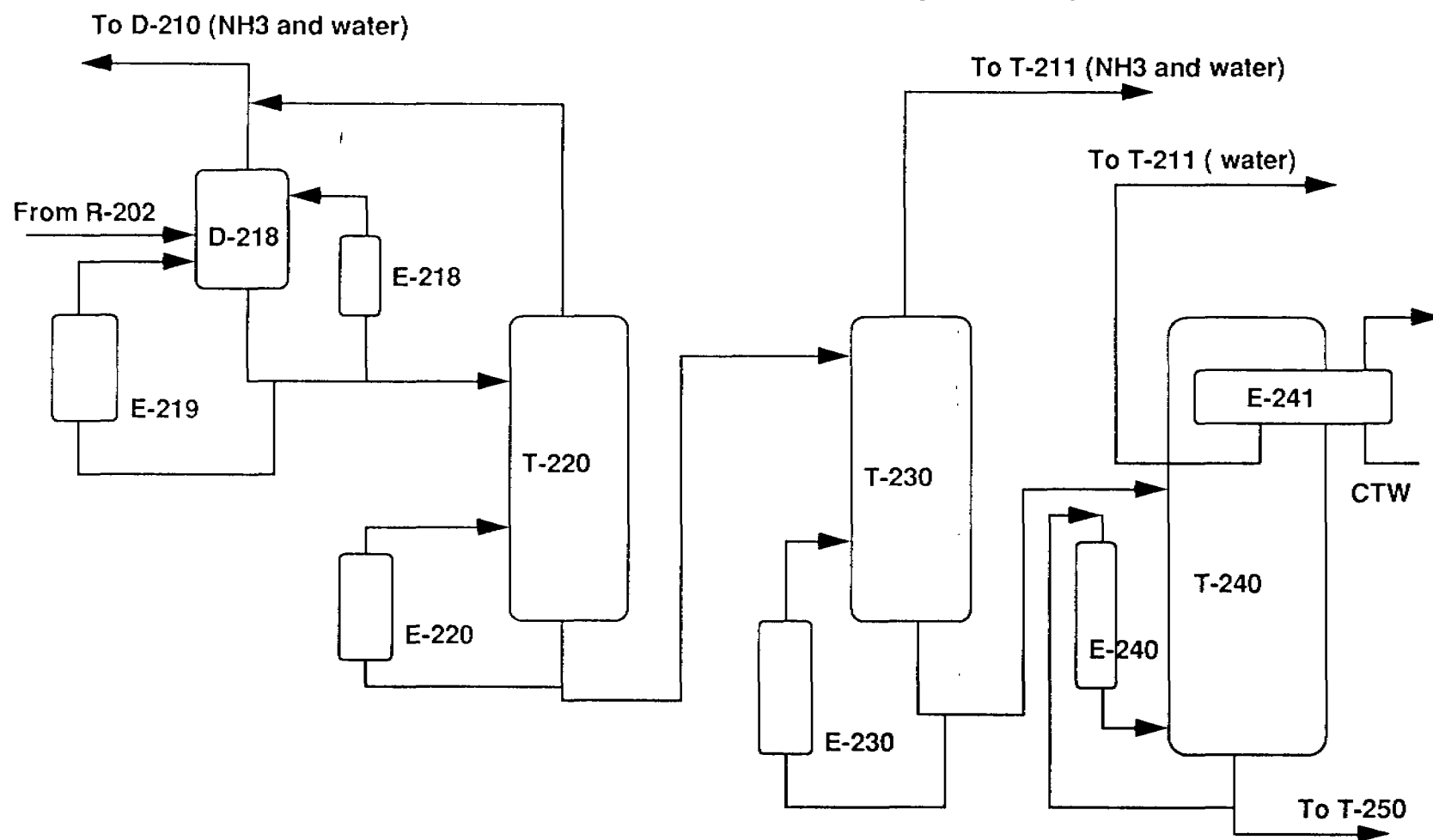


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The Ethanolamines Process

(NH₃ & Water Removal System)

