

# ADVANCED SERVICE TECHNOLOGY FOR STATE OF THE ART ROLL GRINDERS<sup>1</sup>

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## Abstract

Man power reductions in maintenance staffing coupled with increased production in the mill make it necessary to guarantee higher up-times and easy operation. The professional monitoring and maintenance system "Grinder Diagnostic System" (GDS) allows easy preventative maintenance planning, offers menu-driven help in solving problems, as well as a complete online machine documentation. It offers the operator help in the event of a problem with functions of the machine and not only guides him via the menu to the component responsible for the fault in the online documentation, but also indicates what solutions are available for its rectification. The redundant setup of the monitor, hard drive and power supply, and the standard PC components used as hardware, reduce downtimes to a minimum. The benefits of this are high reliability, reduced maintenance and repair, and easy procurement of spare parts. BUS systems with fiber optic cables connect the central control unit with the local drives and monitoring systems and reduce the required amount of cables to a minimum.

**Key words:** Roll grinder; Rolls; Teleservice; Diagnostic system.

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## INTRODUCTION

Since 1840, WALDRICH SIEGEN has been working in close cooperation with our customers to develop solutions for the most challenging applications. The feedback from our partners throughout the world combined with our experience, is the motor that drives the continuous development process. This interaction to achieve an efficient overall performance has become the philosophy and strength of our company.

In a spirit of cooperation, specific solutions and special tools have been developed to reduce downtimes, make trouble shooting easy and reduce time consuming and expensive service work. In the following some examples for this advanced service technology in state of the art grinding machines are described.

### 1. Teleservice

Customers demand efficient and convenient trouble shooting as quickly as possible. The global market, with machines installed at very remote locations (e.g. close to the border of Alaska in British Columbia, etc.), make it difficult to send a service engineer out in case of machine problems.

As a standard, today roll grinding machines are provided with a teleservice package.

A service PC-station located in our service office can be connected via telephone line and modem with the roll grinding machine at the customer's plant. After the connection is established our service specialist is able to support operators and maintenance engineers during trouble shooting and process optimization. Also, our commissioning engineers use this tool to shorten installation times by getting direct support from the home base.

The service engineer gets the same display and operation like for the GDS system. He has access to the system level (password protected) and a bi-directional transfer of data (back-ups, updates, etc.) is also possible.

#### Advantages of the teleservice system:

- Focused trouble shooting
- Reduced installation & commissioning time
- Quick trouble shooting
- Minimum downtime
- Transfer of optimized grinding programs.
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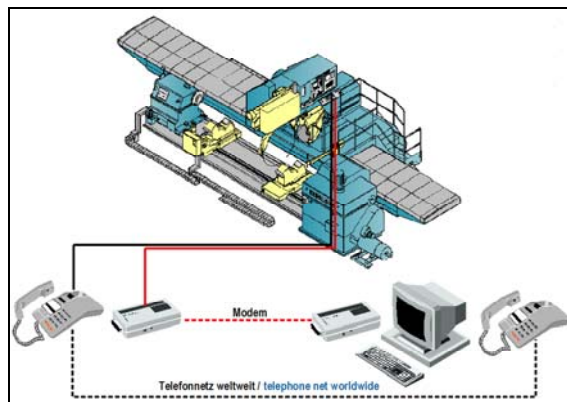


Figure 1. Principle sketch teleservice set-up

All the customer has to provide is two telephone lines to the machine. The first telephone line is directly connected to the modem. The second line is used for the dialogue between machine operator respective maintenance engineer and the WALDRICH SIEGEN service engineer parallel with the data transfer via modem. A specialist can access PLC, CNC and the GDS system, thus ensuring that the machine is operational again as quickly as possible.

## 2. Grinder Diagnostic System (GDS)

The “Grinder Diagnostic System” (GDS) supports the service personnel during maintenance and error diagnosis. A message is classified in error warning, service message and maintenance message. It offers help in the event of a malfunction and not only guides maintenance personal and machine operators via the menu to the component responsible for the fault in the online documentation, but also indicates what solutions are available for its rectification.

