



# FORGINGS FOR LARGE CALIBER GUNS

As a leading supplier of defense high performance steels, Aubert & Duval has over 65 years' experience in providing forgings for gun barrels. Aubert & Duval supports worldwide weapon manufacturing sector delivering forgings solutions for large gun calibers.



## Customer benefits

- + Combat proven
- + High endurance
- + Excellent behavior in any environmental conditions
- + Resistance to intensive fire rates
- + Extended munitions range
- + Long cycle life maintaining high accuracy
- + Optimized properties of dedicated alloys grades
- + Providing global solution for breech blocks rings and barrels
- + Dedicated Technical Support and R&D Team

## Increasing system life

Aubert & Duval CLARM® grades offer unique ability for:

- + Thickness Reduction due to high mechanical performances to decrease weight impact
- + Increasing systems service life
- + Cost reduction (maintenance & logistics) to battlefield
- + Acceptation of most demanding and powerful ammunitions

Aubert & Duval has the capability to vertically heat treat barrels in order to minimize distortion and residual stresses in the product, avoiding barrel deformation during machining and firing.

## Why using CLARM<sup>®</sup> steel grades?

- + 3 different CLARM<sup>®</sup> Grades depending on final requirements
- + Optimized chemical analyses for the best YS/KV (-40°C) and YS/K1C compromise
- + High toughness at -40°C; Typical K1C in the 140/180 MPa.m<sup>1/2</sup> range
- + Elevated temperature tensile strength up to 400°C
- + Allow homogeneous yield strength along the barrel for optimum autofrettage
- + Heat treated in vertical position for lower deformation and mechanical properties homogeneity

## Choose the best designed grade for your application

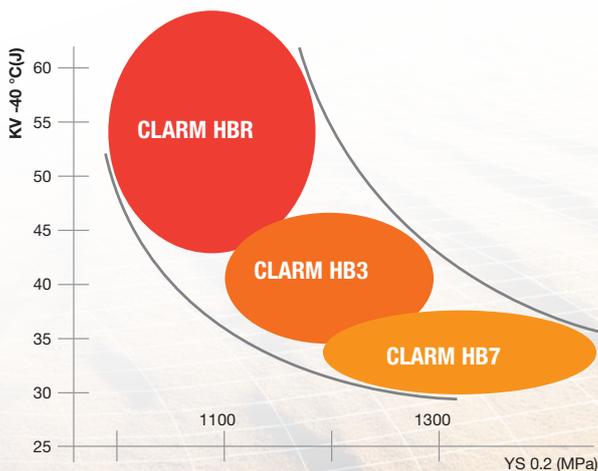
The choice of steel grade for gun barrel forgings is mainly governed by a compromise between yield strength (YS) and toughness at low temperatures (KV-40°C).

To guarantee these comprise the choice of optimum material for large gun barrels obviously fell on the Ni-Cr-Mo or Ni-Cr-Mo-V steels grades with a content of carbon between 0.3 et 0.4%. The chemical composition can be adjusted regarding the final mechanical properties.

Among the steel grades for artillery forgings available from Aubert & Duval, three are especially designed for gun blanks and mortar barrel forgings.

• CLARM<sup>®</sup>HBR / CLARM<sup>®</sup>HB3 / CLARM<sup>®</sup>HB7

The **CLARM<sup>®</sup> family** is famous worldwide for its exceptional combination of tensile strength, ductility and toughness. The steel grade choice is mainly governed by the required compromise between yield strength (YS) and toughness at low temperature (KV-40°C). See drawing below.



Corresponding data sheets are available on request.

## Applications design

- + **Field towed guns:**  
105 - 155 mm
- + **Tank guns:**  
60 - 90 - 100 - 105 - 120 - 125 - 140 mm
- + **Self-propelled howitzers:**  
105 - 155 mm
- + **Naval guns:**  
40 - 57 - 76 - 127 mm
- + **Mortars:**  
60 - 81 - 120 mm
- + **Breech ring and breech block**  
to complete any firing set

## CLARM<sup>®</sup>HBR

The grade used for the 155mm caliber Howitzer and 120mm battle tank is the CLARM<sup>®</sup>HBR. This steel grade shows a high level of impact toughness thanks to an optimization of the chemical analysis which able to water quench the forgings after austenitizing heat treatment. Combining high quenching rates and elevated tempering temperatures bring a best toughness/ ultimate strength compromise.

## CLARM<sup>®</sup>HBR & CLARM<sup>®</sup>HB7

The search for ever higher mechanical characteristics led a few years ago to the development of the CLARM<sup>®</sup>HBR and CLARM<sup>®</sup>HB7 grades, the latter allowing yield strength of more than 1300MPa combined with exceptional K1c values.

