Centrix

Engineered Aerospace Solutions

www.CENTRIX-US.com

1022 West Valley Highway Kent, WA 98032 ------- Ph: 253-872-4773

Single Sided Fasteners

Adapters

Specialty Tools

PATENTED AND PATENT PENDING DESIGNS.

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Centrix is an Aerospace Engineering Solutions Company

We specialize in the design and manufacturing of highly specialized aerospace products. With customers in over 15 countries, and products in use or in developments for every new airplane program in the world, we have developed a world wide support structure including over 20 high-level people in the field.

Centrix is the Leader in Fastener Technology

Our fastening products offer concentric alignment and high clamping forces. Combined with our miniaturized product lines, we are the key gateway technology that enables one up assembly and robotic assembly. We offer complete and integrated fastening solutions by pairing our custom tooling with industry leading torque source providers.

We use the latest in Computer Aided Design and advanced Non Linear Finite Element Analysis (FEA). We have developed and implemented a robust testing and quality system to validate the performance of each fastener before it leaves our facility. We currently work with all major airframe manufacturers to help satisfy their requirements.

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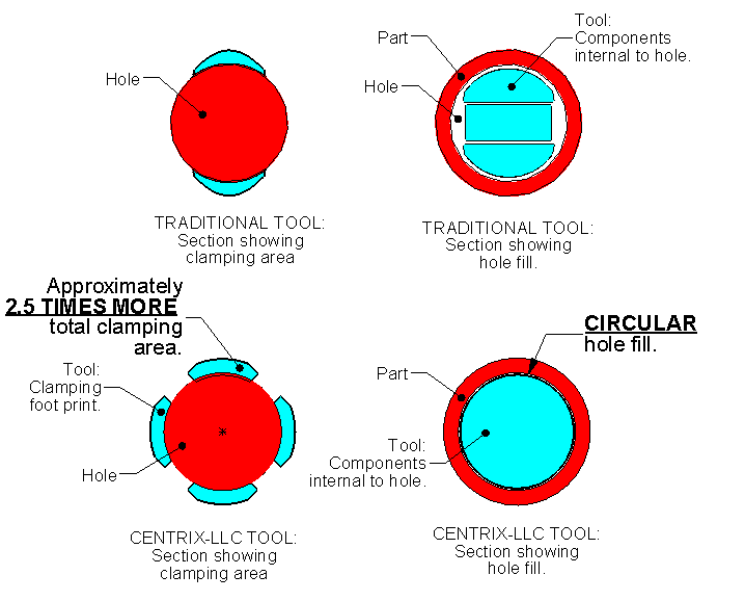
Our Patented Products

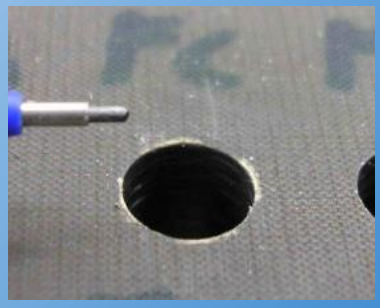
Centrix Single Sided Temporary Fastener Family (SSTF)

- Used for PRECISION alignment and clamp-up.
  a. Part Clamp (Airplane component clamping and alignment).
  b. Tool Clamp (Jig to Airplane attachment and alignment).
- Custom order diameter and length (almost all sizes available).
- Standard tool diameter tolerances is -0.001 to -0.002 thousands of and inch less than callout. Special requests include +0.000 to -0.001.
- Optional Undercut on clamping feet prevents the fastener from contacting the corner of the hole.

Centrix SSTF Advantages

- SSTF align (dowel) close tolerance parts.
- Clamp load is more evenly distributed across substrate
- High clamp loads stabilize the assembly and reduce interlaminate burr.
- High clamp loads do not damage the structure.
- Need to access only a single side of the assembly.
- Better accuracy maintains location of components during other assembly processes.
- Repeatedly locates without a supporting jig.
- Structure is drilled and indexed to the same holes (with the same tolerances) where the final, fly-away fasteners will later be inserted.
- SSTFs do not cause damage on the tail side of the structure (CFRP, AL, or Ti).





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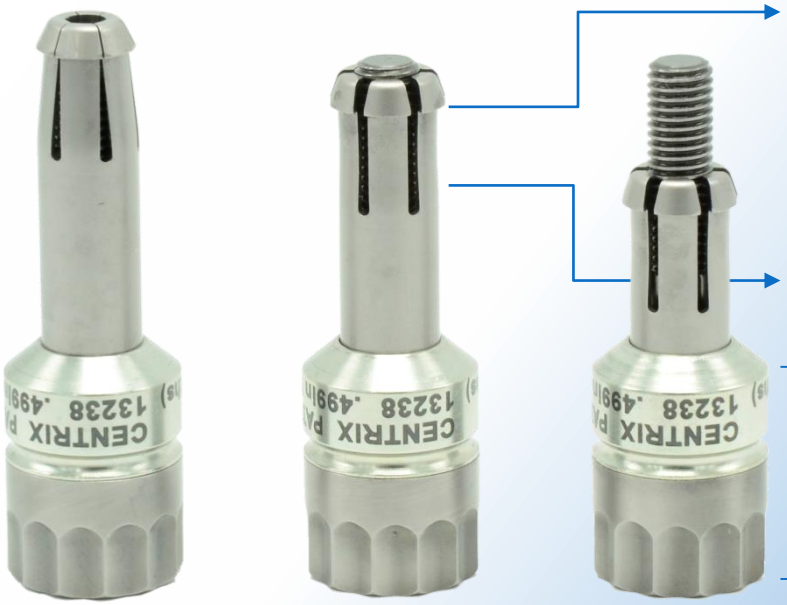
Fasteners for Automation

Low-Profile Robotic Fastener with "Free Spin"



Enhanced clamping area. Qualified for use on composite stacks at all major OEMs.

Precision alignment across entire grip can be held up to .001.

Low profile, ideal for automated installation.

The Free-Spin fastener's unique design combines a large clamping area and greater strength, enabling one up assembly due to high adjacent hole clamp load.

When the Free Spin Fastener is driven in the counter clockwise direction for removal, it reaches its "free spin" state and the screw spins harmlessly in place. This eliminates any chance of damaging the fastener by over torqueing during removal.

Manual installation is available using Centrix's line of adapters.

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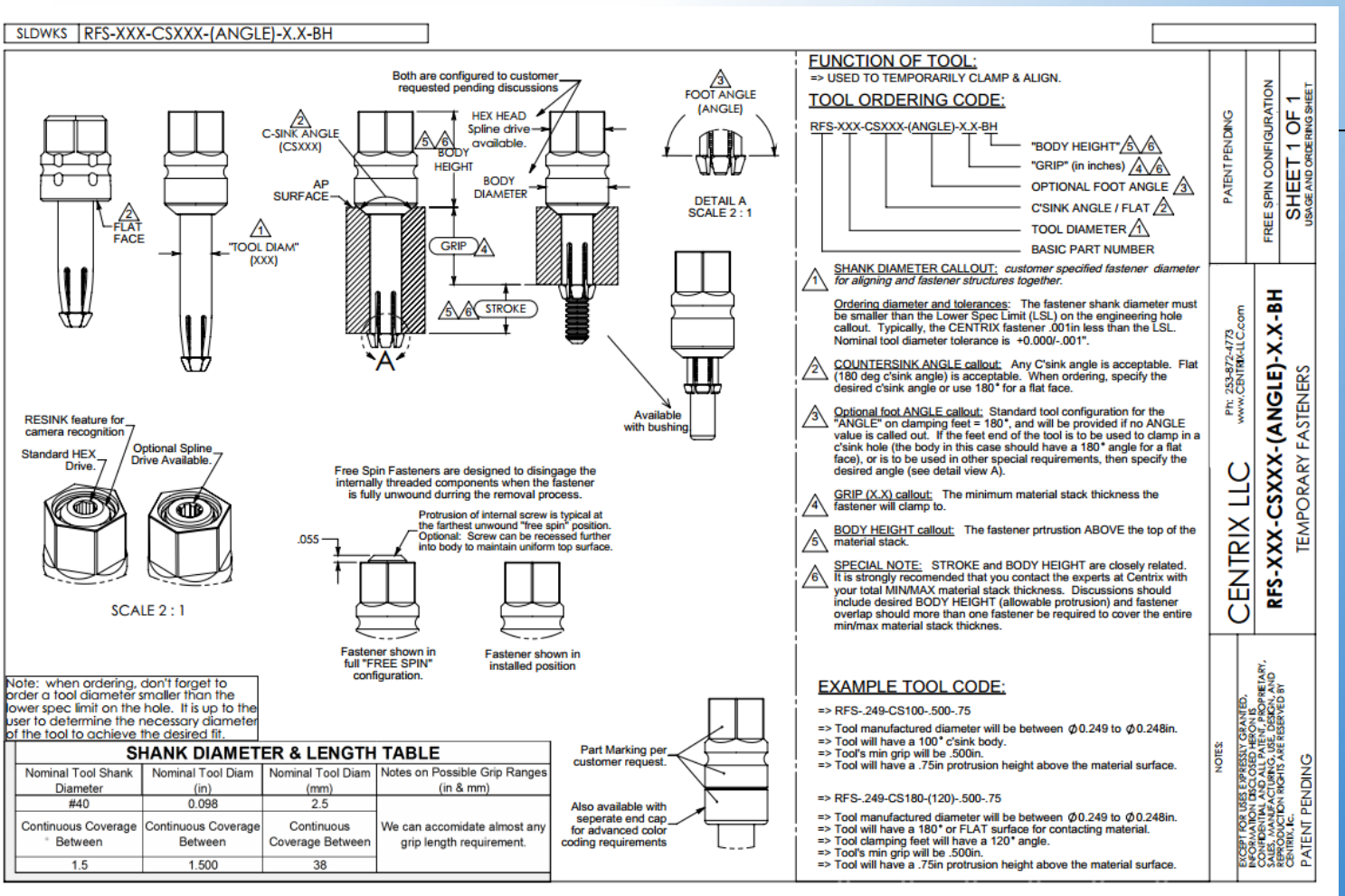
Low-Profile Robotic Fastener with "Free Spin"

