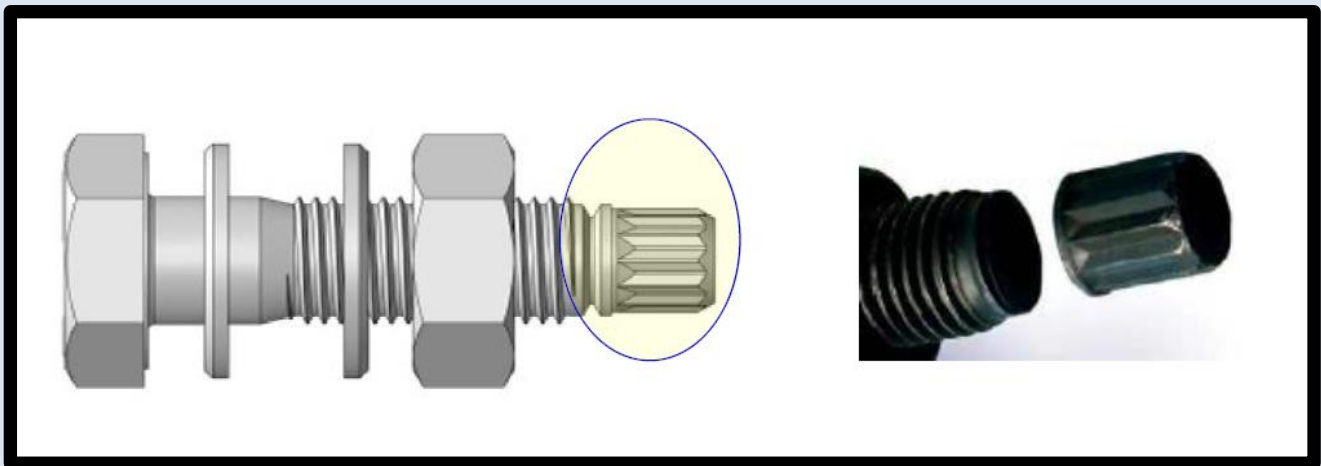


STRUCTURAL BOLTS FOR METAL CONSTRUCTIONS

TC BOLTS

EN14399-10 HRC – CUP HEAD / HEXAGON HEAD



The most effective product for any situation

- Used for cutting and tightening joints
- Higher speed of assembly, tightening procedure reduced by half
- Instant tightening torque checking
- Immediate visual inspection
- Installation performed by non- specialized personnel and reduced menwork
- Cost reduction at the construction site

Savings up to 30%

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PRODUCTION RANGE:

- From M12 to M36 K2 system
- Cup or hexagon head EN 14399-10, class 10.9 with long partial-thread
- EN14399-3 nuts HR 0,9 (d) class 10
HRD 1 (d) class 10
- EN14399-6 300 HV washers



SURFACE TREATMENTS :



- Black oxide (plain)
- Zink flakes EN ISO 10683 according to customers' request (salt spray fog test ISO 9227 600-1000 hours depending on the surface)
- Na-norust (patented by SBE-VARVIT to withstand extreme weather conditions ; C5 class from 1000 to 3000 hours depending on the surface treatment)

