POGGIPOLINI

SPECIAL FASTENERS CATALOGUE

TECHNICAL CATALOGUE

01/20 edition

EXPERTISE, INNOVATION, EXCELLENCE.

Calisto, my father, founded the Poggipolini company in 1950, in Bologna, Italy.
His talent led him to work for special medical and jewelry industries.

In 1970 we manufactured the first titanium fasteners for racing applications. In our region, also called Motor-Valley, many of the major high performance motorsports companies (such as Ferrari, Lamborghini, Ducati, etc..) are established and for this reason we developed our technologies and business towards this sector.

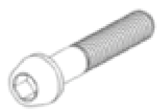
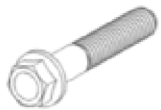
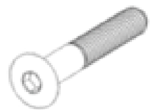
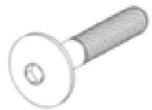
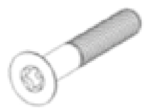
After 40 years, Poggipolini is recognised as a leading manufacturing company in the Motorsports and Automotive industries, but from 2008 we started to focus on the Aerospace industry. So we started to transfer our know-how and technologies to this sector and today Aerospace represents our main market.

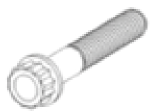
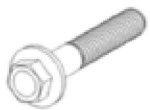
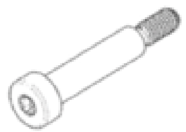
I always remind to our people that we are just at the beginning of a new, important chapter of our history.
We are here to prove our values: expertise, innovation & excellence.

Stefano Poggipolini
President | CEO

1.0 BOLT CONFIGURATION

BOLTS TYPE

01	02	04	05	06	07
HEXAGON SOCKET HEAD CAP BOLTS, CONICAL HEAD	HEXAGON BOLTS WITH FLANGE	HEX SOCKET COUNTERSUK HEAD BOLTS, FOREHEAD	HEXAGON SOCKET BUTTON HEAD BOLTS	HEXALOBULR SOCKET HEAD CAP BOLTS, CILINDRICAL HEAD	HEXALOBULR SOCKET COUNTERSUK HEAD BOLTS
					

11	12	13	14	15
DOUBLE HEXAGON BOLTS WITH FLANGE	HEXALOBULR SOCKET BUTTON HEAD BOLTS	HEXAGON HEAD BOLT WITH LARGE FLANGE	BOLT, CILINDRICAL HEAD, EXALOBULAR SOCKET, SPECIAL SHANK	SCREW, FLAT 100° FLUSH HEAD, CLOSE TOLERANCE, OFFSET CRUCIFORM RECESS
				

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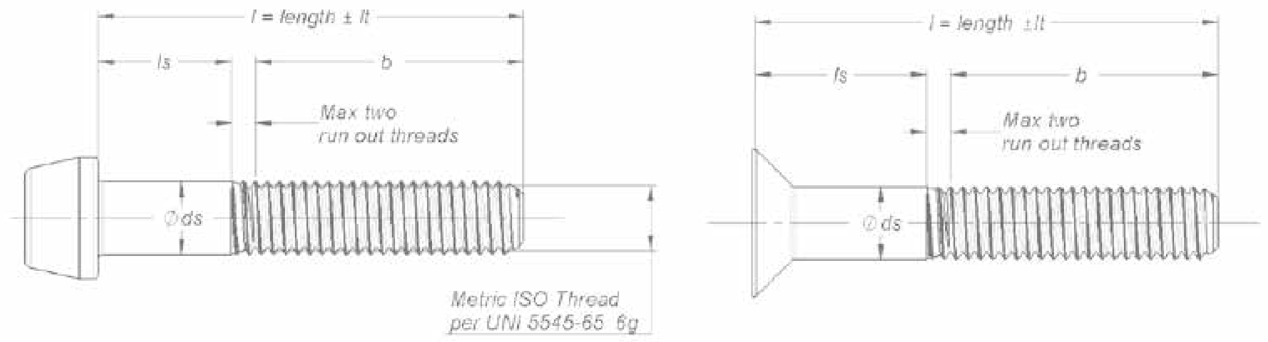
BOLT DIMENSIONS



Length CHOOSE THE LENGTH FROM MINIMUN UP TO MAXIMUN DIMENSIONS, SEE (D) TABLE 2

b, ds, ls, and all dimensions not in view, SEE THE CODE TABLE BOLT TYPE CHOSEN AND EXAMINE THE LINE OF THE RELEVANT THREAD

BOLT CODING SYSTEM

H (F) (A) (B) (C) (D) (E)

PART NUMBER CODING BY CHOICE OF THE FEATURES

TAB. 2

CODE = H (F) (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NUMBER	(F) BOLTS TYPE SEE TAB. 1	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) LENGTH 1mm STEPS	(E) ADDITIONAL OR DIFFERENT FEATURES
H	01	AA= Ti6Al4V annealed	0 = NO TREATMENT	03A = M3 X 0.5	003	A = none
	02	BA= 7075 T6-T651	A = BLUE ANODIZING (FOR TITANIUM)	04A = M4 X 0.7	-	C = 6h tolerance thread
	04	BB= 2024 T4	B = PASSIVATING	05A = M5 X 0.8	200	D = 4h6h tolerance tread
	05	BC= AL 7068 T6511	C = PVD TIN	06A = M6 X 1		X = not forged head
	06	DA=13-8 PH 1517MPa min 10%A min	D = DLC	07A = M7 X 1		
	07	IA= INCONEL 718, 1480MPa min 10%A min	E = IVD	08A = M8 X 1.25		
	11	EA = 15-5 PH, 1310MPA MIN 10%A MIN	F = DRY LUBRIFICANT COATING	08B = M8 X 1		
	12	FA= 17-4 PH, 1310MPA MIN 10%A MIN	G = ZINC ALUMINIUM FLAKES COATING	10A = M10 X 1.5		
	13	GA= AISI 4340, 1200MPA MIN 16%A MIN		10B = M10 X 1.25		
		HA= MLX 17, 1655MPA MIN 10%A MIN		12A = M12 X 1.75		
		JA=AERMET 100, 1999MPa 8%A min	COLOR ANODIZING	12B = M12 X 1.5		
		KA= MP35N, 1793MPa min 8%A min	ONLY FOR 7075 ALUM. ALLOY	12C = M12 X 1.25		
		LA= MARAGING 300, 2035MPa min 12%A min	B= BLUE	14A = M14 X 2		
		MA= 30NCD16 1350MPa min 14%A min	G= GOLD	14B = M14 X 1.75		
		NA= CRES A286 uts1150÷1200MPa	K= BLACK	14C = M 14 X 1.5		
		NB= CRES A286 uts 850÷900MPa	N= GREEN	14D = M 14 X 1.25		
			P= PURPLE	16A = M 16 X 2		
			R= RED	16B = M16 X 1.75		
			S= SILVER	16C = M16 X 1.5		

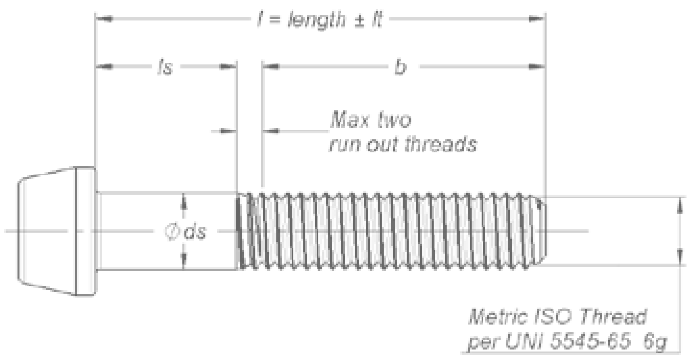
Example:

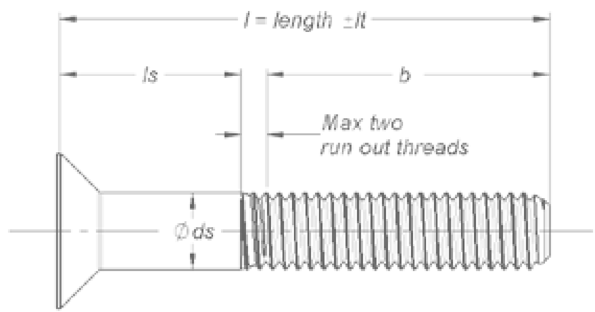
H 05 AA 0 06A 056 C = *Hexagon socket button head bolt, 56mm length bolt, Ti6Al4V material, M6x1 6h thread, 18mm thread length*

TAB. 1

BOLTS TYPE CODE

01	02	04	05	06	07	11	12	13	14	15
HEXAGON SOCKET HEAD CAP BOLTS, CONICAL HEAD	HEXAGON BOLTS WITH FLANGE	HEX SOCKET COUNTERSUK HEAD BOLTS, FOREHEAD	HEXAGON SOCKET BUTTON HEAD BOLTS	HEXALOBULR SOCKET HEAD CAP BOLTS, CILINDRICAL HEAD	HEXALOBULR SOCKET COUNTERSUK HEAD BOLTS	DOUBLE HEXAGON BOLTS WITH FLANGE	HEXALOBULR SOCKET BUTTON HEAD BOLTS	HEXAGON HEAD BOLT WITH LARGE FLANGE	BOLT, CILINDRICAL HEAD, EXALOBULAR SOCKET, SPECIAL SHANK	SCREW, FLAT 100° FLUSH HEAD, CLOSE TOLERANCE, OFFSET CRUCIFORM RECESS





length	b, ds, ls, and all dimensions not in view,
CHOOSE THE LENGTH FROM MINIMUN UP TO MAXIMUN, SEE (D) TABLE 2	SEE THE CODE TABLE BOLT TYPE CHOSEN AND EXAMINE THE LINE OF THE RELEVANT THREAD

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

CUSTOMIZE BOLTS CONFIGURATION TABLE

PART NUMBER SEE TABLE 2
H (F)(A)(B)(C)(D)(E)

TAB. 2

CODE = H (F) (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NUMBER	(F) BOLTS TYPE SEE TAB. 1	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) LENGTH 1mm STEPS	(E) ADDITIONAL OR DIFFERENT FEATURES
H	01 02 04 05 06 07 11 12 13 14 15	AA= Ti6Al4V annealed BA= 7075 T6-T651 BB= 2024 T4 BC= AL 7068 T6511 DA=13-8 PH 1517MPa min 10%A min IA= INCONEL 718, 1480MPa min 10%A min EA = 15-5 PH, 1310MPA MIN 10%A MIN FA= 17-4 PH, 1310MPA MIN 10%A MIN GA= AISI 4340, 1200MPA MIN 16%A MIN HA= MLX 17, 1655MPA MIN 10%A MIN JA=AERMET 100, 1999MPa 8%A min KA= MP35N, 1793MPa min 8%A min LA= MARAGING 300, 2035MPa min 12%A min MA= 30NCD16 1350MPa min 14%A min NA= CRES A286 uts1150÷1200MPa NB= CRES A286 uts 850÷900MPa	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING COLOR ANODIZING ONLY FOR 7075 ALUM. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	03A = M3 X 0.5 04A = M4 X 0.7 05A = M5 X 0.8 06A = M6 X 1 07A = M7 X 1 08A = M8 X 1.25 08B = M8 X 1 10A = M10 X 1.5 10B = M10 X 1.25 12A = M12 X 1.75 12B = M12 X 1.5 12C = M12 X 1.25 14A = M14 X 2 14B = M14 X 1.75 14C = M 14 X 1.5 14D = M 14 X 1.25 16A = M 16 X 2 16B = M16 X 1.75 16C = M16 X 1.5	003 ÷ 200	A = none C = 6h tolerance thread D = 4h6h tolerance tread X = not forged head

Example:

H 05 AA 0 06A 056 C = Hexagon socket button head bolt, 56mm length bolt, Ti6Al4V material, M6x1 6h thread, 18mm thread length
H 02 AA F 12B 112 D = Hexagon bolts with flange,112mm length, Ti6Al4V material, dry lubrificant coating, M12x1.5 4h6h thread, 30mm thread length
H 01 BA K 08A 021 A = Hexagon socket head cap bolts, conical head; 7075 aluminum alloy, M8x1.25 6g thread, total shank threaded, black color anodizing

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

CUSTOMIZE BOLTS CONFIGURATION TABLE

PART NUMBER SEE TABLE 2

H (F)(A)(B)(C)(D)(E)

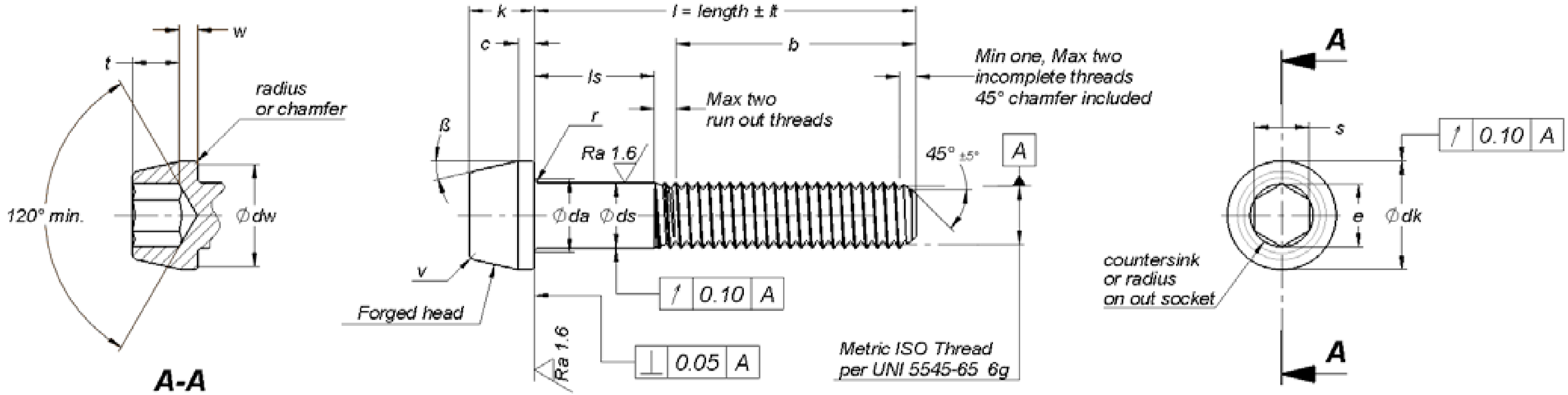
2.0 DATA SHEETS

SPECIAL FASTENERS

NUTS

WASHERS

TAB. 1

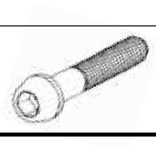


TYPE SCREW CODE	THREAD SIZE		b	β	c	Øda	Øds	Ødk	Ødw	ls	lt	e	k		r	v	s		t	w
FIRST PART NR.	EXT.	PITCH	SEE TAB 1B		+0.2 -0	MAX	+0 -0.1	+0 -0.15	MIN	MIN	±	MIN	MAX	MIN	MIN	MAX	MIN	MAX	MIN	MIN
H01	M4	0.7	20 - 25	13°	0.8	4.7	4	7	6.53	ls = lenght – b – 2pitch	0.3	3.44	4	3.82	0.2	0.4	3.02	3.08	2.0	1.4
H01	M5	0.8	20 - 25	13°	0.8	5.7	5	8.5	8.03		0.3	4.58	5	4.82	0.2	0.5	4.02	4.10	2.5	1.9
H01	M6	1	22 - 25	13°	1.0	6.8	6	10	9.38		0.5	5.72	6	5.7	0.3	0.6	5.02	5.14	3.0	2.3
H01	M8	1.25	26 - 30	13°	1.0	9.2	8	13	12.33		0.5	6.86	8	7.64	0.4	0.8	6.02	6.14	4.0	3.3
H01	M10	1.5 - 1.25	26 - 30	13°	1.5	11.2	10	16	15.33		0.5	9.15	10	9.64	0.4	1	8.03	8.18	5.0	4.0
H01	M12	1.75 - 1.5 - 1.25	26 - 30	10°	1.5	13.7	12	18	17.23		0.5	11.43	12	11.57	0.6	1.2	10.03	10.18	6.0	4.8
H01	M14	2 - 1.75 - 1.5 - 1.25	26 - 30	10°	1.8	15.7	14	21	20.17		0.5	13.72	14	13.57	0.6	1.4	12.03	12.21	7.0	5.8
H01	M16	2 – 1.75 – 1.5	26 - 30	10°	2.0	17.7	16	24	23.17		0.5	16	16	15.57	0.6	1.6	14.03	14.21	8.0	6.8

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



HEXAGON SOCKET HEAD CAP BOLTS, CONICAL HEAD

PART NUMBER SEE TABLE 2

H01(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 2

CODE = H01 (A) (B) (C) (D) (E) PART NUMBER CODING BY CHOICE OF THE FEATURES					
BASIC PART NUMBER	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD CODE	(D) LENGTH mm	(E) ADDITIONAL FEATURES
H01	AA= Ti6Al4V annealed BA= 7075 T6-T651	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING COLOR ANODIZING ONLY FOR 7075 ALUM. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 07A = M7 x 1 08A = M8 x 1.25 10A = M10 x 1.5 10B = M10 x 1.25 12A = M12 x 1.75 12B = M12 x 1.5 12C = M12 x 1.25 14A = M14 x 2 14B = M14 x 1.75 14C = M14 x 1.5 14D = M14 x 1.25 16A = M16 x 2 16B = M16 x 1.75 16C = M16 x 1.5	010 015 020 025 030 035 040 045 050 ÷ 140	A = none C = 6h thread D = 4h6h thread X = not forged head

TAB. 1B

"l" LENGTH	"b" THREAD LENGTH							
	M4	M5	M6	M8	M10	M12	M14	M16
10	ALL THREADED SHANK							
15								
20								
25	20	20	22	22				
30	20	20	22	25	26	26	26	26
35	20	20	25	25	30	30	30	30
40	25	25	25	25	30	30	30	30
45	25	25	25	25	30	30	30	30
50	25	25	25	25	30	30	30	30
÷	÷	÷	÷	÷	÷	÷	÷	÷
140	25	25	25	25	30	30	30	30

CODE EXAMPLES:

PART NUMBER: H01 AA 0 10B 035 A

- A — No Additional Features
- 035 — "l" BOLT LENGTH 35mm; "b" 30mm; "ls" 2.5mm
- 10B — THREAD CODE (M10 x 1.25)
- 0 — NO TREATMENT
- AA — Ti6Al4V MATERIAL
- H01 — HEX. SOCKET HEAD CAP BOLTS, CONICAL HEAD

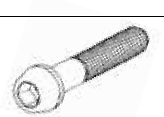
PART NUMBER: H01 BA K 08A 020 X

- X — not forged head
- 020 — "l" BOLT LENGTH 20mm all threaded shank
- 08A — THREAD CODE (M8 x 1.25)
- K — BLACK ANODIZING
- BA — AL 7075 T6
- H01 — HEX. SOCKET HEAD CAP BOLTS, CONICAL HEAD

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

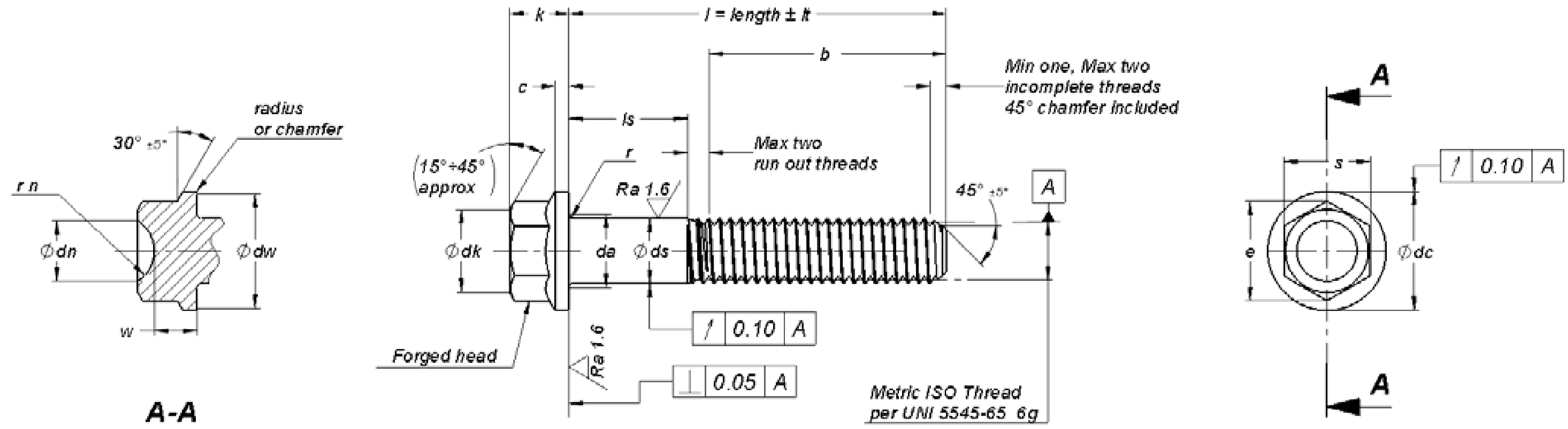


HEXAGON SOCKET HEAD CAP BOLTS, CONICAL HEAD

PART NUMBER SEE TABLE 2

H01(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1

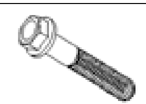


TYPE BOLT CODE	THREAD SIZE		b	c	Øda	Ødc	Øds	Ødk	Ødn	Ødw	ls	lt	e	k		r	s		r n	w
FIRST PART NR.	EXT.	PITCH	SEE TAB 1B	+0.2 -0	MAX	+0 -0.15	+0 -0.1	+0 -0.3	MAX	MIN	MIN	±	MIN	MAX	MIN	MIN	MAX	MIN	REF.	MIN
H02	M4	0.7	20 - 25	1.0	4.7	9	4	6	4	8.5	ls = lenght – b – 2pitch	0.3	6.51	4.5	4.3	0.2	6	5.85	2.2	2.3
H02	M5	0.8	20 - 25	1.0	5.7	10	5	7	5	9.5		0.3	7.59	5.0	4.8	0.2	7	6.85	2.5	2.5
H02	M6	1	22 - 25	1.3	6.8	11	6	8	6	10.4		0.5	8.71	5.5	5.3	0.3	8	7.85	2.8	2.7
H02	M8	1.25 - 1	22 - 25	1.3	9.2	13.5	8	10	8	12.8		0.5	10.95	6.5	6.3	0.4	10	9.85	3.5	3.0
H02	M10	1.5 - 1.25	26 - 30	1.5	11.2	16.5	10	12	10	15.8		0.5	13.29	8.0	7.7	0.4	12	11.82	4.5	3.5
H02	M12	1.75 - 1.5 - 1.25	26 - 30	1.8	13.7	20	12	14	12	19.2		0.5	15.38	10	9.7	0.6	14	13.73	5.5	4.5
H02	M14	2 - 1.75 - 1.5 - 1.25	26 - 30	2.1	15.7	24	14	17	14	23.2		0.5	18.75	12	11.7	0.6	17	16.73	7.0	5.0
H02	M16	2 – 1.75 - 1.5	26 - 30	2.4	17.7	28	16	20	16	27.2		0.5	22.06	14	13.6	0.6	20	19.67	8.0	5.5

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



BOLT, HEXAGON HEAD, FLANGE

PART NUMBER SEE TABLE 2

H02(_ _)(_)(_ _ _)(_ _ _) (_)

DRAWING NUMBER – CODICE DOCUMENTO | ISSUE DATE – DATA RILASCIO | REVISIONS - REVISIONI

H02XX-XXX- - -X | 05-05-2016

POGGIPOLINI

TAB. 1B

"l" LENGTH	"b" THREAD LENGTH (see add. features also)							
5mm step	M4	M5	M6	M8	M10	M12	M14	M16
10	ALL THREADED SHANK							
15								
20								
25	20	20	22	22				
30	20	20	22	25	26	26	26	26
35	20	20	25	25	30	30	30	30
40	25	25	25	25	30	30	30	30
45	25	25	25	25	30	30	30	30
50	25	25	25	25	30	30	30	30
÷	÷	÷	÷	÷	÷	÷	÷	÷
140	25	25	25	25	30	30	30	30

TAB. 2

CODE = H02 (A) (B) (C) (D) (E)

PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NR.	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) LENGTH mm	(E) ADDITIONAL FEATURES
H02	AA= Ti6Al4V annealed BA= 7075 T6-T651 BC= AL 7068 T6511 DA=13-8 PH 1517MPa min 10%A min FA= 17-4 PH 1310MPa min 10%A min GA= AISI4340 1200MPa min 16%A min HA= MLX 17 1655MPa min 10%A min JA=AERMET 100 1999MPa 8%A min KA= MP35N 1793MPa min 8%A min LA= MARAGING 300 2035MPa min 12%A min MA= 30NCD16 1350MPa min 14%A min NA= CRES A286 uts 1150÷1200MPa	0 = NO TREATMENT A = ANODIZING (BLUE FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING COLOR ANODIZING ONLY FOR 7075 ALUM. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 07A = M7 x 1 08A = M8 x 1.25 08B = M8 x 1 10A = M10 x 1.5 10B = M10 x 1.25 12A = M12 x 1.75 12B = M12 x 1.5 12C = M12 x 1.25 14A = M14 x 2 14B = M14 x 1.75 14C = M 14 x 1.5 14D = M 14 x 1.25 16A = M 16 x 2 16B = M16 x 1.75 16C = M16 x 1.5	010 015 020 025 030 035 040 045 050 ÷ 140	A = none B = 6h tolerance thread C = 4h6h tolerance thread X = not forged head E = thread: MJ ISO5855, 11mm length, 4h6h tol. F = thread: MJ ISO5855, 14mm length, 4h6h tol.

