



SERVICE CONCEPTS

FOR

SHAFT HOISTING SYSTEMS IN
UNDERGROUND MINING AND REPOSITORIES

*PRECISELY ADAPTED SERVICE CONCEPTS FROM SIEMAG TECBERG
- AS INDIVIDUAL AS YOUR MAINTENANCE OBJECTS!*

**SIEMAG
TECBERG**

group

Increase productivity and safety

SIEMAG TECBERG implements service concepts as integral components in the shaft hoisting technology delivery programme

Your requirements

Complex shaft hoisting systems are supplied with a defined annual output, whereby the output of hoisting machines and conveying equipment is precisely aligned with the mine operator's production planning, which is typically based on maximum plant efficiency and availability.

The latter two are related to the quality aspect of shaft hoisting technology - which implies the fulfillment of premium quality - and on the other hand demonstrate the high interest of mine operators in maintaining the value of their investments against the background of an optimum technical product service life - this is where sophisticated, tailored service concepts come into play on the supplier side, which already include efficient service management.



Our experience

During the construction phase of the Swiss Gotthard Base Tunnel, SIEMAG TECBERG was itself the plant operator of extensive shaft hoisting systems over a period of 10 years. This has given our experts a fund of experience that is certainly unique in the world and, moreover, the self-confident realization that high plant quality only develops its full performance potential in conjunction with sophisticated service concepts.

Our service concepts

- are appropriately set up in a modular fashion, i.e. distinguish between plant structuring (relevant maintenance objects), inspection, documentation, recommendations for action and, if necessary, offers for the installation of spare parts and the resources required for this.
- They take into account the country-specific requirements or inspection and maintenance obligations of the local supervisory authorities in maintenance plans and inspection activities, and are thus elementary for the maintenance of the operating licence of the plants.

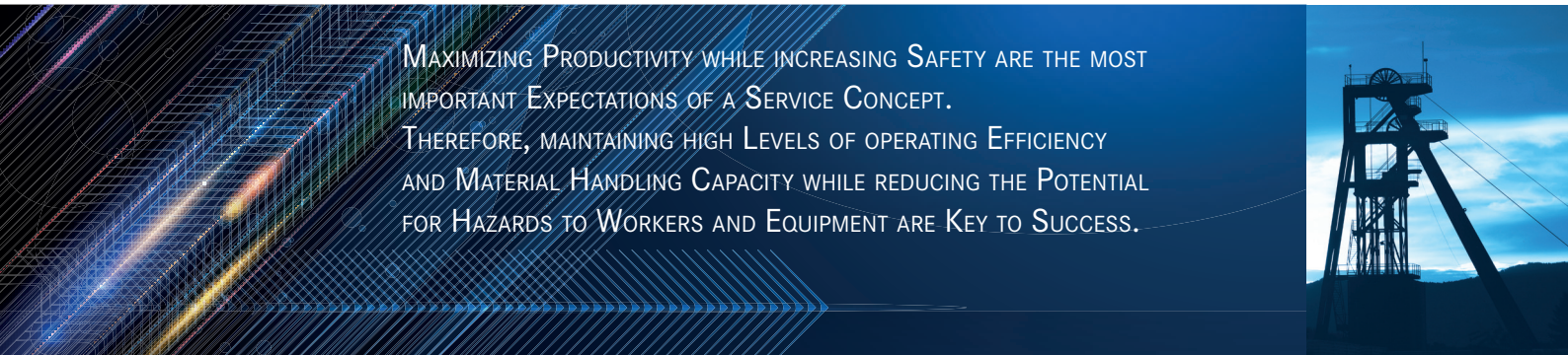


TECBERG
digital

A LOGICAL STEP FOR EVEN MORE PLANT EFFICIENCY

INTEGRATE CONDITION MONITORING AND SERVICE MANAGEMENT INTO
YOUR SERVICE CONCEPT WITH OUR DIGITAL PRODUCT *TECBERG DIGITAL!*

- They take into account the geographical mine-operator/supplier situation, are therefore also economically balanced and offer a sensible mix of maintenance services by the mine-operator's service personnel and selected support by SIEMAG TECBERG experts, coupled with the deadlines for maintenance measures, which are defined by the fixed maintenance intervals of plant components.
- If the aspects listed so far are still at the level of classic service concepts, these - if requested - also incorporate the benefits of digitally based *condition monitoring*, which provides mine operators with a compact overview of the wear reserves and impending damage to plant components. For this purpose, in addition to the sensor data of the plants, selected process data is also processed on site or transmitted to a *monitoring centre* via a secure VPN connection and processed there in a database-based and self-learning trend analysis. Maintenance work can thus be scheduled during non-production periods and the necessary resources can be planned at an early stage.
- In addition to visualisations, alarm messages and reports from digital condition monitoring, this in turn offers automatic feedback to digital *service management*. Condition monitoring triggers concrete maintenance proposals with recommendations for action that can be conveniently and efficiently integrated into maintenance planning in digital service management.



