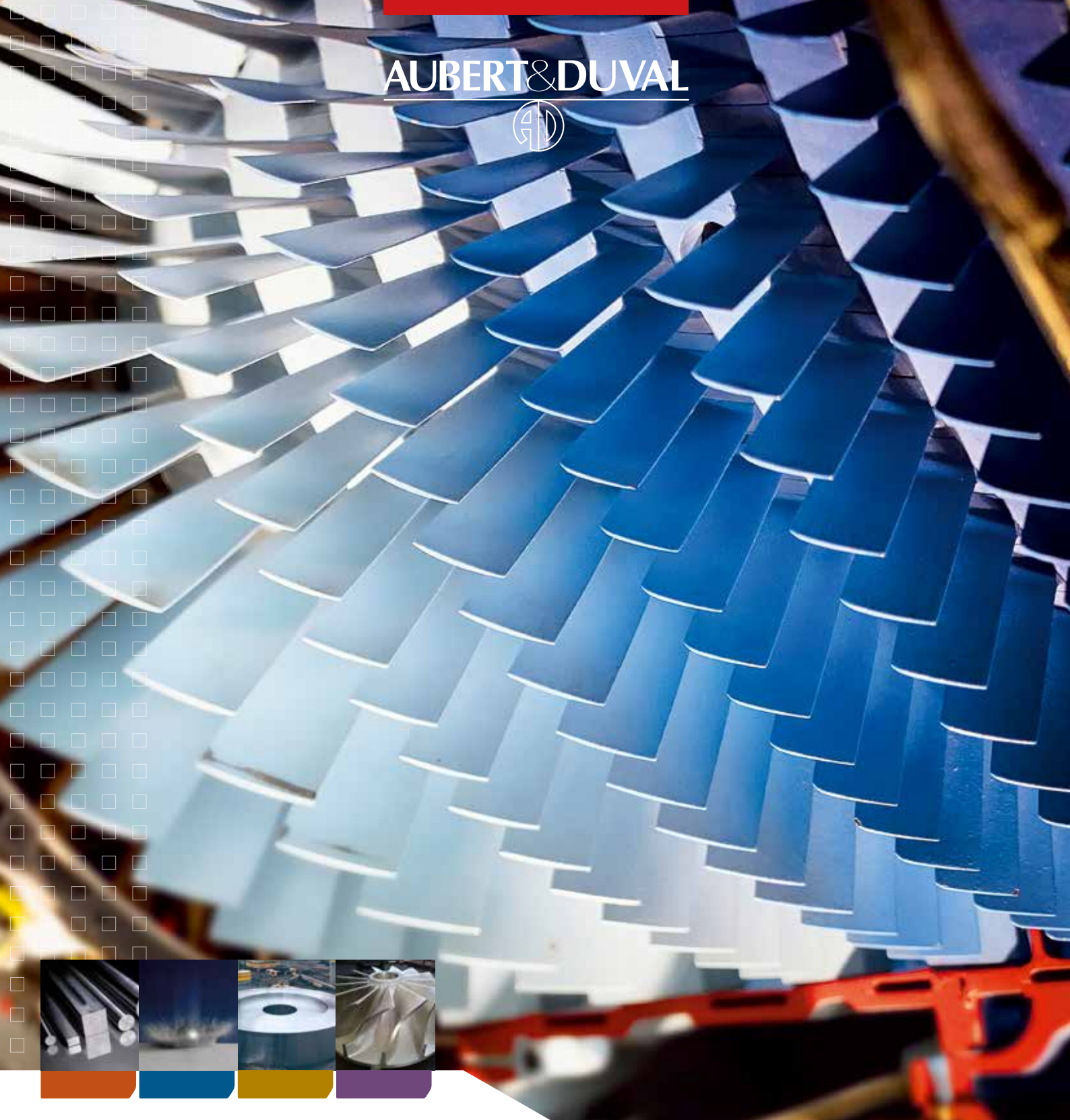


AUBERT&DUVAL



