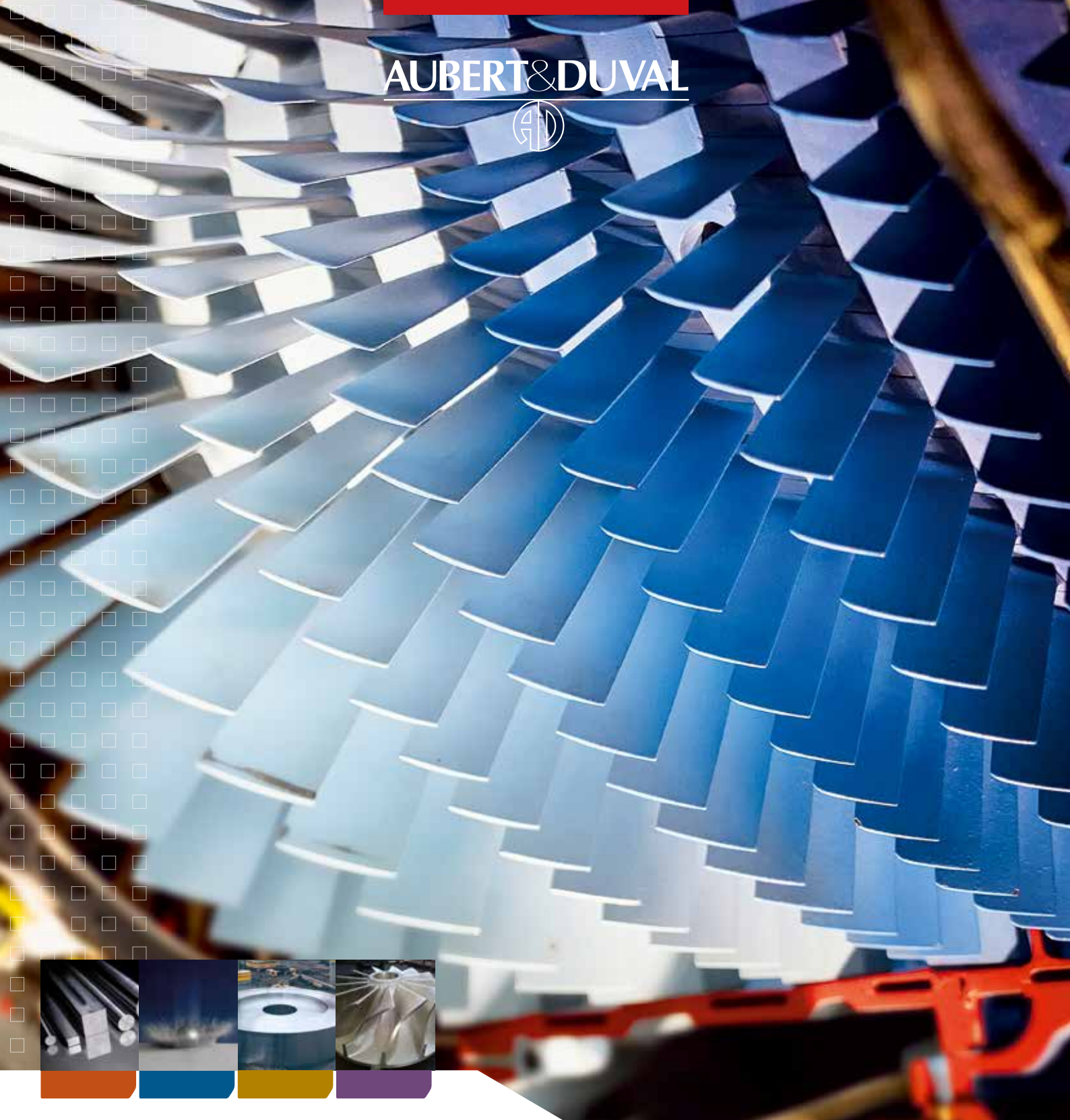


AUBERT&DUVAL



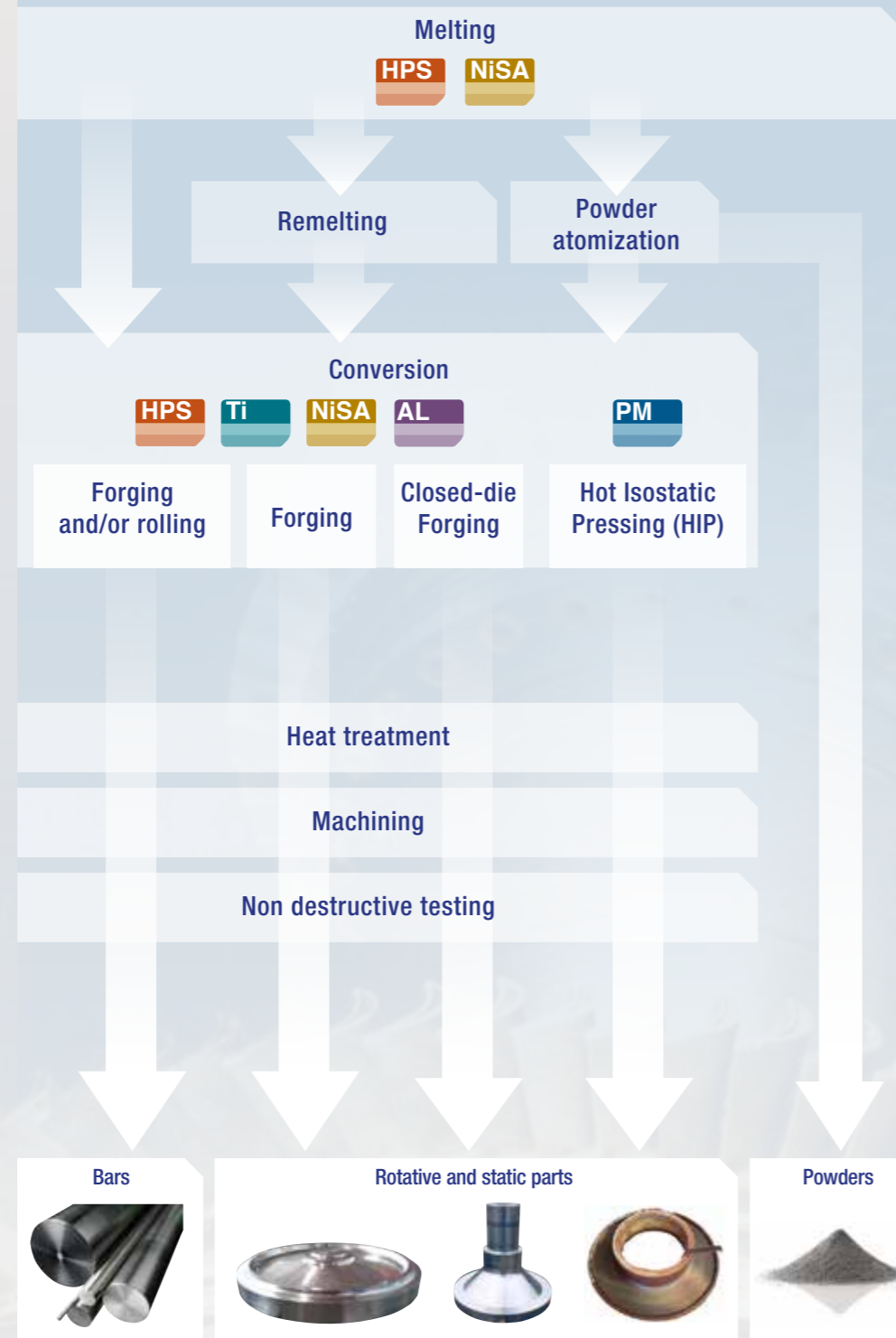
Steels and Alloys for Gas and Steam turbines

Enhancing your performance

Aubert & Duval: a supplier of choice for OEMs and MRO

Since the dawn of the 20th century, Aubert & Duval has been manufacturing products for the most stringent industries: power generation, oil & gas, aerospace, defense, nuclear, automobile. From small (2 to 3 MW) to the biggest heavy duty turbines (above 500 MW), Aubert & Duval is the partner of choice to develop and to produce materials and parts meeting the most severe requirements including corrosion resistance, fatigue, high stress and high temperature resistance.