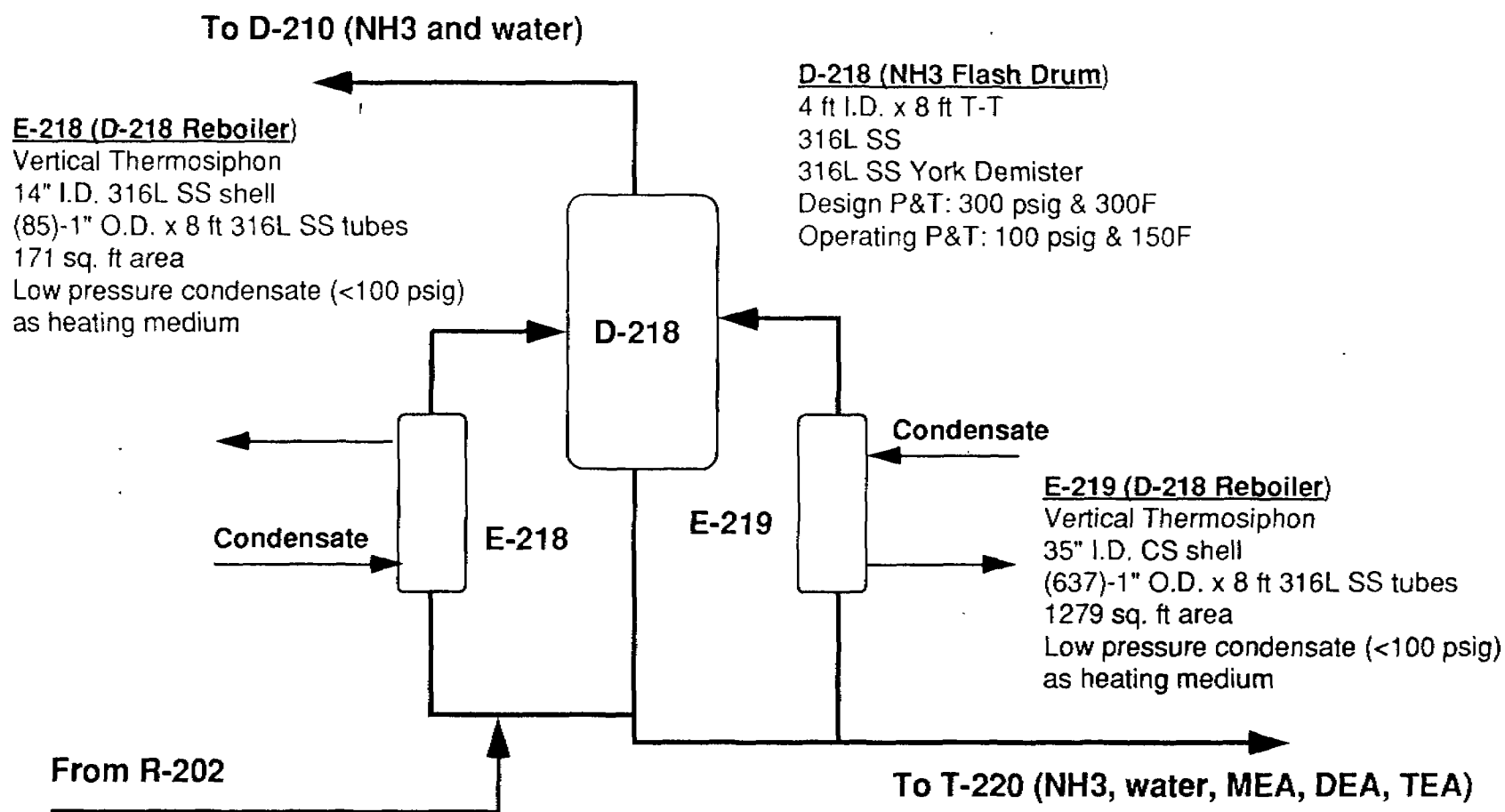


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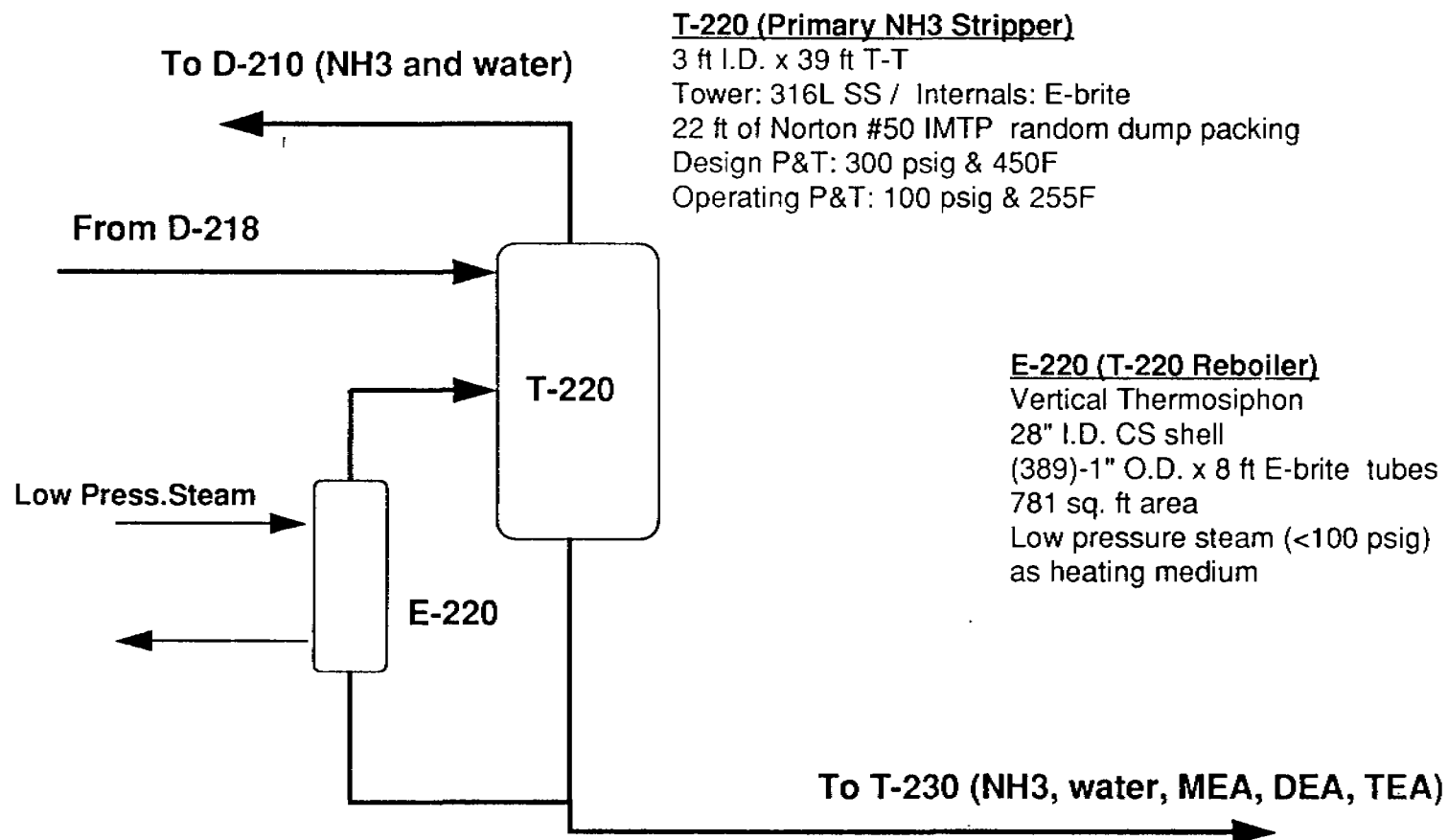
ETHANOLAMINES / GLYCOL ETHERS

The Ethanolamines Process (NH₃ & Water Removal System)



The Ethanolamines Process

(NH₃ & Water Removal System)

