Automotive aluminum castings and market trends

Norberto F. Vidaña
Market Intelligence Manager
Aluminum
Contents

• Nemak’s overview
• Automotive Industry overview
• Aluminum Market overview
• Price trends

Disclaimer:
This report is presented for informational purposes only. It is not intended to be a comprehensive or detailed statement or report on any subject and no representations or warranties, express or implied, are made as to its accuracy, timeliness or completeness. Nothing in this report is intended to provide financial, legal, accounting or tax advice nor should it be relied upon. Neither NEMAK nor the author is liable whatsoever for any loss or damage caused by, or resulting from, any use of or any inaccuracies, errors or omissions in the information provided.
Nemak’s overview
Nemak is one of the core divisions of Alfa

2013 Revenues $15.9B

Revenues

2013

US$ B

Petrochemicals

44%

Auto-parts

28%

Food

24%

Telecomm.

3%

Exploration & Production

1%

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**

- Plants: 35*
- Capacity: 55 Mill. equivalent units
- Employees: ~20,000

---

* Considering the recently approved plant in Russia, which will be fully operational in 2015

---

**2013 Revenues**

- Engine Block 33%
- Cylinder Head 51%
- Transmissions 13%
- Other 2%
Focused on complex high-tech aluminum components for the automotive industry, reducing vehicle weight

**Powertrain**

**Cylinder Head**
Main Trends - Increased mechanical properties, Complex designs, integrated manifold

**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

---

**Structural Components**

**Longitudinal Members, Cross Members, Shock Towers, Pillars**
Main Trends – Shift from steel (stamping) to aluminum (integrated castings)
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*
NEMAK GLOBAL ´14 : 815 KMT

TOTAL NORTH AMERICA: 535

USA/CANADA: 200
- ALLOY 380: SITE WIS*
- ALLOY 380: SITE ALA HPDC
- ALLOY 319: SITE MEX
- ALLOY 319: SITE ALA LF

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

EUROPE: 222
- ALLOY 319: SITE DIL
- ALLOY 380: SITE SPA*
- ALLOY 356P: SITE LNZ
- ALLOY 356: SITE SVK
- ALLOY 319: SITE CZR

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

* Melting Center

Alloys Distribution:
- 319: 63%
- 380: 13%
- 356/356P: 24%
Nemak Premium Alloys Unit (México)

- Vertical integration to supply internal demand and also external customers
  - +330 kton capacity
  - Benchmark practices
Automotive Industry Overview
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
- Aluminum pricing is volatile and under uncertainty (Financial deals, Queues, Energy pricing, Scrap exports, Forex,…)
- Opportunities in the aluminum supply chain
  - Closed loops among producers and consumers
  - Direct relationship with 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
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)
Market trend
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
- Aluminum pricing is volatile and under uncertainty (Financial deals, Queues, Energy pricing, Scrap exports, Forex,…)
- Opportunities in the aluminum supply chain
  - Closed loops among producers and consumers
  - Direct relationship with 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
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
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 (MPG)

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

### Pounds Per Vehicle

- 2002: 245
- 2012: 326
- 2020: 426

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

- **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

Levers

2020 max potential % CO₂ reduced

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

Source: European Aluminum Association, BCG analysis, Nemak research
### Structural components with the highest projected growth

#### NA and EU LV Aluminum Content (pounds per vehicle)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder Heads</td>
<td>52</td>
<td>53</td>
<td>54</td>
<td>55</td>
<td>55</td>
<td>57</td>
</tr>
<tr>
<td>Engine Blocks</td>
<td>51</td>
<td>55</td>
<td>60</td>
<td>65</td>
<td>71</td>
<td>79</td>
</tr>
<tr>
<td>Transmissions</td>
<td>45</td>
<td>47</td>
<td>49</td>
<td>51</td>
<td>53</td>
<td>57</td>
</tr>
<tr>
<td>Wheels &amp; Brakes</td>
<td>55</td>
<td>58</td>
<td>61</td>
<td>64</td>
<td>67</td>
<td>71</td>
</tr>
<tr>
<td>Heat Transfers</td>
<td>31</td>
<td>33</td>
<td>34</td>
<td>35</td>
<td>37</td>
<td>39</td>
</tr>
<tr>
<td>Others</td>
<td>43</td>
<td>46</td>
<td>50</td>
<td>54</td>
<td>58</td>
<td>64</td>
</tr>
<tr>
<td>Structural Components</td>
<td>301</td>
<td>324</td>
<td>350</td>
<td>380</td>
<td>426</td>
<td>475</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)

Range Rover 561 21%
Jaguar XJ 546 30%
Audi A8 538 28%
Jaguar XK 453 27%
Mercedes S-Class 388 19%
BMW 7 358 18%
Audi A7 322 18%
BMW 5 307 17%
Porsche Panamera 306 13%
Porsche Cayenne 279 13%
Audi TT 270 13%
Audi Q5 228 10%
VW Touareg 219 11%
Volvo XC60 203 13%
Mercedes C-Class 202 13%
Audi Q3 200 12%
BMW 3 198 13%
Land Rover Evoque 194 11%
Volvo S60 184 12%
Audi A3 169 13%