Process flow



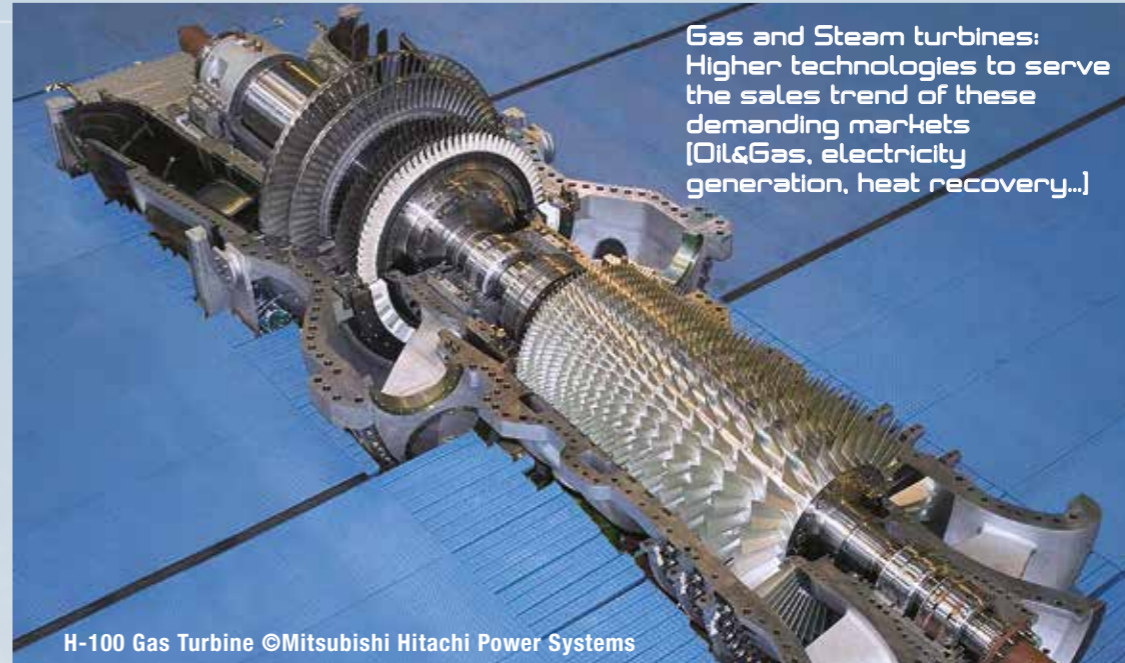
HPS
High Performance Steels:
A range of alloyed steels with tightly controlled characteristics offering optimum value for customers.

NiSA
Nickel-base Superalloys:
Nickel-based superalloys: materials keeping high surface integrity while withstanding severe mechanical stress in a high temperature and corrosive environment.

PM
Powder metallurgy:
Metal Powders (steels, superalloys, titanium) for additive manufacturing, HIP Net Shape parts.

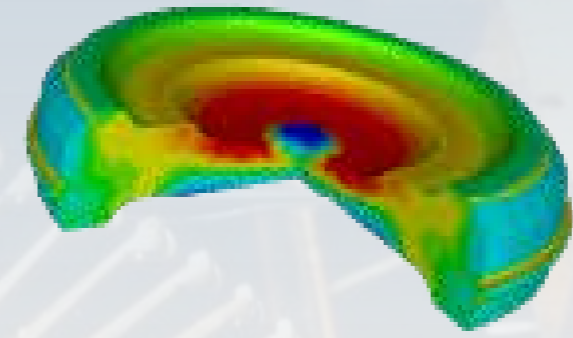
Ti
Titanium:
Pure or alloyed titanium, combining mechanical properties and corrosion resistant with light weight.

AL
Aluminum:
For specific applications combining resistance with light weight.



Vertically integrated from melting - including superalloy big diameter triple-melt ingots - through to forged and machined near-net shape parts, Aubert & Duval offers one of the largest and most comprehensive capabilities to design and manufacture critical closed-die superalloy forgings for land-based turbines. Aubert & Duval processes nickel-base alloys, high-performance steels, aluminum and titanium alloys. Typical products for power generation applications:

- Large, medium and small rotating open and closed-die forgings for gas turbines, compressors and expanders: disks, spacers, shafts, impellers...
- Forgings for steam turbines
- PM HIP static and rotating parts for gas turbines and compressors
- Metal Powders for additive manufacturing
- Non-magnetic retaining rings for generators
- Long products for blades, nuts and bolts, rods...