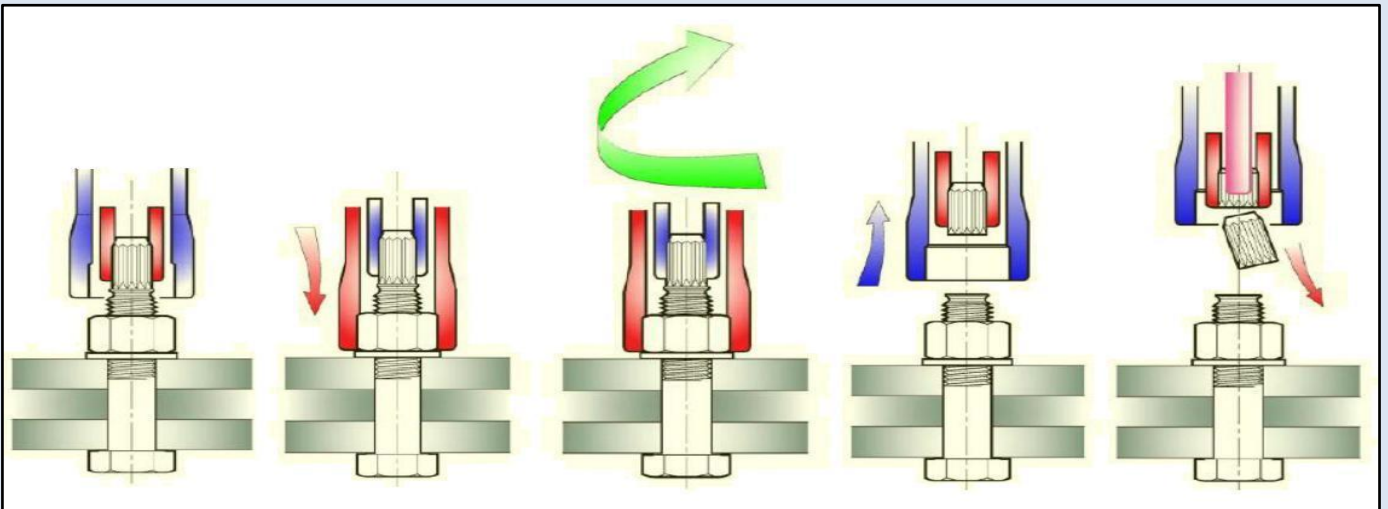
TECHNICAL-SALES SUPPORT

- After sales service
- Fully equipped labs to perform specific tests
- Standard and customized certificates
- Product traceability and CE marking



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TIGHTENING TORQUE METHODS



TOOLS AND EQUIPMENTS

- Electric shear wrench used for approaching
- Electric shear wrench used to tighten when the spline end shears off
- Angulars to tighten in critical positions

TECHNICAL DATA SHEET

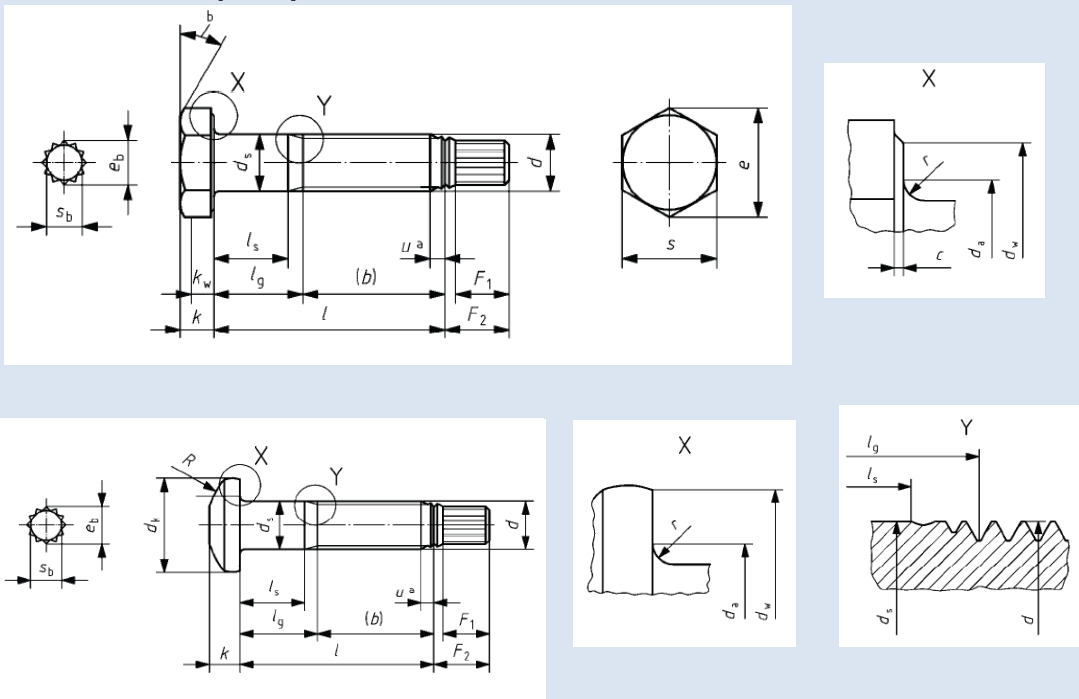
1. Scope and field of application

This Technical Data Sheet defines the requirements of high-strength bolt and nut assemblies with calibrated preload, HRC System, hexagon and cup head bolts, thread dimensions from M12 to M30 and property classes 10.9/10.

