High-Strength Steels and Alloys for the Defense Industry
Our pledge:
Your satisfaction
Committed to support the Defense Industry

A long history
Aubert & Duval has the capability to design, melt, manufacture and market metallurgical products with high mechanical properties in steels, superalloys, aluminum and titanium alloys.

As a leading provider of forgings for gun barrels, Aubert & Duval has over 65 years of experience within this business segment and is proudly serving the gunner community both for new equipment and upgrades.

Qualified Products and Processes
Aubert & Duval is fulfilling the most stringent requirements for artillery applications.

Its sister company, Erasteel, a leading manufacturer of high speed steels, can supply tungsten alloyed high speed steel for ammunition application.

(AISI.T1 / HS 18.0.1 / AFNOR Z80WCV 18.4.1)

Development
Constantly seeking to meet customer’s demands, Aubert & Duval:
- Has developed High Strength Steel Grades for light gun turret and light artillery systems.
- Has recently announced its decision to further invest in titanium forgings, together with UKTMP, a leading supplier in titanium raw material.

Aubert & Duval is also involved in supplying forgings for Navy, Submarine and Torpedo applications.

Please ask for a dedicated brochure.
A Dedicated and Complete Line of Products
Your best source for custom forgings

Equipment to meet your specific needs
A well preserved know-how passed on over the years
Our range of equipment is one of the widest, most flexible and most modern in the world.
- 40 to 70-ton arc furnaces
- Ladle refining
- Vacuum degassing equipment
- Vacuum induction furnaces (VIM), up to 12 tons
- Electro-slag remelting furnaces (ESR), up to 25 tons
- Vacuum-arc remelting furnaces (VAR), up to 30 tons
- Atomizing towers for powder production.

Closed-die forgings
Open-die forgings

Forging presses
from 1,200 to 4,500 tons

Die forging presses
from 4,600 to 65,000 tons

Hammers
from 3,500 to 60,000 kg/m

Continuous forging machine
from Ø 70 to Ø 450 mm

Rolling mills
bars from Ø 7 to Ø 200 mm

Heat treatment furnaces
- Horizontal up to 21 meters
- Vertical up to 9.5 meters
Products for missiles

For every stressed component of a missile, Aubert & Duval offers:
- Tubes
- Forged and closed-die forged parts
- Rolled sheets
- Bars

Made of Maraging, stainless steel grades, aluminum or titanium alloys to meet the most stringent requirements for critical parts of a missile.

> Corrosion, extra-low or high-temperature resistance, ductility at negative temperature and weldability, mechanical resistance.

Aubert & Duval is also able to provide steels suitable for flow-forming, leading to specific mechanical properties.

### Form Fabrication process

<table>
<thead>
<tr>
<th>Form</th>
<th>Fabrication process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thin tubes</td>
<td>Extruded</td>
</tr>
<tr>
<td>Heavy tubes</td>
<td>Hot rolled / hollow forged</td>
</tr>
<tr>
<td>Sheet thickness &lt; 12 mm</td>
<td>Cold rolled</td>
</tr>
<tr>
<td>Sheet thickness &gt; 12 mm</td>
<td>Hot rolled</td>
</tr>
<tr>
<td>Bars Ø 130 to 200 mm</td>
<td>Rolled / forged</td>
</tr>
<tr>
<td>Bars Ø 300 mm</td>
<td>Forging machine</td>
</tr>
<tr>
<td>Forged parts</td>
<td>Open-die or closed-die</td>
</tr>
</tbody>
</table>

### A long history of proven systems

Antiship Missiles, Air to Air, Cruise Missiles, Ground to Air, Air to Ground, Tactical Missiles, Antitank Missiles (EXOCET® FAMILY - MICA® - STORMSHADOW® - ASTER® - AMRAAM® - SPIKE® - METEOR® - IRIS-T®).

Aubert & Duval fulfills the most stringent requirements in terms of grade composition, micro-structural material integrity, dimensional tolerances and quality control.

All our products comply with ASTM standards.

### Developments

- **New stainless steel grades:**
  NYB66 superaustenitic and MLX17 precipitation hardened stainless steel.

- **Powder Metallurgy:**
  Aubert & Duval also offers small and medium-size near-net-shape products to answer requirements for difficult-to-machine parts.

### Castings

Our castings are made of custom-designed grades to meet stringent requirements for demanding duties (up to 20 tons).

