Presentation SOUTRAC®
Non-Linear Weld System

SOUTRAC - The Future for Welding
AHSS Tailored Blanks

Soudronic Automotive
Soudronic

SOUTRAC®
Characteristic of Parts

Linear

Linear shifted

Non linear
SOUTRAC®
Market Share Non-linear Tailored Blank

Application oriented

Market for SOUTRAC

Volume in Mio. TB

Rails 2002
Rails 2005
Pillars 2002
Pillars 2005
Tunnel/Wheelh. 2002
Tunnel/Wheelh. 2005
Others 2002
Others 2005
Closures 2002
Closures 2005
Body Side / Body Side /

non linear
linear

Market volume total

2000
2005

non linear
linear

www.autosteel.org
max. speed: 120 m/min
max. acceleration: 4 m/s²

max. speed: 30 m/min
max. acceleration: 4 m/s²

max. blank size: 2200 x 3600 mm
min. radius: 100 mm

weld speed: 2...18 m/min
max. # of blanks: 4
max. # of welds: 12
## Function groups

<table>
<thead>
<tr>
<th>Function groups</th>
<th>SOUVIS® 1 (SOUVIS® 5000)</th>
<th>SOUKA®</th>
<th>Laser head</th>
<th>SOUVIS® 2 (SOUVIS® 5000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOUVIS® 1</td>
<td>Edge position measurement</td>
<td></td>
<td>Monobloc</td>
<td>Monobloc</td>
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<td></td>
<td></td>
<td></td>
<td>Process gas</td>
<td>Process gas</td>
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<td></td>
<td></td>
<td></td>
<td>Laser position control</td>
<td>Laser position control</td>
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<td></td>
<td></td>
<td></td>
<td>Gap driven filler wire</td>
<td>Gap driven filler wire</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Double spot</td>
<td>Double spot</td>
</tr>
<tr>
<td>SOUVIS® 2</td>
<td></td>
<td></td>
<td></td>
<td>Seam profile top</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Seam profile root</td>
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<tr>
<td>SOUVIS® 3</td>
<td></td>
<td></td>
<td></td>
<td>Seam homogeneity</td>
</tr>
</tbody>
</table>

**SOUTRAC® combines all functions in only 3 groups**
The Solution - Absolute Accuracy of Main Axes

- R = 100 mm
- V = 12 m/min

Nominal weight of weld shuttle: 4000 kg
Nominal weight of weld head: 300 kg
Nominal position
Measured position
Maximum absolute deviation: 0.05 mm

- x-axis, weld shuttle
- y-axis, weld head

0.1 mm
Requirement for quality welds:
Following precisely a curved contour with 3 different function groups each positioned normal to the weld line

Solution:
Besides 2 main axes for the main movement (x,y), we need 5 numerically controlled axes integrated into the weld head
Requirement for quality welds:
Welding different blank gauges in the same weld cycle, even T-shaped combinations can occur.

Solution:
Each function group has its own independent numerically controlled height (z-) axis.
Requirement for quality welds:
Following precisely a curved contour even if the pre-programmed line does not fit with the actual edge position

Solution:
Position dependent edge tracking and position-driven correction of the laser head normal to the actual weld line
**Requirement for quality welds:**
Overcome varying gap width up to 0.3 mm

**Solution:**
Position dependent gap width measurement and corresponding control of wire feeding speed
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SOUTRAC®
Mechanical solution for the weld head

(Patent pending)
Soutronic

SOUPTRAC®
Welding Demonstration

open house

March 10, 2003 - March 14, 2003
Livonia-MI, USA

www.soudronic.com
There is a higher risk of the gap problem in the non-linear Tailored Blanks welding process due to the sum of geometrical tolerances. **Therefore a safe solution for the gap closing prior to welding process is mandatory.** Only then a safe and reliable high production output can be guaranteed!
**Gap = Missing material**

Possible causes of gap:

- Released tension during blanking
- Tolerance of part measurement and/or positioning
- Large die gap
- Damage during transportation/handling

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**What is a Gap?**

- Decreasing or increasing gap
- Local gap
- Undercut because of blanking and shearing problems
Blanking is a Forming Process:

Good formability of mild steel means **good** blanking ability

**Limited** formability of AHSS means **bad** blanking ability
## SOUTRAC® Solution
### Automatic Adjustment of Filler Wire Speed

<table>
<thead>
<tr>
<th>Filler wire speed (m/min.)</th>
<th>Gap width (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.20</td>
<td>0.30</td>
</tr>
<tr>
<td>3.95</td>
<td>0.19</td>
</tr>
<tr>
<td>0.40</td>
<td>0.01</td>
</tr>
</tbody>
</table>

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**Great Designs in Steel Seminar**
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SOUTRAC® Solution
Automatic Adjustment of Laser Position

Position (mm)  Gap width (mm)
0.00  0.15
-0.14  0.01
0.15  0.30
Gap 0.38 mm

Corresponding weld with controlled filler wire
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SOULRAC® Solution
Examples of Hardness Profiles

A / TRIP 600

G / DP 1400

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Integration of SOUVIS® 5000 Inline Quality System

SOUVIS® 1
- Edge position determination
- Gap width determination

SOUVIS® 2
- Profile analysis
- Seam homogeneity analysis

Laser head
- Integrated position control axis
- Gap driven filler wire
CMOS Camera with adaptive response characteristics

Short pulse flash light

Diode laser line

Combined acquisition of gray scale image and laser triangulation line

Resolution: 0.01 mm
Max. speed: 30 m/min
Max. data flow: 60 MB/s
Extraction of seam geometry information

Easy to operate, Low number of parameters

Reduced maintenance and spare parts requirements

No complicated and diffuse fuzzy logic necessary to combine multiple sensor arrangements

Extraction of seam homogeneity information

Microscopic resolution and outstanding discrimination capabilities (human eye is the standard)

Easy to integrate
Determination of

- Edge position (laser position control)
- Gap width (wire feeding control)
- Blank gauge difference
- Blank alignment
- Edge quality
Determination of

- Seam concavity
- Seam convexity
- Mismatch
- Seam width
- Seam roundness
- Lack of penetration
- Porosity
- Expulsion
- Pinholes
Upper seam surface of a tailored blank

Texture analysis

Pore analysis

Profile analysis
Reasons for Failure

Local edge defects
Plasma absorption

Expulsions, holes
Missing texture
Reason for failure

Partial evaporation of dirt or zinc particles located between the weld edges

Porosity

0.1 mm x 0.3 mm
A safe online quality control is a must for an efficient production of non-linear tailored blanks.

It's not sufficient to detect some of the relevant weld failures and some not.

**SOUVIS® 5000** represents the only integrated solution today capable of detecting all relevant failures in non-linear tailored blanks.

**SOUVIS® 5000** performs with only one unique sensor, i.e. less complexity and more reliability.
Golf Door (non linear)

Cycle Time: 10.5 sec / TB
GMT 370 Body Side

Cycle Time: 36sec / TB
A-MPV (PQ35)

Cycle Time: 25 sec / TB
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Example Part

Honda New Accord Front Door Upper

Cycle Time: 16.0 sec / TB
ROVER 75 Front Door

Cycle Time: 12.5 sec / TB
Cycle time per side ring 25 sec.
Cycle time

15.8 sec

16.3 sec

17.0 sec
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SOUTRAC®
Production System for Body Side
Soudronic SOUTRAC®

The right solution to meet the high market demand!

regarding
- high output of quality Tailored Blanks
- low scrap rate
- high uptime

based on
- 20 years of experience
- 38 Mash Seam TB welding lines
- 54 Laser Seam TB welding lines (11-02)