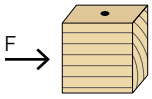
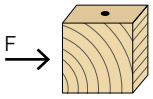
MINIMUM DISTANCES FOR SHEAR LOADS | TIMBER

screws inserted **WITHOUT pre-drilled hole** — **G ≤ 0.48**

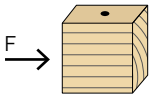


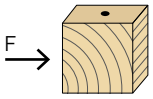


d_1	[in]		0.16	0.18	0.20	0.24
	[mm]		4	4,5	5	6
a_1	[in]	**15·d**	2 3/8	2 11/16	2 15/16	3 1/2
a_2	[in]	**5·d**	13/16	7/8	1	1 3/16
$a_{3,t}$	[in]	**15·d**	2 3/8	2 11/16	2 15/16	3 1/2
$a_{3,c}$	[in]	**10·d**	1 9/16	1 3/4	1 15/16	2 3/8
$a_{4,t}$	[in]	**10·d**	1 9/16	1 3/4	1 15/16	2 3/8
$a_{4,c}$	[in]	**5·d**	13/16	7/8	1	1 3/16

	0.16	0.18	0.20	0.24
	4	4,5	5	6
10·d	1 9/16	1 3/4	1 15/16	2 3/8
5·d	13/16	7/8	1	1 3/16
15·d	2 3/8	2 11/16	2 15/16	3 1/2
10·d	1 9/16	1 3/4	1 15/16	2 3/8
10·d	1 9/16	1 3/4	1 15/16	2 3/8
5·d	13/16	7/8	1	1 3/16

screws inserted **WITHOUT pre-drilled hole** — **0.48 < G ≤ 0.50**

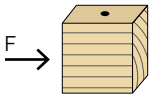


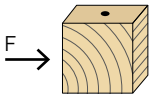


d_1	[in]		0.16	0.18	0.20	0.24
	[mm]		4	4,5	5	6
a_1	[in]	**15·d**	2 3/8	2 11/16	2 15/16	3 1/2
a_2	[in]	**5·d**	13/16	7/8	1	1 3/16
$a_{3,t}$	[in]	**15·d**	2 3/8	2 11/16	2 15/16	3 1/2
$a_{3,c}$	[in]	**10·d**	1 9/16	1 3/4	1 15/16	2 3/8
$a_{4,t}$	[in]	**10·d**	1 9/16	1 3/4	1 15/16	2 3/8
$a_{4,c}$	[in]	**5·d**	13/16	7/8	1	1 3/16

	0.16	0.18	0.20	0.24
	4	4,5	5	6
10·d	1 9/16	1 3/4	1 15/16	2 3/8
5·d	13/16	7/8	1	1 3/16
15·d	2 3/8	2 11/16	2 15/16	3 1/2
10·d	1 9/16	1 3/4	1 15/16	2 3/8
10·d	1 9/16	1 3/4	1 15/16	2 3/8
5·d	13/16	7/8	1	1 3/16

screws inserted **WITHOUT pre-drilled hole** — **G > 0.50**

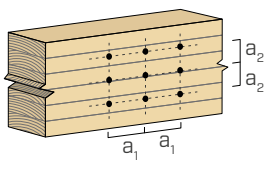




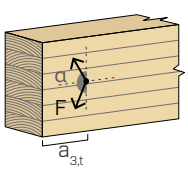
d_1	[in]		0.16	0.18	0.20	0.24
	[mm]		4	4,5	5	6
a_1	[in]	**15·d**	2 3/8	2 11/16	2 15/16	3 1/2
a_2	[in]	**7·d**	1 1/8	1 1/4	1 3/8	1 5/8
$a_{3,t}$	[in]	**20·d**	3 1/8	3 1/2	4	4 3/4
$a_{3,c}$	[in]	**15·d**	2 3/8	2 11/16	2 15/16	3 1/2
$a_{4,t}$	[in]	**12·d**	1 7/8	2 1/8	2 3/8	2 13/16
$a_{4,c}$	[in]	**7·d**	1 1/8	1 1/4	1 3/8	1 5/8

