



Crimp Quality Assurance & Statistical Process Control

Elpress Analyzer Software

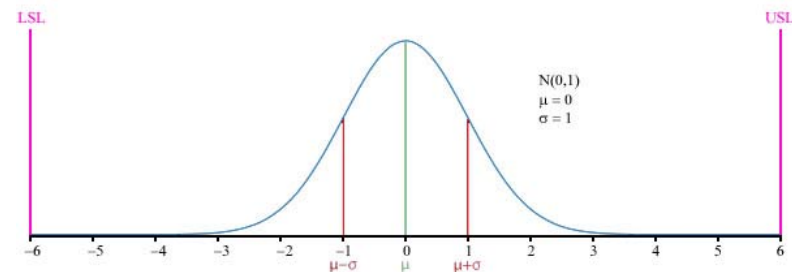




Statistical Process Control

Basic SPC theory

- ❑ What is Statistical Process Control?
- ❑ Control methods:
 - ❑ Target value control
 - ❑ Tolerance value control
- ❑ C_{mk} > Machine Capability Index
- ❑ C_{pk} > Process Capability Index
- ❑ Standard deviation, σ
- ❑ Six sigma > Normal distribution chart



Elpress Analyzer – SPC tool



- ❑ A target value control by use of the EC value
- ❑ The target value is determined as the mean value of 30 crimp characteristics
- ❑ The value of the EC number is the target value for each crimp process
- ❑ Minimizing errors:
 - ❑ Capability of machine and process
 - ❑ Calibrated system
 - ❑ Education of operator
- ❑ High machine capability index, C_{mk}
- ❑ The process capability, C_{pk} , is influenced by the tool, terminal and conductor



Setup register

Setup register

Import of a unique setup



Setup register

Import setup...

Setup ID
{3DAEBE74-F7E4-43E6-B1D1-69015E962947}

Setup Name
KRF95

Pump

Cable
H07V-K 95

Cable terminal
KRF95-10

Crimp dies
13DCB20

Press head
CS2500

Note

EC
EC-number
300.94

Reference curve
0056709030910320000004

Ok

The setup is a tested combination of dies, terminal and conductor.

The EC- number is the numerical value representing the unique crimp combination.



Analyze of crimps

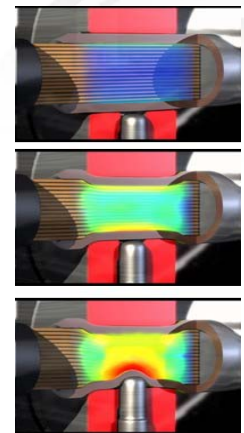
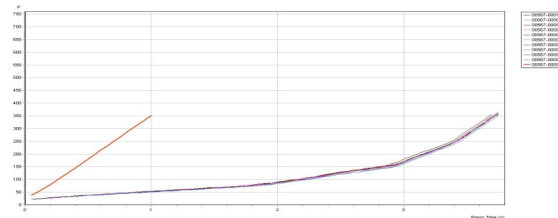
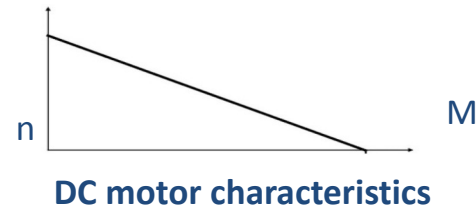
Crimping work definition:

Crimping force x crimping distance, for a certain previous crimp combination

- Hydraulic pressure prop. force.
- Force prop. material cross section + hardness.
- Motor torque prop. pressure.
- Motor speed prop. motor torque.
- Hydraulic flow prop. motor speed.
- Crimp time prop. flow.

EC number:

”The numerical mean value of area from the pressure-time graph for an amount of crimp data based on a tested crimp combination reduced with the area coming from a calibration crimp cycle is named EC, crimp work or energy.”



