“placed exactly where you need us – in the heart of Europe”

Excellent road and rail connections ensure a good supply and timely distribution

95 km south from Graz (ca. 1 hour with car)
• Year of establishment: 1954
• Sales 2014: 138,464 t
• Turn over 2014: 281 mil. EUR
• Export: 80 %
• R & D: 5 % (7.5% Castings)
• Ownership: ELES 84%

*(ELES is Slovenian national electrical grid operator.)*

• Number of employees: 1,179

<table>
<thead>
<tr>
<th>TALUM Total</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue collar</td>
<td>956</td>
</tr>
<tr>
<td>White collar</td>
<td>223</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,179</td>
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</table>

<table>
<thead>
<tr>
<th>TALUM Castings (May 2015)</th>
<th></th>
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<tbody>
<tr>
<td>143</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
</tr>
<tr>
<td>165</td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Event</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>1954</td>
<td>Start up of Alumina Plant and Electrolysis A (17,000 t/y)</td>
</tr>
<tr>
<td>1964</td>
<td>Start up of Electrolysis B (45,000 t/y)</td>
</tr>
<tr>
<td>1988</td>
<td>Start up of Electrolysis C - Phase I (75,000 t/y)</td>
</tr>
<tr>
<td>1995</td>
<td><strong>Start-up with Low pressure-Die-Casting</strong></td>
</tr>
<tr>
<td>2003</td>
<td>Start up of Electrolysis C - Phase II (117,000 t/y)</td>
</tr>
<tr>
<td>2004</td>
<td>Total production (primary and re-melting) 155,000 t/y</td>
</tr>
<tr>
<td>2004</td>
<td>Acquisition certificate ISO/TS 16949</td>
</tr>
<tr>
<td>2006</td>
<td><strong>Start-up with Gravity-Die-Casting</strong></td>
</tr>
<tr>
<td>2007</td>
<td>Start-up with Re-melting Plant</td>
</tr>
<tr>
<td>2010</td>
<td>Start of 1 MWp Solar Power Plant</td>
</tr>
<tr>
<td>2011</td>
<td>Installation of additional 5MWp in 2011</td>
</tr>
<tr>
<td>2013</td>
<td><strong>42 new development items went into serial production</strong></td>
</tr>
<tr>
<td>2014</td>
<td>Increase of production (Turnover) + 105% against 2013</td>
</tr>
<tr>
<td>2015</td>
<td>Increase of production (Turnover) additional + 45% against 2014</td>
</tr>
</tbody>
</table>
TALUM’s area

100ha of factory yard, production buildings > 100,000m²
“our location and existing infrastructure enable further production expansion”
TALUM d.d.
(affiliated group)

**Production units**

- **Talum ALUMINIJ**
  (primary aluminium production)
- **Talum LIVARNA**
  (Foundry alloys, billets)
- **Talum RONDELICE**
  (slugs and discs production)
- **Talum IZPARILNIKI**
  (Roll-bond evaporators)
- **Talum ULITKI**
  (Castings)

**Service daughter companies (Ltd)**

- **Talum SERVIS IN INžENIRING doo**
  (engineering and maintenance)
- **Talum INšITUT doo**
  (research of metals, environment protection, counsel)
- **VITAL doo**
  (catering and commerce)
- **REVITAL doo**
  (sale of flowers, Vegetables, environment maint.)
- **STORAL doo**
  (wooden/metal products, packaging etc.)
- **VARGAS doo**
  (technical and fire protection of the property)
- **Talum Beograd doo**
  (collecting, sorting and processing of waste aluminium)
“Quality comes first”

ISO 9001:2008 (approval since 1996)

ISO 17025:2005

ISO 14001:2004 (approval since 2001)

ISO 18001:2007 (approval since 2001)

ISO/TS 16949:2010 (approval since 2004)

