

## Acid Dilution System

The equipment is intended for diluting battery acid. Concentrated acid ( $H_2SO_4$ ), density is diluted with de-ionized water ( $H_2O$ ) to obtain the required densities. The mixing is done continuously or in batches of approximately  $2.5-4.0m^3$ . Reclaim acid can also be used in the process. The density is measured by a Coriolis mass flow meter. The mixing process is fully automatic and controlled by PLC.

Källström can supply a complete integrated system including mixing unit (batch or continuous) with heat exchanger, storage tanks, cooling unit, de-ionising plant for water, dosing unit for  $Na_2O_4/NaOH$ , sedimentation/filtering unit for waste acid, all controlled by one PLC.

All tanks for acid are made in HDPE or PP and are equipped with safety tanks in the same material. All piping is made in PVC and PVDF.

For safety reasons all pumps in the system are of vertical type.

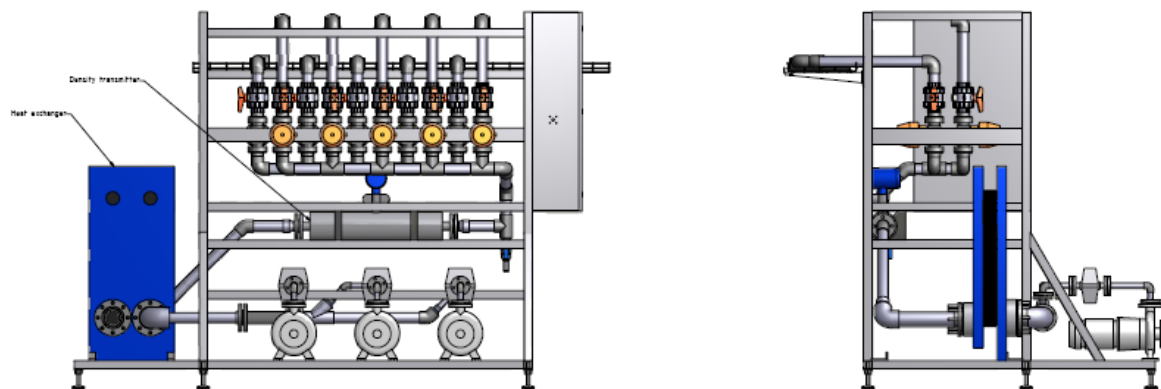
There are no connections in the bottom of the tanks.

The heat exchanger is made in graphite, Hastelloy or plastic.

Note. - All valves are normally closed. This means that they are all shut if air or electricity is cut off.



Batch Acid Mixing unit



Continuous Acid mixing unit

## Acid Dilution System

### Principle of operation:

The PLC unit receives a signal from a storage tank to indicate that the acid level has fallen to the point where new acid should be diluted.

The PLC unit stores this information, and when the mixing system is free, it starts a new mixing cycle, batch or continuous, for the desired density. If several different densities are required at the same time, they are stored in the order in which the PLC receives the information.

The operator chooses between automatic or manual mixing via recipes in the PLC.

For batch and continuous operation, see next two pages

### Capacity:

The equipment is manufactured with capacities as per the specific requirements of the customer.

### Accuracy:

The tolerance range is  $\pm 0.001 \text{ g/cm}^3$  regardless of density.



Acid mixing system

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### Batch

Deionised water will be pumped to the mixing tank until the level entered for start volume in the selected recipe has been reached. As soon as enough water has been added to the mixing tank the agitator and the pump for circulation through heat exchangers will start.