Analyze of crimps

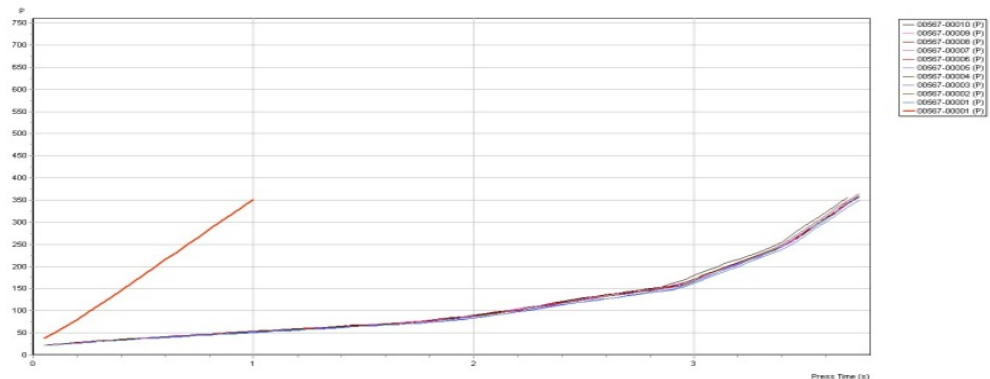


How is the crimp monitored?

- The control system logs the hydraulic pressure with a frequency of 20 Hz.
- The measurement starts at 15 bar.

What can be analyzed?

- Variation of process
- Cross section variations
- Hardness of material
- Crimp component combinations



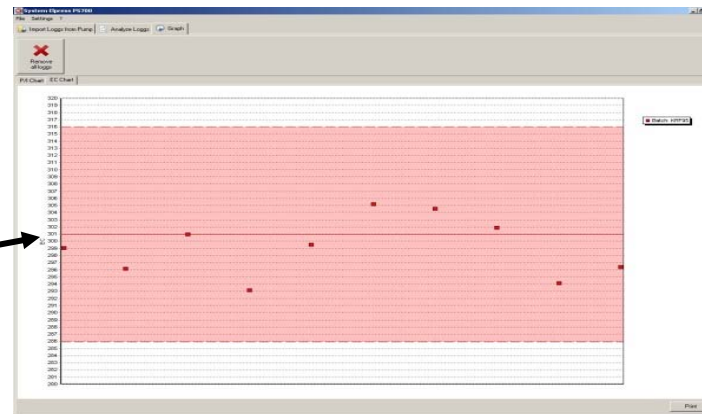


Control chart

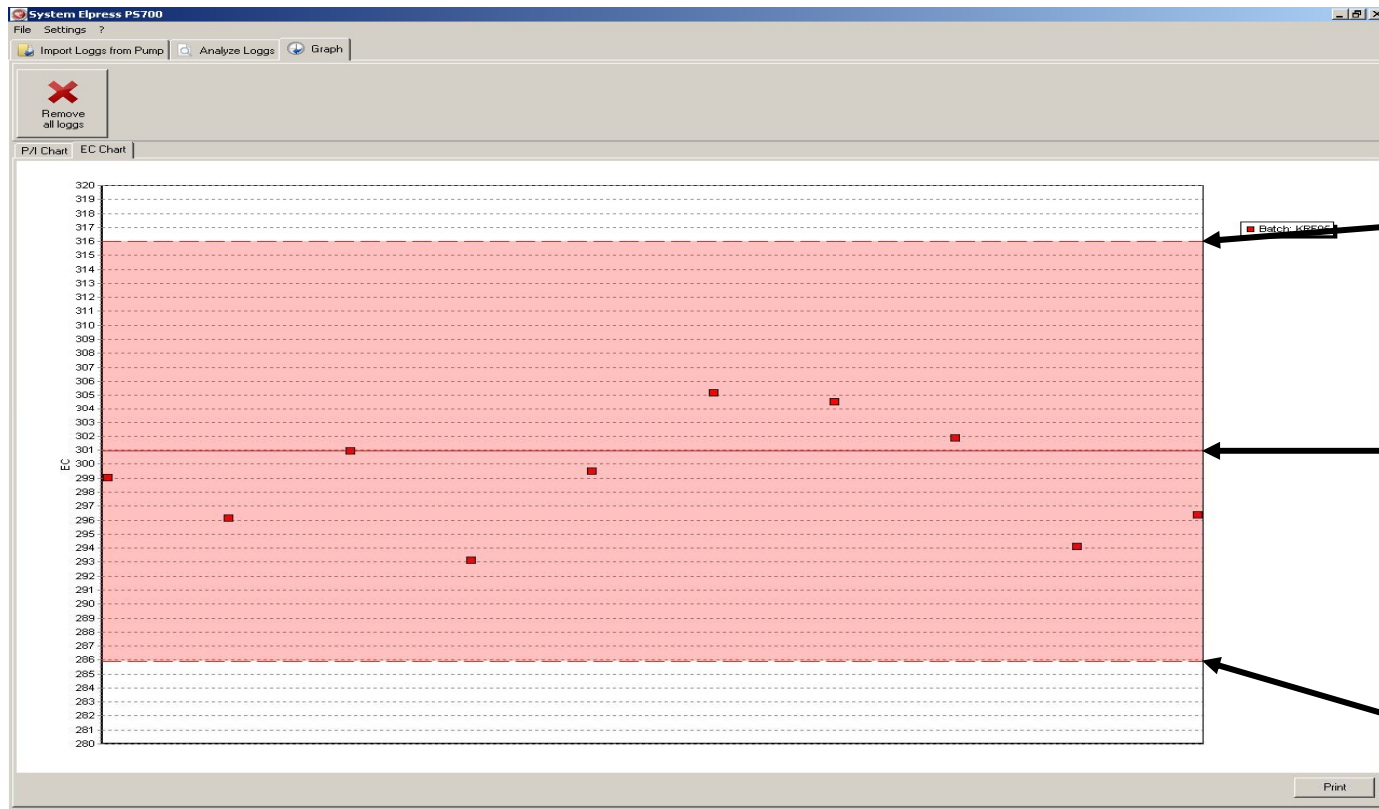
The control chart consists of the following:

- ❑ Measurements of crimp characteristics taken from the crimp process at different times.
- ❑ A target line, the EC- value for each unique setup.
- ❑ Upper and lower control limits calculated from the standard deviation of the process.

Target line



Control chart



Upper control limit

EC value

Lower control limit

Example

- ❑ Tensile strength test demand of 5500 N
- ❑ Customer demand C_{pk} value: 1,67
- ❑ Test method: Tensile test
- ❑ Lower control limit: 5500 N
- ❑ Tensile test result >
- ❑ Customer example

Tensile test (N)
6130
6035
6080
5935
6230
6130
6080
6130
6030
6380
6180
6130
6030
5935
6280
6180
6030
6030
6330
6080
6118
119
1,73



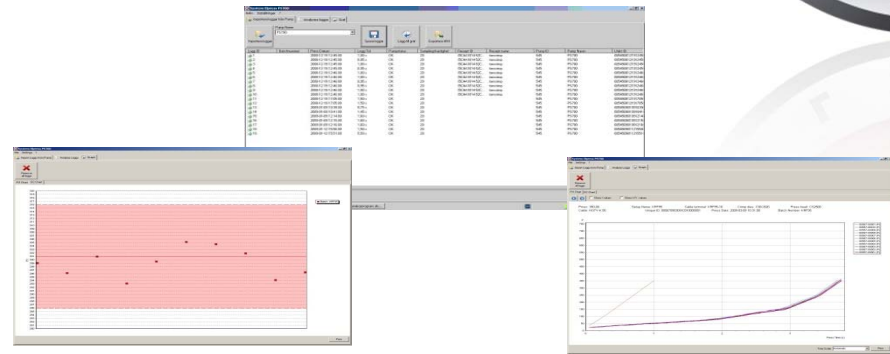
The System – Quality assurance



The Crimping System



The Analyzer Software



A High Quality Solution





Introduction to the software

Software - main properties

- Enables statistical analyze of the crimping process.
- Each crimp is monitored by the control system.
- Each crimp characteristics are saved.
- Each crimp is given a unique identification number in the database.
- Equipment calibration by export and import of crimp files.
- Possibility to print different reports.



