

A&D PRODUCT MANUAL

Standard Products

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The main purpose of this A&D Product Manual is to give the Sales Task Force the AUBERT & DUVAL STANDARD product and offer from Les Ancizes and Firminy plants ; actually this Product Manual answers the following question : if a customer has no specific requirement what will he receive (volume, surface aspect, document ...) ?

.All you don't find in this document you have to ask Customer Services or Market Management.

This first version is restricted to Long Products and Tool Steels manufactured in Les Ancizes & Firminy plants

In case of large volume requirements, other grades or dimensions can always be considered. Please consult the corresponding Customer Service or Market Managers

Abbreviation meanings :

MOQ : Minimum Ordering Quantity

L : Length

W : Width

T : Thickness

PLANTS

LES ANCIZES

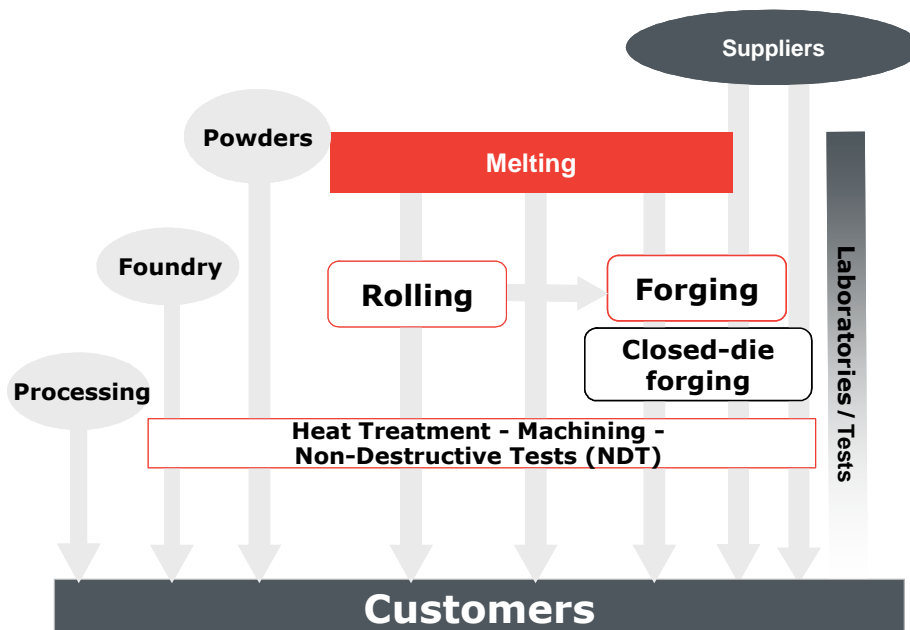
- Product lines: Aircraft engines, Power generation, 65 KT, Tool Steels, Semi-finished forged products, Metallurgical Engineering parts, Flat sheets, Foundry
- 1,450 employees
- Activities:
 - Processing and melting of steels and super alloys
 - Hot conversion by rolling and forging
 - Heat treatments
 - Machining
 - Non destructive testing
 - Inspection, test and research laboratories

FIRMINY

- Product lines: Unit Forged Parts, Defence, Mandrels, Tool Steels
- 300 employees
- Activities:
 - Melting
 - Forging
 - Heat Treatment
 - Machining
 - Inspections / tests

PROCESSES

Melting - Rolling - Forging – Closed-die forging



MELTING

Air melting

The solidification may take place by continuous pouring (large quantities) or by casting in ingots (production of special quality, of higher properties)

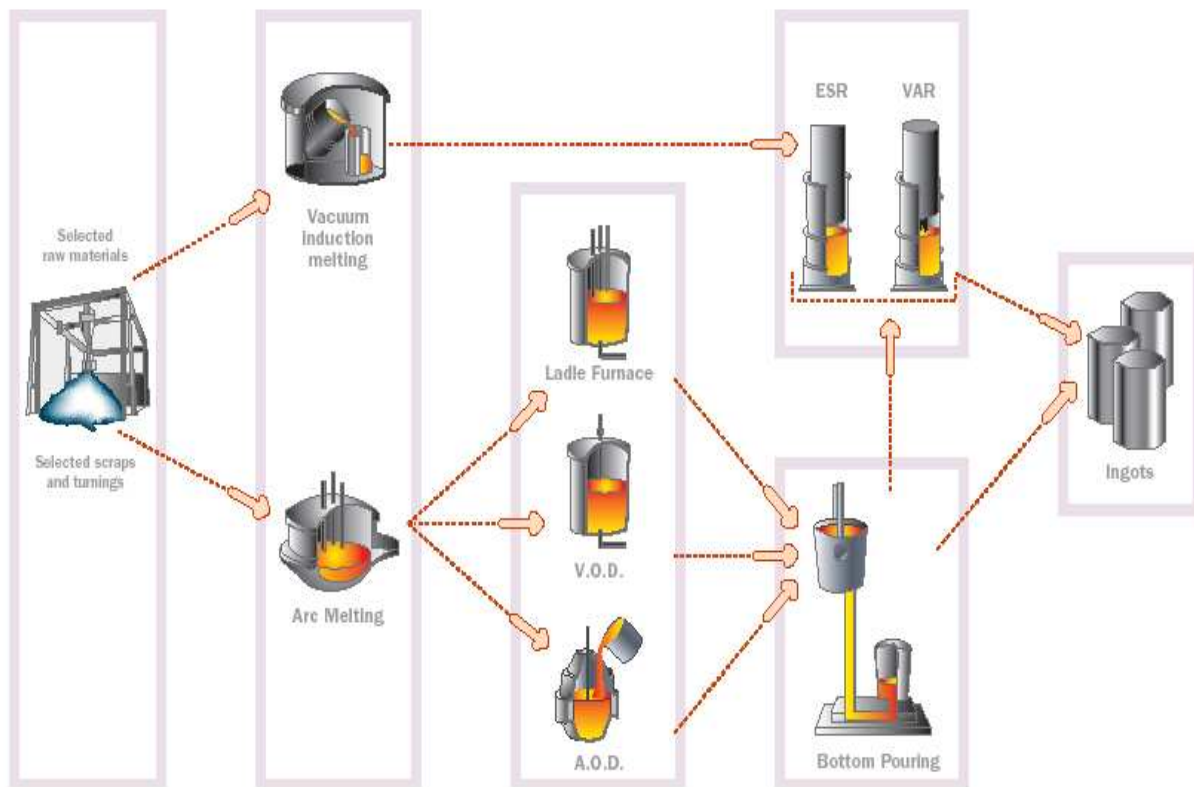
Vacuum melting

Used for alloys with higher stress applications

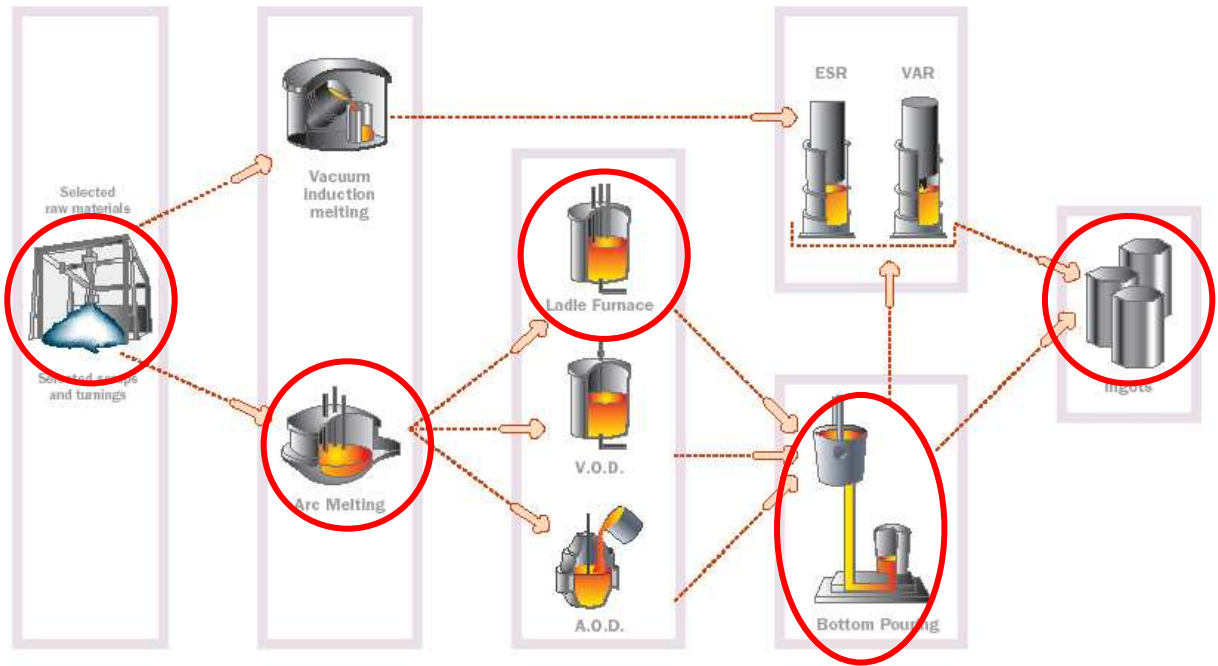
Remelting

May be under vacuum or slag. Allows improved properties and reliability of parts. Remelting is used for certain critical parts.