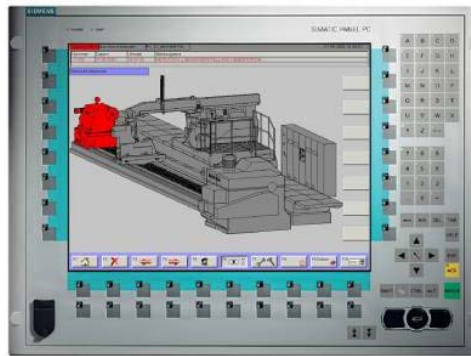


Figure 2.- GDS - computer

The GDS-system is always custom made and gives an exact description on all accessories used on the machine. A separate panel PC with keyboard and integrated mouse is provided in a location near the machine.

### 2.1 Conventional Diagnostic System

On a conventional diagnostic system an error number (e.g. W263), short text information and a location (e.g. E27.5) are provided.



Figure 3. Standard error display

To get more information related to the error number, a paper copy of the documentation has to be searched. Also the location has to be found in the pile of drawings usually delivered together with the machine.

All fault messages are only displayed one after the other and a message only appears for a short while on the display and then the display automatically jumps to the next message.

## 2.2 Trouble Shooting With the GDS System

The cause of a problem and its location can be identified through graphic display of the fault message. Therewith, a direct reference is made to the customer's machine configuration. Service personnel or machine operators are able to find the source of any error quickly. This means that the failed component can be determined in order to carry out the necessary maintenance, checking, repairing or spare part ordering. In combination with the display of the actual machine documentation a quick and efficient error diagnosis is guaranteed. If necessary, documents or drawings can be generated using the printer provided with the machine.

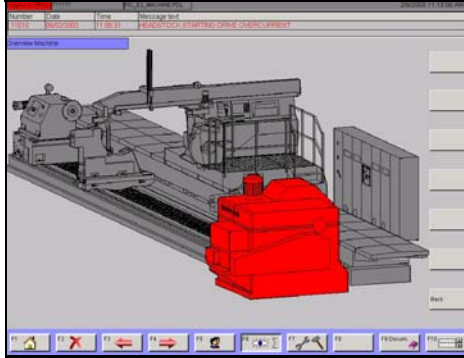


Figure 4. Display of occurring error (GDS-Screen Shot).

The system displays continuing information to a message:

- display of possible error source, steps to take and tips
- possibility of an error history: creating of a comment by operator or maintenance personnel (log book)
- graphical pursuit of the message up to the installation site of the component, which has generated the message

A history of all messages and continuing information to the message is provided. A logbook with list of faults, taken actions, dates, times and operator names is created in the system.

### Message Management

- List display of all messages (errors, warning, service message) including hints for site and cross-reference to flow diagram or drawing
- Graphic display of current messages in diagrams
- Storage of all messages in a short-term (“first-in-first-out-memory”) or long-term (2 months, only the capacity of the hard disk is the limitation for the memory capacity of messages) archive

Depending on access rights, different diagnosis functions can be executed:

- Status of incoming, outgoing as well as internal signals of PLC
- Service function for checking of analogue actual values and checking / changing of parameters (i.e. center sleeve)

## 2.3 Maintenance Management

This includes scheduling of maintenance work (preventative maintenance). The actual maintenance necessary with display of exceeded time will be

displayed. After acknowledgement the time interval re-starts. Maintenance reports and a log-file of performed work are created.

A regularly scheduled and efficient maintenance is necessary to guarantee the long-term availability of the machine.

## 2.4 Documentation (Data Archive)

Normally machine documentation and operator manual are delivered as paper copy and different copies are stored in different locations. If somebody takes a page out of the file and never puts it back its lost. It gets dirty, nothing can be added or changed and to find a specific drawing you have to manually go page by page through the extensive stack of drawings usually provided with the machine.

The GDS system displays the machine documentation in digital form. The complete operator manual for the machine (description, operation, diagnosis, maintenance, etc.) is provided as a "PDF"-file and can be printed always on the printer provided with the machine. Electrical (layout of electrical devices, circuit diagrams, terminal and plug diagram, PLC-program) and mechanical documentation (hydraulic schemes, assembly drawings, etc.) are provided and easy to access via the GDS PC-unit.