Equipment

- **MELTING**
Melting furnaces (EAF, AOD, VOD) up to 60 tons
Vacuum Induction Melting (VIM) up to 20 tons
Remelting furnaces (ESR, VAR) up to 30 tons
- **POWDER METALLURGY**
Atomization (Air, VIM)
- **FORGING**
Open-die forging presses from 1,500 to 10,000 tons
Closed-die forging presses from 4,500 to 65,000 tons
- **ROLLING MILL**
7-200 mm diameter bars
- **HEAT TREATMENT**
Solution and ageing furnaces
Horizontal and vertical quenching equipment
- **TESTING**
Immersion UT up to 13 tons (28,000 lbs)
Automated contact UT up to 20 tons



Forged and hipped parts for Power generation applications

Combining metallurgical expertise, outstanding industrial capabilities and high manufacturing skill, Aubert & Duval is involved in development programs for advanced generations of steam and gas turbines. Whether working on homogenous structure of closed-die forged superalloy massive discs for gas turbines, or wrought advanced materials for an ultra-high temperature steam turbine, Aubert & Duval is a partner for OEMs striving for technical, economic and environmental performance. Aubert & Duval spends nearly 5% of its added value every year on Research & Development.

Main materials

High performance steels

AD grade	Common name
NMF18	X8CrMnN18 -18
X13VD/X13VDW	JETHETE M152 X12CrNiMoV12-3 Cost E X12CrMoWVNbN10 -1-1
X17U4	17-4PH X5CrNiCuNb16-4
XN26TW	A286 X6NiCrTiMoVB25-15-2

Superalloys

AD grade	Common name
PER901	IN901 X4NiCrMoTi43-13
PER72	U720 NiCr18Co15TiMoAl
PER718	IN718 NiCr19Fe19Nb5Mo3
PER706	IN706 NiFe38Cr16Nb Alloy 617M
AD730® New*	NiCr16Co9Mo3W3Ti3Al2
PER263	IN263 NiCo20Cr20MoTi
PER3	Waspaloy NiCr20Co13Mo4Ti3Al

Aluminum Alloys

AD grade	Common name
AL2618	
AL7050	

Titanium Alloys

AD grade	Common name
TA6V	
Ti6-2-4-2	

Powder metallurgy

AD grade	Common name
Pearl® Micro	
Ni718	IN718
Ni625	IN625
Ni738LC	IN738
HX	Hastelloy® X
CoCr	CoCr (F75)
PER3	Waspaloy®
SYP3	Astroloy®

* Patented grade

Main data

Closed-die forgings (superalloys):

- Diameter up to 2 m / 79 in
- From 20 kgs / 44 lbs up to 13,000 kg / 28,600 lbs

Open-die forgings:

- up to 30,000 kg / 66,000 lbs

PM HIPPED parts

Metal powders for additive manufacturing

Gas turbines







Turbine shroud Astroloy® (PM HIP)
(37 kg – 82 lbs)



Rotor shaft – IN901
(479 kg – 1056 lbs)



Large turbine disc – IN718
(7,265 kg – 16,000 lbs)



Turbine impeller U720
(85 kg - 187 lbs)



Large turbine spacer – IN706
(9,000 kg – 19,841 lbs)



Turbine aft shaft – IN706
(9,000 kg – 19,841 lbs)



Large turbine disc – IN718
(8,731 kg – 19,249 lbs)

Expanders





Expander Discs – Waspaloy®
(1,500 kg – 3,307 lbs and 1,100 kg – 2,425 lbs)

Compressors









Impeller aluminum forging
(1,092 kg 2,407 lbs)



Impeller – IN625M (PM HIP)
(312 kg – 688 lbs)

Steam turbines (New generation)






Steam Turbine Rotor Shaft – Superalloy
(2,020 kg – 4,453 lbs)



Open die forging Superalloy
(3,365 kg – 7,418 lbs)

Powder metallurgy (AM and HIP)



Powders for Additive Manufacturing and HIPPED parts

Ni-Base	Ni 625, Ni 718, etc.
Co-Base	Co 6, Co 21, etc.
Ti-Base	Ti6Al4V, Ti6Al4V ELI
Steels	316L, 17-4PH, ASP®, etc.