Certificate TÜV SÜD PED 97/23/EC

The Lightness of the Future
• spectrometer ARL 4460 SMS 1000
• thermo analyze IDECO TA74CT/VM613CO
• vacuum test UDIP 2000
• Microscopic test Leica MEF4M
• X Ray GE SEIFERT X-Cube (x/y/1050x1500mm, work piece up to 60kg), SEMI ADR + CT
• 3D coord. measurements, Wenzel (x/y/z/3000x1200x1000mm) DEA(x/y/z/2000x1000x860mm)
• mechanical properties, surface roughness
• diverse leakage test devices
TALUM CASTINGS
Each product is developed in cooperation with our customers from inquiry to order. Assurance of expected product properties by combining production and control technologies as well as following material flow through all production phases of our products.

**Key production technologies in company TALUM CASTINGS are:**

- **Gravity tilt and low pressure die casting,**
- Core production according to the ColdBox procedure,
- Thermal treatment T6,
- CNC - machining of castings.

**We produce:**

- **Aluminium castings, weight from 0.5 to 30 kg,**
- ColdBox sand cores, weight from 0.2 to 20 kg,
- Casting series from 3000 to 200.000 pieces per year,
- Annual casting production up to 2.500 tones (390.000 pieces),
- Up to 50 % of castings treated with CNC-machines.
INTRODUCTION  TALUM Castings - PROCES DEVELOPMENT LOOP

BUYER // input request
3D model / Catia
specification, alloy definition

TALUM R&D
design and process optimization,
alignment with customer

CORE BOX
design, manufacture

sand core simulation  casting simulation

MOULD,
design, manufacture

TALUM PRODUCTION
sand core production, casting,
finalization, CNC machining

x-ray  computer tomography  3D scan  3D CMM

TALUM R&D, PRODUCTION

PPAP // TALUM > BUYER  >>  SOP // BUYER > TALUM

The Lightness of the Future
Design Tools:
3D: Catia (3), Inventor (3)
2D: Auto cad (3)

Reverse Engineering Tools:
3D scan, Creaform (1)
Geo magic (1)
MAGMASOFT Integrating optimization tools in TALUM is being used for optimization of casting designs and combined processes. Upon definition of optimization goals we can evaluate the best possible solution from quality, economy and time perspective in advance. Empirical casting know-how is implemented into the set-up of casting and process design from the beginning. At TALUM we take great care by having our own equipment and team of skilled and trained operators.
“Incorporated Talum’s products and our partners”
<table>
<thead>
<tr>
<th>AUTOMOTIVE</th>
<th>SEGMENT</th>
<th>PARTS</th>
<th>WEIGHT [kg]</th>
<th>PROCESS/ REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine</td>
<td>CR pump housings</td>
<td>1.5 - 10.0</td>
<td>Technology: GDC or LPDC with sand core, porosity requirements (0.2mm), mechanical strength requirements Hardness &gt;80HB 5/250 Rm &gt; 160Mpa Rp 0.2 &gt; 120Mpa A5 &gt; 0.5%, machining</td>
<td></td>
</tr>
<tr>
<td>Engine</td>
<td>Air and cooling pipes</td>
<td>1.0 - 15.0</td>
<td>Technology: GDC with sand core, tightness requirements, machining</td>
<td></td>
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<tr>
<td>Engine</td>
<td>Engine brackets</td>
<td>0.5 - 5</td>
<td>Technology: LPDC, heat treatment T6, mechanical strength requirements Hardness 85-115HB 5/250 Rm &gt; 240Mpa Rp 0.2 &gt; 220Mpa A5 &gt; 1.3%, machining</td>
<td></td>
</tr>
</tbody>
</table>
### TALUM Castings