Fasteners for Automation



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Fasteners for Automation

Low-Profile Robotic Fastener with "Hard Stop"

Enhanced clamping area. Qualified for use on composite stacks all major OEMs.

Precision alignment across entire grip. Diameters can be held up to .001 tolerance.

Low profile, ideal for robotic installation.

A 3 finger spline design is offered with a hard stop, enhancing the grip range of the fastener.

The Hard-Stop fastener maximizes the stroke of the low profile body.

When the fastener is driven in the counter clockwise direction, it reaches its "hard stop" in which the bushing of the fastener seats against a ledge inside the collet. Torque control is required during removal to avoid damage to the fastener.

Manual application is supported using Centrix's line of adapters.

PATENT PENDING

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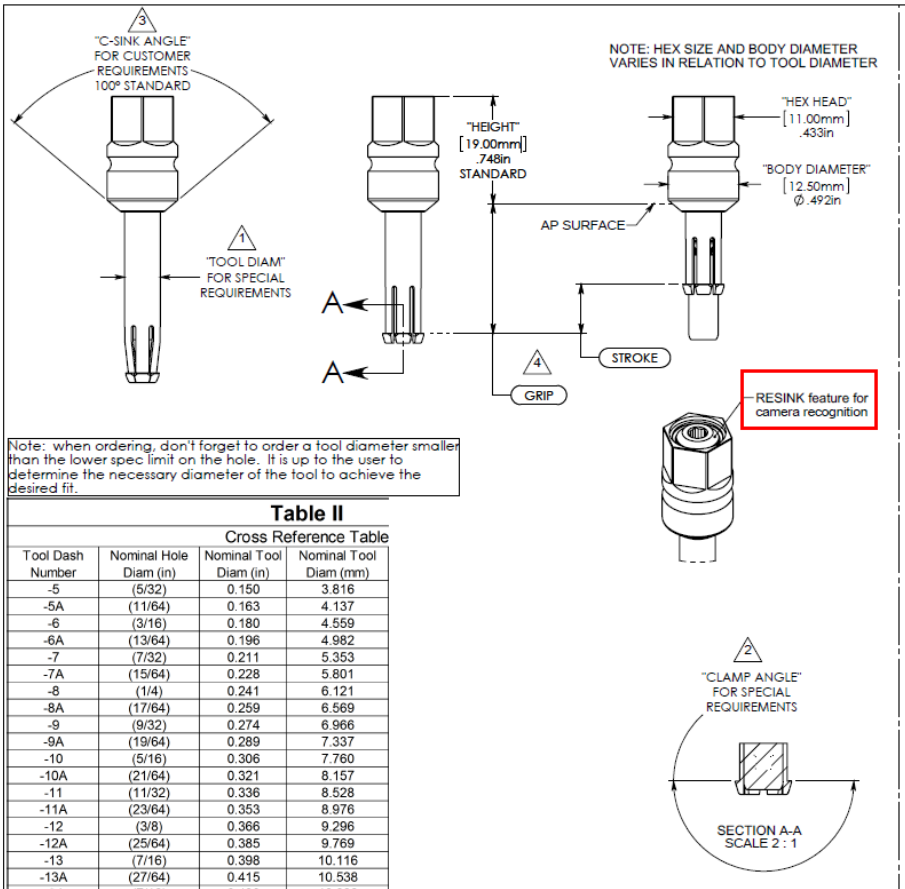
Low-Profile Robotic Fastener with "Hard Stop"

Fasteners for Automation

SLDWKS | DM-XXX-(ANGLE)-(X.X)



Note: when ordering, don't forget to order a tool diameter smaller than the lower spec limit on the hole. It is up to the user to determine the necessary diameter of the tool to achieve the desired fit.

Table II

Cross Reference Table

Tool Dash Number	Nominal Hole Diam (in)	Nominal Tool Diam (in)	Nominal Tool Diam (mm)
-5	(5/32)	0.150	3.816
-5A	(11/64)	0.163	4.137
-6	(3/16)	0.180	4.559
-6A	(13/64)	0.196	4.982
-7	(7/32)	0.211	5.353
-7A	(15/64)	0.228	5.801
-8	(1/4)	0.241	6.121
-8A	(17/64)	0.259	6.569
-9	(9/32)	0.274	6.966
-9A	(19/64)	0.289	7.337
-10	(5/16)	0.306	7.760
-10A	(21/64)	0.321	8.157
-11	(11/32)	0.336	8.528
-11A	(23/64)	0.353	8.976
-12	(3/8)	0.366	9.296
-12A	(25/64)	0.385	9.769
-13	(7/16)	0.398	10.116
-13A	(27/64)	0.415	10.538
-14	(7/16)	0.430	10.909
-14A	(29/64)	0.447	11.357

FUNCTION OF TOOL:

=> USED TO TEMPORARILY CLAMP & ALIGN.

TOOL ORDERING CODE:

DM-XXX-(CS-XXX°)-(ANGLE)-(X.X)

- (X.X) — OPTIONAL "GRIP" (in inches) 4
- (ANGLE) — OPTIONAL CLAMP ANGLE 3
- (CS-XXX°) — OPTIONAL COUNTER SINK AND COUNTERSINK ANGLE 2
- XXX — TOOL DIAMETER 1
- DM — BASIC PART NUMBER

TOOL DASH NUMBER (XXX) is specified as either a *dash number* shown in TABLE II, or as a *custom diameter* (XXX).

STANDARD DIAMETERS: if TOOL DIAMETER is called out as a dash number (-X), then the tool's manufactured diameter is shown in TABLE II. Nominal tool diameter tolerance is +0.000/-.001 and applies to values shown in TABLE II.

1 Custom DIAMETER requirements: if TOOL DIAMETER is called out as a 3 PLACE number (XXX), then the tool is manufactured to the specified diameter. Nominal tool diameter tolerance is +0.000/-.001".

2 Optional COUNTERSINK ANGLE callout: Standard tool configuration is WITH the 100° COUNTERSINK, and the tool will be provided without 100° countersink body if not called out.

3 Optional ANGLE callout: Standard tool configuration is the "ANGLE" on clamping feet = 180°, and will be provided if no ANGLE is called out. If the tool is to be used to clamp in a c'sink hole, or is to be used in other special requirements, then specify the desired angle (see detail view A) in the "(ANGLE)" space located in the part number (see example tool code below).

4 Optional GRIP (X.X) callout: Standard Grip range is shown in TABLE II, and will be provided if no custom GRIP is called out. If a longer maximum grip is required, specify max grip length in the part number (see example tool code below).
Note: Stroke will still be 1.0"

EXAMPLE TOOL CODE:

DM-8
=> Tool manufactured diameter will be between Ø0.247 to Ø0.245 for nominal hole diameter of Ø 1/4".
=> Tool WILL have a FLAT BODY.
=> Tool's grip range will be determined per customer specs.
=> Angle on feet (see detail view A) will be 180°.