Brochures “Hot Isostatic Pressing” and “Additive Manufacturing” are available on www.aubertduval.com

Generators



Please ask for the retaining rings brochure on www.aubertduval.com

A complete long products offer for Power generation applications

The initial quality of the selected material is key in the final performance of the part. We offer a wide range of products in several forms of bars (round, flat and square), billets, sheets and wire rods to better fit customers requirements. Because we offer more than just a bar of material, we bring technical support and innovation to our customers as well as different services in heat treatment and logistic.

HPS	
AD grade	Common name
56GE/W**	X20CrMoWVNb - AISI 422
56T5	X19CrMoNbVN11-1
MARVAL® X12H	X1CrNiMoAlTi12-10-2
MARVAL® 13X	X13CrNiMoAl13-8-2 (PH13-8Mo)
MLX® 17 New*	X1CrNiMoAlTi12-11-2
X12NBW**	X14CrNb12
X13VD/X13VDW	JETHETE M152 X12CrNiMoV12-3
X17U4	17-4PH X5CrNiCuNb16-4
XN26TW	A286 X6NiCrTiMoVB25-15-2

NiSA	
AD grade	Common name
PER718	IN718 NiCr19Fe19Nb5Mo3
AD730® New*	NiCr16Co9Mo3W3Ti3Al2
PER263	IN263 NiCo20Cr20MoTi
PER3	Waspaloy® NiCr20Co13Mo4Ti3Al

* Patented grade
** On request

Main Materials

HPS High Performance Steels	NiSA Ni-base Superalloys
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Innovation

A&D continuously develops new processes and new products able to face technical and economic challenges.

HPS MLX® 17

One of the main technical challenges to improve efficiency and reduce construction costs of power generation plants is to extend the last stage blades. MLX® 17 is a precipitation hardening martensitic stainless steel capable of tensile strength up to 1700 MPa, combined with high toughness, high fatigue and stress corrosion cracking resistance. Together with another of Aubert & Duval's grade - MARVAL® X12H, MLX® 17 is currently among the best steel grades to design the longest end-blades of steam turbines.

NiSA AD730®

Is a fully innovative nickel-base superalloy. It withstands higher temperatures (750 °C / 1,382 °F), while preserving strength, creep and fatigue resistance at a competitive cost. Targeted applications: turbines blades, buckets, fasteners, as well as rotating parts for gas turbines.