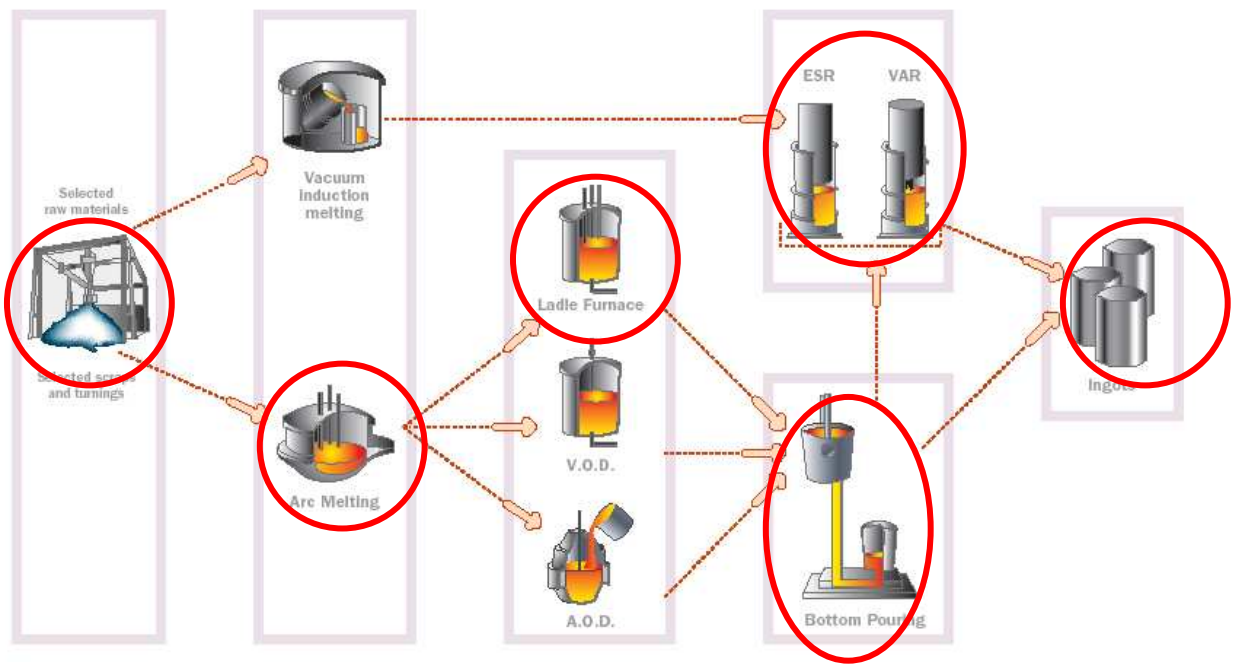
MELTING ROUTES



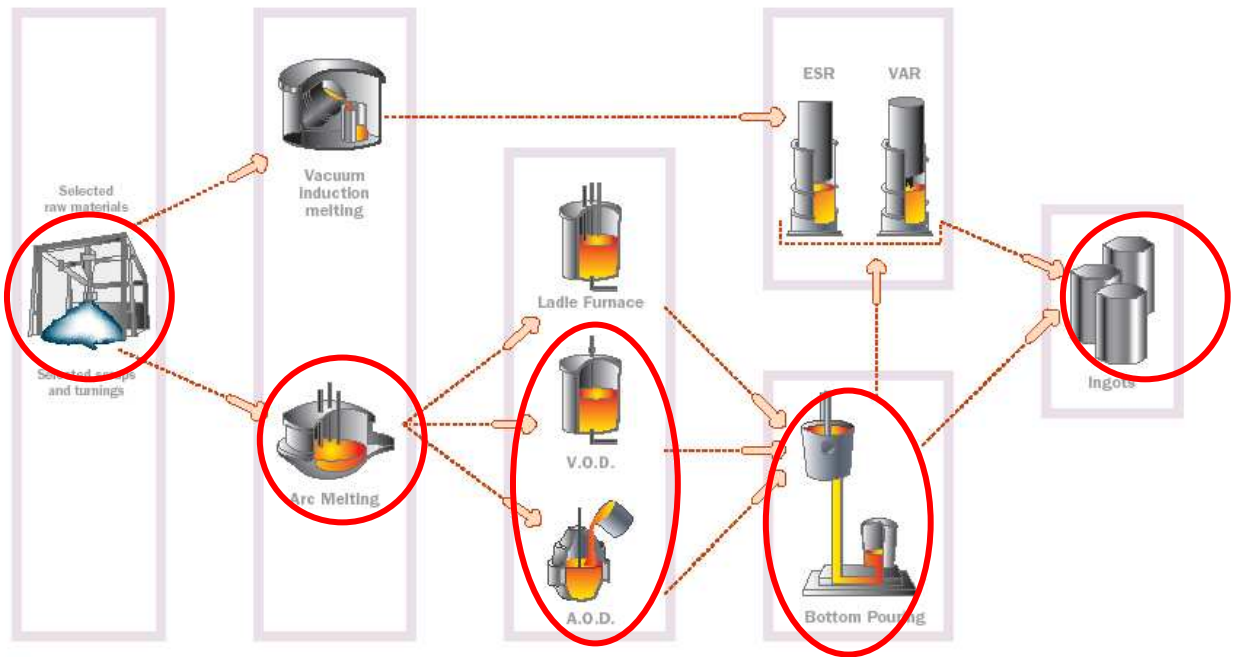
LOW ALLOY STEEL MELTING ROUTE



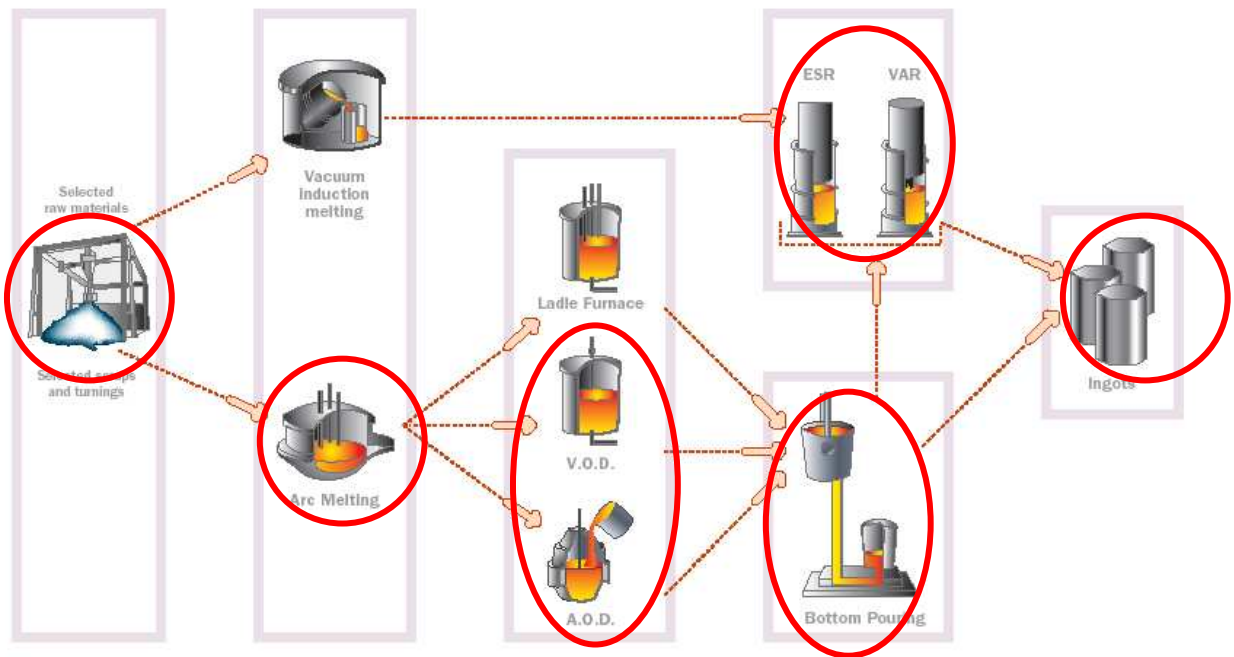
REMELTED LOW ALLOY STEEL



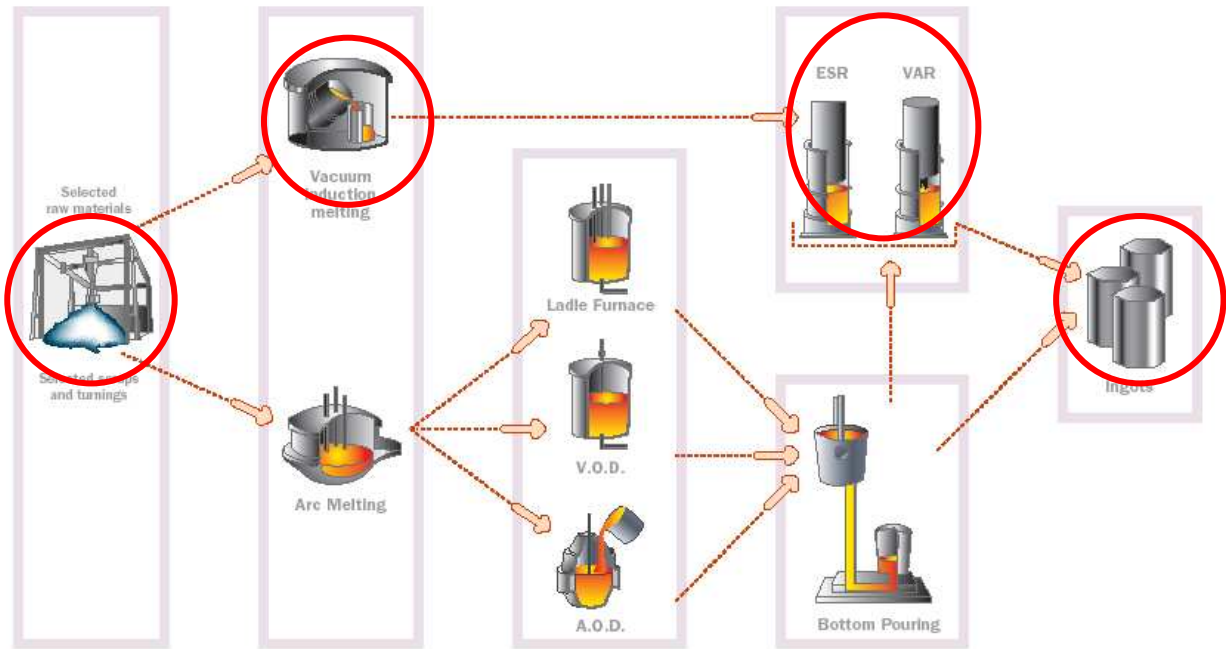
STAINLESS STEEL



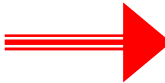







REMELTED STAINLESS STEEL



VACUUM INDUCTION MELTING STEEL & ALLOYS

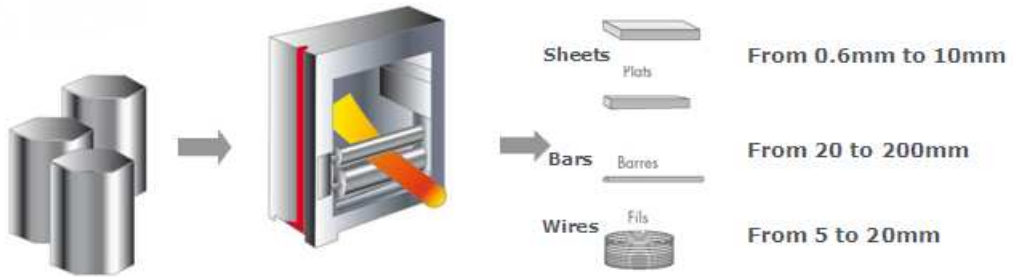


REMELTING PROCESS INFLUENCE on ALLOY ELEMENT CONTENT

ALLOY ELEMENT	VAR	ESR
Cr		
Cu		
Mn		
N ²		

For example effect of VAR process is decreasing N² content in steel but no effect of ESR process., so an electrode intended for remelting under vacuum (VAR) cannot be moved for remelting under slag (ESR)

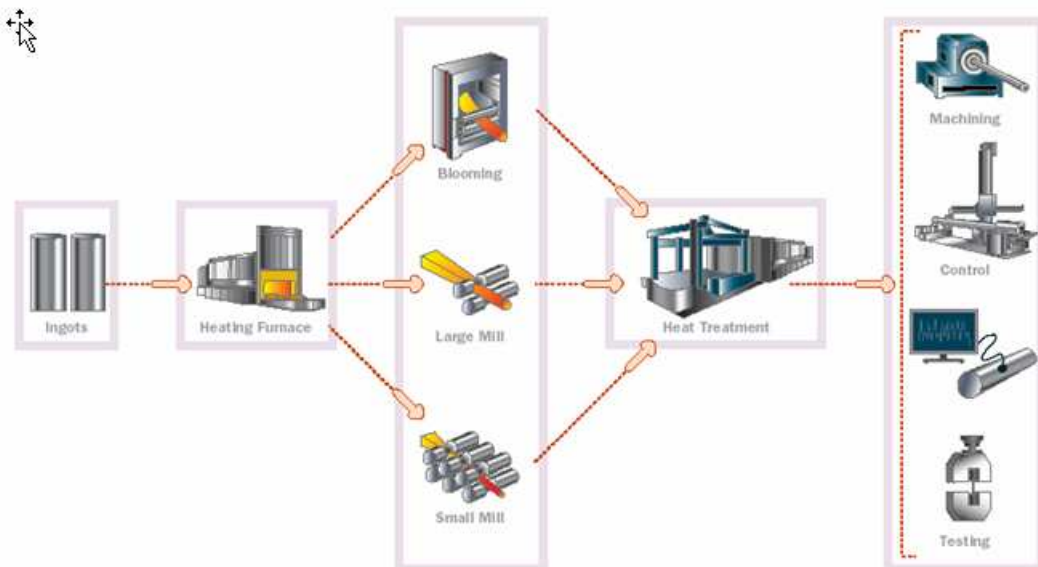
Rolling: Reshaping of metal between two cylinders



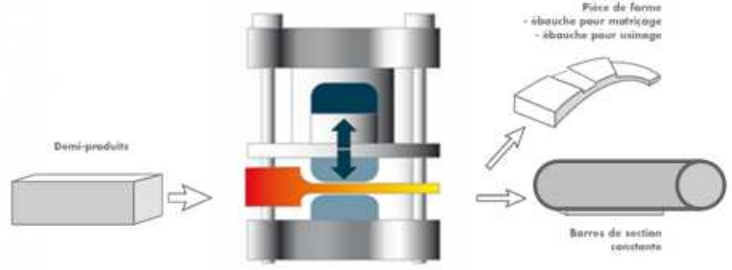
Bars



Machine wires



Forging: Reshaping of metal between two flat tools



Forging machine (SMX) - Les Ancizes



Forging of tooling at Firminy - 4,500t Press



**BARS STANDARD OFFER FOR
LONG PRODUCTS AND TOOL STEELS**

GRADE LIST AND ROLLED DIMENSIONS RANGE

Status grade meanings :

C : Catalog grade for standard offer, no restrictions to be manufactured

D1 : Grade under development

D2 : Grade sold by Full Heat only

S : Deleted grade ; we had to carry out a new study to manufacture again this grade with new Request For Quotation considering a big quantity (two heats and more)

* Cells colored in green = standard grade

Grade	Rolled Rond Bar	Rolled Flat & Square Bar
820	7.5 à 190	see following graph
830	7.5 à 190	see following graph
1087	7.5 à 190	see following graph
30NC11	7.5 à 190	see following graph
30NCDV14	7.5 à 190	see following graph
50NILYW	7.5 à 190	see following graph
56A	7.5 à 190	see following graph
56AJ	7.5 à 190	see following graph
56BI	7.5 à 163	see following graph
56BN	7.5 à 163	see following graph
56C	7.5 à 150	see following graph
56GE	7.5 à 150	see following graph
56HS	7.5 à 163	see following graph
56T4	7.5 à 163	see following graph
56T5	7.5 à 163	see following graph
56TG	7.5 à 190	see following graph
56TN	7.5 à 190	see following graph

Grade	Rolled Rond Bar	Rolled Flat & Square Bar
67T2D	7.5 à 150	see following graph
819A	7.5 à 190	see following graph
819B	7.5 à 190	see following graph
819C	7.5 à 190	see following graph
836J	7.5 à 190	see following graph
897D	7.5 à 190	see following graph
897DMO	7.5 à 190	see following graph
AD10S	7.5 à 190	see following graph
AD21	7.5 à 190	see following graph
AD3	7.5 à 190	see following graph
AD8S	7.5 à 190	see following graph
ADC3	7.5 à 170	see following graph
ADC4	7.5 à 170	see following graph
ADNIC261D	7.5 à 140	on request
ADNIC262E	7.5 à 140	on request
ADNIC265D	7.5 à 140	on request
ADNIC272D	7.5 à 140	on request
ADNIC275E	7.5 à 140	on request
ADNIC278	7.5 à 140	on request
ADNIC280	7.5 à 140	on request
ADNIC280R	7.5 à 140	on request
ADNIC56D	7.5 à 102	on request
ALACRITE163D	7.5 à 65	on request
ALACRITE164S	7.5 à 65	on request
APX	7.5 à 163	see following graph
APX2	7.5 à 87	see following graph
APX4	7.5 à 170	see following graph
APXV	7.5 à 170	see following graph
APZ2	7.5 à 87	on request

Grade	Rolled Rond Bar	Rolled Flat & Square Bar
APZ5	7.5 à 87	on request
APZ9	7.5 à 87	on request
BED	7.5 à 190	see following graph
BEV	7.5 à 190	see following graph
BM2	7.5 à 190	see following graph
BM9	7.5 à 150	see following graph
BMS	7.5 à 190	see following graph
BMV4	7.5 à 163	see following graph
BX0	7.5 à 190	see following graph
BX1	7.5 à 190	see following graph
BX3	7.5 à 190	see following graph
BXM	7.5 à 190	see following graph
CNS	7.5 à 190	see following graph
CNSMO	7.5 à 190	see following graph
D25TW	7.5 à 152	see following graph
DH11	7.5 à 190	see following graph
DH13	7.5 à 177	see following graph
DH33	7.5 à 177	see following graph
DH53	7.5 à 177	see following graph
DU3	7.5 à 163	see following graph
EA1W	7.5 à 140	on request
F27	7.5 à 190	see following graph
F30	7.5 à 190	see following graph
F33	7.5 à 190	see following graph
F65	7.5 à 190	see following graph
F65S	7.5 à 190	see following graph
F66J	7.5 à 190	see following graph
F66SS	7.5 à 190	see following graph
FAD	7.5 à 190	see following graph

Grade	Rolled Rond Bar	Rolled Flat & Square Bar
FADC	7.5 à 190	see following graph
FADH	7.5 à 190	see following graph
FADS	7.5 à 190	see following graph
FDG	7.5 à 190	see following graph
FDMA	7.5 à 190	see following graph
FND	7.5 à 190	see following graph
GD223	7.5 à 163	see following graph
GH4	7.5 à 190	see following graph
GH9	7.5 à 190	see following graph
GK3	7.5 à 190	see following graph
GK5	7.5 à 190	see following graph
GK5S	7.5 à 190	see following graph
GKH	7.5 à 190	see following graph
GKJ	7.5 à 190	see following graph
GKP	7.5 à 190	see following graph
H20D	7.5 à 87	on request
JD19	7.5 à 190	see following graph
JE9	7.5 à 190	see following graph
LHD	7.5 à 190	see following graph
LK3	7.5 à 190	see following graph
LK5	7.5 à 190	see following graph
LK5CA	7.5 à 190	see following graph
LXM4	7.5 à 190	see following graph
M25W6	7.5 à 120	on request
M27	7.5 à 190	see following graph
M29	7.5 à 190	see following graph
M30NW6	7.5 à 120	on request
M64BCW6	7.5 à 70	on request
MARVAL13X	7.5 à 155	see following graph

