COMPANY PRESENTATION

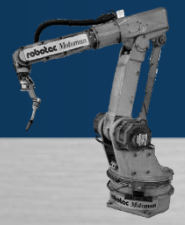
TPV AUTOMOTIVE


CREATING MOBILITY of the FUTURE
OUR VISION

TIMELINE

1954
IMV

1989
TPV ESTABLISHMENT



1991
FIRST ROBOT

1996
IN-HOUSE DEVELOPMENT

2013
IMPLEMENTATION OF AUTONOMOUS PROCESSES

2019
NEW HQ + R&D CENTER

LIGHTWEIGHT SOLUTIONS SPECIALISTS

part of **automotive industry** since **1954**

R&D experiences since **1996**

FAST SOLUTIONS

Innovation is the foundation of our operations:

20.000+ submitted IPs

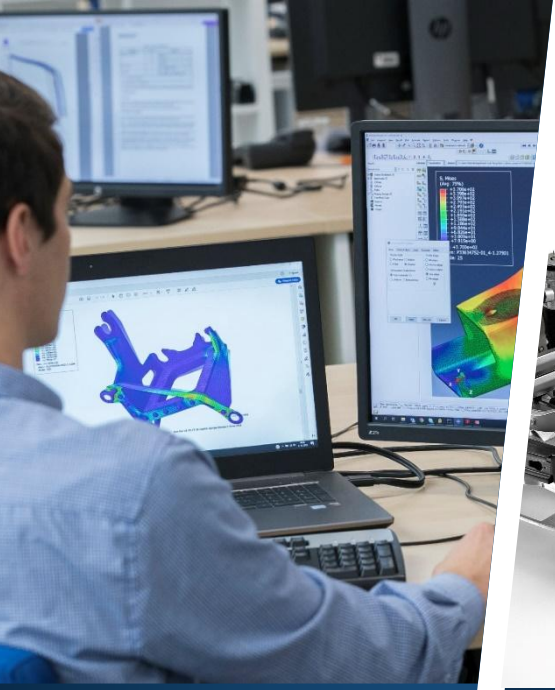
80+ awarded prizes

TPV INNOVATION STATION

Sustainability oriented Lifecycle management

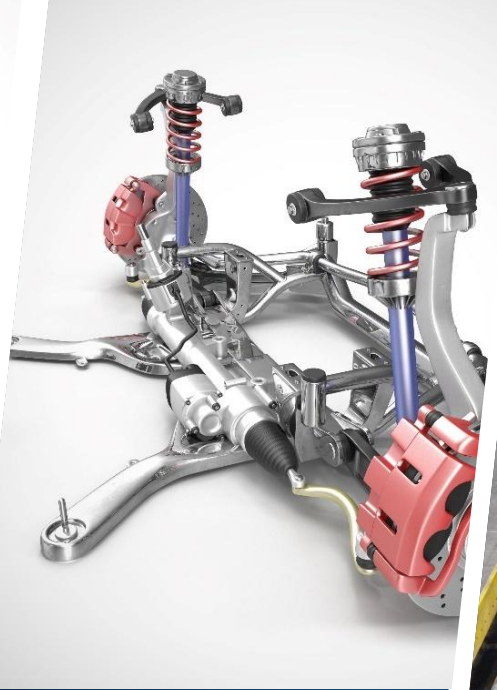
WHO ARE WE ?


OUR LOCATIONS

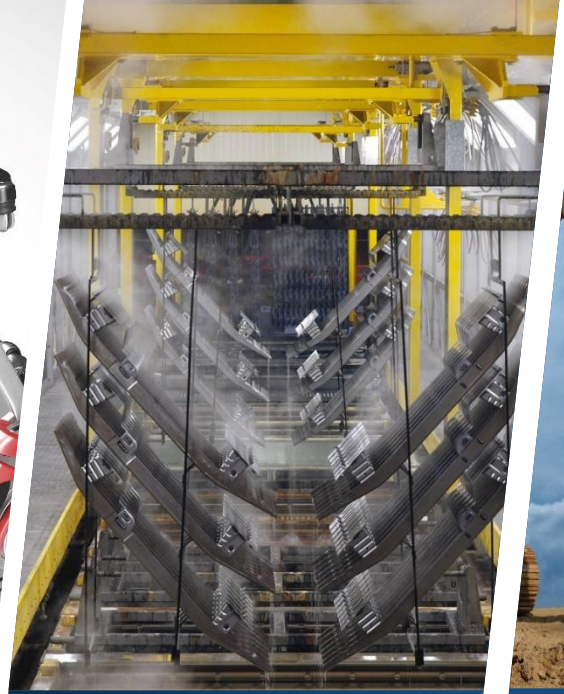


R&D SERVICES

COMPLEX ALUMINUM STRUCTURES



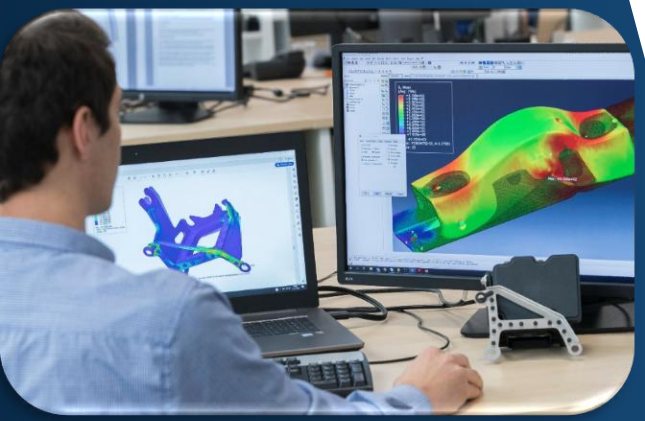
HIGH STRENGTH STEEL COMPONENTS



SURFACE PROTECTION

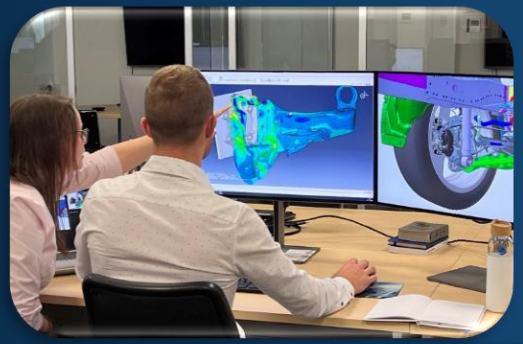
AGRICULTURAL AND CONSTRUCTION EQUIPMENT

CORE PROGRAMMES



R&D SERVICES

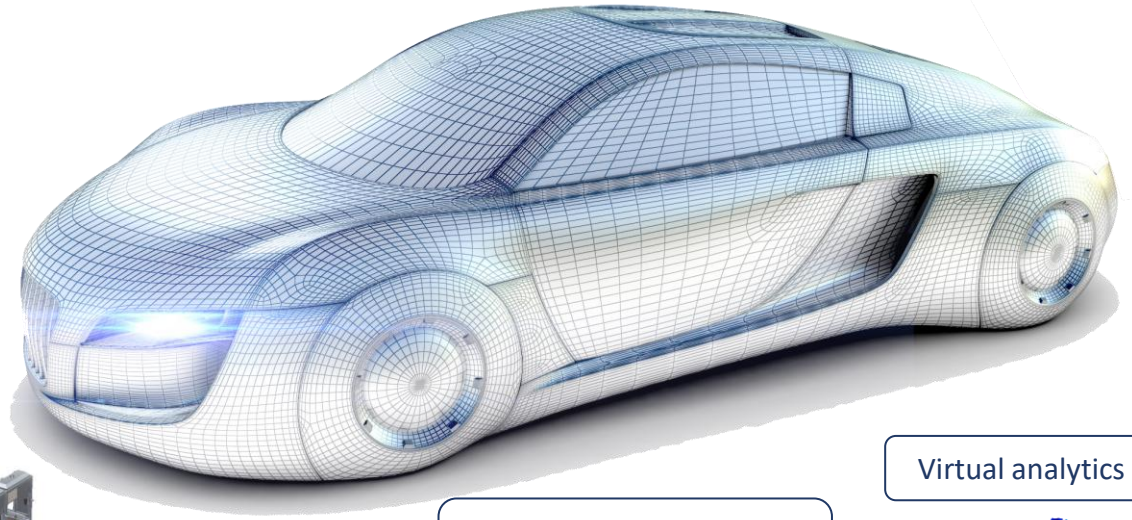
We offer R&D services for development of products and technological processes with possibility of prototypes and laboratory testing



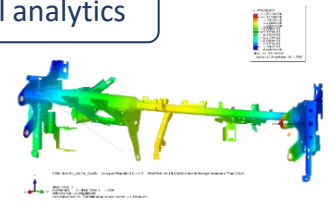
Research

Base for product and product development

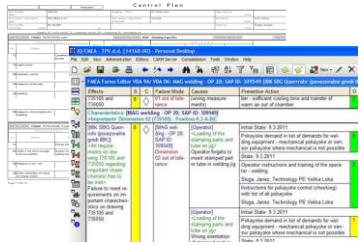
Virtual product development



Virtual analytics



Feasbility & FMEA study – Control plan



Development of smart factories

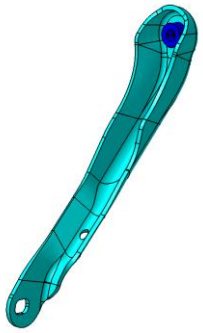
TPV AUTOMOTIVE

R&D COMPETENCES

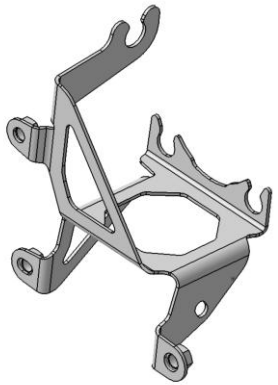
DESIGN IMPROVEMENTS (lower costs, lighter products, improved funtcionality, …):

Baseline design

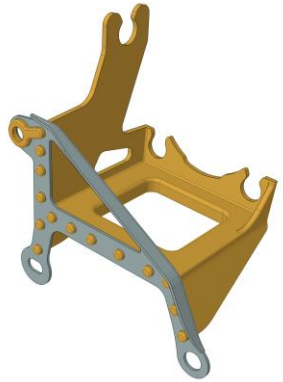
TPV design



Baseline design

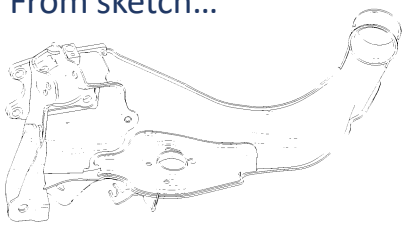


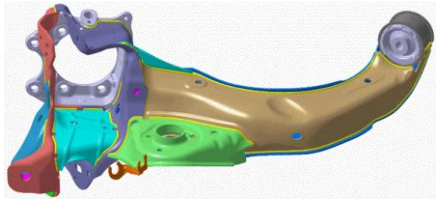
TPV design



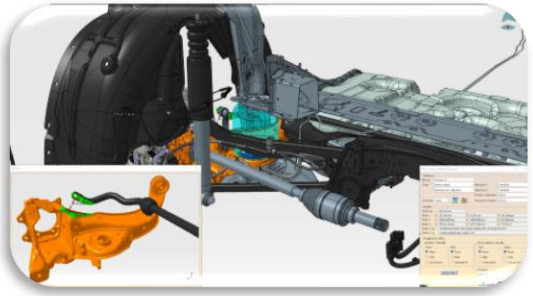
INTEGRATED DEVELOPMENT PROJECTS:

From sketch…





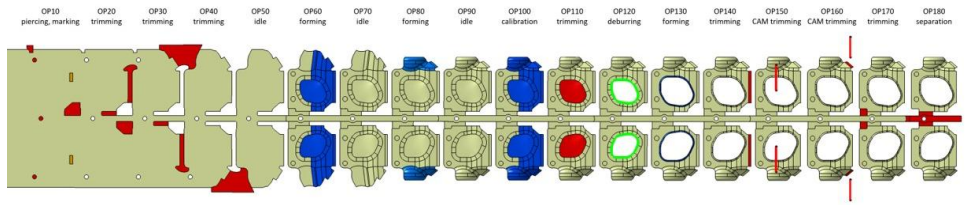
…over 3D models…



…to prototypes…

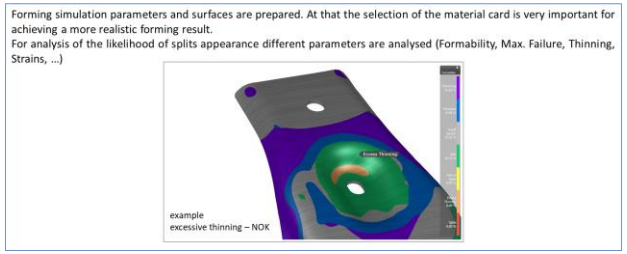
…and to final part assembly

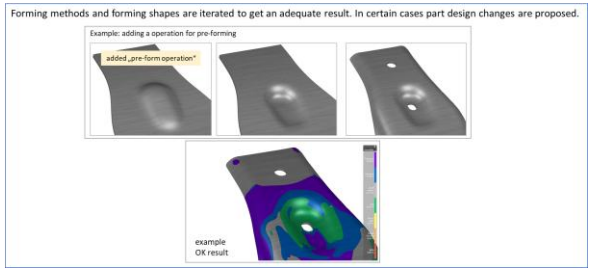
TECHNICAL DEVELOPMENT COMPETENCES - Stamping

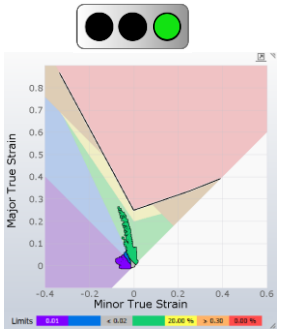


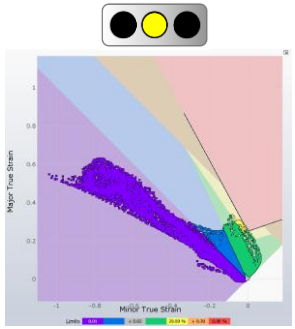
Evaluation phase

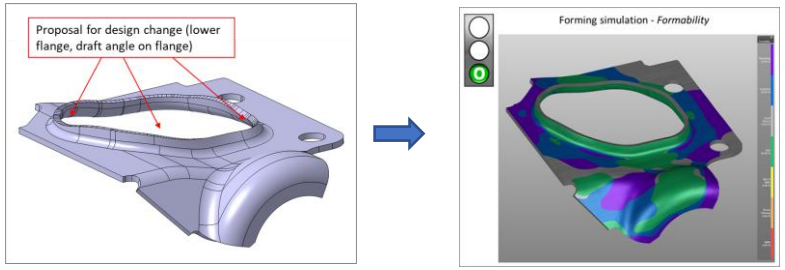
- Blank definition
- Concept design of the strip layout (method plan)
- Forming simulation
- Optimisation of forming method
- Checking of critical area and feasibility study
- Robustness analysis (deviation)
- Tooling price evaluation
- FLD diagrams
- Material Thinning simulations
- Material Springback simulations
- Raw material & process variations simulations











CHECK TECHNICAL COMPETENCES

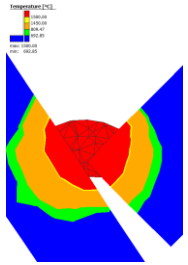
CATIA · AutoForm Forming Reality · HEXAGON · simufact · TPV AUTOMOTIVE · FEMFAT software · ANSA PRE PROCESSOR · SIMULIA ABAQUS

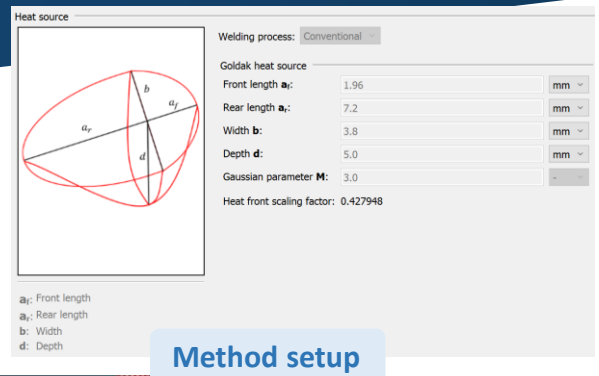
TECHNICAL DEVELOPMENT COMPETENCES - Welding

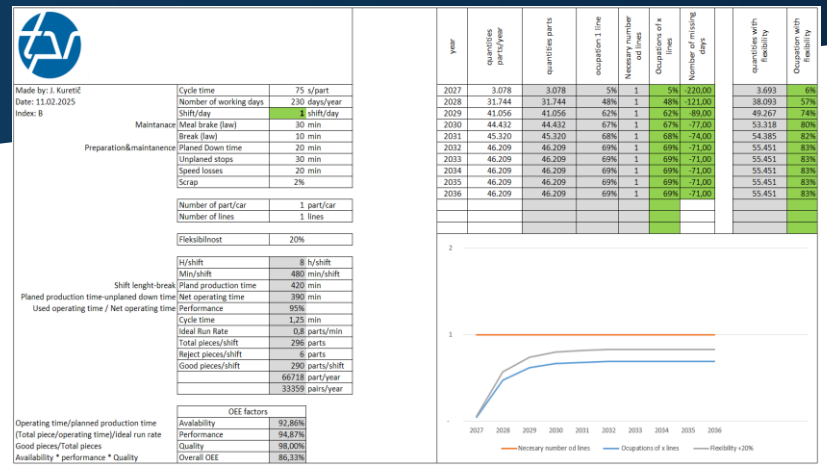
Evaluation phase
- Capacity evaluation
- Welding trajectories
- Welding parameters
- Dimensions of welding source – real macrography tests – proof of parameters
- Welding cycle
- Welding sequence

Boundary conditions:
- Welding tools concept
- Temperature
- Cooling times

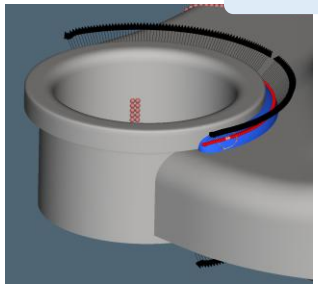
Results
- Residual stresses
- Deformations
- Welding sequence impacts
- Different tooling clamping concepts impact

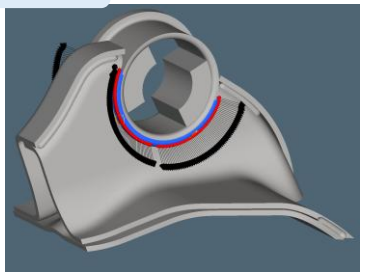


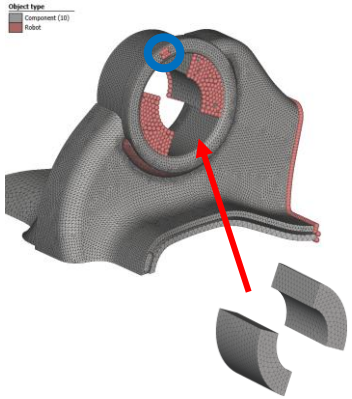


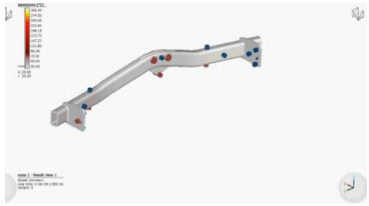


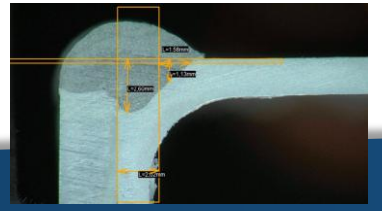
Method setup



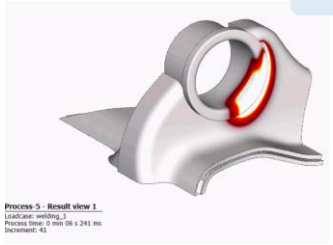


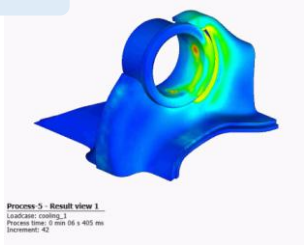


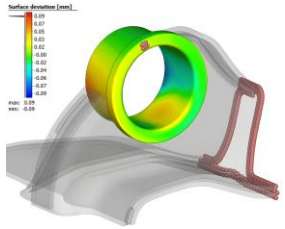


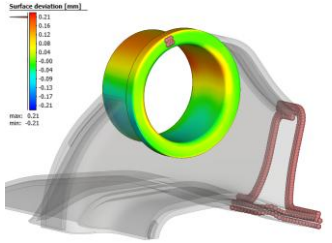


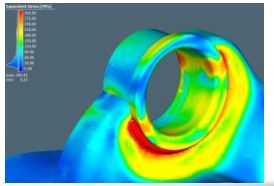
Results











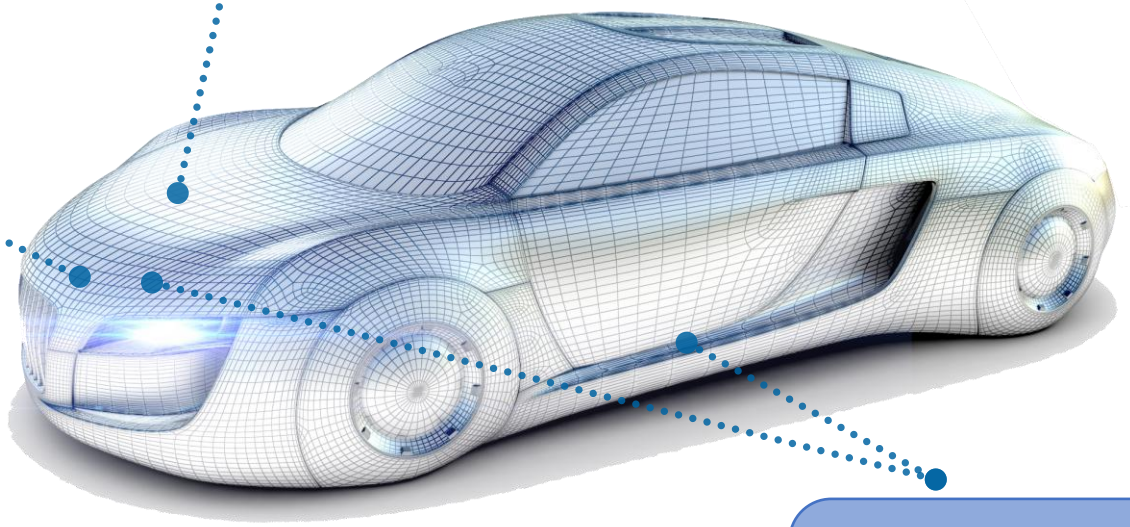
CATIA · AUTOFORM Forming Reality · HEXAGON · simufact · TPV AUTOMOTIVE · FEMFAT software · ANSA PRE PROCESSOR · SIMULIA ABAQUS

SURFACE PROTECTION

We offer services for steel parts surface protection alongside corrosion standardised testing → highest level of surface protection quality

E – coating (KTL) painting
- Thick-layer
- Thin-layer
- Etching in Zn phosphating

