Automotive aluminum castings and market trends

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Market Intelligence Manager
Aluminum
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Nemak's overview
Nemak is one of the core divisions of Alfa

2013 US$ B
Revenues $15.9

Petrochemicals 44%
Auto-parts 28%
Food 24%
Telecomm. 3%
Exploration & Production 1%
## Nemak at a glance

### Highlights
- Leading supplier of complex, high-tech automotive aluminum components
- Global footprint across 15* countries
- Diversified product portfolio and customer base
  - More than 50 customers worldwide
  - Supplying 650+ vehicle platforms
- Experienced management team

### 2013 Key Metrics

<table>
<thead>
<tr>
<th></th>
<th>2013 Key Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants:</td>
<td>35*</td>
</tr>
<tr>
<td>Capacity:</td>
<td>55 Mill. equivalent units</td>
</tr>
<tr>
<td>Employees:</td>
<td>~20,000</td>
</tr>
</tbody>
</table>

### 2013 Revenues

- Cylinder Head: 51%
- Engine Block: 33%
- Transmissions: 13%
- Other: 2%

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*Considering the recently approved plant in Russia, which will be fully operational in 2015*
Long-term relationships with key automotive customers
Global footprint serving all major markets

- 35 manufacturing facilities strategically located close to its customers sites
  - North America (17), Europe (12), South America (3), Asia (3)

*Fully operational by 2015
Focused on complex high-tech aluminum components for the automotive industry, reducing vehicle weight

<table>
<thead>
<tr>
<th>Powertrain</th>
<th>Structural Components</th>
</tr>
</thead>
</table>
| **Cylinder Head**  
Main Trends - Increased mechanical properties, Complex designs, integrated manifold  
| **Longitudinal Members, Cross Members, Shock Towers, Pillars**  
Main Trends – Shift from steel (stamping) to aluminum (integrated castings) |
| **Engine Blocks**  
Main Trends – OEMs starting to switch diesel blocks to aluminum and accelerating replacement of remaining cast iron blocks in gasoline engines  
|   |
| **Transmissions**  
Main Trends – Shift to complex automatic transmissions and increasing number of gears  
|   |

Diagram showing various parts of a vehicle with labels for Cylinder Heads, Engine Block, Cross Member, Shock Tower, Frame Rail, Cargo Floor Reinforcement, Tank Cover Frame, and Transmission Housing.
Aluminum penetration allows Nemak to grow faster than the industry

Global Cylinder Head Demand
(M Units)

Global Engine Block Demand
(M Units)

<table>
<thead>
<tr>
<th>Year</th>
<th>Aluminum</th>
<th>Iron</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>118</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>103</td>
<td>4</td>
</tr>
<tr>
<td>2010</td>
<td>4</td>
<td>103</td>
</tr>
<tr>
<td>2015</td>
<td>3</td>
<td>118</td>
</tr>
</tbody>
</table>

Incremental Market of 4.1 B USD(1)

Note: Global demand for light vehicles
Source: IHS Automotive (April 2013), Nemak research

(1) Calculated based on an average block price of 120 USD / unit
Nemak Global Aluminum consumption

NEMAK GLOBAL ´14e : 815 KMT

TOTAL NORTH AMERICA: 535

USA/CANADA: 200
- 380 WIS* ALA HPDC
- 380 ALA HPDC
- 319 TEN
- 380 KTY*
- 319 CAN HF
- 319 ALA LF

SOUTH AMERICA: 335
- 319-356 MTY*
- 319 SAL
- 319-356 MVA

MEXICO: 34
- 319-380 BRA
- 319-380 ARG

EUROPE: 222
- 319 DIL
- 380-319 POL
- 355-319 WER
- 319-356 GYR
- 380 SPA*
- 356P-319 LNZ
- 356-356P SVK
- 319 CZR

ASIA: 25
- 319-386 NAN
- 319-380 CHE
- 319-380 CHQ

Alloys Distribution:
- 319: 13%
- 380: 24%
- 356/356P: 63%

* Melting Center
- Vertical integration to supply internal demand and also external customers
  - +330 kton capacity
  - Benchmark practices
Auto Industry Trends

Growing Markets
- China, India and Europe will be major contributors for future growth
  - China and India will account for ~35% of the total sales by 2020
  - Europe gradually recovering pre-crisis levels

Fuel Efficiency
- Stricter fuel efficiency regulations
- Light weighting, powertrain improvement, hybridization & electrification

Connectivity
- Infotainment, traffic assist, autonomous cars
- All major OEMs making alliances with tech companies

Safety
- Drive assistance in emergency situations
- Traffic recognition and pedestrian detection
Global light vehicle sales

- US has reached pre crisis levels, marginal growth expected
- China continues with significant growth
- Europe recovering at a modest pace