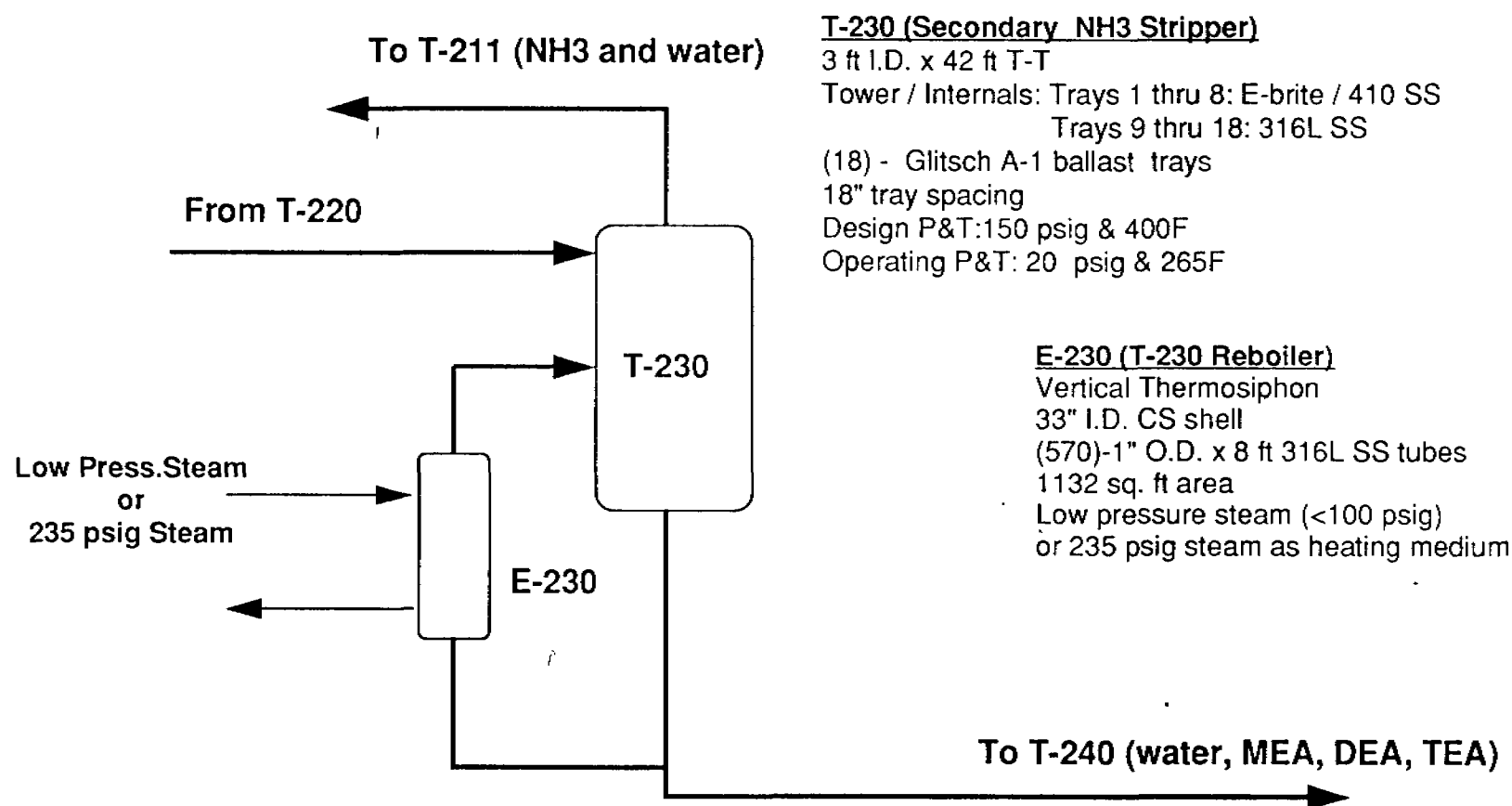


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The Ethanolamines Process (NH₃ & Water Removal System)



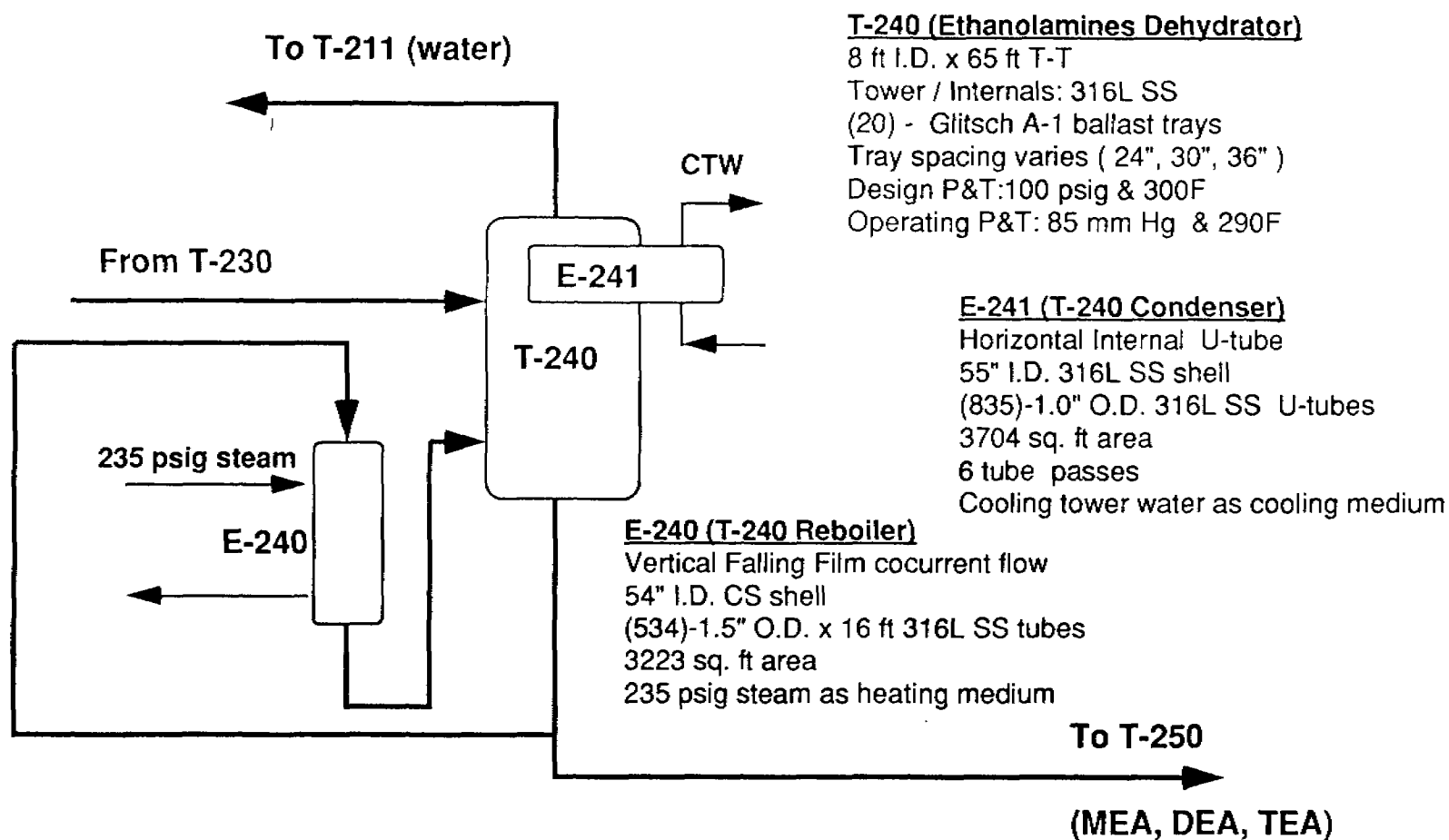
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ETHANOLAMINES / GLYCOL ETHERS

The Ethanolamines Process (NH₃ & Water Removal System)

