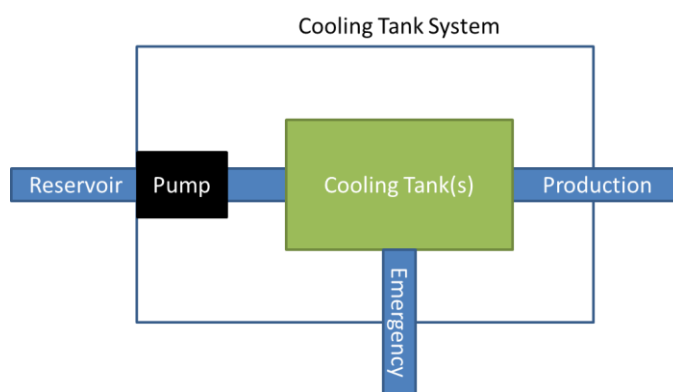


Cooling Tank Challenge Problem

CONOPS/High-Level Requirements

CONOPS

An industrial facility has a need to cool a liquid as one stage in a process. The facility would like to have one or more cooling tanks added in the middle of the production line. Prior to the cooling tank(s), the liquid is held in a reservoir that is large enough to be considered to always have liquid available to be moved into the cooling tanks. The liquid will need to be pumped from the reservoir into the cooling tank system and the pump will be considered part of the cooling tank system. After the liquid has been cooled to the appropriate temperature range, it must be sent to the next stage of the process via a production line. There is an emergency dumping line that liquid may be sent to in the case of emergencies.



Requirements

1. The cooling tank system (CTS) shall contain a pump to transfer liquid from a reservoir to the CTS.
 - a. It may be assumed that the reservoir has an unlimited supply of liquid.
2. The CTS shall contain at least one tank where the liquid will be cooled.
 - a. NOTE: Temperature is being abstracted away in this challenge problem. A large assumption is being made that the liquid gets “appropriately cooled” by being inside of the cooling tank(s) of the CTS.
3. The CTS shall use a production liquid line to send cooled liquid to the next stage of the process.
 - a. The production line may accept up to $0.2 \text{ m}^3/\text{s}$ of cooled liquid.
 - b. It may be assumed that the production line never gets backed up (i.e. cooled liquid may always be passed on to the next stage)
4. The CTS shall dump liquid into an emergency line in the case of a safety or other emergency.
 - a. The emergency line may accept up to $0.5 \text{ m}^3/\text{s}$ of liquid.
 - b. It may be assumed that the emergency line never gets backed up (i.e. liquid may always be dumped into the emergency line)
5. The CTS shall not cause any unsafe situations for the workers in the facility.
 - a. No liquid may leave the CTS except through the production or emergency lines.