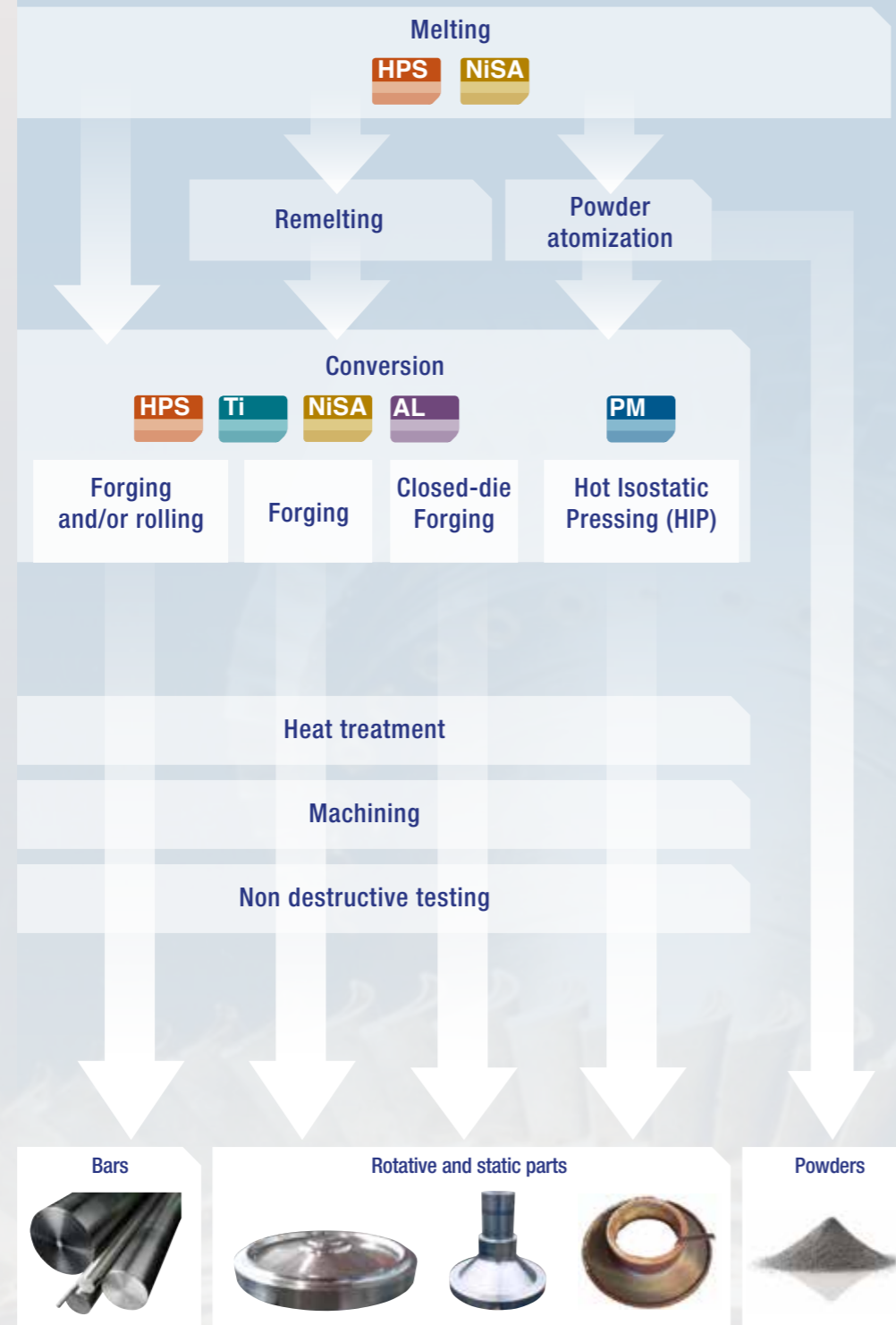
# Steels and Alloys for Gas and Steam turbines

