

# **THE WAY FROM QUALITY INSPECTION TO CUSTOMER SATISFACTION**

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## **SUMMARY:**

**Ensuring that customers are satisfied means more than merely fulfilling the technical requirements in an order contract. In terms of ISO 9001:2000 customer satisfaction is a process undergoing continuous improvement. There are specific facts such as price, technical requirements and delivery time but problem-solving competence in general customer service, innovation and development are increasingly necessary to achieve customer satisfaction. Long before the ISO 9001:2000 revision was introduced ESW started to implement the technical basis for analysing data by introducing a database. Every form of input from customers throughout all stages of production and testing is documented, stored and is available for evaluation. The last stage in this procedure was the creation of a customer-specific database containing all relevant factual information. Extensive statistical processing is undertaken and is explained by the different applications within the database.**

**41<sup>st</sup> ROLLING SEMINAR PROCESSES, ROLLED AND COATED PRODUCTS  
October 26 to 28, 2004 - Joinville - SC - Brazil**

## **Introduction:**

ESW as a roll producer has a tradition of developing a special relationship with its customers. Roll manufacture means the production of a single item; the roll is then used as a tool in the mill. An influential factor for the mill operator is how convenient and reliable his suppliers are. Over the years the relationship between supplier and client have been influenced by standards like the ISO 9000 series. The latest revision of ISO 9000:2000 focuses in particular on customer satisfaction. Several years ago ESW began to introduce special facilities to meet the new challenges of the future.

## **Implementation of database**

In 1993 the management of ESW decided to transfer the basis of its commercial and technical information systems from paper to a database. To remind us what this looked like, the files on paper and other archives are shown in illustration 1. The different archives had a great disadvantage. If you needed all the data, starting with the offer, then the actual order and all relevant data from the production process to the final shipment and feedback from the customer, files had to be collected from various places. This method was very time consuming and not geared towards the future. Initially the main data of an order were stored in the database. Specifications from the customer and all data required for the internal production were available in every department in the company. The next step was the compilation of cost-optimised charges and the casting report for the melting process and foundry. This was followed by all the different tests on the various samples and the findings from online testing facilities. This was at a time when the PC was not in widespread use and we had to rely on semi-graphic terminals. Over the past few years another evolution occurred, indeed a real revolution. Instead of terminals we are now all familiar with a computer and graphic applications. There were also tremendous developments in databases which made it necessary to adjust all our reports and solutions to the new standard. Today we are proud to announce that we have achieved a solution within the enterprise, something that is certainly exceptional for a company of our size and specialisation.

To give you an impression of what action we took and what we intend to do, I will try to show you the main features of an information and control system founded totally on a database.

I will start with the quality management process as stipulated by ISO 9001:2000. The process begins by the customer placing an order, which includes the necessary specifications. This is followed by the internal order in the company, the complete planning and control system, evaluation possibilities for test data according to SPC, final inspection and shipment. Then comes customer feedback in the form of a report and this is followed up by an analysis of customer satisfaction.

## **Internal Order:**

The order from the customer is transferred to the relevant sections of our structured system. Data are based on the existing calculation for the offer. Specifications which cannot be entered into the structured model of the database are included as plain text. In this way we can maintain a constant up-to-date status of the actual order. Every change within ESW or on the part of the customer is documented and can be traced by the historical log file.

### **Planning and Scheduling:**

After the sales department has paved the way for an order, the different technical departments are automatically involved in order to make the necessary checks for confirming the order. Afterwards the order is split into positions (delivery date) and if necessary into lots. Each lot is a single roll, with a specific roll number. The full workflow is determined for each roll and the timetable is foreseeable. Illustrations 2, 3.

### **Melting and Foundry:**

The first step in the production is the melting and casting of the roll. The material is planned by the cost-optimised charge compilation program according to the internal material code. The different components, the entire melting process and chemical analysis, including temperatures, are recorded and can be traced to each single roll. Illustrations 4, 5.

### **Samples of the solid roll in as cast status:**

Samples are taken at the barrel edge of all rolls with graphite in the shell. The metallographic investigation is carried out on an automatic image analyser and afterwards a hardness test is performed in Rockwell C. Illustration 6.

Rolls without graphite in the shell, which have a high temperature heat treatment cycle, are checked at the neck for the graphite and carbide content as well as for the chromium content.

### **Samples after heat treatment:**

Once a roll has completed the first part of the high temperature cycle a sample is taken from the barrel edge. The hardness and transformation status is checked and the exact annealing cycle is fixed. Illustration 7.

### **Automatic Ultrasonic Bonding Test:**

The first step in machining is the grinding of the barrel and the bonding test on the online automatic testing machine. The testing routine and parameters are fixed by UT personnel, the test itself is performed by the grinder. Depending on the results of the evaluation the next step is either further machining or the process is stopped for further investigation by UT personnel. This step is automatically closed in the database, thereby generating an NC report. QM decides whether the roll can be processed or is to be removed from the process. Illustration 8.