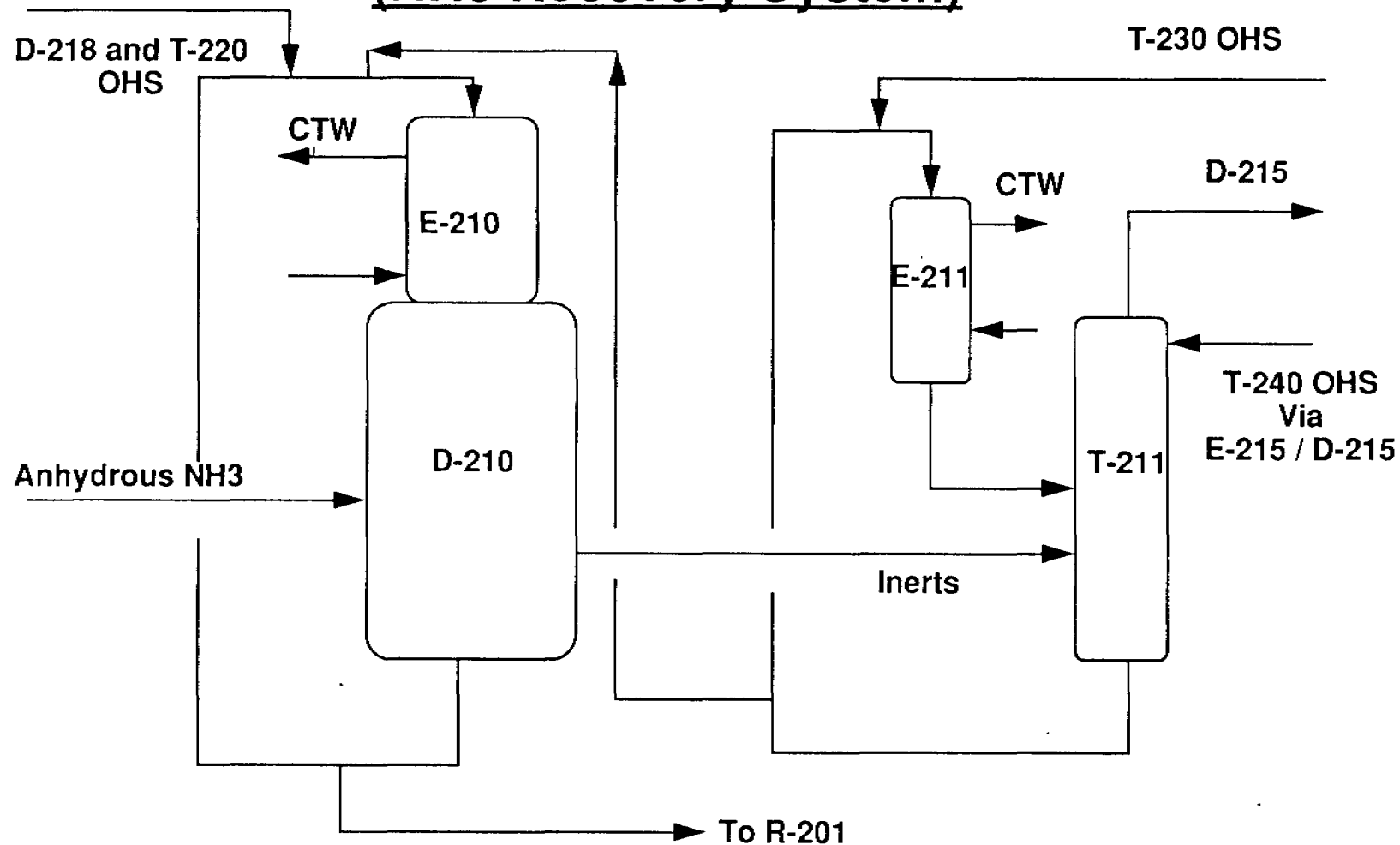


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The Ethanolamines Process

(NH₃ Recovery System)



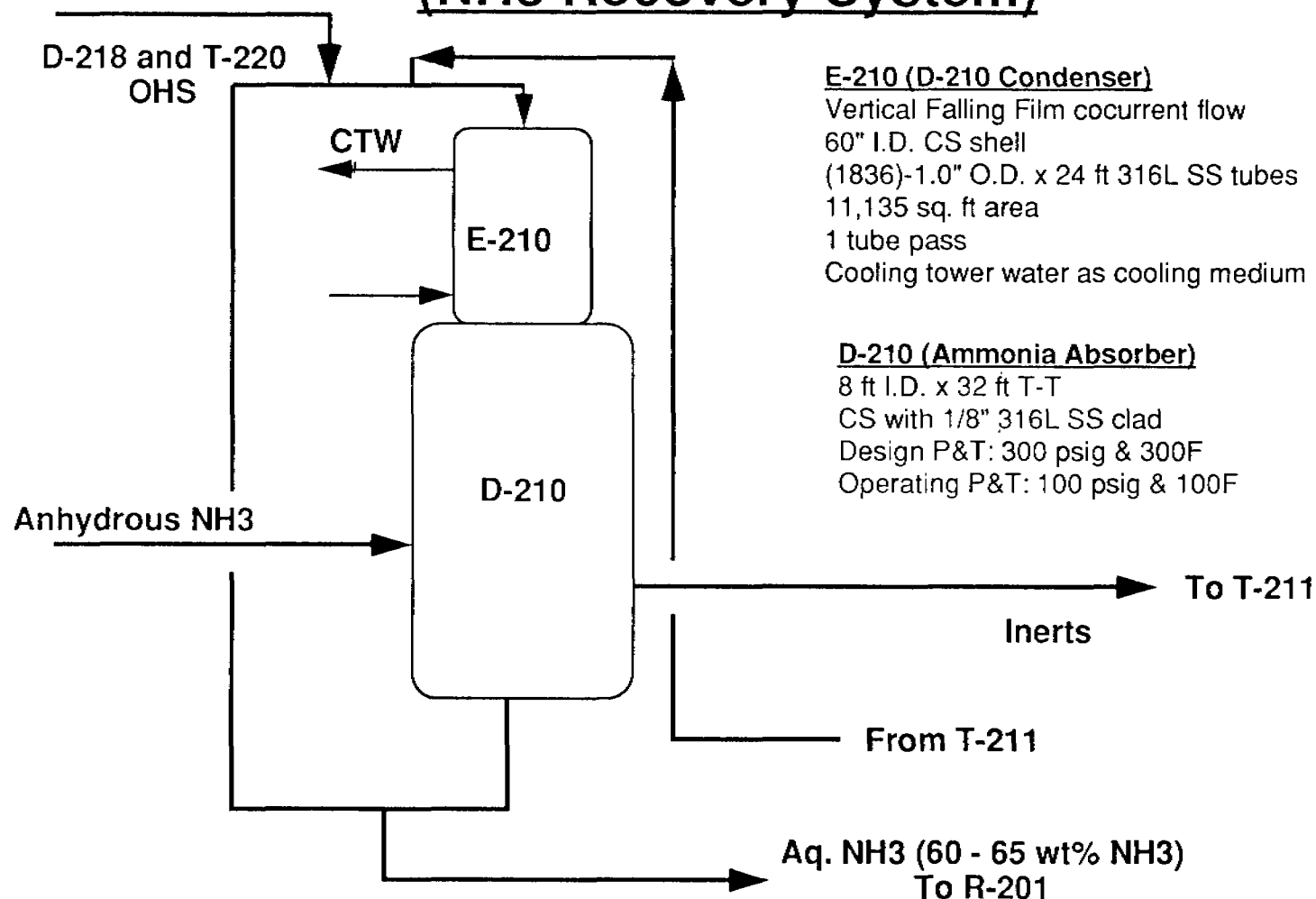
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The Ethanolamines Process