POWDER COATING



WASHING AND ALUMINIUM PASSIVATION
- **SurTec**

HIGH STRENGTH STEEL & ALUMINUM COMPONENTS

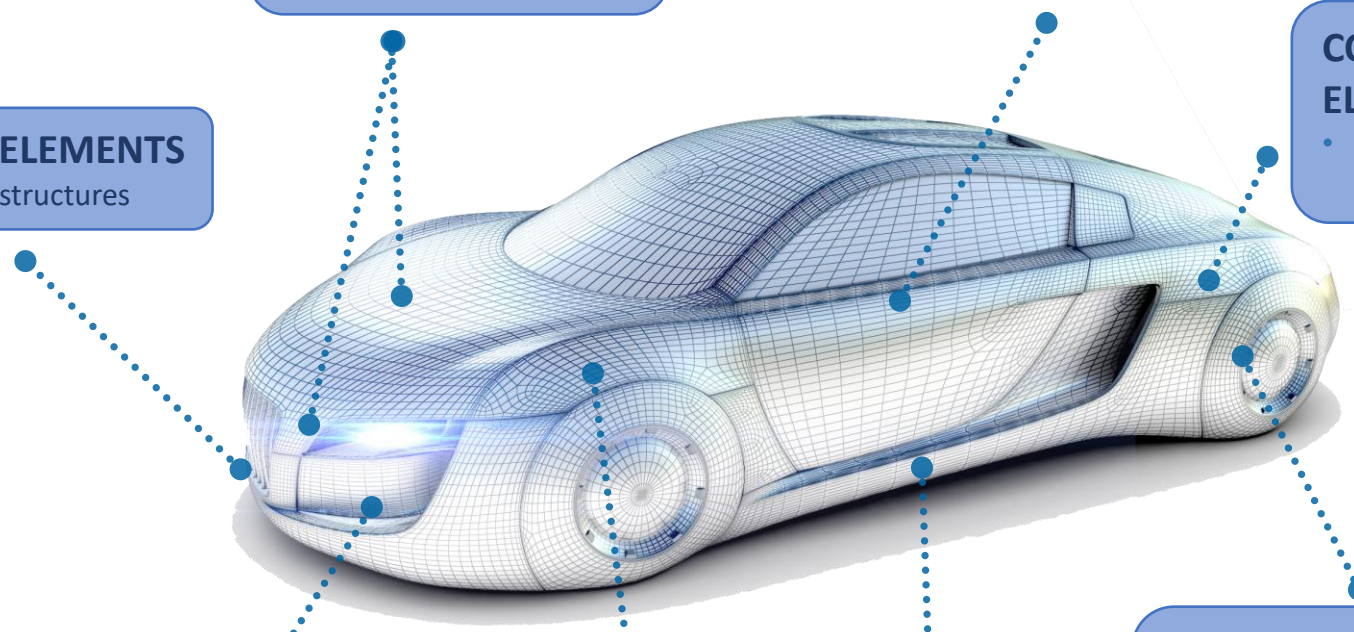
We offer development and production of High Strength Steel and Aluminum Components with important influence on driving dynamics, alongside other bodywork components and car seat structures. Following the guidelines for use od High strength steel

Chassis components
- Engine cranks
- Anti-vibration ties
- Crash structures

INTERIOR ELEMENTS
- Seats and seat components
- Dashboard carriers and holders

CONNECTING ELEMENTS
- Re-inforcing elements

SAFETY ELEMENTS
- Crash structures



BEV elements for engine protection

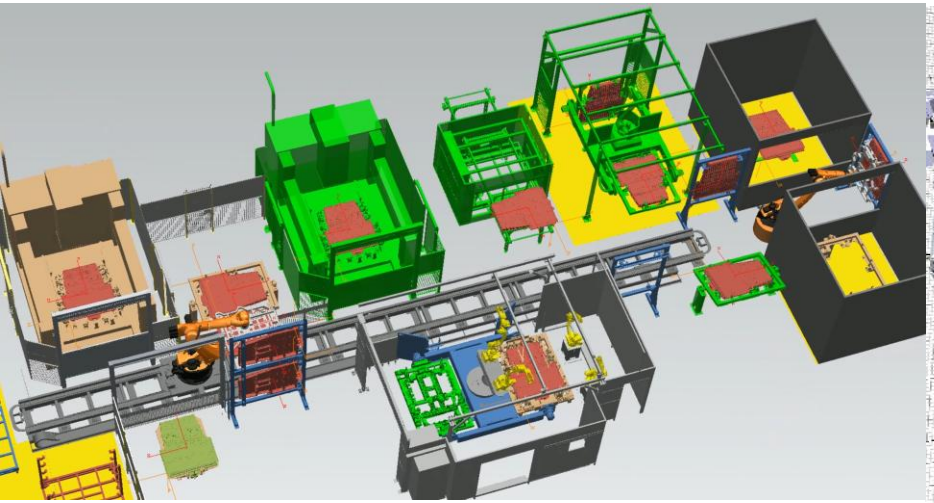
BODYWORK COMPONENTS

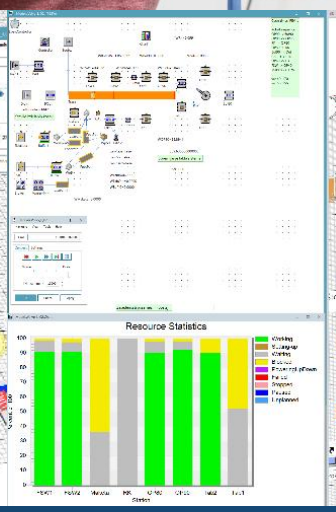
BATTERY HOUSINGS

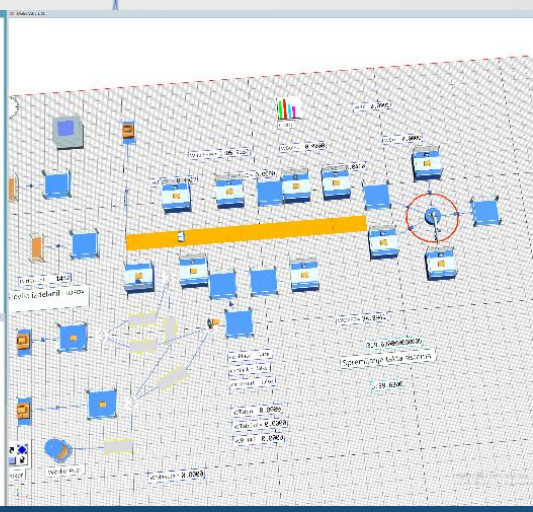
DRIVING DYNAMICS:
- Wheel carriers (front and back)
- Shock absorbers and linkages

VIRTUAL DEVELOPMENT OF ROBOTIZED PROCESSES

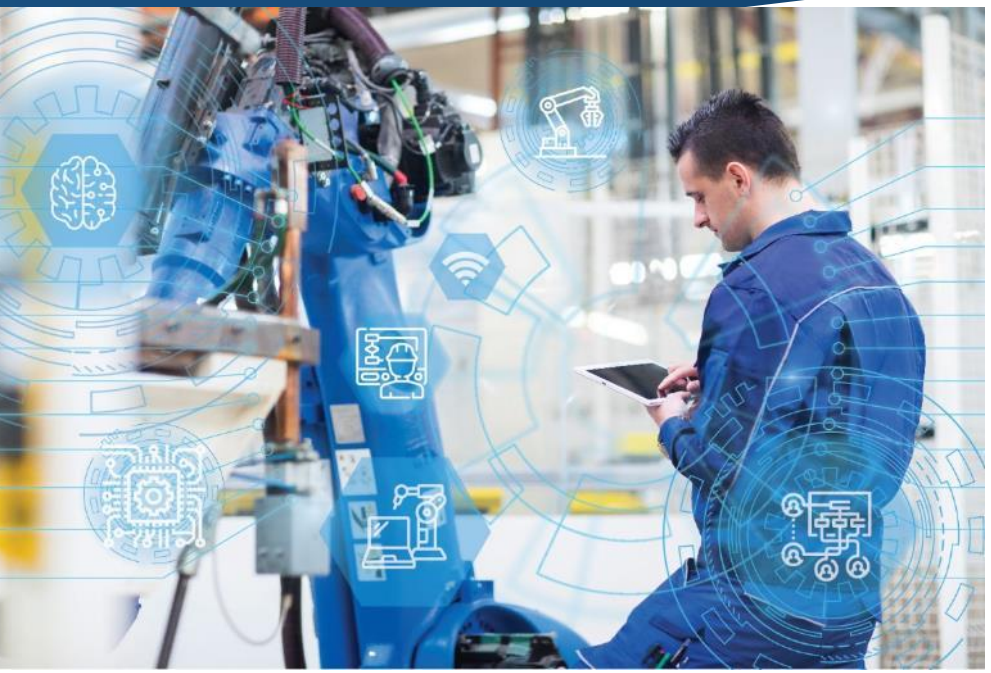
- **Planning, developing and validating in digital twin factory**
- **Processes simulations**
- **Process optimizations**
- **Smart Factories**
- **One-piece flow**

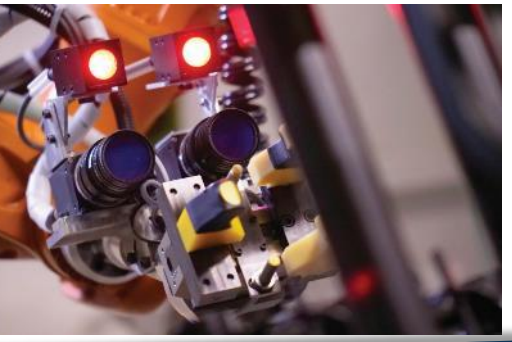






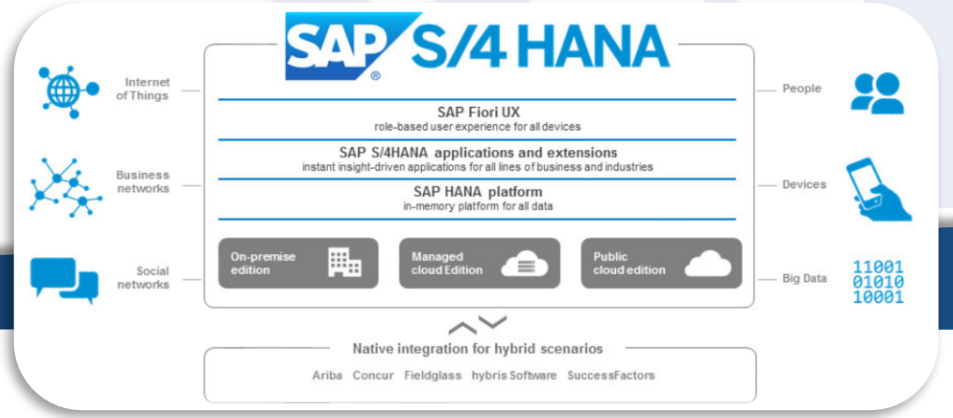
SMART FACTORY MODULES – INDUSTRY 4.0

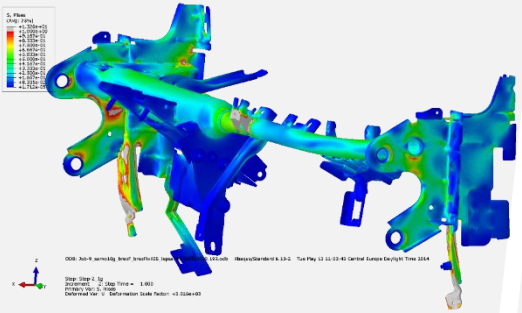


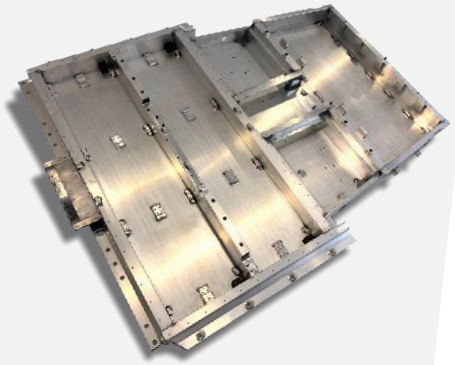


In-house developed & implemented modules for smart factories:

- Automated production logistics with AGV
- Bin picking systems
- 3D tracking systems
- autonomous commissioning
- Every part tracability to single component information
- PowerBI reports – downtimes, productivity, scrap, OEE, other KPI‘s







R&D SERVICES

COMPLEX ALUMINUM STRUCTURES

HIGH STRENGTH STEEL COMPONENTS

SURFACE PROTECTION

AGRICULTURAL AND CONSTRUCTION EQUIPMENT

KEY PRODUCTS

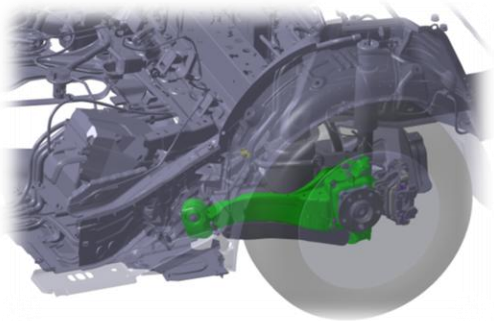
TRAILING ARM – HIGH STRENGTH COMPLEX STEEL

Weight: 8 kg

Dimensions: 280 x 290 x 650 mm

Nb. Of single parts: 17 (13 stamped parts, 1 forged part, 2 nuts, 1 rubber bushing)

Weight on single part: 3,5 m



Part family: Trailing arm suspension/Chassis

Material:
Stamped parts: Hot-rolled complex phase (HSS) HR660Y760T-CP-UC-U
Forged parts: Micro alloyed steel: 19MnV5

Project volumes

Lifetime quantities: 4.500.000

Avg. Yearly quantity: 450.000

Improvements compared to Alu cast parts:
10 % less weight
10 % increased strength
Less production cost
Better production process for better Quality insurance