DM-255-CS
=> Tool manufactured diameter will be between Ø0.255 to Ø0.254 for custom hole diameter.
=> Tool WILL have a COUNTERSUNK BODY (determined by customer).
=> Tool's grip range will be determined per customer specs.
=> Angle on feet (see detail view A) will be 180°.

DM-.248-120-1.5
=> Tool manufactured diameter will be between Ø0.248 to Ø0.247 for custom hole diameter.
=> Tool WILL have a FLAT BODY.
=> Clamping feet will be made to a 120 degree angle (see detail view A).
=> => Tool's grip range will be determined per customer specs..

PATENT PENDING

SCALE: 3:2 UNLESS OTHERWISE NOTED

SHEET 1 OF 1

USAGE AND ORDERING SHEET

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DM-XXX-(ANGLE)-(X.X)

TEMPORARY FASTENERS

NOTES:

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Flush Head Fastener

Low Profile Fasteners

Flush-Head seats in countersink holes below the skin surface.

Precision alignment. (.001 tolerance not available for Flush-Head design)

Enhanced clamping area. Qualified for use on composite stacks at all major OEMs.

Special 3 fingered spline design allows many possible low profile combinations. The head of the fastener sits flush with the clamping material, making it the ideal low profile fastener.

The Flush-Head Fastener is operated by Centrix's line of adapters that works with common aerospace tooling.

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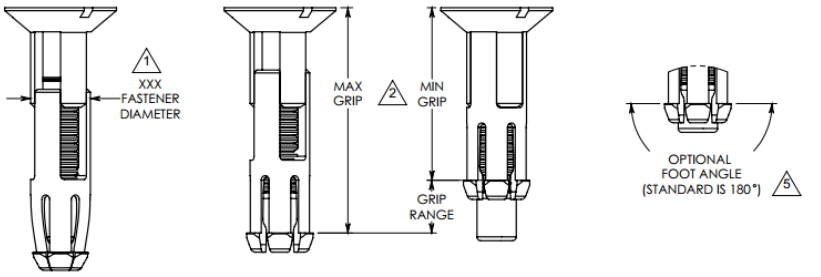
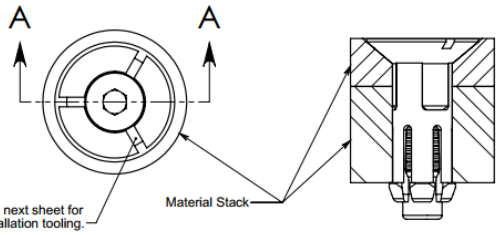
Flush Head Fastener

Low Profile Fasteners

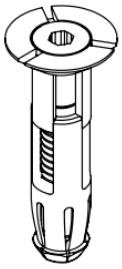
SLDWKS | CENTRIX-FHS- PRODUCT SHEET

REV: NEW: 7/15/2009





SECTION A-A
SCALE 2 : 1



Note: when ordering, it is up to the user to determine the necessary diameter of the tool to achieve the desired fit.

FUNCTION OF TOOL:

=> USED TO TEMPORARILY CLAMP & ALIGN.

TOOL ORDERING CODE:

FHS-XXX-XX:XX-CSANGLE-CSØ-(FOOTANGLE)

OPTIONAL ANGLE OF FEET 5
DIAMETER OF COUNTER SINK 4
COUNTER SINK ANGLE 3
MINto MAX GRIP 2
TOOL DIAMETER 1
BASIC PART NUMBER

1 TOOL DIAMETER (XXX) specified by customer as a *custom diameter. The Tool is manufactured to the custom diameter with typical tolerances of -0.001 to -0.003.*

1 DIAMETER requirements: if TOOL DIAMETER is called out as a 3 PLACE number (XXX), then the tool is manufactured to the specified diameter. Nominal tool diameter tolerance is -0.001/-.003 inch (see example tool code below).

2 MINto MAX GRIP: The tool is manufactured to be slightly less than the minimum grip required by the customer. Depending on the stroke of the temporary fastener, we will try to accomidate all of the grip ranges in one tool (i.e from MIN grip to MAX grip). If the tool is unable to reach to the MAX grip then additional fasteners will need to be produced to accomadate the different material stacks. Each temporary fastener is given a part number using the minimum grip (all fasteners are labelled with min grip and max grip).

3 COUNTER SINK ANGLE: Angle of the counter sink. (Typically 100°

4 DIAMETER OF COUNTERSINK: Diameter of the countersink.

5 Optional ANGLE callout: Standard tool configuration is "ANGLE" on clamping feet = 180°, and will be provided if no ANGLE is called out. If the tool is to be used to clamp in a c'sink hole, or is to be used in other special requirements, then specify the desired angle (see detail view A) in the "(ANGLE)" space located in the part number (see example tool code below).

EXAMPLE ORDERING TOOL CODE:

Customer orders: FHS-312-.50:1.10-100°-.620
=> Tool manufactured diameter will be between Ø0.311 to Ø0.309 for nominal hole diameter of Ø.312.
=> Tool will be made with a standard 100° countersink, that sits flush with the material at a counter sink Ø of .620.
=> Angle on feet (see detail view A) will be 180° (default).
=> Tool's grip range will be from .5 inch to 1.2 inch. If this can not be accomadated with 1 tool then CENTRIX will break up the grip range into different tools. For Example the given grip range may require the following tools:

FHS-312-.50-100°-.620
This tool has a diameter of Ø0.311 to Ø0.309 and grips material from 0.50" to 0.80". It has counter sink angle of 100° and sits flush with the material at a diameter of Ø0.620.
FHS-312-.80-100°-.620
This tool has a diameter of Ø0.311 to Ø0.309 and grips material from 0.80" to 1.10". It has counter sink angle of 100° and sits flush with the material at a diameter of Ø0.620.

Assy drawing only | SCALE: 2:1 & NOTED | SHEET 1 of 2 | FHS-312-.50:1.20-100-.620

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CENTRIX-FHHS-312

FLUSH BLIND TEMPORARY FASTENER

NOTES:

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Unrestricted Fastener

Low Profile Fasteners

Enhanced clamping area. Qualified for use in composite stacks at most OEMs

Maximized grip range. The fastener maintains stroke length while opening the fingers during installation.

Precision diameters up to .001 total tolerance for precise alignment across the entire grip.

The screw protrudes before installation and recedes towards the fastener body after install.

Unique low profile design maximizes the stroke of the fastener by allowing the screw to protrude prior to installation. During installation the head of the screw installs towards the body until it seats on the top of the body. This feature, paired with the low height of the body, make it ideal for low profile applications without sacrificing the available grip range of the fastener.

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Small Diameter Fastener

Low Profile Fasteners

For pilot hole applications, the collet feet have an angled clamping surface for easy removal. The large clamping area ensures no pull through even at high clamp loads.

Precision alignment across entire grip. High strength.

Low profile body. Robot compatible.

Our smallest diameter fasteners feature .098 (2.5 mm) and .125 (3.3 mm) collet diameters. They utilize the free spin features and are capable of applying very high clamp loads.

Application of the small diameter fastener is supported by Centrix's line of adapters.