2. Standard references

- EN 14399-1 High-strength structural bolting assemblies for preloading.
Part 1: General requirements
- EN 14399-2 High-strength structural bolting assemblies for preloading.
Part 2: Suitability test for preloading
- EN 14399-6 High-strength structural bolting assemblies for preloading.
Part 6: Plain chamfered washers
- EN 14399-10 High-strength structural bolting assemblies for preloading.
Part 10: System HRC – Bolt and nut assemblies with calibrated preload

3. Dimensions (mm)



Key

- a Incomplete thread $u \leq 2P$
- b 15° to 30°

NOTE The difference between l_g and l_s should not be less than $1,5P$.

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Dimension of the bolt with hexagon head

Thread d	M12	M16	M20	M22	M24	M27	M30									
P ⁽¹⁾	1,75	2	2,5	2,5	3	3	3,5									
b (ref)	l ≤ 125 ⁽²⁾	30	38	46	50	54	60									
	125 < l ≤ 200	-	44	52	56	60	66									
	l > 200	-	-	65	69	73	79									
c	max	0,8	0,8	0,8	0,8	0,8	0,8									
	min	0,4	0,4	0,4	0,4	0,4	0,4									
d _a	max	15,2	19,2	24,4	26,4	28,4	32,4									
d _s	max	12,70	16,70	20,84	22,84	24,84	27,84									
	min	11,30	15,30	19,16	21,16	23,16	26,16									
d _w	max	d _{w max} = s _{actual}														
	min	20,1	24,9	29,5	33,3	38,0	42,8									
e	min	23,91	29,56	35,03	39,55	45,20	50,85									
k	max	7,95	10,75	13,40	14,90	15,90	17,90									
	min	7,05	9,25	11,60	13,10	14,10	16,10									
k _w	min	4,9	6,5	8,1	9,2	9,9	11,3									
r	min	1,2	1,2	1,5	1,5	1,5	2,0									
s	max	22	27	32	36	41	46									
	min	21,16	26,16	31	35	40	45									
s _b	max	8,0	11,6	14,4	15,7	17,1	19,3									
	min	7,4	11,0	13,8	15,1	16,5	18,7									
e _b	min	8,36	12,43	15,60	17,06	18,65	21,13									
F ₁	min	11,0	13,0	15,0	15,5	16,0	19,0									
F ₂	max	16,0	18,0	20,0	21,0	21,5	24,0									
Length l			Shank lengths l _s ^(*) and l _g ^(**)													
nom	max	min	l _s min	l _g max	l _s min	l _g max	l _s min	l _g max	l _s min	l _g max	l _s min	l _g max	l _s min	l _g max	l _s min	l _g max
40	41,25	38,75	6	11,25	8	14										
50	51,25	48,75	11,25	20	8	14	10	17,5	11	18,5						
60	61,5	58,5	21,25	30	12	22	10	17,5	11	18,5	12	21	13,5	22,5		
70	71,5	68,5	31,25	40	22	32	11,5	24	11	18,5	12	21	13,5	22,5	15	25,5
80	81,5	78,5	41,25	50	32	42	21,5	34	17,5	30	12	21	13,5	22,5	15	25,5
90	91,75	88,25	51,25	60	42	52	31,5	44	27,5	40	21	36	15	30	15	25,5
100	101,75	98,25	61,25	70	52	62	41,5	54	37,5	50	31	46	25	40	16,5	34
110	108,25	111,75			62	72	51,5	64	47,5	60	41	56	35	50	26,5	44
120	118,25	121,75			72	82	61,5	74	57,5	70	51	66	45	60	36,5	54
130	132	128			76	86	65,5	78	61,5	74	55	70	49	64	40,5	58
140	142	138			86	96	75,5	88	71,5	84	65	80	59	74	50,5	68
150	152	148			96	106	85,5	98	81,5	94	75	90	69	84	60,5	78
160	164	156									85	100	79	94	70,5	88
170	174	166									95	110	89	104	80,5	98
180	184	176									105	120	99	114	90,5	108
190	194	186									115	130	109	124	100,5	118
200	204	196									125	140	119	134	110,5	128

1) P = pitch of thread (coarse thread).

