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# State-of-the-art-automation at NOV in Kalundborg

*NOV manufactures flexible pipes, which are used when oil and gas are to be transported from wells on the seabed and up to the surface. It is very demanding for the pipe design, physical strength and flexibility. And it places high demands on the machines which manufacture the pipes on NOV's factory in Kalundborg. It is huge sizes and physical forces that are at stake, here. The requirements for automation as well as the electrical and mechanical systems are also very extensive.*

During the following 3-4 years, National Oilwell Varco in Kalundborg need to have replaced electrical panels, PLC-controls and user interfaces(GUI) in 11 large production machines. This is carried out by DI-Teknik.

A large modernization and standardization project is started on NOV's production plant in Kalundborg. A total of 13 production lines are to be extended in the years 2014-2020. 11 out of the 13 output lines will be replaced during the next 3-4 years. The task is assigned to DI-Teknik, who supply NOV with replacement of electrical panels, PLC-controls and new user interfaces for operators. The major project is an exercise in planning, project management and collaboration, so production of flexible pipes from NOV can operate with continuously maximum uptime.

"The overall goal is to get our factory and all its production lines upgraded, modernized and standardized, in order to obtain an optimized production and higher security on-site. It involves both operating extension of the product facilities, as well as optimizing its daily operations to minimize errors and downtime, and gain an optimal control of the machines, thus gaining improved productivity, "explains Rune Wissing, senior project manager at NOV in Kalundborg.

## *But the clock is ticking for several of the production facilities and their automation at NOV*

"We are approaching a situation where some of the facilities and components are so old that it starts to become a problem to obtain spare parts and thus to repair our facility. We have also seen that our PLC systems have been faulty, so there is need for an upgrade of our entire PLC control units, "emphasizes Bent Lodberg, project manager for automation renewal in NOV.

## Professional handling

The task of providing new electrical pan-

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els, new PLC controls (SIMATIC S7) and new user interfaces are assigned to DI-Teknik, who previously has helped NOV with upgrading and standardizing a so-called carcass system. Under the current contract, is preliminary one production line for pressure reinforcement of flexible pipes, and 1 production line for Extrusion modernized. Now there is another 11 out of a total of 13 production machines left to modernize. The whole project will be completed in 2020.

“DI-Teknik has shown an understanding of our situation, that we have not experienced with other suppliers. They are committed and have been able to provide us with competent consultancy and challenge in the decision-making process. DI-Teknik has been dedicated to learn our daily routines and all the necessary technical processes. They have handled tasks without anything “falls-between-two-chairs". DI-Teknik has clear standards to perform with the different phases of the projects. Overall, everything is implemented very professionally and it has given us peace of mind along the way,” says Rune Wissing.

Not least, the determination of risks of the plants cf. The Machinery Directive has been a very important part of the project and continuously is, of all future systems to be modernized.

“The Machinery Directive has been an important guideline in the projects. We want both maximum operational reliability, but also a physical security for our employees. In collaboration with DI-Teknik, we have improved the working environment and safety of our facilities, "comments Bent Lodberg.

The task requires that DI-Teknik has precise knowledge of every component and machinery part, to perform the technical documentation. An additional benefit is that NOV now will obtain a complete updated technical documentation of its facilities.
"Our machines have different ages and are typically rebuilt several times, and an updated technical documentation have not been completed along with it.  Now, we will get an overall update from DI-Teknik as the facilities are modernized and standardized the coming years, "says Bent Lodberg.

## New signs and new user interface

In “Trykameringslinje”1, the initial setup consisted of several independent controllers from different generations PLC, Siemens S5-115 and S7-400.
S5 PLC was the original control to the machine. S7-section was a later modification of the machine to handle "curve control” which e.g. controls the torque adjustment for the four coils for material supply of threads. Effects and signals to the "curve" took place by slip rings.
The operator control consisted of Siemens S5 OP panel, local controls and Zenon HMI interface which had been added concurrent with the newer S7.
In the "old" control / power boards there were many components from previous discontinued machine parts as a result of optimization of the production lines over time.

## The new setup

Replacing all control and power boards and new control panel with 19 "HMI interface built at DI-Teknik’ s own workshop. Communication using Profinet between PLC, remote I / O, AC and DC drives.
For the new “curve control” placed on the impeller, Wireless Profinet is applied. Since production is very exposed, a backup solution is made with duplicated Profibus onto slip rings with SIMATIC Powerrail Booster. The wireless solution works flawlessly, and it has not been necessary to use the backup solution.