Grade	Rolled Rond Bar	Rolled Flat & Square Bar
MARVAL14	7.5 à 190	see following graph
MARVAL18	7.5 à 190	see following graph
MARVAL18H	7.5 à 190	see following graph
MARVAL18S	7.5 à 170	see following graph
MARVALX12	7.5 à 190	see following graph
MARVALX12H	7.5 à 190	see following graph
MEK3	7.5 à 190	see following graph
MEK4	7.5 à 190	see following graph
MEP	7.5 à 170	see following graph
MES	7.5 à 163	see following graph
MLX138	7.5 à 145	see following graph
MLX17	7.5 à 190	see following graph
MMR0	7.5 à 190	see following graph
MMR1	7.5 à 190	see following graph
MMR3	7.5 à 190	see following graph
MO6AC	7.5 à 190	see following graph
MOC2	7.5 à 190	see following graph
MOC2J	7.5 à 190	see following graph
MOC3	7.5 à 190	see following graph
MOC3J	7.5 à 190	see following graph
MOC7	7.5 à 190	see following graph
MOCV2	7.5 à 190	see following graph
MOCV3	7.5 à 190	see following graph
MRL1	7.5 à 190	see following graph
MUV	7.5 à 190	see following graph
MVS	7.5 à 163	see following graph
MX455	7.5 à 163	see following graph
MY14	7.5 à 190	see following graph
MY16	7.5 à 190	see following graph

Grade	Rolled Rond Bar	Rolled Flat & Square Bar
MY19	7.5 à 190	see following graph
MY23	7.5 à 190	see following graph
MY24	7.5 à 190	see following graph
N4	7.5 à 190	see following graph
N7	7.5 à 190	see following graph
N8	7.5 à 190	see following graph
NC25M	7.5 à 190	see following graph
NC26S	7.5 à 190	see following graph
NC30M	7.5 à 190	see following graph
NC310	7.5 à 190	see following graph
NC35M	7.5 à 190	see following graph
NC35M1	7.5 à 190	see following graph
NC40M	7.5 à 190	see following graph
NC40M1	7.5 à 190	see following graph
NC40M4	7.5 à 190	see following graph
NC40S	7.5 à 190	see following graph
NCAV	7.5 à 190	see following graph
NCAV2	7.5 à 190	see following graph
NCAV2U	7.5 à 190	see following graph
NCAV4	7.5 à 190	see following graph
NCAV5	7.5 à 190	see following graph
NOXIS	7.5 à 87	on request
NOXIS1	7.5 à 87	on request
NY276	7.5 à 102	on request
NY600	7.5 à 140	on request
NY625	7.5 à 102	on request
NY690	7.5 à 140	on request
NY800	7.5 à 142	on request
NY810	7.5 à 142	on request

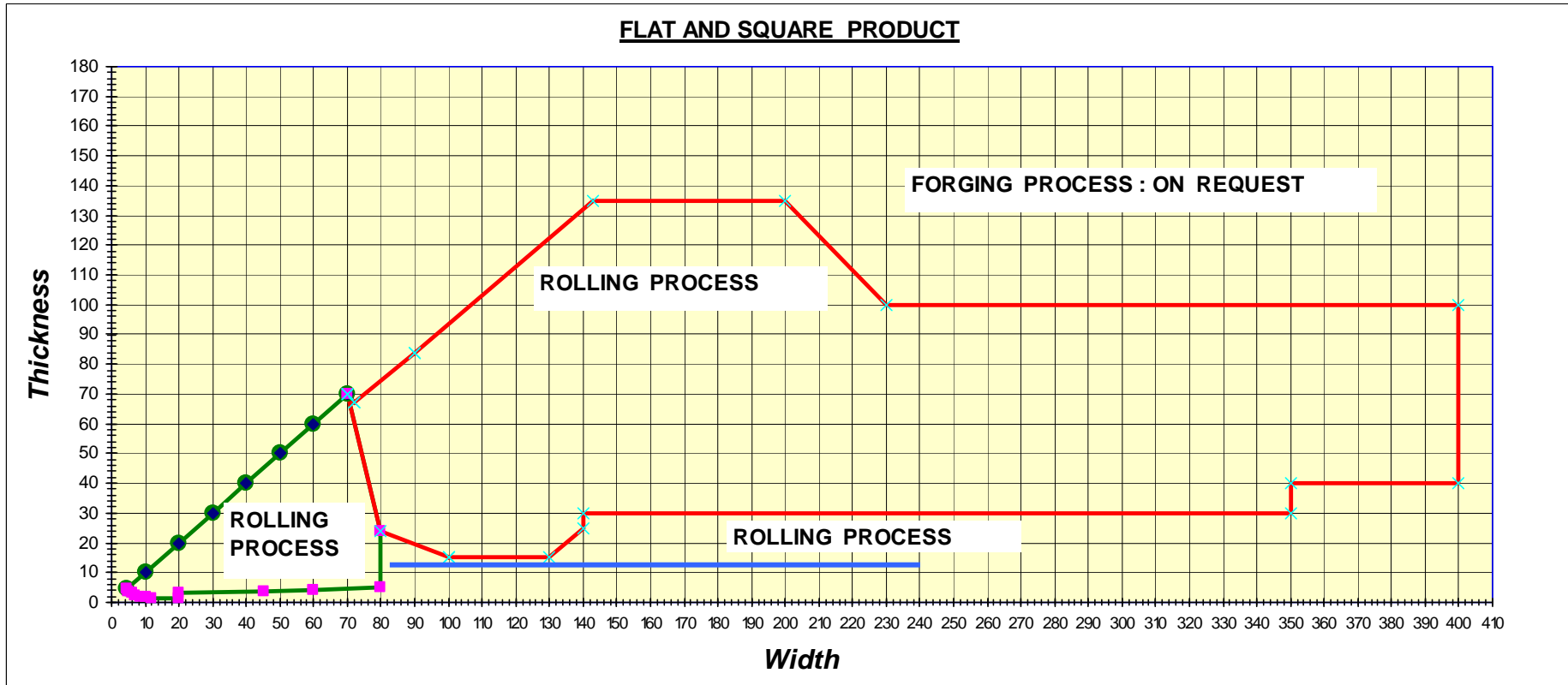
Grade	Rolled Rond Bar	Rolled Flat & Square Bar
NY811	7.5 à 142	on request
NY825	7.5 à 142	on request
NY925	7.5 à 140	on request
NYF44	7.5 à 145	on request
NYF49	7.5 à 145	on request
P3C	7.5 à 70	on request
P43V	7.5 à 140	on request
P53NC	7.5 à 110	on request
P65C	7.5 à 102	on request
PER20NW	7.5 à 140	on request
PER263W	7.5 à 140	on request
PER2UW	7.5 à 140	on request
PER2XW	7.5 à 140	on request
PER3HW	on request	on request
PER3W	7.5 à 70	on request
PER41W	on request	on request
PER5W	on request	on request
PER625W6	7.5 à 102	on request
PER72W	on request	on request
PER75W6	7.5 à 140	on request
PER7HW	on request	on request
PYRAD33	7.5 à 142	on request
PYRAD38	7.5 à 142	on request
PYRAD44DW	7.5 à 140	on request
PYRAD49DW6	7.5 à 140	on request
PYRAD53NW	7.5 à 110	on request
R2C	7.5 à 190	see following graph
R6110	7.5 à 177	see following graph
R7050	7.5 à 177	see following graph

Grade	Rolled Rond Bar	Rolled Flat & Square Bar
RA4	7.5 à 130	on request
RA5	7.5 à 130	on request
RA50YW	7.5 à 130	on request
RA6	7.5 à 90	on request
RAD	7.5 à 160	see following graph
RADM	7.5 à 140	see following graph
RAPIDEB	7.5 à 87	on request
RAPIDEM	7.5 à 90	on request
SANCY2	7.5 à 130	see following graph up to 250mm width
SCV	7.5 à 190	see following graph
SIMO	7.5 à 163	see following graph
SM2	7.5 à 190	see following graph
SM2CB	7.5 à 190	see following graph
SM33LC	7.5 à 190	see following graph
SMH	7.5 à 120	see following graph up to 250mm width
SMI	7.5 à 190	see following graph
SMP3	7.5 à 177	see following graph
SMR	7.5 à 177	see following graph
SMR4	7.5 à 177	see following graph
SMR7	7.5 à 177	see following graph
SMS3	7.5 à 177	see following graph
SMV	7.5 à 177	see following graph
SMV3	7.5 à 177	see following graph
SMV4	7.5 à 177	see following graph
SMV5	7.5 à 177	see following graph
SOS3	7.5 à 145	see following graph
SRV2	7.5 à 145	see following graph up to 250mm width
SY26	7.5 à 120	on request
SY4	7.5 à 110	see following graph up to 250mm width

Grade	Rolled Rond Bar	Rolled Flat & Square Bar
TITAL318	15 à 110	on request
TITAL318ELI	15 à 110	on request
V300	7.5 à 190	see following graph
V325	7.5 à 190	see following graph
VCE	7.5 à 190	see following graph
VCE4	7.5 à 190	see following graph
VOLVIC	7.5 à 87	on request
VOLVIC10	7.5 à 120	on request
VOLVIC2	7.5 à 87	on request
VOLVIC4	7.5 à 87	on request
WIS	7.5 à 190	see following graph
X12NB	7.5 à 163	see following graph
X13	7.5 à 163	see following graph
X13BC	7.5 à 163	see following graph
X13D	7.5 à 163	see following graph
X13DN	7.5 à 163	see following graph
X13E	7.5 à 163	see following graph
X13M	7.5 à 163	see following graph
X13MA	7.5 à 163	see following graph
X13MB	7.5 à 163	see following graph
X13MU	7.5 à 163	on request
X13N4	7.5 à 163	see following graph
X13T1	7.5 à 163	see following graph
X13T5	7.5 à 163	see following graph
X13T6	7.5 à 163	see following graph
X13U	7.5 à 163	on request
X13VD	7.5 à 163	see following graph
X13VK	7.5 à 163	see following graph
X13W3	7.5 à 163	see following graph

Grade	Rolled Rond Bar	Rolled Flat & Square Bar
X15D2	7.5 à 95	see following graph
X15U5	7.5 à 170	see following graph
X15U5D	7.5 à 170	see following graph
X15V	7.5 à 170	see following graph
X16D3	7.5 à 100	see following graph
X17T	7.5 à 150	see following graph
X17U4	7.5 à 170	see following graph
X17U4R	7.5 à 170	see following graph
X18	7.5 à 163	see following graph
X18BC	7.5 à 160	see following graph
X18J	7.5 à 160	see following graph
X18LB	7.5 à 160	see following graph
X18M	7.5 à 160	see following graph
X18MBC	7.5 à 160	see following graph
X18MC	7.5 à 160	see following graph
X18MNB	7.5 à 160	see following graph
X18MP	7.5 à 160	see following graph
X18NB	7.5 à 160	see following graph
X18NBJ	7.5 à 160	see following graph
X18PA	7.5 à 160	see following graph
X18U	7.5 à 87	on request
X19T4	7.5 à 50	see following graph
X203	7.5 à 120	on request
X20DU	7.5 à 87	on request
X20T	7.5 à 140	see following graph
X20T2	7.5 à 160	see following graph
X20T3	7.5 à 140	see following graph
X20T3R	7.5 à 140	see following graph
X21M2	7.5 à 50	on request

Grade	Rolled Rond Bar	Rolled Flat & Square Bar
X21RB	7.5 à 50	on request
X21RC	7.5 à 50	on request
X23N	7.5 à 50	on request
X25	7.5 à 142	on request
X25A	7.5 à 142	on request
X25V	7.5 à 152	on request
X35	7.5 à 50	on request
X39	7.5 à 50	on request
X39V	7.5 à 152	on request
X45U	7.5 à 170	see following graph
X47D	7.5 à 120	on request
X4S	7.5 à 170	see following graph
X520	7.5 à 170	see following graph
X52DU	7.5 à 120	on request
XD15N	7.5 à 170	see following graph
XDBD	7.5 à 120	see following graph up to 250mm width
XDBDW	7.5 à 120	see following graph up to 250mm width
XM112	7.5 à 50	on request
XM114	7.5 à 50	on request
XM114U	7.5 à 50	on request
XM19	7.5 à 90	on request
XM211	7.5 à 50	on request
XMF24	7.5 à 145	on request
XN26AW	7.5 à 152	see following graph
XN26TW	7.5 à 152	see following graph
XN26TWS	7.5 à 152	see following graph
XN904	7.5 à 140	see following graph
XSH	7.5 à 100	on request
XSL	7.5 à 100	on request



ROUND BARS : BLACK – PEELED - GROUND

DIMENSIONS (mm)	TOLERANCES (mm)	SURFACE DELIVERY	DIMENSIONS (mm)	LENGTH (mm) (other dimensions on request)	STRAIGHTNESS	ROUGHNESS (micrometer)	SURFACE INSPECTION	DIMENSIONS (mm)
$7.5 \leq \varnothing \leq 10$	+/- 0,25	Black only	$7.5 \leq \varnothing \leq 10$	3500 to 6000	2 mm/m with < 0.12% on total length	black :Ra ≤ 12.5 μm peeled : Ra ≤ 6.3 μm ground : Ra ≤ 3.2 μm	Eddy current (up to dia 50mm on peeled and ground bars)	$7.5 \leq \varnothing \leq 10$
$10 < \varnothing \leq 14$	+/- 0.25	Black or peeled	$10 < \varnothing \leq 14$					$10 < \varnothing \leq 14$
$14 < \varnothing \leq 20$	+/- 0.25	Black. peeled or ground	$14 < \varnothing \leq 20$					$14 < \varnothing \leq 20$
$20 < \varnothing \leq 40$	+/- 1.25% Ø		$20 < \varnothing \leq 40$					$20 < \varnothing \leq 40$
$40 < \varnothing \leq 50$	+/- (0.1 + 1% Ø)	peeled or ground	$40 < \varnothing \leq 50$				US (above dia 50mm)	$40 < \varnothing \leq 50$
$50 < \varnothing \leq 125$	+/- (0.1 + 1% Ø)		$50 < \varnothing \leq 125$					$50 < \varnothing \leq 125$
$125 < \varnothing \leq 140$	- 0 /+ (0.2 + 2% Ø)		$125 < \varnothing \leq 140$					$125 < \varnothing \leq 140$
$140 < \varnothing \leq 190$	- 0 /+ 3 - * for ground		$140 < \varnothing \leq 190$	$140 < \varnothing \leq 190$				
$190 < \varnothing \leq 350$	- 0 /+ 3	peeled	$190 < \varnothing \leq 350$	3500 to 8000	3 mm/m	VISUAL	$190 < \varnothing \leq 350$	
$350 < \varnothing \leq 900$			$350 < \varnothing \leq 900$	2000 to 6000	3 mm/m with < 0.12% on total length		peeled Ra ≤ 12.5 μm	$350 < \varnothing \leq 900$

In case of milled forged bars tolerance on diameter is -0/+5 mm

Marking : batch number+ heat number+ brand name on : $\varnothing < 12$: label - $12 \leq \varnothing < 50$ on generatrice (ink or stamp) - $\varnothing > 50$: stamp on end bar section : batch number

Packaging : Wooden box for sea - air shipping ; others : fastened with 3 straps (middle and each end) - ground bars are packed in wrapped bundles or on wooden pallets

NDT US Inspection: FBH 2 mm (long+ group) à 3 mm (alone) : control performed on product or semi -product

Release Note : Chemical analysis

Ovality : 75% on black - 50% on peeled & ground on tolerance diameter

Chamfer : black : N/A ; peeled : 45° chamfer from 3 up to 6 mm on range dia 50 to 120 mm ; ground : on request

MINIMUM ORDERING QUANTITY : FOR ROUND BARS

ROUND ROLLED BARS

Kg	Engineering steel		Stainless steel		XDBD / X18PA	RA50YW	Superalloys	
	Arc melted	Remelted	Arc melted	Remelted	Arc melted	Remelted		
<u>Wire and black bar dia < 50mm</u>	MOQ	(3 x 190) + n x 190					(3 x 190) + n x 190 Wire only	
<u>Ø < 50 peeled</u>	MOQ	(3 x 170) + n x 170					(2 x 100) + n x 100	
<u>52 < Ø < 164</u>	MOQ	1850 + n x 1850	1450 + n x 1450	1650 + n x 1650	1350 + n x 1350	1230 + n x 1230	1400 + n x 1400	900 + n x 900
<u>165 < Ø < 200</u>	MOQ	1400 + n x 1400	1400 + n x 1400		1350 + n x 1350			

n = 0 or 1 or 2 or 3 ...