	0.16	0.18	0.20	0.24
	4	4,5	5	6
10·d	1 9/16	1 3/4	1 15/16	2 3/8
7·d	1 1/8	1 1/4	1 3/8	1 5/8
20·d	3 1/8	3 1/2	4	4 3/4
15·d	2 3/8	2 11/16	2 15/16	3 1/2
12·d	1 7/8	2 1/8	2 3/8	2 13/16
7·d	1 1/8	1 1/4	1 3/8	1 5/8

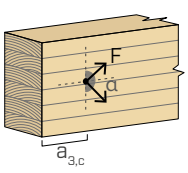
α = load-to-grain angle
d = d_1 = nominal diameter of the screw



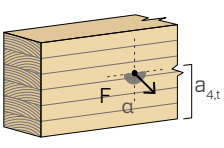
stressed end
-90° < α < 90°



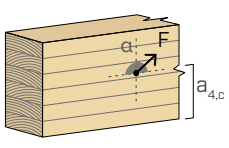
unloaded end
90° < α < 270°



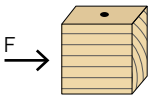
stressed edge
0° < α < 180°

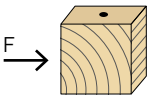


unload edge
180° < α < 360°



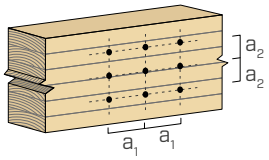
screws inserted **WITH pre-drilled hole**



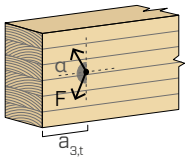


d_1	[in]		0.16	0.18	0.20	0.24		0.16	0.18	0.20	0.24
	[mm]		4	4,5	5	6		4	4,5	5	6
a_1	[in]	**10·d**	1 9/16	1 3/4	1 15/16	2 3/8	**5·d**	13/16	7/8	1	1 3/16
a_2	[in]	**4·d**	5/8	11/16	13/16	15/16	**4·d**	5/8	11/16	13/16	15/16
$a_{3,t}$	[in]	**12·d**	1 7/8	2 1/8	2 3/8	2 13/16	**12·d**	1 7/8	2 1/8	2 3/8	2 13/16
$a_{3,c}$	[in]	**7·d**	1 1/8	1 1/4	1 3/8	1 5/8	**7·d**	1 1/8	1 1/4	1 3/8	1 5/8
$a_{4,t}$	[in]	**7·d**	1 1/8	1 1/4	1 3/8	1 5/8	**7·d**	1 1/8	1 1/4	1 3/8	1 5/8
$a_{4,c}$	[in]	**3·d**	1/2	9/16	9/16	11/16	**3·d**	1/2	9/16	9/16	11/16

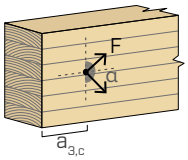
α = load-to-grain angle
d = d_1 = nominal diameter of the screw



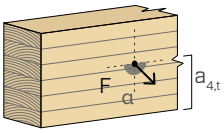
stressed end
-90° < α < 90°



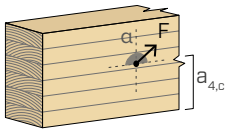
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



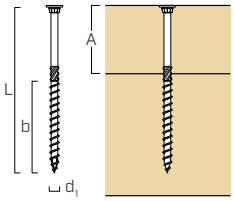
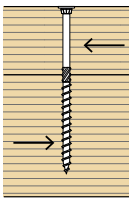
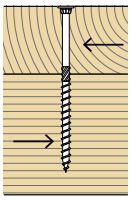
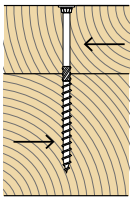
unload edge
180° < α < 360°



NOTES

- Values in blue are from Table 10 of ESR-4645 (REDUCED CONNECTION GEOMETRY REQUIREMENTS BASED ON TESTING);
- The minimum spacing and distances comply with ESR-4645, where d refers to the nominal diameter of the screw, and are valid for screw installed into sawn lumber, structural glued laminated timber and cross laminated timber;
- Wood member stresses must be checked in accordance with the corresponding Sections of the NDS; end distances, edge distances and fastener spacing may need to be increased accordingly.

