PRODUCTS IN HOT STAMPED BORON STEEL

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Agenda

• Overview Corporación Gestamp
• Hotstamping process
• Ford Focus 1 Front Bumper
• Volvo XC90
  • Side Impact Beams
  • Rear Bumper
  • Structural Reinforcements
Corporación Gestamp

European Group with presence in 14 countries in Europe and America

Turnover: Approximately 2.400 Million €.

Employs 11.200 people.

58 industrial plants worldwide.

Leadership:

Steel Service Centers

Components, assemblies and systems for the automotive industry
### Activity
- Supply Metal Components to the OEM’s.

### Facilities
- 32 Plants in UE 15.
- 5 Plants in Mercosur (Brasil and Argentina)
- 4 Plants in N. America (US and México)
- 2 Plants in E.E.

### Employment
- 2.003: 7,045 Employees.
- 2.004: 8,740 Employees.

### Leadership
- Wide range of technologies.
- Different components for body & white structures
- Focus in weight reduction and increase of safety

### Total Sales
- In 2002: 1.025 Million €.
- In 2003: 1.100 Million €.
- In 2004: 1.250 Million € approximately
Geographical Distribution
Strategic Products

Rear/Front Beam Impact Systems

"A-B" Pillar

Instrument Panel System

Subchassis Module

Closures

Pedal Assembly

Rear axle

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Total collaboration with our clients: Right from the design and development phase, we set up project and simultaneous engineering teams to monitor the value chain, contributing our industrial know-how and experience in all of the technologies and responsibilities involved in the process.
Customers 2004

- Tools and various: 10%
- Industrial vehicles: 1%
- Tier 1: 4%
- Fiat: 1%
- Ford: 6%
- Mercedez: 6%
- GM: 10%
- Opel: 22%
- Renault: 22%
- Nissan: 18%
- PSA Peugeot Citroën: 22%
- SERT: 22%
- Volkswagen: 22%
- Audi: 10%
- PSA: 18%
- Tools and various: 10%

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Gestamp HardTech

1974 Patent on hotstamping
1986

Mason
Detroit

1998

Luleå
Stockholm
Hot Stamping Process

- Boron Steel
- Alu coated Boron Steel
- Shot Blasting
Material data: Hot Stamped Boron Steel

- **HOT STAMPED BORON STEEL**
- **FINISHED PART**
- **HIGH TENSILE STEELS**
- **MILD STEEL**

**Yield strength (N/mm² (Ksi))**
- 1200 (175)
- 1000 (145)
- 800 (115)
- 600 (85)
- 400 (60)
- 200 (30)

**Workability at 900°**
- 10
- 20
- 30
- 40
- 50 (%) Workability (Fracture strain, A₅₀)

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Usibor 1500 Aluminum Coated

Corrosion Resistant shotblasting

As delivered

No need for

Al-layer (Hardness approx. 60 HV, thickness approx. 25 µm)

Base metal (approx 185 HV)

After Hot Stamping

Al/Fe-layer (approx. 800 HV)

Base metal (approx 470 HV)
Full Service Supplier

1990 Side Impact Beams
1995 Bumper Beam Systems

Design, CAE, Prototyping and Testing

CAD

• UG
• IDEAS
• CATIA V4, V5

CAE LS-DYNA

• CRASH ANALYSIS
• FORMING ANALYSIS
• STATIC LARGE INTRUSION
Test Equipment

Beam Test Rig FMVSS214

Swick-Roell  600 kN Test Machine

Door Test Rig FMVSS214
Crash Test Equipment

Crash track
- Speed 13.6 mph (21 km/h) with 3300 lb
- Speed 11 mph (17 km/h) with 5500 lb

Pendulum
- Speed 11 mph (17 km/h) with 2200 lb
- Speed 6.5 mph (10 km/h) with 5500 lb

Test cart
- Weight 1540 – 5500 lb (700-2500 kg)