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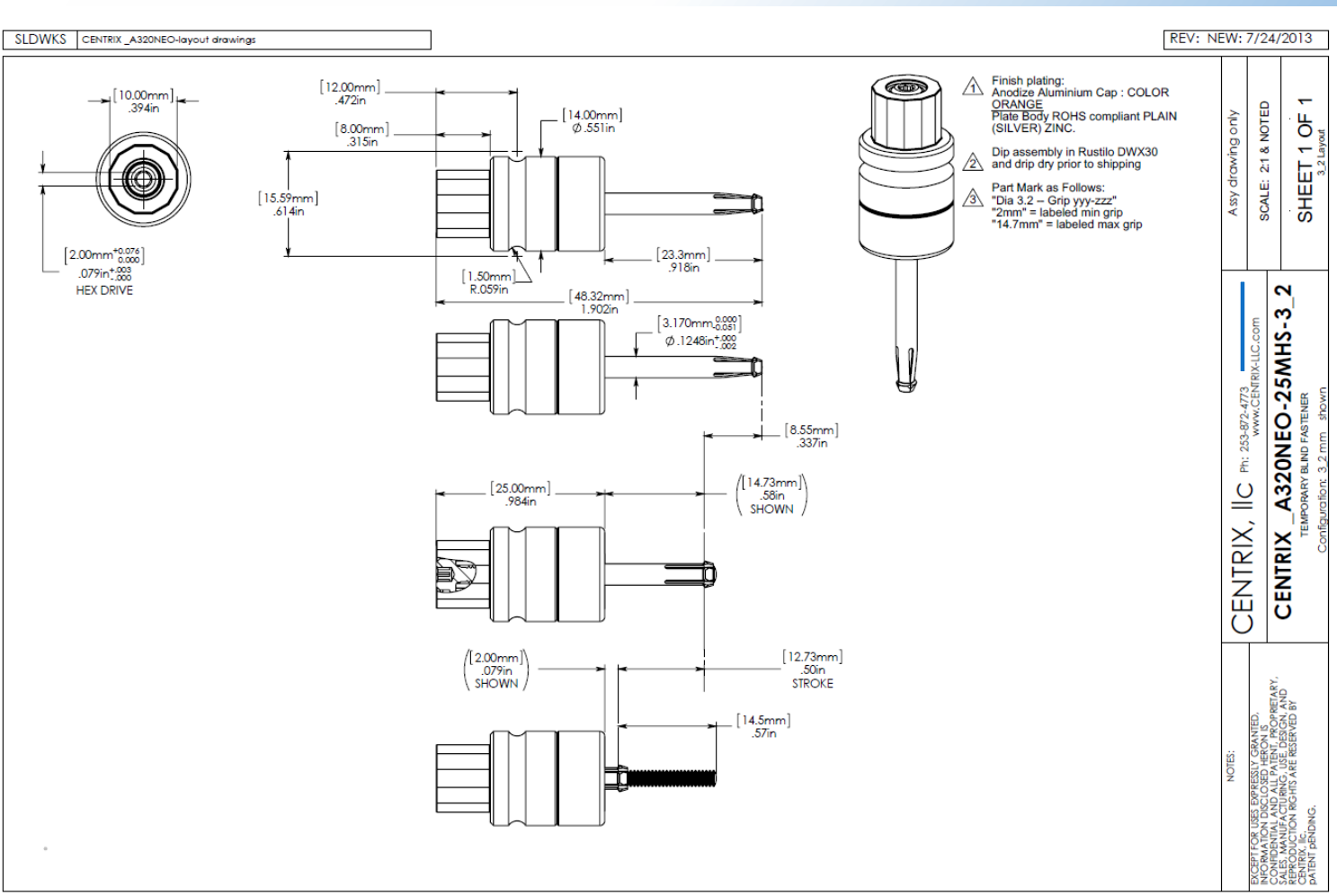
Small Diameter Fastener

Low Profile Fasteners



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Drill Jig Fastener

Low Profile Fasteners

Enhanced clamping area. Qualified for use in composite stacks for all major OEMs.

Precision diameters up to .001 total tolerance for precise alignment across the entire grip. Almost any length possible.

Very low profile above surface of drill jig.

Unique body design allows fastener to be installed with very little material protruding above the drill jig. The fastener provides precision alignment and clamp of the jig and part.

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Clamp Loc

Long Stroke Fasteners

Ideal for applications with limited backside clearance, helps distribute load evenly, and never protrudes more than shown in these pictures.

Clamping face is precision machined with undercut to prevent damage to corner of hole regardless of clamping force.

Custom order diameters and lengths. Diameter is held to -.001/-.002 of specified diameter.

Standard Hex sizes

Fully contained tool: Nothing protrudes past bottom hex.

PATENT # 7,300,042 B2 AND PENDING

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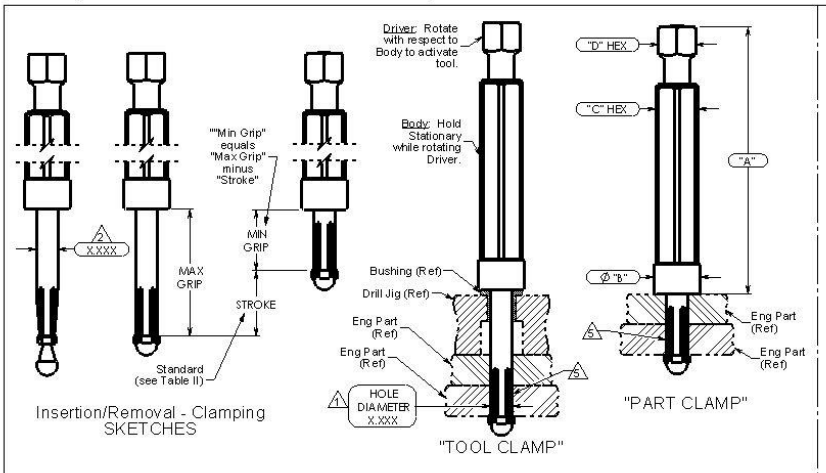
SLDWKS | CENTRIX -- PRODUCT SHEET | REV: A: 03/31/08



FUNCTION OF TOOL:

=> USED TO TEMPORARILY CLAMP & ALIGN DRILL JIG TO PRODUCTION PART.
=> USED TO CLAMP AND ALIGN PRODUCTION PART STACKS.

TOOL ORDERING CODE:

CL - X.XXX - X.X
- MAX GRIP (in inches) 3
- DIAMETER (in thousands of an inch) 1 2
- BASIC PART NUMBER

1. Use lower Spec. Limit (LSL) when ordering. For example: If engineering calls out a hole diameter of Ø0.498 to Ø0.505, then callout X.XXX as 0.498
2. Tool diameter (X.XXX) is manufactured 0.001 to 0.002 less than X.XXX callout. For example: if X.XXX is called out as 0.498, the tool's manufactured diameter is Ø0.497 to Ø0.496
3. When ordering, specify desired Tool Grip (X.X) - plus 1/4" for minimum recommended clearance. See Table II for minimum allowed Tool Grips. Maximum Tool Grip and and increments as shown in Table II are prefered, but others can be ordered. Tool Clamping Range = Stroke
4. For requests outside of standards shown in table, call for engineering support.
5. Clamping force causes finger to "bulge" slightly in the radial direction - this helps with alignment.
6. The torque values shown only apply to certified nutsetters. The values listed are recomendations only. Jig strength and clamping requirements should be weighed carefully. All usage is at the discretion of the user.

EXAMPLE TOOL CODE:

CL-0.375-4.5
=> LSL for engineering hole diamter is 0.375
=>Tool will apply clamp to stack heights between 4.5 inch thick and 3.0 inch thick.
=> Tool manufacted diameter will be between Ø0.374 to Ø0.373

CL-0.505-3.0 SHOWN | SCALE: 1:2 & NOTED | SHEET 1 OF 1

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TEMPORARY FASTENERS
USAGE AND ORDERING SHEET

Table II
4 CROSS REFERENCE TABLE

"Max Grip" (recomended max values)	"Max Grip" (recomended minimum values)	"Stroke" (standard values)	Nominal Hole Size	TOOL DASH NUMBER (ref only)	Hole Diam Callout Range	"A" Dimension (Body Length)	"C" Dimension (Body Hex)	"D" Dimension (Drive Hex)
(5.0) 3.0	1.0	1.0	3/16 thru 1/4	-6 thru -8	0.185 thru 0.254	3.7	9/16	1/2
6.0	1.5	1.5	5/16 thru 7/16	-10 thru -14	0.307 thru 0.444	5.6	3/4	5/8
7.5	1.5	1.5	1/2 thru 21/32	-16 thru -21	0.495 thru 0.650	6.3	1.0	7/8
8	2.0 (2.25)	2.0 (2.25)	11/16 thru 1.0	-22 thru -32	0.683 thru 1.001	8.4	1 1/2	1 3/8
13	3.25	3.25	1.0 thru 1 3/8	-32 thru -44	1.0thru 1.38	11.35	2	1 3/4

For Ø1/4" Tool only.
For Ø1.0" Tool only.
Tool sizes are generally designed around nominal fractional (in 1/32) drill sizes.
Example: 1/4 drill size converts to 8/32 as a 1/32 based fraction . This is expressed as a "Dash Number" for short, in other words, a "-8".