### **Final inspection:**

The last step is a final inspection before a roll is prepared for shipment. The basis is the order, the customer's drawing and additional specifications. In most cases a certificate has to be prepared. Illustration 9.

### **Non Conformity (NC) Report:**

We operate three different types of NC reports. Foundry-related, machining-related and customer claims. The way these reports are structured allows us to make exact

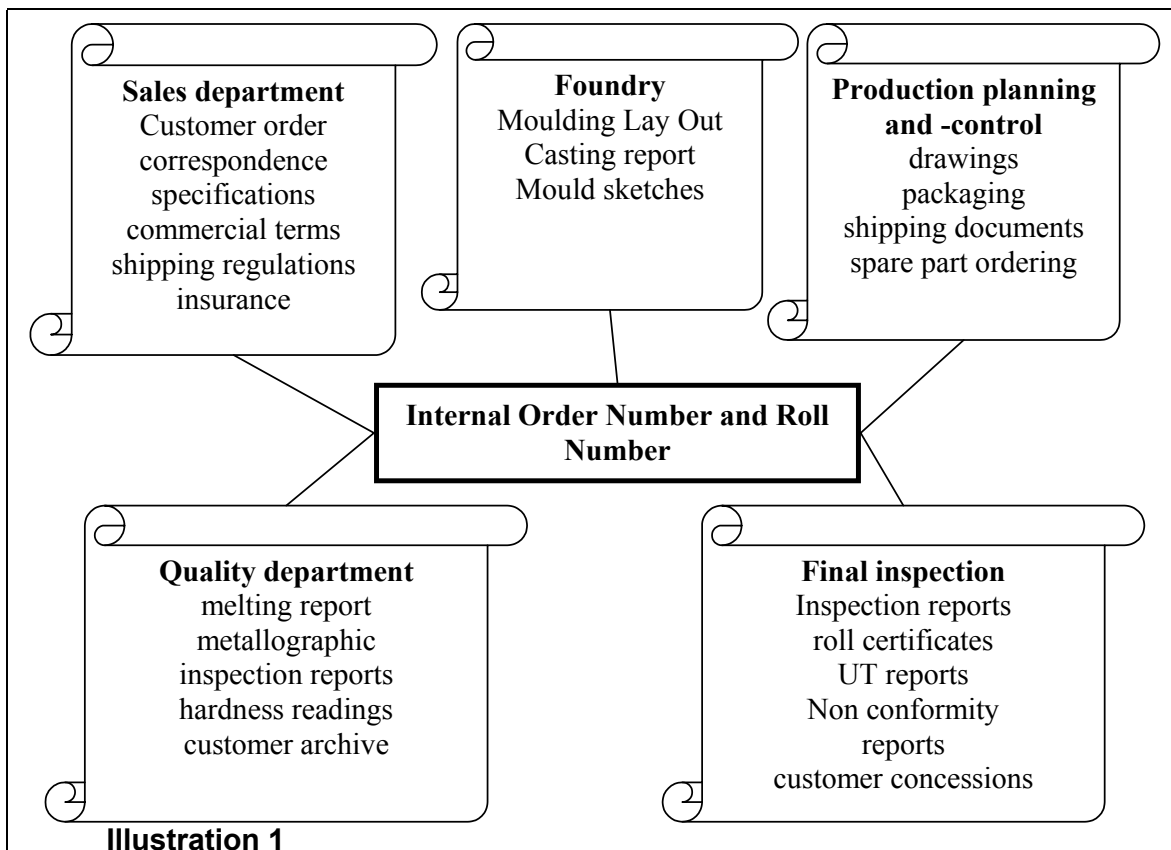
evaluations and focus on corrective actions which we undertake and especially with regard to our customers.

**Statistical processing of testing data:**

One of our major aims in meeting customer requirements and reacting in the shortest possible time is our SPC module in the database. Over 20 main properties and several sub-groups are available for investigation and production control. By making comparisons with performance figures or evaluating information from the customer we are able to make detailed improvements for each individual customer. Illustration 10, 11, 12.

**Measurement and monitoring of customer satisfaction:**

The most recent invention in the database was the module for the evaluation of customer satisfaction. The module is part of our integrated customer and order information system in the database. Input data such as price, punctual and accurate delivery, fulfilment of technical requirements and roll performance, innovations, technical support, claims, time from inquiry to offer are filed for every customer. The software makes it possible to compare previous with current results from one customer, for example, as well as making comparisons with other customers. It also includes information on other factors such as sales areas, customers with similar requirements as well as the entire range of customers. This means that customers and their requirements can be tracked continuously. Consequently specific goals can be defined as regards single customers and groups of customers as well as regions. This means therefore that strategic decisions can be taken for the future. Illustration 13



Oracle Forms Runtime - [ESW-Auftrag 2644/02]

Aktion Bearbeiten Abfrage Block Datensatz Feld Fenster Hilfe

Auftrag Position Loseinteilung **Arbeitsplan**

anlegen löschen

Positionsverzeichnis

1 2 3 4 5

Pos 1 Stk 2 Walze(n) 117453 - 117454 VM VYSG LT-Kde Ende Mai 2003

FPK 27394 FP 2 WM 1 Info Lade FPK

gesperrt LT-ESW Ende Mai 2003

modifiziert Off.Pos. Var

Ba-Dm-Kde 1220 +3/+0 Kde ESW

Ba-Dm-ESW 1223,00 + 0,00 - 3,00 Zng H 28056/ Rev.3/Mark B 1 - 3825 TIF?