Main processes

Cold forming / Stamping

⇩

Washing

⇩

Resistance + MAG welding (CMT technology)

⇩

CNC machining + robot debburing

⇩

KTL surface protection + waxing

⇩

Bushing inserting

TRAILING ARM PROCESS

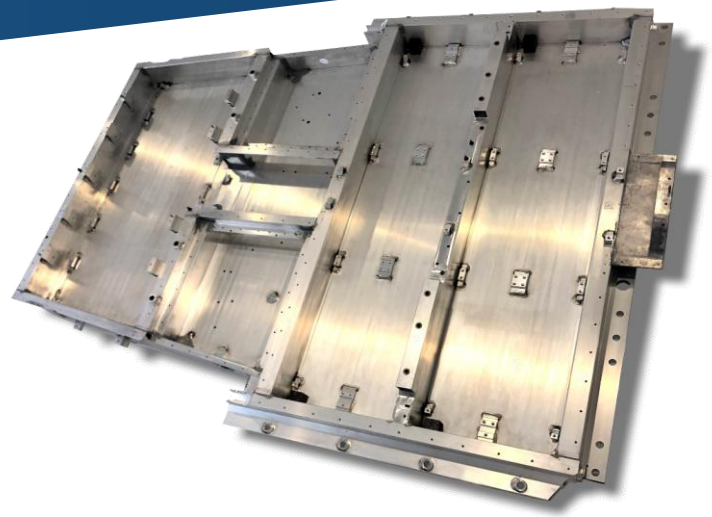
Process development

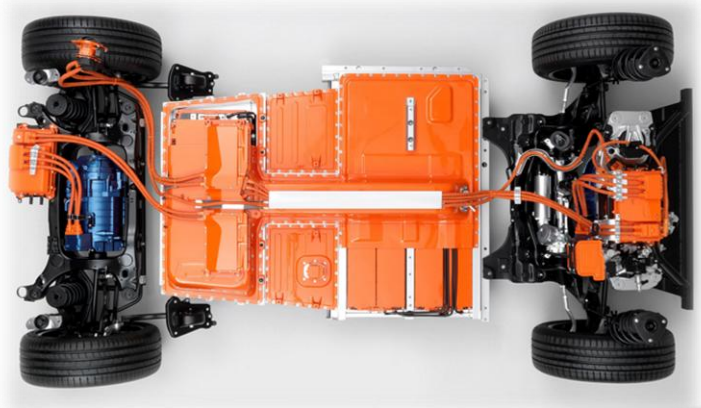
- Fully automated assembly line, surface protection and waxing,
- Productivity of 8000 pieces per day (left and right),
- " One piece flow " production and guaranteed traceability,
- Virtual validation of production processes,
- MAG welding technology,
- Using CMT technology,
- WCR control:
  - Arc stability control, arc drop monitoring (if the arc drops by more than 70 hundreds, the WCR control reports that the weld may be bad),
  - Monitoring of welding shape alarms.

Process challenges:

- Complex product design and tight tolerances:
  - Tight tolerances for the welded piece,
  - 100% geometry control required within the assembly line,
  - Max. welding gap is 1.2 mm,
- Large distortions during welding:
  - One authorized and validated welding sequence,
  - All input components "wrongly made" to achieve the correct geometry of the product at the output,
- Hard-to-reach penetrations:
  - The use of CMT and MIX welding technology allows us greater flexibility,
- High dynamic loads:
  - Security component,
  - All welded joints are safety (weekly implementation of macro control)
  - Annual validation of dynamic strength,
  - Every change must be dynamically tested and validated,
  - 100% control of welding joints with the SmartRay system
- Resistance welding of nuts and „horseshoes“
  - Resistance welding of high strength steels,
  - Various materials (CP800 and S500, CP800 and 20MnB4)

BATTERY TRAY





Materials

Main materials: Aluminum:
EN 755-2 AW-6005-T6, AW-6063-T6
EPP foam
Sealant: TEROSON MS939FR
Filler aluminium alloy (welding wire):
ISO 18273 AlSi5 (4043); D=1,6 mm
Shielding gas: ISO 14175 Argon 5.0

Project volumes

Lifetime quantities: > 600.000
Avg. Yearly quantity: 100.000

Weight: 70 kg

Dimensions: 1800 x 1500 x 200 mm

Nr. Of components: 120 (40+ different components)
MIG weld length: 6,7 m
FSW weld length: 11 m
Sealing length: 2,5 m

Main processes

Cutting Al profiles

⇩

CNC machining

⇩

Degreasing and passivation

⇩

MIG/Friction stir welding

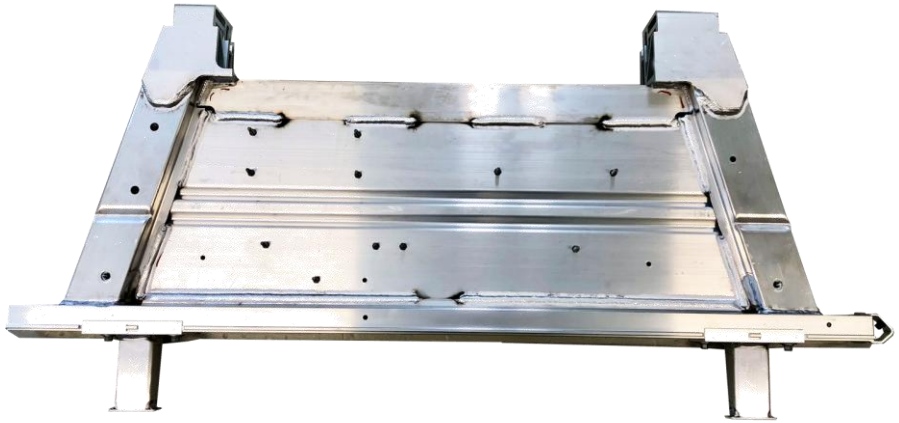
⇩

Sealing

⇩

Leakage testing

IMPACT MEMBER



Materials

Main materials: Aluminum:
EN 755-2 AW-6005-T6, AW-6063-T6
EPP foam
Sealant: TEROSON MS939FR
Filler aluminium alloy (welding wire):
ISO 18273 AlSi5 (4043); D=1,6 mm
Shielding gas: ISO 14175 Argon 5.0

Project volumes

Lifetime quantities: > 600.000
Avg. Yearly quantity: 100.000

Weight: 15 kg
Dimensions: 100 x 600 x 1200 mm
Nr. Of components: 47 (12 extruded parts, 15 screws,
16 rivet nuts)
MIG weld length: 4 m

Main processes

Cutting Al profiles
↓
CNC machining
↓
Degreasing and passivation
↓
MIG/Friction stir welding
↓
Sealing
↓
Leakage testing

BATTERY TRAY AND IMPACT MEMBER PROCESS

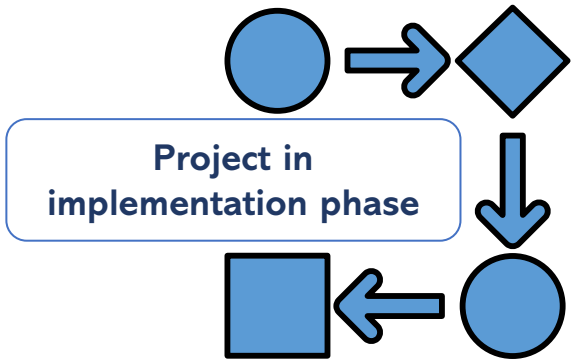
Process development

- Fully automated assembly line,
- Productivity of 3000 pieces per week,
- MIG CMT welding technology,
- FSW technology.

Process challenges:

- Complex product design and tight tolerances:
  - Tight tolerances for the welded piece,
  - 100% geometry control required within the assembly line,
  - Required tightness of welds.
- Large distortions during welding:
  - Welding tool with forced clamping,
  - One authorized and validated welding sequence.
- Surface preparation:
  - Washing with an emphasis on degreasing,
  - Removal of the oxide layer,
  - Passivation.
- Complex shape of the weld:
  - Inaccessibility of welds (non-optimal position of the "gun" and gas supply),
  - Variable base thickness on one weld,
  - Short welds,
  - Uneven welds (L) - the need for a lot of robot movement to ensure the right angle of the „ welding torch".
- FSW welds:
  - Very rigid and complex clamping of components,
  - Demanding provision of gap between components,
  - Durability of welding pins.
- Sealing the corners to transfer tightness from the outside to the inside of the BT:
  - The need for deep penetration of the MIG weld to join the FSW weld from the other side of the wall.
- High weld loads:
  - Safety component,
  - All welded joints are safety (weekly implementation of macrological control).

BATTERY TRAY2



Materials

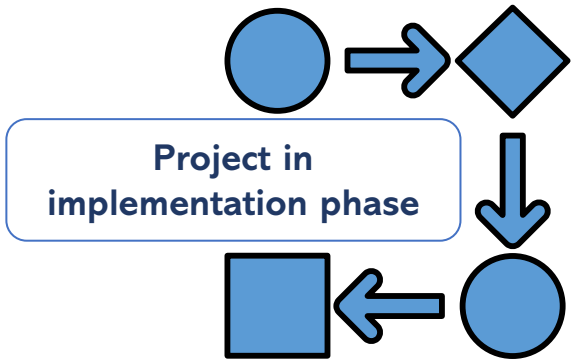
Casting material: AlSi10MnMg (EN AC – 43500)
Extruded profiles: DBL 4919.20 & DBL 4919.40
Sealant: TEROSON MS 9320 SF

Weight: 73,5 kg
Dimensions: 2065 x 1388 x 158 mm
Nr. Of components: 24 (6 extruded parts, 12 metal single components, 4 plastic single components, 2 casting parts)
MIG weld length: 8 m
FSW weld length: 13,6 m

Main processes

Cutting Al profiles
↓
CNC machining
↓
Degreasing and passivation
↓
MIG/Friction stir welding
↓
Sealing
↓
Leakage testing

BATTERY TRAY 3&4



Project in implementation phase

Weight: 15 kg
Dimensions: 320 x 240 x 1070 mm
Nr. Of components: 12 (2 extruded profiles, 8 cooling VDA connectors, 2 positioning elements)
MIG weld length: 1,2 m

Weight: 9 kg
Dimensions: 320 x 240 x 600 mm
Nr. Of components: 8 (4 extruded profiles, 4 cooling VDA connectors)
MIG weld length: 0,7 m

Materials

Casting material: AlSi10MnMg (EN AC – 43500)
Extruded profiles: EN AW-6063 T6 (AlMgSi)

Requirements

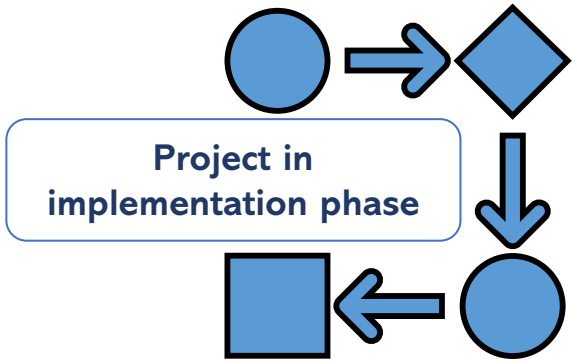
Required tests:

- 5Leak tightness test,
- Tensile test,
- 3-point bending test,
- Hardness test,
- Technical cleanliness,
- No burr

Main processes

Cutting Al profiles
↓
CNC machining
↓
MIG welding
↓
Leakage testing
↓
Degreasing and passivation
↓
Implanting threaded inserts

HALTER PLATE



Materials

Extruded profiles: EN AW-6063 T6 (AlMgSi)
Stamped part: EN 485-4 1,5 mm

Weight: 4,5 kg
Dimensions: 1240 x 590 x 60 mm
Nr. Of components: 23 (1 stamped part, 2 extruded profiles, 8 welding studs, 8 bushes, 4 rivet nuts)
MIG weld length: 1,5 m

Main processes

Cutting Al profiles
↓
CNC machining
↓
MIG welding
↓
Leakage testing
↓
Degreasing and passivation
↓
Implanting threaded inserts

CROSS CAR BEAM

Weight: 7 kg

Dimensions: 315 x 580 x 1260 mm

Single parts no.: 60 (41 stamped parts, 3 tubes, 6 screws, 6 nuts, 4 stamped nuts)

Weld length on single part: 2 m

Part family: Dashboard

Material:
Stamped parts: Hot-rolled S420MC, DD13
Stamped parts: Cold-rolled H360LA, H400LA
Welded and cold sized tubes: E355+CR1