CODE EXAMPLES:

PART NUMBER: H02 AA 0 10B 035 A

- A — No Additional Features
- 035 — "l" BOLT LENGTH 35mm; "b" 30mm; "ls" 2.5mm
- 10B — THREAD CODE (M10 x 1.25)
- 0 — NO TREATMENT
- AA — Ti6Al4V MATERIAL
- H02 — BOLT, HEXAGON HEAD, FLANGE

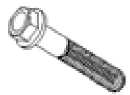
PART NUMBER: H02 NA B 08A 048 F

- F — Add. Features (see TAB. 2) MJ ISO5855 4h6h, b=11mm
- 048 — "l" BOLT LENGTH 48mm; "b" 14mm; "ls" 32mm
- 08A — THREAD CODE (M8 x 1.25)
- B — PASSIVATING
- NA — CRES A286 - UTS 1150÷1200 MPa MATERIAL
- H02 — BOLT, HEXAGON HEAD, FLANGE

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

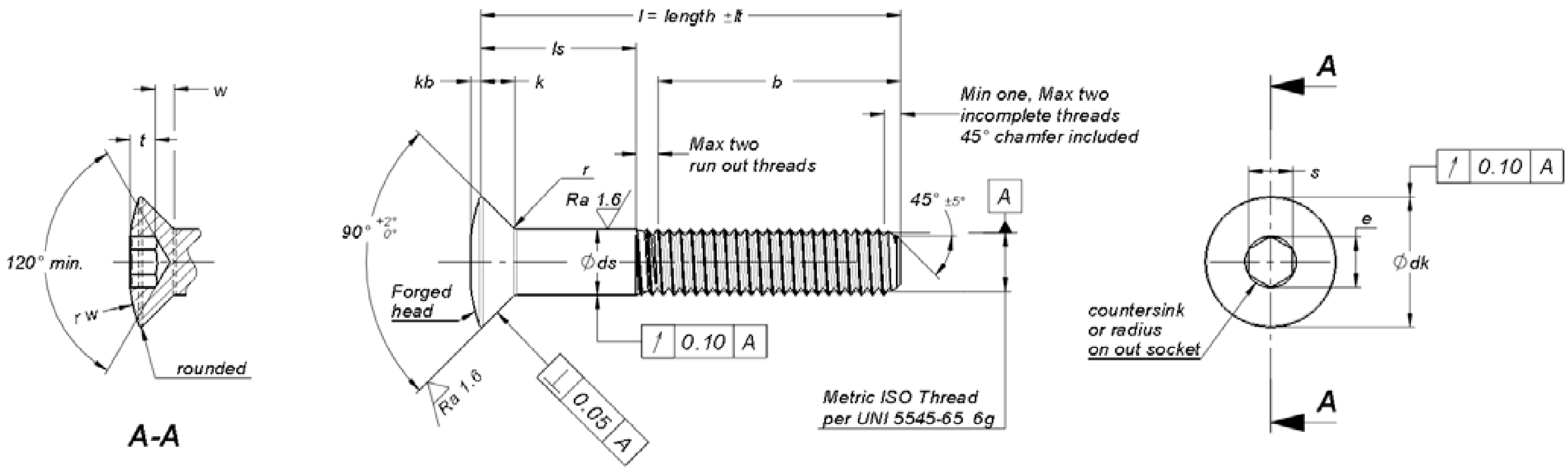


BOLT, HEXAGON HEAD, FLANGE

PART NUMBER SEE TABLE 2

H02(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1



TYPE BOLT CODE	THREAD SIZE		b	Øds	Ødk	ls	lt	e	k	kb	r	r w	s		t	w
FIRST PART NR.	EXT.	PITCH	SEE TAB 1B	+0 -0.1	+0 -0.3	MIN	±	MIN	+0 -0.15	±0.2	+0.2 -0	REF.	MIN	MAX	MIN	MIN
H04	M4	0.7	14	4	8	ls = lenght – b – 2pitch	0.3	2.87	2	0.7	0.2	12	2.52	2.58	1.7	0.6
H04	M5	0.8	16	5	10		0.3	3.44	2.5	0.9	0.2	15	3.02	3.08	2.2	0.8
H04	M6	1	18	6	12		0.5	4.58	3	1.1	0.3	18	4.02	4.10	2.5	1.0
H04	M8	1.25	18 - 22	8	16		0.5	5.72	4	1.4	0.4	25	5.02	5.14	3.4	1.4
H04	M10	1.5 - 1.25	26	10	20		0.5	6.86	5	1.8	0.4	30	6.02	6.14	4.2	1.8

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

HEXAGON SOCKET COUNTERSUNK HEAD BOLTS, FOREHEAD

PART NUMBER SEE TABLE 2

H04(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 2

CODE = H04 (A) (B) (C) (D) (E) PART NUMBER CODING BY CHOICE OF THE FEATURES					
BASIC PART NUMBER	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) LENGTH mm	(E) ADDITIONAL OR DIFFERENT FEATURES
H04	AA= Ti6Al4V annealed BA= 7075 T6-T651 BC= AL 7068 T6511	0 = NO TREATMENT A = ANODIZING (BLUE FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT G = ZINC ALUMINIUM COLOR ANODIZING ONLY FOR 7075 ALUM. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 07A = M7 x 1 08A = M8 x 1.25 08B = M8 x 1 10A = M10 x 1.5 10B = M10 x 1.25	010 015 020 025 030 035 040 045 050 ÷ 140	A = none C = 6h tolerance thread D = 4h6h tolerance tread

TAB. 1B

"l" LENGTH 5mm step	"b" THREAD LENGTH M4	M5	M6	M8	M10
10	ALL THREADED SHANK				
15					
20	14	16			
25	14	16	18	18	
30	14	16	18	22	
35	14	16	18	22	26
40	14	16	18	22	26
45	14	16	18	22	26
50	14	16	18	22	26
÷	X	X	18	22	26
140	X	X	18	22	26

CODE EXAMPLES:

PART NUMBER: H04 AA 0 10B 035 A

- A — No Additional Features
- 035 — "l" BOLT LENGTH 35mm; "b" 30mm; "ls" 2.5mm
- 10B — THREAD CODE (M10 x 1.25)
- 0 — NOTREATMENT
- AA — Ti6Al4V MATERIAL
- H04 — HEX SOCKET COUNTERSUNK HEAD BOLTS, FOREHEAD

PART NUMBER: H04 BA R 10A 025 A

- A — No Additional Features
- 025 — "l" BOLT LENGTH 25mm; all threaded bolt
- 10A — THREAD CODE (M10 x 1.5)
- R — RED ANODIZING
- BA — AL 7075 T6-T651
- H04 — HEX SOCKET COUNTERSUNK HEAD BOLTS, FOREHEAD

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

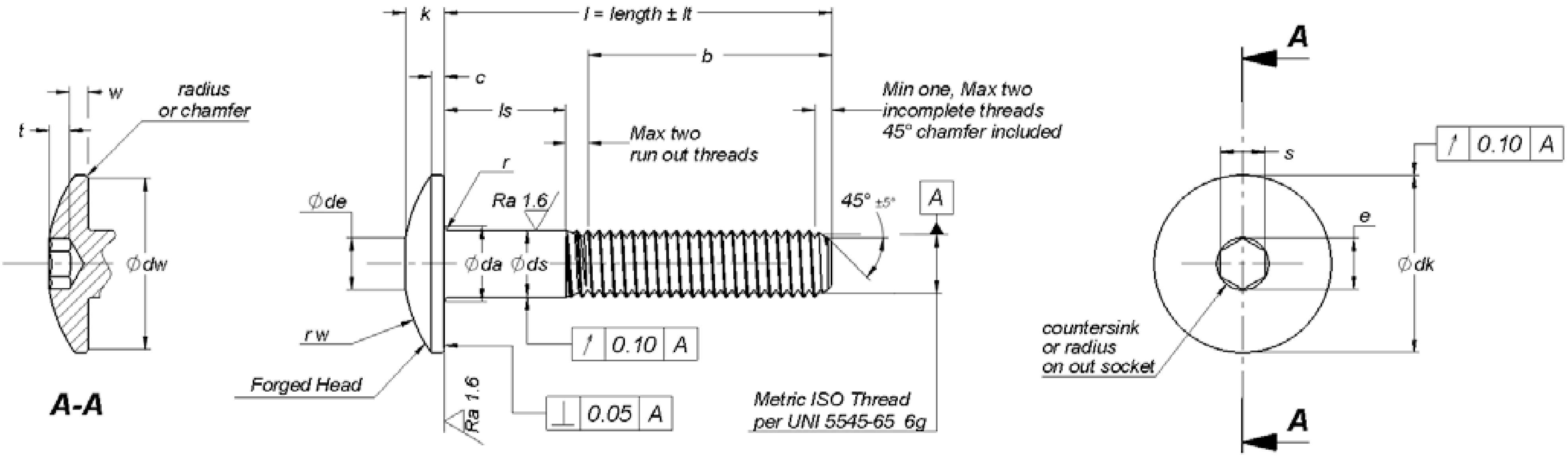
ROUGHNESS Ra 3.2

HEXAGON SOCKET COUNTERSUNK HEAD BOLTS, FOREHEAD

PART NUMBER SEE TABLE 2

H04(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1

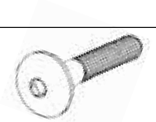


TYPE BOLT CODE	THREAD SIZE		b	c	Øda	Ødk	Øds	Ødw	e	k		ls	lt	r w	r	s		t	w
FIRST PART NR.	EXT.	PITCH	MIN	+0.2 -0	MAX	+0 -0.15	+0 -0.1	MIN	MIN	MAX	MIN	MIN	±	REF.	MIN	MIN	MAX	MAX	MIN
H05	M4	0.7	14	0.5	4.7	10	4	9.5	2.87	2.6	2.4	ls = lenght – b – 2pitch	0.3	6.9	0.2	2.52	2.58	2.3	0.1
H05	M5	0.8	16	1.0	5.7	12	5	11.3	3.44	3.1	2.9		0.3	9.4	0.2	3.02	3.08	2.5	0.4
H05	M6	1	18	1.2	6.8	16	6	15.3	4.58	3.7	3.3		0.5	14	0.25	4.02	4.10	2.7	0.6
H05	M8	1.25	22	1.3	9.2	16	8	15.3	5.72	3.7	3.3		0.5	14	0.4	5.02	5.14	2.9	0.4
H05	M10	1.5 - 1.25	26	1.6	11.2	18	10	17.2	6.86	4.2	3.8		0.5	16	0.4	6.02	6.14	3.2	0.6
H05	M12	1.75 - 1.5 - 1.25	30	1.8	13.7	20	12	19.2	9.15	4.7	4.3		0.5	16.5	0.5	8.03	8.18	3.5	0.8

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



HEXAGON SOCKET BUTTON HEAD BOLTS

PART NUMBER SEE TABLE 2

H05(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1B

"l" LENGTH 5mm step	"b" THREAD LENGTH M4	M5	M6	M8	M10	M12
10	ALL THREADED SHANK					
15						
20	14	16				
25	14	16	18	22		
30	14	16	18	22		
35	14	16	18	22	26	30
40	14	16	18	22	26	30
45	14	16	18	22	26	30
50	14	16	18	22	26	30
55	X	16	18	22	26	30
60	X	16	18	22	26	30
÷	X	X	18	22	26	30
100	X	X	18	22	26	30
÷	X	X	X	22	26	30
140	X	X	X	22	26	30

TAB. 2

CODE = H05 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NUMBER	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) LENGTH mm	(E) ADDITIONAL OR DIFFERENT FEATURES
H05	AA= Ti6Al4V annealed BA= 7075 T6-T651 BC= AL 7068 T6511	0 = NO TREATMENT A = ANODIZING (BLUE FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT G = ZINC ALUMINIUM COLOR ANODIZING ONLY FOR 7075 ALUM. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 07A = M7 x 1 08A = M8 x 1.25 08B = M8 x 1 10A = M10 x 1.5 10B = M10 x 1.25	010 015 020 025 030 035 040 045 050 ÷ 140	A = none C = 6h tolerance thread D = 4h6h tolerance tread X = not forged head

CODE EXAMPLES:

PART NUMBER: H05 AA 0 10B 035 A

- No Additional Features
- "l" BOLT LENGTH 35mm; "b" 26mm; "ls" 6.5mm
- THREAD CODE (M10 x 1.25)
- NO TREATMENT
- Ti6Al4V MATERIAL
- HEXAGON SOCKET BUTTON HEAD BOLT

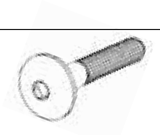
PART NUMBER: H05 BA R 10A 025 X

- with "different feature": not forged head
- "l" BOLT LENGTH 25mm; all threaded bolt
- THREAD CODE (M10 x 1.5)
- RED ANODIZING
- AL 7075 T6-T651
- HEXAGON SOCKET BUTTON HEAD BOLT

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

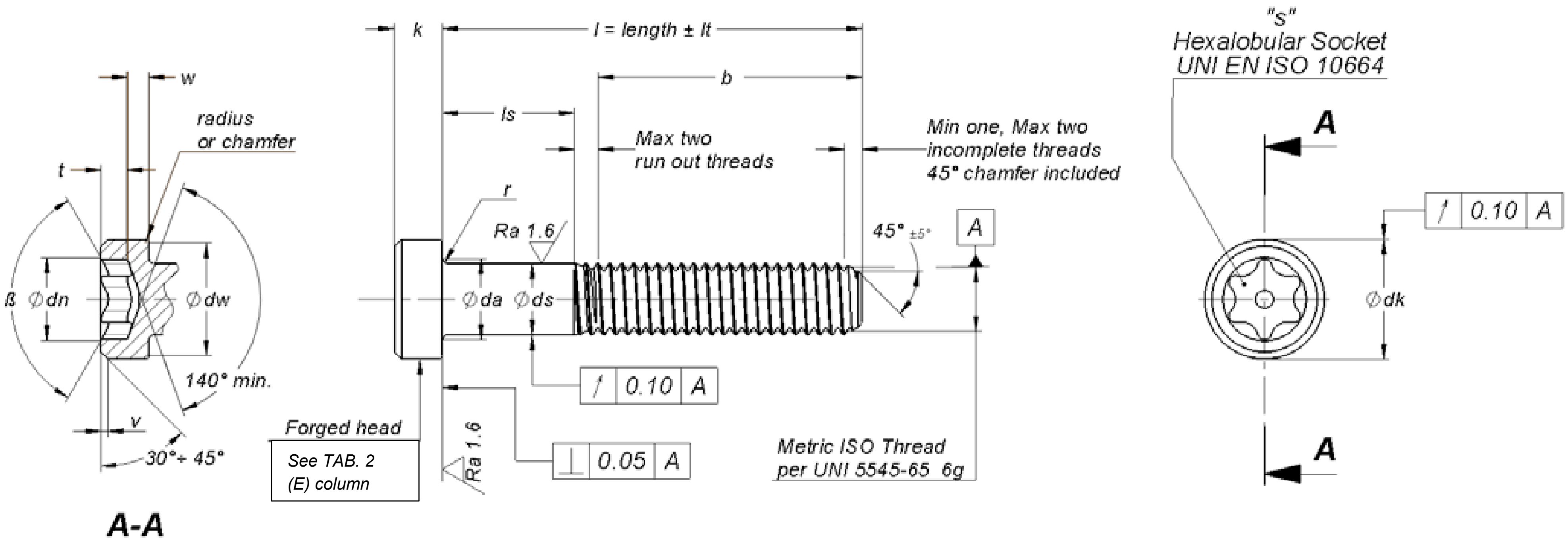


HEXAGON SOCKET BUTTON HEAD BOLTS

PART NUMBER SEE TABLE 2

H05(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1

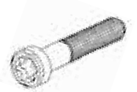


TYPE BOLT CODE	THREAD SIZE		b	Øda	Øds	Ødk	Ødw	Ødn	ls	lt	k		r	β	s	t	v	w
FIRST PART NR.	EXT.	PITCH	SEE TAB 1B	MAX	+0 -0.1	+0 -0.15	MIN	MAX	MIN	±	MAX	MIN	MIN	±5°	NR SOCKET	MIN	±0.1	MIN
H06	M2.5	0.45	17	3.1	2.5	4.5	4.2	3.0	= length – b – 2pitch	0.3	2.2	2.3	0.1	150°	10	1.0	0.25	1.2
H06	M3	0.5	18	3.6	3	5.5	5.1	3.5		0.3	2.5	2.4	0.1	150°	15	1.2	0.3	1.2
H06	M4	0.7	20	4.7	4	7	8.5	4.7		0.3	3.0	2.9	0.2	150°	25	1.5	0.4	1.2
H06	M5	0.8	20 - 25	5.7	5	8.5	9.5	5.9		0.3	3.5	3.4	0.2	150°	30	1.9	0.5	1.4
H06	M6	1.0	20 - 25 - 30	6.8	6	10	10.4	7.0		0.5	4.0	3.9	0.3	120°	40	2.4	0.6	1.7
H06	M8	1.25	20 - 25 - 30 - 35	9.2	8	13	12.8	9.5		0.5	5.0	4.8	0.4	120°	50	3.2	0.7	2.3
H06	M10	1.5	20 - 25 - 30 - 35	11.2	10	16	15.8	12.0		0.5	6.0	5.8	0.4	120°	55	3.8	0.9	3.1

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



**HEXALOBULAR SOCKET,
CILINDRICAL HEAD BOLT**

PART NUMBER SEE TABLE 2

H06(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1B

"l" LENGTH	"b" THREAD LENGTH M2.5	M3	M4	M5	M6	M8	M10
4		X	X	X	X	X	X
5			X				
6				X			
8					X		
10						X	X
12							
14			ALL THREADED SHANK				
16							
18							
20							
22	17	18					
25	17	18			20	20	20
30	X	18	20	20	20	20	20
35		X	20	20	20	20	20
40			20	20	20	20	20
45			X	25	25	25	25
50				25	25	25	25
55				X	25	25	25
60					25	25	25
65					30	30	30
70					30	30	30
75					X	30	30
80						30	30
85						35	35
100	X	X	X	X	X	35	35

TAB. 2

CODE = H06 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NUMBER	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) LENGTH mm	(E) ADDITIONAL OR DIFFERENT FEATURES
H06	AA = TI6AL4V ANNEALED BA = AL 7075 T6-T651 BC = AL 7068 (T6511)	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING COLOR ANODIZING FOR 7075, 7068 AL. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	25G = M2.5 x 0.45 03A = M3 x 0.5 35G = M3.5 x 0.6 04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 08A = M8 x 1.25 10A = M10 x 1.5	004 005 006 008 010 012 014 016 018 020 022 025 030 ÷ (5mm step) 100	A = none C = 6h thread D = 4h6h tread **NB** 7075 and 7068 alloy bolts normally have no forged head. Under M4 with all alloys the head is not necessarily forged. For a forged head, specific request is needed

CODES EXAMPLES:

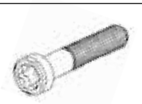
PART NUMBER: H06 AA 0 25G 25 A

- A — No Additional Features
- 25 — "l" BOLT LENGTH 25mm; "b" 17mm; "ls" 7mm
- 25G — THREAD CODE (M2.5 x 0.45)
- 0 — NOTREATMENT
- AA — Ti6Al4V MATERIAL
- H06 — HEXALOBULAR SOCKET, CIL HEAD BOLT

PART NUMBER: H06 BA S 04A 008 A

- A — No Additional Features
- 008 — "l" BOLT LENGTH 8mm; all threaded bolt
- 04A — THREAD CODE (M4 x 0.7)
- S — SILVER ANODIZING
- BA — 7075 Aluminum Alloy MATERIAL
- H06 — HEXALOBULAR SOCKET, CIL HEAD BOLT

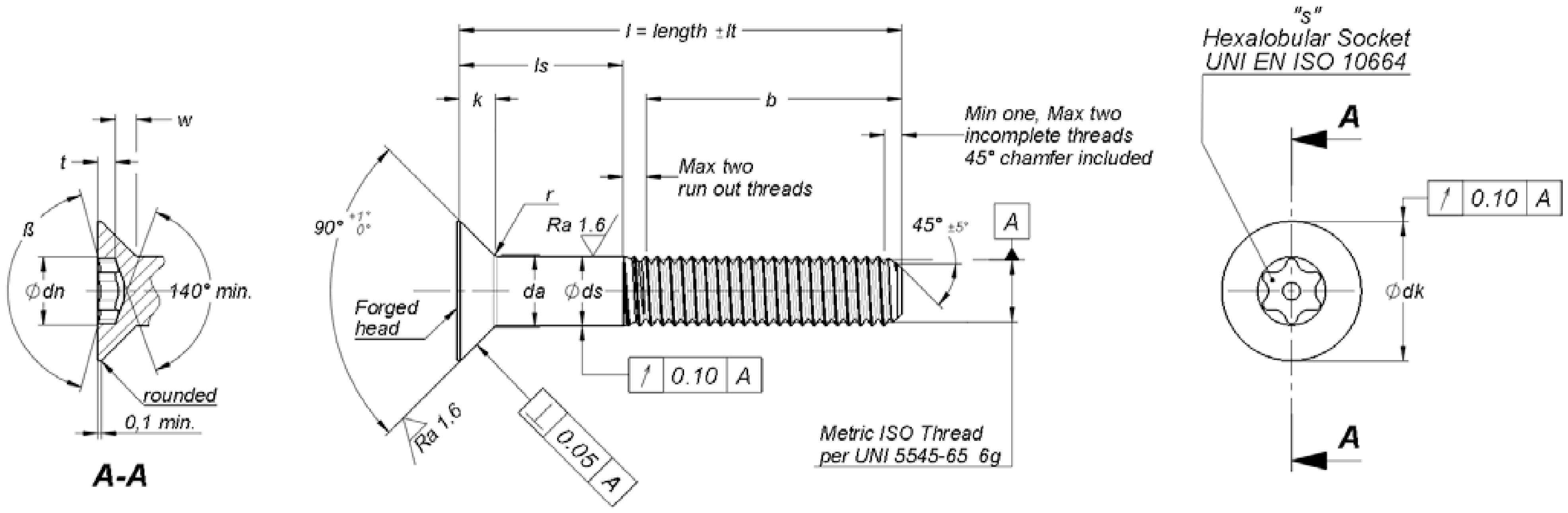
TOLERANCES UNLESS OTHERWISE NOTED
METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°
ROUGHNESS Ra 3.2