Barriers
- Pendulum
- AZT 40 % offset 0°, 10°
- IIHS 0°, 30° and Pole

Data acquisition system Kayser-Threde
Load, displacement, speed and accelerometer measurement
High speed camera Red Lake
- 16,000 frames/s
Ford Focus1 Front Bumper

Requirements

- ECE Pendulum 2.5 mph
- AZT 10 mph 40% offset
- Minimize intrusion
Ford Focus1 Front Bumper

**TOWING HOOK TUBE**
- Push through at crash
- Weight: 0.62 lb (0.28 kg)

**BEAM**
- Hot Stamped Boron Steel
- Thickness: 1.5 mm
- Weight: 9.46 lb (4.3 kg)

**MOUNTING PLATE**
- Thickness: 2.0 mm
- Weight: 2 x 0.64 lb (0.29 kg)

**TOWING HOOK PLATE**
- HSS
- Thickness: 2.0 mm
- Weight: 0.84 lb (0.38 kg)

**FRONT PLATE**
- HSS Steel
- Thickness: 1.0 mm
- Weight: 2.16 lb (0.98 kg)
Replace foam/beam Bumper System to improve AZT crash test behaviour

14.3 lb (6.5 kg)

14.3 lb (6.5 kg)
AZT (RCAR) 10 mph crashtest

- Crash is triggered at barrier hitpoint
- Section collapses under controlled load
- Protect siderails from damage and minimize intrusion
- The overall beam stiffness decreases during collapse which minimize bending of siderails from curved beam
- Patented
AZT (RCAR) 10 mph crash test
Performance comparisision

REDUCED INTRUSION 60 mm

- Hotstamped beam
- Coldformed beam with foam
Cooling airflow

- Improved airflow to cooler with;
  - Lower section height on backside of beam
  - More outboard position in Y0
Research on IIHS Test

5 mph  0° barrier

Intrusion  34 mm

5 mph  30° barrier

Intrusion  66 mm
Volvo XC90

Weight Savings 33lb (15 kg) / vehicle
Volvo XC90 Front Side Impact Beam

- **Design**
  - Thickness: 2.0 mm
  - Weight: 2.6 lb (1.8 kg)
Volvo XC90 Rear Side Impact Beam

- Design
  - Thickness 1.7 mm
  - Weight 2.6 lb (1.19 kg)
Volvo XC90 B-pillar Reinforcement

- **Requirements**
  - Rollover crash load
  - IIHS SUV barrier load

- **Design**
  - Thickness 2.0 mm
  - Weight 14.9 lb (6.8 kg)
  - Lasercut trim and holes
Volvo XC90 B-pillar Reinforcement

- Forming analysis
  - Coupled Thermal and Mechanical analysis
  - Predict blankshape
  - Evaluate excess material and material thinning
  - Evaluate pressload and press settings
Volvo XC90 B-pillar Reinforcement

Tensile test

Section depth 95 mm

Section depth 52 mm
Volvo XC90 Roof Reinforcement

- Design
  - Thickness 2.0 mm
  - Weight 9.5 lb (4.3 kg)
Volvo XC90 Rear Bumper

Rear Bumper Beam
- Thickness 1.2 mm
- Weight 9.59 lb (4.36 kg)
- Lasercut trim and holes

Back Panel
- Thickness 1.2 mm
- Weight 9.09 lb (4.13 kg)
- Lasercut trim and holes
Conclusions

**Hot Stamping Process**
- Very high formability
- Forming of complex geometries
- UHSS material data quenched
- High toughness
- High elongation at brake
- Material properties not dependent of forming depth
- Good dimensional tolerances
- Good weldability
- Well suited for crash applications

**Bumper Beams**
- Integrated Crossmember
- Excellent air flow for cooler
- Crash Energy Management System
- Energy absorption without foam
- Design flexibility
  - Crosssectional changes
  - Deep Sections
  - High sweep
- Low weight
- Low stackup after crash
- Low intrusion