(NH₃ Recovery System)



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The Ethanolamines Process

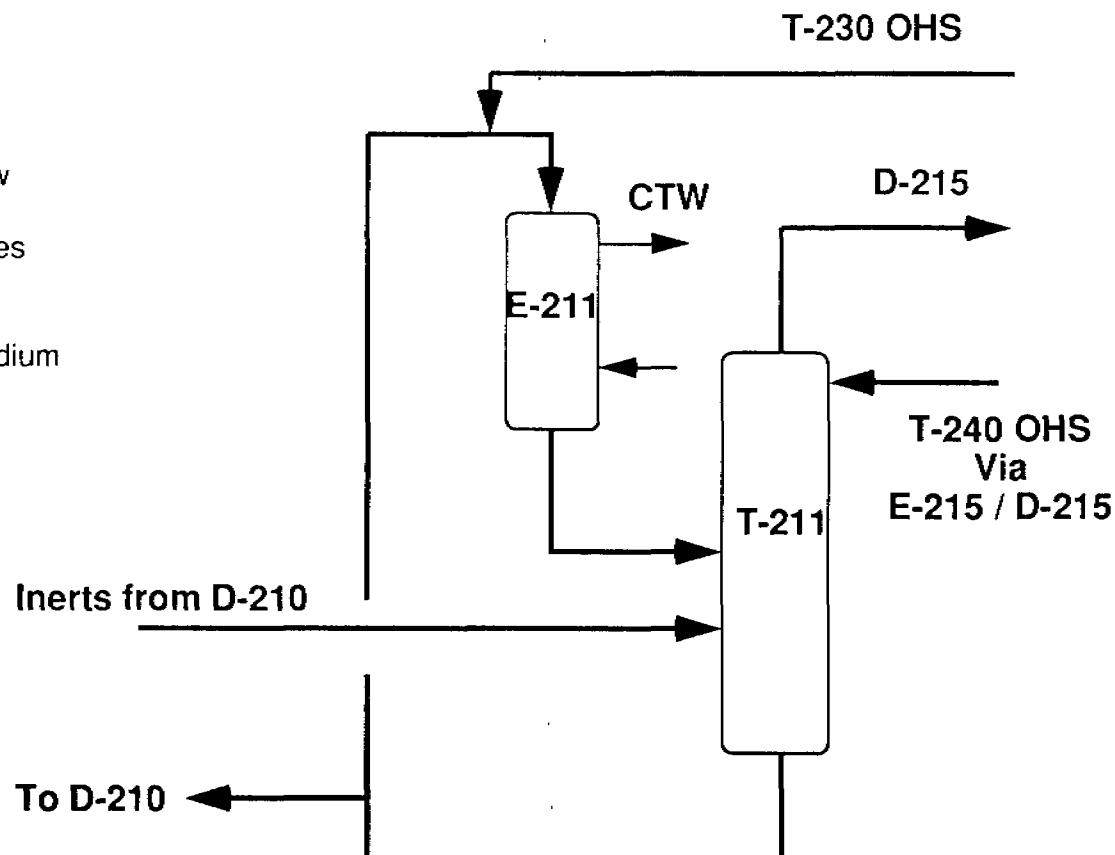
(NH3 Recovery System)

E-211 (T-211 Condenser)

Vertical Falling Film Cocurrent Flow
45" I.D. CS shell
(1095)-1" O.D. x 16 ft 316L SS tubes
4586 sq. ft area
1 tube pass
Cooling tower water as cooling medium

T-211 (NH3 Scrubber)

2.5 ft x 24 ft T-T
Tower: 316L SS / Internals: Cermanic
11 ft of Norton 1" Saddles dump packing
Design P&T: 300 psig & 250F
Operating P&T: 15 psig & 68F