- We supply muzzle brakes - lashing hooks - hull parts, etc...
- For sight systems parts low expansion alloys are also available.
The fine art of making gun barrels

3 main steel grades designed for heavy gun barrels

The right steel for every application

- Field towed guns 105 - 122 - 155 mm
- Tank guns 60 - 90 - 100 - 105 - 120 - 125 - 140 mm
- Self-propelled howitzers 105 - 120 - 155 mm
- Naval guns 40 - 57 - 76 - 127 - 155 mm
- Mortars 60 - 81 - 120 - 160 mm
- Breech rings, breech blocks and muzzle brakes

Medium caliber barrels

- For medium caliber cannons 20 - 25 - 30 - 35 and 40 mm, we propose the following steel grades:

<table>
<thead>
<tr>
<th></th>
<th>GKH</th>
<th>GK4W</th>
<th>CLARM HB7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rm (N/mm²)</td>
<td>950</td>
<td>1000</td>
<td>1300</td>
</tr>
<tr>
<td>Rpo.2% (N/mm²)</td>
<td>790</td>
<td>840</td>
<td>1080</td>
</tr>
<tr>
<td>A5d (%)</td>
<td>17</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>KV -40 °C (J)</td>
<td>150</td>
<td>60</td>
<td>40</td>
</tr>
</tbody>
</table>

Corresponding data sheets are available on request.
Transportation and equipment

Closed-die forgings

Aluminum alloys series:
- 2000
- 5000
- 7000

Titanium alloys:
- T40
- Ti64

Superalloys Ni base

Special steels

Application | Commercial steel grades | EN grades
--- | --- | ---
Pinions and gears for transmissions | FAD/FADH | 16NiCrMo13
| FDMA | 30NiCrMo16
| V300 | 45SiCrMo6
| LX35 | X1CrNiMoAlTi12.10.2
| GKH/GK3 | 32CrMoV12 / 30CrMo12
| 819B | 36NiCrMo16

Torsion Bars
| V300 | 45SiCrMo6
| LX35 | X1CrNiMoAlTi12.10.2

Energy recovery systems
| F66S | 25CrMo4
| F65 | 34CrMo4
| GK3 | 30CrMo12
| NC25M | 28NiCrMo11

Rolled products

Cover
Gun shield
Hook support
Body receiver
Suspension arm
Loading arm
Support gun
Rim
1/2 Wheel for track

Rolled products
Assault weapons, pistols and accessories

Products / Applications:
Our GKH is manufactured by a special process which confers particular suitability for cold swaging of small caliber barrels.

The process has been perfected over the years to produce a steel which possesses excellent transverse properties, especially low temperature impact properties. Our tight control of the heat treatment process guarantees strong consistency in the mechanical properties, as well as very good dimensional stability during machining and while in service.

For the stainless versions, we would advise use of our MLX12 and MLX12H steels.

X15TN is a stainless steel exhibiting excellent corrosion resistance, high hardness and superb cutting properties. Because of this, it is particularly suitable for the production of knives and bayonets.

<table>
<thead>
<tr>
<th>Application</th>
<th>Commercial steel grades</th>
<th>EN grades</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firing pins</td>
<td>NCAV</td>
<td>12NiCr12</td>
</tr>
<tr>
<td></td>
<td>FDMA</td>
<td>30NiCrMo16</td>
</tr>
<tr>
<td></td>
<td>819B</td>
<td>36NiCrMo16</td>
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<tr>
<td></td>
<td>MY18</td>
<td>X2NiCoMo18.8.5</td>
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<tr>
<td>Extractors</td>
<td>FDMA</td>
<td>30NiCrMo16</td>
</tr>
<tr>
<td></td>
<td>FADH</td>
<td>16NiCrMo13</td>
</tr>
<tr>
<td></td>
<td>819AW</td>
<td>E35NiCrMo16-H</td>
</tr>
<tr>
<td></td>
<td>GKH</td>
<td>32CrMoV12.10</td>
</tr>
<tr>
<td></td>
<td>FND</td>
<td>15NiMoCr10</td>
</tr>
<tr>
<td>Ejectors</td>
<td>F65</td>
<td>34CrMo4</td>
</tr>
<tr>
<td></td>
<td>GH1</td>
<td>32CrMoV12.10</td>
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<tr>
<td></td>
<td>GH4W</td>
<td>40CrMoV12</td>
</tr>
<tr>
<td></td>
<td>MLX12*</td>
<td>X1CrNiMoAlTi12.9.2</td>
</tr>
<tr>
<td></td>
<td>MLX12H*</td>
<td>X1CrNiMoAlTi12.10.2</td>
</tr>
<tr>
<td>Barrels</td>
<td>F65</td>
<td>34CrMo4</td>
</tr>
<tr>
<td></td>
<td>GH1</td>
<td>32CrMoV12.10</td>
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</tr>
<tr>
<td>Knives &amp; Bayonets</td>
<td>X15TN</td>
<td>X40CrMoVN16.2</td>
</tr>
</tbody>
</table>

*stainless
The information and the data presented herein are typical or average values and are not a guarantee of maximum or minimum values. Applications specifically suggested for material described herein are made solely for the purpose of illustration to enable the reader to make his own evaluation and are not intended as warranties, either express or implied, of fitness for these or other purposes. Aubert & Duval’s liability shall not extend, under any circumstances, to the choice of the Product and its consequences.

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