2) b (ref) do not applies for nominal lengths above the stepped line

*) l_s min. = l_g max. - 5 P (l_g max - 3 P above stepped line)

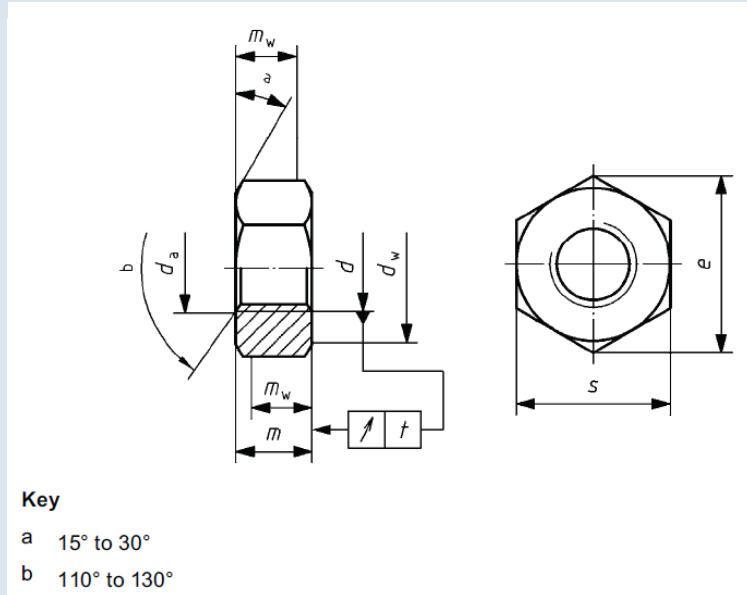
***) l_g max. = l nominal size - b

Dimension of the bolt with cup head

Thread d		M12	M16	M20	M22	M24	M27	M30								
P ⁽¹⁾		1,75	2	2,5	2,5	3	3	3,5								
b (ref)	l ≤ 125 ⁽²⁾	30	38	46	50	54	60	66								
	125 < l ≤ 200	-	44	52	56	60	66	72								
	l > 200	-	-	65	69	73	79	85								
d _a	max	15,2	19,2	24,4	26,4	28,4	32,4	35,4								
d _s	max	12,00	16,00	20,00	22,00	24,00	27,00	30,00								
	min	11,30	15,30	19,16	21,16	23,16	26,16	29,16								
d _k	min	21	27	34	38,5	43	48	52								
d _w	min	20	26	33	37	41	46	50								
k	max	8,8	10,8	13,9	14,9	15,9	17,9	20,0								
	min	7,2	9,2	12,1	13,1	14,1	16,1	18,0								
r	min	1,2	1,2	1,5	1,5	1,5	2,0	2,0								
R	nom	18	20	22	23	25	27	30								
s _b	max	8,0	11,6	14,4	15,7	17,1	19,3	21,4								
	min	7,4	11,0	13,8	15,1	16,5	18,7	20,8								
e _b	min	8,36	12,43	15,60	17,06	18,65	21,13	23,50								
F ₁	min	11,0	13,0	15,0	15,5	16,0	19,0	21,0								
F ₂	max	16,0	18,0	20,0	21,0	21,5	24,0	26,0								
Length l			Shank lengths l _s ^(*) and l _g ^(**)													
nom	max	min	l _s min	l _g max	l _s min	l _g max	l _s min	l _g max	l _s min	l _g max	l _s min	l _g max	l _s min	l _g max	l _s min	l _g max
40	41,25	38,75	6	11,25	8	14										
50	51,25	48,75	11,25	20	8	14	10	17,5	11	18,5						
60	61,5	58,5	21,25	30	12	22	10	17,5	11	18,5	12	21	13,5	22,5		
70	71,5	68,5	31,25	40	22	32	11,5	24	11	18,5	12	21	13,5	22,5	15	25,5
80	81,5	78,5	41,25	50	32	42	21,5	34	17,5	30	12	21	13,5	22,5	15	25,5
90	91,75	88,25	51,25	60	42	52	31,5	44	27,5	40	21	36	15	30	15	25,5
100	101,75	98,25	61,25	70	52	62	41,5	54	37,5	50	31	46	25	40	16,5	34
110	108,25	111,75			62	72	51,5	64	47,5	60	41	56	35	50	26,5	44
120	118,25	121,75			72	82	61,5	74	57,5	70	51	66	45	60	36,5	54
130	132	128			76	86	65,5	78	61,5	74	55	70	49	64	40,5	58
140	142	138			86	96	75,5	88	71,5	84	65	80	59	74	50,5	68
150	152	148			96	106	85,5	98	81,5	94	75	90	69	84	60,5	78
160	164	156									85	100	79	94	70,5	88
170	174	166									95	110	89	104	80,5	98
180	184	176									105	120	99	114	90,5	108
190	194	186									115	130	109	124	100,5	118
200	204	196									125	140	119	134	110,5	128