Control and power boards are built with SIMATIC S7-400 failsafe and S7-ET200M nodes. For control of AC motors, G120 drives and Sirius compact starters with I / O link are used, and for DC motors, DCM drives are used.

The different controls and operating modes are defined in the risk assessment, and in situations where there is a need for the operator to operate the machine with the covering open, it is performed under safe low speed and by using e.g. a tree-point-handle.

All accesses to the machine is updated with new interlocking (door contacts) which are monitored from the failsafe PLC. DI-Teknik has also designed a new graphical user interface using SIMATIC WINCC for operation of the PLC-based production plant. A standardized user interface provides a more optimal and safe operation, with less possibility for

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the operator to make mistakes, and the new user interface can be used as a new standard for all 13 production lines, which until now have been various in the user interface from facility to facility.

Before DI-Teknik deliver a new solution to NOV, it has undergone both a Factory Acceptance Test (FAT), and a Site Acceptance Test (SAT) and a final test during ordinary production. Here, the system must operate for 30 days without failure.

»DI-Teknik act fully professional in all aspects of the tasks to be solved. It is very important to us that deadlines are met, so that our production does not stop producing for longer than scheduled, and so far, everything has been performed strictly by the book. Already, we are experiencing an optimized operation of the first modernized plant, and we look forward to having the other facilities future-proof as well, "states Rune Wissing.

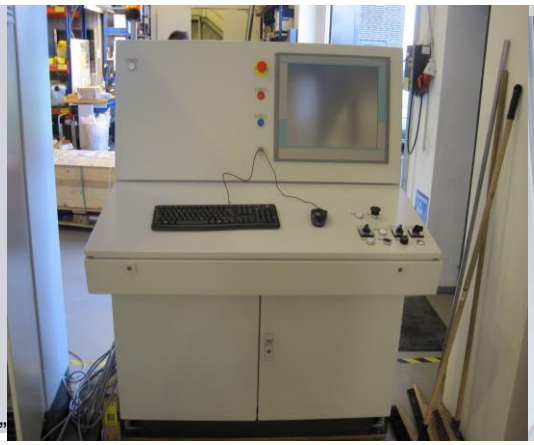
## Comprehensive project management

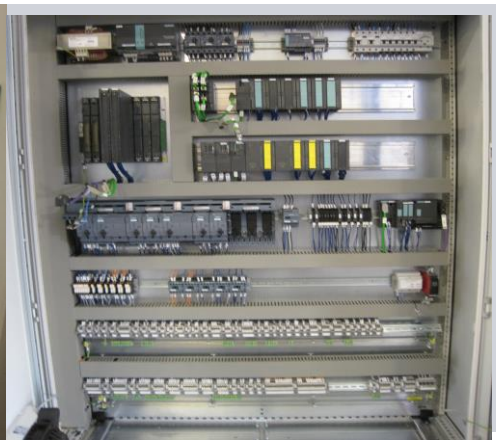
It is a great satisfaction to everybody at DI-Teknik, that we have succeeded in becoming a supplier to NOV's comprehensive modernization and standardization project.

"We see it as a huge recognition of our technical and project management skills. We provide both “state-of the-art” technical solutions and a comprehensive project management, which includes that all deadlines will be met, so production at the plant is not shutdown a second longer than agreed for, "comments Rasmus Thygesen, CEO of DI-Teknik.

"As far as possible, in a project of this duration, DI-Teknik strive to work with the same team of employees from start to finish, creating a professional continuity and thus optimal workflows for the project" says Rasmus Thygesen on.
When it comes to project management, time factor is very important. The shutdown of production lines must be as short as possible.

"We are facing a long-term and huge commitment with multiple manufacturing facilities, where each one is different. In principle, they are all unique production lines. It is starting over with each production line, when making controls and risk assessments. Only when it comes to the design of the user interface, we can reuse our solutions from facility to facility. We strive very tight schedules for the replacement work, which requires shutdown of production. So, we run with extended hours in the weeks when the replacement is undergoing and the first modernized production line is delivered ready for production on time, "states Rasmus Thygesen.





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