

Ethanolamines/Glycol Ethers In Plant Training (IPT)

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Ethanolamines - Reactor Area R-201 & R-202

Answers:

1. Physically locate:

- A. MX-201
- B. PSV R-201 A/B
- C. EJ-201 A/B
- D. Aqua ammonia control valve
- E. R-201 shell pressure control loop
- F. PSV E-201 A/B
- G. R-201 outlet hi/lo pressure transmitters
- H. Oxide control valve to R-201
- I. E-201A
- J. 30# steam make up
- K. Condensate make up
- L. P-200
- M. Process water tie in to E-201A

2. Explain the physical features of R-201.

- A. How many passes through R-201?
22
- B. What is each pass made up of?
Stainless steel tube bundles consisting of 60 5/8ths tubes wrapped around a 3/4ths inch tube.
- C. Where are the temperature probes in each pass?
The center tube has three thermocouples- one in the center and one in each end.
- D. How many temperature probes are there?
3 on each pass - 66 in R-201.

E. How are R-201 and E-201A connected?

The shell of R-201 and the shell of E-201 are connected by a rectangular opening called a plenum chamber.

3. Explain the purpose of P-200.

Re-circulates condensate on the shell side of R-201 to have a more consistent temperature throughout the shell.

A. What does it pump?

Condensate

B. Where does it pump it to?

1. Re-circulates condensate to the top of R-201.
2. Re-circulates condensate to the bottom (3 places) of R-201.
3. Pumps it to the ditch.

4. State how condensate flow into R-201 shell is controlled.

From P-511 condensate header through R-201 level control valve.

A. Locate condensate control valve.

B. State where the condensate level in R-201 shell should be.

Level needs to be above the highest tube bundle to be able to remove the heat of reaction.

5. State why we have steam piped to R-201 shell. State what type steam. Locate steam valve to R-201 shell.

30# steam is used to preheat the shell side of the reactor so that the EO/aqua ammonia reaction will start faster in the tube side.

6. Explain how the pressure in E-201A and R-201 shell are maintained.

Steam ejectors (EJ-201 A/B), are used to pull a vacuum. A pressure control valve false loads the ejector with air to control the pressure.

7. Explain the purpose of E-201A.

Remove the heat of reaction from the condensate in the shell side.

A. What utility flows are piped up to E-201A.

Cooling tower water with process water as a backup.

B. Locate the process water block valve to E-201A.

8. Explain how R-201 temperature and pressure are related.

As the pressure rises so does the temperature.

9. **State what the lowest temperature on R-201 before putting oxide on.**
65-70 degrees c.
10. **Explain how you would know that you had oxide not completely reacting in R-201 and getting through to R-202.**
The temperature in R-202 would be higher than R-201 outlet. The reaction in R-202 would be heating up.
11. **Explain the purpose of R-202.**
R-202's purpose is to give the space for any remaining EO to react. It is a safety precaution to insure the reaction takes place in a controlled vessel made for reactions.
12. **State how the inside of R-202 is made.**
Stainless steel, 30 alternating baffles.
13. **Explain what could happen if R-201 or R-202 had a high temperature or hot spot.**
The ammonia/EO Mixture could vaporize, leading to an uncontrolled reaction. The reactor would pressure up, blowing the PSV's, causing the ammonia/EO Mixture to be vented to the sump. The reactor system would trip and shutdown.

Note: Explosions are possible results of uncontrolled reactions.
14. **Explain what is the maximum amount of oxide you would allow in R-202 inlet and outlet.**
Inlet- not more than would bring R-202 temp up 10-12 degrees c. Outlet- none.
15. **Explain what the line-of-logic is.**
Instrument nest that monitors temperatures, pressures, ratios, and critical pump status. It has the ability to trip off or shut down the reactor if indications are out of control.
16. **State what raw materials are fed into R-201 and what the reactor effluent is made up of.**
Ethylene oxide and aqua ammonia, amines as recycle and CO2 at times are fed in. Crude Ethanolamines (MEA, DEA, TEA, & Higher), ammonia, some glycols, and H2O make up the reactor effluent.
17. **Locate and explain the function of the ammonia vent header. State what product streams vent into this header.**
The vent headers purpose is to dilute any product stream vented to the sump through the PSV's. 30# steam and process water trip on rising pressure in the header to dilute liquid and reduce vapor. All product vessels which contain ammonia vent into this vent header.
18. **State why we sometimes recycle MEA or DEA.**
Recycling MEA produces more DEA. Recycling DEA produces more TEA. Recycle is another way of controlling the concentration of production.

Revisions:

Revision No. 1	06-28-93	Yearly Review
Revision No. 2	12-09-94	Yearly Review