**“You can't be too light or too powerful”**

<table>
<thead>
<tr>
<th>AUTOMOTIVE</th>
<th>SEGMENT</th>
<th>PARTS</th>
<th>WEIGHT [kg]</th>
<th>PROCESS/ REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transmission</td>
<td>Drive, Clutch, Flywheel housings</td>
<td>1.5 - 30.0</td>
<td>Technology: GDC with or without sand core, or LPDC; heat treatment T6; mechanical strength requirements, Machining</td>
</tr>
<tr>
<td></td>
<td>Brakes</td>
<td>Retarder housings, Visco damper, housings</td>
<td>1.0 - 10.0</td>
<td>Technology: LPDC; heat treatment T6; mechanical strength requirements; Hardness &gt;100HB 5/250 machining</td>
</tr>
<tr>
<td></td>
<td>Suspension</td>
<td>Suspension carriers, Motorcycle swing arms</td>
<td>0.5 - 10</td>
<td>Technology: LPDC or GDC with sand core; heat treatment T6; mechanical strength requirements; Hardness &gt; 85HB 5/250; Rm &gt; 305Mpa; Rp 0.2 &gt; 240Mpa; A5 &gt; 5%; machining; Safety parts (x ray, cracks, mechanical properties monitoring)</td>
</tr>
<tr>
<td>ELECTRO INDUSTRY</td>
<td>SEGMENT</td>
<td>PARTS</td>
<td>WEIGHT [kg]</td>
<td>PROCESS/REQUIREMENTS</td>
</tr>
<tr>
<td>------------------</td>
<td>---------</td>
<td>-------</td>
<td>-------------</td>
<td>----------------------</td>
</tr>
<tr>
<td></td>
<td>Housings</td>
<td>Junction box housings EX</td>
<td>1.5 - 57.0</td>
<td>LPDC, mechanical strength requirements, pressure test, machining</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Command &amp; control unit housings</td>
<td>1.0 - 10.0</td>
<td>Technology: LPDC, mechanical strength requirements, machining</td>
</tr>
<tr>
<td></td>
<td>High voltage switchers</td>
<td>Contactor carrier</td>
<td>0.5 - 10</td>
<td>Technology: GDC dielectric surface requirements</td>
</tr>
<tr>
<td>HEATING INDUSTRY</td>
<td>SEGMENT</td>
<td>PARTS</td>
<td>WEIGHT [kg]</td>
<td>PROCESS/ REQUIREMENTS</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------</td>
<td>--------------------------------------------</td>
<td>-------------</td>
<td>---------------------------------------------------------------</td>
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<tr>
<td></td>
<td>LPG Boilers</td>
<td>Heat exchanger, fire/water body</td>
<td>5 - 15.0</td>
<td>Technology: GDC with sand core, tightness requirements,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>machining, water leakage proof test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LPG Boilers</td>
<td></td>
<td>Technology: LPDC, tightness requirements, machining,</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Differential pressure leakage proof test</td>
</tr>
<tr>
<td></td>
<td>Fire chamber housing</td>
<td></td>
<td>2 - 10</td>
<td></td>
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<tr>
<td>GENERAL ENGINEERING</td>
<td>SEGMENT</td>
<td>PARTS</td>
<td>WEIGHT [kg]</td>
<td>PROCESS/ REQUIREMENTS</td>
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<tr>
<td>---------------------</td>
<td>--------------</td>
<td>------------------</td>
<td>-------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ropeways</td>
<td>Ropeway wheels</td>
<td>3-20,0</td>
<td>Technology: LPDC, heat treatment, mechanical strength requirements, machining, Safety parts (x ray, cracks, mechanical properties monitoring)</td>
<td></td>
</tr>
<tr>
<td>Compressed air</td>
<td>Air management parts</td>
<td>2-10</td>
<td>Technology: LPDC, heat treatment, mechanical strength requirements, Hardness &gt; 90HB 5/250, Rm &gt; 290Mpa, Rp 0,2 &gt; 210Mpa, A5 &gt; 4%, In appliance with guideline 97/23/EG for pressure devices</td>
<td></td>
</tr>
</tbody>
</table>
**TALUM Castings**