Table I
6 Recommended torque - clamping force cross reference

Nominal CL Diam	Aprox. MAX Clamping Force	Req'd Torque at 1000 lbs Clamp Force	Req'd Torque at 2000 lbs Clamp Force	Req'd Torque at 3000 lbs Clamp Force
3/16	800 lbs	10 in*lbs (600 lb Clamp)	---	---
1/4	1300 lbs	35 in*lbs	---	---
5/16	1900 lbs	45 in*lbs	---	---
3/8	2200 lbs	45 in*lbs		
7/16 to 15/32	3200 lbs	45 in*lbs	90 in*lbs	---
1/2 to 21/32	5000 lbs	75 in*lbs	160 in*lbs	210-220 in*lbs
22/32 to 1.0	12000 lbs	80 in*lbs	160 in*lbs	240-250 in*lbs
1 1/8 to 1 1/4	30000 lbs	90 in*lbs	190 in*lbs	285-300 in*lbs

NOTES:

SLDWKS | CENTRIX -- PRODUCT SHEET | REV: NEW: 02/12/2009

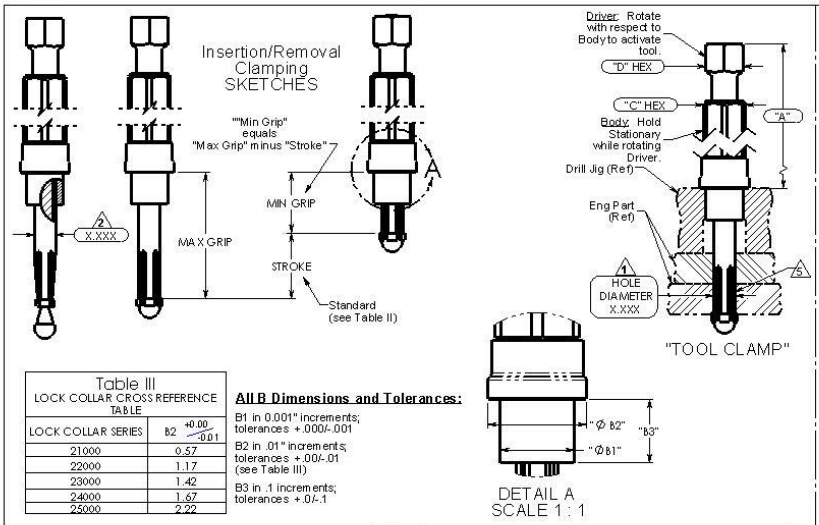

Table III
LOCK COLLAR CROSS REFERENCE TABLE

LOCK COLLAR SERIES	B2 +0.00 -0.01
21000	0.57
22000	1.17
23000	1.42
24000	1.67
25000	2.22

All B Dimensions and Tolerances:

B1 in 0.001" increments; tolerances +.000/-.001
B2 in .01" increments; tolerances +.00/-.01 (see Table III)
B3 in .1 increments; tolerances +.0/-.1

FUNCTION OF TOOL:

=> USED TO TEMPORARILY CLAMP & ALIGN DRILL JIG TO PRODUCTION PART.

TOOL ORDERING CODE:

CL-B- X.XXX - X.X - ØB1 - ØB2 - B3
- CUSTOM ORDER BUSHING DIMENSIONS
- MAX GRIP (in inches) 3
- DIAMETER (in thousands) 1 2
- BASIC PART NUMBER

1. Use lower Spec. Limit (LSL) when ordering. For example: If engineering calls out a hole diameter of Ø0.498 to Ø0.505, then callout X.XXX as 0.498
2. Tool diameter (X.XXX) is manufactured 0.001 to 0.002 less than X.XXX callout. For example: if X.XXX is called out as 0.498, the tool's manufactured diameter is Ø0.497 to Ø0.496
3. When ordering, specify desired Tool Grip (X.X) - plus 1/4" for minimum allowed Tool Grips. Maximum Tool Grip and and increments as shown in Table II are prefered, but others can be ordered. Tool Clamping Range = Stroke
4. For requests outside of standards shown in table, call for engineering support.
5. Clamping force causes finger to "bulge" slightly in the radial direction - this helps with alignment.
6. The torque values shown only apply to Boeing certified nutsetters. The values listed are recomendations only. Jig strength and clamping requirements should be weighed carefully. All usage is at the discretion of the user.

EXAMPLE TOOL CODE:

CL-B-0.375-4.5-.875-1.17-.75
=> LSL for engineering hole diamter is 0.375
=>Tool will apply clamp to stack heights between 4.5 inch thick and 3.0 inch thick.
=> Tool manufacted diameter will be between Ø0.374 to Ø0.373
=> Bushing ID will be a slip-fit for tool, OD=.875, Step OD=1.0, Length=1.0

CLB-0.505-3.0-.875-1.17-.75 WITH BUSHING SHOWN | SCALE: 1:2 & NOTED | SHEET 1 OF 1 USAGE AND ORDERING SHEET

CENTRIX, llc Ph: 253-872-4773 www.CENTRIX-LLC.com
WITH BUILT IN BUSHING
CL - B - XXX - XX
TEMPORARY FASTENERS

Table II
4 CROSS REFERENCE TABLE

"Max Grip" (recomended max values)	"Max Grip" (recomended minimum values)	"Stroke" (standard values)	Nominal Hole Size	TOOL DASH NUMBER (ref only)	Hole Diam Callout Range	"A" Dimension (Body Length)	"C" Dimension (Body Hex)	"D" Dimension (Drive Hex)
(5.0) 3.0	1.0	1.0	3/16 thru 1/4	-6 thru -8	0.185 thru 0.254	3.7	9/16	1/2
6.0	1.5	1.5	5/16 thru 7/16	-10 thru -14	0.307 thru 0.444	5.6	3/4	5/8
7.5	1.5	1.5	1/2 thru 21/32	-16 thru -21	0.495 thru 0.650	6.3	1.0	7/8
8	2.0 (2.25)	2.0 (2.25)	11/16 thru 1.0	-22 thru -32	0.683 thru 1.001	8.4	1 1/2	1 3/8
13	3.25	3.25	1.0 thru 1 3/8	-32 thru -44	1.0thru 1.38	11.35	2	1 3/4

For Ø1/4" Tool only.
For Ø1.0" Tool only.
Tool sizes are generally designed around nominal fractional (in 1/32) drill sizes.
Example: 1/4 drill size converts to 8/32 as a 1/32 based fraction . This is expressed as a "Dash Number" for short, in other words, a "-8".

Table I
6 Recommended torque - clamping force cross reference

Nominal 7216A Diam	Req'd Torque at 1000 lbs Clamp Force	Req'd Torque at 2000 lbs Clamp Force	Req'd Torque at 3000 lbs Clamp Force
3/16	20 in*lbs (600 lb Clamp)	---	---
1/4	35 in*lbs	---	---
5/16 to 3/8	45 in*lbs	---	---
7/16 to 15/32	45 in*lbs	90 in*lbs	---
1/2 to 21/32	75 in*lbs	160 in*lbs	210-220 in*lbs
22/32 to 1.0	80 in*lbs	160 in*lbs	240-250 in*lbs
1 1/8 to 1 1/4	90 in*lbs	190 in*lbs	285-300 in*lbs
	Recommended max clamp force for power feed drilling up to 0.375 diameter, for mounting drill jigs and for clamping airplane parts together.		

NOTES:

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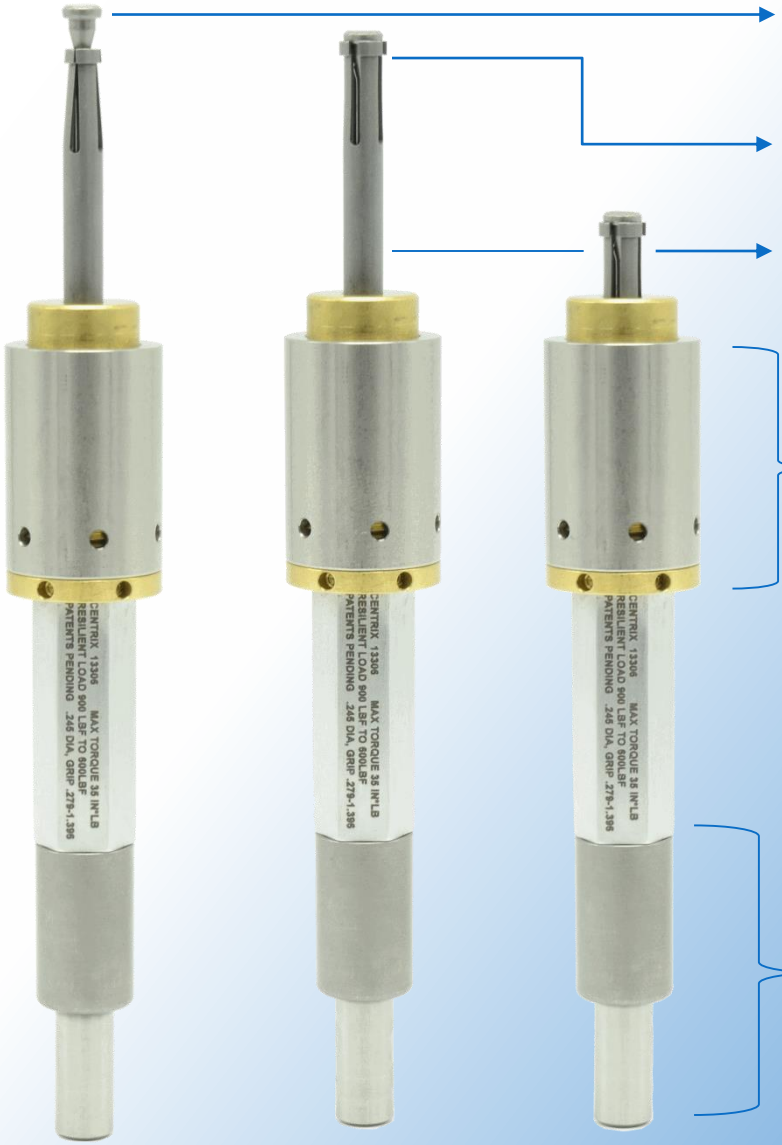
Constant Pressure Fastener