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



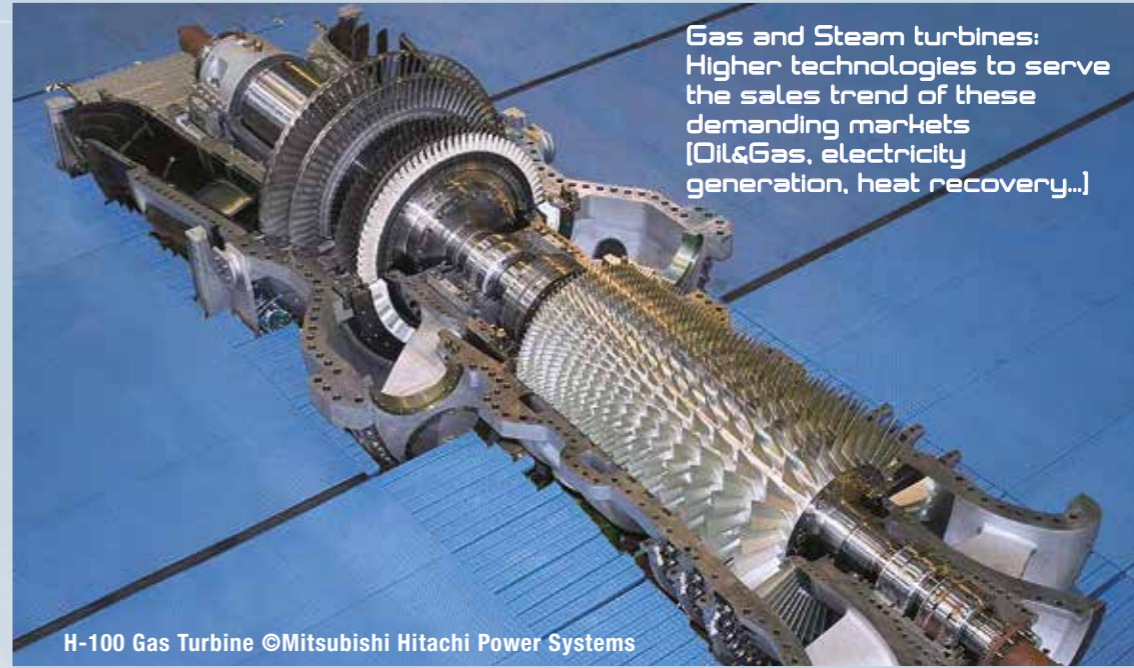
**HPS**  
High Performance Steels:  
A range of alloyed steels with tightly controlled characteristics offering optimum value for customers.

**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.

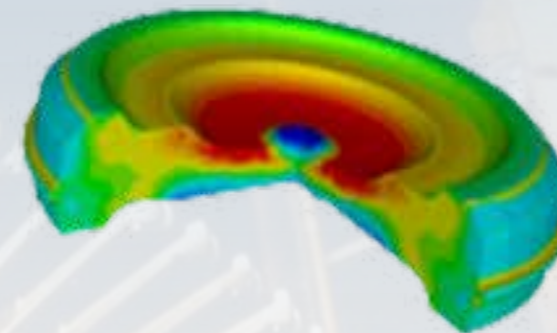


Vertically integrated from melting - including superalloy big diameter triple-melt ingots - through to forged and machined near-net shape parts, Aubert & Duval offers one of the largest and most comprehensive capabilities to design and manufacture critical closed-die superalloy forgings for land-based 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



65,000 tons closed-die forging press



# Forged and hipped parts for Power generation applications

**C**ombining 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® <b>New*</b>	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

## Expanders





## Compressors


## Steam turbines (New generation)







## 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](http://www.aubertduval.com)

## Generators



Please ask for the retaining rings brochure on [www.aubertduval.com](http://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 <b>New*</b>	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® <b>New*</b>	NiCr16Co9Mo3W3Ti3Al2
PER263	IN263 NiCo20Cr20MoTi
PER3	Waspaloy® NiCr20Co13Mo4Ti3Al

\* Patented grade  
\*\* On request

## Main Materials

<b>HPS</b> High Performance Steels	<b>NiSA</b> 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