Project volumes

Lifetime quantities: 900.000

Avrg. Yearly quantity: 140.000

Main processes

Stamping & Cutting

↓

Tube forming

↓

Nut impressing

↓

100% part control

↓

MAG welding

↓

Screwing

ZSB TRANSMISSION MOUNT

Weight: 8 kg

Dimensions: 250 x 600 x 700 mm

Single parts no.: 16 (6 stamped parts, 3 bushes, 3 nuts, 3 rubber mounts, 1 tube)

Weld length on single part: 2 m

Part family: Lightweight chassis steel components

Material:
Stamped parts: Hot-rolled S315MC
Cold drawn Bushes: E235
Welded and cold sized tubes: E235
Weld nut: Class 10

Project volumes

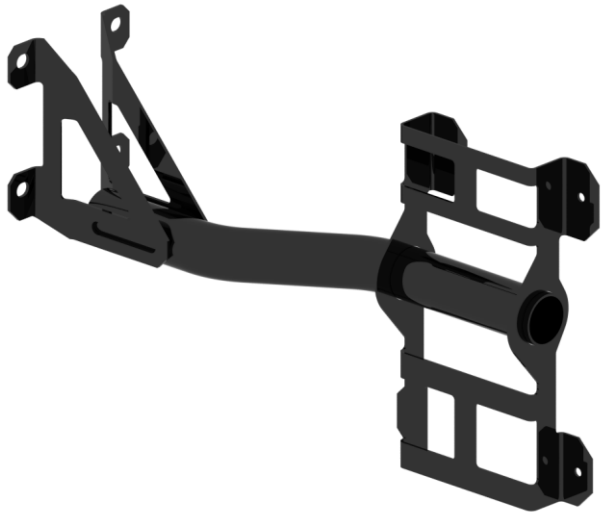
Lifetime quantities: 510.000

Avrg. Yearly quantity: 34.000

Main processes

Stamping
↓
Tube cutting
↓
Bending
↓
Turning
↓
Resistance + MAG welding
↓
KTL + Powder coating
↓
Rubber mount inserting + threading

BEAM FENDERS FAMILY

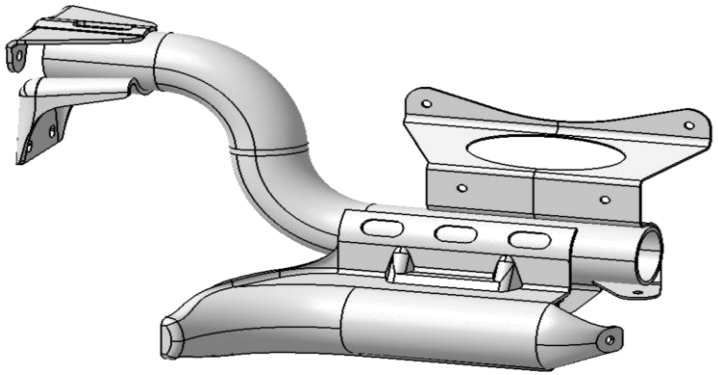


Weight: 5,5 kg

Dimensions: 230 x 430 x 660 mm

Nb. Of single parts: 4 (3 stamped parts, 1 tube)

Weld length on single part: 0,6 m



Part family: Chassis – Fender attachments

Materials:
Stamped parts: S500MC
Tubes: Welded cold sized: E355+N

Project volumes

Lifetime quantities: 130.000

Avg. Yearly quantity: 13.000

Main processes

Cutting of tube

⇩

Cold forming / Stamping & Tube forming

⇩

MAG welding (CMT technology)

⇩

KTL surface protection

TOW BARS – HIGH STRENGTH STEEL (pre SOP – ramping up)

Weight: 15,3 kg – 21,2 kg

Dimensions:1250 x 565 x 95 mm

Nb. Of single parts: 12 (7 stamped parts, 1 forged part, 2 nuts, 2 bushes)

Weight on single part: 2,4 m

Part family: Tow bar - Chassis

Materials:
Stamped parts: S235JR, S355MC, S500MC, S700MC
Tubes: S355J2H
Forged part: 25MnV5
Bushes: S355MC

Project volumes

Lifetime quantities: 1.20.000

Avg. Yearly quantity: 220.000

Main processes

Laser cutting

↓

Cold forming / Stamping

↓

MAG welding (CMT technology)

↓

CNC machining

↓

Weld and Dimension automatic inspection

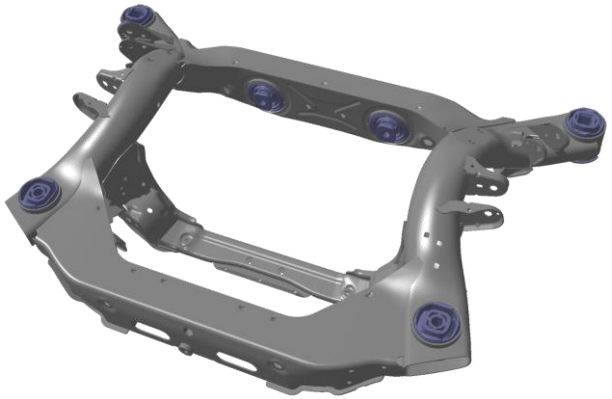
↓

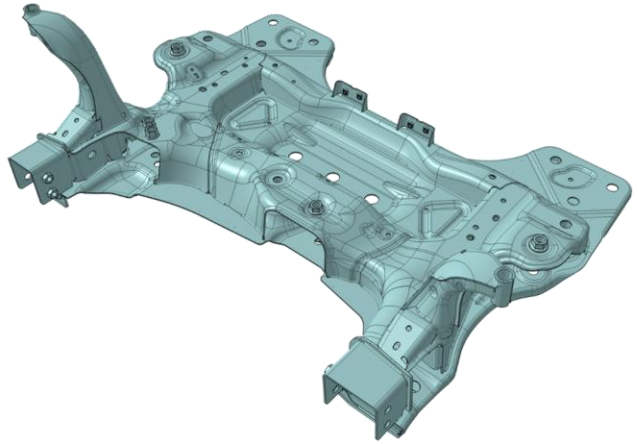
Sandblasting

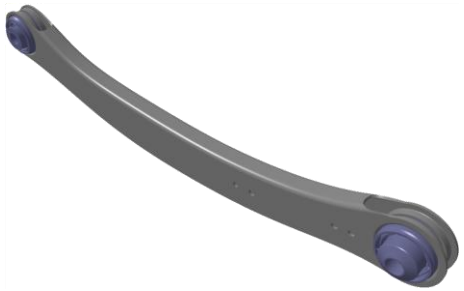
↓

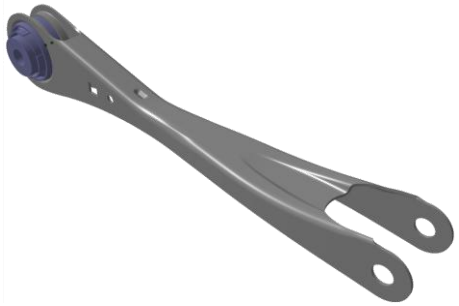
KTL surface protection

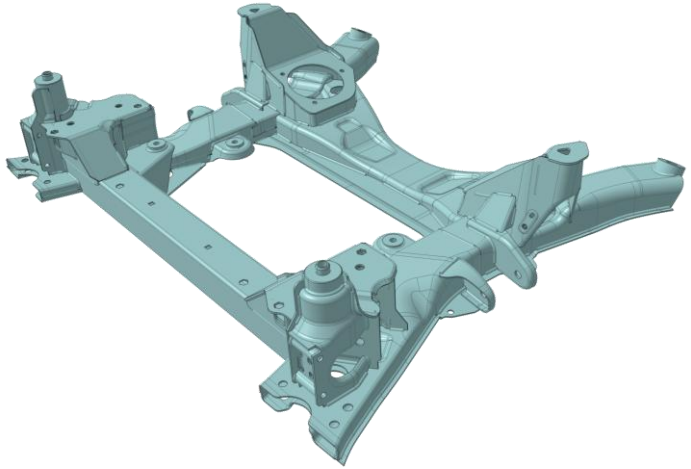
OTHER CHASSIS COMPONENTS











Concept development support

Design for manufacturing optimizations and feasibility analyses

Gross material consumption reduction

Virtual evaluations of part functionality

Process development

Selection of optimal material considering part function and predicted technology

PRODUCT PORTFOLIO DIVERSITY

2,000
final products

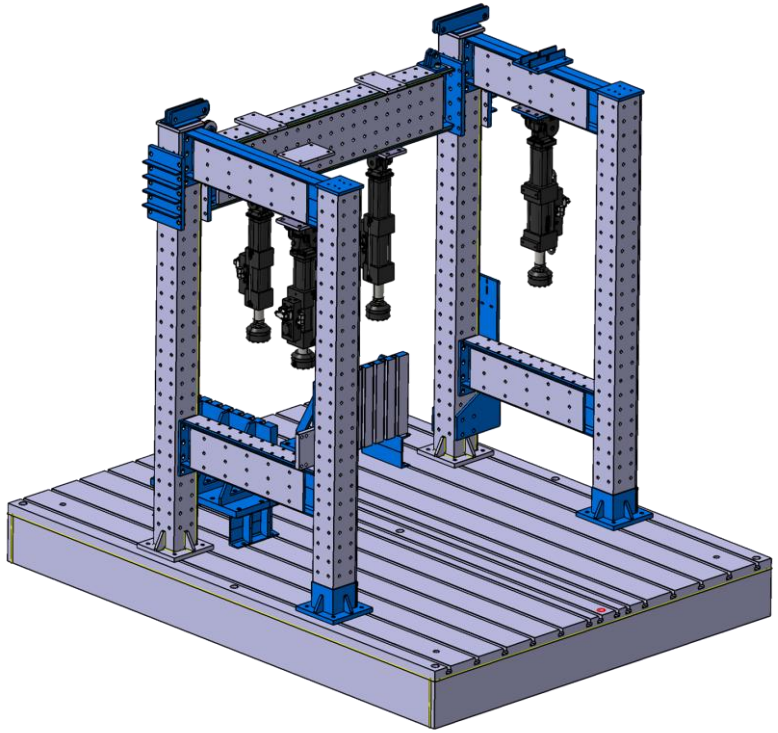
KEY CUSTOMERS

BMW
brose Technik für Automobile
BUGATTI RIMAC
CLAAS
DAIMLER TRUCK
JAGUAR
KLIPPAN
Mercedes-Benz
MINI
Webasto
RIMAC TECHNOLOGY
ROLLS-ROYCE
VOLVO
STELLANTIS


over
100
awards
over
22.000
innovative
proposals
INNOVATION
SUSTAINABILITY
technological
INNOVATIONS
LIGHTWEIGHT
product
concept
Hydrogen
H_2
RECYCLED
material
CERTIFICATES
ISO 9001
ISO 14001
ISO 45001
IATF 16949
TISAX
ISO
International
Organization for
Standardization
TISAX


TPV AUTOMOTIVE
IN-HOUSE
process
development
500+
robots
FAGOR
presses up to
2.500 T
2
the most
advanced
SURFACE
PROTECTION
LINES

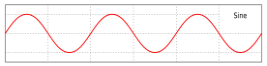
MTS TESTING FACILITY



- Static test
- Dinamic test
- Fatigue test
- CARLOS test
- 4 hydraulic actuators
- Theoretically achievable frequency: 50 Hz

Sample excitation signal types:

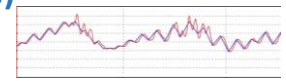
- Sine



- Pulse

- Triangle

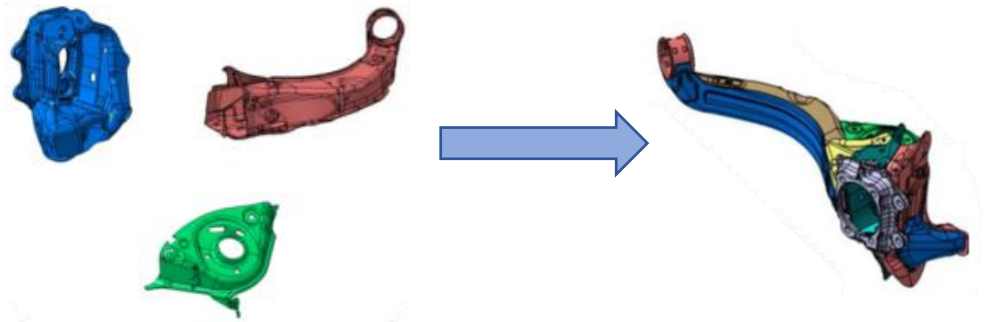
- Arbitrary signal (e.g., from road surface)