Long Stroke Fasteners



Ideal for applications with limited backside clearance.

Large clamping area prevents damage to backside of the structure

Available in almost any diameter and length.

Spring pack can be customized to provide various residual clamp forces after sealant squeeze out.

Works with existing pneumatic tooling, but can be made to work with any installation tooling.

The Centrix Constant Pressure Fastener (CPF) provides residual clamping in sealant squeeze out applications. As the material stack height decreases due to sealant squeeze out, the spring pack maintains clamp force. The CPF is also available with a drill jig clamping and alignment bushing. The CPF concept can be adapted to almost any Centrix long stroke fastener type in order to meet various customer specifications.

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Mini Loc Fastener

Low Profile Fasteners

Ideal for applications with limited backside hole clearance, helps distribute load evenly, and never protrudes more than shown in these pictures.

Optional countersink clamping surface available

Custom order diameters and lengths. Diameter is held to -.001/-.002 of specified diameter.

Low profile. Fully contained tool during clamp up: Nothing protrudes past the bottom of the hex

The Mini Loc Fastener utilizes the design concepts from our Clamp Loc fastener, just in a miniaturized form. The low profile design makes it adaptable for use in automated applications.

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Round Body Fastener

Long Stroke Fasteners

Optional: custom order angle on clamping face for clamping in c'sunk finished holes.

Standard diameters and lengths are stocked - custom order diameters and lengths available per request. Available in 1.0 inch stroke. Diameter is held to -.000/-.002, even across legs.

Short tool height once clamped. 2 Inch total height above top surface when clamped.

Nothing will protrude from the back of the nut, even when clamped through the thinnest stacks.

*Available in many different sizes.
-- All sizes have the same body and nut.
-- Body and nut are designed to work with existing installation tools.

PATENT PENDING

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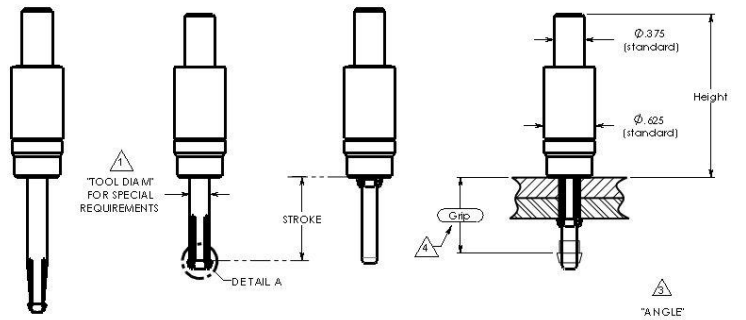
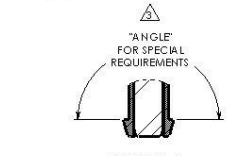
SLD WKS | CENTRIX-TACK-RD PRODUCT SHEET



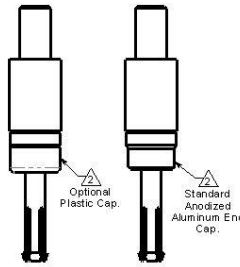
Note: when ordering, don't forget to order a tool diameter smaller than the lower spec limit on the hole. It is up to the user to determine the necessary diameter of the tool to achieve the desired fit.

Table II
Cross Reference Table

Tool Dash Number	Nominal Hole Diam (in)	Nominal Tool Diam (in)	Nominal Tool Diam (mm)	Standard Stroke (in)	Standard Grip (in)	"HEIGHT" (in)
-5	(5/32)	0.150	3.816	1.0	1.0	2.0
-5A	(11/64)	0.163	4.137	1.0	1.0	2.0
-6	(3/16)	0.180	4.559	1.0	1.0	2.0
-6A	(13/64)	0.196	4.982	1.0	1.0	2.0
-7	(7/32)	0.211	5.353	1.0	1.0	2.0
-7A	(15/64)	0.228	5.801	1.0	1.0	2.0
-8	(1/4)	0.241	6.121	1.0	1.0	2.0
-8A	(17/64)	0.259	6.569	1.0	1.0	3.0
-9	(9/32)	0.274	6.966	1.0	1.0	3.0
-9A	(19/64)	0.289	7.337	1.0	1.0	3.0
-10	(5/16)	0.306	7.760	1.0	1.0	3.0
-10A	(21/64)	0.321	8.157	1.0	1.0	3.0
-11	(11/32)	0.336	8.528	1.0	1.0	3.0
-11A	(23/64)	0.353	8.976	1.0	1.0	3.0
-12	(3/8)	0.366	9.296	1.0	1.0	3.0
-12A	(25/64)	0.385	9.769	1.0	1.0	3.0
-13	(7/16)	0.398	10.116	1.0	1.0	3.0
-13A	(27/64)	0.415	10.538	1.0	1.0	3.0
-14	(7/16)	0.430	10.909	1.0	1.0	3.0
-14A	(29/64)	0.447	11.357	1.0	1.0	3.0



DETAIL A
SCALE 2 : 1



FUNCTION OF TOOL:
=> USED TO TEMPORARILY CLAMP & ALIGN.

TOOL ORDERING CODE:
TACK- RB-XXX-(P)-(ANGLE)- (X.X)
- OPTIONAL "GRIP" (in inches) 4
- OPTIONAL ANGLE 3
- OPTIONAL PLASTIC CAP 2
- TOOL DIAMETER 1
- BASIC PART NUMBER

1 TOOL DASH NUMBER (XXX) is specified as either a *dash number* shown in TABLE II, or as a *custom diameter* (XXX).

STANDARD DIAMETERS: if TOOL DIAMETER is called out as a dash number (-X), then the tool's manufactured diameter is shown in TABLE II. Nominal tool diameter tolerance is +0.000/-.004 and applies to values shown in TABLE II.

Custom DIAMETER requirements: if TOOL DIAMETER is called out as a 3 PLACE number (XXX), then the tool is manufactured to the specified diameter. Nominal tool diameter tolerance is +0.000/-.004".

2 Optional PLASTIC CAP callout: Standard tool configuration is WITHOUT the plastic cap, and the tool will be provided without plastic cap if not called out. Note: Tools without plastic cap will have anodized Aluminum end cap.

3 Optional ANGLE callout: Standard tool configuration is the "ANGLE" on clamping feet = 180°, and will be provided if no ANGLE is called out. If the tool is to be used to clamp in a c'sink hole, or is to be used in other special requirements, then specify the desired angle (see detail view A) in the "(ANGLE)" space located in the part number (see example tool code below).

4 Optional GRIP (X.X) callout: Standard Grip range is shown in TABLE II, and will be provided if no custom GRIP is called out. If a longer maximum grip is required, specify max grip length in the part number (see example tool code below). Note: Stroke will still be 1.0"

EXAMPLE TOOL CODE:

TACK-RB-8
=> Tool manufactured diameter will be between Ø0.241 to Ø0.237 for nominal hole diameter of Ø1/4".
=> Tool WILL NOT have a plastic cap.
=> Tool's grip range will be from 1.0 inch to 0.0 inch.
=> Angle on feet (see detail view A) will be 180°.

TACK-RB-255-P
=> Tool manufactured diameter will be between Ø0.255 to Ø0.251 for custom hole diameter.
=> Tool WILL have a plastic cap.
=> Tool's grip range will be from 1.0 inch to 0.0 inch.
=> Angle on feet (see detail view A) will be 180°.