1) P = pitch of thread (coarse thread).
2) b (ref) do not applies for nominal lengths above the stepped line
*) l_s min. = l_g max. - 5 P (l_g max - 3 P above stepped line)
**) l_g max. = l nominal size - b

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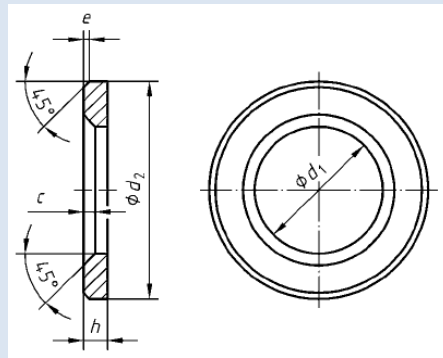


Dimension of the nut

Thread d		M12	M16	M20	M22	M24	M27	M30
P		1,75	2	2,5	2,5	3	3	3,5
d _a	max	13	17,3	21,6	23,7	25,9	29,1	32,4
	min	12	16	20	22	24	27	30
d _w ⁽¹⁾	min	20,1	24,9	29,5	33,3	38,0	42,8	46,6
e	min	23,91	29,56	35,03	39,55	45,20	50,85	55,37
	max	10,8	14,8	18	19,4	21,5	23,8	25,6
m	min	10,37	14,1	16,9	18,1	20,2	22,5	24,3
	max	8,3	11,3	13,5	14,5	16,2	18,1	19,5
s	max	22	27	32	36	41	46	50
	min	21,16	26,16	31	35	40	45	49
t		0,38	0,47	0,58	0,63	0,72	0,80	0,87

⁽¹⁾ The maximum value of d_w shall not exceed the actual width across flats

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Dimension of the washer

Nominal size d		12	16	20	22	24	27	30
d ₁	max	13,27	17,27	21,33	23,33	25,33	28,52	31,62
	min	13	17	21	23	25	28	31
d ₂	max	24	30	37	39	44	50	56
	min	23,48	29,48	36,38	38,38	43,38	49	54,80
h	max	3,3	4,3	4,3	4,3	4,3	5,6	5,6
	min	2,7	3,7	3,7	3,7	3,7	4,4	4,4
e	max	1,0	1,50	1,50	1,50	1,50	2	2
	min	0,5	0,75	0,75	0,75	0,75	1	1
c	max	1,9	1,9	2,5	2,5	2,5	3,0	3,0
	min	1,6	1,6	2,0	2,0	2,0	2,5	2,5

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4. Technical specification

		Bolts	Nuts	Washers
Mechanical properties	Material	Carbon steel with additives or alloyed steel		Steel
	Property class	10.9	10	300-370 HV
	As specified in	ISO 898-1	ISO 898-2	EN 14399-6
Impact strength	Value	$K_{V, \min} = 27 \text{ J}$ at -20°C	n.a.	
	Test piece	ISO 148-1	n.a.	
	Test	EN10045-1	n.a.	
General requirements		EN 14399-1		
Thread	Tolerance	6g	6H or 6AZ	n.a.
	International standard	ISO 261 ISO 965-2 ISO 965-4	ISO 261 ISO 965-2 ISO 965-5	
Tolerance	Product grade	C except r lengths ≥ 150 mm: $\pm 4,0$ mm	B except m	A
	As specified in	ISO 4759-1		ISO 4759-3
Surface finish	Plain	As processed		
	Hot-dip galvanized ¹⁾	ISO 10684		
	Others	To be agreed		
Surface discontinuities		ISO 6157-1	ISO 6157-2	Parts shall be uniform and free from irregularities or detrimental defects. No protruding burrs shall appear on the washer
1) All dimensions and tolerances apply before hot dip galvanizing				

5. Marking

In addition to the binding marking requirement according ISO 898-1, ISO 898-2 and EN 14399-10, bolts and nuts are marked with an identification code that ensure the traceability to the production process records.