MAXIMIZING PRODUCTIVITY WHILE INCREASING SAFETY ARE THE MOST IMPORTANT EXPECTATIONS OF A SERVICE CONCEPT. THEREFORE, MAINTAINING HIGH LEVELS OF OPERATING EFFICIENCY AND MATERIAL HANDLING CAPACITY WHILE REDUCING THE POTENTIAL FOR HAZARDS TO WORKERS AND EQUIPMENT ARE KEY TO SUCCESS.

Service concepts in the more traditional sense - or nowadays increasingly in combination with and cleverly supported by digital asset and maintenance management on a software basis - offer the mining industry a truly efficient option in maintaining the value of its assets.

At SIEMAG TECBERG, individually adapted service concepts in various forms are therefore an integral part of the delivery program for shaft hoisting technology, just as the hoisting technology is tailored exactly to the customer's situation.

Using digitization as an opportunity

The digital extension of service concepts with TECBERG digital

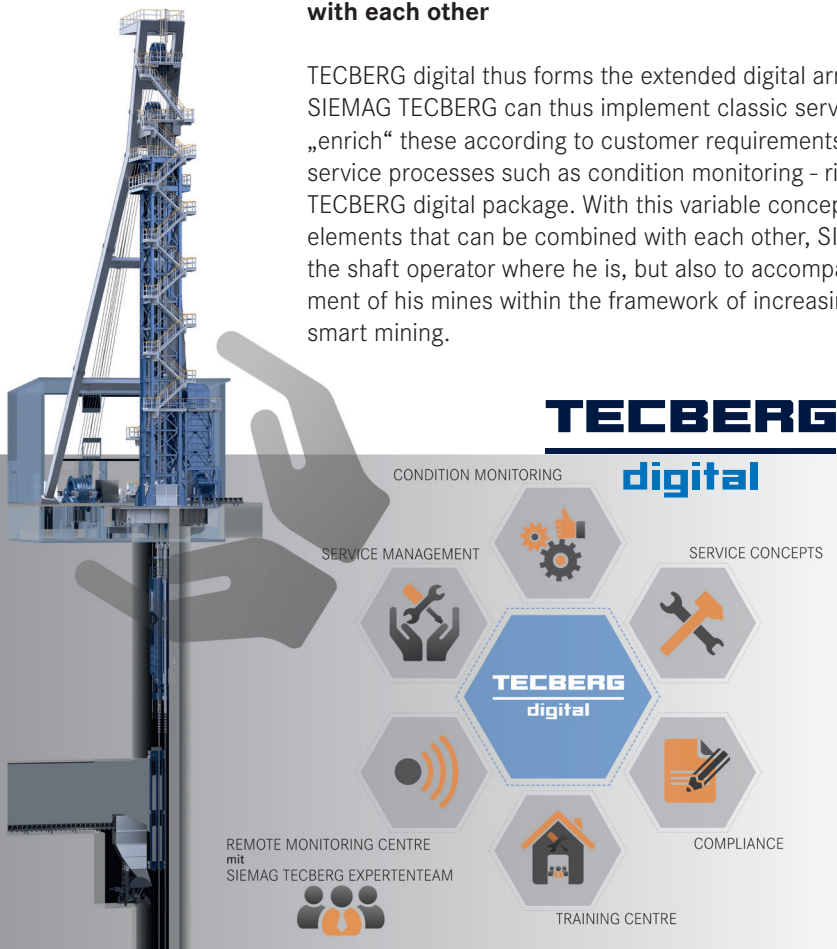
SIEMAG TECBERG understands *TECBERG digital* as a range of digital products and services for shaft hoisting systems. This complete package consisting of a modular software platform and analysis services optimally supports plant operators in plant diagnosis and maintenance management as well as comprehensive service management.