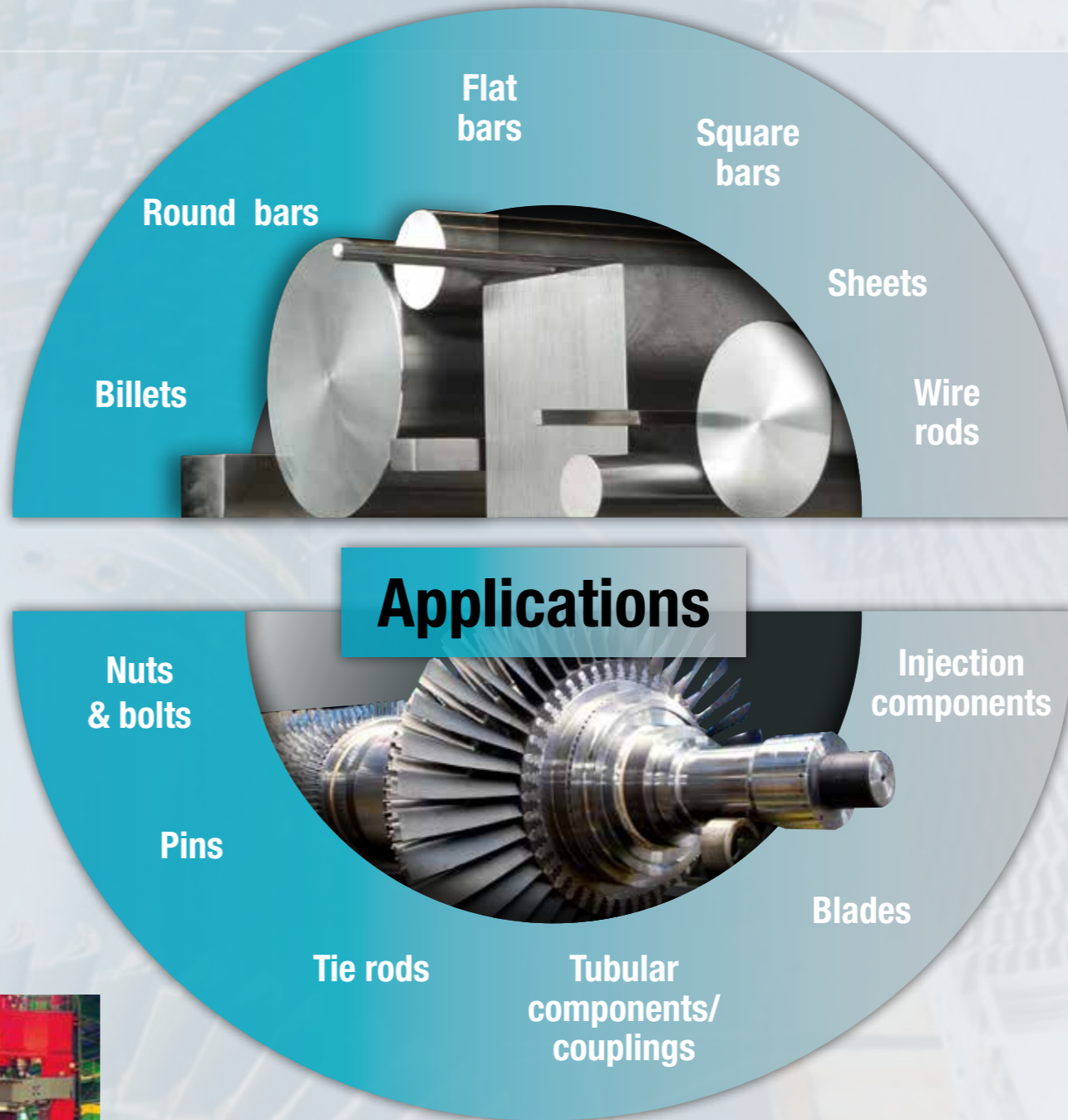
Rolling

Forging



### 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.



### 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



# AUBERT & DUVAL



[www.aubertduval.com](http://www.aubertduval.com)

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