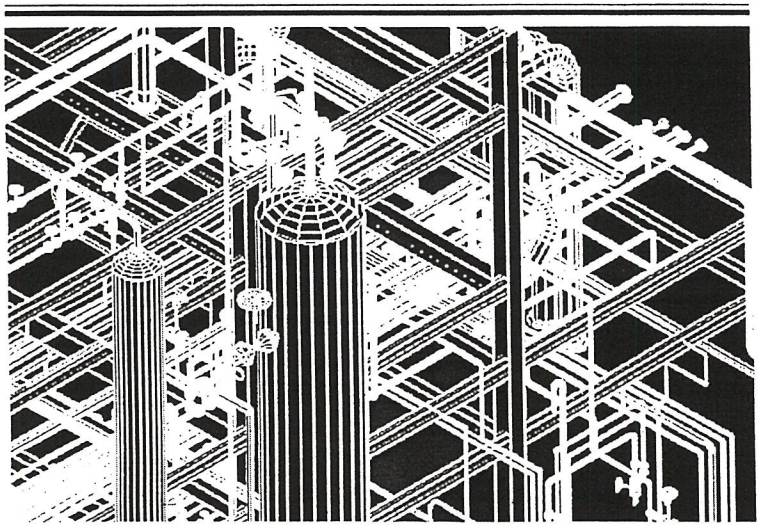
Designing petrochemical plants in 3-D reduces piping design time by 30pc

The productivity gains through using a new spec-driven, 3-D plant design software package that works within AutoCAD are discussed here by Sung Jin Kim and Ok-Ki Lee. Both are from the Lucky Engineering Company Ltd in Seoul, Korea



An example of the new generation of personal computer based 3-D plant design software package entitled Auto PLANT. Depicted here is a detail of an AutoCAD 3-D model of a specialty chemical plant. (Photo courtesy of Lucky Engineering Corp).

Lucky Engineering Company was established in 1978 as a general engineering and contracting firm.

It offers a wide range of technical services including feasibility studies and planning, project management, design engineering, procurement, inspection, construction and start-up operations.

Since its foundation, the company has built a reputation of delivering projects on time and within budget and evolved into a highly diversified corporation specialising in process plant design, environmental control, HVAC and clean room, electrical power systems, architectural and civil engineering.

Lucky is a member of the Lucky-Goldstar Group, one of Korea's leading enterprises which owns and operates more than 50 plants in a wide range of industries.

It became the first Korean engineering firm to take on a major North American project when it designed a Union Carbide polypropylene plant.

One of the company's most recent projects used with AutoPLANT is a 3900-ISO Methyl Methacrylate and Isobutylene plant currently under construction in Yeochin, Korea, whose design was completed in March 1992.

When manual drafting methods were used, the company's designers typically needed about 150-200 hours to produce a typical 30-ISO, AO-size orthographic drawing from the P&ID.

The isometric for each line took about four hours to draw and two hours to check.

Thus, the total time required to design each piping section was about 380 hours.

On a 3900-ISO plant like this one, the total piping engineering time for this phase of the plant design would be something on the order of 50,000 hours.

The company's first efforts to reduce this figure resulted in the installation of two-dimensional computer-aided design (CAD) software package about five years ago.

The CAD software was basically used an electronic drawing board so essentially the same methods were used as with manual drafting.

In particular, in order to draw each isometric, the designer needed to carefully determine the proper perspective and type in detailed bill-of-materials information.

More recently, Lucky has begun to use a new spec-driven, three-dimensional plant design software package (Auto PLANT from Engineering Design Automation Inc, Berkeley, California), that works within AutoCAD's CAD software.

The key advantage of the new approach is that the entire plant layout is produced from the start in three-dimensions.

Rather than simply entering elevation data on the drawing as before, elevation becomes an integral part of the drawing.

Then the drawing can be viewed from the front or any other angle to check clearances and fits.

This simplifies the design process to the point that the time required to lay out a typical 30-ISO, AO-section is reduced to only 180 hours.

But, the major advantage of the new approach is that, once the three-dimensional layout is completed, the isometric drawings can be produced much faster than before.

All that is required is defining the entities which make up the line and the desired view which takes a maximum of three hours including checking.

Thus, the time required to complete each section has been reduced to only about 270 hours.

The time used to produce orthographics and isometrics for the Yeochin plant, the first completely-produced with the new methodology, was reduced to about 35,000 hours which is 30 per cent less than the manual approach would have needed.

The ability to link textual bill of materials data such as description, size, weight, vendor, etc, provided additional time savings.

Designers have been freed from the need to enter descriptions on the drawing.

Instead, a secretary types the specifications for each component into a simple flat-file textual database.

The specific fields used in the database were selected by Lucky engineers to fit the needs of this project.

Whenever a symbol was entered into the drawing, the textual information was automatically linked to the drawing.

This information was then be used to provide further time savings in producing reports such as the bill of materials, valve and specialty lists, instrument lists and line designation schedules.

Data could also manipulated to save engineering time such as by separating stainless steel components onto a different report or subtracting the length of in-line components to provide cut length data.

If an error was discovered in a specification, it could be corrected simply by typing the correct data into the database.

Every instance of that item in the project was automatically be updated.

The information can also be exported in ASCII, Lotus and dBase and, when the project is completed, will be down-loaded to the customer's system for administrative use.

While the greatest savings came from the reduced time required to produce orthographics and isometrics as detailed above, other advantages were apparent throughout the design process.

For example, the ability to view the entire project in three dimensions saved more time by helping designers to detect interferences and other problems much earlier than would have been possible before.

This substantially increased the accuracy of the in-itial drawings and thus minimised rework time.

Lucky management also believes that the ability to determine interference between components will contribute a five per cent reduction in total plant due to reduced field rework and better constructability.

Additional time savings came from linking the orthographics and isometrics — changes only had to be entered in the orthographic drawings and they automatically rippled through the rest of the system.

An added incentive to convert to AutoPLANT was the fact that it uses the AutoCad user interface which is widely familiar to Lucky's designers and suppliers thus minimising training costs and the need to duplicate CAD software functionality thereby reducing software conversion costs.

Besides saving time, Lucky executive C M Park expects that the new technology will help the company win new business as they begin to inform existing and prospective customers of the benefits of the process.

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