Main Processes



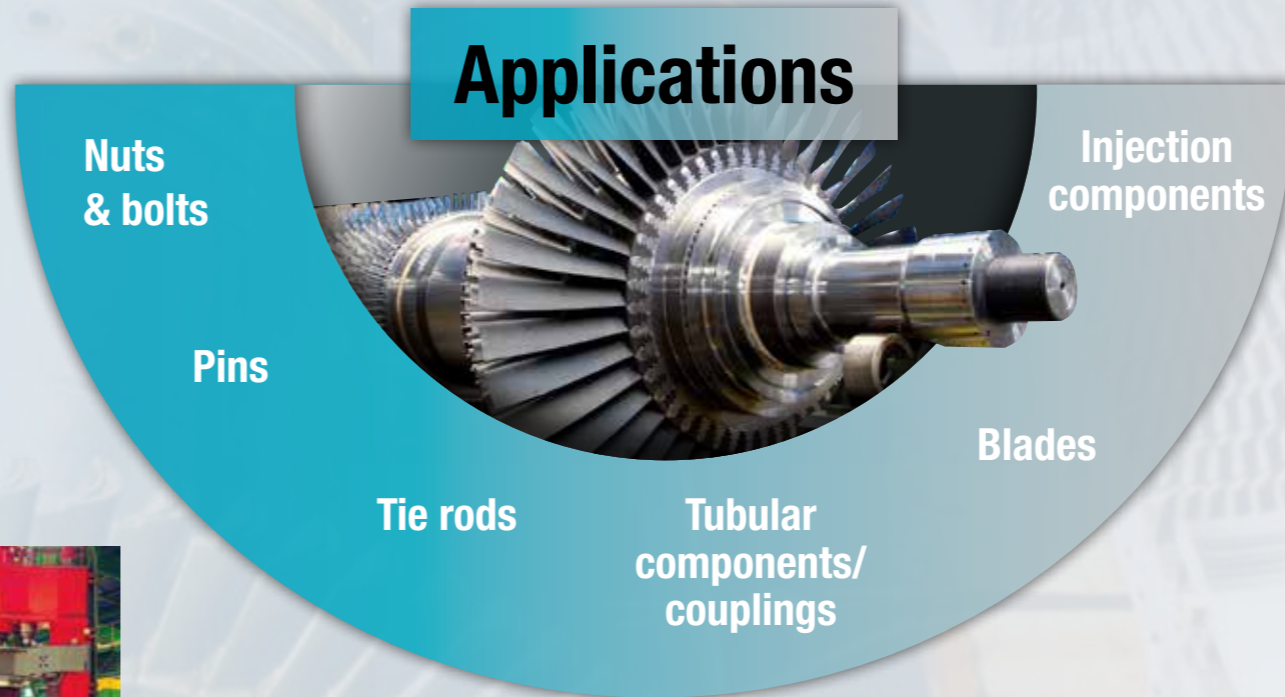
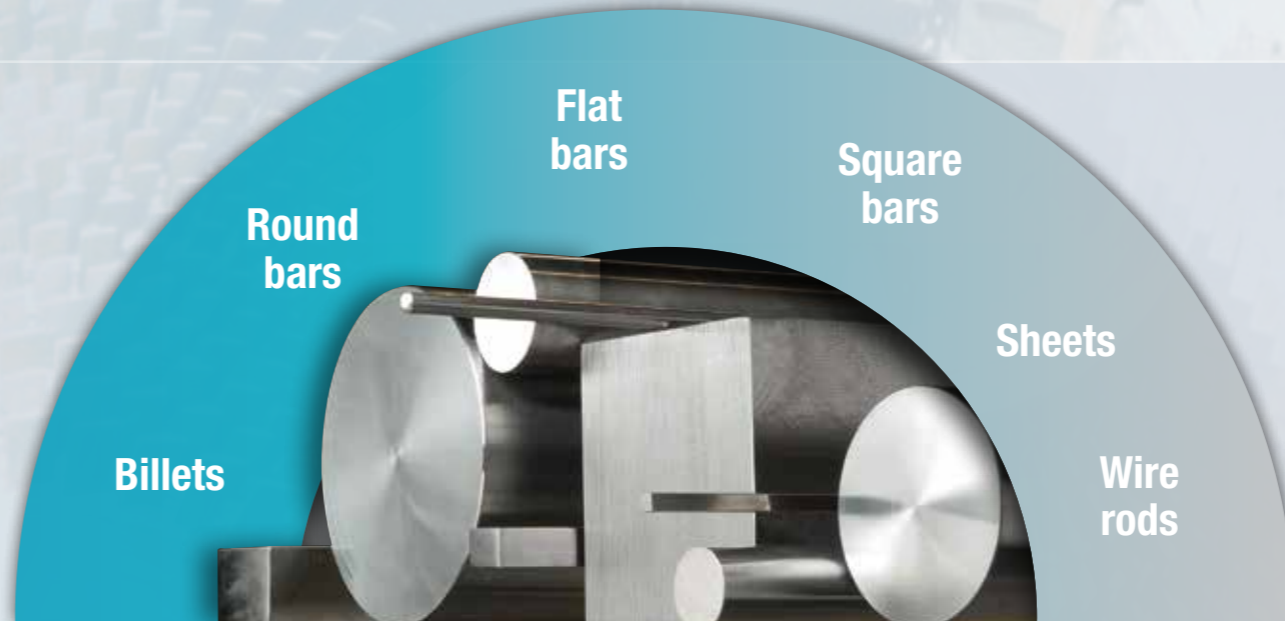
Melting / Remelting



Rolling



Forging



Main sizes

	mm	inches
Round Bars	Ø 7.5-500	Ø 0.30-20
Flat & Square Bars	T ≤ 310	T ≤ 12
Sheets	0.6 ≤ T ≤ 150	0.2 ≤ T ≤ 6

Surface conditions

- Black
- Ground
- Peeled
- Others

Heat treatment conditions

- Annealed
- Hyperquenched
- Normalized
- Heat solution treated
- Heat treated
- Aged



Certifications and specifications

In addition to general certifications (ISO 9001, ISO 14001, ISO 18001), our Service Center is certified to the most stringent industry specific standards.



AUBERT & DUVAL



www.aubertduval.com

Design by makheia affinity - Aubert & Duval - 05-2017

Printed in France - PEFC 10-31-1592

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