**HIGH MECHANICAL PROPERTIES – “A project for you, a priority for us”**

### ALLOY 226 A

<table>
<thead>
<tr>
<th></th>
<th>Rm [Mpa]</th>
<th>Rp0,2 [Mpa]</th>
<th>A5 [%]</th>
<th>Hardness [HB]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard EN 1706</td>
<td>170</td>
<td>100</td>
<td>1</td>
<td>75</td>
</tr>
<tr>
<td>Talum</td>
<td>180</td>
<td>135</td>
<td>1</td>
<td>85</td>
</tr>
<tr>
<td>Difference</td>
<td>5%</td>
<td>35%</td>
<td>0%</td>
<td>13%</td>
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</table>

### ALLOY 239

<table>
<thead>
<tr>
<th></th>
<th>Rm [Mpa]</th>
<th>Rp0,2 [Mpa]</th>
<th>A5 [%]</th>
<th>Hardness [HB]</th>
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</thead>
<tbody>
<tr>
<td>Standard EN 1706</td>
<td>260</td>
<td>220</td>
<td>1</td>
<td>90</td>
</tr>
<tr>
<td>Talum</td>
<td>320</td>
<td>270</td>
<td>1,6</td>
<td>105</td>
</tr>
<tr>
<td>Difference</td>
<td>18%</td>
<td>22%</td>
<td>60%</td>
<td>21%</td>
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</table>

### ALLOY A1Si7Mg0,3 T6

<table>
<thead>
<tr>
<th></th>
<th>Rm [Mpa]</th>
<th>Rp0,2 [Mpa]</th>
<th>A5 [%]</th>
<th>Hardness [HB]</th>
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</thead>
<tbody>
<tr>
<td>Standard EN 1706</td>
<td>290</td>
<td>210</td>
<td>4</td>
<td>75</td>
</tr>
<tr>
<td>Talum</td>
<td>300</td>
<td>230</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Difference</td>
<td>3%</td>
<td>9%</td>
<td>250%</td>
<td>20%</td>
</tr>
</tbody>
</table>

---

**The Lightness of the Future**
All of the technologies are described in detail as follows:

**Melt preparation**
- ColdBox Cores
- Production of aluminium castings
- Casting finalisation
- Surface treatment
- Thermal treatment
- CNC-machining
- Washing of castings
- Leakage test
- Assembly, stamping bushes
- Casting packaging
- Warehouse, logistics

**Process-oriented quality management and requirements management**

- Spectrometry
- Thermal analysis, vacuum test
- Vacuum test
- X-Ray control, ADR
- CT tomography
- 3D scanning
- Mechanical testing
- Surface roughness
- 3D measurements
- Microscopy
- Leakproofness control (water, air)
MELTING AREA

- **Capacity:** 7,500 t / year

- **Melting Furnaces:**
  - ZPF 12 t (1x)
  - ZPF 2,5 t (1x)
  - MARCONI 2 t (2x, year 2014)
  - Hindenlang KLEP 1 t (2x)

- **Melt preparation:**
  - Vortex Impeller, degassing with Ar

- **Alloy Types:**
  - AlSi7Mg 0,3
  - AlSi10Mg (239 A)
  - AlSi9Cu3 (226 A)
CORE PRODUCTION / COLD BOX:

Lämpe machine: Typ L20 and L40

Core box, air-conditioned warehouse for core
Gravity casting machines: Senator KM8 (2x), Senator KM6 (10x), Senator KM4 (2x), Robot or manual ladling.

Robotized pouring of metal and taking parts out of mould, automatic heating the molds.