Washers are marked according to EN 14399-6.

6. Testing of the assembly

Functional characteristics of the assembly is determined according to EN 14399-10 and EN 14399-2. Suitability test for preloading and additional suitability test for calibrated preload is carried out.

Limiting values of bolt force at the fracture of the spline-end

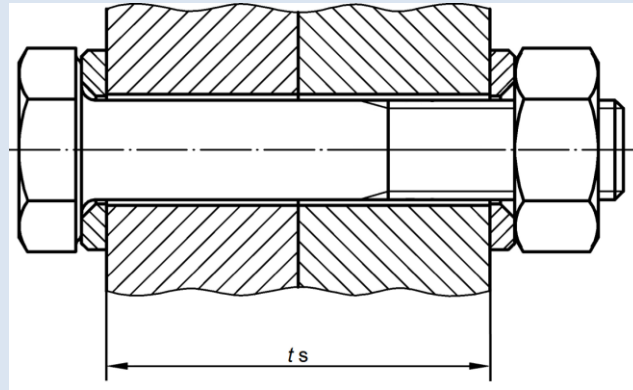
Thread <i>d</i>	Nominal stress area of standard test mandrel <i>A_s</i> mm ²	$F_{r \text{ min}}$ $0,7 \times f_{ub} \times A_s^a$ N	$F_{r \text{ mean min}}$ $0,77 \times f_{ub} \times A_s^a$ N
M12	84,3	59 010	64 911
M16	157	109 900	120 890
M20	245	171 500	188 650
M22	303	212 100	233 310
M24	353	247 100	271 810
M27	459	321 300	353 430
M30	561	392 700	431 970

^a f_{ub} is the nominal tensile strength of the bolt ($R_{m, \text{nom}}$).

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Annex A

Grip length t_s (informative only)



Bolt length	M12		M16		M20		M22		M24		M27		M30	
	ts min	ts max	ts min	ts max	ts min	ts max	ts min	ts max	ts min	ts max	ts min	ts max	ts min	ts max
40	13	20												
45	17	25												
50	22	30	15	23										
55	27	34	18	28										
60	32	39	23	33	20	29	21	28						
65	37	44	28	38	27	34	21	33						
70	42	49	33	43	27	39	21	38	26	35	26	31	31	28
75	47	54	38	48	32	44	28	43	26	40	26	36	31	33
80	52	59	43	53	37	49	33	48	26	45	26	41	31	38
85	57	64	48	58	42	54	38	53	36	50	28	45	31	43
90	62	69	53	63	47	59	43	58	41	55	33	51	31	48
95	67	74	58	68	52	64	48	63	46	60	38	55	34	53
100	72	79	63	73	57	69	53	68	51	65	43	60	39	58
105			68	78	62	74	58	73	56	70	48	65	44	63
110			73	83	67	79	63	78	61	75	53	70	49	68
115			78	88	72	84	68	83	66	80	58	75	54	73
120			83	93	77	89	73	88	71	85	63	80	59	78
125			87	98	81	94	77	93	75	90	68	85	63	83
130			87	103	81	99	77	98	75	95	67	90	63	88
135			92	108	86	104	82	103	80	100	72	95	68	93
140			97	113	91	109	87	108	85	105	77	100	73	98
145			102	118	96	114	92	113	90	110	82	105	78	103
150			107	123	101	119	97	118	95	115	87	110	83	108
155									100	118	92	113	88	111
160									105	123	97	118	93	116
165									110	128	102	123	98	121
170									115	133	107	128	103	126
175									120	138	117	133	108	131
180									125	143	117	138	113	136
185									130	148	128	143	118	141
190									135	153	127	148	123	146
195									140	158	138	153	128	151
200									145	163	137	158	133	156