Ba-Länge 2075,00 Kal-A

Ges-Länge 4826,00 Kal-D

Innen-Dm + - Ring W- /WA

Kal-Radius FGew 24520 Gerüst Einbau

Mst-b-TkDm Bund-Dm Str

Aussch.-Dm 1000 DZ Verw WBB A V RQ Walzenverwendung

Ba-Härte-Kde WM VCZ 1117 /1 N3

Za-Härte-Kde Gvf SH Gvf-Kde Formmeth 1

Rep W - /WA

Ba-H Za-H MSt HT WB ACD LO 1662 TIF? Ko 1280x350C

Kde 70-75 Verp W4 Gew 1164 Kosten 1.246

ESW 70-75 120-140

Arbeitsablaufplan  PPS-Kontrolle

Anzahl der bestellten Walzen zu dieser Position  
Datensatz: 1/1

Illustration 2

Oracle Forms Runtime - [Arbeitsplan für Auftragslos 2644/05/13/02 - 1 Stück]

Aktion Bearbeiten Abfrage Block Datensatz Feld Fenster Hilfe

Auftrag Position Loseinteilung **Arbeitsplan**

anlegen löschen ABP1 <-> ABP2 ABP1 <-> ABP3 NK-Zuordnung AG-Bemerkung

FNr	PW	IndWo	AG	Status	ASNr	Stk	ABP1	VGZ1	ABP2	VGZ2	ABP3	VGZ3	K	ZusText
10	0	0422	260	GP	1652246	1	FOR	32,0					0	
20	2	0424	964	GP	1652247	1	PUS	2,0					0	
30	2	0424	11	GP	1652248	1	MD1	2,8					0	Auf Ø 480mm andrehen!!
40	2	0424	950	GP	1652249	1	VKT						0	
50	2	0424	954	GP	1652250	1	VKT						0	
60	3	0425	908	GP	1652251	1	WB3						0	
70	5	0427	903	GP	1652252	1	WB3						0	
80	6	0428	909	GP	1652253	1	WB3						0	
90	8	0430	904	GP	1652254	1	WB3						0	
100	8	0430	980	GP	1652255	1	FU						0	
110	8	0430	991	GP	1652256	1	ZWK						0	
120	9	0431	965	GP	1652257	1	PUS	1,1					0	
130	10	0432	13	GP	1652258	1	MD1	13,2					0	###
140	10	0432	1	GP	1652259	1	ZG1	1,0					0	
150	10	0432	740	GP	1652260	1	WS1	4,0					0	###
160	10	0432	992	GP	1652261	1	FU						0	
170	10	0432	305	GP	1652262	1	FU						0	

Arbeitsschein? Lzt. Bearb.?

Arbeitsgangfolge innerhalb des Arbeitsplans  
Datensatz: 1/31

Illustration 3

charge\_d0: Vorschau

CHARGENGESAMTAUSDRUCK VOM 04.12.02 16:38 VON CHARGE 71418 BIS 7141

Charge 71418 vom 03.07.00 (02./20:00 bis 03./09:40), abgeschlossen

Werksmarke : NR Gew.Plan : 22.000 kg Stromzähler  
 EMAT-Werksmarke: NR Gew.kalter Einsatz: 23.171 kg Stromzähler  
 Gießverfahren : SH Schleuderguß horizontal Ausbringung fl.Fe : 21.243 kg Stromverbrauch  
 Ofen : SO12 12-to NF-Schmelzofen Akt.Tiegel-Nr. : 67 Schmelzmeister  
 Tiegel : T20 SO12- 24-to Schmelztiegel Lzt.Neuzustellung: 13.05.00 Schmelzer  
 Tiegelzustand: OK Lzt.Nachstampfen : 10.06.00 Lzt.EDV-Bearb.  
 Bemerkungen : 1250 kWh Warmhalten!