Components of TECBERG digital

- Condition monitoring (Monitoring of wear reserves and component-related trend analyses of incipient damage). Among others with the individual solutions
 - *CRIS* Camera-supported Rope Inspection System
 - *HYDCOM* Hydraulic Condition Monitoring for Brake and Bearing Fluids of Shaft Hoisting Machines
- Service management (Planning, control and monitoring of all maintenance measures)
- Service concepts (Individual maintenance concepts - analog/digital)
- Technical documentation (Software-supported seamless documentation of maintenance events)
- Training Centre (at the SIEMAG TECBERG site in Haiger, Germany)
- Remote Monitoring Centre (Remote Live Monitoring with SIEMAG TECBERG experts)

Towards smart mining - variably combine service concepts and TECBERG digital with each other

TECBERG digital thus forms the extended digital arm of service concepts. SIEMAG TECBERG can thus implement classic service concepts for the customer and „enrich“ these according to customer requirements in the sense of *Smart Mining* with digital service processes such as condition monitoring - right up to the use of the complete TECBERG digital package. With this variable concept of „analogue“ and digital products and elements that can be combined with each other, SIEMAG TECBERG is in a position to meet the shaft operator where he is, but also to accompany him effectively in the further development of his mines within the framework of increasing digitalization processes - keyword smart mining.

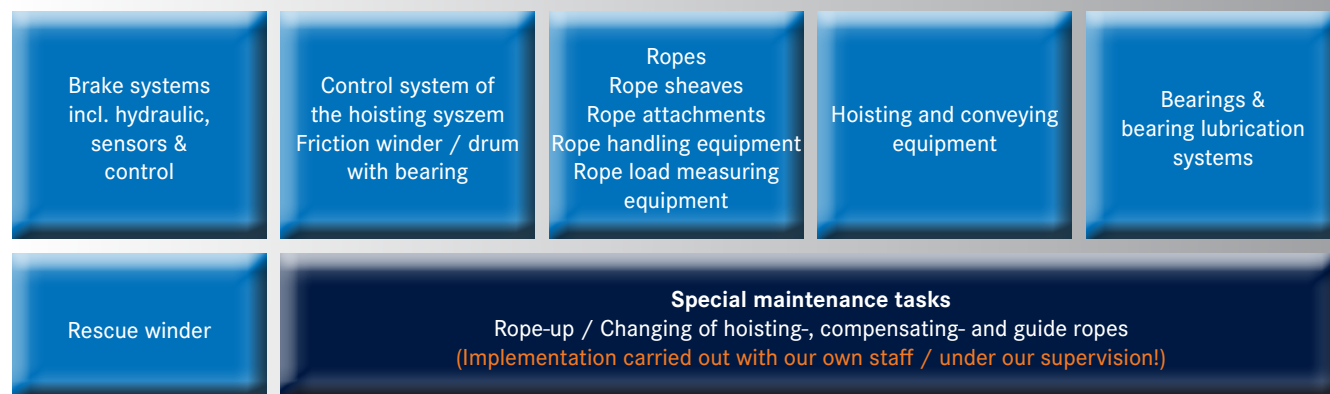


MAXIMUM VALUE RETENTION OF YOUR INVESTMENT

FOR MAXIMUM OPTIMIZATION OF PLANT EFFICIENCY, CONDITION MONITORING OF ASSETS IN TERMS OF PERMANENT MAINTENANCE WILL BECOME STANDARD IN THE NEAR FUTURE. HOWEVER, A CORRESPONDINGLY DIGITIZED SERVICE MANAGEMENT ALREADY PROVIDES CUSTOMERS WITH RATIONALIZATION ADVANTAGES AND CAN ALREADY BE OFFERED BY SIEMAG TECBERG TODAY BY MEANS OF THE TECBERG DIGITAL SOFTWARE PACKAGES.

Service concepts in practice

From a safety point of view, shaft hoisting relevant groups of plant components in service concepts