TACK-RD-248-120-1.5
=> Tool manufactured diameter will be between Ø0.248 to Ø0.244 for custom hole diameter.
=> Tool WILL NOT have a plastic cap.
=> Clamping feet will be made to a 120 degree angle (see detail view A).
=> Tool's grip range will be from 1.5 inch to 0.5 inch.

PATENT PENDING
SCALE: 1:1 UNLESS OTHERWISE NOTED
SHEET 1 OF 1
UPSIZE AND ORDERING SHEET

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TACK-RB-XXX-(P)-(ANGLE)-(X.X)
TEMPORARY FASTENERS

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Product Definition

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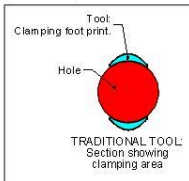
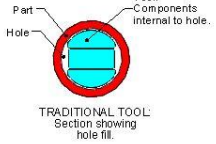
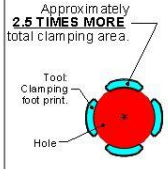
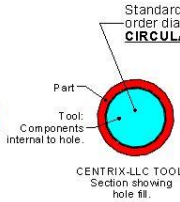
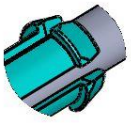
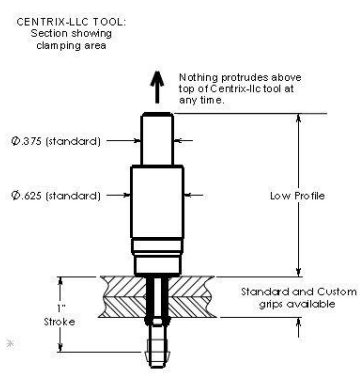












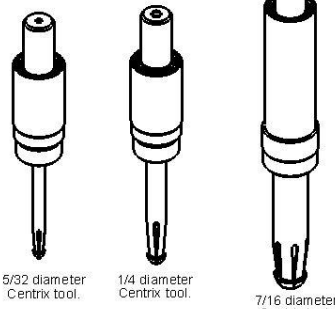
FUNCTION OF TOOL:
=> USED TO TEMPORARILY CLAMP & ALIGN.

ADVANTAGES:

CLAMPING AREA:
Approximately 2.5 times the clamping area of traditional tools.

HOLE FILL:
Circular, machined profile fills hole equally in all directions.
Custom diameters for precise alignment.

LOW PROFILE:
Approximately 1/2 profile of existing tools.
No protruding threaded rod above end of tool at any time.



PATENT PENDING
SCALE: 1:1 UNLESS OTHERWISE NOTED
SHEET 1 OF 1
Reference Information

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TACK-RB-- ADVANTAGES
TEMPORARY FASTENERS

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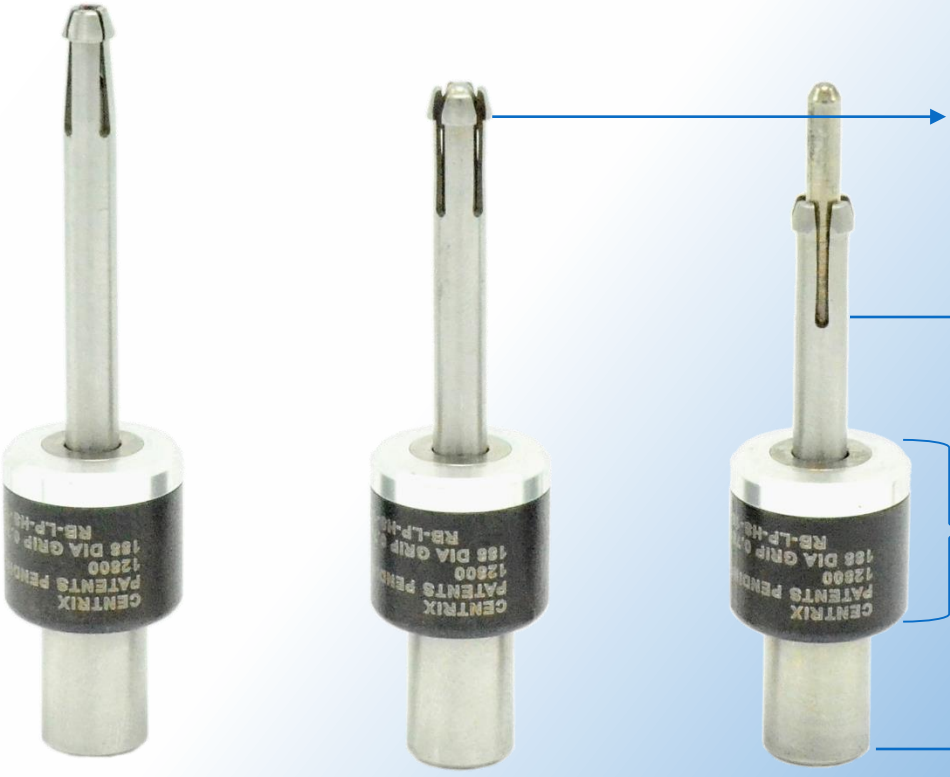
Low-Profile Round Body Fastener

Low Profile Fasteners



Optional: custom order angle on clamping face for clamping in c'sunk finished holes.

Diameter is held to -.000/-.002, even across legs.

Low profile body ideal for automated installation.

Nothing will protrude from the back of the nut, even when clamped through the thinnest stacks.

- Body and driver are designed to work with existing aerospace Installation tooling.

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Specialty Fasteners

Alignment Fastener

Expanding collet legs align the holes across the entire grip.

Short tool height once clamped. 2 inch total height above top surface when clamped.

Nothing will protrude from the back of the nut, even when clamped through the thinnest stacks.

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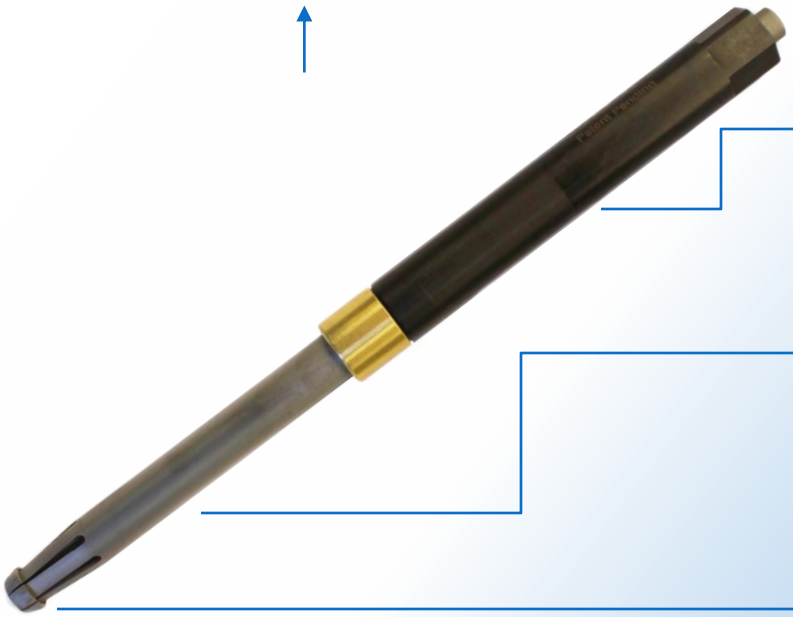
Long Stroke Fasteners

High Strength Jig Alignment/ Part Clamp



Body diameter is very close to collet diameter, allowing unique assembly processes.

High Strength. Precision diameters up to .001 total tolerance for precise alignment across entire grip.

High clamp load. Enhanced clamping area qualified for use in composite stacks at all major OEMs.

The fastener provides high strength part clamp and jig alignment, with clearance between the jig and the fastener.