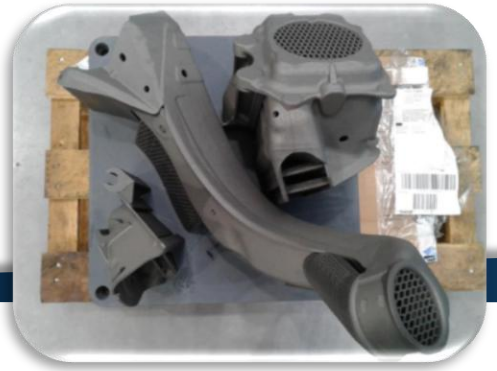


CHECK TECHNICAL SPECIFICATIONS

PROTOTYPE WORKSHOP

Stamping + Forging (conventional)	+	Welding	+	Milling Assembling KTL	=	NOT RATIONAL
3D sub components	+	Welding	+	Milling Assembling KTL	=	RATIONAL

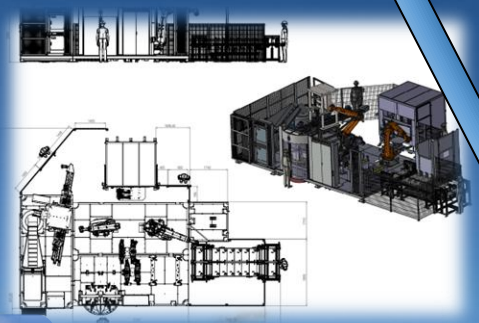




- Sample for Static & Dynamic tests - concept
- Measuring engineering curve
- True stress – true strain curves
- Surface properties research
- Material properties reasearch
- Fatigue calculation
- Welding tests & samples for tests
- Weld durability comparison
- FEM models & simulations
- RPC fatigue simulations
- BAB fatigue simulations
- Welding simulations
- Forming simulations

BREZINA FACTORY

CHECK LOCATION

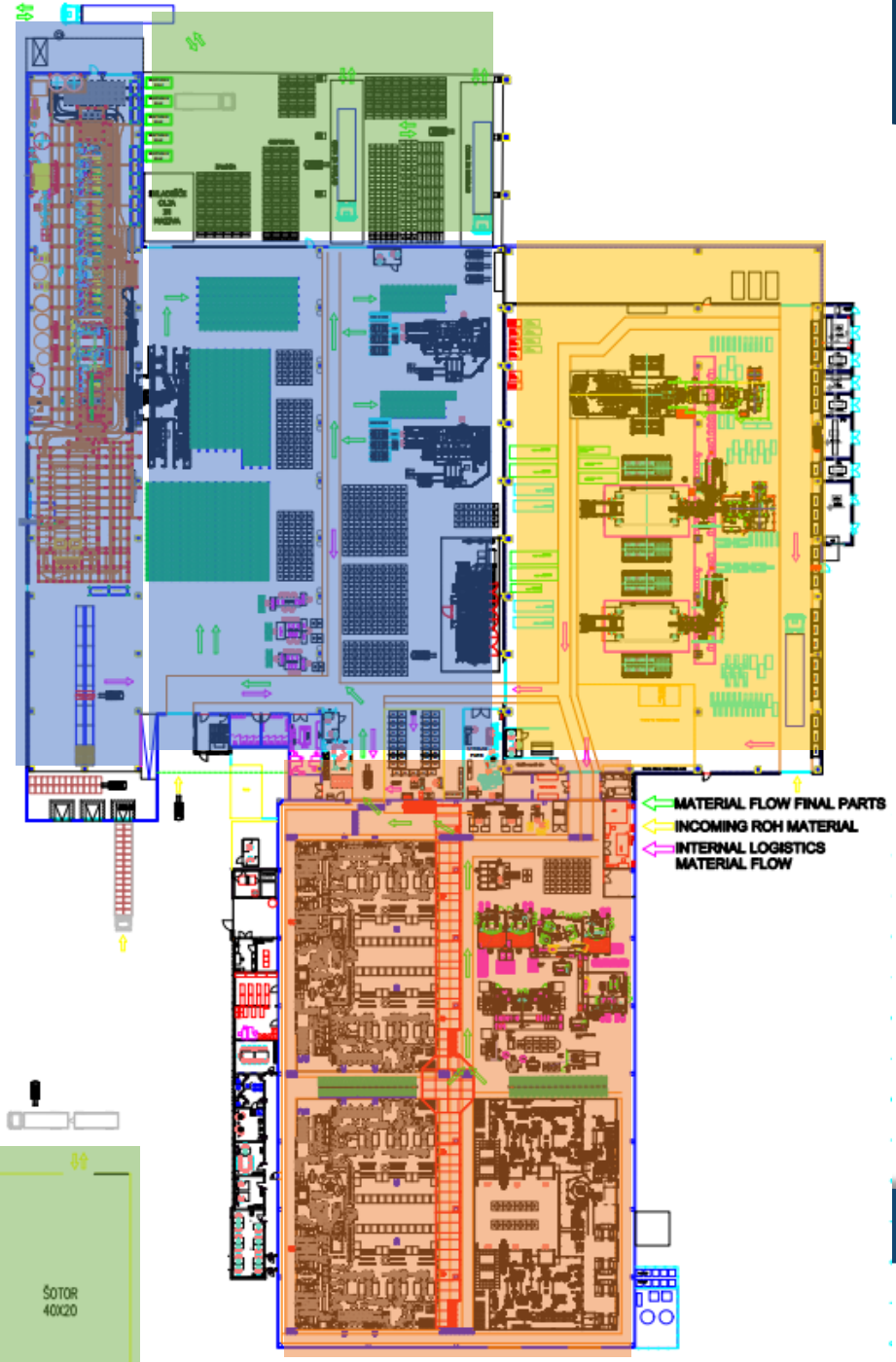


Surface protection

Welding

Cold forming

LAYOUT BREZINA



1. Cold forming [3200 m2]
2. Welding [4150 m2]
3. Surface protection [5900 m2]
4. Warehouse [800m2 + 1000m2]

COLD FORMING

AVRG. FORMED QUANTITY 9.000 t material / year

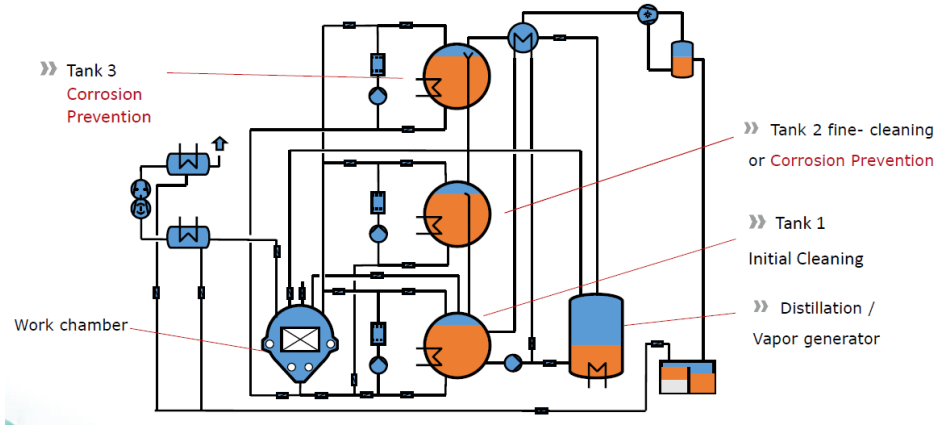
- **3 SERVO STAMPING PRESSES**
- **1x 1000 t**
- **2x 2500 t (progressive & transfer)**
- **Own tool shop**

- **3x servo motors 817kW**
- **3x flywheel asynchronous motor**

CHECK TECHNICAL SPECIFICATIONS CATALOGE

WASHING (stamped parts)

Typical Cleaning and Solvent Conservation in ONE system

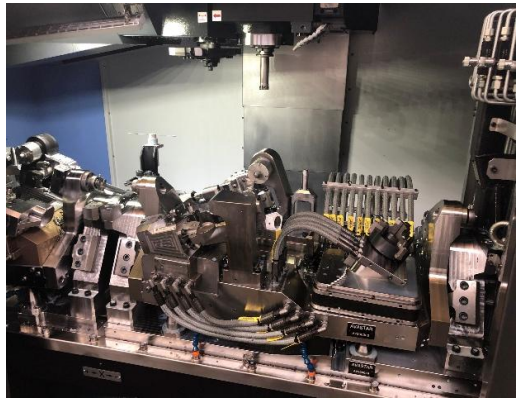


Advantages of Technology

- Technology of washing/de-greasing with alcoholic baths
- Vacuum drying
- Bath with anti corrosion for safe stock
- Cleaning with no need of organized components