Source: Nemak research, IHS Automotive (September 2014)
Light-weighting trend

- OEMs implementing actions to reach aggressive fuel economy targets
  - Powertrain, weight, transmissions, electrification
- Light weighting trend will continue pushing aluminum usage
  - Aluminum usage for vehicles will increase by US$30 B

Fuel Economy – Normalized to US Standards

<table>
<thead>
<tr>
<th>Year</th>
<th>US</th>
<th>EU</th>
<th>Japan</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>245</td>
<td>268</td>
<td>278</td>
<td>284</td>
</tr>
<tr>
<td>2012</td>
<td>326</td>
<td>336</td>
<td>346</td>
<td>356</td>
</tr>
<tr>
<td>2020</td>
<td>426</td>
<td>436</td>
<td>446</td>
<td>456</td>
</tr>
</tbody>
</table>

Targets in MPG:
- US 2025: 56.2
- EU 2021: 60.6
- Japan 2020: 55.1
- China 2020: 50.1

Source: International Council of Clean Transportation, Ducker Worldwide
Five different avenues to accomplished fuel emissions regulations

- **Engine technology**
  - Engine downsizing
  - Energy loss reduction
  - Turbo housing
  - Vaporization & combustion optimization
  - Start-stop system
  - Aluminum castings

- **Weight**
  - Lightweight material
  - New manufacturing technologies
  - Content optimization

- **Transmissions**
  - Dual clutch
  - Increase numbers of gears
  - Continuous variable transmissions

- **Aerodynamics**
  - Optimized design (drag coefficient and frontal area)
  - Optimized tires

- **Power management**
  - Switch from mechanical to electric accessories
  - Optimization of accessories’ electric consumption

2020 max potential % CO₂ reduced

- Engine technology: ~40%
- Weight: ~8 – 12%
- Transmissions: ~5 – 10%
- Aerodynamics: ~5%
- Power management: ~3 – 5%

**Nemak Opportunities**

Source: European Aluminum Association, BCG analysis, Nemak research
Aluminum structural components growth drivers

- Strict emissions and fuel economy regulation
- Increasing pressure on OEMs
- Vehicle weight is a key lever to meet regulations

- Aluminum substitution in body-in-white, including Structural Components
- Trend began with European premium OEMs and selected North American OEMs
  - Audi, Jaguar, Land Rover, Porsche, Mercedes Benz and BMW
- Current market size of ~1 B USD with a potential to reach ~7 B by 2025
Fuel emission regulations driving aluminum usage

Aluminum Pounds per Vehicle

<table>
<thead>
<tr>
<th>Year</th>
<th>North America</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>272</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>316</td>
<td>218</td>
</tr>
<tr>
<td>2009</td>
<td>327</td>
<td>258</td>
</tr>
<tr>
<td>2012</td>
<td>343</td>
<td>294</td>
</tr>
<tr>
<td>2020</td>
<td>452</td>
<td>308</td>
</tr>
<tr>
<td>2025</td>
<td>550</td>
<td>463</td>
</tr>
</tbody>
</table>

CAGR

- U.S. – 3.6%
- Europe – 3.2%

Source: Ducker Worldwide, Nemak research
Structural components with the highest projected growth

NA and EU LV Aluminum Content
(pounds per vehicle)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Others</td>
<td>301</td>
<td>324</td>
<td>350</td>
<td>380</td>
<td>426</td>
<td>475</td>
</tr>
<tr>
<td>Heat Transfers</td>
<td>24</td>
<td>33</td>
<td>43</td>
<td>54</td>
<td>58</td>
<td>64</td>
</tr>
<tr>
<td>Wheels &amp; Brakes</td>
<td>43</td>
<td>46</td>
<td>50</td>
<td>54</td>
<td>58</td>
<td>64</td>
</tr>
<tr>
<td>Transmissions</td>
<td>31</td>
<td>33</td>
<td>34</td>
<td>35</td>
<td>37</td>
<td>39</td>
</tr>
<tr>
<td>Engine Blocks</td>
<td>55</td>
<td>58</td>
<td>61</td>
<td>64</td>
<td>67</td>
<td>71</td>
</tr>
<tr>
<td>Cylinders Heads</td>
<td>55</td>
<td>55</td>
<td>60</td>
<td>65</td>
<td>71</td>
<td>79</td>
</tr>
</tbody>
</table>

Source: Ducker Worldwide, Nemak research
Premium OEMs expected to drive aluminum growth