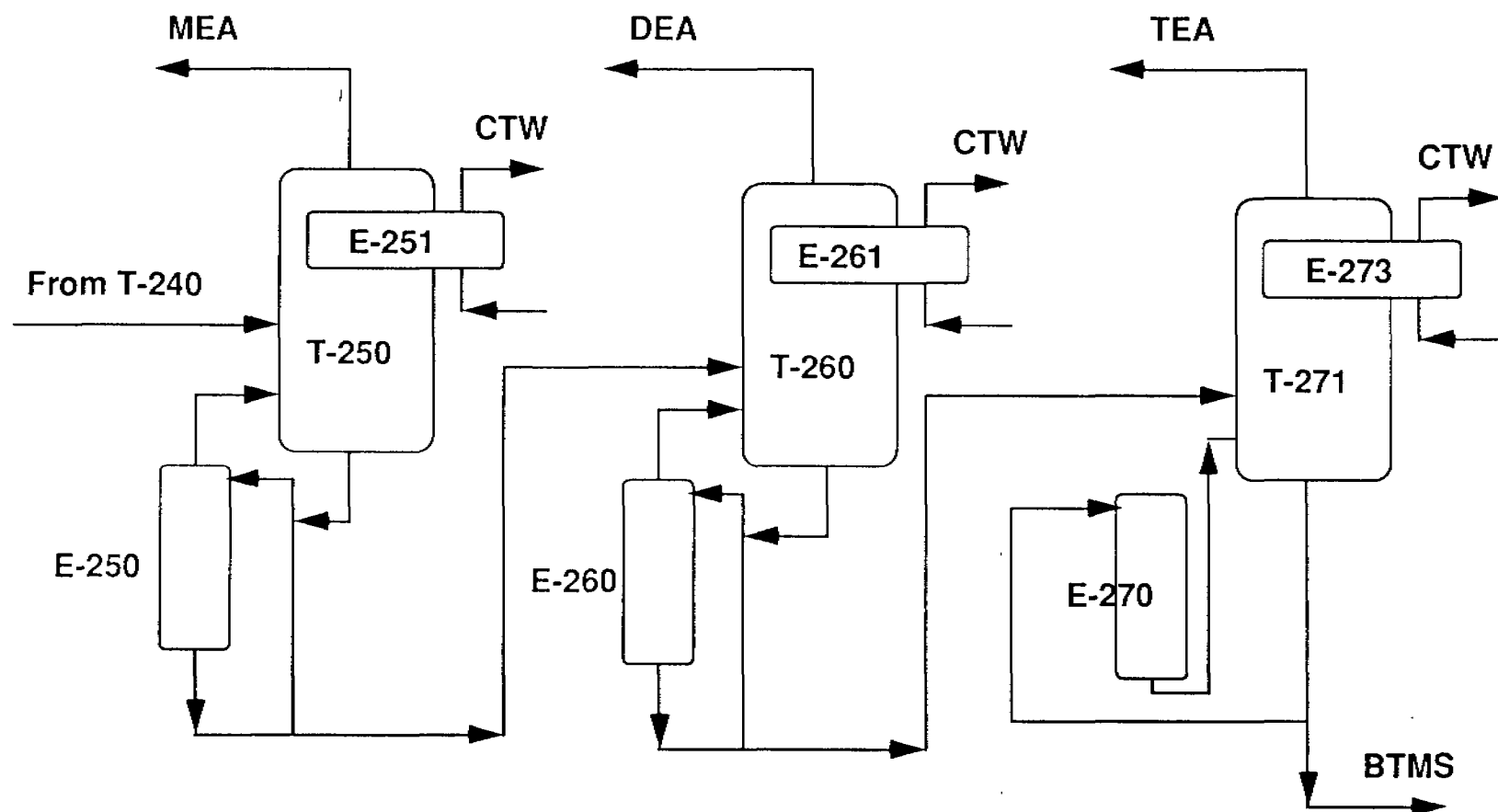


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The Ethanolamines Process

(Purification System)