WELDING LINES

CNC automatic clamping devices



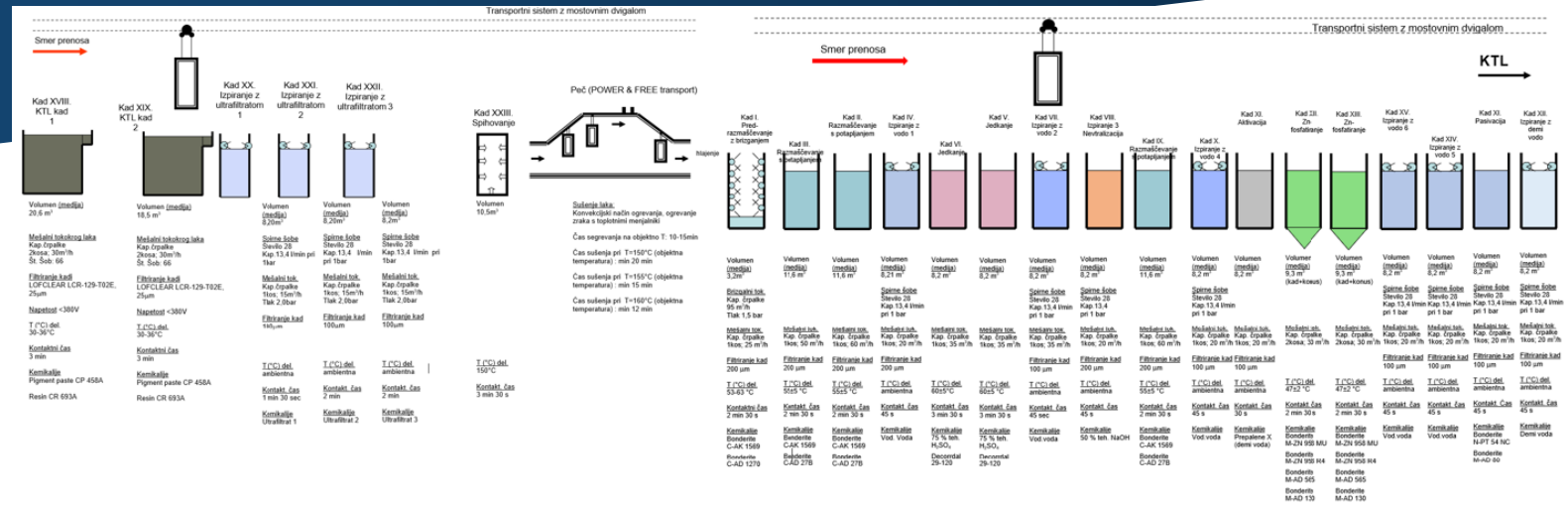
Custom manipulation grippers

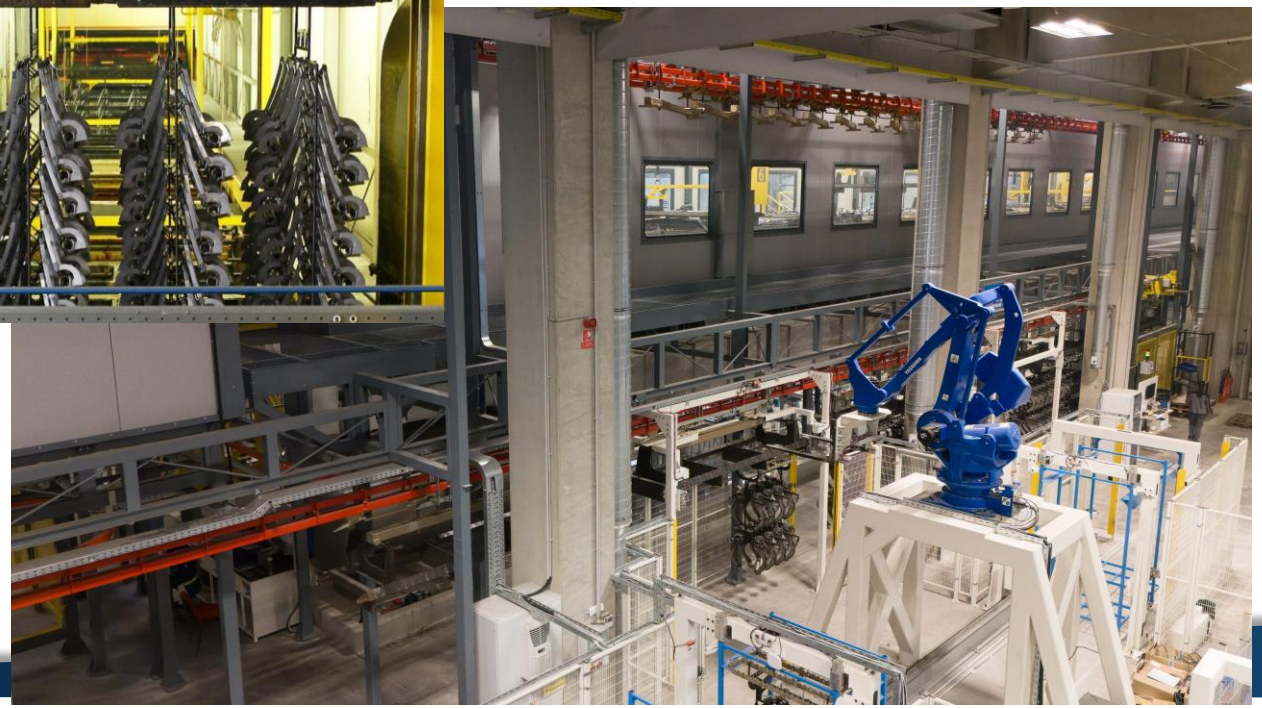
WELDING LINES

- 4x ROBOTIZED WELDING LINES(3 x 700 m2, 1x 350 m2)
- 80x WELDING ROBOTS (KUKA & YASKAWA)
- 91x MANIPULATIVE ROBOTS
- 18x CNC MACHINING CENTERS (Doosan)
- 93x WELDING SOURCES (Fronius)
- 7x PROJECTION/RESISTANCE WELDING MACHINES
- 4x HYDRAULIC HOLE PUNCHING MACHINES
- 21x SmartRay SCANNING (weld seams) OPERATIONS
- 20 km OF WELDS SEAMS, 2.3 t welding wire / day
- 4x „InLine 3D“ Final geometry control systems (more than 20 camers)

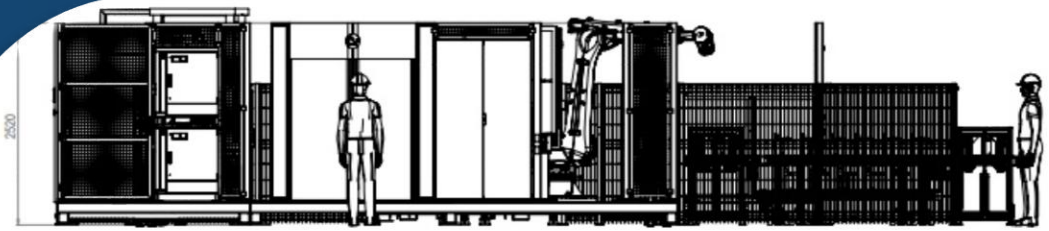
E - COATING (KTL) LINE

Robotized line with each KTL roof/rack traceability

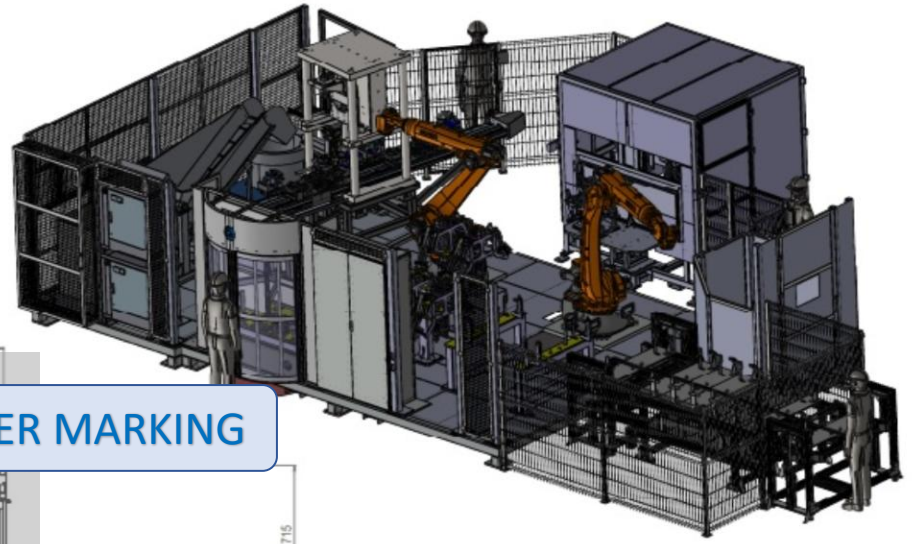




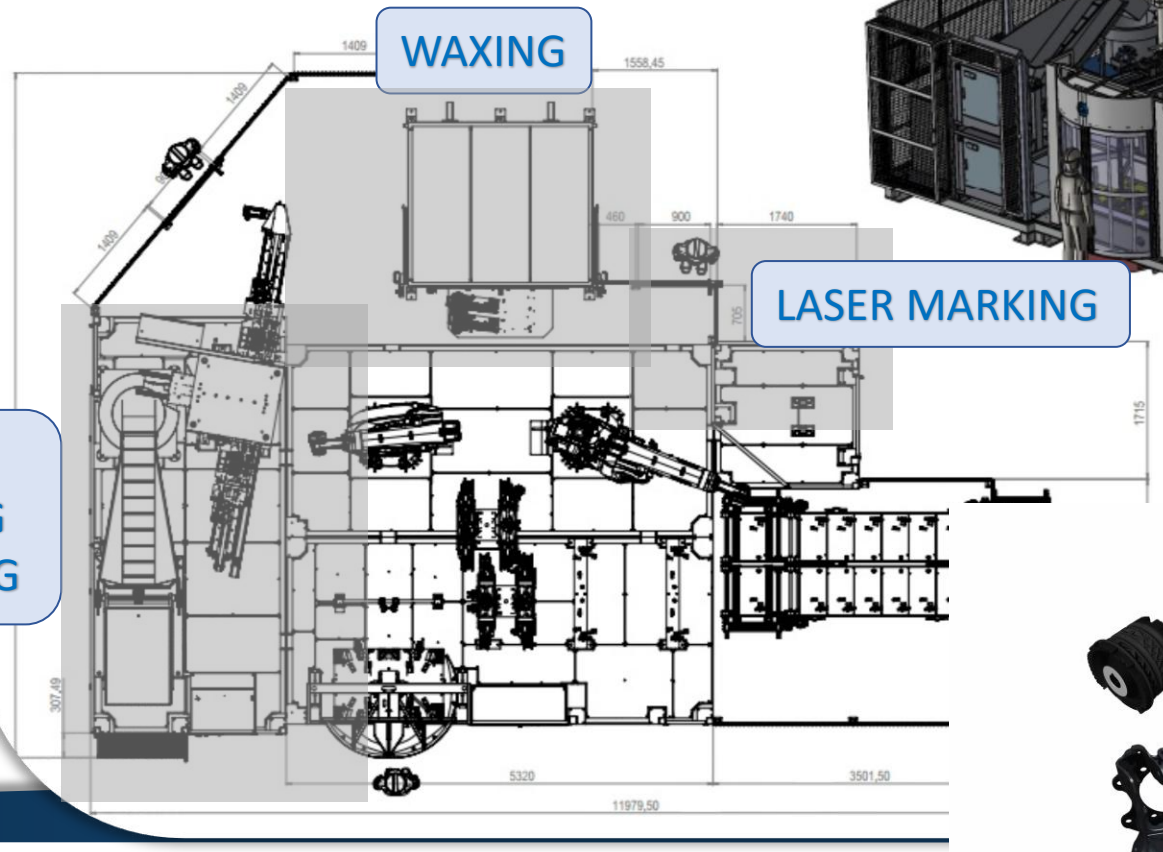
WAXING LINE



WAXING



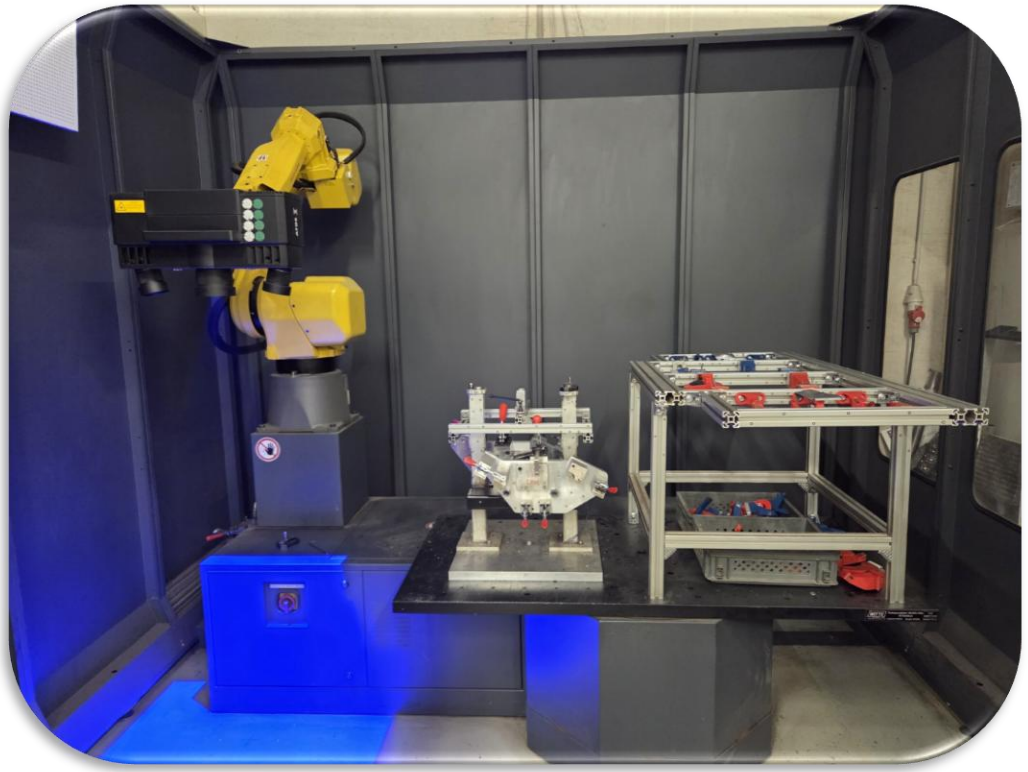
LASER MARKING



RUBBER BUSHING INSERTING

3D SCANNING UNIT

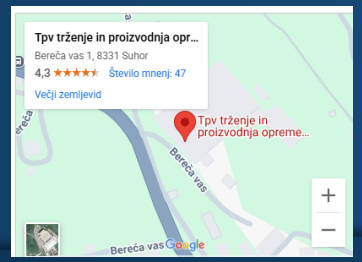
GOM – ATOS SCANBOX



- Fanuc robotized 3D scanning cell / unit
- Possibility of 3D scanning
- Possibility of 3D measuring
- Measurement of stamped parts
- Measurement of welding assemblies
- Scanning of stamping tool segments (matrix, knife, hosuings,…)
- ZEISS software

SUHOR FACTORY

CHECK LOCATION



SUHOR PLANT PROGRAM

- 20x Stamping Presses (Cold forming)
- LASER MACHINE – LVD PUMA FL4020
- HYDRAULIC PRESS BRAKE – BENDING MACHINE (LVD PPEB 220/30)
- Own tool shop
- 11x welding presses/resistance welding machines

LINIJA OF ECCENTRIC PRESSES RAVNE

RAVNE SE-2 630T (I.) | RAVNE SE-2 500T (II.) | RAVNE SE-2 630T (III.) | RAVNE SE-2 630T (IV.)