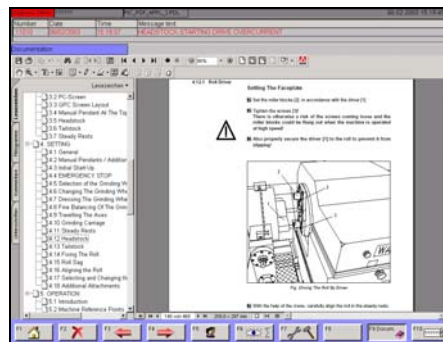


Figure 5. Display of machine documentation (GDS-screen shot)

## 3. Minimal Quantity Lubrication System (MMKS)

### 3.1 The Application

When using grinding machines the jaws supporting the rolls have to be lubricated. Normally sponges are used which will be soaked with oil or so-called drip lubrication. This solution does not allow an exact positioning of the oil portion. Therefore it is inevitable that remainders of this oil will flow into the grinding emulsion and contaminate it. This shortens the endurance of the emulsion. In addition this bears the risk that the sponges will harden and lead to a lubrication film break. In both cases an earlier and extra service and maintenance work would be necessary.

State of the art grinding machines are provided with an advanced and cost saving technique for jaw lubrication. By means of a minimal quantity lubrication system (MMKS), which is integrated in the machine control. It leads to big savings with regard to oil consumption and reduced maintenance work.

### 3.2 MMKS-System

Only a low quantity of oil will be sprayed onto the contact point between roll and steady rest jaw. Compared to a normal system the oil consumption is reduced significantly. The amount depends on the size of roll, used medium and previous settings of sponges. Field experience shows a deduction of oil quantity by 50 – 90 per cent.

This also increases the endurance of the grinding emulsion, as considerable less oil remainders will get into the emulsion. Longer endurance time means less disposal costs. Indirectly you therewith contribute to a resource saving process. Furthermore, the availability of the machine is increased, as less standstill time due to oil exchange is needed.



**Figure 6.** Minimal Quantity Lubrication System (MMKS) – test set-up

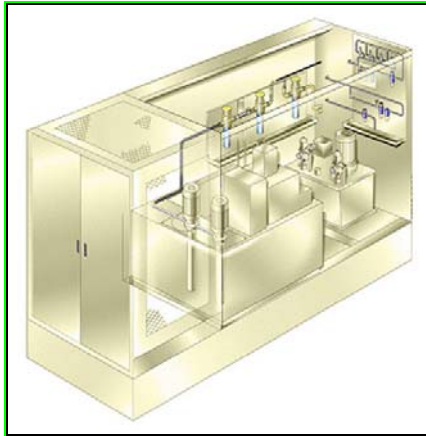
The machine is provided with a Steidle Lubrimat<sup>®</sup> L50 system, which is equipped with 2, 4 or 6 adjustable link hose nozzles (depending on the size of rolls to be ground). Connected to the nozzles is a piston-portioning pump located in the energy box (chapter 4). They are especially designed for conveyance of minimal liquid quantities. The conveying capacity as well as the compressed air quantity necessary for spraying the oil can be adjusted individually.

### 4. Energy Box

Normally the various individual supply units (e.g. hydraulic unit, lubrication unit, cooling unit, etc.) are installed separately on a roll grinder. To maintain and check all components a maintenance engineer has to be all over the machine to find the different units.

On the new ProfiGrind roll grinders provided by WALDRICH SIEGEN these units have been consolidated into just one central unit, the energy box. The Energy box supplies the machine with all fluids needed – with exception of the grinding water.





**Figure 7.** Energy Box (principle sketch)

The energy box is arranged above floor level and contains:

- Hydraulic unit
- Cooling/heating units for hydraulic and hydrostatic oil
- Lubrication unit
- Hydrostatic unit
- Valve control system
- And terminal box

Below the enclosed housing of an energy box – consisting of three sides with doors and a detachable back wall – there is an oil sump for the total volume of all circulating liquids. Ventilators for heat exhaustion are installed on the top. The box is fully installed and tested at the manufacturing facility and easy to install by crane during final assembly at the customers plant. Connections are only plugged back in and the unit is operational again.

Advantages of an energy box, which is completely tested prior to delivery, are:

- Reduced on-site assembly time
- Clean installation
- Cooling of all supply units
- Reduced costs thanks to serial production
- And easy maintenance with all units in one place



**Figure 8.** Energy box at assembly site

## 5. PC-Based Control System With Redundancy Function

### 5.1 Profigrind Control PGC 10

The control system has been specially configured to meet specific roll grinding needs. It guarantees precise measuring and exact logging of the measurements, as well as optimization of grinding programs during the grinding process. A standard Industrial PC is used as CNC. It uses a Windows XP operating system, which enables a simple and intuitive operation of the machine. Integrated in the system is a software PLC, which eliminates the regular PLC hardware components.