Sollanalyse :	%C	%SI	%Mn	%P	%S	%Cr	%Ni	%Mo	%V	%W
min.	3,20	2,20	0,60	0,000	0,000	0,20	0,60	0,00	0,00	0,00
max.	3,30	2,30	0,70	0,150	0,010	0,30	1,20	0,15	0,03	0,00

Beschreibung, Tätigkeit	kg	%	%C	%SI	%Mn	%P	%S	%Cr	%Ni	%Mo	%V	%W
1 12010 St > Mn	15.303,0	69,56	0,20	0,15	0,75	0,020	0,020	0,05				
2 18041 GBR - VIBN alt	4.330,0	19,68	3,20	2,35	0,75	0,060	0,020	1,00	1,70	0,15		
3 18091 GBR - NS-2a	1.008,0	4,58	3,20	2,20	0,65	0,060	0,020	0,65	1,50	0,15		
4 10050 SO-RE 1 (1%Si)	608,0	2,76	4,50	1,00	0,06	0,050	0,015	0,02	0,03			
5 17800 Kohle 90%	551,0	2,50	90,00									
6 16600 Si	200,0	0,91	75,00									
	22.000,0	100,00	3,29	1,38	0,68	0,030	0,019	0,26	0,40	0,04		

Ent-S um 04:45 bei 0.OP  
17600 CaC 170 0,77

1.OP 04:58 b. 1.384 °C	%C	%SI	%Mn	%P	%S	%Cr	%Ni	%Mo	%V	%W
Probe 6010/0 um 05:07	3,38	1,17	0,81	0,025	0,006	0,25	0,55	0,07	0,01	0,00

01 16600 Si	kg	%	%C	%SI	%Mn	%P	%S	%Cr	%Ni	%Mo	%V	%W
70,0	0,32	75,00										

Aufleg 05:11 70,0 3,37 1,41 0,81 0,025 0,006 0,25 0,55 0,07 0,01 0,00

2.OP 07:40 b. 1.439 °C	%C	%SI	%Mn	%P	%S	%Cr	%Ni	%Mo	%V	%W
Probe 6017/0 um 07:47	3,36	1,39	0,81	0,025	0,007	0,25	0,55	0,07	0,01	0,00

Illustration 4

charge\_d0: Vorschau

CHARGENGESAMTAUSDRUCK VOM 04.12.02 16:38 VON CHARGE 71418 BIS 7141

Charge 71418 vom 03.07.00 (02./20:00 bis 03./09:40), abgeschlossen

Sollanalyse :	%C	%SI	%Mn	%P	%S	%Cr	%Ni	%Mo	%V	%W
min.	3,20	2,20	0,60	0,000	0,000	0,20	0,60	0,00	0,00	0,00
max.	3,30	2,30	0,70	0,150	0,010	0,30	1,20	0,15	0,03	0,00

Beschreibung, Tätigkeit	kg	%	%C	%SI	%Mn	%P	%S	%Cr	%Ni	%Mo	%V	%W
01.Abst. 09:32 / 1.474 °C	21.000	K30 (vorgew., ausgosp.)										
01 17200 SiMgM	331,4	1,50	45,00									
02 16615 2 - 6 mm	43,5	0,20	65,00									
03 17910 Topex	43,4	0,20										
04 18296 KBR - N, NS, NR	663,3	3,00	3,20	2,60	0,65	0,050	0,020	0,75	1,50	0,15		
05 16630 8GI	11,0	0,05	65,00									
Probe 6067/0			3,25	2,14	0,77	0,026	0,005	0,24	0,55	0,08	0,01	0,00
01Auftr 6334/ 1/ 1/ 00	21.243	100,00	Walze 109917	VIBV	80	NR	SH	952 + 3.560,00 mm,	70 - 7			

Restmenge Kessel 850 3,85 zurueck in Ofen  
 Sumpfwiedergabe - 1.800 an Charge 71425 (NS im 8012 vom 03.07.)

