#1

CLEANING AND HYDROCARBON RECOVERY IN STORAGE TANKS

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#2

Types of Cleaning

- Mechanical Cleaning
- Automated Mechanical Physical Cleaning
- Physical Chemical Cleaning
- Automated Physical Chemical Cleaning
    - Online Cleaning
    - Out of Operation Cleaning

#3

Types of Cleaning

Mechanical Cleaning

- Mechanical extraction and disposal of mud.
    - 0% hydrocarbon recovery
    - Tanks are offline for an excessive period of time
    - 0% return on investment for refinery
    - Unsafe environment
    - Hydrocarbon spillage
    - Obsolete and costly process

#4

Automated Mechanical Physical Cleaning

- Mud extraction using robots
    - High costs and robots are unable to reach to all internal sections of the tank
    - Necessity of maintenance personnel to physically enter the tank
    - 0% hydrocarbon recovery
    - 0% return on investment

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Chemical Cleaning with Hydrocarbon Recovery

- Online Cleaning
    - This type of cleaning is done with the tank in operation, utilizing the TumTank™ for Process Equipment system, separating in-line the hydrocarbon, water, and sediment from existing sludge, gradually monitoring sediment quantity at the bottom, forming a water interface at the bottom of the tank.
    - This type of cleaning is recommended for tank maintenance so as to return clean tanks back into operation.

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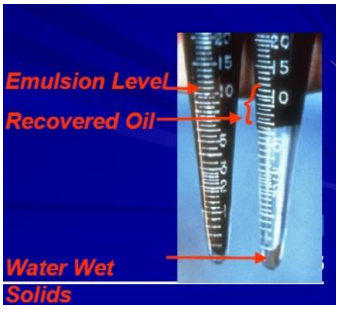
Online Cleaning is done in two ways:

- Continuous injection type (3 – 10 ppm of chemical product) for a minimum of 3 months
- Batch type (30 – 100 ppm) for a minimum of 5-10 injections



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Out of Operation Cleaning

- When tank is out of operation due to high mud content and/or maintenance.
    - The following test must be done to verify hydrocarbon recovery feasibility
        - Age of mud
        - Quantity of mud (sludge)
        - Volume and distribution of mud in tanks (Thermographic 3D images, profiling)
        - Laboratory cleaning simulation
        - Determination of existing % of hydrocarbon, % of water, and % of sediments
        - Hydrocarbon quality

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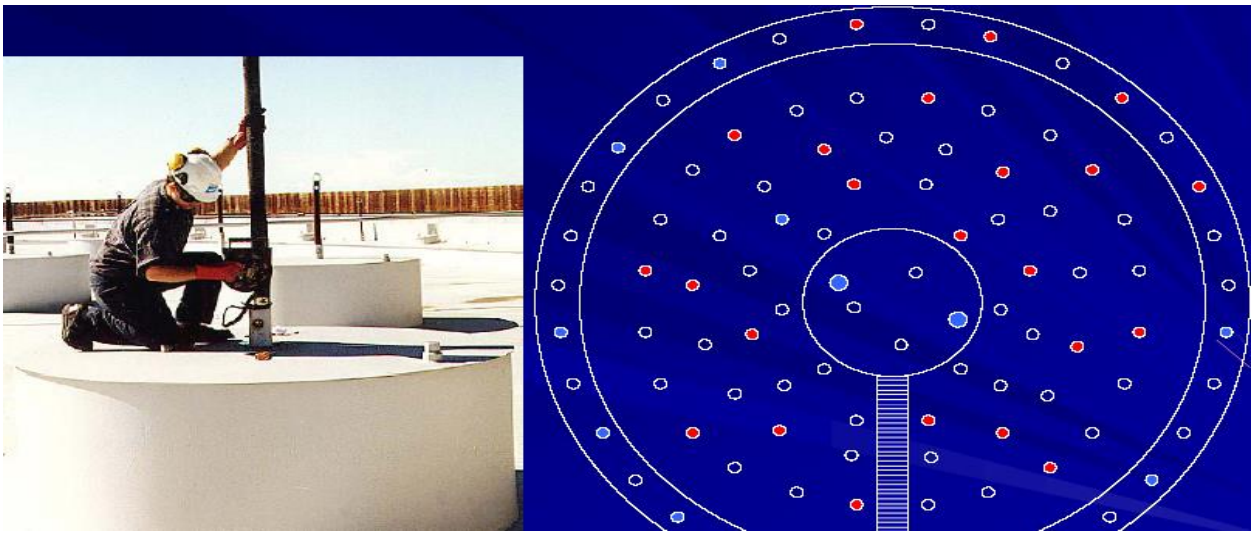
Volumetric Profiling and Mud (Sludge) Composition