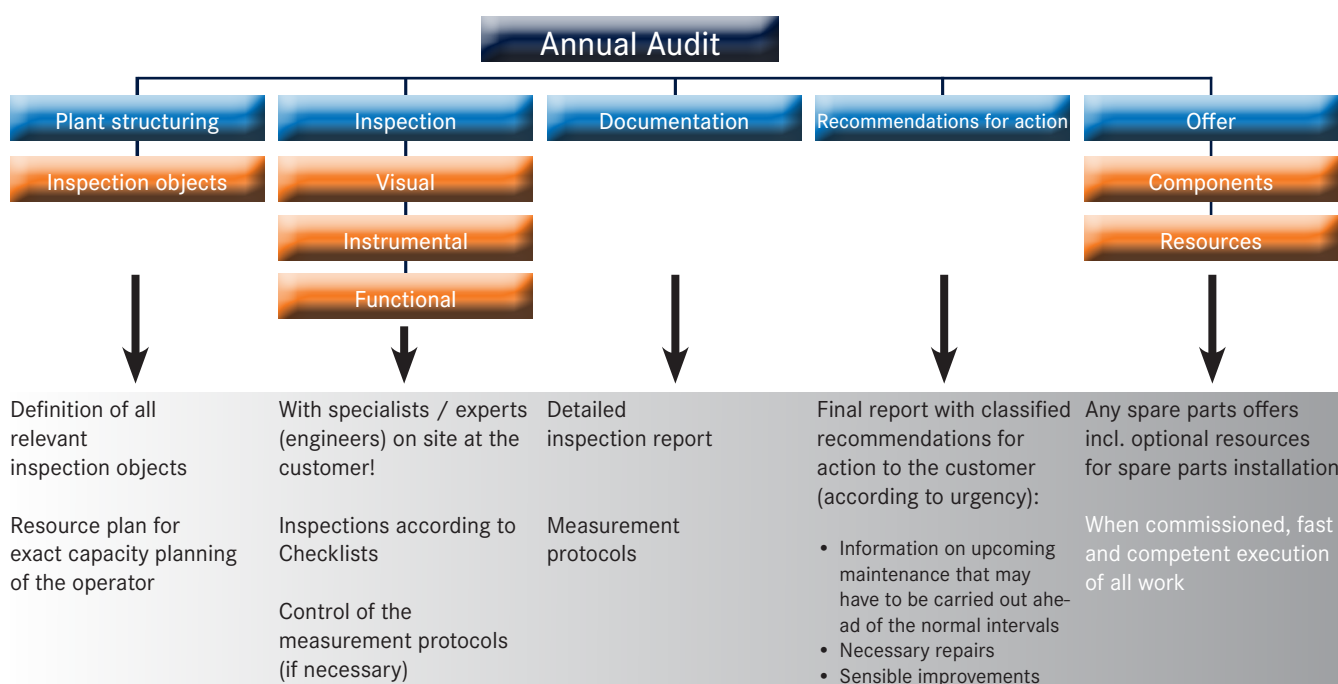


Inspections always include a check of the mechanical, hydraulic and electrical components!



Service concepts for shaft hoisting equipment in nuclear repositories naturally take into account all guidelines, requirements and specifications of national and international nuclear regulations.

Modular elements of service concepts using the example of the „Annual AUDIT“ service concept



SIEMAG TECBERG service concepts considerably contribute to maximum plant availability and productivity.

Service concepts within the framework of regular maintenance intervals by the plant operator

Between the annual audits, the operator carries out the *maintenance tasks* with his own personnel, which are required as per local authorities as well as the tasks specified by SIEMAG TECBERG according to the respective maintenance intervals for individual plant components (daily, weekly, monthly, etc.).

All procedural instructions and necessary documents such as checklists etc. are designed and conceived by SIEMAG TECBERG with the aim of efficiently supporting the plant operator's personnel in carrying out maintenance tasks. Procedural instructions in particular have been consistently developed on the basis of the optimized procedures in product assembly at SIEMAG TECBERG in order to be able to carry out maintenance tasks efficiently and in a time-saving manner.

- Handover of detailed checklists to the plant operator containing all maintenance tasks
- Provide a resource plan detailing what work is to be performed by personnel with what skill level
- Resource plan with defined specifications for proper maintenance, each with a defined time limit
- If necessary, test and procedure instructions additionally describe how and with which tool a maintenance task is to be carried out
- Appropriate measurement protocols are provided, which are checked for anomalies during the annual audit
- Checklists are provided in analog or digital form as required, providing the interface to digital service management

All of the above allow operators to optimally plan their capacities in advance.

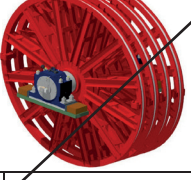


VALUE PROPOSITION

On the basis of this approach to the customization of service concepts, a correspondingly careful, correct and verifiable execution of all maintenance measures by the operator and an assessment of the general state of maintenance of all assets, SIEMAG TECBERG guarantees the shaft operator a considerable contribution to maximum plant availability and productivity.

Technological maps - basis for checklists

Checklists with continuous links to further information allow maintenance tasks to be worked through quickly.