### Top 20 vehicle models with highest Aluminum content (2012)

*Aluminum kg / vehicle*

<table>
<thead>
<tr>
<th>Model</th>
<th>Al weight percentage</th>
<th>Units produced (K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Rover</td>
<td>21%</td>
<td>27</td>
</tr>
<tr>
<td>Jaguar XJ</td>
<td>30%</td>
<td>15</td>
</tr>
<tr>
<td>Audi A8</td>
<td>28%</td>
<td>36</td>
</tr>
<tr>
<td>Jaguar XK</td>
<td>27%</td>
<td>4</td>
</tr>
<tr>
<td>Mercedes S-Class</td>
<td>19%</td>
<td>61</td>
</tr>
<tr>
<td>BMW 7</td>
<td>18%</td>
<td>57</td>
</tr>
<tr>
<td>Audi A7</td>
<td>18%</td>
<td>29</td>
</tr>
<tr>
<td>BMW 5</td>
<td>19%</td>
<td>370</td>
</tr>
<tr>
<td>Porsche Panamera</td>
<td>17%</td>
<td>27</td>
</tr>
<tr>
<td>Porsche Cayenne</td>
<td>13%</td>
<td>83</td>
</tr>
<tr>
<td>Audi TT</td>
<td>18%</td>
<td>22</td>
</tr>
<tr>
<td>Audi Q5</td>
<td>13%</td>
<td>210</td>
</tr>
<tr>
<td>VW Touareg</td>
<td>10%</td>
<td>88</td>
</tr>
<tr>
<td>Volvo XC60</td>
<td>11%</td>
<td>113</td>
</tr>
<tr>
<td>Mercedes C-Class</td>
<td>13%</td>
<td>394</td>
</tr>
<tr>
<td>Audi Q3</td>
<td>12%</td>
<td>107</td>
</tr>
<tr>
<td>BMW 3</td>
<td>13%</td>
<td>415</td>
</tr>
<tr>
<td>Land Rover Evoque</td>
<td>11%</td>
<td>112</td>
</tr>
<tr>
<td>Volvo S60</td>
<td>12%</td>
<td>68</td>
</tr>
<tr>
<td>Audi A3</td>
<td>13%</td>
<td>165</td>
</tr>
</tbody>
</table>

Source: Ducker Worldwide, Nemak research, IHS Automotive
Secondary Foundry Alloy (SFA)

Higher content of hardeners (Si+Cu) and wider ranges for non desired elements (Fe+Zn), allowing the usage of scrap material:

- AlSi9Cu3 – 380 – ADC12
- AlSi7Cu3 – 319
- AlSi10MgCu – 356.1 – AC2A

Primary Foundry Alloy (PFA)

High aluminum content and lower tolerances to impurities
Main alloy for the upcoming structural components
Only able to be produced with primary metal:

- AlSi7Cu0.5 – 356.2

Chemical Composition

<table>
<thead>
<tr>
<th>Element</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td>S</td>
<td>Sec</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Si</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cu</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Zn</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Mn</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Industry served

- Packaging
- Naval
- Construction
- Aerospace
- Automotive

Nemak Alloys

- P1020
- 1100
- 2010
- 3003
- 5154
- 6063
- 7021
- 356.2
- 356.1
- 319.1
- 380.0

*Avg. content (Aluminum Association)
Primary aluminum

Global production 48 mtons (2013)
China the main consumer (47%)
• Aluminium capacity continues to climb in China
• China will remain self-sufficient in aluminium
China's consumption = 1.7 times USA + Japan + Western Europe.

Source: ScotiaBank
Aluminum weak prices, checked by smelter expansion in China

LME aluminium pricing below average world cash costs for smelters (~US$ 1,905/t).

Smelters are covering costs with record premia, pushed by queues and financial deals (~US$ 506/t) or +25% of LME price

Source: LME, Nemak Global Metal Report and ScotiaBank
Primary vs Secondary Alloys

High pressure alloy (380) derived to smaller discount vs primary alloys

Source: Nemak Global Metal Report, LME and Platt’s
US Aluminum Scrap exports

Continuous demand from emerging countries (Asia)
China’s green fence strategy limiting the import of lower scrap grades

US Exports of Aluminum Scrap

Source: Compiled by Nemak with data of U.S. Commerce Department and AMM

* no breakdown available for 2012 and 2013
Die Casting Alloy (380) vs US Transactions price

Increased alloy demand and scrap shortages has supported secondary alloy price

Source: Platt's
Die Casting Alloy price US vs EU

Similar trends with some arbitrage opportunities

Source: Platt’s and Metal Bulletin
US Transactions price vs Scrap (Old cast)

Increased alloy demand and scrap shortages has supported scrap pricing

Source: Platt’s
Price forecast

Bullish sentiment across analysts for 2015

LME Forecast

Source: Bloomberg Oct 2014
Aluminum trends in automotive

- Growing car production in the coming years leaded by emerging economies
- Stringent emissions regulation driving aluminum substitution
  - Vehicle weight is a key lever to meet such regulations
- Next wave of aluminum substitution to come from body-in-white, including Structural Components
- Trend has already begun with European premium OEMs

Opportunities in the aluminum supply chain
- Sustainable relationships among producers and consumers
- Direct relationship with aluminum alloy producers
- Long term formula contracts
- Material Swap, reducing logistics and process cost
- Improve recycling rate and keep it within the region
- Hedge to reduce exposure to market volatility
- Build loyal relationship

Source: Nemak research
Thank you

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