REQUIRED SAMPLES ARE TAKEN WITH STRATIFIER EQUIPMENT

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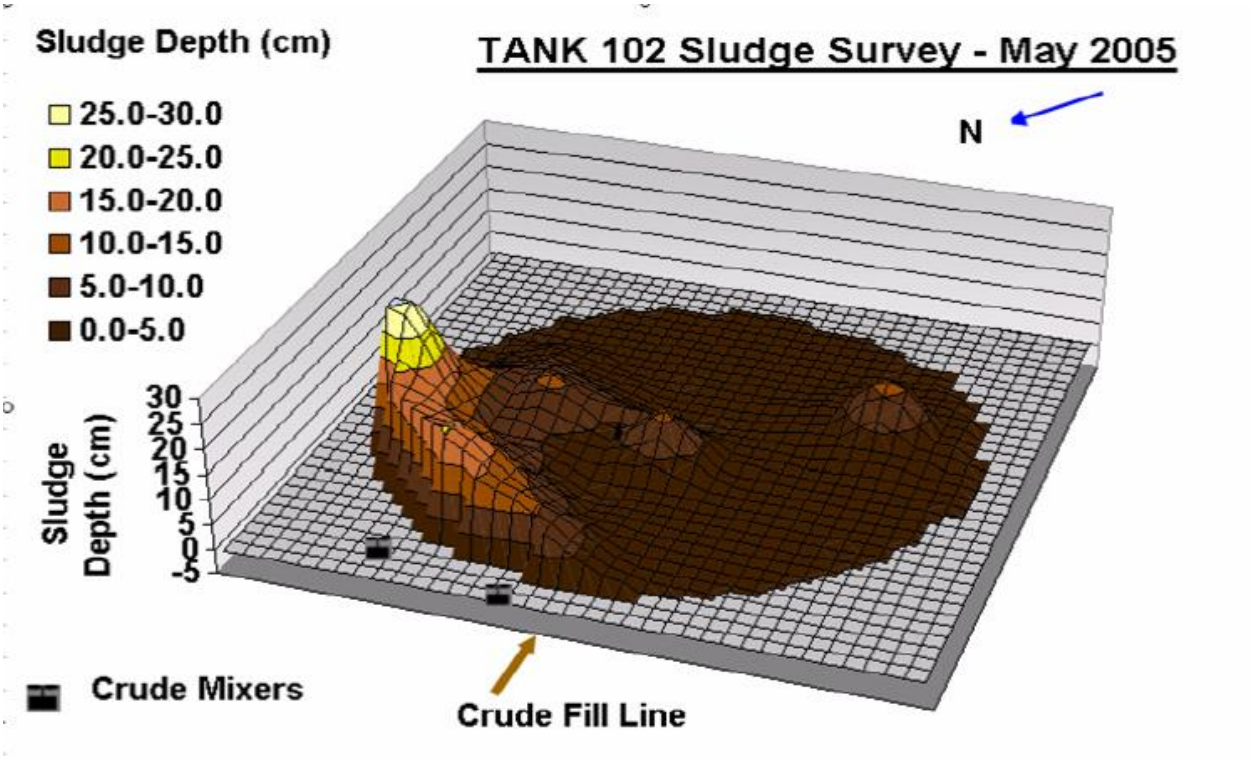