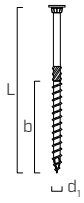
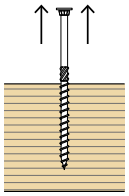
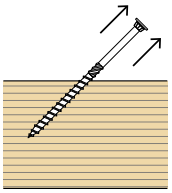
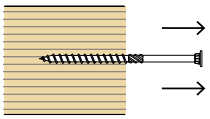
REFERENCE LATERAL DESIGN VALUES (Z) | WOOD-TO-WOOD

geometry				$Z_{\parallel}$				$Z_{\perp/\parallel}$				$Z_{\perp}$			
															
d_1	L		b	G				G				G			
				0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] [in]	[mm]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
4 **0.16**	30	1 3/16(1)	11/16	47	55	61	67	43	50	56	61	14	16	18	20
	35	1 3/8(1)	13/16	54	62	70	76	49	57	64	69	16	19	21	23
	40	1 9/16(1)	15/16	68	78	87	95	62	71	80	87	20	23	26	29
	45	1 3/4(2)	1 3/16	88	101	114	124	80	92	103	113	26	30	34	37
	50	1 15/16(2)	1 3/16	88	101	114	124	80	92	103	113	26	30	34	37
4,5 **0.18**	20	13/16(1)	9/16	36	41	46	50	32	37	42	46	11	12	14	15
	40	1 9/16(1)	15/16	66	76	85	93	60	69	78	85	20	23	26	28
	45	1 3/4(1)	1 3/16	86	99	111	121	79	90	101	111	26	30	33	36
	50	1 15/16(1)	1 3/16	86	99	111	121	79	90	101	111	26	30	33	36
	60	2 3/8(2)	1 3/8	103	119	133	145	94	108	121	132	31	36	40	44
	70	2 3/4(2)	1 9/16	120	138	155	169	109	126	141	154	36	42	47	51
5 **0.20**	40	1 9/16(1)	15/16	77	89	99	109	70	81	91	99	23	27	30	33
	50	1 15/16(1)	1 3/16	101	117	131	144	92	107	119	131	30	35	39	43
	60	2 3/8(1)	1 3/8	122	141	157	172	111	128	143	157	36	42	47	52
	70	2 3/4(2)	1 9/16	142	164	183	201	129	149	167	183	43	49	55	60
	80	3 1/8	1 15/16	182	211	236	259	166	192	214	235	55	63	71	78
	90	3 1/2	2 3/16	203	234	262	287	185	213	238	262	61	70	79	86
	100	4	2 3/8	223	258	288	316	203	234	262	288	67	77	86	95
6 **0.24**	80	3 1/8(1)	1 9/16	175	202	229	252	160	184	208	229	53	61	69	75
	100	4(2)	1 15/16	227	262	296	326	207	238	270	296	68	78	89	98
	120	4 3/4	2 3/8	279	321	364	400	253	292	331	364	84	96	109	120

(1) The embedded thread length does not comply with the minimum requirement of ESR-4645 (6 times the outer thread diameter for screws installed at 90° to the grain and 8 times the outer thread diameter for screws installed at an angle $0° \leq \alpha < 90°$ to the grain).

(2) The embedded thread length does not comply with the minimum requirement of ESR-4645 (8 times the outer thread diameter for screws installed at an angle $0° \leq \alpha < 90°$ to the grain).