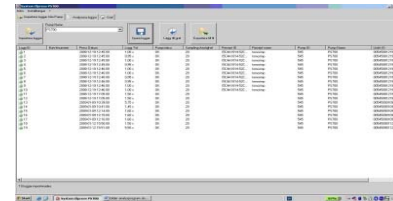
Software – work process



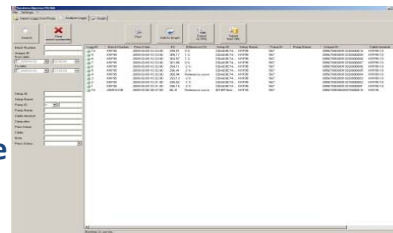
Registration of pump.



Start window: From this window import and save crimps from the pump unit into the database.



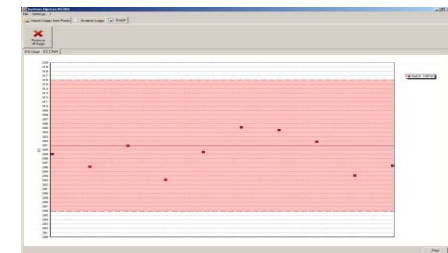
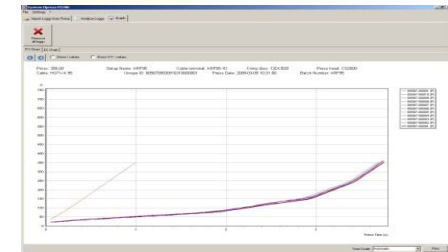
The database: From this window name a batch, connect a crimp/batch to a setup, make selections of crimps/batches, analyze crimps/batches, import/export files.