According to the data collected and thermographic images, three-dimensional volumetry of sludge is determined

#11

Laboratory Simulation and Determination of % of HC, % of Water, and % of Sediment

Mud Sample

Mud separated as hydrocarbon, water, and sediment

#12

BASIC CLEANING PROCEDURE

- After having quantified the amount and distribution of the mud (sludge)
    - Conduct a tank survey, to verify inputs and outputs, drains, service vapor, water, electricity, accessibility, etc.
    - Service distance and quality
    - Distribution of lines between tanks

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BASIC PROCEDURE

- Once the study has been carried out, along with the DTI of the provisional installation, the circulation and heating of the system will proceed, as follows.

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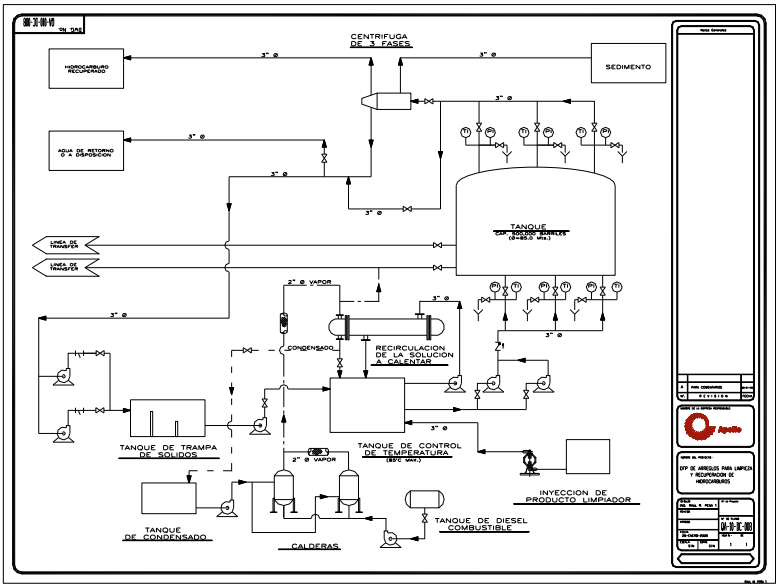

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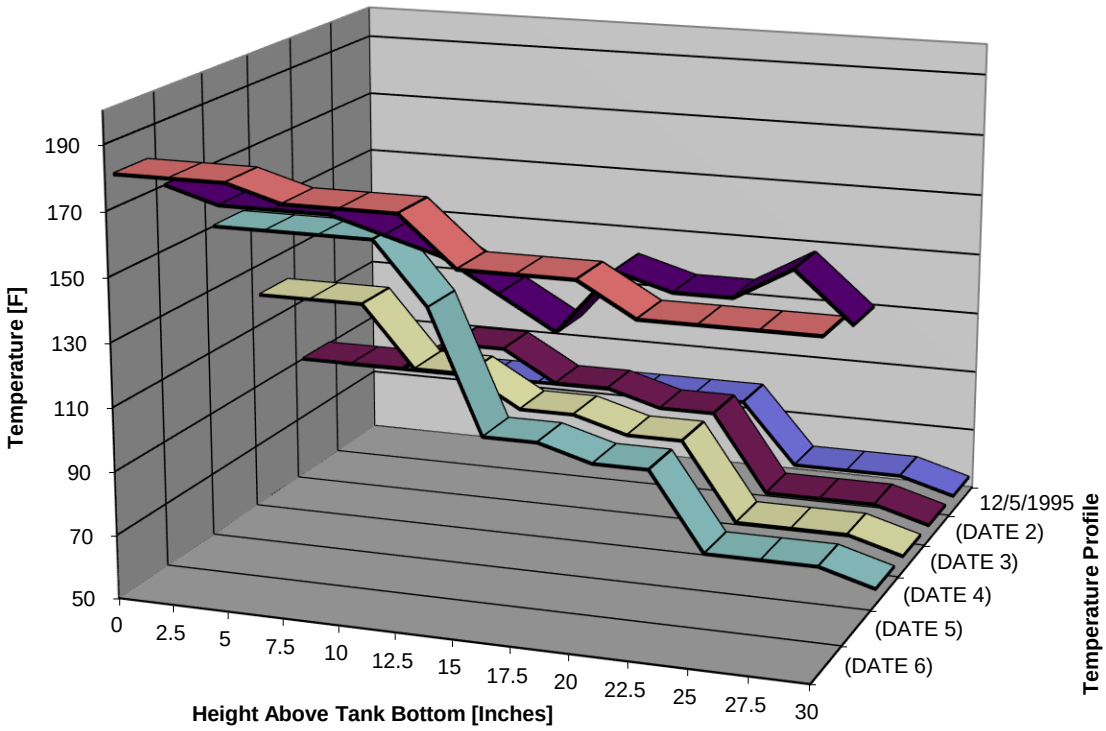
- Progressively we will monitor, keep a record, and new temperature profiling from the interfaces inside the tank to follow the progress of sludge separation, with the help of the infrared vision and specialized software.