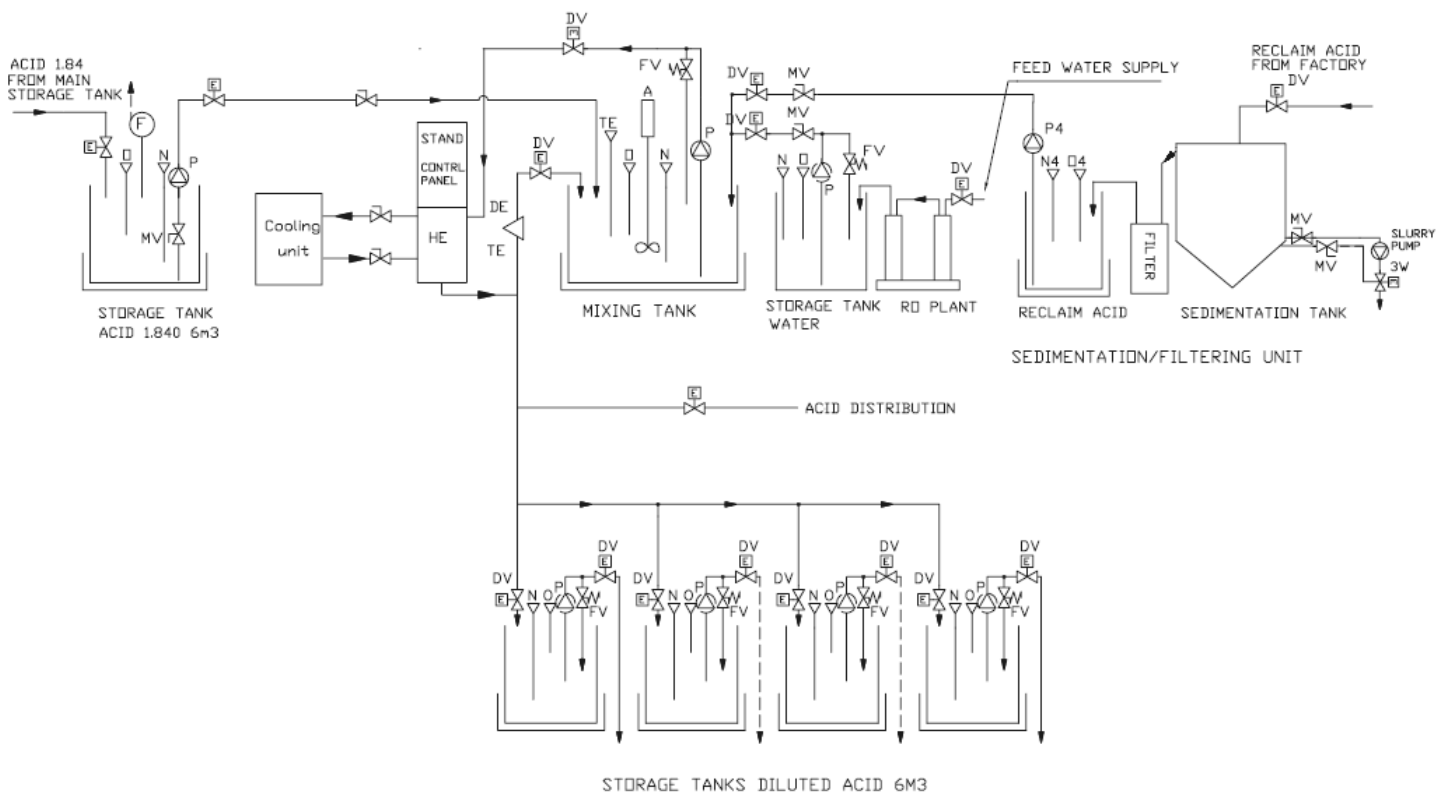
When the initial water volume has been reached concentrated acid is added. At the same time the volume in the mixing tank continues to circulate through the heat exchangers for cooling. The density is monitored during the whole mixing process and the adding of acid will continue until the mixing density equals the value in the recipe.

The temperature of the mixing process is controlled with temperature probes. If the temperature gets too high (set point value) the inlet valve for concentrated acid is closed only circulation through the heat exchanger (cooling) will continue. The mixing process will then automatically restart as soon as the temperature has dropped below the reset temperature.

When the correct density has been achieved the circulation through the heat exchanger will, if necessary, continue until the temperature registered after the heat exchanger equals the distribution temperature selected.

The mixed acid is ready it is distributed to the storage tank.

When the mixing tank is empty a new mix will automatically start if there is one waiting



