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**New DEUTZ MOTOR factory uses forward-looking
production technologies**

**Combining of all modern elements of engineering,
logistics and organization of the work**

As an engine supplier, DEUTZ MOTOR serves sundry markets showing very complex requirements and customers' requests. The engine production in the Cologne-Porz factory is able to meet these demands with the engine type 1011 with two, three and four cylinders as well as the type 1012/1013 with four respectively six cylinders.

The particular high efficiency arises from the smooth interaction between specially trained employees and the newest production technologies assisted by a relevant information technique. Due to the consequent constancy and consistency, the product is optimised, thus achieving a significant advantage in competition for KHD and consequently for the customers. On the whole, 600 million DM are invested, including expenditures for assembly shops, suppliers, foundry and machining section.

Engines are never isolated parts, but always components of a complete system. In the same way, Deutz Motor sees the new production as a 'component' of the equipment production on the whole. The reliability of the engines is based on design and production.

To avoid waste of time and unnecessary freezing of capital, a modern enterprise should do without receiving inspection, partly or totally reduce the inventories and cut down order

processing. Reflecting this, the principal objectives of the new engine production result: lowest manufacturing costs possible, high delivery performance and flexibility as well as a secure and high standard.

Employees are kept informed

Principally, the 540 staff members working in the assembly shops are to realize the objectives expected. The so-called typical assembly line workers doing monotonous work don't exist any longer. The employees have to come up to the following criterions: capability of teamwork and dealing with conflicts, receptivity and sense of responsibility. A special training supports these qualities.

Teams comprising of each six to ten employees organizing their work by themselves master all the tasks of the team relevant to the production.

The information-technical 'workers' guide' informs the employees at any time and workstation in order that they know exactly the different customers' requirements, production objectives and products and, resulting from this, have the best qualification to permanently improve product and productivity and to ensure to a large extent meeting the schedule.

Control circuits guarantee a high standard

Quality control circuits guaranteeing a high standard are a further component of the general conception. Undoubtedly, the customer is the most important part of the circuit. The quality assurance system DIN ISO 9000 was decisive for the selection of the suppliers having already a say in the design phase. In addition, the suppliers have to prove to be under personal capacity to sue, this confirming the demanded zero-defect quality of the bought-out items. To produce engines having zero defects, the setting of high-level demands is inevitable.

Deutz Motor takes another decisive step:

parts delivered in faulty condition are no longer reworked, but rejected. Above all, this means that rather a shutdown of production is accepted than a quality defect of an engine.

Not only the employees trained in modern methods of quality assurance, who have their appointed tasks all along the logistic chain, belong to the quality assurance system of the assembly hall measuring 22,000 sqm. Each team represents a quality control circuit, each individual employee checking the quality of his work before passing on.

In one sentence: quality is not controlled but produced, thus giving an extraordinarily high productivity to this factory, even compared with the Japanese standards. The conception

means to realize tomorrow's world of work. Some other innovations: the employees can influence their wages by being flexible as well as by determining themselves quantity and mainly quality of their work.

Assembly in two independent working systems

The assembly system combines the advantages of the assembly line and the stand assembly and is divided into two independent working systems. The assembly line system does not have fixed cycles. Here, the 'workers' guide' screen gives the worker all the informations relevant to the respective basic engine. The worker is allowed to set by himself a time for the assembly vehicle to pass on.

The security of this assembly method is ensured by the inspection loop, the engine being passed through in case of defective parts. While the assembly system keeps operating, the part is being exchanged and the engine reintegrated. In this way, neither the belt has to be stopped, nor the engine with the defective part is passing the whole assembly system.

Using robots, process security as well as flexibility in view of programme modifications and product development is achieved to a large extent. Robots are harnessed for high-standard assembly work and may be switched over at short notice. Material banking and maintenance services as well, for the first time integrated into the team and therefore having a share in its success, ensure process security.

In addition to all the tests during the assembly work, an operational test at the end of the assembly line system ensures that only correctly assembled engines leave this sector.

Teamwork is done in the stand assembly, too, the team getting its informations on the engines from screens with graphics capability. This method is able to realize a nearly infinite variety of variants harmonizing with the customers' requirements. The necessary material is arranged per type of engine and delivered by an AGV handling system.

Furthermore, the AGVS ensures quality security, exact delivery terms, optimal operating sequences as well as the reproducibility of the material flows.

The finished engine has already been checked several times. That's why the 15 final test benches mainly serve to optimise the running-in: the engine is specifically made ready for service. Having passed the general programme, it is adjusted to the specific characteristics of the cutomers documented in an acceptance run, considering the individual characteristics of the customers' equipment and working conditions. Consequently, a readjustment is not necessary.

Zero defects concept simplifies installation at the customer

The guaranteed high quality of the engines delivered simplifies the installation at the customer. Further advantages: no need for customers' checkings, significantly reduced stock, no retrofiting, because all required supply scopes are delivered in perfect condition and at short notice.

The last manufacturing process, after assembly and tests, gives the engine the chosen colour, surface protection at the same time. This process is executed by robots using water-soluble varnish and ensuring a constant quality.

The painting shops and the dispatch both reconcile the idea of high quality and environmental protection: the painting shop uses solvents only in small quantities, and the effluents are reprocessed. To guarantee that it arrives at the customers without any damages, the engine is fixed to reused steel frames.

Computer conception supports consistency of the production

All the sections are supported by a 3-level-computer conception to be able to realize the universal production conception of the new production system.

The upper level is the product planning and control system planning, controlling and supervising all the orders in view of specific customers' requirements, quantity and time of the delivery from offer processing to dispatch.

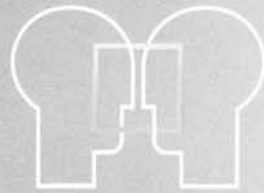
To the lower production management level belong the assembly master computer, the handling computer and the plant supervision. Taking the personnel, plant and equipment capacities into consideration, the detailed order sequence corresponding to the customers' requirements is determined, treating rush jobs separately. The priority control is able to reduce the assembly processing from 14.5 to 10 hours.

The new production is what we call High-Tech today using the headword "Lean production" formed by the Japanese. This means that the whole process - starting from the suppliers and our production up to the customers - runs directly, efficiently, without frictional losses, without rejects and without wastefulness. Something special: this process does not need any additional control and security networks. Technology and men are in harmony. The employees determine processes and rhythm. They are the centre of the enterprise.

The engine production in Cologne-Porz is no utopia: selection and training of the employees have already started, and, after April 1992, the production facilities will be installed. The production will start off next year in October. The annual capacity, at a production volume of 100%, is designed for 13,000 to 15,000 engines.

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Key figures of the new Deutz engine factory

engine types:	2/3/4 cylinders 1011 4/6 cylinders 1012/1013
capacity:	130,000 - 150,000 units/year additional expansion potential: approx. 100,000 units/year
capital investments:	600 million DM external and internal suppliers included (foundry and machining sections)
staff members:	assembly plant 540 buying department and logistics included
build-up area:	assembly plant 22,000 sqm
total job processing	3 weeks
assembly job processing:	14.5 hours
equipment loading time:	99 hours/week
production flexibility:	each type every day
order precision:	to the day
quality:	zero errors strategy

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