#16

Temperature Profiling from different tank heights



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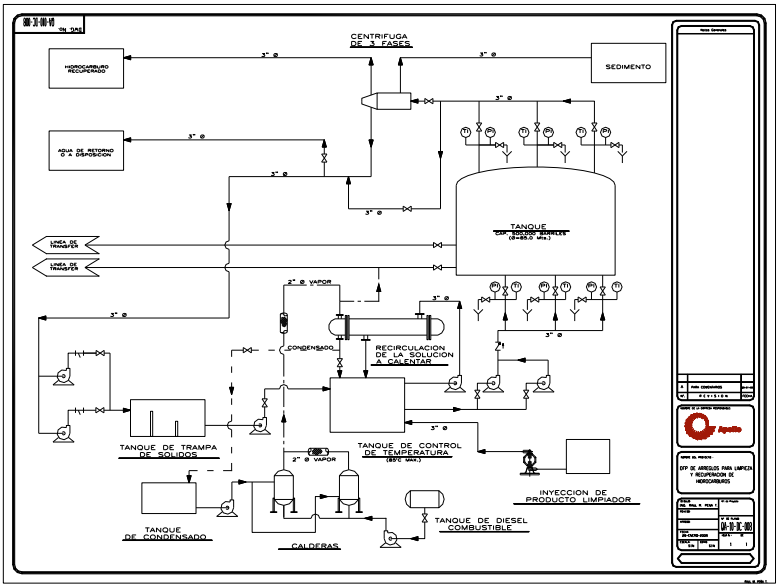
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SEDIMENTO
AGUA DE RETORNO
O A DISPOSICION
TANQUE
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TRANSFER
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CONDENSADO