Tolerance of MOQ is ± 10%

ROUND FORGED BARS FOR TOOL STEELS

Ancizes :

Electric Arc Furnace (EAF)

Minimum Ordering Quantities (kg) \pm 10%	
DIAMETER (mm)	ELECTRIC ARC FURNACE (EAF)
dia rolled to 300	1 900
300 < Φ < 340	2 400
340 < Φ < 370	3 100
370 < Φ < 435	4 200
435 < Φ < 550	6 400
550 < Φ < 900	8 000

Vacuum Arc Remelting (VAR) & Electro-Slag Remelting ' ESR)

Minimum Ordering Quantities (kg) \pm 10%	
REMELTED (VAR or ESR)	DIAMETER (mm)
1 800	dia rolled to 290
2 300	290 < Φ < 320
2 900	320 < Φ < 365
4 300	365 < Φ < 440
6 100	440 < Φ < 520
8 500	520 < Φ < 620
12 200	620 < Φ < 900

Firminy specific to 5%Chromium Steels

Minimum Ordering Quantities (kg) \pm 10%	
DIAMETER (mm)	ELECTRIC ARC FURNACE (EAF)
350-380	3 325
381-450	4 750
451-535	6 475
536-610	9 700
611-900	12 500

ROUND FORGED BARS FOR SEMI-PRODUCT

The following table is available only with standard condition: bars are manufactured by direct drawing and conversion ratio is equal to 5.

For Aeronautic Orders move down the diameter range by 50mm

Minimum Ordering Quantities (kg) ± 10%				
DIAMETER (mm)	ELECTRIC ARC FURNACE (EAF)	VACUUM ARC REMELTED (VAR)	ELECTRO- SLAG REMELTED (ESR)	DIAMETER (mm)
dia rolled to 200	1600	2800	2800	dia rolled to 200
205 - 220	2200	6000		6300
225 - 240			245 - 290	
245 - 290	3800		5000	
295 - 300		305 - 400		
305 - 400		-	-	-
405 - 450				

Concerning Superalloys forged bars: the minimum Ordering Quantity vary between 900 kg up to 6000 kg depending on the melting route or ingot supplier

FLAT OR SQUARE BARS

PRODUCTS	DIMENSIONS (mm) (other dimensions on request)	TOLERANCES (mm)		STRAIGHTNESS	DELIVERY SURFACE	SQUARENESS
Flat bars	thickness : ≤ 170 width : ≤ 400 see graph for rolled possibility ; other on request	see table in appendix		3 mm/m	black or shot - peening / blasted	≤ 0.03
	$170 \leq \text{Thickness} \leq 700$ $400 \leq \text{Width} \leq 1050$	0 +5				
Square bars	square max rolled C = 70 mm	Side ≤ 20	+/- 0.20	4 mm/m	black or shot - peening / blasted	≤ 0.06
		$20 < C \leq 40$	+/- 1.25% C			
		$40 < C \leq 70$	+/- (0.1 + 1% C)			
Square billets	side (C) as rolled dimensions	+/- 3% C		4 mm/m	black or milled	≤ 0.06
	$50 \leq C \leq 105$					
	$115 \leq C \leq 220$	+/- 2				
	$220 \leq C \leq 310$					
Blooms	Thickness : 120 à 220	+/- 3% C		4 mm/m	black or milled	≤ 0.06
	Width : 140 à 250					

Length : 2000 to 6000 mm , others on request

Roughness : $Ra \leq 12.5 \mu\text{m}$

Marking : label or stamp

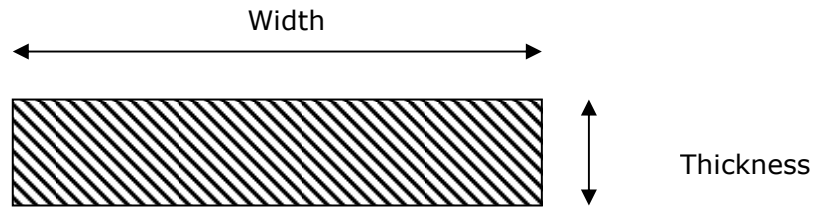
NDT US Inspection : FBH 2 mm (long + group) to 3 mm (alone)

Tolerances on cutting length : - 0 / + 50 mm

Surface inspection : visual

Packaging : Wooden box for sea - air shipping ; others : fastened with 3 straps (middle and each end) -or on wood pallets.

TOLERANCES FOR ROLLED FLAT PRODUCT



Flat standard tolerances ⇒ green and red zone on graph

width (w in mm)	width tolerances (mm)	Thickness tolerances (t in mm)						
		t < 13	13 < t ≤ 20	20 < t ≤ 40	40 < t ≤ 50	50 < t ≤ 75	75 < t ≤ 100	100 < t ≤ 170
w ≤ 20	± 0,4	± 0,3	± 0,3	-	-	-	-	-
20 < w ≤ 40	± 0,6	± 0,3	± 0,4	± 0,5	-	-	-	-
40 < w ≤ 50	± 0,8	± 0,4	± 0,5	± 0,6	± 0,75	-	-	-
50 < w ≤ 100	± 1,2	± 0,4	± 0,5	± 0,75	± 0,75	± 1,0	-	-
100 < w ≤ 125	± 1,5	± 0,4	± 0,5	± 0,75	± 0,75	± 1,0	± 1,5	-
125 < w ≤ 150	± 1,5	-	± 0,5	± 0,75	± 0,75	± 1,0	± 1,5	± 2,5
150 < w ≤ 400	± 0,01 b	-	± 0,6	± 1,2	± 1,5	± 2,0	± 2,5	± 3,0

⇒ Green zone : possibilities see in the following table

⇒ Red zone : more strict tolerances on request

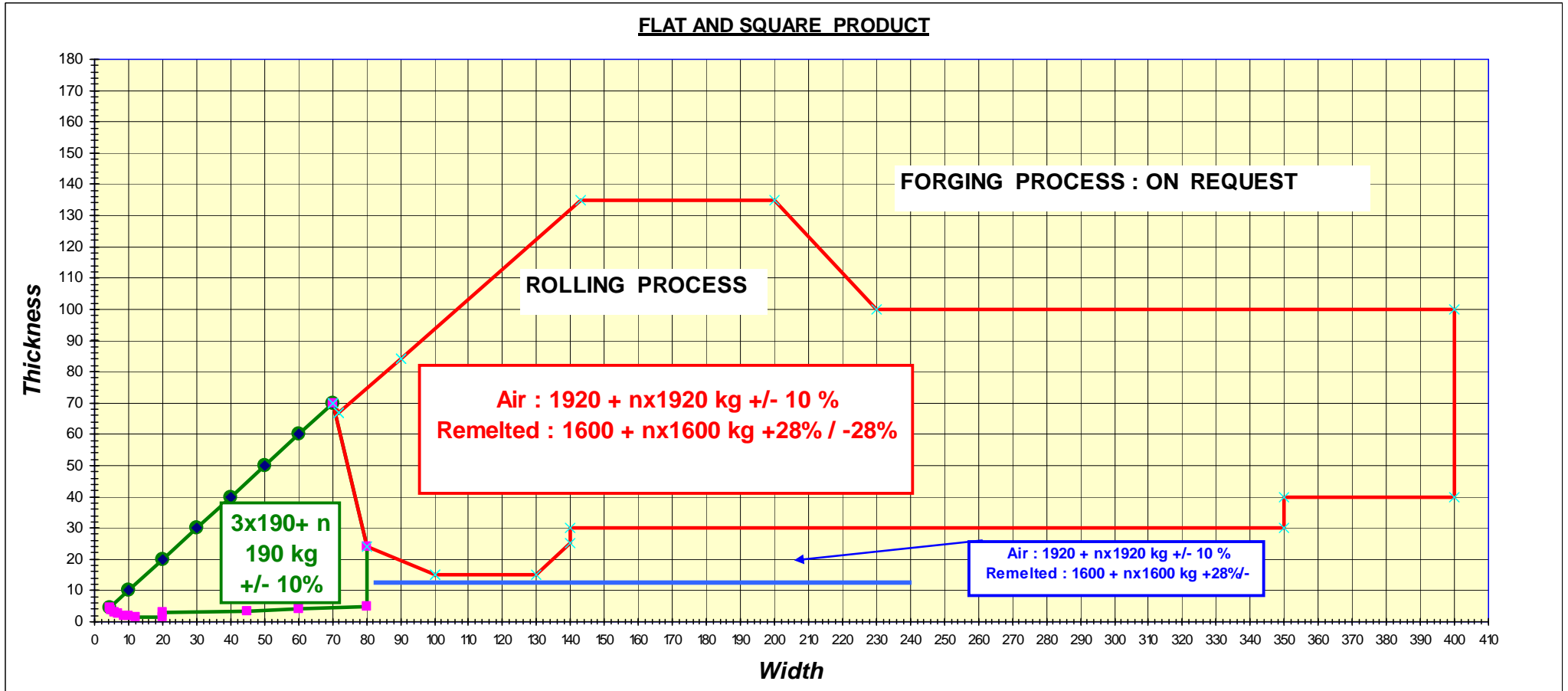
Possible tolerances

(Green zone in Minimum Ordering Quantity Flat & Square product graph)

		Width (mm)			
		W ≤ 40	40 < W ≤ 60	W ≥ 60	
Thickness (mm)	t ≤ 20	Tol e	± 0,20		
		Tol L	± 0,50	± 0,60	± 0,70
	20 < t ≤ 30	Tol e	± 0,20		
		Tol L	± 0,50	± 0,60	± 0,70
	30 < t ≤ 40	Tol e	± 0,30		
		Tol L	± 0,60	± 0,70	± 0,80
	40 < t ≤ 50	Tol e	± 0,35		
		Tol L		± 0,80	± 0,90
	t ≥ 50	Tol e	± 0,40		
		Tol L		± 0,90	± 1,00

MINIMUM ORDERING QUANTITY (MOQ) : FOR FLAT BARS

ROLLED FLAT BARS



FLAT FORGED BARS FOR TOOL STEEL

Ancizes :

Electric Arc Furnace (EAF)

Vacuum Arc Remelting (VAR)
& Electro-Slag Remelting (ESR)

Minimum Ordering Quantities (kg) $\pm 10\%$	
Section (dm ²)	ELECTRIC ARC FURNACE (EAF)
S ≤ 10.0	2 400
10.0 < S ≤ 12.9	3 100
12.9 < S ≤ 17.4	4 100
17.4 < S ≤ 27.0	6 500
27.0 < S	8 000

Minimum Ordering Quantities (kg) $\pm 10\%$	
Section (dm ²)	REMELTED (VAR or ESR)
S ≤ 8.7	2000
8.7 < S ≤ 11.0	29000
11.0 < S ≤ 17.6	4100
17.6 < S ≤ 24.8	5900
24.8 < S ≤ 35.5	8400
35.5 < S	11900

Firminy

TOOL STEELS IN FIRMINY PLANT			DH11/DH13 DH53 55 NCDV 7	ADC3 - SMV3 BLACK	ADC3/SMV3 2 SIDES GROUND
Tol = +10/- 0	Tol = +10/-0		Tol = +/- 5 %	Tol = +/- 5 %	Tol = +/- 5 %
Width (mm)	thickness (mm)	Number of bar	MOQ (kg)	MOQ (kg)	MOQ (kg)
410	180	2	3640	3430	3180
450	260	1	3640	3430	3180
500	150 - 185	2	3640	3430	3180
500	190-200	1	3640	3430	3180
510	150	2	3640	3430	3180
510	160-225	1	3640	3430	3180
515	285	1	5200	4900	4600
570	180	1	3640	3430	3180
600	150-155	2	3640	3430	3180
600	160-225	1	3640	3430	3180
600	230-250	1	5200	4900	4600
610	215-260	1	3640	3430	3180
610	265-316	1	5200	4900	4600
700	150-195	1	3640	3430	3180
800	150-170	1	3640	3430	3180
800	175-230	1	5200	4900	4600
800	235-300	1	7050	6650	6300

TOOL STEELS IN FIRMINY PLANT			DH11/DH13 DH53 55 NCDV 7	ADC3 - SMV3 BLACK	ADC3/SMV3 2 SIDES GROUND
Tol =+10/- 0	Tol =+10/0		Tol = +/- 5 %	Tol = +/- 5 %	Tol = +/- 5 %
Width (mm)	thickness (mm)	Number of bar	MOQ (kg)	MOQ (kg)	MOQ (kg)
810	150-170	1	3640	3430	3180
810	175-215	1	5200	4900	4600
810	265-315	1	7050	6650	6300
900	200-210	1	5200	4900	4600
900	215-310	1	7050	6650	6300
900	315-400	1	10550	9950	9450
960	150-195	1	5200	4900	4600
960	200-290	1	7050	6650	6300
960	295-300	1	10550	9950	9450
960	510	1	13380	12600	12000
1000	200-275	1	7050	6650	6300
1000	280-350	1	10550	9950	9450
1100	300-365	1	10550	9950	9450
1100	370-700	1	13380	12600	12000
1200	300-600	1	13380	12600	12000
1300	300-500	1	13380	12600	12000