HEXALOBULAR SOCKET, CILINDRICAL HEAD BOLT

PART NUMBER SEE TABLE 2
H06(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1

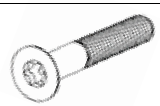


TYPE BOLT CODE	THREAD SIZE		b	β	Øda	Øds	Ødk	Ødn	ls	lt	k		r	s	t	w
FIRST PART NR.	EXT.	PITCH	SEE TAB 1B	±5°	MAX	+0 -0.1	+0 -0.4	MAX	MIN	±	MAX	MIN	±0.1	NR. H. SOCKET	MIN	MIN
H07	M4	0.7		150°	4.7	4	8	4.2	ls = lenght – b – 2pitch	0.3	2.4	1.9	0.3	20	1.4	0.4
H07	M5	0.8	20	150°	5.7	5	10	4.7		0.3	3.1	2.4	0.4	25	1.8	0.6
H07	M6	1	20 - 25	150°	6.8	6	12	5.9		0.5	3.7	2.9	0.5	30	2.2	0.7
H07	M7	1	20 - 25	120°	7.8	7	14	7.0		0.5	4.2	3.4	0.6	40	2.5	0.9
H07	M8	1.25	20 - 25	120°	9.2	8	16	8.3		0.5	5	3.9	0.7	45	2.8	1.1
H07	M10	1.5 - 1.25	20 - 25	120°	11.2	10	20	9.5		0.5	6.2	4.8	0.8	50	3.2	1.6

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



HEXALOBULAR SOCKET COUNTERSUNK HEAD BOLTS

PART NUMBER SEE TABLE 2

H07(_)(_)(_ _ _)(_ _ _) (_)

TAB. 1B

"l" LENGTH	"b" THREAD LENGTH					
	M4	M5	M6	M7	M8	M10
12	ALL THREADED SHANK					
14						
16						
18						
20						
22						
25						
30	X					
35	X	20	20	20	20	20
40	X	X	20	20	20	20
45	X	X	25	25	25	25
50	X	X	X	25	25	25

TAB. 2

CODE = H07 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NUMBER	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) LENGTH mm	(E) ADDITIONAL OR DIFFERENT FEATURES
H07	AA= Ti6Al4V annealed	0 = NO TREATMENT	04A = M4 x 0.7	012	A = none
		A = BLUE ANODIZING (FOR TITANIUM)	05A = M5 x 0.8	014	C = 6h thread
		B = PASSIVATING	06A = M6 x 1	016	D = 4h6h tread
		C = PVD TIN	07A = M7 x 1	018	
		D = DLC	08A = M8 x 1.25	020	
		E = IVD	10A = M10 x 1.5	022	
		F = DRY LUBRIFICANT COATING	10B = M10 x 1.25	025	
		G = ZINC ALUMINIUM FLAKES COATING		030	
				035	
				040	
				045	
				050	

CODE EXAMPLES:

PART NUMBER: H07 AA 0 10B 035 A

- A — No Additional Features
- 035 — "l" BOLT LENGTH 35mm; "b" 20mm; "ls" 12.5mm
- 10B — THREAD CODE (M10 x 1.25)
- 0 — NO TREATMENT
- AA — Ti6Al4V MATERIAL
- H07 — HEXALOBULAR SOCKET COUNTERSUNK HEAD BOLT

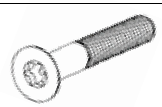
PART NUMBER: H07 AA D 10A 030 A

- A — No Additional Features
- 030 — "l" BOLT LENGTH 30mm; all threaded bolt
- 10A — THREAD CODE (M10 x 1.5)
- D — DLC COATING
- AA — Ti6Al4V MATERIAL
- H07 — HEXALOBULAR SOCKET COUNTERSUNK HEAD BOLT

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

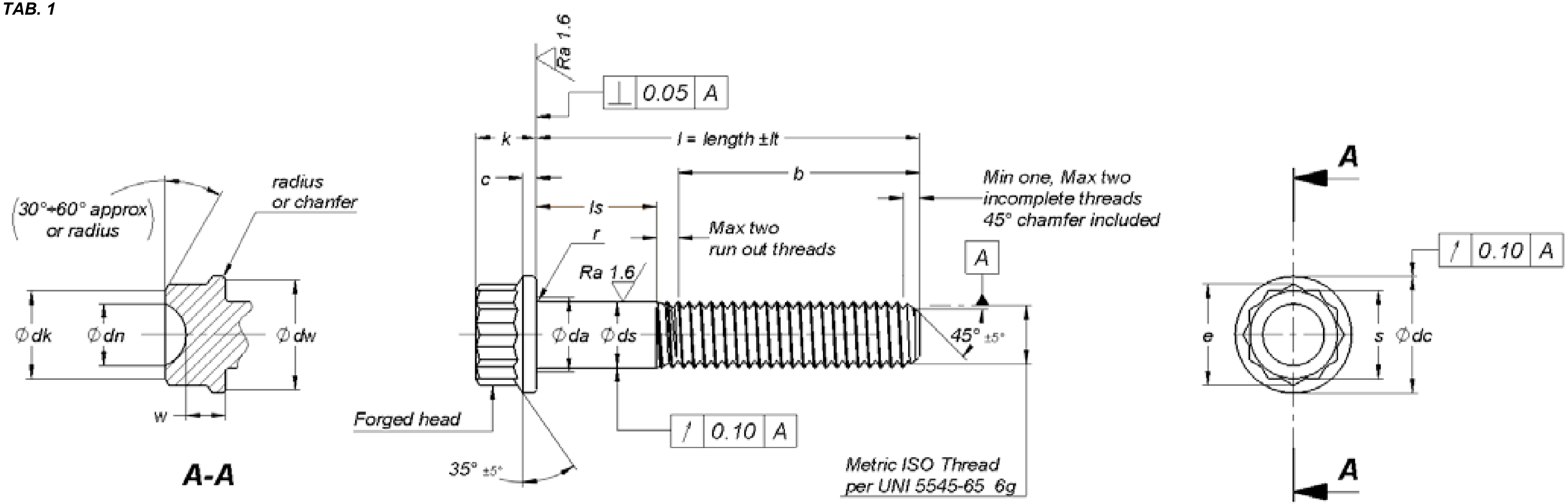
ROUGHNESS Ra 3.2



HEXALOBULAR SOCKET COUNTERSUNK HEAD BOLTS

PART NUMBER SEE TABLE 2
H07(_)(_)(_ _ _)(_ _ _) (_)

TAB. 1

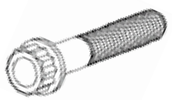


TYPE BOLT CODE	THREAD SIZE		b	c	Øda	Ødc	Øds	Ødk	Ødn	Ødw	ls	lt	e	k		r	s		w
FIRST PART NUMBER	EXT.	PITCH	MIN	+0.2 -0	MAX	+0 -0.15	+0 -0.1	+0 -0.3	MAX	MIN	MIN	±	MIN	MAX	MIN	MIN	MAX	MIN	MIN
H11	5	0.8	20	1	5.7	9.1	5	6.8	5	8.6	LS = LENGHT – B – 2PITCH	0.3	7.74	5.5	5.30	0.2	7	6.85	2.5
H11	6	1	22	1.2	6.8	10.6	6	7.8	6	10.0		0.5	8.84	6	5.80	0.3	8	7.85	2.5
H11	7	1	24	1.4	7.8	12.1	7	8.8	7	11.5		0.5	9.92	6.5	6.30	0.4	9	8.85	2.5
H11	8	1.25	26	1.6	9.2	13.6	8	9.8	8	12.9		0.5	11.22	7	6.80	0.6	10	9.85	2.5
H11	10	1.5 - 1.25	30	2	11.2	16.7	10	11.7	10	16.0		0.5	13.29	8	7.75	0.6	12	11.82	2.5
H11	12	1.75 - 1.5 -1.25	34	2.4	13.7	19.9	12	13.6	12	19.1		0.5	15.51	9	8.75	0.6	14	13.73	2.5

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



DOUBLE HEXAGON BOLTS, WITH FLANGE

PART NUMBER SEE TABLE 2

H11(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1B

"l" LENGTH	"b" THREAD LENGTH					
5mm step	M5	M6	M7	M8	M10	M12
10	ALL THREADED SHANK					
15						
20						
25	20	22	24			
30	20	22	24	26		
35	20	22	24	26	30	34
40	20	22	24	26	30	34
45	20	22	24	26	30	34
50	20	22	24	26	30	34
55	X	X	24	26	30	34
60	X	X	24	26	30	34
÷	÷	÷	÷	÷	÷	÷
100	X	X	24	26	30	34
÷	÷	÷	÷	÷	÷	÷
140	X	X	X	26	30	34

TAB. 2

CODE = H11 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NUMBER	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) LENGTH mm	(E) ADDITIONAL OR DIFFERENT FEATURES
H11	AA= TI6AL4V ANN. BC= AL 7068 T6511 DA=13-8 PH 1517MPa min 10%A min FA= 17-4 PH 1310MPamin 10%A min GA= AISI 4340 1200MPa min 16%A min HA= MLX 17 1655MPa min 10%A min IA= INCONEL 718 1480MPa min 10%A min JA=AERMET 100 1999MPa 8%A min MA= 30NCD16 1350MPa min 14%A min	0 = NO TREATMENT A = ANODIZING (BLUE FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING	04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 07A = M7 x 1 08A = M8 x 1.25 10A = M10 x 1.5 10B = M10 x 1.25 12A = M12 x 1.75 12B = M12 x 1.5 12C = M12 x 1.25	010 015 020 025 030 035 040 045 050 ÷ 140	A = none C = 6h thread D = 4h6h tread

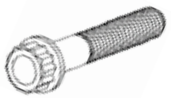
CODE EXAMPLES:

PART NUMBER: H11 AA 0 10B 035 A

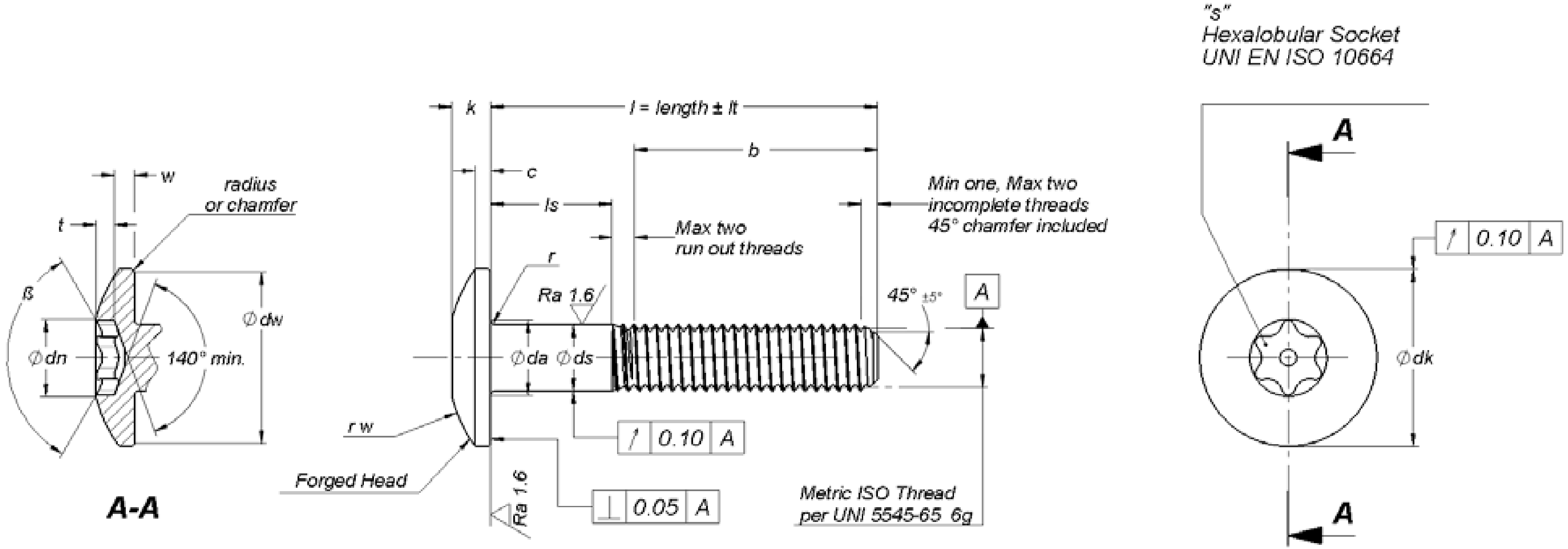
- A: No Additional Features
- 035: "l" BOLT LENGTH 35mm; "b" 30mm; "ls" 2.5mm
- 10B: THREAD CODE (M10 x 1.25)
- 0: NO TREATMENT
- AA: Ti6Al4V MATERIAL
- H11: DOUBLE HEXAGON HEAD BOLTS, WITH FLANGE

PART NUMBER: H11 IA 0 06A 020 A

- A: No Additional Features
- 020: "l" BOLT LENGTH 20mm; all threaded bolt
- 06A: THREAD CODE (M6 x 1)
- 0: NO TREATMENT
- IA: INCONEL 718
- H11: DOUBLE HEXAGON HEAD BOLTS, WITH FLANGE



TAB. 1

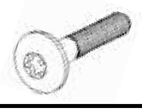


TYPE BOLT CODE	THREAD SIZE		b	c	Øda	Øds	Ødk	Ødn	Ødw	ls	lt	k		r	(r w)	s	t	w
FIRST PART NR.	EXT.	PITCH	SEE TAB 1B	±0.1	MAX	+0 -0.1	+0 -0.4	MAX	MIN	MIN	±	MAX	MIN	MIN	REF.	NR. HEX.SOCKET	MIN	MIN
H12	M5	0.8	16	1.1	5.7	5	9.5	5.0	8.8	ls = lenght – b – 2pitch	0.3	3.1	2.9	0.2	10	25	1.9	1.0
H12 (..) (.) (…) (…) L	M5	0.8	16	1.1	5.7	5	12	5.0	11.3		0.3	3.1	2.9	0.2	10	25	1.9	1.0
H112	M6	1	18	1.4	6.8	6	12	6.1	11.3		0.5	3.7	3.5	0.3	12	30	2.0	1.5
H12 (..) (.) (…) (…) L	M6	1	18	1.4	6.8	6	16	6.1	15.3		0.5	3.7	3.5	0.3	12	30	2.0	1.5
H112	M8	1.25	22	1.5	9.2	8	16	8.5	15.3		0.5	4.7	4.4	0.4	16	45	2.8	1.6
H12 (..) (.) (…) (…) L	M8	1.25	22	1.5	9.2	8	18	8.5	17.2		0.5	4.7	4.4	0.4	16	45	2.8	1.6
H112	M10	1.5	26	1.9	11.2	10	18	9.5	17.2		0.5	5.8	5.5	0.5	20	50	3.6	1.9
H12 (..) (.) (…) (…) L	M10	1.5	26	1.9	11.2	10	20	9.5	19.2		0.5	5.8	5.5	0.5	20	50	3.6	1.9
H112	M12	1.75	30	2.2	13.7	12	20	12.0	19.2		0.5	7.1	6.8	0.6	24	55	4.8	2.0
H12 (..) (.) (…) (…) L	M12	1.75	30	2.2	13.7	12	24	12.0	23.2		0.5	7.1	6.8	0.6	24	55	4.8	2.0

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



HEXALOBULAR SOCKET BUTTON HEAD BOLTS

PART NUMBER SEE TABLE 2

H12(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1B

"l" LENGTH (5mm step)	"b" THREAD LENGTH M5	M6	M8	M10	M12
10	ALL THREADED SHANK				
12					
15					
20					
25	16	18	22		
30	16	18	22		
35	16	18	22	26	30
40	16	18	22	26	30
45	16	18	22	26	30
50	16	18	22	26	30
55	16	18	22	26	30
60	16	18	22	26	30
÷	X	÷	÷	÷	÷
100	X	18	22	26	30
÷	X	X	÷	÷	÷
140	X	X	22	26	30

TAB. 2

CODE = H12 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NUMBER	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) LENGTH mm	(E) ADDITIONAL OR DIFFERENT FEATURES
H12	AA= Ti6Al4V annealed	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING	05A = M5 x 0.8 06A = M6 x 1 08A = M8 x 1.25 10A = M10 x 1.5 12A = M12 x 1.75	010 012 015 020 025 030 035 040 045 050 ÷ 140	A = none L = increased Ødk head

CODE EXAMPLES:

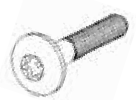
PART NUMBER: H12 AA 0 06A 035 A

- A — No Additional Features
- 035 — "l" SCREW LENGTH 35mm; "b" 18mm; "ls" 15mm
- 06A — THREAD CODE (M6 x 1)
- 0 — NOTREATMENT
- AA — Ti6Al4V MATERIAL
- H12 — HEXALOBULAR SOCKET BUTTON HEAD BOLTS

PART NUMBER: H12 AA A 10A 030 L

- L — with "different feature": INCREASED HEAD
- 030 — "l" 30mm SCREW LENGTH; ALL THREADED SHANK
- 10A — THREAD CODE (M10 x 1.5)
- A — BLUE ANODIZING
- AA — Ti6Al4V MATERIAL
- H12 — HEXALOBULAR SOCKET BUTTON HEAD BOLTS

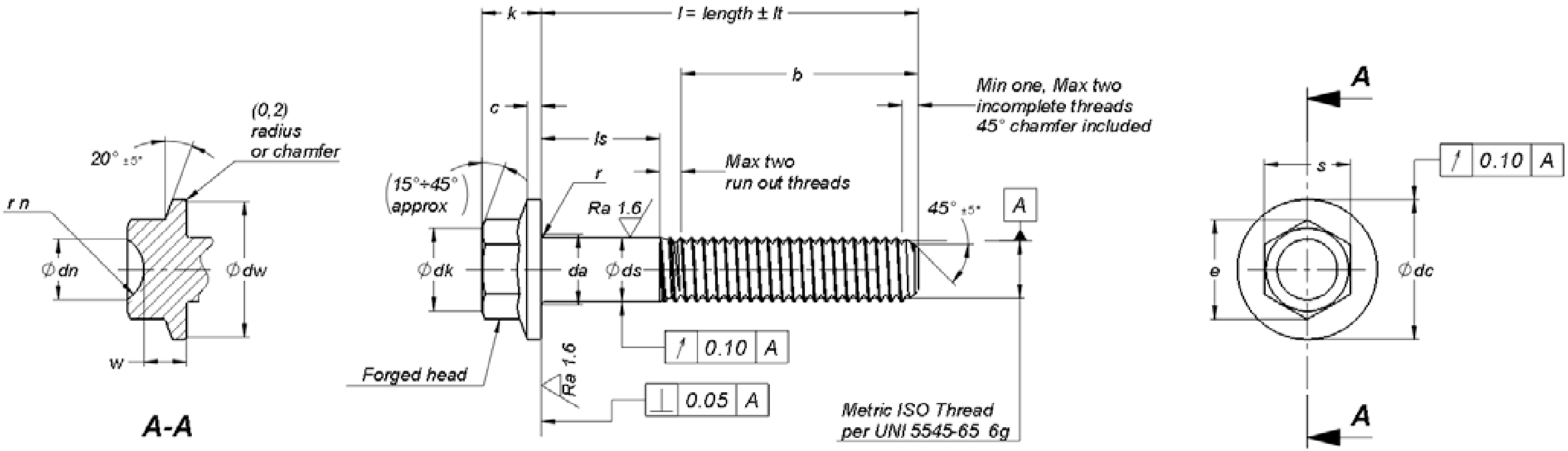
TOLERANCES UNLESS OTHERWISE NOTED
METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°
ROUGHNESS Ra 3.2



HEXALOBULAR SOCKET BUTTON HEAD BOLTS

PART NUMBER SEE TABLE 2
H12(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1

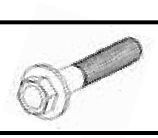


TYPE BOLT CODE	THREAD SIZE		b	ls	lt	c	Øda	Ødc	Øds	Ødk	Ødw	Ødn	e	k		r	s		r n	w
FIRST PART NR.	EXT.	PITCH	SEE TAB 1B	MIN	±	+0.2 -0	MAX	+0 -0.15	+0 -0.1	+0 -0.15	MIN	MAX	MIN	MAX	MIN	MIN	MAX	MIN	REF.	MIN
H13	M4	0.7	20 - 25	ls = lenght – b – 2pitch	0.3	1.0	4.7	10	4	6	9.5	4.4	6.51	4.5	4.3	0.2	6	5.85	2.7	2.3
H13	M5	0.8	20 - 25		0.3	1.0	5.7	11	5	7	10.5	5.0	7.59	5.0	4.8	0.2	7	6.85	3.0	2.5
H13	M6	1	22 - 25		0.5	1.3	6.8	13	6	8	12.4	5.6	8.71	5.5	5.3	0.3	8	7.85	3.3	2.7
H13	M8	1.25	22 - 25		0.5	1.3	9.2	16	8	10	15.4	7.0	10.95	6.5	6.3	0.4	10	9.85	4.0	3.0
H13	M10	1.5 - 1.25	26 - 30		0.5	1.5	11.2	20	10	12	19.3	9.0	13.29	8.0	7.7	0.4	12	11.82	5.0	3.5
H13	M12	1.75 - 1.5 - 1.25	26 - 30		0.5	1.8	13.7	24	12	14	13.2	10.5	15.38	10	9.7	0.6	14	13.73	6.0	4.5
H13	M14	2 - 1.75 - 1.5 - 1.25	26 - 30		0.5	2.1	15.7	28	14	17	27.2	13.5	18.75	12	11.7	0.8	17	16.73	7.5	5.0
H13	M16	2 – 1.75 - 1.5	26 - 30		0.5	2.4	17.7	30	16	20	29.2	16.0	22.06	14	13.6	0.8	20	19.67	9	5.5

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



HEXAGON HEAD BOLTS WITH LARGE FLANGE

PART NUMBER SEE TABLE 2

H13(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1B

"l" LENGTH 5mm step	"b" THREAD LENGTH M4	M5	M6	M8	M10	M12	M14	M16
10	ALL THREADED SHANK							
15								
20								
25	20	20	22	22				
30	20	20	22	25	26	26	26	26
35	20	20	25	25	30	30	30	30
40	25	25	25	25	30	30	30	30
45	X	25	25	25	30	30	30	30
50	X	25	25	25	30	30	30	30
55	X	X	25	25	30	30	30	30
60	X	X	25	25	30	30	30	30
÷	÷	÷	÷	÷	÷	÷	÷	÷
140	X	X	X	25	30	30	30	30