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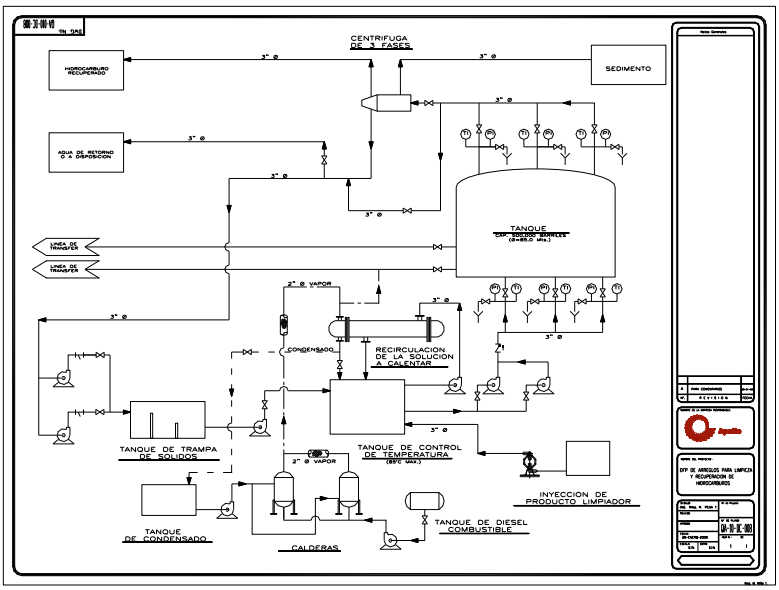
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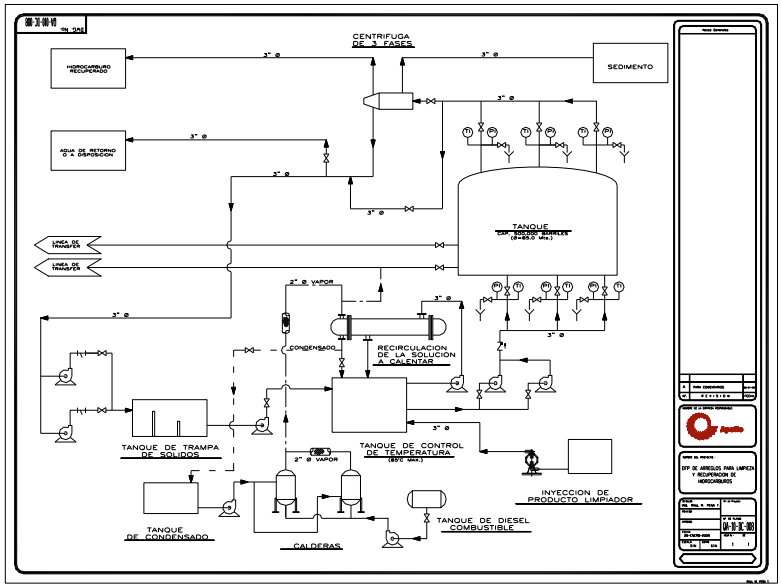
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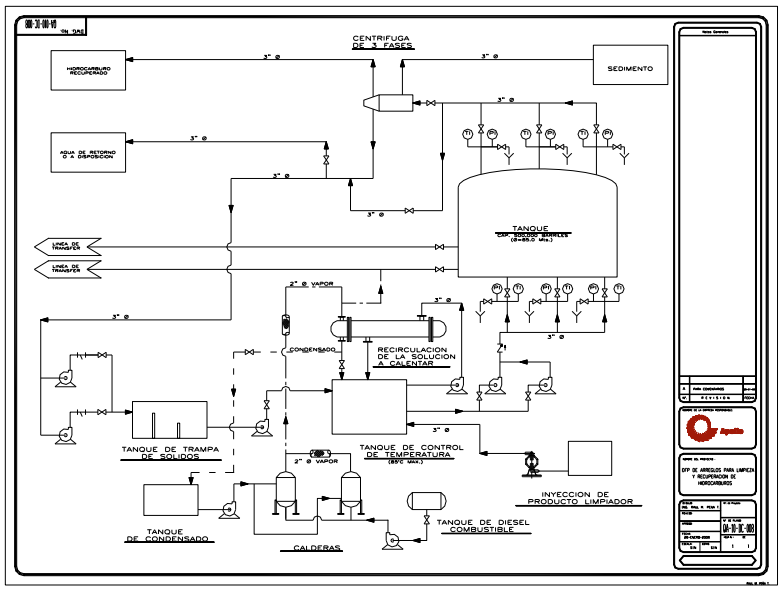
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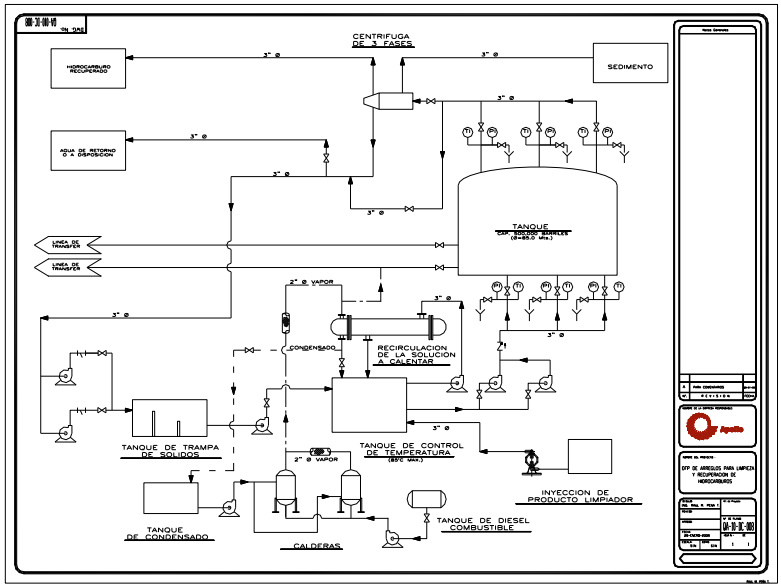