Illustration 5

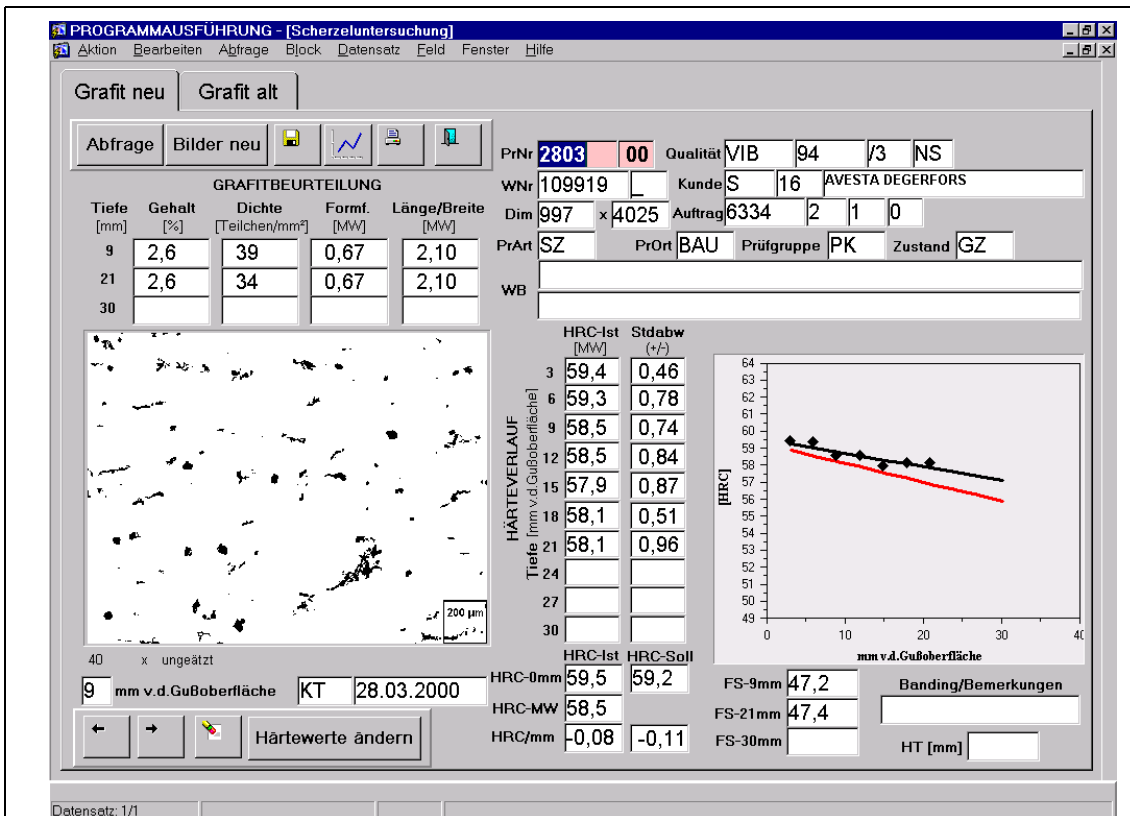


Illustration 6

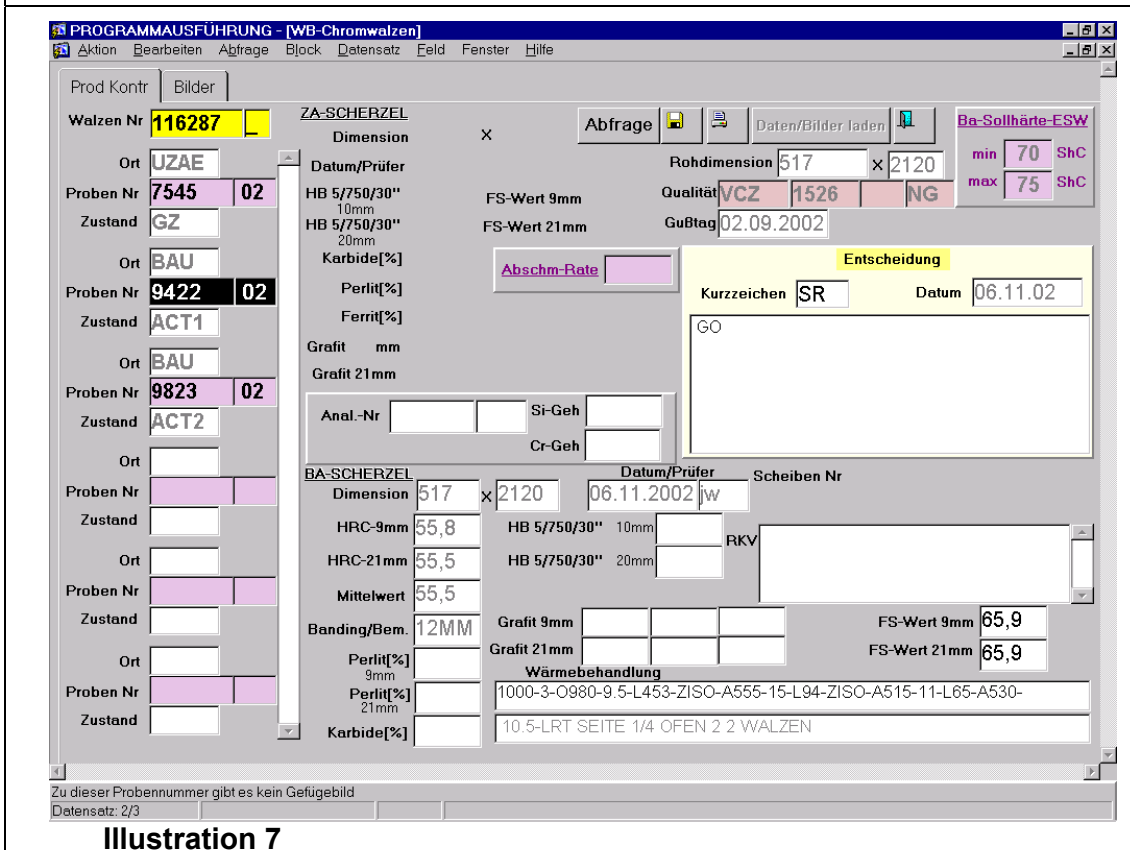


Illustration 7

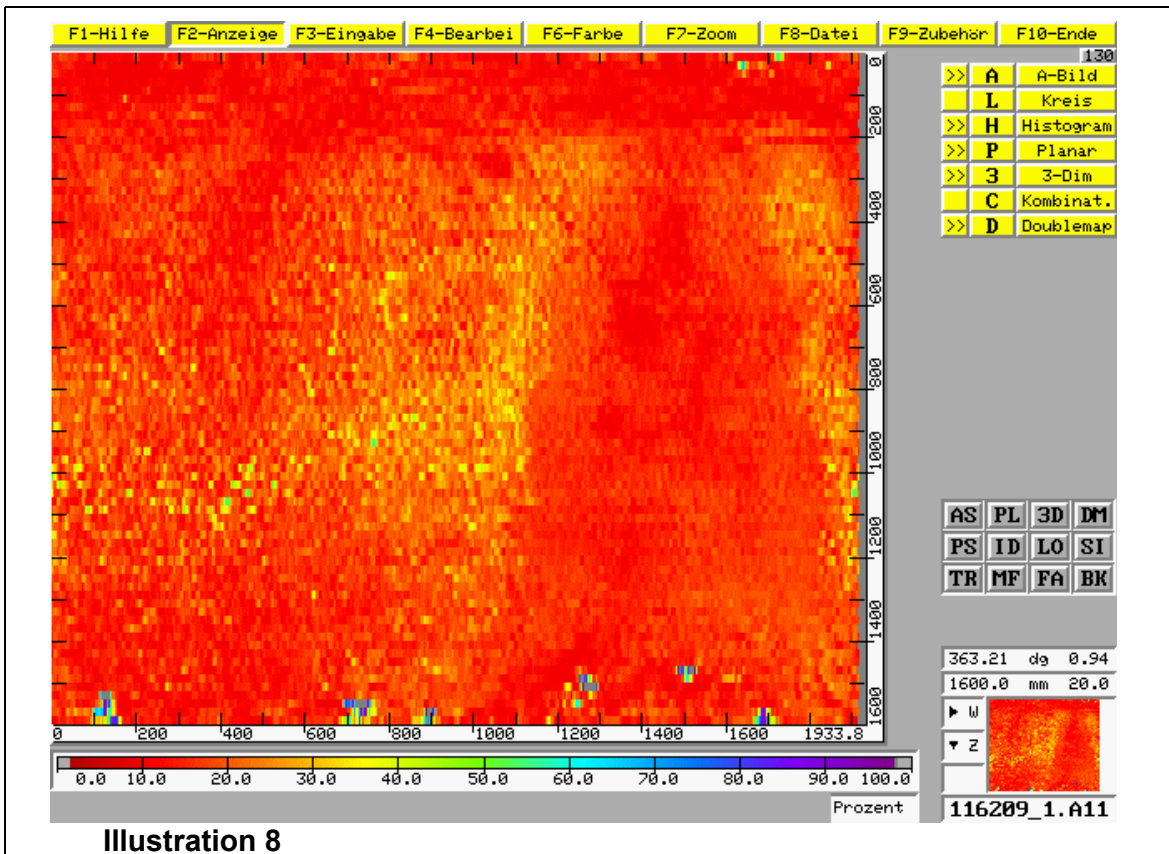


Illustration 8

Illustration 9 shows a software interface titled "Walzenendkontrolle - Anzeige - [Programmausführung]". It displays a data entry form for "BALLENHÄRTE" and "MST-HT / TK Zapf-H" with various input fields for min/max values and a table for "Pos", "Soll-min", "Soll-max", "Ist-O", and "Ist-U". The interface also includes a menu bar, a toolbar, and a status bar at the bottom.

BALLENHÄRTE								Pos	Soll-min	Soll-max	Ist-O	Ist-U
O		M		U		Zeugnis						
min	max	min	max	min	max	min	max					
Soll		70	75									
Ist	73	75	72	74	72	74	72					

MST-HT / TK Zapf-H					
min	max	min	max	Ball-DM	Ball-Länge
Soll	50	70		702,00	1.925,00
			bis	702,00	1.925,00
			von	700,00	1.925,00
IstO	58	67	35	37	
IstU	52	60	36	38	701,98
			Roh	724,00	

Bemerkungen:

gemessen am: 10.08.00 12:00 von: BG Izt.Bearb.: 19.09.00 13:54 WO

FRM-40501: ORACLE-Fehler: Datensatz konnte zum Aktualisieren/Löschen nicht reserviert werden.  
Datensatz: 1/1 Werteliste

Illustration 9



Grafit bei Scherzelpfen Grafit Bildanalyse 21 mm - [SPC]

Aktion Bearbeiten Abfrage Block Datensatz Feld Fenster Hilfe

Parameter Zeitdiagramm Zeit Daten Häufigkeitsdiagr. Häufigkeit Daten SQL

Grafit bei Scherzelpfen \* Grafit Bildanalyse 21 mm \*

Werksmarke VIB 94/3 NR Ballen-DM von 600 bis 800 Wiederverwendung  
 Ja  
 Nein

Kunde % %

Datum von 01.01.00 bis 03.12.02 Ausschuß  Ja  Nein Anzahl Klassen für Häufigkeit 10