TAB. 2

CODE = H13 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NUMBER	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) LENGTH mm	(E) ADDITIONAL OR DIFFERENT FEATURES
H13	AA= Ti6Al4V annealed BA= 7075 T6-T651 BC= AL 7068 T6511 GA= AISI 4340 1200MPa min 16%A min HA= MLX 17 1655MPa min 10%A min JA=AERMET 100 1999MPa 8%A min KA= MP35N 1793MPa min 8%A min LA= MARAGING 300 2035MPa min 12%A min MA= 30NCD16 1350MPa min 14%A min NA= CRES A286 Rm1150÷1200MPa	0 = NO TREATMENT A = ANODIZING (BLUE FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING	04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 07A = M7 x 1 08A = M8 x 1.25 08B = M8 x 1 10A = M10 x 1.5 10B = M10 x 1.25 12A = M12 x 1.75 12B = M12 x 1.5 12C = M12 x 1.25 14A = M14 x 2 14B = M14 x 1.75 14C = M 14 x 1.5 14D = M 14 x 1.25 16A = M 16 x 2 16B = M16 x 1.75 16C = M16 x 1.5	010 015 020 025 030 035 040 045 050 ÷ 140	A = none C = 6h thread D = 4h6h tread

CODE EXAMPLES:

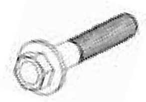
PART NUMBER: H13 AA 0 10B 035 A

- A — None Additional Features
- 035 — "l" BOLT LENGTH 35mm; "b" 30mm; "ls" 2.5mm
- 10B — THREAD CODE (M10 x 1.25)
- 0 — WITHOUT TREATMENT
- AA — Ti6Al4V MATERIAL
- H13 — HEXAGON HEAD BOLT WITH LARGE FLANGE

PART NUMBER: H13 AA D 12A 030 A

- A — None Additional Features
- 030 — "l" BOLT LENGTH 30mm; all threaded bolt
- 12A — THREAD CODE (M12 x 1.75)
- D — DLC COATING
- AA — Ti6Al4V MATERIAL
- H13 — HEXAGON HEAD BOLT WITH LARGE FLANGE

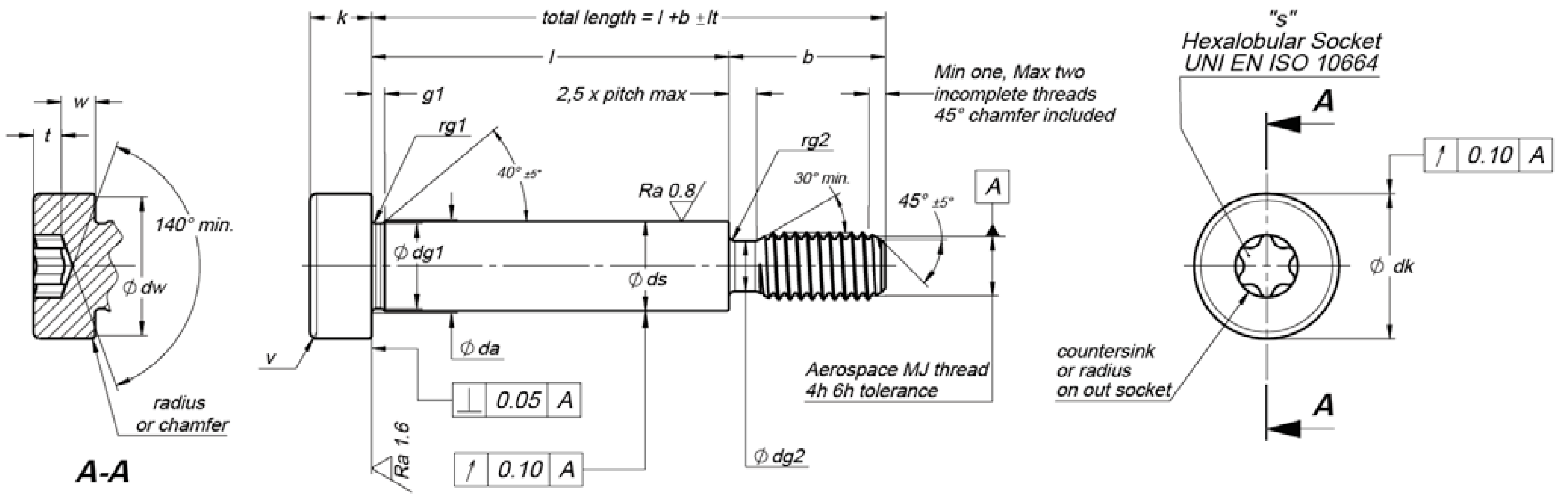
TOLERANCES UNLESS OTHERWISE NOTED
METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°
ROUGHNESS Ra 3.2



HEXAGON HEAD BOLTS WITH LARGE FLANGE

PART NUMBER SEE TABLE 2
H13(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1



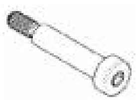
CAN BE COUPLED WITH HN3 NUT

TYPE BOLT CODE	THREAD SIZE		b	Øda	Ødg1	Ødg2	Øds	Ødk	Ødw	g1	Tot. Length	lt	l (grip)	k		rg1	rg2	s	t	w	v
FIRST PART NR.	EXT.	PITCH	± 0.3	MAX	MIN	+0 -0.15	h8	+0 -0.3	MIN	± 0.2	→	±	± 0.2	MAX	MIN	MIN	MIN	NR. SOCKET	MIN	MIN	+0.2 -0.0
H14	M5	0.8	11	6.6	5.42	3.86	6	10	9.4	0.3	Total lenght = b + l	0.3	See Tab. 2 D code	4.5	4.2	0.3	0.50	20	2.4	1.0	0.5
H14	M6	1	13	8.8	7.42	4.58	8	13	12.3	0.4		0.5		5.5	5.2	0.4	0.53	25	3.3	1.2	0.6

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



BOLT, CILINDRICAL HEAD, EXALOBULAR SOCKET,SPECIAL SHANK

PART NUMBER SEE TABLE 2

H14(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 2

H14 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NR.	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) "l" SHANK LENGTH CODE	(E) ADDITIONAL FEATURES
H14	AA= Ti6Al4V annealed IA= INCONEL 718 1480MPa min 10%A min NA= CRES A286 uts1150÷1200MPa NB= CRES A286 uts 850÷900MPa	0 = NO TREATMENT A = ANODIZING (BLUE FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING	04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 07A = M7 x 1 08A = M8 x 1.25 08B = M8 x 1 10A = M10 x 1.5 10B = M10 x 1.25 12A = M12 x 1.75 12B = M12 x 1.5 12C = M12 x 1.25	GRIP 1mm Length Stepped Ex: 012 032 ÷ (140)	A = none

CODE EXAMPLES:

PART NUMBER: H14 NB B 05A 032 A

- A — No Additional Features
- 032 — "l" SHANK LENGTH 32mm; (Total length 42mm)
- 05A — THREAD CODE (M5 x 0.8)
- B — PASSIVATED
- NB — A286 850÷900 MPa MATERIAL
- H14 — BOLT WITH SPECIAL SHANK

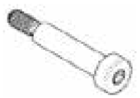
PART NUMBER: H14 NA D 06A 012 A

- A — No Additional Features
- 012 — "l" SHANK LENGTH 12mm; (Total length 25mm))
- 06A — THREAD CODE (M6 x 1)
- D — DLC COATING
- NA — A286 - UTS 1150÷1200 MPa MATERIAL
- H14 — BOLT WITH SPECIAL SHANK

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

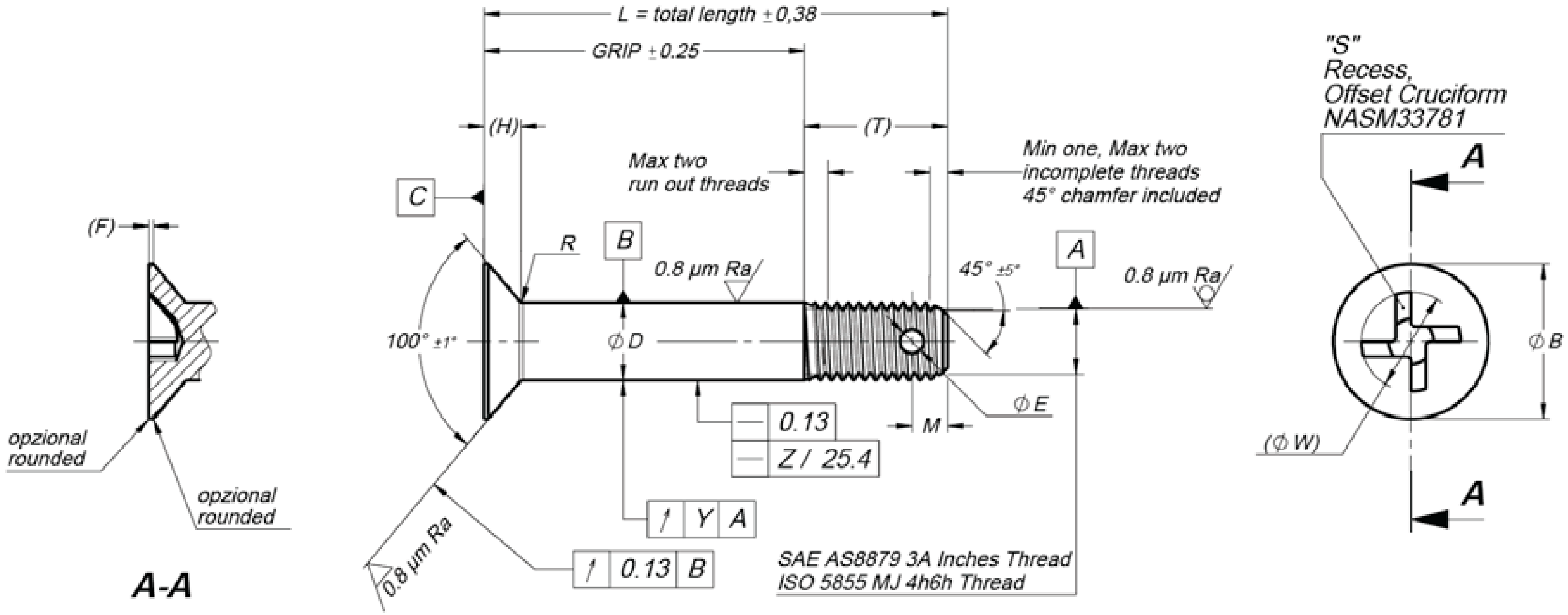


BOLT, CILINDRICAL HEAD, EXALOBULAR SOCKET,SPECIAL SHANK

PART NUMBER SEE TABLE 2

H14(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1

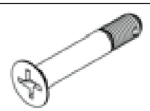


TYPE BOLT CODE	THREAD SIZE		NAS REF	ØB	ØD		ØE	H	L	M	R		S	T	W	Y	Z
FIRST PART NR.	EXTERNAL INCHES & METRIC DIAM.	PITCH NR. THREADS X INCH & MM		MIN	MAX	MIN	TOLLERANCES. SEE BELOW	REF	± 0.38	+0.25 -0.0	MAX	MIN	NR. RECESS	REF	REF	MAX	MAX
H15	M3	0.5	-	4.63	2,987	2,962	0.8 -0 +0.10	1,21	L = GRIP + T	-	0.45	0.20	4	6,4	3,6	0,11	0,10
H15	M3.5	0.6	-	5.60	3,493	3,467	1.0 -0 +0.10	1,46		-	0.45	0.20	6	7,0	4,5	0,11	0,10
H15	.1380 IN.	32 TH.	NAS1151	5.61	3,487	3,462	-	1,41		-	0.50	0.25	6	7,0	4,5	0,11	0,10
H15	M4	0.7	-	6.78	3,987	3,962	1.0 -0 +0.10	1,69		-	0.50	0.25	8	7,0	4,5	0,11	0,10
H15	.1640 IN.	32 TH.	NAS1152	7.11	4,153	4,128	-	1,81		-	0.50	0.25	8	7,0	5,3	0,11	0,10
H15	.1900 IN.	32 TH.	NAS1153	8.33	4,813	4,788	1.6 -0 +0.25	2,05		2.95	0.50	0.25	10	7,0	6,2	0,11	0,10
H15	M5	0.8	-	8.68	4,987	4,962	1.5 -0 +0.14	2,07		2.95	0.50	0.25	10	7,5	6,2	0,11	0,10
H15	M6	1	-	10.71	5,987	5,962	1.5 -0 +0.14	2,50		2.95	0.50	0.25	10	7,5	8,1	0,11	0,10

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



SCREW, FLAT 100° FLUSH HEAD, CLOSE TOLERANCE, SHORT THREAD, OFFSET CRUCIFORM RECESS

PART NUMBER SEE TABLE 2

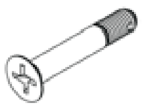
H15(_ _)(_)(_ _ _)(_ _ _)(_)

TYPE BOLT CODE	THREAD SIZE		NAS REF	ØB	ØD		ØE	H	L	M	R		S	T	W	Y	Z
FIRST PART NR.	EXTERNAL INCHES & METRIC DIAM.	PITCH NR. THREADS X INCH & MM		MIN	MAX	MIN	TOLLERANCES. SEE BELOW	REF	± 0.38	+0.25 -0.0	MAX	MIN	NR. RECESS	REF	REF	MAX	MAX
H15	.2500 IN.	28 TH.	NAS1154	11.40	6,337	6,312	1.9 -0 +0.25	2,70	L = GRIP + T	2.95	0.50	0.25	1/4	8,0	8,1	0,11	0,08
H15	M7	1	-	12.70	6,987	6,962	1.5 -0 +0.14	2,91		2.95	0.64	0.30	1/4	8,0	8,1	0,11	0,08
H15	.3125 IN.	24 TH.	NAS1155	14.66	7,925	7,899	1.9 -0 +0.25	3,39		3.00	0.64	0.30	5/16	9,5	8,9	0,15	0,08
H15	M8	1.25	-	14.78	7,987	7,962	2.0 -0 +0.25	3,37		3.00	0.76	0.40	5/16	9,5	8,9	0,15	0,08
H15	.3750 IN.	24 TH.	NAS1156	17.88	9,512	9,487	2.7 -0 +0.25	4,08		3.05	0.76	0.40	3/8	9,9	10,7	0,15	0,06
H15	M10	1.5	-	18.83	9,987	9,962	2.0 -0 +0.25	4,23		3.10	0.76	0.40	3/8	10,0	10,7	0,15	0,06
H15	.4375 IN.	20 TH.	NAS1157	21.13	11,100	11,074	2.7 -0 +0.25	4,78		3.10	0.76	0.40	7/16	11,5	12,5	0,15	0,06
H15	M12	1.5	-	22.95	11,987	11,962	3.0 -0 +0.25	5,12		3.10	0.76	0.40	1/2	11,5	14,3	0,15	0,05
H15	.5000 IN	20 TH.	NAS1158	24.36	12,687	12,662	2.7 -0 +0.25	5,47		3.15	0.76	0.40	1/2	11,5	14,3	0,15	0,05

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



SCREW, FLAT 100° FLUSH HEAD, CLOSE TOLERANCE, SHORT THREAD, OFFSET CRUCIFORM RECESS

PART NUMBER SEE TABLE 2

H15(_ _)(_)(_ _ _)(_ _ _)(_)

TAB. 2

CODE = H15 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NUMBER	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE		(D) GRIP LENGTH mm	(E) ADDITIONAL OR DIFFERENT FEATURES
H15	AA= Ti6Al4V annealed	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING D = DLC E = IVD F = DRY LUBRIFICANT COATING	03A = M3 x 0.5 35G = M3.5 x 0.6 04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 07A = M7 x 1 08A = M8 x 1.25 10A = M10 x 1.5 12B = M12 x 1.5	I07 = .1380-32 I08 = .1640-32 I09 = .1900-32 J11 = .2500-28 K12 = .3125-24 K13 = .3750-24 L14 = .4375-20 L15 = .5000-20	004 to 150	A = NONE B = WITH DRILL ØE

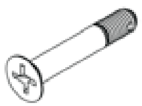
CODES EXAMPLES:

PART NUMBER: H15 AA 0 35G 020 A

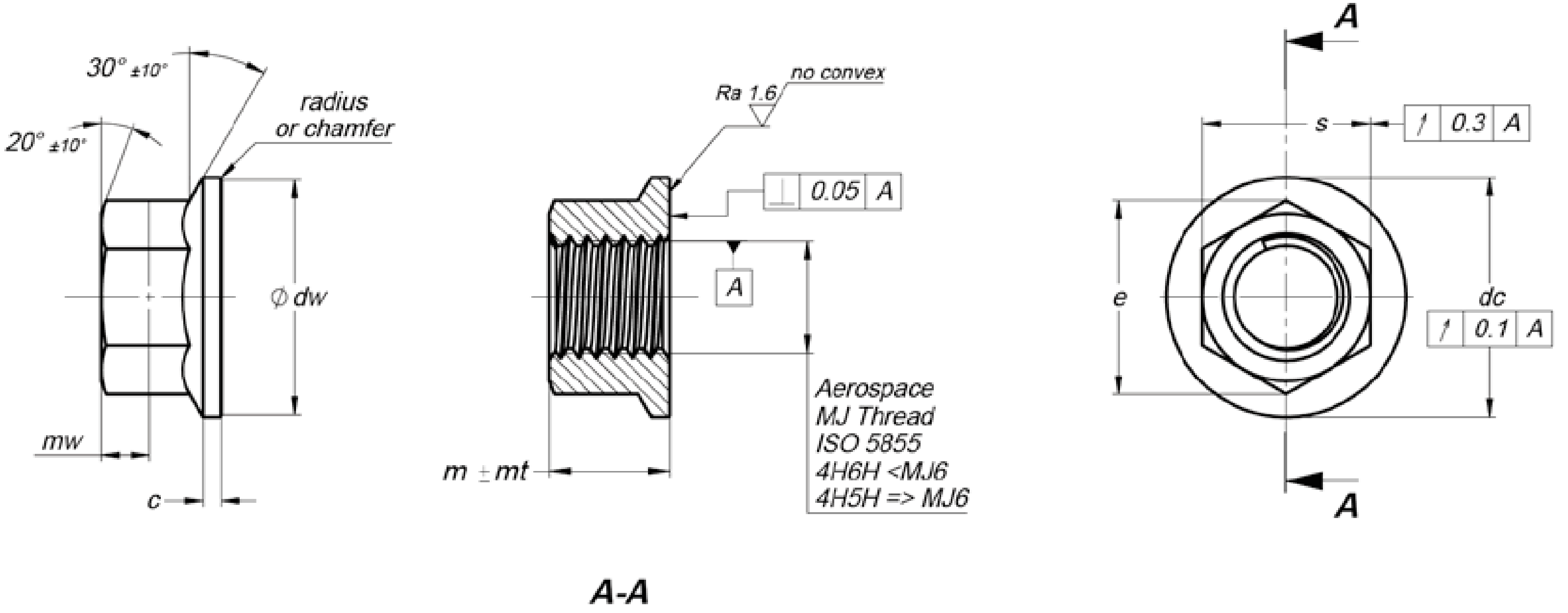
- A — No Additional Features
- 020 — GRIP LENGTH 20mm; “L” 27mm
- 35G — METRIC THREAD CODE (M3.5 x 0.6)
- 0 — NO TREATMENT
- AA — Ti6Al4V MATERIAL
- H15 — FLAT 100° FLUSH HEAD, OFFSET CRUCIFORM RECESS

PART NUMBER: H15 AA D L15 030 B

- B — Additional Features: with drill ØE
- 030 — GRIP LENGTH 30mm; “L” 41.5mm
- L15 — INCHES THREAD CODE (.5000-20)
- D — DLC COATING
- AA — Ti6Al4V MATERIAL
- H15 — FLAT 100° FLUSH HEAD, OFFSET CRUCIFORM RECESS BOLT



TAB. 1

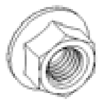


TYPE NUT CODE	THREAD SIZE		c	Ødc	Ødw	m	mt	e	s		mw
FIRST PART NR.	INT.	PITCH	+0.3 -0	MAX	MIN	Tol. = mt	±	MIN	MAX	MIN	MIN WORK HEX
HN2	M4	0.7	0.9	10	9.5	4	0.10	7.69	7	6.80	2.8
HN2	M5	0.8	1.0	11	10.4	5	0.15	8.79	8	7.78	3.2
HN2	M6	1	1.1	13	12.2	6	0.15	8.79	8	7.78	3.2
HN2	M7	1	1.1	14	13.2	7	0.15	9.99	9	8.78	3.6
HN2	M8	1.25	1.2	16	15.0	8	0.18	13.38	12	11.73	4.8
HN2	M10	1.5 - 1.25	1.5	20	19.0	10	0.18	15.60	14	13.73	5.6
HN2	M12	1.5	1.8	24	13.0	11	0.22	18.95	17	16.73	6.8
HN2	M14	1.5	2.1	27.5	26.5	12	0.35	21.18	19	18.73	7.6
HN2	M16	1.5	2.4	32	31	12	0.35	24.52	22	21.67	8.8
HN2	M18	1.5	2.6	35	34	14	0.50	26.75	24	23.67	9.6
HN2	M20	1.5	3.0	39	38	15	0.65	30.10	27	26.50	10.8

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



HEXAGON NUTS WITH FLANGE

PART NUMBER SEE TABLE 2

HN2(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 2

HN2 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NR.	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) DIAMETER FLANGE CODE	(E) ADDITIONAL FEATURES
HN2	AA = TI6AL4V ANNEALED BA = AL 7075 T6-T651 NA = A286 1150÷1200MPa	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING H = ARGENTATURA COLOR ANODIZING ONLY FOR 7075 ALUM. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 07A = M7 x 1 08A = M8 x 1.25 10A = M10 x 1.5 10B = M10 x 1.25 12B = M12 x 1.5 14C = M 14 x 1.5 16C = M16 x 1.5 18C = M16 x 1.5 20D = M16 x 1.5	XXX = XX,X DIMENSION x 10 Example: 12.8 mm Flange Diameter Code = 128	A = none X= not forged

PART NUMBER EXAMPLES:

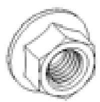
HN2 AA F 10A 200 A

- A – No Additional Features
- 200 – 20mm Flange Diameter
- 10A – THREAD CODE (M10 x 1.5)
- F – WITH DRY LUBRIFICANT
- AA – Ti6Al4V ANNEALED MATERIAL
- HN2 – HEXAGON NUT WITH FLANGE

HN2 BA R 05A 110 X

- X – Not forged
- 110 – 11mm Flange Diameter
- 05A – THREAD CODE (M5 x 0.8)
- R – RED ANODIZING
- BA – Al 7075 T6-T651 MATERIAL
- HN2 – HEXAGON NUT WITH FLANGE