THREAD WITHDRAWAL (W) | WOOD

geometry				thread withdrawal α = 90°				thread withdrawal α = 45°				thread withdrawal α = 0°			
															
d_1	L		b	G				G				G			
				0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55	0.35	0.42	0.49	0.55
[mm] [in]	[mm]	[in]	[in]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]	[lbf]
4 **0.16**	30	1 3/16(1)	11/16	47	55	61	67	43	50	56	61	14	16	18	20
	35	1 3/8(1)	13/16	54	62	70	76	49	57	64	69	16	19	21	23
	40	1 9/16(1)	15/16	68	78	87	95	62	71	80	87	20	23	26	29
	45	1 3/4(2)	1 3/16	88	101	114	124	80	92	103	113	26	30	34	37
	50	1 15/16(2)	1 3/16	88	101	114	124	80	92	103	113	26	30	34	37
4,5 **0.18**	20	13/16(1)	9/16	36	41	46	50	32	37	42	46	11	12	14	15
	40	1 9/16(1)	15/16	66	76	85	93	60	69	78	85	20	23	26	28
	45	1 3/4(1)	1 3/16	86	99	111	121	79	90	101	111	26	30	33	36
	50	1 15/16(1)	1 3/16	86	99	111	121	79	90	101	111	26	30	33	36
	60	2 3/8(2)	1 3/8	103	119	133	145	94	108	121	132	31	36	40	44
	70	2 3/4(2)	1 9/16	120	138	155	169	109	126	141	154	36	42	47	51
5 **0.20**	40	1 9/16(1)	15/16	77	89	99	109	70	81	91	99	23	27	30	33
	50	1 15/16(1)	1 3/16	101	117	131	144	92	107	119	131	30	35	39	43
	60	2 3/8(1)	1 3/8	122	141	157	172	111	128	143	157	36	42	47	52
	70	2 3/4(2)	1 9/16	142	164	183	201	129	149	167	183	43	49	55	60
	80	3 1/8	1 15/16	182	211	236	259	166	192	214	235	55	63	71	78
	90	3 1/2	2 3/16	203	234	262	287	185	213	238	262	61	70	79	86
	100	4	2 3/8	223	258	288	316	203	234	262	288	67	77	86	95
6 **0.24**	80	3 1/8(1)	1 9/16	175	202	229	252	160	184	208	229	53	61	69	75
	100	4(2)	1 15/16	227	262	296	326	207	238	270	296	68	78	89	98
	120	4 3/4	2 3/8	279	321	364	400	253	292	331	364	84	96	109	120

(1) The embedded thread length does not comply with the minimum requirement of ESR6) 4645- times the outer thread diameter for screws installed at °90 to the grain and 8 times the outer thread diameter for screws installed at an angle °0≤ α <°90 to the grain).

(2) The embedded thread length does not comply with the minimum requirement of ESR-4645 (8 times the outer thread diameter for screws installed at an angle 0°≤ α <90° to the grain).

GENERAL PRINCIPLES

- Tabulated values comply with NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION in accordance with ESR-4645.
- To determine allowable loads for use with ASD, design loads for use with LRFD or both, tabulated values must be multiplied by all adjustment factors included in the NDS for dowel-type fasteners. The design of connection with steel side plate must comply with Section 11.2.3 of the NDS.
- As part of the connection design, the structural wood members, the steel plates must be sized and verified in accordance with the corresponding Section of the NDS and must be done separately by the designer.
- Connections with multiple screws must be designed in accordance with the corresponding Sections of the NDS and ESR-4645.
- KKF AISI410 screws must be installed and used in dry in-service conditions in accordance with the NDS (wet service factor for connection CM is 1.0).
- KKF AISI410 screws must be positioned in accordance with the minimum distances.

REFERENCE LATERAL DESIGN VALUES

- Tabulated values are determined from the yield model equations in the corresponding Section of the NDS.
- Unless otherwise noted, the threaded part of the screw is fully inserted in the main member.
- The screw penetration into the main member is minimum 6 times the outer thread diameter unless otherwise noted.
- The reference lateral design values may be determined for other connection configurations in accordance with the corresponding Section of NDS and ESR-4645.
- The reference lateral design values are calculated for screws inserted without pre-drilling hole. In the case of screws inserted with pre-drilling hole, greater resistance values can be obtained.