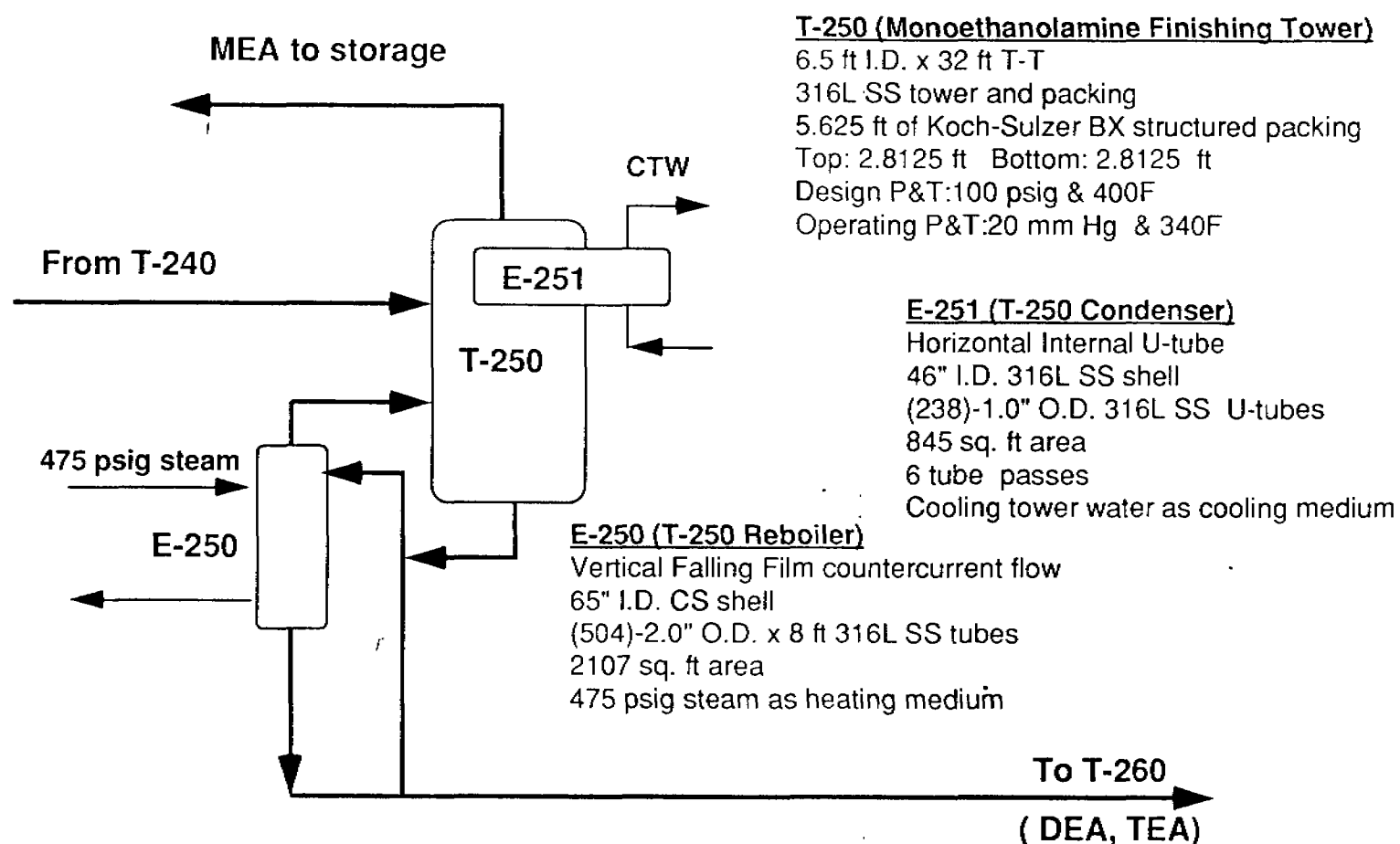


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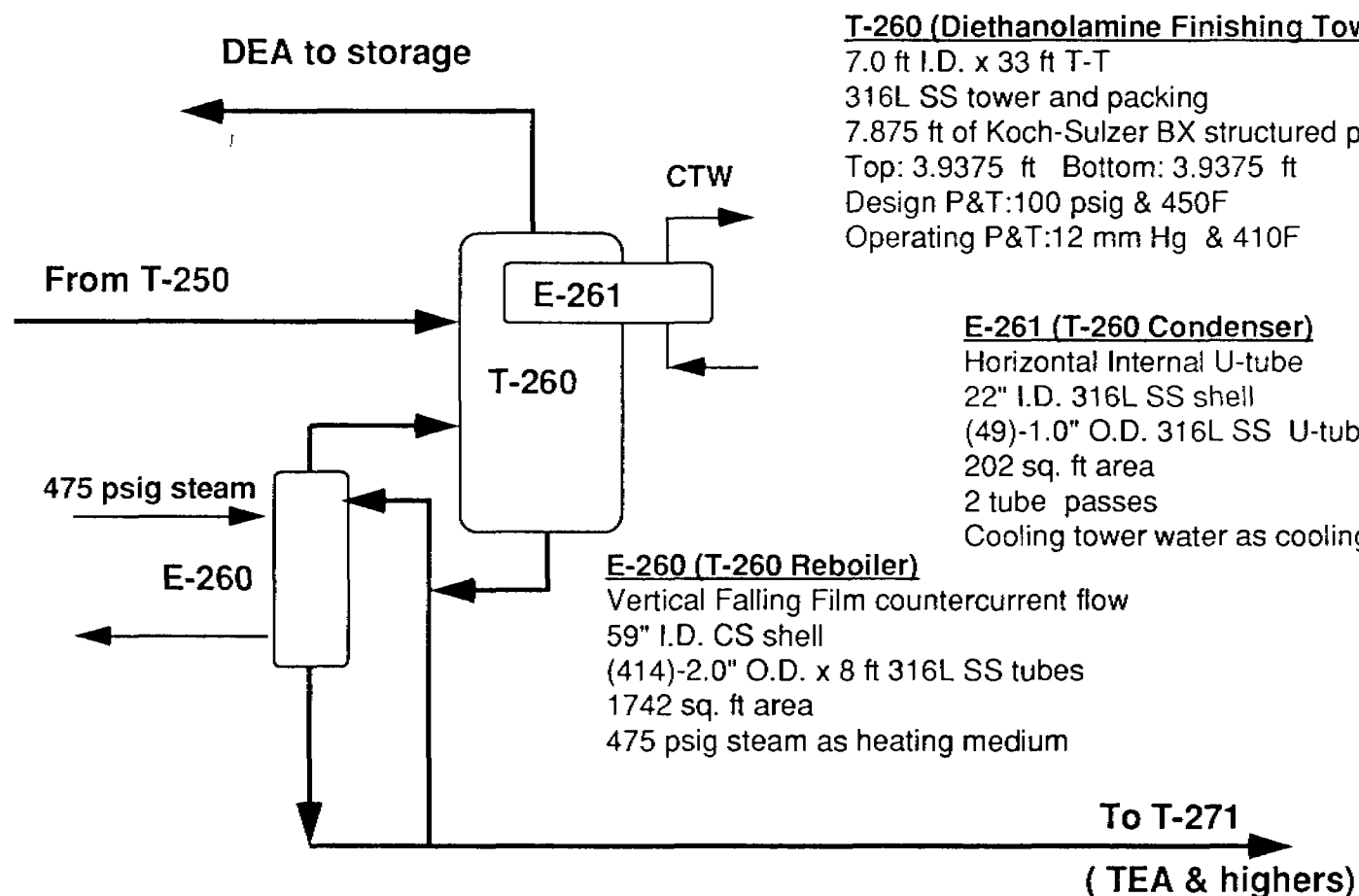
The Ethanolamines Process

(Purification System)



The Ethanolamines Process

(Purification System)



T-260 (Diethanolamine Finishing Tower)

7.0 ft I.D. x 33 ft T-T
316L SS tower and packing
7.875 ft of Koch-Sulzer BX structured packing
Top: 3.9375 ft Bottom: 3.9375 ft
Design P&T: 100 psig & 450F
Operating P&T: 12 mm Hg & 410F

E-261 (T-260 Condenser)

Horizontal Internal U-tube
22" I.D. 316L SS shell
(49)-1.0" O.D. 316L SS U-tubes
202 sq. ft area
2 tube passes
Cooling tower water as cooling medium

E-260 (T-260 Reboiler)

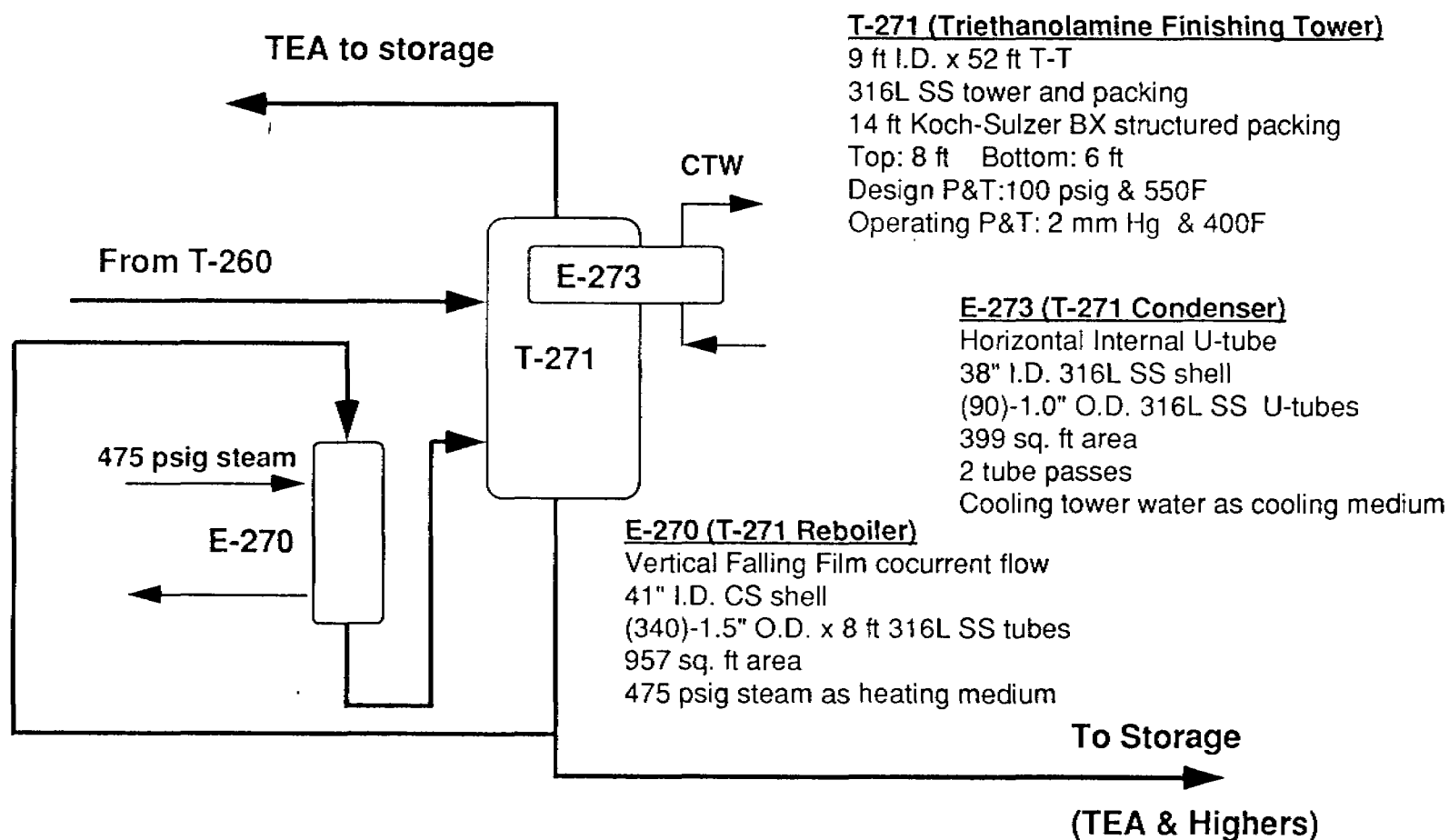
Vertical Falling Film countercurrent flow
59" I.D. CS shell
(414)-2.0" O.D. x 8 ft 316L SS tubes
1742 sq. ft area
475 psig steam as heating medium