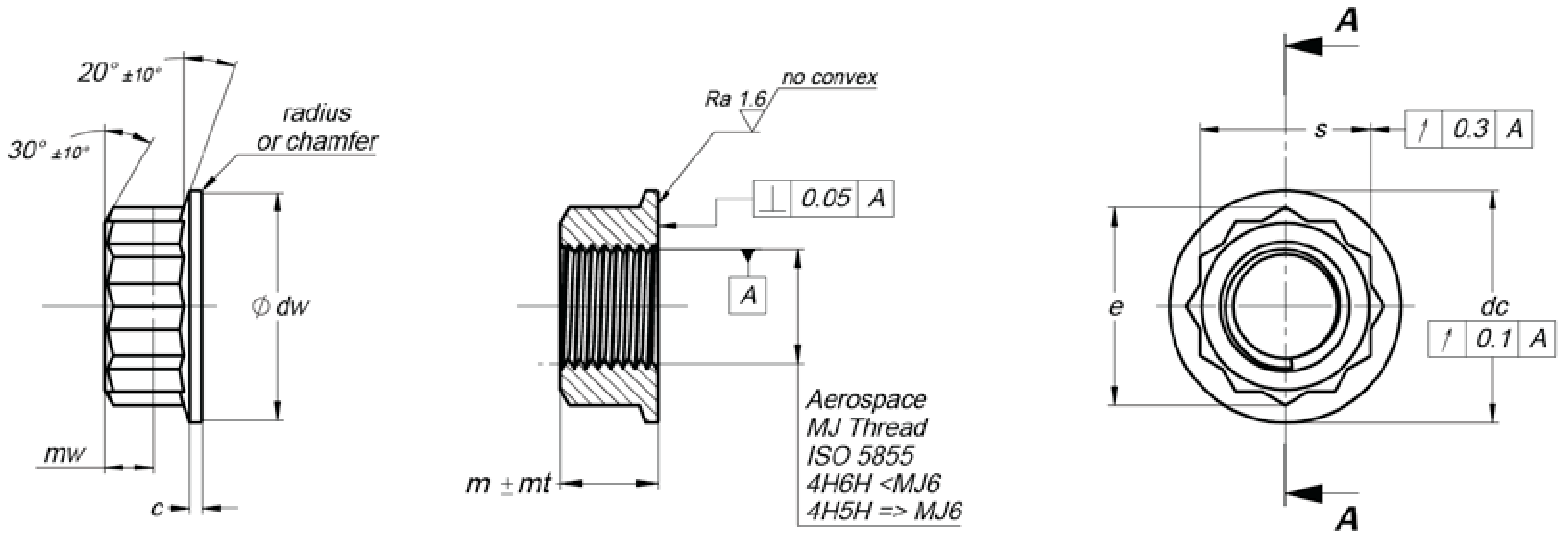
TOLERANCES UNLESS OTHERWISE NOTED
METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°
ROUGHNESS Ra 3.2



HEXAGON NUTS WITH FLANGE

PART NUMBER SEE TABLE 2
HN2(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1



A-A

TYPE NUT CODE	THREAD SIZE		c	Ødc	Ødw	m	mt	e	s		mw
FIRST PART NR.	INT.	PITCH	+0.3 -0	MAX	MIN	Tol. = mt	±	MIN	MAX	MIN	MIN WORK HEX
HD1	M5	0.8	1.0	9.1	8.3	5.5	0.15	7.69	7	6.78	2.8
HD1	M6	1	1.2	10.6	9.8	6.3	0.15	8.79	8	7.78	3.2
HD1	M7	1	1.4	12.1	11.3	6.5	0.15	9.89	9	8.78	3.6
HD1	M8	1.25	1.6	13.6	12.8	6.8	0.18	10.98	10	9.73	4.0
HD1	M10	1.5 - 1.25	2.0	16.7	15.7	7.8	0.18	13.19	12	11.73	4.8
HD1	M12	1.5 – 1.25	2.4	19.9	18.8	9.0	0.22	15.38	14	13.73	5.6

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

DOUBLE HEXAGON NUTS WITH FLANGE

PART NUMBER SEE TABLE 2

HD1(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 2

HD1 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NR.	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) DIAMETER FLANGE CODE	(E) ADDITIONAL FEATURES
HD1	AA = TI6AL4V ANNEALED NA = A286 1150÷1200MPa IA= INCONEL 718 1480MPa min 10%A min	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING H = ARGENTATURA	04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 07A = M7 x 1 08A = M8 x 1.25 10A = M10 x 1.5 10B = M10 x 1.25 12B = M12 x 1.5 14C = M 14 x 1.5 16C = M16 x 1.5 18C = M16 x 1.5 20D = M16 x 1.5	XXX = XX, X DIMENSION x 10 Example: 12.8 mm Flange Diameter Code = 128	A = none X= not forged

PART NUMBER EXAMPLES:

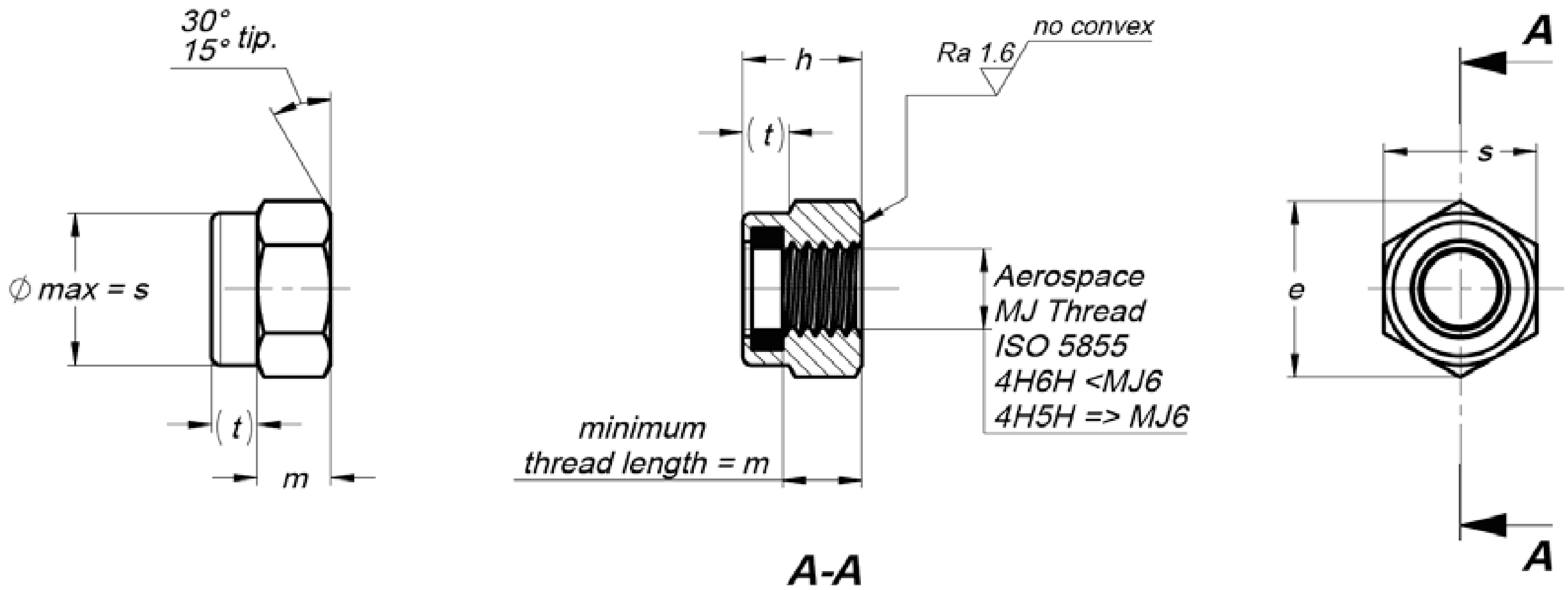
HD1 AA F 10A 167 A

- A — No Additional Features
- 167 — 16.7mm Flange Diameter
- 10A — THREAD CODE (M10 x 1.5)
- F — WITH DRY LUBRIFICANT
- AA — Ti6Al4V ANNEALED MATERIAL
- HD1 — HEXAGON NUT WITH FLANGE

HD1 BA R 05A 091 X

- X — Not forged
- 091 — 9.1mm Flange Diameter
- 05A — THREAD CODE (M5 x 0.8)
- R — RED ANODIZING
- BA — Al 7075 T6-T651 MATERIAL
- HD1 — HEXAGON NUT WITH FLANGE

TAB. 1



TYPE NUT CODE	THREAD SIZE		STANDARD HEIGHT NUTS		LOW HEIGHT NUTS		CUSTOM HEIGHT NUTS		e	s		(t)
			h	m	h	m	h	m				
FIRST PART NR.	INT.	PITCH	MAX	MIN	MAX	MIN	MAX	MIN	MIN	MAX	MIN	(REF)
HN4												
HN4	M4	0.7	6.0	3.2	4.8	2.0			7.7	7	6.78	2.8
HN4	M5	0.8	6.8	4.0	5.4	2.5			8.9	8	7.78	2.8
HN4	M6	1	7.8	4.8	6.0	3.0	XX, X Choose the height dimension	m = h - t	11.1	10	9.78	3.0
HN4	M7	1	9.1	5.6	7.0	3.5			12.1	11	10.73	3.5
HN4	M8	1.25 - 1	10.6	6.4	8.5	4.0			14.4	13	12.73	4.5
HN4	M10	1.5 - 1.25	12.3	8.0	10	5.0			18.9	17	16.73	5.0
HN4	M12	1.75 - 1.5 - 1.25	14.8	9.6	12	6.0			21.1	19	18.67	6.0

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

HEXAGON NUTS, SELF-LOCKING WITH PLASTIC INSERT

PART NUMBER SEE TABLE 2

HN4(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 2

HN4 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NR.	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) HEIGHT DIMENSION CODE	(E) ADDITIONAL FEATURES
HN4	AA= Ti6Al4V annealed BA= 7075 T6-T651	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING H = SILVERING COLOR ANODIZING ONLY FOR 7075 ALUM. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	04A= M4 x 0.7 05A= M5 x 0.8 06A= M6 x 1 07A= M7 x 1 08A= M8 x 1.25 08B= M8 x 1 10A= M10 x 1.5 10B= M10 x 1.25 12A= M12 x 1.75 12B= M12 x 1.5 12C= M12 x 1.25	XXX = XX, X DIMENSION x 10 Example: M4 nut, standard height see Tab.1 = 6,0 Code = 060 M8 nut, low height see Tab.1 = 8,5 Code = 085 M10 nut, 9.0mm Custom Height see Tab.1, max one decimal dimension Code = 090	A = none

PART NUMBER EXAMPLES:

HN4 AA 0 10A 190 A

- A — No Additional Features
- 190 — Standard height (12.3mm)
- 10A — M10 x 1.5 THREAD
- 0 — NO TREATMENT
- AA — Ti6Al4V annealed MATERIAL
- HN4 — HEXAGON NUT WITH FLANGE, SELF-LOCKING

HN4 BA B 08B 075 A

- A — No Additional Features
- 075 — Custom height (7.5mm)
- 08B — M8 x 1 THREAD
- B — BLUE COLOR ANODIZING
- BA — 7075 T6-T651 ALUMINIUM ALLOY MATERIAL
- HN4 — HEXAGON NUT WITH FLANGE, SELF-LOCKING

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

**HEXAGON NUTS,
SELF-LOCKING WITH PLASTIC INSERT**

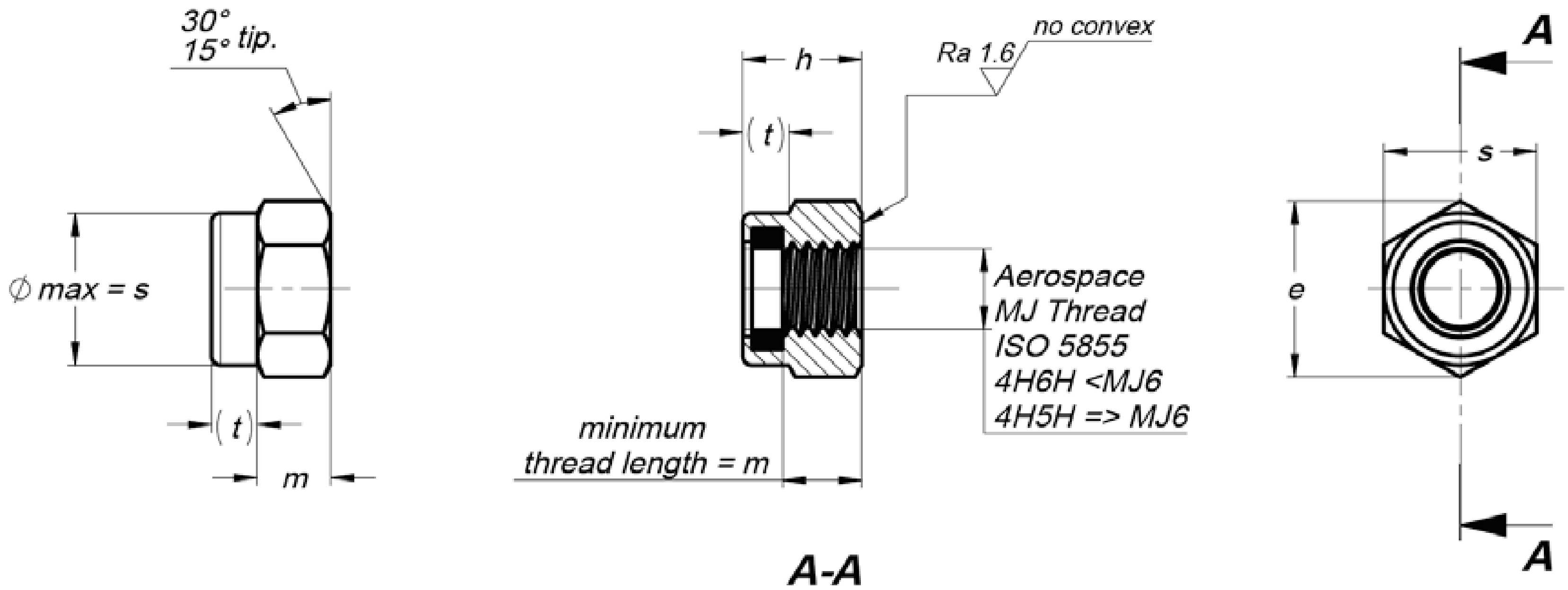
PART NUMBER SEE TABLE 2
HN4(_ _)(_)(_ _ _)(_ _ _) (_)

DRAWING NUMBER – CODICE DOCUMENTO | ISSUE DATE – DATA RILASCIO | REVISIONS - REVISIONI

HN4XX-XXX- - -X 23-06-2016

POGGIPOLINI

TAB. 1



TYPE NUT CODE	THREAD SIZE		STANDARD HEIGHT NUTS		LOW HEIGHT NUTS		CUSTOM HEIGHT NUTS		e	s		(t)
			h	m	h	m	h	m				
FIRST PART NR.	INT.	PITCH	MAX	MIN	MAX	MIN	MAX	MIN	MIN	MAX	MIN	(REF)
HN4												
HN4	M4	0.7	6.0	3.2	4.8	2.0			7.7	7	6.78	2.8
HN4	M5	0.8	6.8	4.0	5.4	2.5			8.9	8	7.78	2.8
HN4	M6	1	7.8	4.8	6.0	3.0			11.1	10	9.78	3.0
HN4	M7	1	9.1	5.6	7.0	3.5	XX, X Choose the height dimension	m = h - t	12.1	11	10.73	3.5
HN4	M8	1.25 - 1	10.6	6.4	8.5	4.0			14.4	13	12.73	4.5
HN4	M10	1.5 - 1.25	12.3	8.0	10	5.0			18.9	17	16.73	5.0
HN4	M12	1.75 - 1.5 - 1.25	14.8	9.6	12	6.0			21.1	19	18.67	6.0

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

HEXAGON NUTS, SELF-LOCKING WITH PLASTIC INSERT

PART NUMBER SEE TABLE 2

HN4(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 2

HN4 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NR.	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) HEIGHT DIMENSION CODE	(E) ADDITIONAL FEATURES
HN4	AA= Ti6Al4V annealed BA= 7075 T6-T651	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING H = SILVERING COLOR ANODIZING ONLY FOR 7075 ALUM. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	04A= M4 x 0.7 05A= M5 x 0.8 06A= M6 x 1 07A= M7 x 1 08A= M8 x 1.25 08B= M8 x 1 10A= M10 x 1.5 10B= M10 x 1.25 12A= M12 x 1.75 12B= M12 x 1.5 12C= M12 x 1.25	XXX = XX, X DIMENSION x 10 Example: M4 nut, standard height see Tab.1 = 6,0 Code = 060 M8 nut, low height see Tab.1 = 8,5 Code = 085 M10 nut, 9.0mm Custom Height see Tab.1, max one decimal dimension Code = 090	A = none

PART NUMBER EXAMPLES:

HN4 AA 0 10A 190 A

- A — No Additional Features
- 190 — Standard height (12.3mm)
- 10A — M10 x 1.5 THREAD
- 0 — NO TREATMENT
- AA — Ti6Al4V annealed MATERIAL
- HN4 — HEXAGON NUT WITH FLANGE, SELF-LOCKING

HN4 BA B 08B 075 A

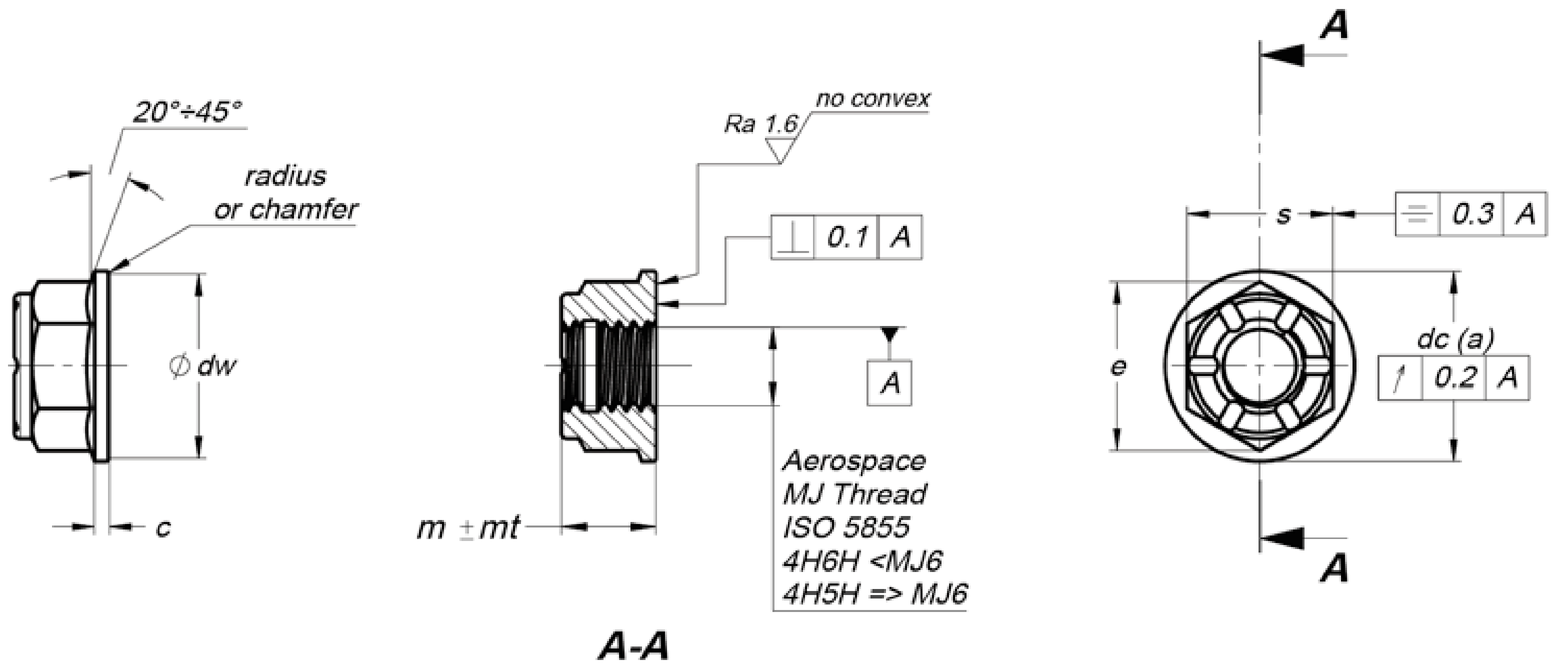
- A — No Additional Features
- 075 — Custom height (7.5mm)
- 08B — M8 x 1 THREAD
- B — BLUE COLOR ANODIZING
- BA — 7075 T6-T651 ALUMINIUM ALLOY MATERIAL
- HN4 — HEXAGON NUT WITH FLANGE, SELF-LOCKING

TOLERANCES UNLESS OTHERWISE NOTED
METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°
ROUGHNESS Ra 3.2

HEXAGON NUTS, SELF-LOCKING WITH PLASTIC INSERT

PART NUMBER SEE TABLE 2
HN4(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 1



(a) Tab.1 standard dimension, or see code "D" Tab.2 for customise dimension

TYPE NUT CODE	THREAD SIZE		c	Ødc	Ødw	m	mt	e	s		mw
FIRST PART NR.	INT.	PITCH	+0.3 -0	MAX	MIN	Tol. = mt	±	MIN	MAX	MIN	MIN WORK HEX
HN8											
HN8	M4	0.7	0.4	10	9.3	5	0.12	7.7	7	6.78	2.8
HN8	M5	0.8	0.6	11	10.3	6	0.15	8.8	8	7.78	3.2
HN8	M6	1	0.8	13	12.3	7.5	0.15	11.1	10	9.78	4.0
HN8	M7	1	1.0	14	13.2	7.5	0.15	12.2	11	10.73	4.4
HN8	M8	1.25	1.2	16	16.2	10	0.18	13.3	12	11.73	4.8
HN8	M10	1.5 - 1.25	1.5	19	18	12	0.18	15.5	14	13.73	5.6
HN8	M12	1.5 - 1.25	1.8	21	18	13	0.22	17.8	16	15.73	6.4
HN8	M14	1.5 – 1.75	2.0	27	25.6	14	0.30	19.9	18	17.73	7.2

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

HEXAGON NUTS WITH FLANGE, “SIX LOCK” SELF-LOCKING

PART NUMBER SEE TABLE 2

HN8(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 2

HN8 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NR.	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) DIAMETER FLANGE CODE	(E) ADDITIONAL FEATURES
HN8	AA= Ti6Al4V annealed BA= 7075 T6-T651 NA= CRES A286 uts 1150÷1200MPa NB= CRES A286 uts 850÷900MPa	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING H = SILVERING COLOR ANODIZING ONLY FOR 7075 ALUM. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	04A= M4 x 0.7 05A= M5 x 0.8 06A= M6 x 1 07A= M7 x 1 08A= M8 x 1.25 10A= M10 x 1.5 10B= M10 x 1.25 12B= M12 x 1.5 12C= M12 x 1.25 14B= M14 x 1.75 14C= M14 x 1.5	XXX = XX, X DIMENSION x 10 Example: M4 standard flange, see Tab.1 Ø10mm Code= 100 Ø 8.5mm M4 Custom Flange Code = 085	A = none X= not forged

PART NUMBER EXAMPLES:

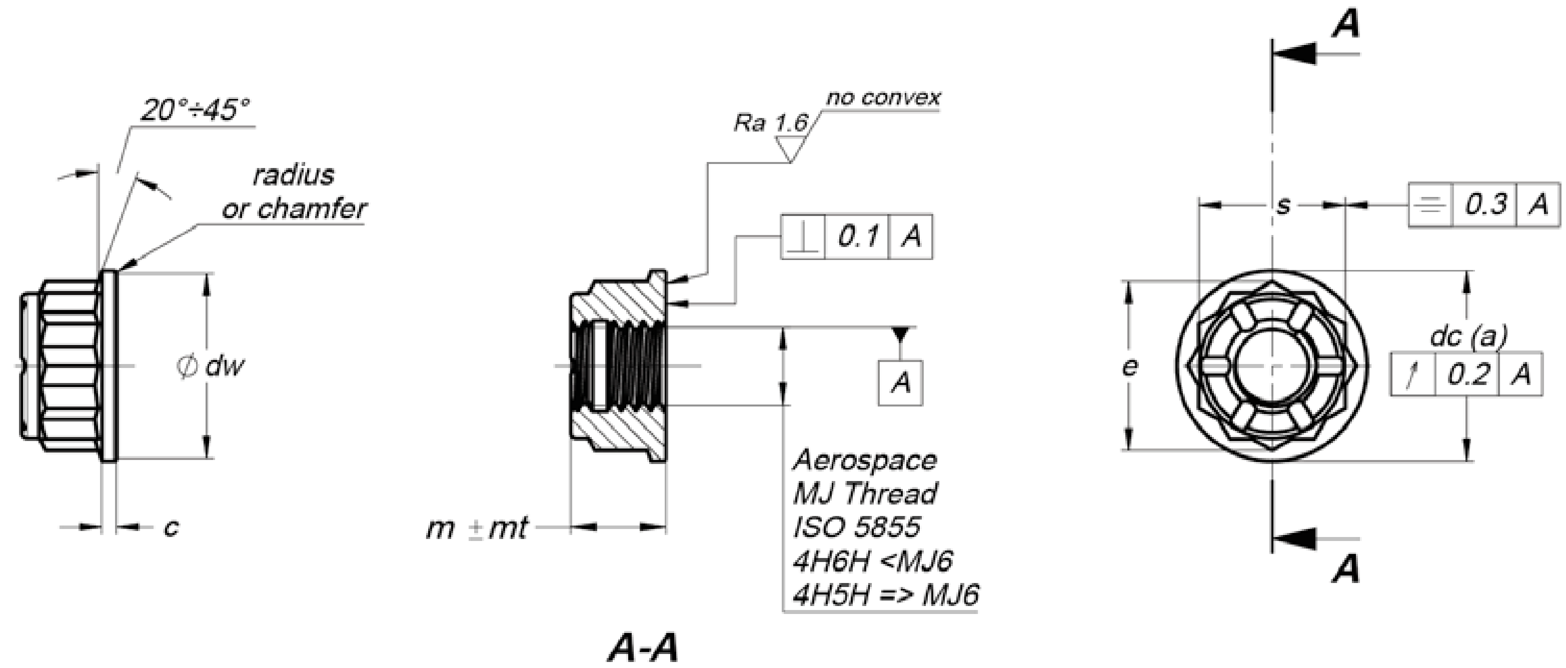
HN8 AA 0 10A 190 A

- No Additional Features
- 19.0mm Flange Diameter
- M10 x 1.5 THREAD
- NO TREATMENT
- Ti6Al4V annealed MATERIAL
- HEXAGON NUT WITH FLANGE, SELF-LOCKING

HN8 BA B 05A 105 X

- not forged
- 10,5mm Flange Diameter
- M5 x 0.8 THREAD
- BLUE COLOR ANODIZING
- 7075 T6-T651 ALUMINIUM ALLOY MATERIAL
- HEXAGON NUT WITH FLANGE, SELF-LOCKING

TAB. 1



(a) Tab.1 standard dimension, or see code "D" Tab.2 for customise dimension

TYPE NUT CODE	THREAD SIZE		c	Ødc	Ødw	m	mt	e	s		mw
FIRST PART NR.	INT.	PITCH	+0.3 -0	MAX	MIN	Tol. = mt	±	MIN	MAX	MIN	MIN WORK HEX
HD2											
HD2	M4	0.7	0.4	10	9.3	5	0.12	7.7	7	6.78	2.8
HD2	M5	0.8	0.6	11	10.3	6	0.15	8.8	8	7.78	3.2
HD2	M6	1	0.8	13	12.3	7.5	0.15	11.1	10	9.78	4.0
HD2	M7	1	1.0	14	13.2	7.5	0.15	12.2	11	10.73	4.4
HD2	M8	1.25	1.2	16	16.2	10	0.18	13.3	12	11.73	4.8
HD2	M10	1.5 - 1.25	1.5	19	18	12	0.18	15.5	14	13.73	5.6
HD2	M12	1.5 - 1.25	1.8	21	18	13	0.22	17.8	16	15.73	6.4
HD2	M14	1.5 – 1.75	2.0	27	25.6	14	0.30	19.9	18	17.73	7.2

TAB. 2

HD2 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NR.	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) DIAMETER FLANGE CODE	(E) ADDITIONAL FEATURES
HD2	AA= Ti6Al4V annealed BA= 7075 T6-T651 NA= CRES A286 uts 1150÷1200MPa NB= CRES A286 uts 850÷900MPa	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING H = SILVERING COLOR ANODIZING ONLY FOR 7075 ALUM. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	04A= M4 x 0.7 05A= M5 x 0.8 06A= M6 x 1 07A= M7 x 1 08A= M8 x 1.25 10A= M10 x 1.5 10B= M10 x 1.25 12B= M12 x 1.5 12C= M12 x 1.25 14B= M14 x 1.75 14C= M14 x 1.5	XXX = XX, X DIMENSION x 10 Example: M4 standard flange, see Tab.1 Ø10mm Code= 100 Ø 8.5mm M4 Custom Flange Code = 085	A = none X= not forged

PART NUMBER EXAMPLES:

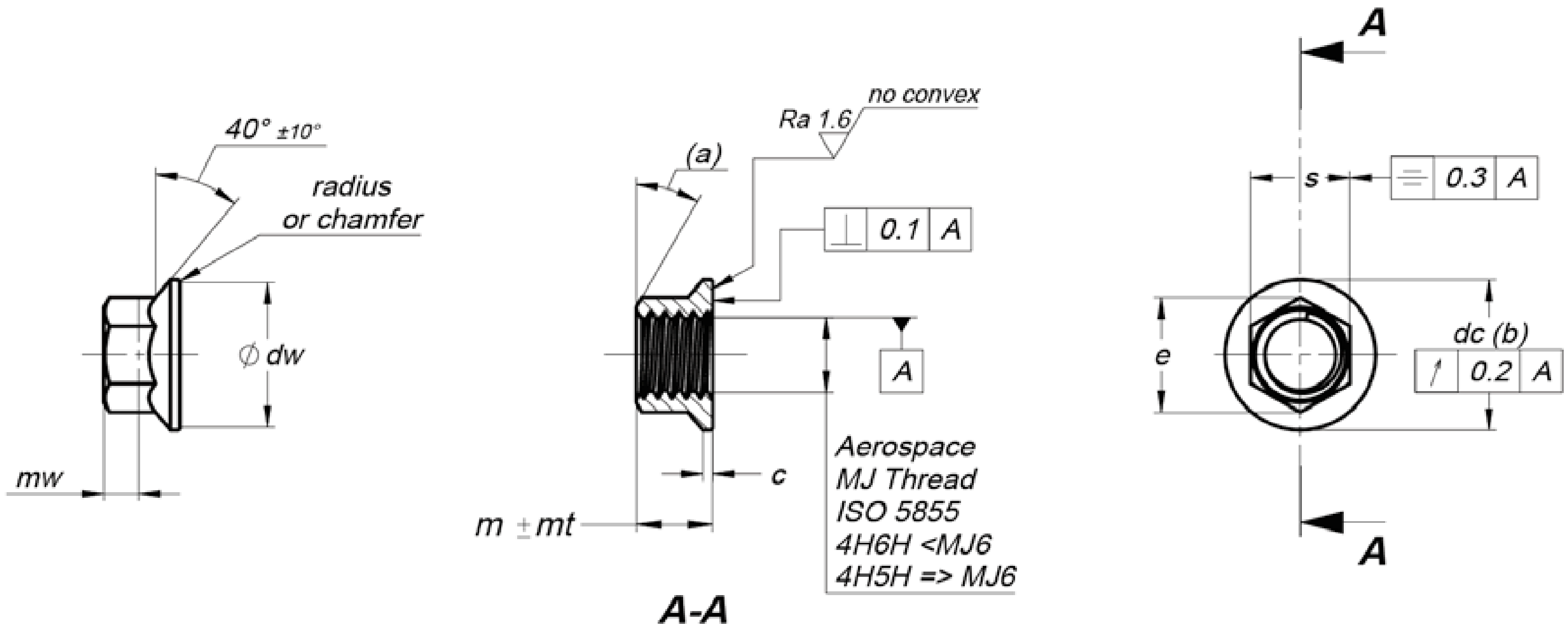
HD2 AA 0 10A 190 A

- A — No Additional Features
- 190 — 19.0mm Flange Diameter
- 10A — M10 x 1.5 THREAD
- 0 — NO TREATMENT
- AA — Ti6Al4V annealed MATERIAL
- HD2 — DOUBLE HEXAGON NUT WITH FLANGE, SELF-LOCKING

HD2 BA B 05A 105 A

- A — No Additional Features
- 105 — 10,5mm Flange Diameter
- 05A — M5 x 0.8 THREAD
- B — BLUE COLOR ANODIZING
- BA — 7075 T6-T651 ALUMINIUM ALLOY MATERIAL
- HD2 — DOUBLE HEXAGON NUT WITH FLANGE, SELF-LOCKING

TAB. 1

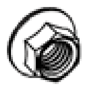


(a) Chamfer 20°÷45° or Radius
(b) Tab.1 standard dimension, or see code "D" Tab.2 for customise dimension

TYPE NUT CODE	THREAD SIZE		c	Ødc	Ødw	m	mt	e	s		mw
FIRST PART NR.	INT.	PITCH	+0.3 -0	MAX	MIN	Tol. = mt	±	MIN	MAX	MIN	MIN WORK HEX
HN5											
HN5											
HN5	M5	0.8	1.0	9.1	8.3	5.5	0.15	7.69	7	6.78	2.8
HN5	M6	1	1.2	10.6	9.8	6.3	0.15	8.79	8	7.78	3.2
HN5	M7	1	1.4	12.1	11.3	6.5	0.15	9.89	9	8.78	3.6
HN5	M8	1.25	1.6	13.6	12.8	6.8	0.18	10.98	10	9.73	4.0
HN5	M10	1.5 - 1.25	2.0	16.7	15.7	7.8	0.18	13.19	12	11.73	4.8
HN5	M12	1.5 – 1.25	2.4	19.9	18.8	9.0	0.22	15.38	14	13.73	5.6

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°
ROUGHNESS Ra 3.2



HEXAGON NUTS WITH FLANGE, SELF-LOCKING, HEAT RESISTING STEEL

PART NUMBER SEE TABLE 2

HN5(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 2

HN5 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NR.	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) DIAMETER FLANGE CODE	(E) ADDITIONAL FEATURES
HN5	NA= CRES A286 uts 1150÷1200MPa NB= CRES A286 uts 850÷900MPa	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING H = SILVERING	04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 07A = M7 x 1 08A = M8 x 1.25 10A = M10 x 1.5 10B = M10 x 1.25 12B = M12 x 1.5 12C = M12 x 1.25	XXX = XX, X DIMENSION x 10 Example: 12.8 mm Flange Diameter Code = 128	A = none X= not forged

PART NUMBER EXAMPLES:

HN5 NA H 10A 167 A

- A — No Additional Features
- 167 — 16.7mm Flange Diameter
- 10A — THREAD CODE (M10 x 1.5)
- H — SILVERING
- NA — A286 uts 1150÷1200MPa MATERIAL
- HN5 — HEXAGON NUT WITH FLANGE

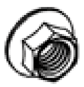
HN5 NB B 05A 091 A

- A — No Additional Features
- 091 — 9.1mm Flange Diameter
- 05A — THREAD CODE (M5 x 0.8)
- B — PASSIVATING
- NB — A286 uts 850÷900MPa MATERIAL
- HN5 — HEXAGON NUT WITH FLANGE

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2



HEXAGON NUTS WITH FLANGE, SELF-LOCKING, HEAT RESISTING STEEL

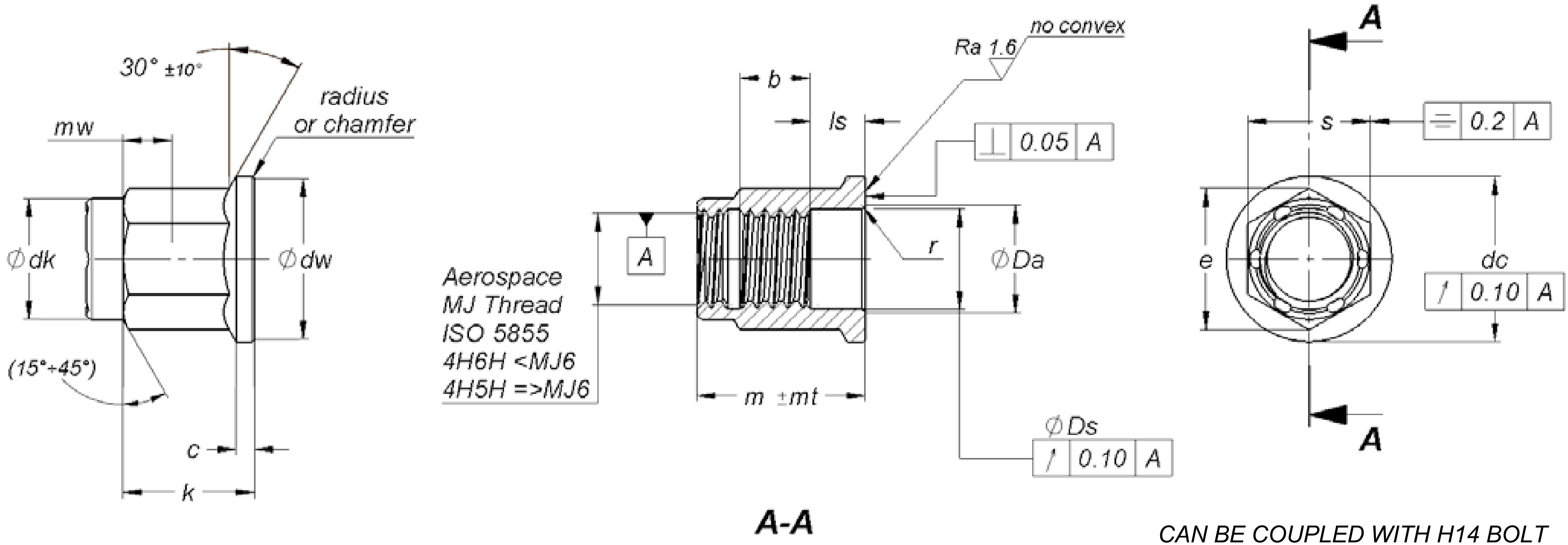
PART NUMBER SEE TABLE 2

HN5(_ _)(_)(_ _ _)(_ _ _) (_)

DRAWING NUMBER – CODICE DOCUMENTO	ISSUE DATE – DATA RILASCIO	REVISIONS - REVISIONI
HN3XX-XXX- - -X	05-05-2016	

POGGIPOLINI

TAB. 1



CAN BE COUPLED WITH H14 BOLT

TYPE NUT CODE	THREAD SIZE		b	c	ØDa	Ødc	ØDs	Ødk	Ødw	m	mt	ls	e	k		r	s		mw
FIRST PART NR.	EXT.	PITCH	± 0.3	+0.3 -0	MAX	+0 -0.15	+0.15 -0	+0 -0.15	MIN		±	+0.2 -0	MIN	MAX	MIN	MIN	MAX	MIN	MIN WORK HEX
HN3	M4	0.7																	
HN3	M5	0.8	4	1.3	7	10	6.2	7.5	9.4	10.6	0.3	3.6	8.71	8.6	7.3	0.3	8	7.85	3.2
HN3	M6	1	5	1.3	7.2	11	6.2	7.85	10.4	12	0.3	4	8.71	9.5	8.6	0.3	8	7.85	3.2
HN3	M6	1	5	1.5	9	13	8.2	9	12.3	12	0.3	4	10.95	9.5	8.9	0.4	10	9.85	4
HN3	M8	1.25	6.25	1.5	9.6	13.5	8.2	9.85	12.8	14.75	0.3	4.5	10.95	11.75	11	0.4	10	9.85	4
HN3	M10	1.5																	
HN3	M12	1.75																	
HN3	M14	2																	

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

HEX SELF LOKING NUTS, FLANGE, INNER UNLOADING

PART NUMBER SEE TABLE 2

HN3(_ _)(_)(_ _ _)(_ _ _) (_)

TAB. 2

HN3 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NR.	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) THREAD-PITCH CODE	(D) INNER UNLOADING DIA CODE (CODE = ØDs)	(E) ADDITIONAL FEATURES
HN3	AA = TI6AL4V ANN. BA = AL 7075 T6-T651 CA = AL 7068 T6511 NA = A286 1150÷1200MPa NB = A286 850÷900MPa NC = AISI 303	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING H = ARGENTATURA COLOR ANODIZING ONLY FOR 7075 ALUM. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	04A = M4 x 0.7 05A = M5 x 0.8 06A = M6 x 1 07A = M7 x 1 08A = M8 x 1.25 08B = M8 x 1 10A = M10 x 1.5 10B = M10 x 1.25 12A = M12 x 1.75 12B = M12 x 1.5 12C = M12 x 1.25 14A = M14 x 2 14B = M14 x 1.75 14C = M 14 x 1.5 14D = M 14 x 1.25 16A = M 16 x 2 16B = M16 x 1.75 16C = M16 x 1.5	062 = 6,2mm 082 = 8,2mm	A = none

PART NUMBER EXAMPLES:

HN3 NC F 08A 082 A

- No Additional Features
- TAB.1 “Ds” IN. UNLOADING 8,2mm DIAMETER
- THREAD CODE (M8 x 1.25)
- WITH DRY LUBRIFICANT
- AISI 303 MATERIAL
- NUT, HEXAGON HEAD, FLANGE, INNER UNLOADING

HN3 NA H 05A 062 A

- No Additional Features
- TAB.1 “Ds” IN. UNLOADING 6,2mm DIAMETER
- THREAD CODE (M5 x 0.8)
- PASSIVATING
- A286 1150÷1200MPa MATERIAL
- NUT, HEXAGON HEAD, FLANGE, INNER UNLOADING

TOLERANCES UNLESS OTHERWISE NOTED
METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°
ROUGHNESS Ra 3.2

HEX SELF LOKING NUTS, FLANGE, INNER UNLOADING

PART NUMBER SEE TABLE 2
HN3(_ _)(_)(_ _ _)(_ _ _) (_)

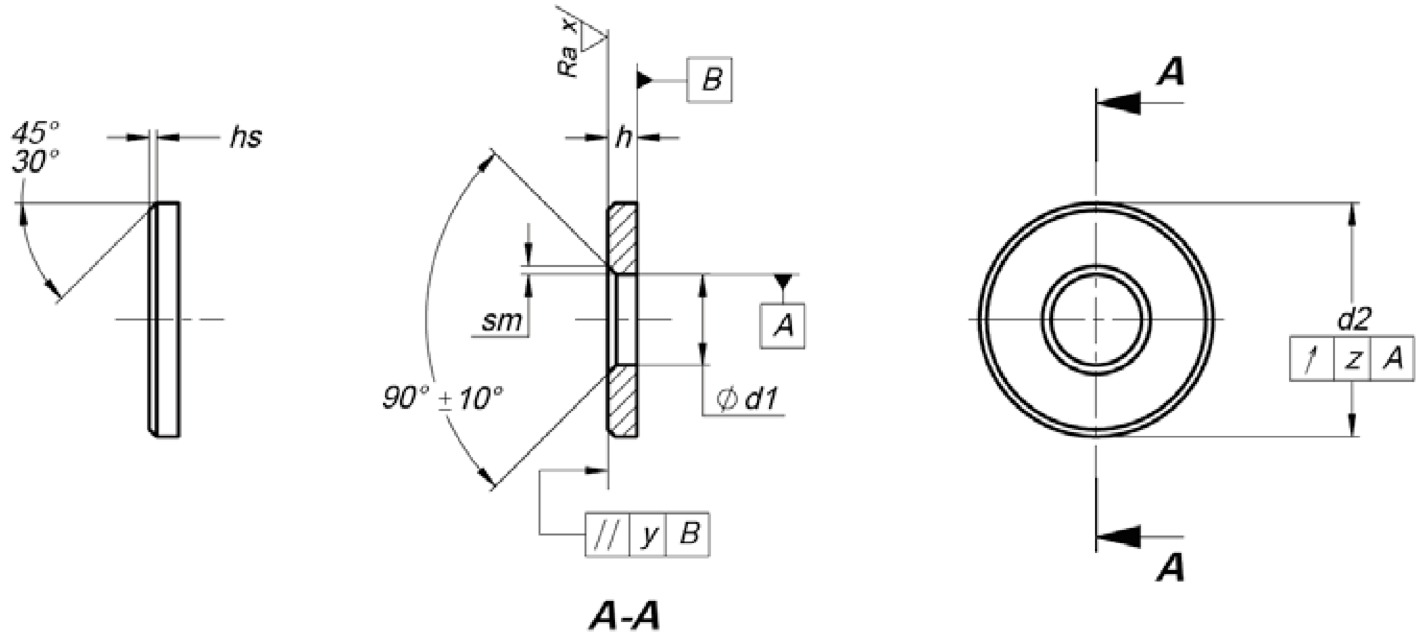
DRAWING NUMBER – CODICE DOCUMENTO: **HW1XX-XX- - -XX**

ISSUE DATE – DATA RILASCIO: 23-06-2016

REVISIONS - REVISIONI

POGGIPOLINI

TAB. 1



TYPE WASHER CODE	(THREAD SIZE)	d1	d2	h		hs	sm	x	y	z
FIRST PART NR.		H13	h13	Nom.	±		-0 +0.2	Ra µmm	mm	mm
HW1	M4	4,2	9.0	0.8	0.05	h/2 ÷ h/4	0.3	1.6	0.03	0.2
HW1	M5	5.2	10.0	1.0	0.10		0.3	1.6	0.03	0.2
HW1	M6	6.2	12.0	1.6	0.10		0.4	1.6	0.04	0.2
HW1	M7	7.2	14.0	1.6	0.10		0.5	1.6	0.04	0.2
HW1	M8	8.2	16.0	1.6	0.10		0.6	1.6	0.04	0.2
HW1	M10	10.3	20.0	1.6	0.10		0.6	1.6	0.05	0.2
HW1	M12	12.4	24.0	2.0	0.15		0.8	3.2	0.05	0.3
HW1	M14	14.5	28.0	2.5	0.20		0.8	3.2	0.05	0.3
HW1	M16	16.5	30.0	2.5	0.20		0.8	3.2	0.05	0.3
HW1	M18	18.5	34.0	3.0	0.25		1.0	3.2	0.06	0.3
HW1	M20	20.5	37.0	3.0	0.25		1.2	3.2	0.06	0.3

TOLERANCES UNLESS OTHERWISE NOTED

METRIC DIMENSIONS
LINEAR ±0.1
ANGULAR ±2°

ROUGHNESS Ra 3.2

MACHINED WASHERS

PART NUMBER SEE TABLE 2

HW1(_ _)(_)(_ _)(_ _ _) (_ _)

TAB. 2

HW1 (A) (B) (C) (D) (E)
PART NUMBER CODING BY CHOICE OF THE FEATURES

BASIC PART NR.	(A) MATERIAL SPECIFY	(B) SURFACE TREATMENT SPECIFY	(C) FOR THREAD CODE	(D) "d2" EXTERNAL DIAMETER CODE	(E) h" HEIGHT DIMENSION CODE
HW1	AA= Ti6Al4V annealed BA= 7075 T6-T651	0 = NO TREATMENT A = BLUE ANODIZING (FOR TITANIUM) B = PASSIVATING C = PVD TIN D = DLC E = IVD F = DRY LUBRIFICANT COATING G = ZINC ALUMINIUM FLAKES COATING H = SILVERING COLOR ANODIZING ONLY FOR 7075 ALUM. ALLOY B= BLUE G= GOLD K= BLACK N= GREEN P= PURPLE R= RED S= SILVER	04= M4 05= M5 06= M6 07= M7 08= M8 10= M10 12= M12 14= M14 16= M16 18= M18 20= M20	XX, X = XX, X DIMENSION x 10 Example: M4 washer, "d2" standard see Tab.1 = 9,0 Code = 090 M10 washer, Ø21,5mm "d2" custom max one decimal dimension Code = 215	X, X = X, X DIMENSION x 10 Example: M4 washer, "h" standard see Tab.1 = 0,8 Code = 08 M10 washer, 2.2mm "h" custom max one decimal dimension Code = 22