SHEETS

PRODUCTS	THICKNESS (mm) (other dimensions on request)	TOLERANCES (mm)	LENGTH (mm) (other dimensions on request)	STRAIGHTNESS - FLATNESS	ROUGHNESS (micrometer)	DELIVERY SURFACE	NDT US	MINIMUM ORDERING QUANTITY	TOLERANCES ON CUTTING LENGTH (mm)
Sheet	0.5 à 9.99 10 à 15	NF EN 10259 (cold rolled) - NF EN 10051 (hot rolled)	2000 x1000	NF EN 10259 (cold rolled) - NF EN 10051 (hot rolled)	cold rolled Ra ≤ 3.2 µm - hot rolled Ra ≤ 6.3 µm	pickled or shot- peening or skin pass	FBH 1.2 mm (long+group) à 2 mm (alone) on semi product	800 kg up to 6000 kg	0/+5 **
	15 à 30	±0.5	up to 4000 on request	NF EN 10051	Ra ≤ 12.5 µm	black or shot - peening	FBH 1.2 mm (long+group) à 2 mm (alone) on semi product and NF EN 10160 classe S3 / E4 on final product	1000 kg up to 7500kg	0/+30 **
	30 à 150	2/0							0/+30 **

** : if water cutting, tolerances become - 0/+100 mm on width and length

Marking on sheets : ink : European norm+ heat treatment symbol+ heat number
+thickness (1/10e mm) +brand name + AD logo + Order
manufacturing number

Packaging : Sheets are wrapped on wood pallets

Release Note : Chemical analysis

Surface inspection : Visual

3D FORGED BLOCKS

3 D Forged Blocks are standard only for Tool Steels. For other grades, please ask the Market Manager in charge

Length (mm)	L ≤ 1800
Dimensions	$L \leq 3/2 (W + H)$ et $L/H \leq 5$ OR $L \leq (W + H)$ et $W/H \leq 7$ OR $L = W$ & $W/H \leq 9$
Tolerances on black blocks (mm)	0,+4% on length and 0,+2% on width & higher
Delivered Surface	as forged
Squareness	$(D - d)/D \leq 0,03$
Max Weight	12 Tons
Flatness	See following table
Marking	Stamp on side the heat number and brand name
Packaging	Wooden box for sea - air shipping; others fastened with 3 straps (middle and each end)
NDT US inspection	FBH 1.2 mm (long+ group) to 2 mm (alone)
Surface inspection	Visual
Release Note	Chemical analysis

L : length ; W : width ; H : height

Minimum Ordering Quantity: ask the Market Manager in charge

3D FORGED DISKS

3 D Forged Disks are standard only for Tool Steels. For other grades, please ask the Market Manager in charge

Diameter (mm)	Diameter ≤ 2800
Dimensions	$1 \leq \text{ratio (dia / thickness)} \leq 10$
Tolerance on black (mm)	.-0/+3% on diameter & -0/+4% on thickness
Delivered surface **	as forged
Max Weight	12 Tons
Marking	Stamp on side the heat number and brand name
Packaging	Wooden box for sea - air shipping; others fastened with 3 straps (middle and each end)
NDT US inspection	FBH 1.2 mm (long+ group) to 2 mm (alone)
Surface inspection	Visual
Release Note	Chemical analysis







**Possibility of machining delivery surface on request

Minimum Ordering Quantity: ask the Market Manager in charge

FLATNESS ON FORGED FLAT BARS, 3D BLOCKS, DISKS

Dimension (mm)	Defect (mm)
$D \leq 200$	≤ 2
$200 < D \leq 300$	≤ 3
$300 < D \leq 500$	≤ 4
$500 < D \leq 700$	≤ 5
$700 < D \leq 1000$	≤ 6
$1\ 000 < D \leq 1400$	≤ 8
$1\ 400 < D \leq 1800$	≤ 10
$1\ 800 < D \leq 2200$	≤ 12
$2\ 200 < D \leq 2800$	≤ 15

OPEN-DIE FORGED PARTS

TYPE	DIA or equiv MINI (in mm)	DIA or equiv MAXI (in mm)	Lg or H min (in mm)	Lg or H max (in mm)	Mini weight (in Kg)	Maxi weight (in Kg)	Grades (except Aluminum and Tool Steels)			Basic Shapes
							Steel (except duplex)	Duplex	Superalloys Titanium	
BARS SHAFTS LONG PARTS	100	500		6 000	150	7 500				
	200	1 200		20 000	2 500	26 000				
SHORT PIPES RINGS	200	2 500		1 000	200	7 500				
	800	2 500		3 000	2 500	26 000				
LONG PIPES TUBES	80	350	100	3 000	5	3 000				
	300	1 500	100	20 000	2 500	26 000				
DISKS	200	3 000	7	500		7 500				
	800	3 000	100	= dia	2 500	26 000				
BLOCKS	100	500	50	1 000		7 500				
	200					26 000				
FLATS	50	500		6 000	150	7 500				
	150	2 200			2 500	26 000				
COMPLEX SHAPE PARTS					10	7 500				

NB: Surfaces can be offered rough or finished

DIA or equiv (in mm) : for example square shape 88 mm or flat 50*157 mm is equivalent to dia 100mm
 general formula is : $w \cdot l = (\pi \cdot D^2) / 4$
 w : width ; l : length ; D : dia equivalent

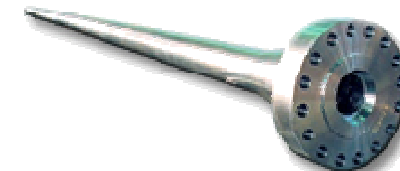
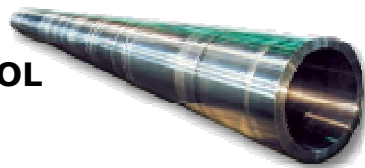




**LENGTH ADJUSTMENT
SPOOL
ASTM A707
10 500 kg**



**HANG-OFF SPOOL
ASTM A707
11 000 kg**

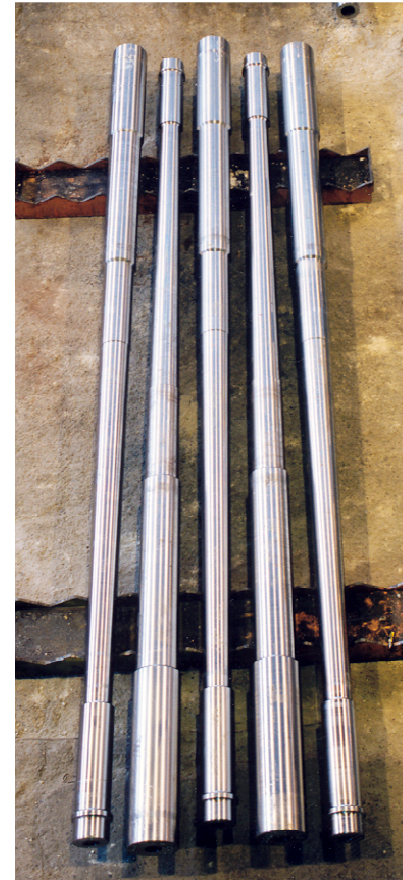


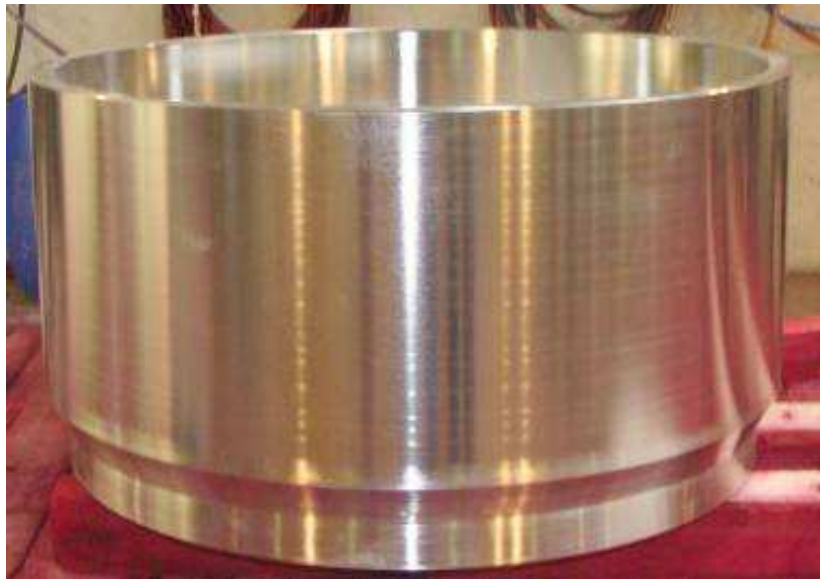
**STRESS JOINT RISER
ASTM A707
2 950 kg**

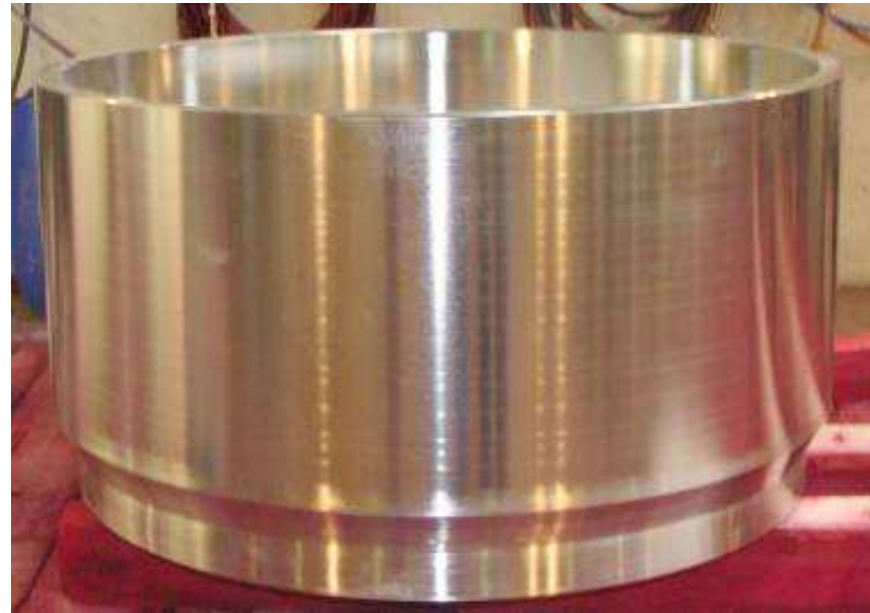
AUBERT&DUVAL



EXAMPLES OF PRODUCTION









OPEN DIE FORGINGS IN ALUMINUM ALLOYS

110307



- MARKETS :
 - non aeronautic part ...
- ALLOYS :
 - Series :
 - 2000 Al + Cooper (2214,2050,2618) ⇒ AERONAUTIC
 - 5000 Al + Magnesium (5083) ⇒ LAND & SEA TRANSPORTATION
 - 6000 Al + Magnesium + Silicon (6061) ⇒ PARTS FOR WELDING
 - 7000 Al+ Zinc + Magnesium + Copper (7010,7050,7175) ⇒ AERONAUTIC
- DELIVERY CONDITIONS :
 - F As forged
 - 01 Quenched with Air cooling
 - T 6 Quenched and Aged
 - T 652 Quenched, compressed and Aged
 - Pre-machining capabilities
- Marking & NDT inspection according to Customer Specification

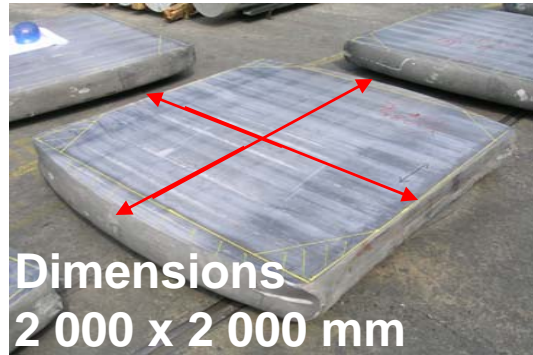


SHAPE	Dia mini (mm)	Dia max (mm)	Thickness mini (mm)	Thickness max (mm)	Width mini (mm)	Width max (mm)	Length mini (mm)	Length max (mm)	Weight max (Kg)
Round bars	100	900	-	-	-	-	1000	7000	6500
Squares and Blocks	-	-	80	750	160	2000	1000	8000	6500
Disks	500	1700	100	1000	-	-	-	-	6500
Complex Shape	-	-	-	750	-	2500		8000	6500



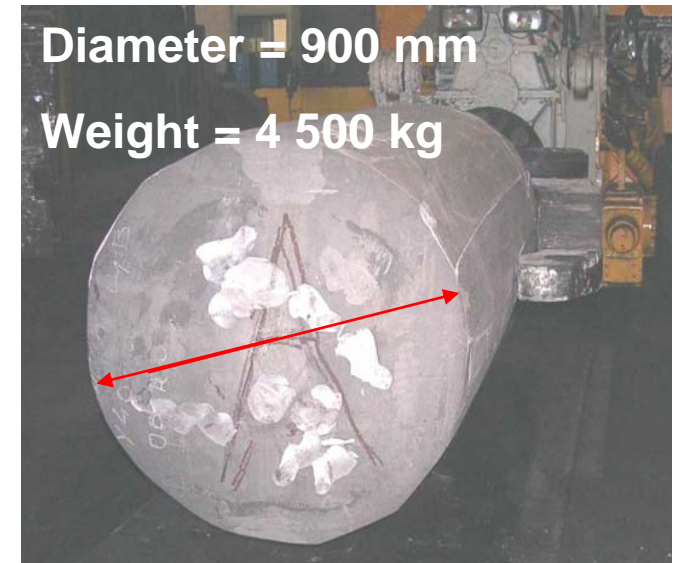
- SQUARED BARS AND BLOCKS:

Thickness	Width	Length	Max Weight
80 → 750 mm	160 → 2 000 mm	1 000 → 8 000 mm	6 500 kg



- LONG CYLINDERS:

Diameter	Length	Max Weight
∅ 100 → ∅ 900 mm	1 000 → 7 000 mm	6 500 kg





- ROUND FORGINGS:

Thickness	Diameter	Max Weight
100 → 1 000 mm	∅ 500 → ∅ 1 700 mm	6 500 kg

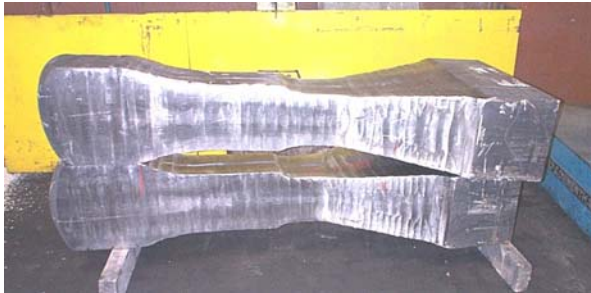


Diameter = 1 600 mm

Weight = 2 300 kg



- COMPLEX FORGED:



Thickness (mm)	Width (mm)	Length (mm)	Max Weight (Kg)
≤ 750	≤ 2000	8000	6500



(pictures with no scale)



- COMPLEX FORGED

Thickness (mm)	Width (mm)	Length (mm)	Max Weight (Kg)
<=750	<=2000	8000	6500



Length = 6 000 mm

Weight = 2 200 kg

(pictures with no scale)

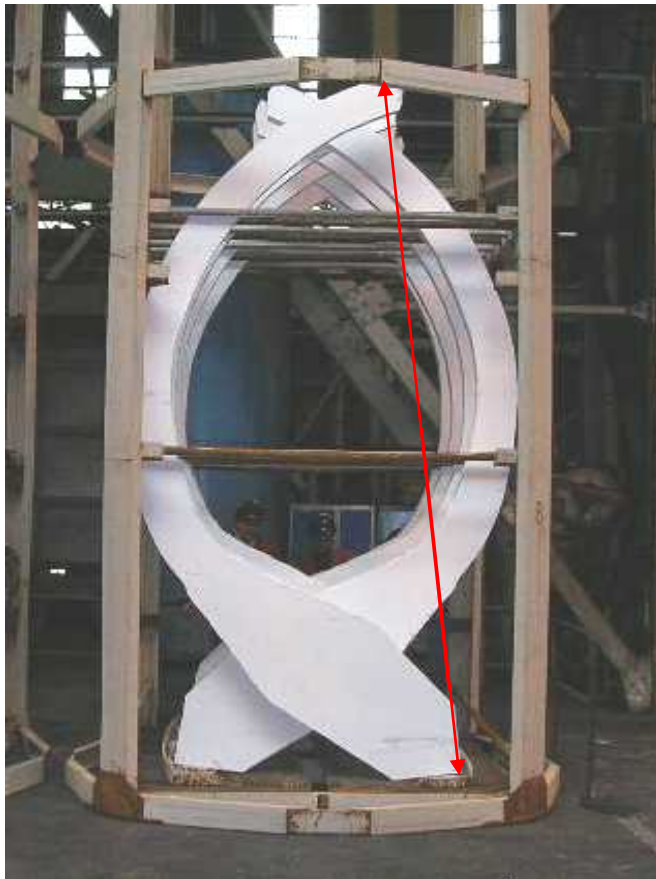


Forged Aluminium Glossary

- **COMPLEX FORGED:**

High = 4 000 mm

Weight = 300 kg

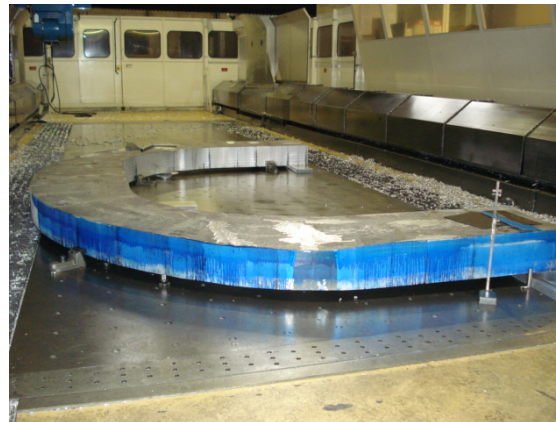


Thickness (mm)	Width (mm)	Length (mm)	Max Weight (Kg)
<=750	<=2000	8000	6500



Length = 3 000 mm

Weight = 230 kg



(pictures with no scale)

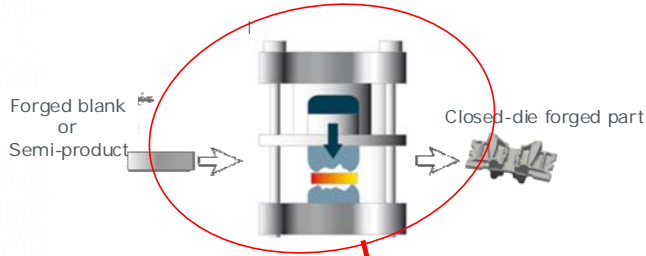
AUBERT&DUVAL



CLOSED-DIE FORGINGS

CLOSED-DIE FORGINGS

Closed-die forging: Shaping of complex parts from a metal blank between two engraved tools



65KT Press (Issoire)



40KI Press (Pamiers)



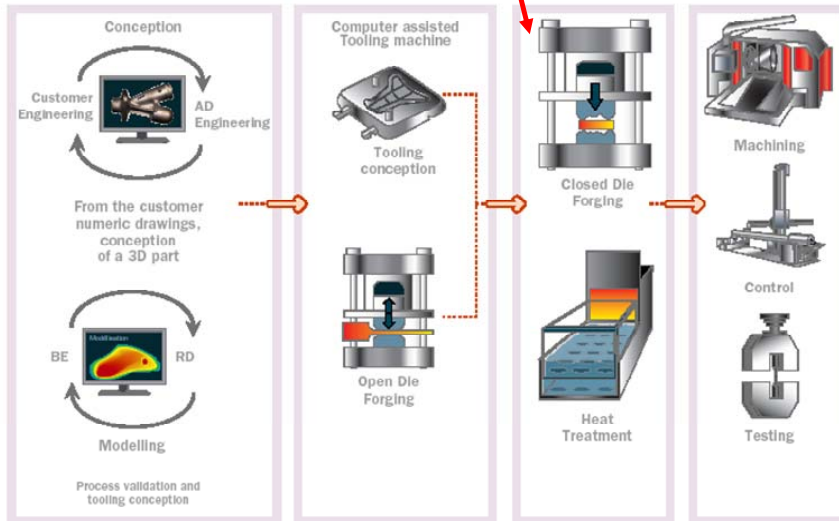
Structural aircraft parts



A380 Spar



Landing gear



ALLOYS	GROSS WEIGHT MIN (Kg)	GROSS WEIGHT MAX (Kg)	MOQ (Kg)	COMMENTS
ALUMINUM	50	2000	-	Possibilities of multi-components die (e.g. 5 parts of 10Kg for a given die) If weight > 2000kg ask the Market Manager
STEEL	25	20 000	8 000	Standard Steels (NC40SW-819B-819AW...)
	25	20 000	2 500	Nitriding & Carburizing steels - Special & Steel under development (e.g. MLX17-MLX19)
SUPERALLOYS	25	20 000	-	
TITANIUM	40	2 000	2 000	Standard (e.g. TA6V-TA6VPQ) & Special Titanium (e.g. Ti1023-Ti5553...)

Maximum weights are purely indicative : if larger parts , please check with Market Manager

If RFQ is related to an outsourced grade the minimum to be ordered is higher (40t and above), then ask the Market Manager in charge

SHAPES AND DELIVERY CONDITIONS

HEAT TREATMENT :

- Annealed
- Solution Treated
- Thermo-Mechanical Treatment
- Quenched, compressed and aged (aluminium alloys)
- Quenched and tempered
- Solution Treated and Aged

ALUMINUM Special Feature : STRESS RELIEVING: A&D is a leader in optimization of stress relieving allowing to machine pieces without strains, and to build a lean machining process due to the low residual stress level

SURFACE CONDITIONS :

- Machining
- Premachining
- Rough machining

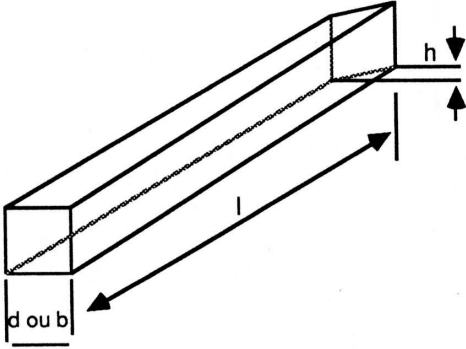
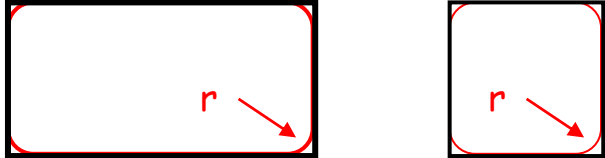
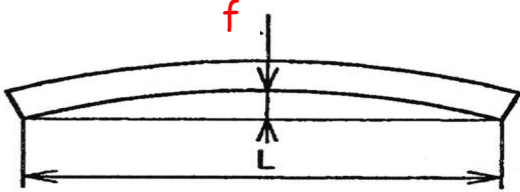
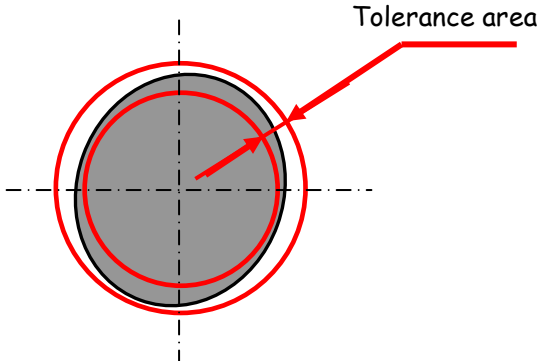
MARKING and NDT inspection according to Customers specifications

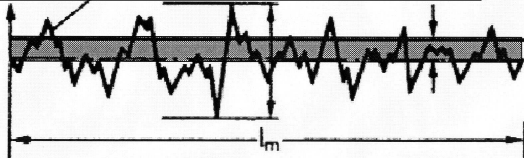
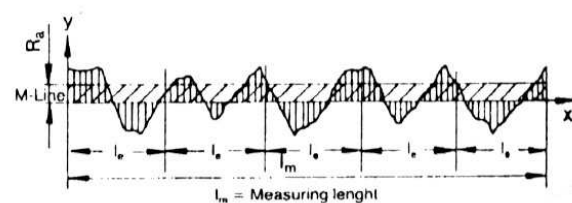
GLOSSARY

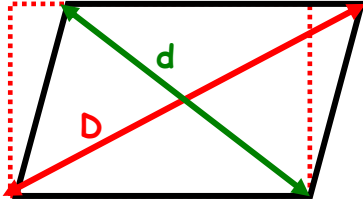
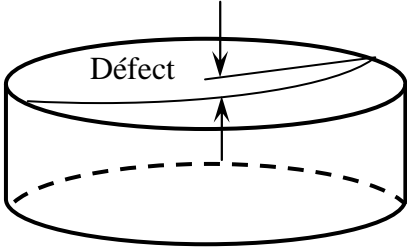
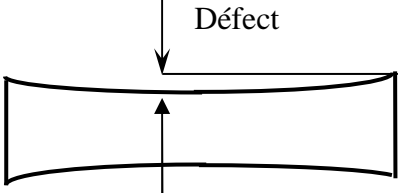
WORD	EXAMPLE OF CRITERIA	EXPLANATION																																																																																																																																														
Tolerance on diameter	$\varnothing \dots \pm 0.25$ $\varnothing \dots \pm (0.1 + 1\% \cdot \varnothing)$	$\varnothing 18 \pm 0.25 = \varnothing 17.75/18.25$ See appendix A, There are 18 levels : IT 01, IT 02,IT17, IT18																																																																																																																																														
	Quality 'x'	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; margin: 0;">14 # 24 TOLÉRANCES FONDAMENTALES IT EN MICRONS</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="border: 2px solid red;">Qualité</th> <th>Jusqu'à 3 inclus</th> <th>3 à 6 inclus</th> <th>6 10</th> <th>10 18</th> <th>18 30</th> <th>30 50</th> <th>50 80</th> <th style="border: 2px solid blue;">80 120</th> <th>120 180</th> <th>180 250</th> </tr> </thead> <tbody> <tr><td>5</td><td>4</td><td>5</td><td>6</td><td>8</td><td>9</td><td>11</td><td>13</td><td>15</td><td>18</td><td>20</td></tr> <tr><td>6</td><td>6</td><td>8</td><td>9</td><td>11</td><td>13</td><td>16</td><td>19</td><td>22</td><td>25</td><td>29</td></tr> <tr><td>7</td><td>10</td><td>12</td><td>15</td><td>18</td><td>21</td><td>25</td><td>30</td><td>35</td><td>40</td><td>46</td></tr> <tr><td>8</td><td>14</td><td>18</td><td>22</td><td>27</td><td>33</td><td>39</td><td>46</td><td>54</td><td>63</td><td>72</td></tr> <tr><td>9</td><td>25</td><td>30</td><td>36</td><td>43</td><td>52</td><td>62</td><td>74</td><td>87</td><td>100</td><td>115</td></tr> <tr><td>10</td><td>40</td><td>48</td><td>58</td><td>70</td><td>84</td><td>100</td><td>120</td><td>140</td><td>160</td><td>185</td></tr> <tr><td style="border: 2px solid red;">11</td><td>60</td><td>75</td><td>90</td><td>110</td><td>130</td><td>160</td><td>190</td><td style="border: 2px solid green;">220</td><td>250</td><td>290</td></tr> <tr><td>12</td><td>100</td><td>120</td><td>150</td><td>180</td><td>210</td><td>250</td><td>300</td><td>350</td><td>400</td><td>460</td></tr> <tr><td>13</td><td>140</td><td>180</td><td>220</td><td>270</td><td>330</td><td>390</td><td>460</td><td>540</td><td>630</td><td>720</td></tr> <tr><td>14</td><td>250</td><td>300</td><td>360</td><td>430</td><td>520</td><td>620</td><td>740</td><td>870</td><td>1 000</td><td>1 150</td></tr> <tr><td>15</td><td>400</td><td>480</td><td>580</td><td>700</td><td>840</td><td>1 000</td><td>1 200</td><td>1 400</td><td>1 600</td><td>1 850</td></tr> <tr><td>16</td><td>600</td><td>750</td><td>900</td><td>1 100</td><td>1 300</td><td>1 600</td><td>1 900</td><td>2 200</td><td>2 500</td><td>2 900</td></tr> </tbody> </table> </div> <div style="text-align: center;"> <p>POSITIONS SCHÉMATISÉES DES TOLÉRANCES</p> </div>	Qualité	Jusqu'à 3 inclus	3 à 6 inclus	6 10	10 18	18 30	30 50	50 80	80 120	120 180	180 250	5	4	5	6	8	9	11	13	15	18	20	6	6	8	9	11	13	16	19	22	25	29	7	10	12	15	18	21	25	30	35	40	46	8	14	18	22	27	33	39	46	54	63	72	9	25	30	36	43	52	62	74	87	100	115	10	40	48	58	70	84	100	120	140	160	185	11	60	75	90	110	130	160	190	220	250	290	12	100	120	150	180	210	250	300	350	400	460	13	140	180	220	270	330	390	460	540	630	720	14	250	300	360	430	520	620	740	870	1 000	1 150	15	400	480	580	700	840	1 000	1 200	1 400	1 600	1 850	16	600	750	900	1 100	1 300	1 600	1 900	2 200	2 500
Qualité	Jusqu'à 3 inclus	3 à 6 inclus	6 10	10 18	18 30	30 50	50 80	80 120	120 180	180 250																																																																																																																																						
5	4	5	6	8	9	11	13	15	18	20																																																																																																																																						
6	6	8	9	11	13	16	19	22	25	29																																																																																																																																						
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8	14	18	22	27	33	39	46	54	63	72																																																																																																																																						
9	25	30	36	43	52	62	74	87	100	115																																																																																																																																						
10	40	48	58	70	84	100	120	140	160	185																																																																																																																																						
11	60	75	90	110	130	160	190	220	250	290																																																																																																																																						
12	100	120	150	180	210	250	300	350	400	460																																																																																																																																						
13	140	180	220	270	330	390	460	540	630	720																																																																																																																																						
14	250	300	360	430	520	620	740	870	1 000	1 150																																																																																																																																						
15	400	480	580	700	840	1 000	1 200	1 400	1 600	1 850																																																																																																																																						
16	600	750	900	1 100	1 300	1 600	1 900	2 200	2 500	2 900																																																																																																																																						