WOOD-TO-WOOD

- The wood main member thickness must be greater than the screw length minus the thickness of the wood side member.
- The tabulated lateral design values are based on both wood members having the same specific gravity G.

STEEL-TO-WOOD

- The steel side member must have a minimum tensile strength equal to 58 ksi (400 MPa) and comply with the minimum requirements of ASTM A36.
- The wood main member thickness must be greater than the screw length minus the thickness of the steel side member.
- In case of steel-to-wood connection with a thick plate, it is necessary to assess the effects of wood deformations and install the connectors according to the assembly instructions.

REFERENCE WITHDRAWAL DESIGN VALUES

- The reference withdrawal design values (W_{ref}) expressed in pounds-force per inch of thread penetration into the main member for screws installed at an angle of 90° to the grain can be found in the ESR-4645.
- The values for screws installed at an angle α to the grain are determined by multiplying the reference withdrawal design values with the effective thread penetration L_{eff} of the screw in the wood member and with the factor k_α:

  $W_\alpha = W_{ref} \cdot k_\alpha \cdot L_{eff}$

  Where:

  - W_{ref} is the reference withdrawal design value for screws installed at an angle of 90° to the grain, as shown in the table on the left;
  - k_α factor is calculated as:

$$k_\alpha = \begin{cases} 35^\circ < \alpha \le 90^\circ & \dfrac{1}{1.2\cdot\cos^2(\alpha)+\sin^2(\alpha)} \\ 0^\circ \le \alpha \le 35^\circ & 0.3+0.7\cdot\dfrac{\alpha}{45} \end{cases}$$

  - α is the angle between the grain direction and screw axis.

  Tabulated values at page 381 are valid for L_{eff} equal to the screw thread length b minus the tip length L_t and k_α = 1 for α=90°, k_α = 0.91 for α= 45°, k_α = 0.3 for α = 0°.
- The minimum embedded thread length is 6 times the outer thread diameter for screws installed at 90° to the grain, unless otherwise noted.
- The minimum embedded thread length for screws installed at an angle 0° ≤ α < 90° to the grain is 8 times the outer thread diameter, unless otherwise noted.
- At least four screws must be used in a connection with screws installed in the wood member with an angle between the grain direction and screw axis α ≤ 15°.
- The reference withdrawal design values must be inferior to f_{tens} of the screw.

REFERENCE HEAD PULL-THROUGH DESIGN VALUES

While designing a connection the head pull-through values must be compared with the tensile resistance of the screw and, if necessary, thread withdrawal. The lower value is the governing one.

KKA AISI410

SELF-DRILLING SCREW
TIMBER-TO-TIMBER | TIMBER-TO-ALUMINIUM

TIMBER-TO-ALUMINIUM
Self-perforating timber-to-metal tip with special bleeder geometry. Ideal for fastening timber or WPC boards to aluminium substructures.

TIMBER-TO-TIMBER
Also ideal for fastening timber or WPC boards to thin wooden substructures, they, too, made with wooden boards.

METAL-TO-ALUMINIUM
Short version ideal for fastening clips, plates and angle brackets to aluminium substructures. Can be used to fix aluminium-aluminium overlaps.

OUTDOOR APPLICATIONS ON ACID WOOD
AISI410 martensitic stainless steel. This stainless steels offers higher mechanical performance compared to the other available stainless steels. Suitable for outdoor applications and on acid wood, but away from corrosive agents (chlorides, sulphides, etc.).

Ø0.20 in

Ø0.16 in

BIT INCLUDED

DIAMETER [in]

0.14 | **0.16** **0.20** | 0.32

LENGTH [in]

13/16 | **13/16** **1 15/16** | 12 5/8

EXPOSURE CONDITION

WET

ATMOSPHERIC CORROSIVITY

C1 C2

WOOD CORROSIVITY

T1 T2 T3 T4

MATERIAL

410 AISI — AISI410 martensitic stainless steel

FIELDS OF USE

Outdoor use.
Wooden boards with density of < 880 kg/m³ [G = 1.05] on aluminium with a thickness of < 1/8" (without pre-drill).