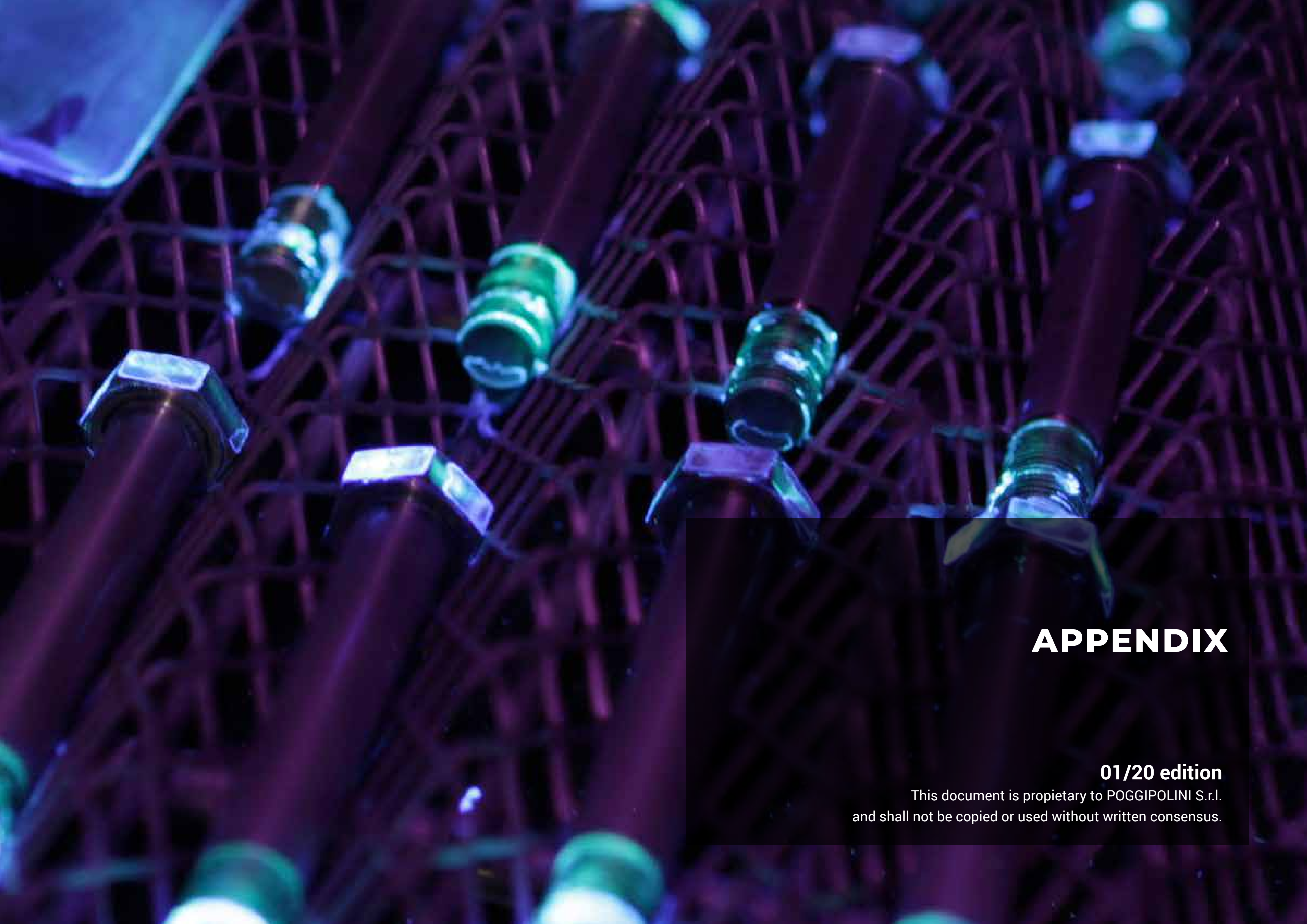
PART NUMBER EXAMPLES:

HW1 AA 0 04 090 08

- 0.8mm "h" dimension
- Ø9.0mm "d2" dimension
- For M4 thread screws
- NO TREATMENT
- Ti6Al4V annealed MATERIAL
- MACHINED WASHER

HW1 BA B 10 215 22

- 2.2mm "h" dimension
- Ø21.5mm "d2" dimension
- For M10 thread screws
- BLUE COLOR ANODIZING
- 7075 T6-T651 ALUMINIUM ALLOY MATERIAL
- MACHINED WASHER



APPENDIX

01/20 edition

POGGIPOLINI

3.0 APPENDIX

3.1 MATERIALS

Since 1950 Poggipolini has acquired considerable expertise on various types of materials.

Poggipolini is capable to work and find the best applications for the following materials:

Ti6Al4V	AISI 4340	MP35N
13-8 PH	MLX 17	Maraging 300
15-5 PH	Inconel 718	AL7075 T6/T651
17-4 PH	Aermet 100	AL7068 T6511

3.2 TITANIUM Ti6Al4V

Titanium is available on the market as commercially pure or as alloys.

Commercially pure titanium has a hexagonal Alfa type crystalline structure and increases its mechanical resistance (ultimate strength psi) with each grade classification (from grade 1 to grade 4). With the addition of alloying elements such as aluminium, vanadium, and molybdenum, titanium alloys are created which have cubic Alfa + Beta crystalline structures. These Alfa + Beta alloys are the most used commercially, due to their ductile-weight-mechanical resistance relationships.
Of these, the most used titanium alloys are 6Al4V (grade 5) and 3Al 2,5V (grade 9) which are used to make bolts, mechanical components and chassis.

Titanium and its alloys are used in all those fields in which one or more of the following factors are important: high strength-to-weight ratio, mechanical resistance, corrosive resistance, electrical resistivity.

Titanium and titanium alloys owe their excellent corrosion resistance to a stable, protective surface layer of titanium oxide; titanium alloys are highly resistant to pitting corrosion, and it is rarely encountered.

Nominal Ø or Least Thickness or Nominal Wall Thickness (mm)	Tensile Strenght (MPa)	Yield Strenght at 0.2% Offset (MPa)	Elongation in 4D% (Long.)	Elongation in 4D% (L.T.)	Elongation in 4D% (S.T.)	Reduction of Area % (Long.)	Reduction of Area % (L.T.)	Reduction of Area % (S.T.)
Up to 50.8	931	862	10	10	-	25	20	-
Over 50.8 to 101.60	896	827	10	10	10	25	20	15
Over 101.60 to 152.40	896	827	10	10	8	20	20	15

3.3 CORROSION RESISTANT

Titanium and titanium alloys owe their excellent corrosion resistance to a stable, protective surface layer of titanium oxide. Titanium metal is highly reactive with oxygen, and the surface oxide forms spontaneously and instantaneously in contact with air and most media. Damage to the oxide film usually heals rapidly if the environment contains oxygen or moisture at the parts per million level. Hence titanium alloys are highly resistant to corrosion, usually corrode at negligible rates and require no corrosion allowance. However, anhydrous or highly reducing conditions may prevent the formation or healing of the oxide film, and corrosion may then become rapid.
This form of corrosion resistance is similar to that of aluminium and magnesium alloys, and of stainless steels, which also rely on a protective oxide film on the surface of a reactive metal.

When titanium is fully passive, corrosion rates are typically lower than 0.04 mm/year, due to the highly stable surface protective film. In many environments the film may thicken, which gives interference colours and a slight weight gain. General corrosion may be encountered in reducing acid conditions, particularly at elevated temperatures. In strong and hot reducing acids the titanium oxide film can dissolve, and the unprotected titanium metal be taken rapidly into solution.

Pitting Corrosion

Titanium alloys are highly resistant to pitting corrosion, and it is rarely encountered.

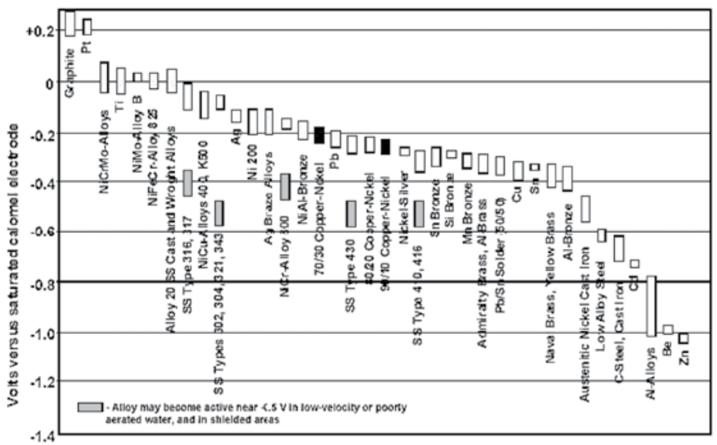
Stress Corrosion Cracking

The commercially pure titanium alloys (grades 1, 2, 7, 11, 12) are immune to SCC except in a few environments, such as anhydrous methanol solutions containing halides, nitrogen tetroxide and red fuming nitric acid.
The higher strength alloys have been found susceptible to SCC in aqueous chloride solutions at high stress levels in laboratory tests, but the problem is rarely encountered in practice.

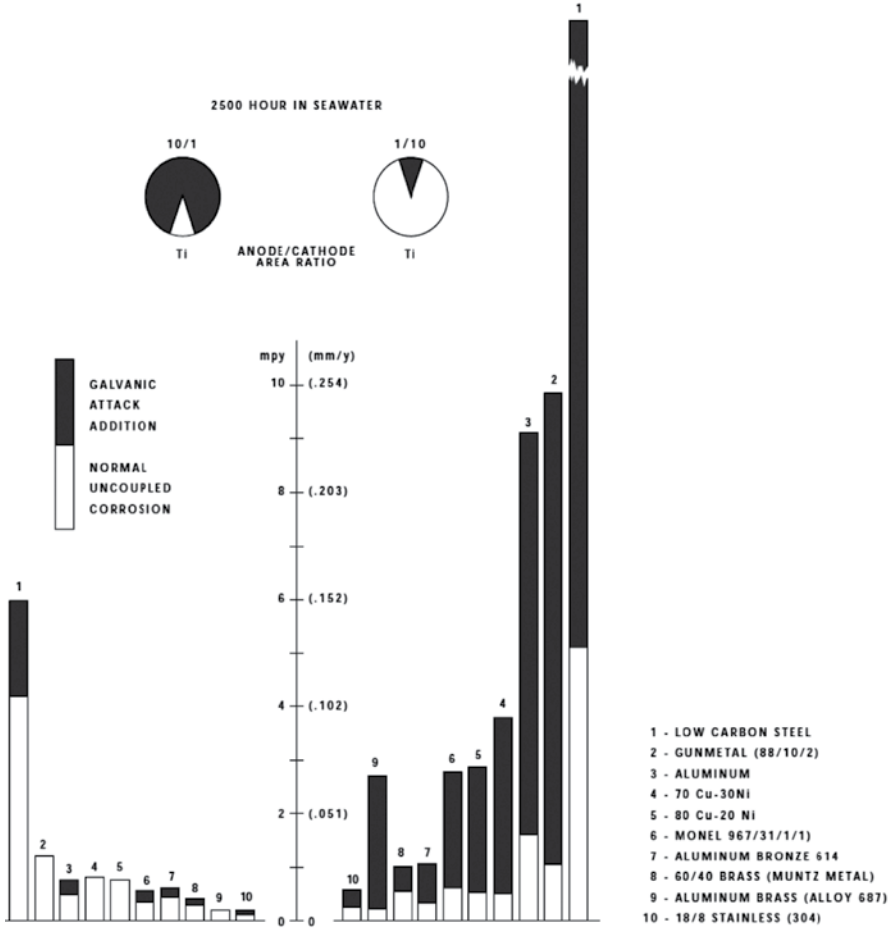
Galvanic Couples

Titanium rarely suffers accelerated corrosion on coupling with other metals, but it may accelerate the corrosion of a more active metal coupled to it. The rate of attack depends on many factors, including solution chemistry and temperature, and the cathode to anode surface area ratio.
The coupling of titanium with dissimilar metals usually does not accelerate the corrosion of the titanium. The exception is in reducing environments where titanium does not passivate. Under these conditions, it has a potential similar to aluminum and will undergo accelerated corrosion when coupled to other more noble metals.
Because titanium is usually the cathodic member of any galvanic couple, hydrogen will be evolved on its surface proportional to the galvanic current flow. This may result in the formation of surface hydride films that are generally stable and cause no problems. If the temperature is above 170°F (77°C), however, hydriding can cause embrittlement.

In order to avoid problems with galvanic corrosion, it is best to construct equipment of a single metal. If this is not practical, use two metals that are close together in the galvanic series, insulate the joint or cathodically protect the less noble metal. If dissimilar metals are necessary, construct the critical parts out of titanium, since it is usually not attacked, and use large areas of the less noble metal and heavy sections to allow for increased corrosion.



The table above gives the galvanic series in seawater. In this environment, titanium is passive and exhibits a potential of about 0.0V versus a saturated calomel reference cell which places it high on the passive or noble end of the series. For most environments, titanium will be the cathodic member of any galvanic couple. It may accelerate the corrosion of the other member of the couple, but in most cases, the titanium will be unaffected.

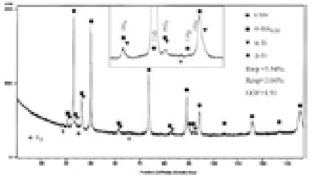


The table above shows the accelerating effect that titanium has on the corrosion rate of various metals when they are galvanically connected in seawater.

If the area of the titanium exposed is small in relation to the area of the other metal, the effect on the corrosion rate is negligible. However, if the area of the titanium (cathode) greatly exceeds the area of the other metal (anode) severe corrosion may result.

Erosion Corrosion

The hardness of the surface oxide film gives excellent resistance to erosion corrosion, which is outstanding compared to most other candidates for heat exchanger service. High flow rates (30m/sec) can be used without problems due to inlet turbulence or pump cavitation effects.



Fatigue Corrosion

The highly protective surface oxide film results in insignificant reductions in fatigue strength in water, sea water and most chloride solutions where corrosion is not active.

Water & Sea Water

Titanium alloys corrode negligibly in sea water at temperatures up to 260°C. Even under biofouling and deposits, pitting and crevice corrosion are not encountered. Marine atmospheres, splash and tidal zones, and soils also have no effect. Corrosion at tight design crevices may be seen in waters with higher than about 1000 ppm of chlorides at temperatures above about 75°C.

Oxidising Media

Titanium alloys are highly resistant to oxidising acids, with corrosion rates typically less than 0.03 mm/year.

Hydrogen Damage

Titanium alloys are widely used in environments containing hydrogen, and where impressed currents or galvanic couples generate hydrogen. Hydrogen embrittlement of the titanium may result due to the formation of titanium hydride precipitates, usually without significant reduction of the performance of the alloy. Embrittlement is loss of ductility and toughness of the alloy.

The surface oxide film is a highly effective barrier to the passage of hydrogen, and only traces of moisture or oxygen are effective in maintaining the oxide film. Hence hydrogen embrittlement can usually be avoided. It is unlikely to be encountered at temperatures below about 80°C, or at solution pH between 3 and 12.
The usual cause of hydrogen damage is excessive hydrogen charging from an impressed current corrosion protection system, or a galvanic couple (see below) with a more active metal, such as aluminium, zinc or magnesium. Metals which remain passive, such as other titanium alloys, stainless steels, copper alloys and nickel alloys, are unlikely to cause this problem.

Reducing Acids

Corrosion of titanium alloys may be encountered when the temperature & concentration of reducing acid solutions exceed critical values, which breaks down the surface oxide layer. Reducing acids include sulphuric, sulphamic, oxalic, trichloroacetic, phosphoric and halogen acids such as hydrochloric and hydrofluoric.

Crevice Corrosion

Titanium alloys may suffer crevice corrosion attack by a similar mechanism to that encountered in stainless steels: oxygen depleted reducing acid conditions develop within tight crevices isolated from the bulk corrosion media. Crevice corrosion may be encountered in hot (>70°C) solutions containing chlorides, bromides, fluorides, iodides or sulphates. It can stem from metal to metal joints such as tube to tubesheet joints or badly designed welds, at gaskets, or at surface deposits.

Alloy Composition Effects

All the commercial purity grades corrode at very low rates while the metal remains in the passive condition. Small contents (< 2 – 3%) of the elements normally present have little effect on the oxide film, and hence on corrosion resistance. However, where the corrosion resistance is marginal (i.e. corrosion rates above about 0.13 mm/year), small amounts of elements such as sulphur and iron accelerate the corrosion rate of the alloy. Minor additions of other elements, such as palladium and nickel, can greatly reduce corrosion under these conditions, and made to highly corrosion resistant alloys such as grade 7.

Titanium 6Al 4V

As in other titanium alloys, Titanium 6Al-4V has excellent resistance to corrosion specially in seawater, making it a good choice for use in offshore and subsea oil & gas operations where seawater corrosion and weight are concerns.

Titanium 6Al-4V is resistant to general corrosion, but may be quickly attacked by environments that cause breakdown of the protective oxide layer including hydrofluoric (HF), hydrochloric (HCl), sulphuric and phosphoric acids. Titanium 6Al-4V resists attack by pure hydrocarbons and most chlorinated and fluorinated hydrocarbons, provided that water has not caused formation of small amounts of hydrochloric and hydrofluoric acids.

4.0 OTHER MATERIALS

13-8 PH

13-8 PH VAR is in a family of martensitic precipitation hardening stainless steel. It is produced as a consumable electrode, vacuum arc remelted product offering excellent transverse toughness and ductility even in large section. High strength is developed by a simple low-temperature heat treatment. Due to the chemical composition and controlled melting practise, 13-8 VAR has an essentially ferrite-free microstructure. This material has a typical density of 7.8kg/dm3.

Ideal for applications where very high strength and toughness are required. This alloy is also used when good general / stress corrosion cracking resistance and minimal property directionality are needed. Applications include aircraft structural parts, landing gear components, shafts, valves, fittings and fasteners.

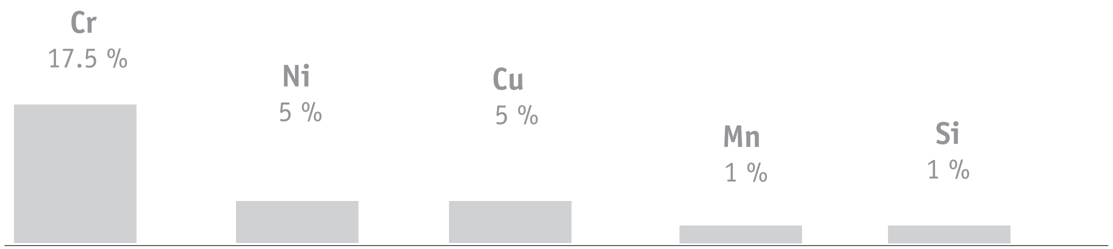
Condition	Specimen Orientation	Tensile Strenght (MPa)	Yield Strenght at 0.2% Offset (MPa)	Elongation in 4D%	Reduction of Area %
H950	Longitudinal Transverse	1517 1517	1413 1413	10 10	45 35
H1000	Longitudinal Transverse	1413 1413	1310 1310	10 10	50 40
H1025	Longitudinal Transverse	1276 1276	1207 1207	11 11	50 45
H1050	Longitudinal Transverse	1207 1207	1138 1138	12 12	50 45
H1100	Longitudinal Transverse	1034 1034	931 931	14 14	50 50
H1150	Longitudinal Transverse	931 931	621 621	14 14	50 50

17-4 PH

17-4 PH is in a family of martensitic precipitation hardening stainless steel; it contains 4% copper and may be hardened by a single low-temperature precipitation hardening heat treatment, producing excellent mechanical properties at a high strength level.

It has a tipical density of 7.75 kg/dm3 and can be magnetised.
Used where high strength and good corrosion resistance are required as well as for application requiring high fatigue strength, good resistance to galling and stress corrosion resistance.

Condition	Tensile Strenght (MPa)	Yield Strenght at 0.2% Offset (MPa)	Elongation in 4D%	Reduction of Area %
H900	1310	1172	10	40
H925	1172	1069	10	44
H1025	1069	1000	12	45
H1075	1000	862	13	45
H1100	965	793	14	45
H1150	931	724	16	50



15-5 PH

15-5 PH VAR is a martensitic, precipitation hardening stainless steel containing 4% copper. It possesses all the advantages of 17-4 PH, including single low-temperature thermal treatment. It also offers excellent transverse notch toughness and ductility and very good uniformity of properties.

The mechanical properties in larger sections and forgeability are superior to that of 17-4 PH. This alloy has a typical density of 7.8 kg/dm3 and magnetic permeability of 95.

15-5 PH is very suitable for intricate parts requiring machining and welding and\or where distortion in conventional heat treatment is a problem. It's employed where high strength and good corrosion resistance are required.

Condition	Specimen Orientation	Tensile Strenght (MPa)	Yield Strenght at 0.2% Offset (MPa)	Elongation in 4D%	Reduction of Area %
H900	Longitudinal Transverse	1310 1310	1172 1172	10 6	35 20
H925	Longitudinal Transverse	1172 1172	1069 1069	10 7	38 25
H1025	Longitudinal Transverse	1069 1069	1000 1000	12 8	45 32
H1075	Longitudinal Transverse	1000 1000	862 862	13 9	45 33
H1100	Longitudinal Transverse	965 965	793 793	14 10	45 34
H1150	Longitudinal Transverse	931 931	724 724	16 11	50 35

AISI 4340

This chromium-nickel-molybdenum alloy is a widely used deep-hardening constructional steel. It is used at a variety of strength levels and at each level possesses remarkable ductility and toughness. High fatigue strength makes AISI 4340 ideal for highly stressed parts. It maintains its strength and hardness at elevated temperatures.
The density of this material is typically 7.85 kg/dm3.

Nominal Cross-Sectional Area Square Centimeters	Tensile Strenght (MPa)	Yield Strenght at 0.2% Offset (MPa)	Elongation in 4D%	Reduction of Area %
Up to 645, inc.	1793	1496	6	30
Over 645 to 929, inc.	1793	1496	5	25
Over 929	1793	1496	4	20

MLX17

This steel stainless has excellent mechanical properties in the longitudinal and transverse directions, excellent balance between strength and toughness properties and excellent fatigue resistance, good resistance to corrosion and stress corrosion and very good weldability.
Its applications are on forgings and mechanical parts in stainless steel requiring very good mechanical properties, structural parts and fasteners.

Condition	Specimen Orientation	Tensile Strenght (MPa)	Yield Strenght at 0.2% Offset (MPa)	Elongation in 4D%	Reduction of Area %
H950	Longitudinal Transverse	1655 1655	1517 1517	10 8	45 35
H1000	Longitudinal Transverse	1517 1517	1379 1379	10 10	50 40

INCONEL 718

Alloy 718 is a precipitation hardenable nickel-based alloy designed to display exceptionally high yield, tensile and creep-rupture properties at temperatures up to 1300°F. This alloy has excellent weldability when compared to the nickel-base superalloys hardened by aluminum and titanium. This alloy has been used for jet engine and high-speed airframe parts such as wheels, buckets, spacers, and high temperature bolts and fasteners.