Probenort BAU Ballen unten

Probenzustand GZ

Berechnen

Datensatz: 1/1 Werteliste

Illustration 10

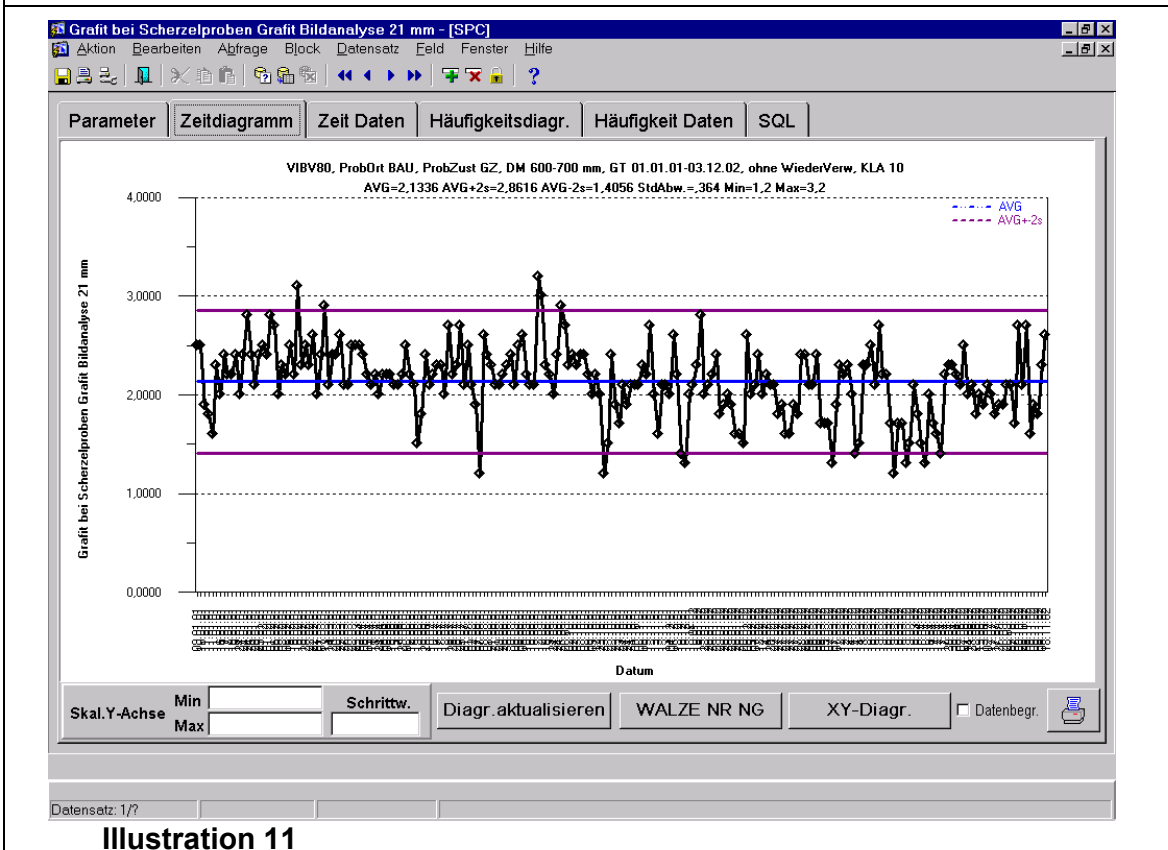