CODES AND DIMENSIONS

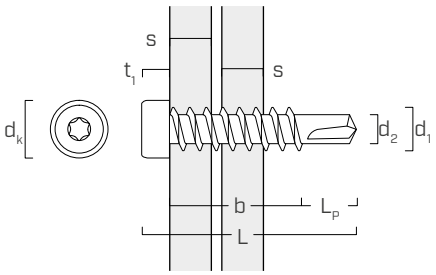
d_1 [mm] [in]	CODE	L [mm]	L [in]	b_1 [in]	b_2 [in]	A [in]	s [in]	pcs
4 **0.16 #7 TX 20**	**KKA420**	20	13/16	7/16	-	-	1/32 - 3/32	200

d_1 [mm] [in]	CODE	L [mm]	L [in]	b_1 [in]	b_2 [in]	A [in]	s [in]	pcs
5 **0.20 #11 TX 20**	**KKA540**	40	1 9/16	5/8	7/16	1 1/8	1/16 - 1/8	200
	KKA550	50	1 15/16	13/16	7/16	1 9/16	1/16 - 1/8	100

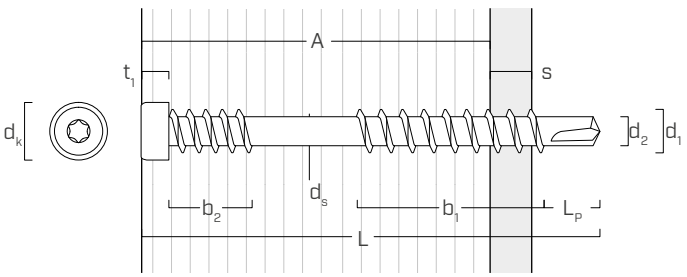
s thickness that can be drilled, steel plate S235/St37
thickness that can be drilled, aluminium plate

GEOMETRY

Ø0.16 in



Ø0.20 in



Nominal diameter	**d_1**	**[in](1)**	**0.16**	**0.20**
Outer thread diameter	**d_1**	[mm]	4	5
		[in]	**0.157**	**0.197**
Head diameter	d_K	[in]	0.248	0.268
Root diameter	d_2	[in]	0.110	0.138
Shank diameter	d_S	[in]	-	0.171
Head thickness	t_1	[in]	0.122	0.132
Tip Length	L_P	[in]	0.217	0.256

(1)The nominal diameter of the screw is converted into imperial units and rounded up to the nearest decimal point.

ALU TERRACE

Ideal for fastening timber or WPC boards, clips or angle brackets to aluminium substructures.

KKA COLOR

SELF-DRILLING SCREW FOR ALUMINIUM

ALUMINIUM

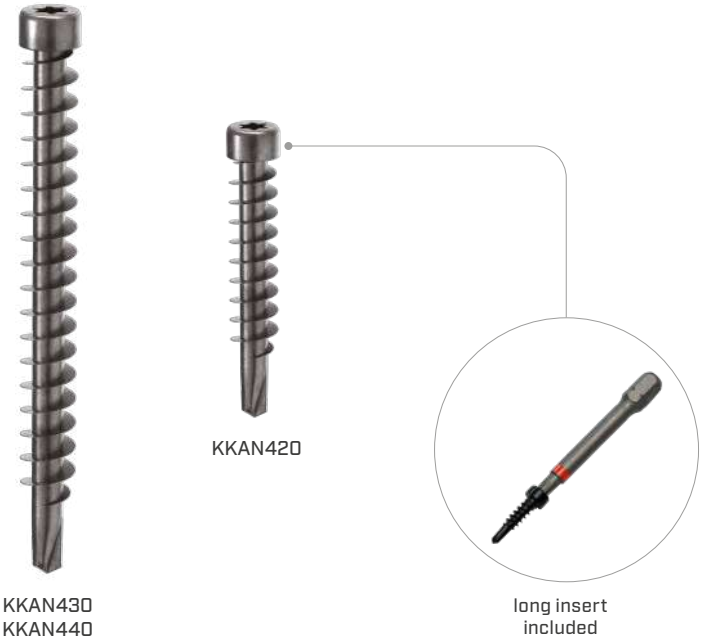
Self-perforating tip with special bleeder geometry. Ideal for fastening clips to aluminium substructures.