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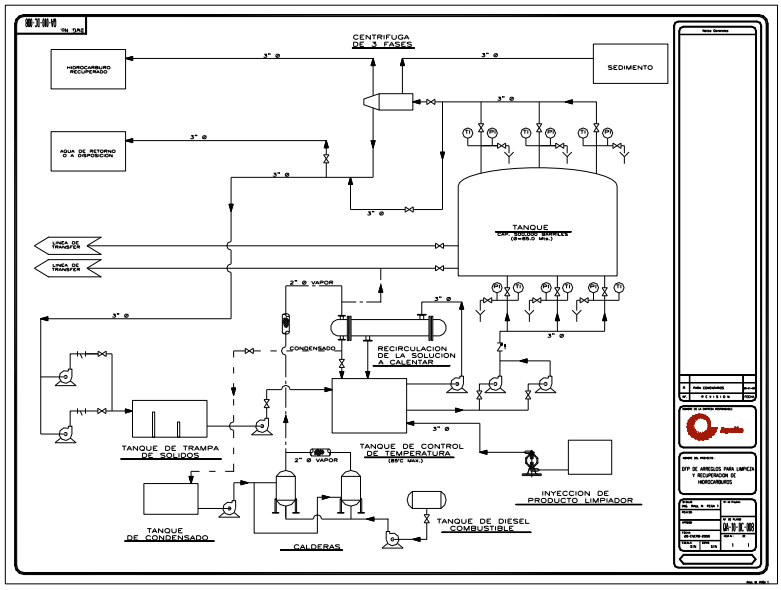
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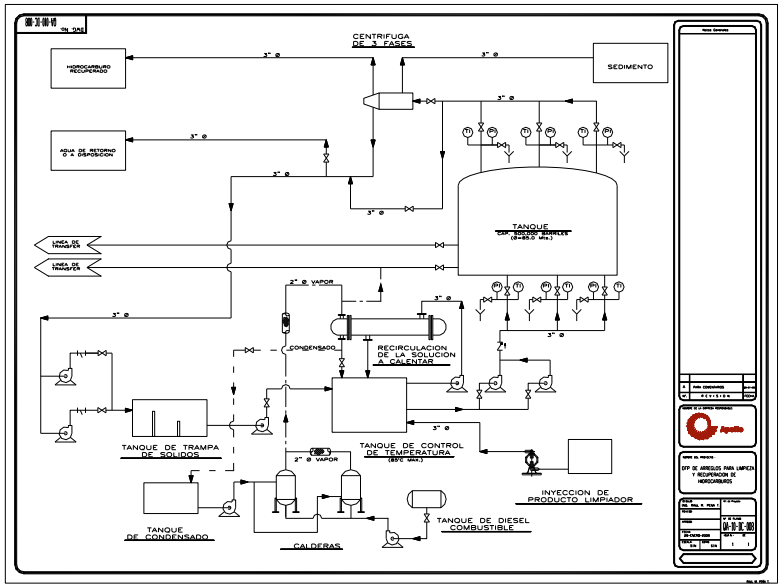
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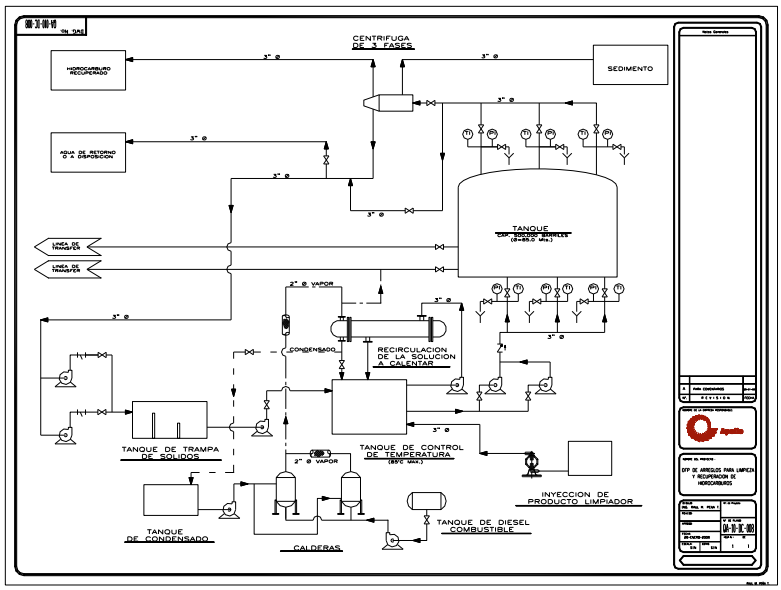
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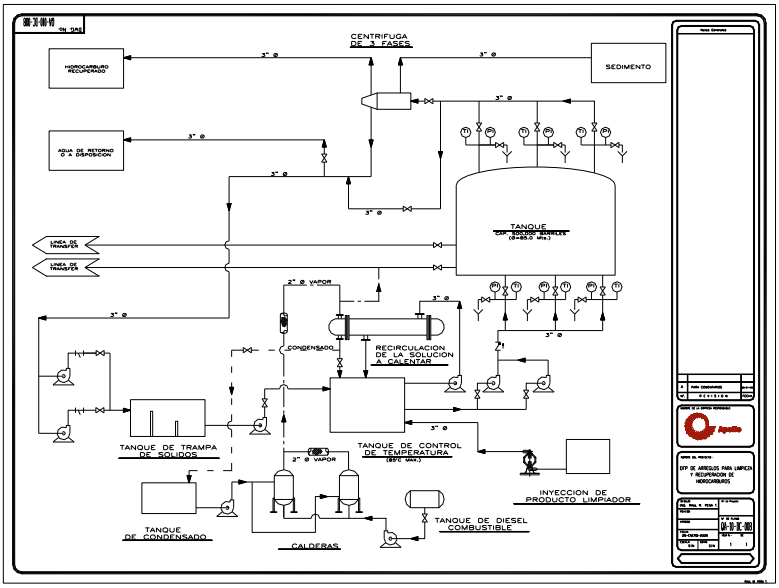
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COMPARISON VS. MECHANICAL CLEANING

MECHANICAL

- 0% Hydrocarbons recovery
- 2 – 8 months execution time
- Approximately cost from $9MM - $15MM pesos

BASIC CLEANING

- 80% - 95% Hydrocarbon recovery
- 0.5 – 2 months execution time
- Approximate cost $11 MM pesos
- High investment returns
- 5 – 20% sludge in solid disposition with low quantities of hydrocarbon and water