8. Cotation tolérancée et ajustements

Extraits de tolérances ISO pour arbres (en microns : 1 μm = 0,001 mm)														
dimensions nominales (en mm)														
au-delà de à (inclus)		1 3	3 6	6 10	10 18	18 30	30 50	50 80	80 120	120 180	180 250	250 315	315 400	400 500
d9	es	-20	-30	-40	-50	-65	-80	-100	-120	-145	-170	-190	-210	-230
	ei	-45	-60	-76	-93	-117	-142	-174	-207	-245	-285	-320	-350	-385
d10	es	-20	-30	-40	-50	-65	-80	-100	-120	-145	-170	-190	-210	-230
	ei	-60	-78	-98	-120	-149	-180	-220	-260	-305	-355	-400	-440	-480
d11	es	-20	-30	-40	-50	-65	-80	-100	-120	-145	-170	-190	-210	-230
	ei	-80	-105	-130	-160	-195	-240	-290	-340	-395	-460	-510	-570	-630
e7	es	-14	-20	-25	-32	-40	-50	-60	-72	-85	-100	-110	-125	-135
	ei	-24	-32	-40	-50	-61	-75	-90	-107	-125	-146	-162	-182	-198
e8	es	-14	-20	-25	-32	-40	-50	-60	-72	-85	-100	-110	-125	-135
	ei	-28	-38	-47	-59	-73	-89	-106	-126	-148	-172	-191	-214	-232
e9	es	-14	-20	-25	-32	-40	-50	-60	-72	-85	-100	-110	-125	-135
	ei	-39	-50	-61	-75	-92	-112	-134	-159	-185	-215	-240	-265	-290
f6	es	-6	-10	-13	-16	-20	-25	-30	-36	-43	-50	-56	-62	-68
	ei	-12	-18	-22	-27	-33	-41	-49	-58	-68	-79	-88	-98	-108
f7	es	-6	-10	-13	-16	-20	-25	-30	-36	-43	-50	-56	-62	-68
	ei	-16	-22	-28	-34	-41	-50	-60	-71	-83	-96	-108	-119	-131
f8	es	-6	-10	-13	-16	-20	-25	-30	-36	-43	-50	-56	-62	-68
	ei	-20	-28	-35	-43	-53	-64	-76	-90	-106	-122	-137	-151	-165
g5	es	-2	-4	-5	-6	-7	-9	-10	-12	-14	-15	-17	-18	-20
	ei	-6	-9	-11	-14	-16	-20	-23	-27	-32	-35	-40	-43	-47
g6	es	-2	-4	-5	-6	-7	-9	-10	-12	-14	-15	-17	-18	-20
	ei	-8	-12	-14	-17	-20	-25	-29	-34	-39	-44	-49	-54	-60
h5	es	0	0	0	0	0	0	0	0	0	0	0	0	0
	ei	-4	-5	-6	-8	-9	-11	-13	-15	-18	-20	-23	-25	-27
h6	es	0	0	0	0	0	0	0	0	0	0	0	0	0
	ei	-6	-8	-9	-11	-13	-16	-19	-22	-25	-29	-32	-36	-40
h7	es	0	0	0	0	0	0	0	0	0	0	0	0	0
	ei	-10	-12	-15	-18	-21	-25	-30	-35	-40	-46	-52	-57	-63
h8	es	0	0	0	0	0	0	0	0	0	0	0	0	0
	ei	-14	-18	-22	-27	-33	-39	-46	-54	-63	-72	-81	-89	-97
h9	es	0	0	0	0	0	0	0	0	0	0	0	0	0
	ei	-25	-30	-36	-43	-52	-62	-74	-87	-100	-115	-130	-140	-155
h10	es	0	0	0	0	0	0	0	0	0	0	0	0	0
	ei	-40	-48	-58	-70	-84	-100	-120	-160	-185	-210	-230	-250	-250
h11	es	0	0	0	0	0	0	0	0	0	0	0	0	0
	ei	-60	-75	-90	-110	-130	-160	-190	-220	-250	-290	-320	-360	-400
h13	es	0	0	0	0	0	0	0	0	0	0	0	0	0
	ei	-140	-180	-220	-270	-330	-390	-460	-540	-630	-720	-810	-890	-970
j6	es	+4	+6	+7	+8	+9	+11	+12	+13	+14	+16	+16	+18	+20
	ei	-2	-2	-2	-3	-4	-5	-7	-9	-11	-13	-16	-18	-20
j7	es	+6	+8	+10	+12	+13	+15	+18	+20	+22	+25	+26	+29	+31
	ei	-4	-4	-5	-6	-8	-10	-12	-15	-18	-21	-26	-28	-32
js5		± 2	$\pm 2,5$	± 3	± 4	$\pm 4,5$	$\pm 5,5$	$\pm 6,5$	$\pm 7,5$	± 9	± 10	11,5	$\pm 12,5$	$\pm 13,5$
js6		± 3	± 4	$\pm 4,5$	$\pm 5,5$	$\pm 6,5$	± 8	$\pm 9,5$	± 11	12,5	$\pm 14,5$	± 16	± 18	± 20
js7		± 5	± 6	$\pm 7,5$	± 9	$\pm 10,5$	$\pm 12,5$	± 15	$\pm 17,5$	± 20	± 23	± 26	$\pm 28,5$	$\pm 31,5$
js9		+12	+15	+18	+21	+26	+31	+37	+43	± 50	± 57	± 65	± 70	± 77
js11		+30	+37	+45	+55	+65	+80	+95	+110	± 125	± 145	± 160	± 180	± 200
js13		± 70	± 90	± 110	± 135	± 165	± 195	± 230	± 270	± 315	± 360	± 405	± 445	± 485
k5	es	+4	+6	+7	+9	+11	+13	+15	+18	+21	+24	+27	+29	+32
	ei	0	+1	+1	+1	+2	+2	+2	+3	+3	+4	+4	+4	+5
k6	es	+6	+9	+10	+12	+15	+18	+21	+25	+28	+33	+36	+40	+45
	ei	0	+1	+1	+1	+2	+2	+2	+3	+3	+4	+4	+4	+5
m6	es	+8	+12	+15	+18	+21	+25	+30	+35	+40	+46	+52	+57	+63
	ei	+2	+4	+6	+7	+9	+9	+11	+13	+15	+17	+20	+21	+23
m7	es	—	+16	+21	+25	+29	+34	+41	+48	+55	+63	+72	+78	+86
	ei	—	+4	+6	+7	+8	+9	+11	+13	+15	+17	+20	+21	+23
n5	es	+8	+13	+16	+20	+24	+28	+33	+38	+45	+51	+57	+62	+67
	ei	+4	+8	+10	+12	+15	+17	+20	+23	+27	+31	+34	+37	+40
n6	es	10	+16	+19	+23	+28	+33	+39	+45	+52	+60	+66	+73	+80
	ei	+4	+8	+10	+12	+15	+17	+20	+23	+27	+31	+34	+37	+40
p6	es	+12	+20	+24	+29	+35	+42	+51	+59	+68	+79	+88	+98	+108
	ei	+6	+12	+15	+18	+22	+26	+32	+37	+43	+50	+56	+62	+68

WORD	EXEMPLE OF CRITERIA	EXPLANATION
Twistness	<p>$\leq 4\%$ of width or thick (with maxi 15° of total length)</p>	
angle roundness	<p>$r \leq 1 \text{ mm}$</p>	
Straightness	<p>1 mm/m (maximum of 0.12% on total length)</p>	 <p>Straightness is measured by camber (straightning defect). f = camber measured L = total length</p>
Ovality	<p>50% of diameter tolerance (mm)</p>	 <p>Wrong circularity, shape of each section has to be included between two circles of which difference diameter is less than 50% of tolerance range nominal value diameter</p>

<p>Roughness</p>	<p>$R_a < 6.3$ μm</p>	<p style="text-align: center;">Roughness</p> <p>It is the total of macroscopic and microscopic surface unevenness : machining surfaces are not perfect, we can see unvenness due to machining process, cutting tools, steel...</p> <p style="color: red;">The lower the index , the more difficult to reach the right roughness and the more expensive the product.</p> <p style="text-align: center;">Criteria</p> <p>This criteria is really microscopic consist in mean variation the range average of the roughness.</p> <p>The statistic criteria R_a, is the difference between arithmetic mean deviation compared with the mean line.</p> $R_a = \frac{1}{l_m} \int_{x=0}^{x=l_m} y dx$ <p style="text-align: center;">Moyenne arithmétique de toutes les distances absolues du profil de</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p>Arithmetic mean of all values of roughness profile R on inspected surface</p> </div>  
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WORD	EXAMPLE OF CRITERIA	EXPLANATION
<p>Squareness</p>	$\frac{D - d}{D} < 0.025$	<div style="text-align: center;">  </div> <p style="text-align: center;">Squareness or transverse tolérance</p> <p>Ratio on difference between two lengths</p> $\frac{D - d}{D} < 0.025$ <p>(example : squares or flats)</p>
<p>Flatness</p>	<p>defect < 2mm</p>	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; margin-bottom: 20px;"> <div style="margin-right: 10px;">Disc</div>  </div> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">Flat</div>  </div> </div>

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
2017							
2024	EN AW-2024 (AlCu4Mg1)	A92024					
2050							
2214							
2219	EN AW-2219 (AlCu6Mn)	A92219					
2618							
5083	EN AW-5083 (AlMg4,5Mn0,7)	A95083					
5086							
5754							
6061		A96061					
6082							
7175	EN 4276-4277-4278-4289-4294	A97175					
5911							
7010	EN AW-7010 (AlZn6MgCu)	A97010					
7020	EN AW-7020 (AlZn4.5Mg1)	A97020					
7040							
7050	EN AW-7050 (AlZn6CuMgZr)	A97050					
7449							
7475							
100HLES	X10NiMoCrV6						
165ND	CoCr28MoNi	R30021		STELLITE 21			
50NILYW	13MoCrNi42-16-14			M50NIL			6278
56AJ	28MoCrV14						
56A	28CrMoV5-8						
56BI	X22CrMoWV12-1				1,4935		
56BN	X20CrMoV11-1				1.4922		
56BN					1.4923		
56CW	X10CrCoMo10-6			FV535	1.4911	S 152	

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
56GE	X20CrMoWNi12	S42200					5655
56T4	X12CrNiMoNbV11			FV448		S 150	
56T5	X19CrMoNbVN11-1				1,4913		
56TG	21CrMoV5-7				1,7709		
56TG	24CrMoV5-7				1,7733		
819AW	35NiCrMo16				~1.6773		
819B	36NiCrMo16				1.6773		
820	40NiCrMo18				~1.2767		
836J	30CrNiMo8				1.6604		
836J					1,6580		
866	34NiCrMo6				1.6582		
897D	30NiCr11		SAE 3435		1,6580		
AD21	35CrNiMoV6						
AD3	10NiCr12		AISI E 3316		~1.5752		
ADC3	X36CrMoV5		~H11	H11 modifié	1,2340		
ADNIC 265 D	NiMo28	N10001		HASTELLOY B	2,4617		
ADNIC 265 D		N10665		HASTELLOY B2	~2.4810		
ALACRITE 602	G-CoCr29W5	R30006		STELLITE 6			5387
APX	X17CrNi16-2	S43100	431	431	1.4044	S 80	
APX					1,4057		
APX4	X4CrNiMo16-5-1				1,4418		
APXV	X17CrNi16-2	S43100	431	431	1,2787		
APZ9	X85CrMoV18-2				1,4748		
BED	43CrMo4				1,3563		
BED	43CrMo4				1,7225		
BM2	15CrMo4-05						
BMV4	40CrMoV20	T20811			1.7784		6437
BMV4							6485
BMV4W	40CrMoV20	T20811			1.7784		6487
BMV4W					1.7784		6488

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
BMV5	36CrMoV20				1,234		
BXM	17CND6						
CLARMHB3	34NiCrMoV14-6						
CLARM HB7	40NiCrMoV15						
CLARM HBR	30NiCrMoV14						
CNS	35NiCr6						
CNSMo	35NiCrMo6						
CX13VD	X12CrNiMoV12-3	S64152			1,4933		5719
CX13VDW	X12CrNiMoV12-3	S64152			1,4933		5719
DH11	X37CrMoV5-1		H11		1,2343		
DH13	X40CrMoV5-1		H13		1,2344		
DH33	32CrMoV12-28		~H10		~1.2365		
DH53	X38CrMoV5-3				1,2367		
D25T	X6NiCrTiMoVB25-15	S66286		A286	1.4980		
DU3	X5CrNiCuNb16-4	S17400	S17400	17-4PH	1.4542		
DU3				630	1.4542		
EA1	NiCr20TiAl	N07080	J775	NIMONIC 80A	2.4952		
EA1			HEV-5				
F65	34CrMo4				1.7220		
F65					1.7224		
F65					1,7225		
F66J	30CrMo4	G41300	4130	4130			6370
F66J							6371
F66J							6348
F66J							6350
F66S	25CrMo4				1.7218	S 142	
F66S					1.7214	S 158	
FAD	16NiCrMo13						
FADC	10NiCrMo13-5	G93106	E9310	9310			6260
FADCW	10NiCrMo13-5	G93106	E9310	9310			6265