ORGANIC COLORED COATING

Black color anti-rust coating for outdoor use in exposure condition 1 on non-acidic woods (T3). Concealed effect on dark substructures and clips.

METAL-TO-ALUMINIUM

Short version ideal for fastening clips, plates and angle brackets to steel or aluminium substructures. Can be used to fix metal-metal overlaps.



KKAN430
KKAN440
KKAN540

BIT INCLUDED

DIAMETER [in]

0.14 | **0.16 0.20** | 0.32

LENGTH [in]

13/16 | **13/16 1 9/16** | 12 5/8

EXPOSURE CONDITION

EC1

ATMOSPHERIC CORROSIVITY

C1 C2 C3

WOOD CORROSIVITY

T1 T2 T3 T4

MATERIAL

ORGANIC COATING — carbon steel with colored organic anti-rust coating

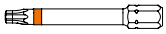
FIELDS OF USE

Outdoor use.
Aluminium thickness < 1/8" (without pre-drill).

CODES AND DIMENSIONS

d_1 [mm] [in]	CODE	L [mm]	L [in]	b [in]	A [in]	s [in]	pcs
4 **0.16 #7 TX 20**	**KKAN420**	20	13/16	3/8	-	1/16 - 1/8	200
	KKAN430	30	1 3/16	13/16	7/8	1/16 - 1/8	200
	KKAN440	40	1 9/16	1 3/16	1 1/4	1/16 - 1/8	200
5 **0.20 #11 TX 20**	**KKAN540**	40	1 9/16	1 1/8	1 1/8	1/16 - 1/8	200

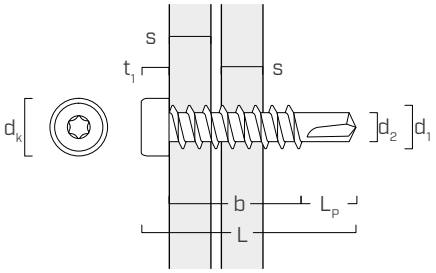
s thickness that can be drilled, steel plate S235/St37
thickness that can be drilled, aluminium plate



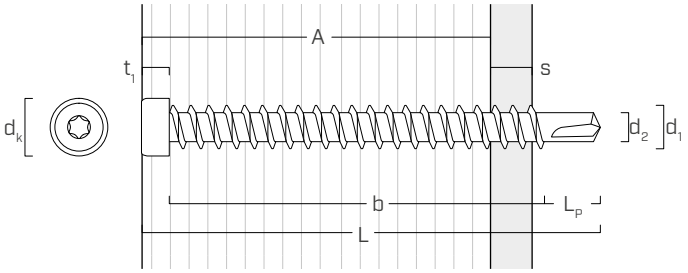
LONG BIT INCLUDED code TX2050

GEOMETRY

KKAN420



KKAN430 | KKAN440 | KKAN540



Nominal diameter	**d_1**	**[in](1)**	**0.16**	**0.20**
Outer thread diameter	**d_1**	[mm]	4	5
		[in]	**0.157**	**0.197**
Head diameter	d_K	**[in]**	0.248	0.268
Root diameter	d_2	**[in]**	0.110	0.138
Head thickness	t_1	**[in]**	0.122	0.132
Tip Length	L_P	**[in]**	0.217	0.256

(1)The nominal diameter of the screw is converted into imperial units and rounded up to the nearest decimal point.

TVM COLOR

Ideal for fastening standard Rothoblaas clips (TVMN) on aluminium. Long bit included in each package.