Specimen Orientation	Tensile Strenght (MPa)	Yield Strenght at 0.2% Offset (MPa)	Elongation in 4D%	Reduction of Area %
Longitudinal	1276	1034	12	15
Long-Transverse	1241	1034	10	12
Transverse	1241	1034	6	8

AERMET 100

AerMet 100 (UNS K92580) is an alloy that has been designed to have properties of excellent hardness and strength combined with exceptional ductility and toughness. AM 100 is used in applications that require high fracture toughness and excellent resistance to stress corrosion cracking and fatigue. AerMet® 100 is considered as a candidate for use in applications such as Armour, Fasteners, Landing Gear, Jet Engine Shafts, Structural Members, Drive Shafts, Structural Tubing.

Property	Value Aged at 900 °F	Value Aged at 875°F
Tensile Strenght	1931 MPa	1999 MPa
Yield Strenght at 0.2% Offset	1620 MPa	1689 MPa
Elongation in 4D	8%	8%
Reduction of Area	45%	35%

MP35N

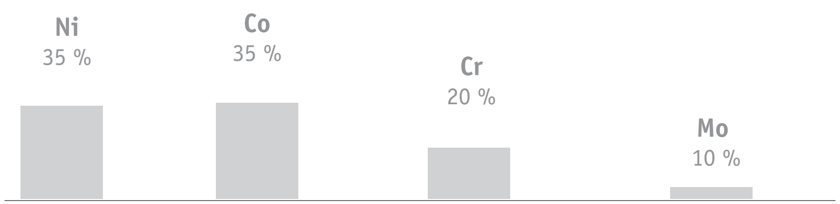
MP35N alloy is a nonmagnetic, nickel-cobalt-chromium-molybdenum alloy possessing a unique combination of ultrahigh tensile strength (up to 300 ksi [2068 MPa]), good ductility and toughness, and excellent corrosion resistance. In addition, this alloy displays exceptional resistance to sulfidation, high temperature oxidation, and hydrogen embrittlement.

MP35N alloy possesses excellent resistance to sulfidation, high temperature oxidation, hydrogen embrittlement, saline solutions and most mineral acids.

This alloy features exceptional resistance to stress corrosion cracking at very high strength levels under severe environmental conditions that can crack most conventional alloys. It is also highly resistant to other forms of localized attack, such as pitting and crevice corrosion.

In seawater environments, this alloy is virtually immune to general, crevice and stress corrosion, regardless of strength level or process condition.

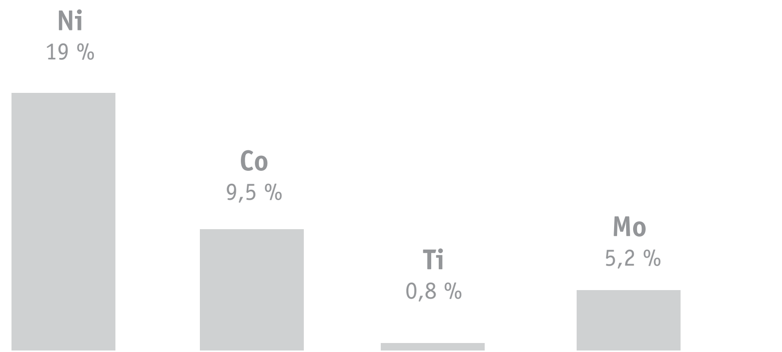
Property	Value
Tensile Strenght	1793 MPa
Yield Strenght at 0.2% Offset	1586 MPa
Elongation in 4D	8%
Reduction of Area	35%



MARAGING 300

Maraging is an iron-based steel alloyed with 18% nickel and 7 to 12% cobalt as a strengthening agent. Essentially carbon-free, other alloying elements include moly, aluminum and titanium. This combination creates a superior steel that maintains high strength and toughness, has uniform, predictable shrinkage during heat treatment, resists corrosion and crack propagation, has a high level of cleanliness and excellent polishability and remains readily weldable.

Property	Value
Tensile Strenght (MPa)	2035
Yield Strenght at 0.2% Offset (MPa)	2000
Elongation in 4D (%)	12
Charpy notch impact (J)	17

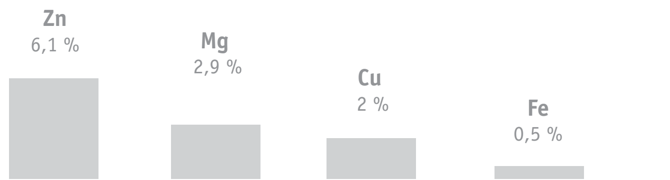


AL7075 T6/T651

Alloy 7075 has been the standard workhorse 7XXX series alloy within the aerospace industry ever since. It was the first successful Al-Zn-Mg-Cu high strength alloy using the beneficial effects of the alloying addition of chromium to develop good stress-corrosion cracking resistance in sheet products. Although other 7XXX alloys have since been developed with improved specific properties, alloy 7075 remains the baseline with a good balance of properties required for aerospace applications.

Alloy 7075 has been thoroughly evaluated for corrosion resistance of atmospheric weathering, stress-corrosion cracking and exfoliation in all currently available tempers. These values have been used as a standard for comparison in the development of more recent high strength aerospace alloys.

Property	Value
Hardness (HB)	150
Hardness (HRC A)	53,5
Hardness (HRC B)	87
Hardness (HV)	175
Tensile Strenght (MPa)	572
Yield Strenght 0.2% Offset (MPa)	503
Elongation (%)	11



AL7068 T6511

7068 alloy provides the highest mechanical strength of all aluminium alloys and matching that of certain steels. This outstanding alloy combines a yield strength of up to 700 MPa (up to over 30% greater than that of 7075 alloy) and good ductility with corrosion resistance similar to 7075 and other features beneficial to high performance component/equipment designers.

The highly attractive overall combination of mechanical properties (retained at elevated temperatures better than 7075) and other important characteristics of 7068 have resulted in the widespread specification of the alloy to markedly reduce the weight/cross section or significantly increase the strength of critical components in diverse market sectors.

Nominal Ø or Least Thickness or Nominal Wall Thickness (mm)	Tensile Strenght (MPa)	Yield Strenght at 0.2% Offset (MPa)	Elongation 4D%
6.35 to 76.20	683	655	5

MATERIAL R&D

Poggipolini works side by side with the most important materials manufacturers with the aim of developing new materials and to find from these new materials the best solutions and applications for its customers.

5.0 MANUFACTURING

Poggipolini controls in house the entire manufacturing process, from Designing to the final NDT special processes.
In the following pages we present in detail each process.

PROCESSES

HOT HEAD FORGING

Poggipolini is expert and specialist on hot head forging. Forging is a metal forming process that involves applying compressive forces to a work piece to deform it, and create a desired geometric change to the material. The forging process is very important in industrial metal manufacture, particularly in the extensive iron and steel manufacturing industry. A steel forge is often a source of great output and productivity.

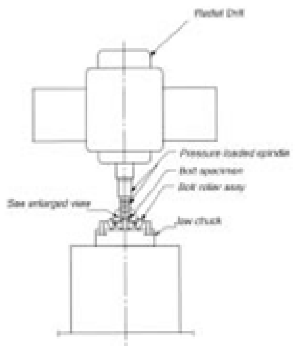
Work stock is put in to the forge. It may be rolled, it may also come directly from cast ingots or continuous castings. The forge will then manufacture steel forgings of desired geometry and specific material properties. These material properties are often greatly improved.

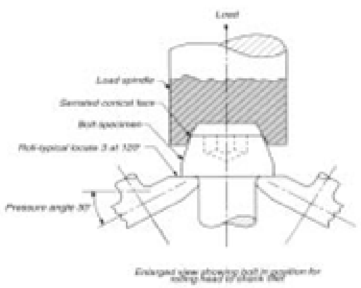
Metal forging is known to produce some of the strongest manufactured parts compared to other metal manufacturing processes and obviously, is not just limited to iron and steel forging, but to other metals as well. Different types of metals will have a different factors involved when forging them. Some will be easier to forge than others. Various tests are described later to determine forging process factors for different materials. Aluminum, magnesium, copper, titanium, and nickel alloys are also commonly forged metals.

Ordinarily, head parts are cold processed by using header or press, but in case of bad plastic processability, material such as Titanium-alloy and heat resisting steel head parts are processed by hot forging. In order to control part processing, fibre flow at head parts is checked usually.

HEAD TO SHANK FILLET

Almost all the bolts rolled after head treatment will break down at the head part due to tension or tension fatigue test. In order to make the strength of head parts and thread parts balance, the strength of head parts is increased. To realize above purpose, by cold processing under head fillet surface roughness is improved by vanishing effect. As a result of this processing residual compression stress is given and fatigue strength of the head part is increased.

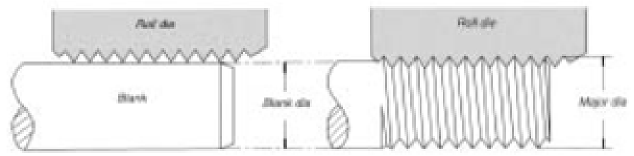




THREAD ROLLING

Thread rolling is a metal rolling process used extensively in manufacturing industry to produce screws, bolts and other fasteners. A common thread rolling process, used in industry to manufacture threaded parts, involves forming the threads into the metal of a blank by a pressing and rolling action between two die. The die surfaces hold the shape and the force of the action forms the threads into the material. A similar metal forming process has been developed for the production of gears.

Thread rolling, in modern manufacturing, has an extremely high productivity rate, significantly higher than producing threaded parts by machining. Machining is the alternative method to industrial manufacturing of threaded parts. Producing threads by this method has several other benefits over machining. Forming will harden the metal through cold working, does not waste material by cutting, and produces a favorable grain structure to strengthen the part with respect to its function.



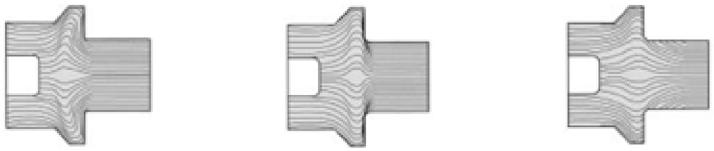
HEAT TREATING

Poggipolini can perform Vacuum Heat Treatment, that permit these different treatments:

- Annealing
- Stress Relieving
- Precipitation Hardening
- Subzero Treatment
- High Pressure Quenching

ANNEALING
Is a heat treatment wherein a material is altered, causing changes in its properties such as strength and hardness. It is a process that produces conditions by heating to above the re-crystallization temperature and maintaining a suitable temperature, and then cooling. Annealing is used to induce ductility, soften material, relieve internal stresses, refine the structure by making it homogeneous, and improve cold working properties.

STRESS RELIEVING
Machining induces stresses in parts. The bigger and more complex the part, the more the stresses. These stresses can cause distortions in the part over the long term. If the parts are clamped in service, then cracking could occur. Also hole locations can change causing them to go out of tolerance. For these reasons, stress relieving is often necessary.



PRECIPITATION HARDENING
Hardening is a process in which steel parts are heated(at a controlled rate) till the austenitic crystal phase is attained and is then quickly cooled(quenched) by introducing a suitable gas.

SUBZERO TREATMENT

Cryogenic hardening is a cryogenic treatment process where the material is cooled to approximately −185 °C (−301 °F), usually using liquid nitrogen. It can have a profound effect on the mechanical properties of certain steels, provided their composition and prior heat treatment are such that they retain some austenite at room temperature.

It is designed to increase the amount of martensite in the steel’s crystal structure, increasing its strength and hardness, sometimes at the cost of toughness.

HIGH PRESSURE QUENCHING

For many years now, gas quenching has been the preferred process in the heat treatment of high-speed steels and hot and cold working tool steels.

With the development of separate gas quenching chambers, it is often possible to replace oil quenching with high-pressure gas quenching using nitrogen or helium for heat treating case hardening steels or other low alloyed materials.

The success of this dry quenching technology is based on its environmental and commercial efficiency. Quenching gases such as nitrogen or helium are absolutely inert and without any ecological risk. They leave no residues on the workpieces or in the hardening furnaces. Therefore, investments in equipment such as washing machines or fire monitoring systems are redundant. This, in turn, reduces operating costs for hardening. When helium is used as a quenching gas, appropriate recycling systems for unlimited repeated use of the helium are available.

THE ADVANTAGES OF PROCESS ARE:

- Reduction of hardening distortion and/or variation of distortion
- Quenching intensity adjustable by control of gas pressure and gas velocity
- Process flexibility
- Clean, non-toxic working conditions
- Integration into manufacturing lines
- Reproducible quenching result
- Clean and dry parts, no washing
- Simple process control

5.1 COATINGS

PASSIVATION

The passivation process returns the stainless steel or other metals back to its original specifications by removing unwanted debris and oils from the surface and then submerging the part into a passivating bath. When a part is machined, various particles can permeate the surface of the base metal, weakening it's resistance to corrosion and making the part more susceptible to environmental factors. Debris, dirt and other particles and residue such as free iron, grease and machining oils all affect the strength of the natural surface and can become embedded in the surface during the machining process. These often go unseen to the human eye and are often the cause of the deterioration.

As stated above, "passive" is defined as being less affected by environmental factors. The process improves and purifies the surface of the part. The restored surface acts like a protective coating to environmental factors such as air, water and other extreme environments. It is important to note that passivation does not change the outward appearance of the base metal.

The passivation of stainless steel is a process performed to make a surface passive, i.e., a surface film is created that causes the surface to lose its chemical reactivity. Stainless steel is already known as being corrosion-resistant, however the passivation process further strengthens its' natural coating by improving the exterior surface of the overall part. Stainless steel passivation unipotentializes the stainless steel with the oxygen absorbed by the metal surface, creating a monomolecular oxide film. Passivation can result in the very much-desired low corrosion rate of the metal. Passivation is also accomplished by stainless steel electropolishing.

ADVANTAGES OF PASSIVATION ARE:

- Improved Corrosion Resistance
- Uniform, Smooth Appearance and Finish
- Deburring (Polished Surface)
- Cleanliness
- Improved and Extended Life of Product

ANODISING

Anodising is an electrochemical process that converts the metal surface into a decorative, durable, corrosion-resistant, anodic oxide finish. Aluminum is ideally suited to anodising, although other nonferrous metals, such as magnesium and titanium, also can be anodised.
The anodic oxide structure originates from the material substrate and is composed entirely of material oxide. This material oxide is not applied to the surface like paint or plating, but is fully integrated with the underlying material substrate, so it cannot chip or peel. It has a highly ordered, porous structure that allows for secondary processes such as coloring and sealing.

Anodising is accomplished by immersing the material into an acid electrolyte bath and passing an electric current through the medium. A cathode is mounted on the inside of the anodising tank; the material acts as an anode, so that oxygen ions are released from the electrolyte to combine with the material atoms at the surface of the part being anodised. Anodising is, therefore, a matter of highly controlled oxidation—the enhancement of a naturally occurring phenomenon. The unique anodized finish is the only one in the metals industry that satisfies each of the factors that must be considered when selecting a high performance material finish:

DURABILITY

Most anodized products have an extremely long life span and offer significant economic advantages through maintenance and operating savings. Anodizing is a reacted finish that is integrated with the underlying aluminum for total bonding and unmatched adhesion.

COLOR STABILITY

Exterior anodic coatings provide good stability to ultraviolet rays, do not chip or peel, and are easily repeatable.

EASE OF MAINTENANCE

Scars and wear from fabrication, handling, installation, frequent surface dirt cleaning and usage are virtually non-existent. Rinsing or mild soap and water cleaning will usually restore an anodised surface to its original appearance. Mild abrasive cleaners can be used for more difficult deposits.

AESTHETICS

Anodising offers a large and increasing number of gloss and color alternatives and minimizes or eliminates color variations. Unlike other finishes, anodising allows the material to maintain its metallic appearance.

COST
A lower initial finishing cost combines with lower maintenance costs for greater long-term value.

HEALTH AND SAFETY
Anodising is a safe process that is not harmful to human health. An anodised finish is chemically stable, will not decompose, is non-toxic, and is heat-resistant to the melting point of material.
Since the anodising process is a reinforcement of a naturally occurring oxide process, it is non-hazardous and produces no harmful or dangerous by-products.

DLC

DLC is an acronym for diamond-like carbon. DLC has some of the valuable properties of diamond, including: high hardness, low friction, resistance to wear, chemical inertness, biological compatability, electrical insulation, optical transparency, and smoothness. In common terms, DLC is harder than natural diamond and slicker than “Teflon.”

DLC coatings are used to impart some of the useful characteristics of diamonds onto other materials. DLC coatings can be deposited on nearly all metals, metal alloys, and also on nonmetals such as silicon, glass, ceramics, plastics, etc. DLC can be deposited at low (<200°C) substrate temperature.
DLC coating has many commercial applications, including machine tools, aerospace parts, engine parts, medical implants, and high-end watches. Depending on the application, different formulations of DLC coatings are used.
DLC coatings produce dramatic improvements in the performance and life of tools, components, and machines. The hardness of DLC coatings is the foundation of their benefits. DLC in all forms is extremely hard.
DLC’s hardness also makes it durable. DLC coatings protects moving parts from abrasion, maintaining smooth movement for much longer than uncoated parts. Engines with DLC coated parts create more horsepower and have longer lifetimes from mechanical parts that rotate, slide, and face other types of wear.

DLC coatings creater lower coefficients of friction. As friction is the enemy of almost all moving parts, lowering it creates nearly universal improvement, regardless of the industry. Thus, DLC is found in engines, tools, the machining of cast and wrought aluminum, plastic injection molds, pumps, machine parts, bearings, cams, and even razor blades. Reduced friction also reduces the need for lubrication, which improves efficiency within the supply chain from raw material through to the end user.

TIN

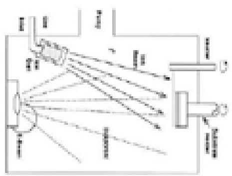
Titanium Nitride, TiN, is a binary compound of titanium and nitrogen. It is an extremely hard ceramic material, often used to coat titanium alloys, steel, carbide and aluminum components, to improve the surface properties of the object.

Applied in a thin layer, TiN is used to harden and protect cutting surfaces and sliding, for decorative purposes, and as a surface finish is non-toxic.
The TiN coatings have a color similar to gold. Depending on the substrate and the surface finish, the TiN has a coefficient of friction between 0.4 and 0.6 with respect to itself (without lubricants). The hardness of the coatings of TiN is difficult to measure, given that the coatings are very hard and when they are very thin the hardness test ultimately penetrate the substrate. It is estimated that the hardness of TiN is ~85 in C scale Rockwell (~2500 in Vickers scale or 24.5 GPa). For such high values the scale of Rockwell is considered approximate.To measure the hardness of TiN particular techniques have been developed.

IVD

Ion Vapor Deposition (IVD) of aluminum is a vacuum plating process which deposits pure aluminum on nearly any metal. The important advantages of this coating over cadmium, are that it is non-toxic, non-hazardous and safe to apply. This assures that the user has an environmentally safe coating. There are as many reasons for using IVD aluminum as there are combinations of substrates and operating environments. The following are the most common:

IVD ALUMINUM ON STEEl
This process provides excellent “sacrificial” corrosion resistance with no hydrogen embrittlement. A .001-.002-inch coating averages 7500 hours in 5% neutral salt. Other benefits include a useful operating temperature up to 925 F and galvanic compatibility with aluminum structures.



IVD ALUMINUM ON HEAT AND CORROSION RESISTANT ALLOYS
Provides the same benefits as with steel, plus oxidation resistance at high temperature-925 F, as deposited and significantly higher after high-temperature diffusion. The coating may be deposited directly on the substrate without special preparation such as nickel strike.

IVD ALUMINUM ON TITANIUM
Provides the same benefits as with steel, plus the coating can be anodised or hard anodised to improve the wear-resistance, low absorptance-high emissivity, dielectric, color and all other properties of anodic coatings on aluminum. The coating retards titanium combustion. And it permits painting and adhesive bonding using the same techniques as with aluminum.

IVD ALUMINUM ON ALUMINUM
Adds corrosion resistance to high strength aluminum alloys without sacrificing fatigue resistance, as will occur with anodising. Allows use of casting (A-380, etc.) and microcrystalline alloys in applications normally restricted to wrought materials. Also provides corrosion resistance in applications where electrical continuity or bond is required. This eliminates “jumper” connections.

TOP COAT\DRY LUBRIFICANT

Dry lubricants or solid lubricants are materials which despite being in the solid phase, are able to reduce friction between two surfaces sliding against each other without the need for a liquid oil medium.

The two main dry lubricants are graphite and molybdenum disulfide. They offer lubrication at temperatures higher than liquid and oil-based lubricants operate. Dry lubricants are often used in applications such as locks or dry lubricated bearings. Such materials can operate up to 350 °C (662 °F) in oxidizing environments and even higher in reducing/non-oxidizing environments (molybdenum disulfide up to 1100 °C, 2012 °F).
The low-friction characteristics of most dry lubricants are attributed to a layered structure at the molecular level, with weak bonding between layers.
Such layers are able to slide relative to each other with minimal applied force, thus giving them their low friction properties.

However, a layered crystal structure alone is not necessarily sufficient for lubrication. In fact, there are also some solids with non-lamellar structures that function well as dry lubricants in some applications. These include certain soft metals (indium, lead, silver, tin),polytetrafluroethylene, some solid oxides, rare-earth fluorides, and even diamond.

Limited interest has been shown in low friction properties of compacted oxide glaze layers formed at several hundred degrees Celsius in metallic sliding systems. However, practical use is still many years away due to their physically unstable nature.

THE FOUR MOST COMMONLY USED SOLID LUBRICANTS ARE:

GRAPHITE: used in air compressors, food industry, railway track joints, open gear, ball bearings, machine-shop works, etc. It is also very common for lubricating locks, since a liquid lubricant allows particles to get stuck in the lock, worsening the problem.

MOLYBDENUM DISULFIDE (MOS2): used in CV joints and space vehicles. Will lubricate in a vacuum.

HEXAGONAL BORON NITRIDE: used in space vehicles. Also called "white graphite."

TUNGSTEN DISULFIDE: similar usage as molybdenum disulfide, but due to the high cost, only found in some dry lubricated bearings.

Graphite and molybdenum disulfide are the predominant materials used as dry lubricants.

ZINC ALUMINIUM FLAKES COATINGS

Zinc Aluminium flakes coatings are non-electrolytically applied coatings, which provide good protection against corrosion. These coatings consist of a mixture of zinc and aluminium flakes, which are bonded together by an inorganic matrix.

THERE ARE THREE GROUPS OF ZINC FLAKE COATINGS:

1. Zinc flake coatings containing Cr(VI) (hexavalent chromium): surfaces containing Cr(VI) provide greater anti-corrosion protection with a thinner coating, but Cr(VI) is carcinogenic and poses a potential risk to the environment. New European decrees prohibit the use of surfaces containing Cr(VI).

2. Solvent based Cr(VI)-free zinc flake coatings.

3. Water based Cr(VI)-free zinc flake coatings. Cr(VI)-free coatings are more environmentally friendly than surfaces with a Cr(VI) content. No zinc flake coatings used in the automotive industry nowadays contain this substance. Various manufactures, such as car companies and their suppliers, have produced their own specifications and supply rules in order to define the requirements for these coating systems.

VISION

OUR VISION IS TO BECOME YOUR ADDED VALUE, YOUR SOLUTIONS PROVIDER.

We are driven by a continuous pursuit of excellence on every single aspect from innovative manufacturing systems to the latest materials, coatings and treatments.

Our certifications shows our level of competence and quality.

Our passion shows our commitment to the best and beyond.

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