ECCENTRIC PRESSES

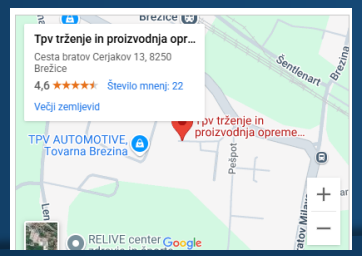
BENDING MACHINE LVD PPEB

CHECK TECHNICAL SPECIFICATIONS CATALOGE

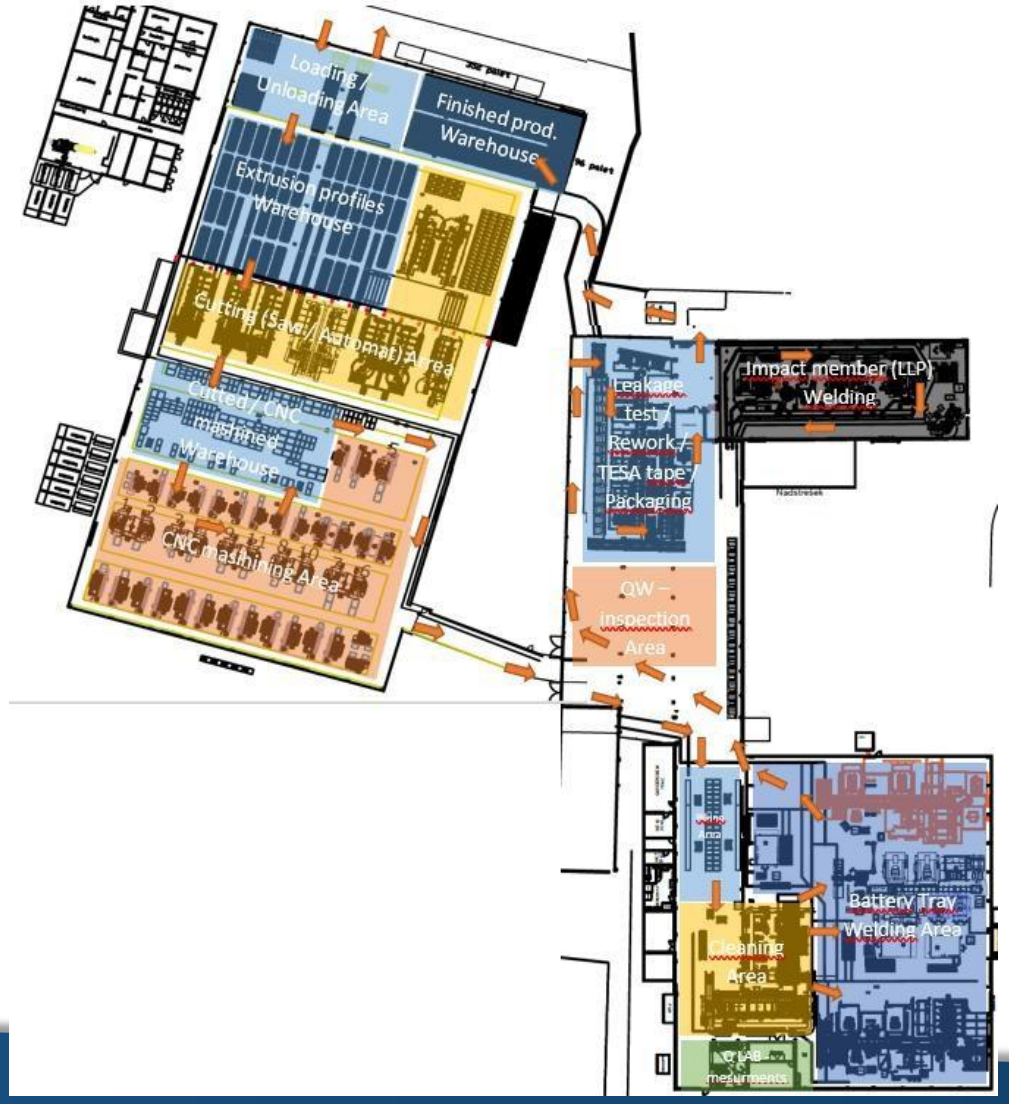
LASER LVD PUMA FL4020

ŠENTLENART FACTORY

CHECK LOCATION



LAYOUT ŠENTLENART – DEDICATED ALUMINUM ASSEMBLY PLANT



Processes:

- Warehouse
- CNC cutting area
- CNC machining area
- Leakage, rework and testing area
- Degreasing and passivation Al
- Assembly area
- Cleaning area
- Quality area

ŠENTLENART PLANT PROGRAM

Processes:

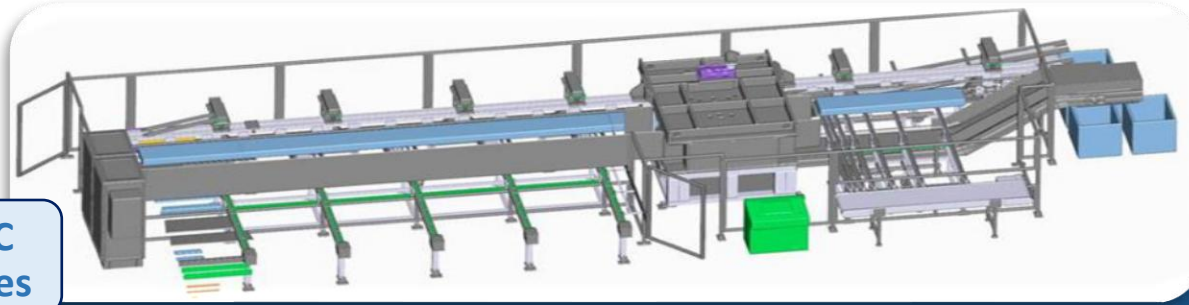
- Input material: 6m Al profiles, screws, nuts, rivets
- 10x Autmatic cutting line with robotization
- 40x CNC machining centers with robotization
- 2x Automatic washing line for degrasing and passivation Al
- 3x High-tech FSW and MIG/MAG welding line, riveting, sealant application, geometry control operations
- Robotized control line of special technical requirements
- 2x Robotized line for tightness control, rework, installation of protection and packaging
- Etching passivation

CHECK TECHNICAL SPECIFICATIONS CATALOGE

Robotized CNC machining centres

FSW, MIG welding line

Automated CNC saws/cutting lines



CNC MACHINING CENTERS

CNC Machining centers DNM:

- **750 L**
- **750 L High**
- **6700XL**
- **6700L**
- **5700**

- **Workpiece dimensions (X/Y/Z):**

from 1050 × 570 × 510 mm up to 2160 × 762 × 650 mm

- **Spindle speed:** from 8000 to 12,000 rpm
- **Spindle power:** 18.5 kW
- **Table load capacity:** from 1000 kg to 1800 kg
- **Spindle type:** ISO #40 (Big Plus)

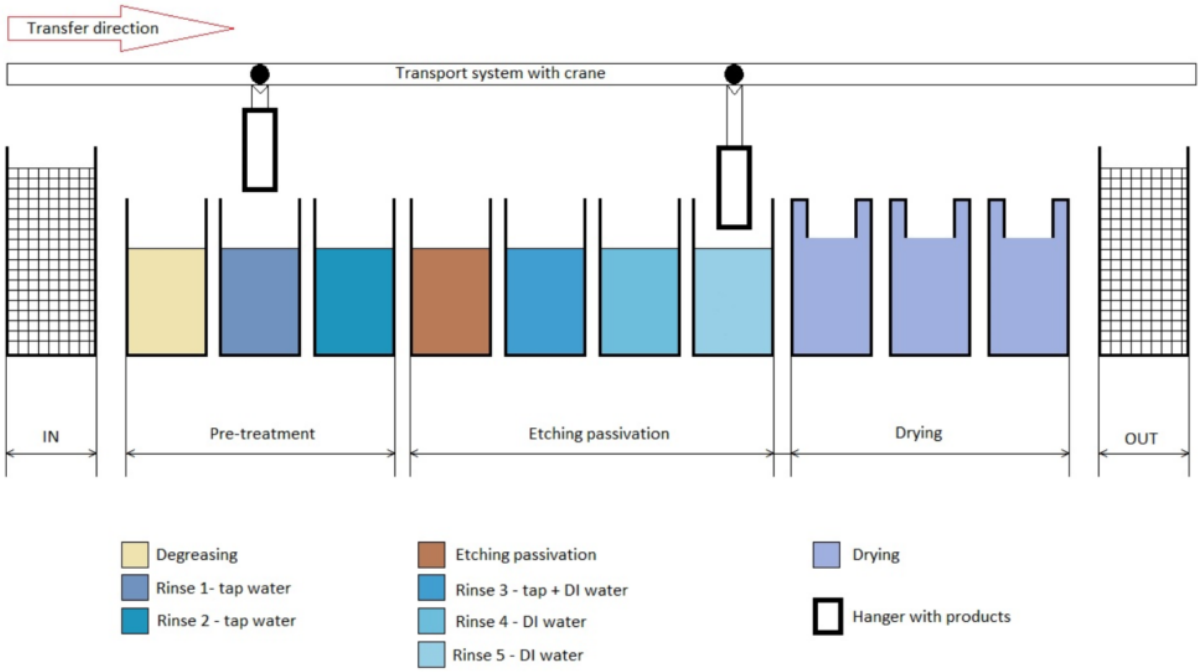
4-axis hydraulic CNC machining centers with direct-drive spindles, designed for high-precision machining of steel, aluminum, and alloys. Suitable for a wide range of industrial applications—from compact components to large structural parts in the automotive, aerospace, and general metalworking industries.

ETCHING PASSIVATION (Aluminium alloy)

Norms for Etching passivation:

- **Volvo**
- **BMW PV 97022**
- **Daimler & Mercedes Benz DBL_1175.11**
- **VW TL96223 & TL82428**
- **JLR TJLR-50-5002-2019**

Materials used for degresing and passivation: Henkel



Washing line 1

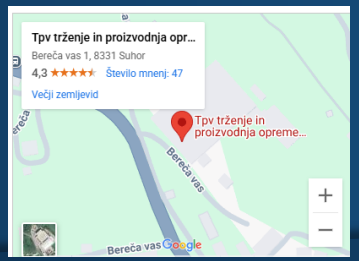
- Bath size:
  1000 x 890 x 1470 mm
- Weight: 200 kg

Washing line 2

- Bath size:
  - 500 x 800 x 1470 mm
- Weight: 400 kg

VELIKA LOKA FACTORY

CHECK LOCATION



VELIKA LOKA PLANT PROGRAM

CNC machining

Resistance welding line

KTL line

- Robotized projection/resistance welding lines
- Robotized MIG/MAG welding cells
- Sandblasting line
- CNC machining
- Powder coating
- E - coating (KTL) line

CHECK TECHNICAL SPECIFICATIONS CATALOGE

In-house Laboratory corrosion testing (salt baths, cyclic chamber) for some standards

Sandblasting line (implementation phase)

Robotized welding cells

Powder coating line

VELIKA LOKA PROGRAM – SURFACE PROTECTION

In-house Laboratory corrosion testing (salt baths, cyclic chamber) for some standards

KTL / E - coating:

- **Max. Product dimensions: 2000x800x1500**
- **Powder thickness: from 20µm to 35µm**
- **Quality of painted surface: 1000h salt bath or 42 cycles ECC1 (salt spray, rain)**

KTL line

POWDER COATING

- **Max. Product dimensions: 1300x800x400**
- **Conveyor load capacity: 150 kg**
- **Powder thickness: from 50µm to 150µm**

Powder coating line

KEY FIGURES

70+ years of experiences in the automotive industry

750+ employees

142 mio sales revenue (2024)

1000+ different products

6 location

50.000+ m² of total production area

FULL IN-HOUSE SUPPORT

- **RESEARCH** - cutting-edge expertise in modern materials and technologies
- Lightweight-driven **PRODUCT DEVELOPMENT** including **PROTOTYPING**
- Innovative **TECHNOLOGY DEVELOPMENT** for the high complexity challenges
- Versatile high-quality **PRODUCTION** capabilities

USP

Contacts:

Domen Fink
Director of Sales
d.dink@tpv.si
Mob: +386 51 348 856

Marko Kerep
Key Account Manager
m.kerep@tpv.si
Mob: +386 41 755 884

TPV AUTOMOTIVE

Brezina 101
8250 Brežice
Slovenia

You are kindly invited to visit us ☺

www.tpv-automotive.si