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
FADCW							6267
FADH	14NiCrMo13-4				1.6657	S 157	
FADHW	14NiCrMo13-4				1.6658		
FADS	16NiCrMo16-5				1.6723	S 82	
FADSW	16NiCrMo16-5				1.6722	S 156	
FDG	20NiCrMo13-4	K41910			1.6660		6492
FDG							6493
FDMA	30NiCrMo16				~1.6657		
FND (W)	15NiMoSiCr10	K51570					6494
FND (W)							6495
GD223	X60NiMnCr13-5-3			X50CrNiMn12		S 131	
GD223				Z50CNM12			
GH2	33CrMoV12-9	K24340					
GH4	40CrMoV13-9				1.8523	S 132	
GH4						S 134	
GH4W	40CrMoV13-9					S 138	
GHC	20CrMo12						
GK3	31CrMo12				1.8564		
GK3					1,7361		
GK3					1,8515		
GK4	40CrMoV13-9				1.8523		
GK5	20CrMo12				1,8519		
GK5S	24CrMo13-6				1,8516	S 106	
GK5S					1,8519		
GKH	33CrMoV12-9	K24340					
GKHW	33CrMoV12-9	K24340					6481
GKJ	31CrMoV9				1,8514		
GKJ					1,8519		
GKJ					1.7707		
GKP	32CrMoNiV5	K23280					6496

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
GKP							6497
GKP							6498
JD19	20NiCrMo2-2	G86200	8620	8620	1.6523		6274
LK3	41CrAlMo7-10	K24065		NITRALLOY 135	1.8509		6470
LK3							6472
LK3W	41CrAlMo7-10	K24065			1.8509		
LK5	32CrAlMo7-10				1.8505		
LXM4	X1CrNiMoAlTi12-9-2				1.4530		
M25W	X2CrNiMo18-15-3	S31673			1.4441		
M30NW	X4CrNiMoN21-9-4			REX734			
M 64 B.C	CoCr28Mo	R31537					
M 64 C	CoCr28Mo	R31538					
MARVAL18	X2NiCoMo18-8-5	K92890		Maraging 250	1.6359	S 162	6512
MY14	X1NiCoMo14-10-05						
MY16	X2NiCoMo18-08-05						
MY17PQ	X2NiCoMo18-08-05						
ML18PQ	X2NiCoMo18-08-05						
MY19	X2NiCoMo18-9-5	K93120			1,6358		
MY23	X2NiCoMo18-12-04						
MY24	X2NiCoMo18-13-05						
MARVALX12	X1CrNiMoAlTi12-9-2				1.4530		5928
MARVALX12H	X1CrNiMoAlTi12-10-2				1,4596		
MARVAL13X	X3CrNiMo13-8-2	S13800	S13800	PH13-8Mo	1.4534		5629
MARVAL13X							5864
MYM1	X2NiCoMo18-8-5	K92890		Maraging 250	1,6379		
MYM1	X2NiCoMo18-8-5	K92890		Maraging 250	~1.2706		
MYM2	X2NiCoMo18-9-5	K93120		Maraging 300	1,6358		
MARVAL X12 H	X1CrNiMoAlTi12-10-2						
MEK3	33CrMoV12-9	K24340			1,7765		6481
MEK3	33CrMoV12-9	K24340			~1.8522		6481

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
MEK4	40CrMoV13-9				1,8523		
MEP	45WCrMo8	S1			1,2542		
MES	35CrWMo12						
MMR0	18NiCr5-4				1.5810		
MMR1	16NiCr5-4						
MMR3	10NiCr5-4				1.5805		
ML340	X23NiCoCrMoAl13-6-3						
MLX17	X1CrNiMoAlTi12-11-2	S11100			1.4612		5937
MLX19	X1CrNiMoAlTi10-12-2	S11902					5938
MLX138	E-Z3CNDA13-8			13-8 Mo			
MOC2	42CrMo4				1.7225		
MOC3J	40CrMo4	G41400	4140	4140			6349
MOC3J							6382
MOCV2	40CrMoV4-6	K14675		17-22 A	1,7711		6304
MOCV2W	40CrMoV4-6	K14675		17-22 A			6305
MPY	NiCr20Co13Mo4Ti3Al	N07001		WASPALLOY	2.4654		5544
MPYV	NiCr20Co13Mo4Ti3Al	N07001		WASPALLOY	2.4654		5544
MX455	X3CrNiCuTiNb12-9	S45500		CUSTOM 455	1,4543		5617
MX455							5860
NC25M	28NiCrMo11						
NC310YW	40SiNiCrMoV10			HP310			6499
NC40M	41NiCrMo7-3-2	G43400	4340	4340	1,6563	S 149	6415
NC40M							6359
NC40M1	40NiCrMo7-3	K24064					
NC40MW	41NiCrMo7-3-2	G43400	4340	4340	1,6563		6414
NC40MW							6454
NC40SW	40NiSiCrMo7	K44220		300M	~1.6928	S 155	6417
NC40SW							6419
NC40SW							6257
NCAV	12NiCr12						

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
NCAV2	14NiCr12						
NCAV4	16NiCr12						
NFM18	X8MnCrN19-19						
NY276	NiMo16Cr15W	N10002		HASTELLOY C	2,4819		5530
NY276		N10276		HASTELLOY C276			
NY32750	X2CrNiMoN25-7-4	S32750			1.4410		
NY32760	X2CrNiMoCuWN25-7-4	S32760			1.4501		
NY32760		S32520					
NY45N	X2CrNiMoN22-5-3	S31803			1.4462		
NY47N+	X2CrNiMoN25-7-4						
NY52N	X2CrNiMoCuN25-6-3	S32550			~1.4507		
NY52N+	X2CrNiMoCuN25-6-3	S39255					
NY52N+		S32520			~1.4507		
NY600	NiCr15Fe	N06600		INCONEL 600			5540
NY600							5665
NY625	NiCr22Mo9Nb	N06625		INCO 625			
NY690	NiCr29Fe	N06690		INCONEL 690	2,4642		
NY690							
NY718	NiCr19Fe19Nb5Mo3	N07718		INCO 718			
NY904L	X2NiCrMoCu25-20-5-2	N08904	904L		1.4539		
NY904L	X1NiCrMoCu25-20-5						
NY928	X2NiCrMoCu32-27-4-1	N08028			~1.4563		
NY928	X1NiCrMoCu31-27-4						
NY750	NiCr15Fe7TiAl	N07750		INCONEL X750	2.4669		
NY750							5667
NY750							5668
NY750							5671
NY810	X10NiCrAlTi32-21	N08810			~1.4958		
	X5NiCrAlTi31-20						
NY811	X8NiCrAlTi32-21	N08811			~1.4959		

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
PYRAD 49 D PYRAD49D	NiCr22Fe18Mo	N06002		HASTELLOY X	2.4665	HR 6	5536
					2.4665	HR 204	5754
PYRAD53NW PYRAD53NW PYRAD53NW PYRAD53NW PYRAD53NW	NiCr19Fe19Nb5Mo3	N07718		INCO 718	2.4668		5596
					2.4668		5597
							5662
							5663
							5664
R25T2	X6NiCrTiMoVB25-15	S66286		A286	1.4944		
R6110	X38CrMoV5-3				1,2367		
RA4W	80MoCrV42-16	T11350		~M50	1,3551		
RA50YW RA50YW	80MoCrV42-16	T11350		M50	1.3552		6490
							6491
RA6	X82WMoCrV6-5-4			M2	1,3343		
RA6W	X82WMoCrV6-5-4			M2	1,3343		
RAD RAD	100Cr6	G52986	E52100		1.3504	S 135	
					1,3505		
RADW RADW	100Cr6	G52986	E52100		1.3514	S 136	6444
					1,3505		6447
RADYW RADYW	100Cr6	G52986	E52100		1.3504		
					1,3505		
RAPIDEM	X85WMoCrV6-5-4-2	T11302	M2	M2	1.3343 / 1.3339		
SANCY	X180CrMoW13		~D2				
SANCY2	X160CrMoV12		~D2		1,1379		
SC2104 SC2104	X2CrNiMoN17-13-3	S31654		316LN	1,4429		
SC2109	X2CrNi18-10			Z2 CN 19-10			
SC 2118 SC2118	X2CrNiMo17-12			Z 2 CND 18-12 + N2			
SCV SCV	15CrMoV6				1.7734		
					1,7736		

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
SCVW	15CrMoV6				1.7736		
SCVW					1,7734		
SDC	X35CrMoNiV5-2-2						
SIMO	X40CrSiMo10-2				1.4731		
SM2	55CrNiMoV4						
SM2M	55CrNiMoV5						
SMH	X100CrMoV5				1.2363		
SMI	60NiCrMo11						
SMK	X35CrWMoV5						
SMK3	X37CrMoV5-1	T20811					
SMP3	X37CrMoV5-1	T20811			1,234		
SMR	32CrMoV12-2-8		~H10		1.2365		
SMR4	35CrWMoV12-8-8						
SMR7	X38CrMoCoV5-3-3						
SMS3	X37CrMoV5-1						
SMV	X35CrWMoV5		~H12		1,2605		
SMV3	X37CrMoV5-1	T20811	H11	H11	1,2343		
SMV4S	X40CrMoV5-1		H13	H13 Superior	1,2344		
SMV5	X50CrMoWV5						
SOS3	X45CrSi9-3		J775	SILCHROME 1	1.4718		
SOS3			HNV3				
SY4	X150CrMoVCo12						
T40	3460	R50400		T40	3.7034		
T40	3451	R50400		T40	3.7034		
TA2	35NiCrMo16				~1.2766		
TA3	40NiCrMo18				~1.2767		
TA4DE	3351			IMI550	3.7184		
TA4DE	3465			IMI550	3.7184		
TA4DE	>3466			IMI550	3.7184		
TA5CD4		R58650		Ti17			

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
TA6E4Zr				IMI834			
TA6V4	3310	R56400		Ti6Al4V	3.7164		4920
TA6V4	>3315	R56400		Ti6Al4V	3.7164		4928
TA6V4		R56400		Ti6Al4V	3.7164		4965
TA6V4		R56400		Ti6Al4V	3.7164		4967
TA6V	3310	R56400		Ti6Al4V	3.7164		4920
TA6V	>3315	R56400		Ti6Al4V	3.7164		4928
TA6V		R56400		Ti6Al4V	3.7164		4965
TA6V		R56400		Ti6Al4V	3.7164		4967
TA6VE	3318		R56620	Ti662			4971
TA6VE	>3320		R56620	Ti662			4978
TA6VE			R56620	Ti662			4979
TA6VELI		R56401		Ti6Al4VELI			4930
TA6VELI		R56407		Ti6Al4VELI			4931
TA6VELI		R56401		Ti6Al4VELI			4930
TA6VELI		R56407		Ti6Al4VELI			4931
TA6Zr4DE	3735	R54620		Ti6242	3.7144		4975
TA6Zr4DE	>3737	R54620		Ti6242	3.7144		4976
TA6Zr5D	3321			IMI685	3.7154		
TA6Zr5D	3322			IMI685	3.7154		
TAD6Zr4E		R56260		Ti6246			4981
TV10A3F2	3115	R56410		Ti1023			4983
TV10A3F2	3356	R56410		Ti1023			4984
TV10A3F2		R56410		Ti1023			4986
TV10A3F2		R56410		Ti1023			4987
TYF22	14CrMoMn10-10						
TYF22VMOD	14CrMoMnV10-10						
TYHY80	15NiCrMo12-6		HY80				
TX304L	X2CrNi18-9	S30403	304L		1,4307		5511
TX304L	X2CrNi19-11				1,4306		5647
TX304L	X2CrNi19-10						

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
TX304L	X2CrNi19-9						
TX316L	X2CrNiMo17-12-2	S31603	316L		1,4404		5653
TX316L	X2CrNiMo18-12-3				1,4432		5507
TX316L	X2CrNiMo17-12-3				1,4449		
TX316L	X2CrNiMo17-13-2						
TX316L	X2CrNiMo17-11-2						
TX316L	X2CrNiMo16-10-2						
TX316LN	X2CrNiMoN17-11-2	S31654	316LN		1.4406		
TX316Nb	X6CrNiMoNb18-12-2						
TX321	X6CrNiTi18-10	S32100	321		1,4533		5510
TX321					1,4541		5645
TX321							5646
TX347	X6CrNiNb18-10	S34700	347		1,455		5512
TX347					1,4912		
TX410	X12Cr13	S41000	410				
TXF6NM	X2CrNi13-4	S41500	415				
V300	46SiCrMo6			45SiCrMo6	1.8062		
V325	50SiCrMo6				1.8063		
V3S	45SiCrMo6						
VCE	51CrV4	G61500	6150	6150	1.8159		6448
VCE4	52CrMoV4				1.7701		
VOLVIC10	X20CoCrWMo10-10-6-2				1,2888		
X12NBW	X14CrNb12	S41041		403 CB			
X13	X30Cr13	S42000			1,4028		
X13D	X20Cr13	S42000	420	420	1.4014	S 62	
X13D					1,4021		
X13E	X12CrNi13	S41001			1,4024		5612
X13E		S41000					5613
X13EW	X12CrNi13	S41001					5611
X13M	X12Cr13	S41000	410		1,4006	S 61	

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
X203							5769
X20MD	X4CrNiMoN21-9-4			REX734			
X20T	X25CrNiWSi20-9						
X20T2	X25CrNiW22						
X21RB	X53CrMnNiNb21-9				1.4870		
X21RC	X50CrMnNiNbN21-9		J775	21-4Nb	1.4882		
X21RC			XEV-F				
X23N	X33CrNiMn23-08		J775	23-8N			
X23N			EV15	NITRONIC 20			
X25V	X15CrNiSi25-21	S31400	314		1,4841		
X25V					1,2782		
X26RC	X30CrNiMnNbN25-12						
X39V	X10NiCrSi39-18						
X45U	X4CrNiCuMo15-06-01	S45000		CUSTOM 450			
X45UW	X4CrNiCuMo15-06-01	S45000		CUSTOM 450			5773
X45UW							5859
NY47N+	X2CrNiMoN25-7			URANUS 47N+			
X520	X5CrNiMoCuNb14-5			FV 520 B	1.4594	S 143	
X520						S 144	
X520						S 145	
NY52N+	X2CrNiMoCuN25-6-3			URANUS 52N+	1.4507		
XD15NW	X40CrMoVN16-2	S42025			1.4123		5925
XD16N	X50CrSiMnVN16-1	S42716					5926
XD440	X105CrMo17	S44004	440C	440C	1.4125		5630
XDBD	X105CrMo17	S44004	440C	440C	1.4125		5630
XDBD							5880
XDBDW	X105CrMo17	S44004	440C		1.3544		5618
XM114	X53CrMnNiN21-9		J775	21-4N	1.4871		
XN26AW	X2NiCrTiMoV25-15						
XN26TW	X6NiCrTiMoVB25-15-2	S66286		A286	1,4944	HR 51	5525

Aubert & Duval Grade Name	European Norm	UNS	AISI / SAE	usual trade name(2)	Werkstoff	British Standard	AMS
XN26TW					1,498	HR 650	5731
XN26TW							5732
XN26TW							5734
XN26TW							5737
XN26TW							5726
XN26TWS	X3NiCrTiMoV25-15-2-1				1,4943	HR52	
XN26TWS						HR251	
XSH	CoCr20W15Ni	R30605		HS25	2.4964	HR 40	5537
XSH				L605	2.4964	HR240	5759