3D Process Equipment Modelling and Design

A Technical Report on the Application of AutoCAD Plant 3D for Equipment Design

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1. Introduction

In modern process engineering, 3D modeling plays a critical role in visualizing, analyzing, and optimizing equipment layout and interaction. This project explores the capabilities of **AutoCAD Plant 3D** in modeling essential industrial process equipment. The scope of work includes creating precise 3D models of systems such as separators, heat exchangers, air dryers, and LPG storage units using real-world design specifications. The models were built with functionality, spatial integration, and maintai...

2. Objectives

To develop 3D CAD models of selected process equipment using AutoCAD Plant 3D. To include accurate sizing, component configuration, and connection details in each model. To support process layout, visualization, and integration with piping and instrumentation systems. To extract orthographic and isometric drawings for engineering documentation.

3. Equipment Modeled

The following process equipment were modeled as part of this project: **Horizontal Phase Separators Vertical Separators Shell and Tube Heat Exchangers Heatless Desiccant Air Dryer Systems LPG Storage and Dispensing Systems** Each unit was developed with respect to dimensional accuracy, nozzle placement, material specifications, and assembly configuration.

4. Design Description

Horizontal and Vertical Separators: These were modeled to simulate real-world oil and gas applications. The horizontal design focuses on gas-liquid separation with demister pads, while the vertical units emphasize liquid-liquid separation. Each vessel includes support structures, access hatches, and internal components. Models are compliant with ASME standards for pressure vessels.

Shell-and-Tube Heat Exchangers: Designed to handle typical thermal loads in refinery and chemical operations. The model includes baffles, tube bundles, channel heads, and flanged connections. Dimensional data was obtained from standard TEMA (Tubular Exchanger Manufacturers Association) guidelines.

Heatless Desiccant Air Dryers: The skid-mounted twin tower design includes switching valves, silencer, inlet filters, and outlet check valves. These systems are critical in air preparation units and modeled with instrumentation such as pressure indicators and control solenoids.

LPG Storage and Dispensing Systems: This includes horizontal cylindrical LPG tanks, dispensers with flow metering, vapor recovery lines, and safety relief valves. The layout is designed according to NFPA 58 safety spacing and compliance codes for LPG installations.

5. Outputs and Deliverables

The 3D models generated were used to produce technical drawings such as: Orthographic Projections (Front, Side, Top Views) Isometric Piping Diagrams Bill of Materials (BOM) General Arrangement Layouts These documents aid in procurement, fabrication, and site installation planning.

6. Conclusion

The project successfully demonstrates the use of **AutoCAD Plant 3D** as a versatile tool for process equipment modeling. By integrating engineering standards with CAD capabilities, the resulting models offer not just visualization, but detailed technical insights for downstream applications. This approach enhances communication across engineering disciplines and lays the groundwork for digital twin development in process industries.