Illustration 11

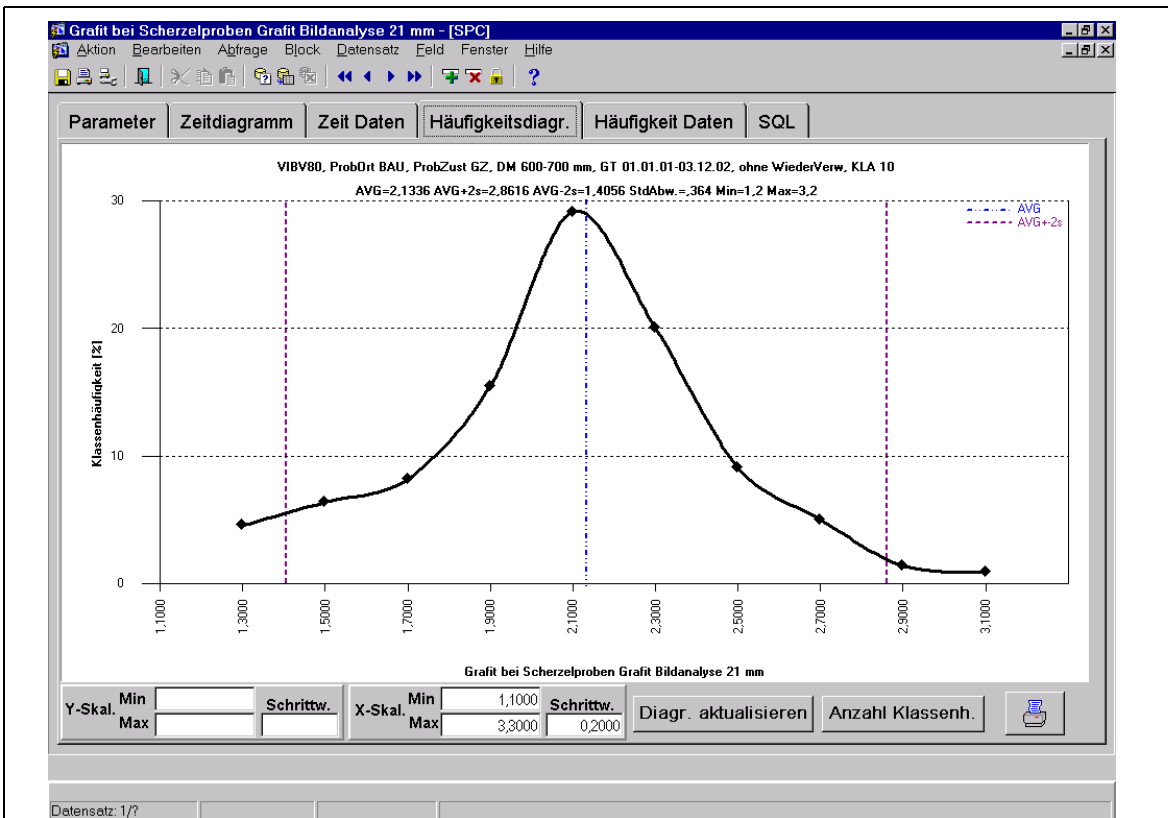


Illustration 12

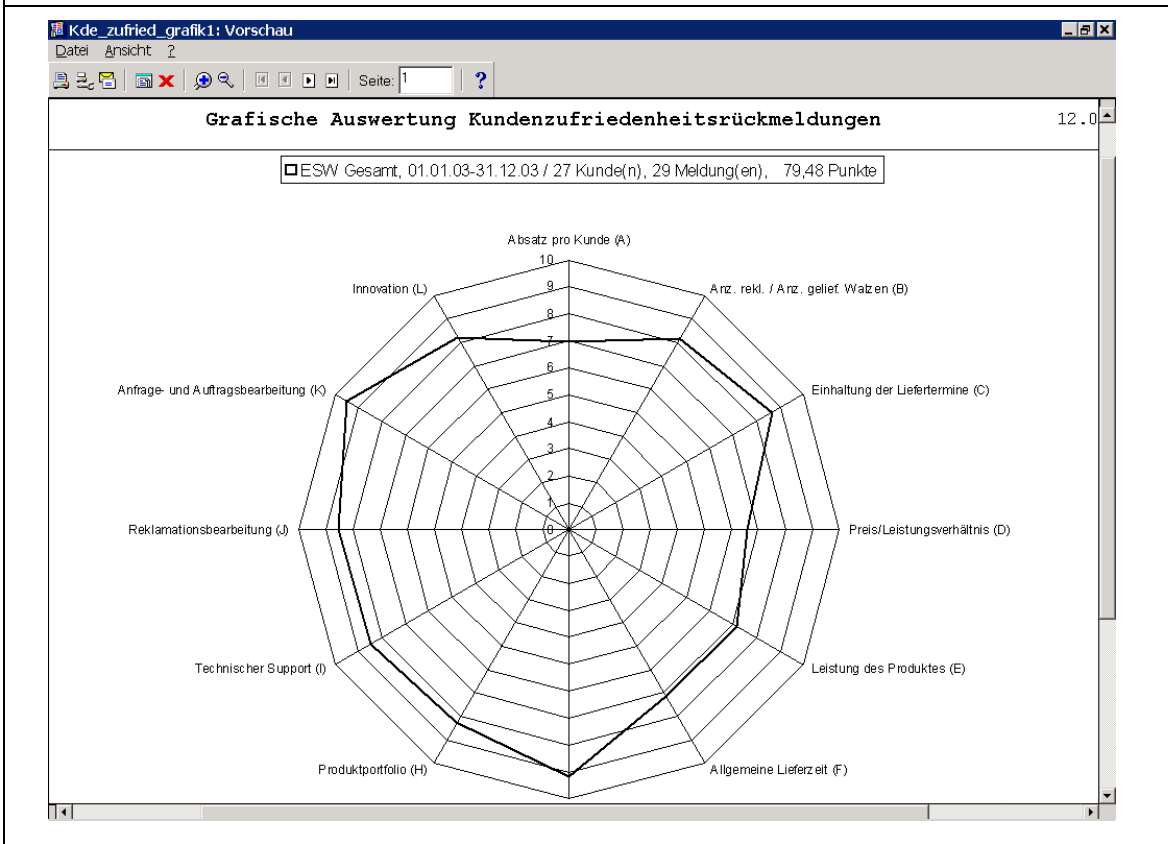


Illustration 13