**Flow diagram of a typical batch system**

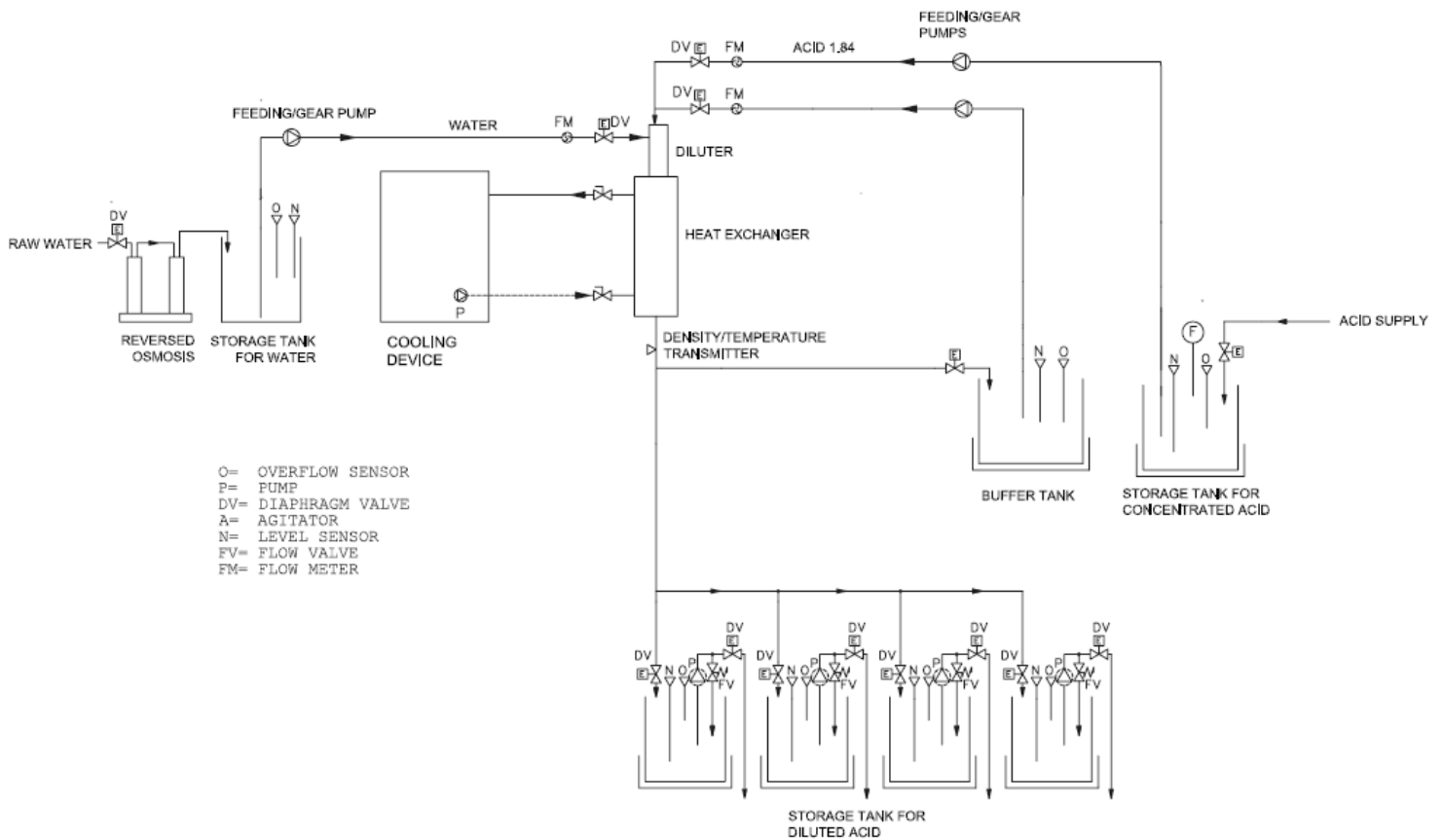
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### Continuous

Concentrated acid and water is pumped through flow meters directly to a diluter (placed on top of the heat exchanger) where the two liquids are mixed. The mixture then continuous through the heat exchanger where it is cooled to the required temperature. A density meter measures the density after the heat exchanger. If the density is the correct the diluted acid is pumped to the storage tanks.

If the density is not correct it can be pumped to a buffer tank until the correct density is reached. The acid in the buffer tank can be used for mixing new densities.

When the correct amount of acid is mixed and distributed the system will start mixing the next required density.



Flow diagram of a typical continuous system

## Acid Dilution System

### FEATURES:

- Fully automatic operation
- Batch or Continuous operation
- High Accuracy
- Safe operation
- Robust design

### OPTIONS:

- Storage tanks
- Chiller/Cooler
- De-ionized water
- Filtration & Sedimentation of waste acid
- Adding of Na<sub>2</sub>SO<sub>4</sub> or NaOH

### TECHNICAL DATA

Capacity	Up to 6m <sup>3</sup> /h
Accuracy	± 0.001g/cm <sup>3</sup>
Dimensions	Depends on design
Voltage	3x400V-50Hz or 3x480V-60Hz
Power consumption	Depends on design
Pressure	6 bar
Air consumption	Depends on design
PLC system/OP	Siemens Siematic or Allen Bradley (other brands/models available on request)