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The Ethanolamines Process

(Purification System)



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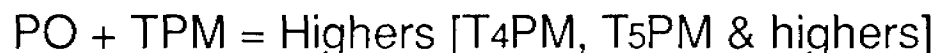
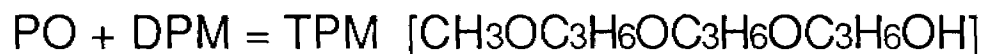
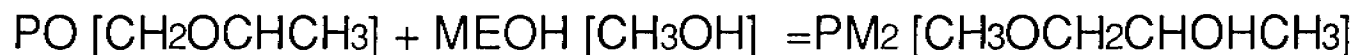
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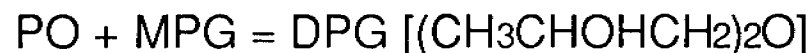
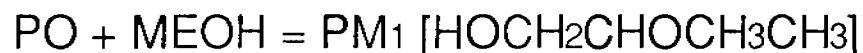
The Glycol Ethers Process

Process Chemistry - PM Series

DESIRED REACTIONS *



UNDESIRE D REACTIONS *



* KOH is present as a catalyst

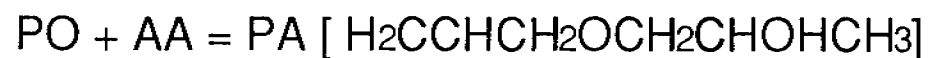
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The Glycol Ethers Process

Process Chemistry - PM Series

UNDESIRE REACTIONS *

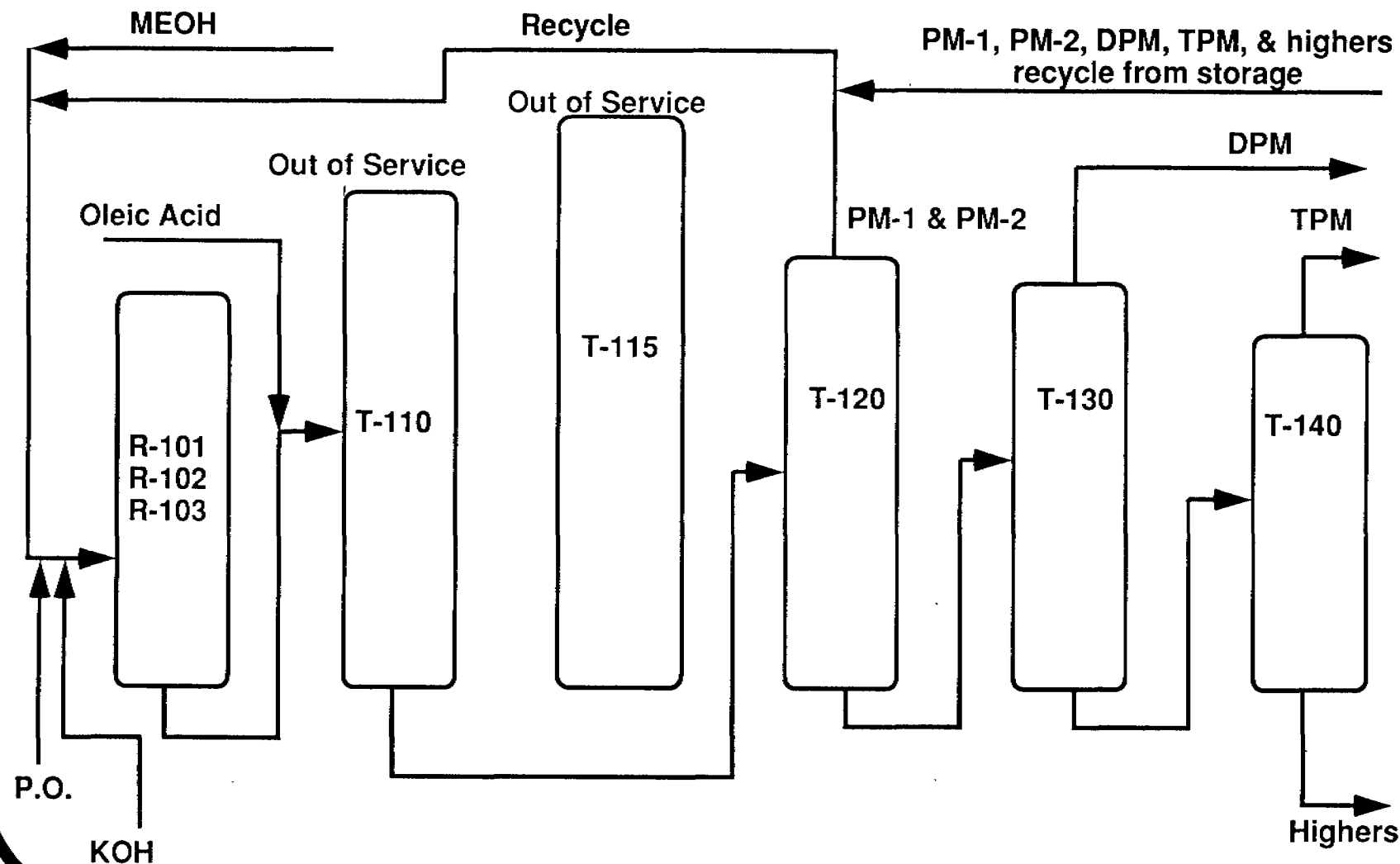


* KOH is present as a catalyst

ETHANOLAMINES / GLYCOL ETHERS

The Glycol Ethers Process

Process Flow Sheet - Dowfroth Mode



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The Glycol Ethers Process