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:

380 - AlSi9Cu3 – 226 – ADC12  
319 - AlSi7Cu3  
356.1 - 233 – 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:

356.2 - AlSi10MgCu

---

### Chemical Composition

<table>
<thead>
<tr>
<th>Aluminum Alloys*</th>
<th>Al</th>
<th>Fe</th>
<th>Zn</th>
<th>Si</th>
<th>Cu</th>
<th>Mn</th>
<th>Mg</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>6063</td>
<td>51%</td>
<td>5%</td>
<td>4%</td>
<td>8%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>20%</td>
</tr>
<tr>
<td>2010</td>
<td>50%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
<td>20%</td>
</tr>
<tr>
<td>1100</td>
<td>55%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
<td>20%</td>
</tr>
<tr>
<td>3003</td>
<td>50%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
<td>20%</td>
</tr>
<tr>
<td>5154</td>
<td>55%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
<td>20%</td>
</tr>
<tr>
<td>6063</td>
<td>50%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
<td>20%</td>
</tr>
<tr>
<td>7021</td>
<td>55%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
<td>20%</td>
</tr>
</tbody>
</table>

---

**Industry served**

- Packaging
- Naval
- Construction
- Aerospace
- Automotive

---

*Nemak Alloys

356.2
356.1
319.1
380.0

*Avg. content (Aluminum Association)*
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
- **Aluminum pricing is volatile and under uncertainty** (Financial deals, Queues, Scrap exports, Energy pricing, Forex,…)
- Opportunities in the aluminum supply chain
  - Closed loops among producers and consumers
  - Direct relationship with 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
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 (~USCt 24/Lb) or +29% 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**

<table>
<thead>
<tr>
<th>Year</th>
<th>Others</th>
<th>Mexico</th>
<th>Canada</th>
<th>India</th>
<th>Japan</th>
<th>S. Korea</th>
<th>Hong Kong</th>
<th>Taiwan</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>631</td>
<td></td>
<td>1,016</td>
<td>1,339</td>
<td>1,039</td>
<td>21</td>
<td>15</td>
<td>52</td>
<td>930</td>
</tr>
<tr>
<td>2005</td>
<td>893</td>
<td></td>
<td>1,016</td>
<td>1,339</td>
<td>1,039</td>
<td>21</td>
<td>15</td>
<td>52</td>
<td>1,258</td>
</tr>
<tr>
<td>2006</td>
<td>1,515</td>
<td>134</td>
<td>1,016</td>
<td>1,339</td>
<td>1,039</td>
<td>21</td>
<td>15</td>
<td>52</td>
<td>1,742</td>
</tr>
<tr>
<td>2007</td>
<td>1,919</td>
<td>247</td>
<td>1,016</td>
<td>1,339</td>
<td>1,039</td>
<td>21</td>
<td>15</td>
<td>52</td>
<td>2,522</td>
</tr>
<tr>
<td>2008</td>
<td>1,515</td>
<td>134</td>
<td>1,016</td>
<td>1,339</td>
<td>1,039</td>
<td>21</td>
<td>15</td>
<td>52</td>
<td>1,742</td>
</tr>
<tr>
<td>2009</td>
<td>1,217</td>
<td>134</td>
<td>1,016</td>
<td>1,339</td>
<td>1,039</td>
<td>21</td>
<td>15</td>
<td>52</td>
<td>1,742</td>
</tr>
<tr>
<td>2010</td>
<td>1,447</td>
<td>134</td>
<td>1,016</td>
<td>1,339</td>
<td>1,039</td>
<td>21</td>
<td>15</td>
<td>52</td>
<td>1,742</td>
</tr>
<tr>
<td>2011</td>
<td>1,999</td>
<td>134</td>
<td>1,016</td>
<td>1,339</td>
<td>1,039</td>
<td>21</td>
<td>15</td>
<td>52</td>
<td>1,742</td>
</tr>
<tr>
<td>2012*</td>
<td>1,986</td>
<td>134</td>
<td>1,016</td>
<td>1,339</td>
<td>1,039</td>
<td>21</td>
<td>15</td>
<td>52</td>
<td>1,742</td>
</tr>
<tr>
<td>2013*</td>
<td>1,819</td>
<td>134</td>
<td>1,016</td>
<td>1,339</td>
<td>1,039</td>
<td>21</td>
<td>15</td>
<td>52</td>
<td>1,742</td>
</tr>
</tbody>
</table>

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

* no breakdown available for 2012 and 2013
US Transactions price vs Scrap (Old cast)

Increased alloy demand and scrap shortages has supported scrap pricing.
Die Casting Alloy (380) vs US Transactions price

Increased alloy demand and scrap shortages has supported secondary alloy price

Source: Platt’s
Bullish sentiment across analysts on late 2014 but complex year start
- Low energy pricing, strong dollar, financial deals, queues, ....

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
- Aluminum pricing is volatile and under uncertainty (Financial deals, Queues, Scrap exports, Energy pricing, Forex,…)

Opportunities in the aluminum supply chain

- Closed loops among producers and consumers
- Direct relationship with 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

Norberto F. Vidaña
Market Intelligence Manager
norberto.vidana@nemak.com