The Lightness of the Future
INTRODUCTION  TALUM Castings

PRODUCTION EQUIPMENT “Competence, experience and efficiency”

FOUNDARY : LOW PRESSURE CASTING :

Casting LPDC machines :

LPM (1x),
Röperwerk (4x).
X-Ray and SEMI ADR + CT

**GE Seifert X|cube**

**X Ray with CT Ability**
Combined 2D / 3D (computed tomography) with Cone beam - CT for detailed x-ray inspection provides a detailed resolution of about 0.1 mm depending on the sample size.
FINISHING

Feeder cutting and deburring

- robotic cell Pakman (Kuka, 2010, 1 device),
- three axis CNC saw Hora (2012, 2 devices),
- four axis CNC saw Koyama (2008, 2014, 2 devices)
- automatic band saw machine Ferina (2011, 1 device),
- manual machining center (6 devices),
- manual pneumatic equipment (milling cutters, files, grinders).
SURFACE TREATMENT, Shot blasting of castings

STELUX - C 30
hardness 42 HRC

STELUX - CN 30
hardness 30 HRC

The Lightness of the Future
INTRODUCTION ▶ TALUM Castings

MECHANICAL CNC MACHINING  “A project for you, a priority for us”
CNC CAD-CAM:
Master-cam

Machining Simulation

“TALUM Castings
A project for you, a priority for us”
MACHINING (milling, turning):
- Horizontal (3x Mori Seiki NH5000, 1x Toyoda FH500J, 2 x Heller MCP-H250), Vertical (WEMAS MCV1000)
- Turning (Daewoo Puma 350, 2 x Doosan Lynx 220LB), Partwasher line
TALUM Castings

PRODUCTION EQUIPMENT “Competence, experience and efficiency”

MACHINING (milling, turning):
- Horizontal (3x Mori Seiki NH5000, 1x Toyoda FH500J, 2 x Heller MCP-H250), Vertical (WEMAS MCV1000)
- Turning (Daewoo Puma 350, 2 x Doosan Lynx 220LB), Partwasher line
CONTROL OF PARTS

- 3D-measuring device: 3D DEA (x/y/z/2000x1000x860mm), 3D Wenzel (x/y/z/3000x1200x1000mm)
WAREHOUSE, LOGISTICS

"Competence, experience and efficiency"
Contacts:

<table>
<thead>
<tr>
<th>Mirko Veselic</th>
<th>Born on 28th July 1966 in Ptuj. In 1993 he graduated in the field of mechanical engineering from the Technical Faculty, University of Maribor. In 1994 he was employed as a technologist in the work unit Maintenance at Talum, in 1997 he became assistant manager in the work unit Aluminium processing. In 2004 he started managing the cast house first in the work unit alloy wheel production and from 2006 in the work unit Castings (low pressure die and gravity tilt casting with sand cores). In 2007 he was appointed to the position of purchasing manager at Talum. With company reorganization in 2010 he became managing director of the daughter company Vital d.o.o. He successfully managed this company till the spring of 2013; during his post the Pan was completely refurbished. In March 2013 he was appointed to the position of the managing director of Talum Ulitki d.o.o. due to his personal characteristics, excellent work results and as a sign of trust from the Board.</th>
</tr>
</thead>
</table>
| Executive manager | Tel.: +386 2 7995 570  
Fax.: +386 2 7995 579  
E-mail: mirko.veselic@talam.si |

<table>
<thead>
<tr>
<th>Davor Pecnik</th>
<th>Born on 15th April 1969 in Celje. In 1996 he graduated from marketing on Faculty of Economics, University of Maribor. In 1996 he started working at company Impol Inotechna d.o.o., responsible for purchasing, logistics and custom clearance in production of processing equipment for aluminum industry. From 2003 he worked for the company Alupak d.o.o. as a key account manager in the field of flexible aluminium packaging. In 2008 joined TALUM as commercial startupper for castings, he has been working for Talum as head of Commercial department at Talum Ulitki since it’s beginning in 2011.</th>
</tr>
</thead>
</table>
| Sales manager | Tel.: +386 2 7995 856  
Fax.: +386 2 7995 579  
E-mail: davor.pecnik@talam.si |
“Thank you for your attention”

more ...  www.talum-castings.com