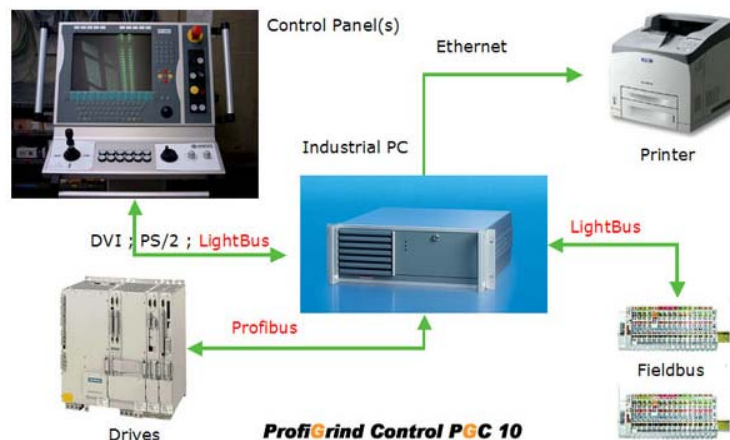


Figure 9. Overview of PGC 10

All drives are connected via Profibus with the CNC; this eliminates individual cables running from each drive to the CNC. Also the use of Light Bus connection has limited the number of cables in the machine.

### 5.2 Redundancy Function

In a field study with our customers we found out that there are three typical wear parts on a control which lead to a failure. These are the monitor, power pack and hard disk. Failure of the control means possible damage to the roll currently being ground in the machine, ultimate loss of data and a machine standstill.

Costs caused by loss of time and repair are:

- Intervention of service specialist
- Time-consuming locating of the cause for failure
- Procurement of spare parts
- Exchange of defective part
- Loss in production
- Reconstruction of situation prior to failure

A redundancy package offered with the machine includes the following components:

#### a) **Additional Monitor**



Integrated in the control panel is a second monitor. It enables to simultaneously observe the machine, optimize technology parameters, program a new parts program and look at the diagnostic function. This generates additional operating comfort and no time loss in case of a monitor failure.

In case one monitor has a failure, the operator has to push one key and the work can be continued without interruptions using the second screen only.

**b) Second Power Pack**

A second power pack is provided. In case of a failure of the first pack, the operator gets an optical and acoustical signal, but with in milli-seconds the machine switches of to the spare power pack. Work can be continued without interruption and the failed power pack can be replaced without loss of production time.

**c) Two Hard Disks**

The second hard disk is automatically used as a back up of the main disk. In case of a failure, the control automatically switches over to the stand-by hard disk. A short error message is shown on the control screen and work can be continued without interruptions. No data loss, since the second disk was used as a back up. After the new disk is installed all data will be automatically copied.

## **CONCLUSION**

State of the art roll grinding machines are equipped with several accessories, which enable the user to be more independent from the service of the machine builder. Special tools, reduction in number of parts and cables, combining supply units in one area and back-up of critical components guarantee high up-times, less maintenance and fast trouble shooting.

Extended support by specialists at the engineering and manufacturing facility is provided to support customers in different parts of the world and only in special cases an engineer has to travel out to the customer and help fixing a problem on site.

## **Resumo**

A redução de mão de obra na manutenção acoplada a uma crescente produção no laminador tornam necessários tempos de disponibilidade maiores e operações facilitadas. O sistema profissional de monitoramento e manutenção "Grinder Diagnostic System" (GDS) permite um planejamento de manutenção, oferece ajuda através de menus bem como uma completa documentação *on line*. Ele oferece ajuda ao usuário no caso de problemas de funcionamento no equipamento através da documentação on line e não somente o leva à origem do problema como sugere soluções para saná-lo. As redundâncias de monitor, disco rígido, fonte de força bem como os componentes padronizados de hardware reduzem paradas a um mínimo resultando em manutenção reduzida.

**Palavras-chave:** Retíficas de cilindros; Cilindros de laminação; Teleservice; Sistemas de diagnóstico