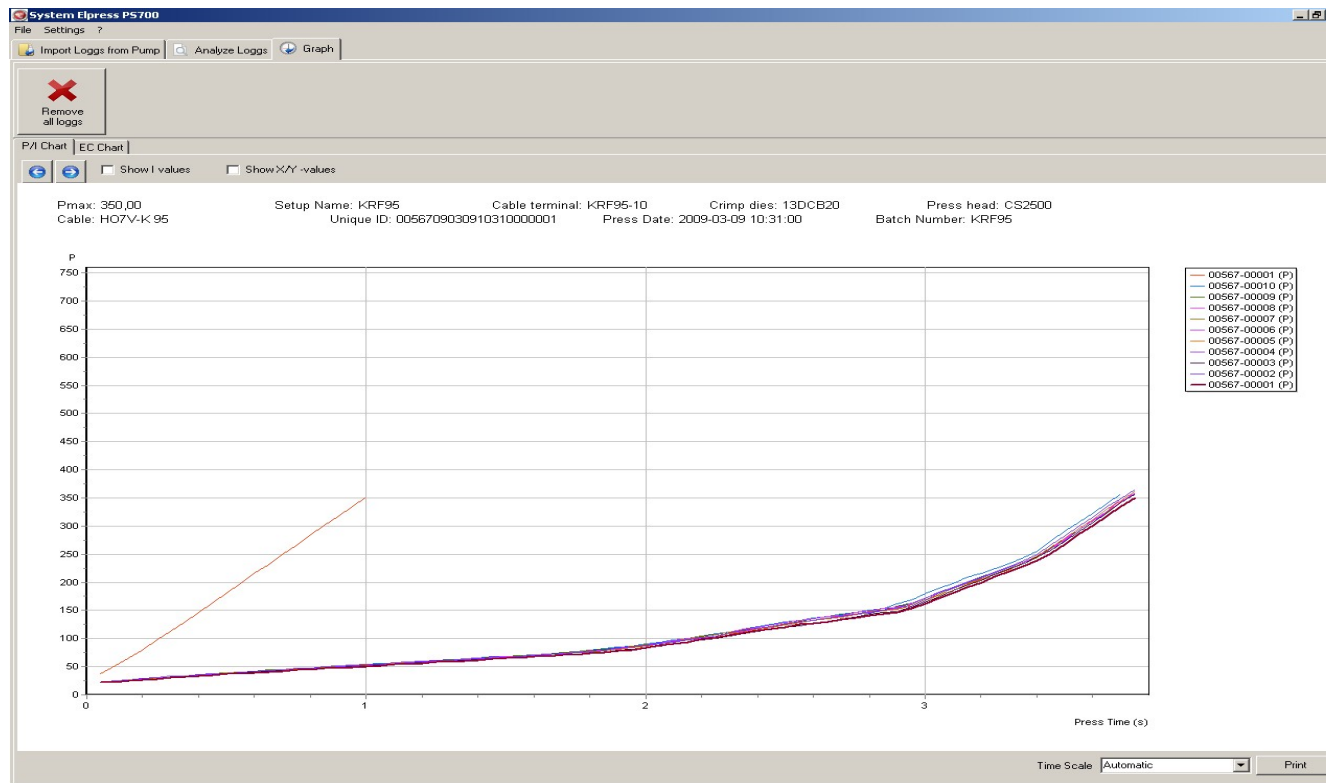
Print of press report



Graph/chart window:
Study/print crimp graphs,
study/print control chart



The crimp graph



Printing of press report



C:\Program Files\Elpress\System Elpress\Import.exe

1 of 1+ 100% Total:11 100% 11 of 11

Press report
567

Press report

2009-04-03

<i>Pump ID</i>	<i>Pump Name</i>	<i>Owner</i>
567	567	Labb

<i>Receipt Name</i>	<i>EC</i>
KRF 95	300,94

<i>Setup ID</i>	<i>Cable Terminal</i>	<i>Crimp Dies</i>
(3DAE9E74-F7E4-43E6-B1D1-69015E962947)	KRF 95-10	13DCB20

<i>Cable</i>	<i>Press Head</i>	<i>Note</i>
HO7V-K 95	CS2500	

<i>Batchnumber</i>	<i>Number of bags in batch</i>	<i>Tolerance OK</i>
KRF 95	10	

Signature: _____

Export/import of crimp



System Elpress P5700 - Advanced

File Settings ?

Import Loggs from Pump Analyze Loggs Graph

Search Clear search parameter Print Add to Graph XML Export to XML Import from XML

Batch Number: KRF95

Unique ID: []

From date: [] 2009-04-03 [] 00:00:00

To date: [] 2009-04-03 [] 23:59:59

Logg Time: []

Pump Status: []

Sample Rate: []

Setup ID: []

Setup Name: []

Pump ID: []

Pump Name: []

Cable terminal: []

Crimp dies: []

Press head: []

Cable: []

Note: []

Press Status: []

Logg ID	Batch Number	Press Date	Curve Area	EC	Difference (%)	Logg Time	Pump Status	Sample Rate	Setup ID	Setup Name	Pump ID
10	KRF95	2009-03-09 10:33:00	406.47	299.51	0 %	3,70	OK	20 Hz	(SDAE BE74... KRF95		567
9	KRF95	2009-03-09 10:33:00	412.13	305.17	1 %	3,75	OK	20 Hz	(SDAE BE74... KRF95		567
8	KRF95	2009-03-09 10:33:00	411.53	304.57	1 %	3,75	OK	20 Hz	(SDAE BE74... KRF95		567
7	KRF95	2009-03-09 10:33:00	408.82	301.86	0 %	3,75	OK	20 Hz	(SDAE BE74... KRF95		567
6	KRF95	2009-03-09 10:32:00	401.07	294.11	-2 %	3,75	OK	20 Hz	(SDAE BE74... KRF95		567
5	KRF95	2009-03-09 10:32:00	403.38	296.41	-2 %	3,75	OK	20 Hz	(SDAE BE74... KRF95		567
4	KRF95	2009-03-09 10:32:00	407.90	300.94	Reference curve	3,75	OK	20 Hz	(SDAE BE74... KRF95		567
3	KRF95	2009-03-09 10:32:00	400.09	293.13	-3 %	3,75	OK	20 Hz	(SDAE BE74... KRF95		567
2	KRF95	2009-03-09 10:31:00	405.98	299.02	-1 %	3,75	OK	20 Hz	(SDAE BE74... KRF95		567
1	KRF95	2009-03-09 10:31:00	403.10	296.14	-2 %	3,75	OK	20 Hz	(SDAE BE74... KRF95		567

Spara som

Spara i: System Elpress

- Export
- gammla databas
- Import
- Recept mm
- script
- xml

Filnamn: 00567090309103200000004.xml

Filformat: >XML Files (*.xml)

Spara Avbryt

Showing 10 curves.