OEM 3_26600.RP		Rope sheave / deflection sheave mounted externally		dd.mm.yyyy	
Customer logo		Checklist		SIEMAG TECBERG	
Order-No.:	220...	Maintenance work to be performed depending on the time interval. (Please select)	Show everything		
Plant:			STO - Annual Audit		
Shaft:			Daily		
Product:	Rope sheave		1 Week		
Product-No.:	26600		1 Month		
Drawing-No.:	49-01-00XXXX		2 Months		
Service-Technician:			6 Months		
Date:			12 Months		
Doc-ID:	S000xxx		24 Months		
Done	Type of maintenance tasks		available links for additional information	I.O.	Comment / ACTUAL condition not OK
26600	Rope sheave / deflection sheave mounted externally		Function Description Technical data (Customer) drawings		
26600.1 Checking the screw connections					
☐	Check the presence of all screw connections			☐	
☐	Checking the tightening torques	Instruction Protocol		☐	
26600.2 Inspection of welds					
☐	Visual inspection for cracks and damage			☐	
26600.3 Inspection of the coating					
☐	Visual inspection for corrosion			☐	
26600.4 Noise and running test					
☐	Acoustically check for unusual running noises			☐	
☐	Runout test by means of dial gauge type 0-5 0.01 SHAN 123774 or distance meter	Instruction Protocol		☐	
26600.5.1 Inspection of rope running groove (unlined rope sheave)					
☐	Visual inspection for dirt and damage			☐	
☐	Measurement of wall thickness	Instruction Protocol		☐	
☐	Measurement of the shape of the rope groove cross section	Instruction Protocol		☐	
26600.5.2 Inspection of the rope sheave chuck					

Technical data
OEM X_P.G.TD
Keyword:
Order:
Doc ID:
Date:

NOTE
This document is only valid in conjunction with and in compliance with the guidelines, regulations and safety instructions from the operating and maintenance manual (OPM)

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1. Technical data rope sheave / deflection sheave with external bearings

1.1 Dimensions, moments of inertia

Size	Abbreviation	Value	Unit
Nominal rope sheave diameter	D		mm
Operating load (max) per rope	F ₀		kN
Rope breaking load per rope	D ₀		mm
Rope diameter	n		[°]
Number of sheaves	q		Grad
Rope wrap angle	γ		m/s
Rope speed	a		mm
Rope spacing	M _{TR}		tm ²

Table 1: Dimensions, moments of inertia

1.2 Masses and weights

Assembly	Quantity	Weight	Unit
Sheave			kg
Axis	1		kg
Bearing	2		kg
Base plate	2		kg
Total weight			kg

Table 2: Masses and weights

1.3 Environmental conditions

The sheaves and their technical components are intended for use at the temperatures specified below:

Umgebungstemperatur	
Maximum temperature:	+32 °C
Lowest temperature (during transport):	-10 °C
Lowest temperature (during operation):	-10 °C

Table 3: Environmental conditions

1.4 Noise emission

Noise emission	
Noise emission	> 80 dB(A)

Table 4: Noise emission

Process instruction
OEM 3_26600.PI

Keyword:
Order:
Doc ID:
Date:

NOTE
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1. Testing of tightening torques of rope / deflection sheave with external

The tightening torque of the screw connections is tightened according to the figures below and with the help of a torque wrench (manual or hydraulic). The Tightening torques can be found in Table 1, for the required tool see document 3_26600.TU. The procedure for proper use of a manual or hydraulic torque wrench can be found in the document OEM 3_26600.PI.

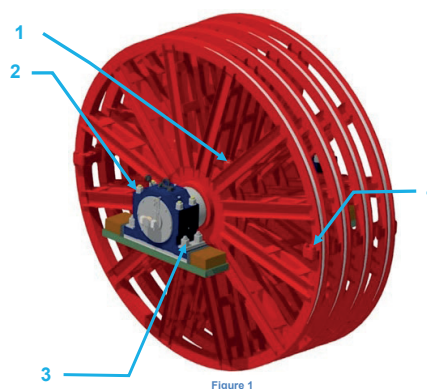


Figure 1

Pos.	Type	Total quantity	wrench size	Tightening torque, oil lubricated, friction coefficient 0,125
1	M30 x 3,5 - 8.8		SW 46	1000 Nm
2	M64 x 4 - 8.8		SW 95	7800 Nm
3	M72 x 6 - 8.8		SW 105	10500 Nm
4	M72 x 4 - 8.8		SW 105	11150 Nm

Technological Maps are used for the organization and safe execution of the plant maintenance work by the operator as well as its documentation. The qualifications of the maintenance personnel, which must be verified by means of appropriate certificates, are shown, as are the maintenance intervals prescribed by local authorities and the plant manufacturer. In addition, technological maps contain important information on regulations concerning safety, health and environmental protection.

Documentation of maintenance work by means of the checklists and protocols provided as part of the Technological Maps is an important prerequisite for maintaining the operating license of the hoisting system.

With service concepts from SIEMAG TECBERG:

- Maximum preservation of the value of your assets
- Maximum productivity



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