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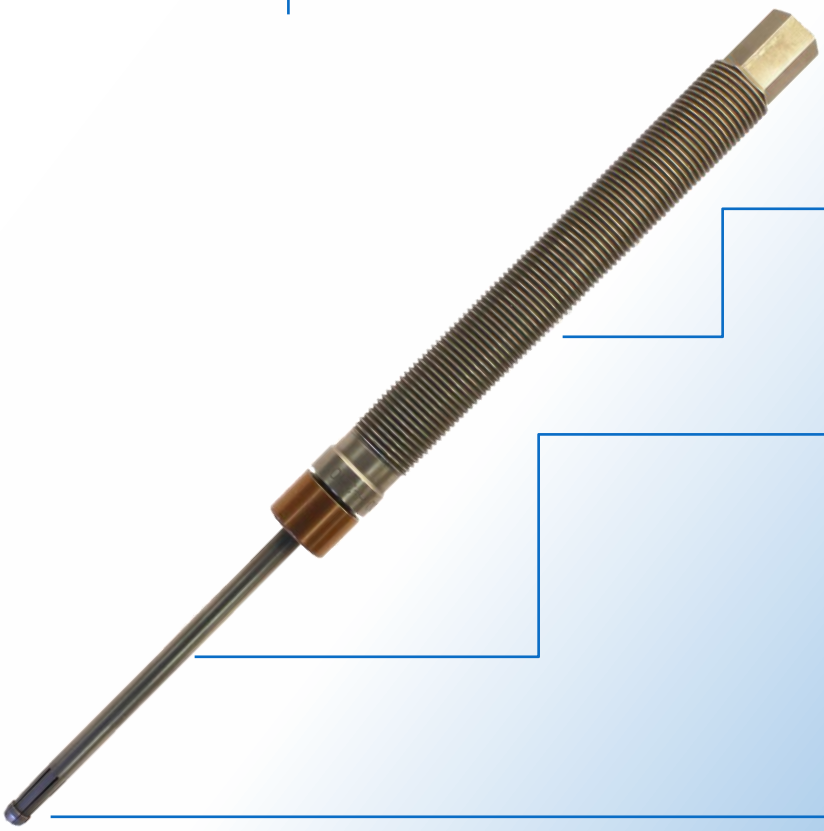
Threaded Jig Fastener

Specialty Fasteners



Externally threaded body allows unique assembly processes.

Precision diameters up to .001 total tolerance for precise alignment across the entire grip.

Enhanced clamping area. Qualified for use in composite stacks for all major OEMs.

Jig floats after part clamp, but is secured by a threaded nut to the external threads of the body.

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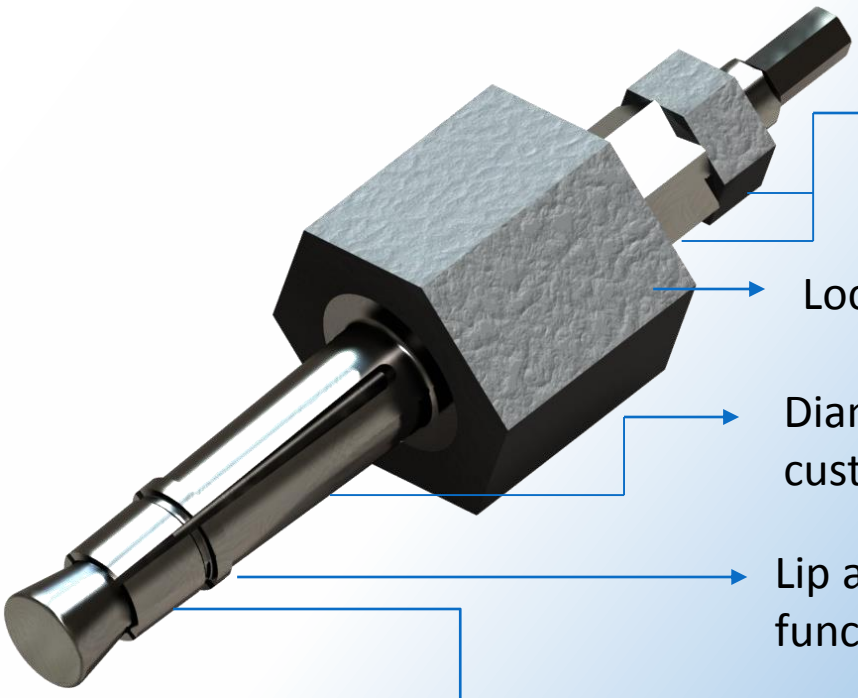
Blind-Hole Fastener

Specialty Fasteners



Double hexes drive the expanding collet system and apply clamping force.

Lock down nut to secure jig or parts.

Diameter is held to -.000/-.002 of custom ordered diameters.

Lip acts as a locator to ensure proper. function

Expanding collet anchors fastener in a blind hole.

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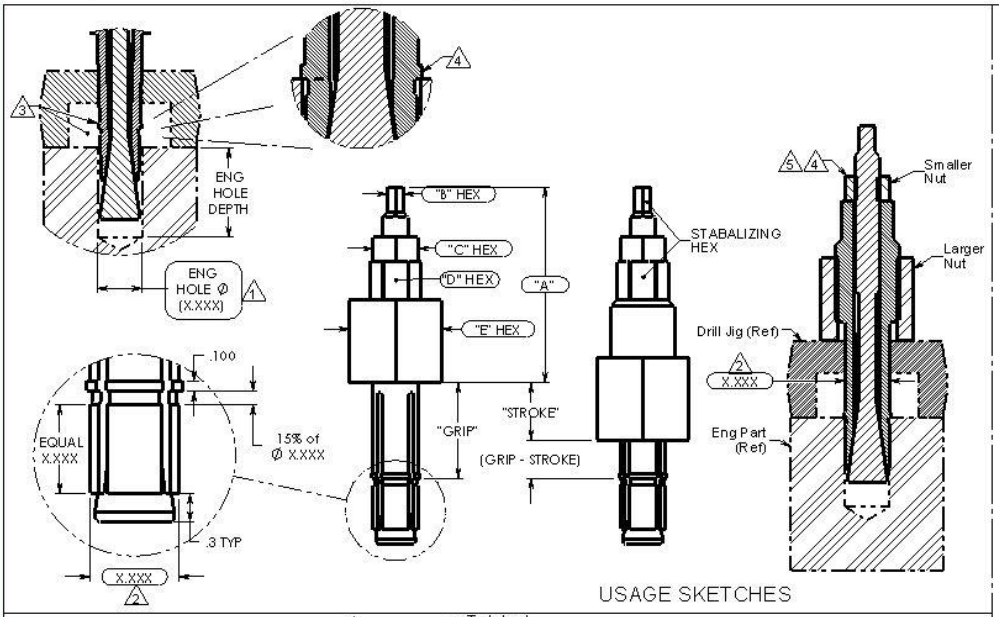
Blind-Hole Fastener

Specialty Fasteners

SLDWKS | CENTRIX - PRODUCT SHEET

REV: A: 03/31/2008



USAGE SKETCHES

Table I
CROSS REFERENCE TABLE

smallest "MAX" Grip callouts allowed	Standard Stroke	"MIN" Grip (Ref)	Nominal Hole Size	Standard Variance: MIN Hole Diam Callout Range	"A" Dimension (Body Length)	"B" Dimension (Hex)	"C" Dimension (Expansion Hex)	"D" Dimension (Hex)	"E" Dimension (Clamp Hex)
--	--	–	1/4	--	--	--	--	--	--
--	--	–	5/16	--	--	--	--	--	--
--	--	–	3/8	--	--	--	--	--	--
--	--	–	7/16	--	--	--	--	--	--
1.25	1.125	.125	30/64	.474--.494	3.2	1/4	9/16	1/2	1 7/16
--	--	–	1/2	--	--	--	--	--	--
--	--	–	9/16	--	--	--	--	--	--
1.375	1.125	.25	5/8	.605--.645	3.1	1/4	11/16	1/2	1 7/16
1.625	1.125	.5	3/4	.730--.770	3.9	5/16	7/8	7/8	1 13/16
1.875	1.125	.75	13/16	.792--.832	3.9	5/16	7/8	7/8	1 13/16
1.875	1.125	.75	27/32	.833--.863	3.9	5/16	7/8	7/8	1 13/16
1.875	1.125	.75	7/8	.850--.900	3.9	5/16	7/8	7/8	1 13/16
2.125	1.125	1.0	1.0	.970--1.030	4.0	3/8	1 1/16	7/8	1 13/16
--	--	–	1 1/8	--	--	--	--	--	--

FUNCTION OF TOOL:

=> USED TO TEMPORARILY CLAMP & ALIGN DRILL JIG TO PRODUCTION PART VIA BLIND HOLE.
=> USED TO CLAMP AND ALIGN PRODUCTION PART STACKS VIA BLIND HOLE.

TOOL ORDERING CODE:

BSCL - X.XXX - X.X
- GRIP (in inches)
- DIAMETER (in thousands) 1 2
- BASIC PART NUMBER

1. Use lower Spec. Limit (LSL) when ordering. For example: If engineering calls out a hole diameter of Ø0.498 to Ø0.505, then callout X.XXX as 0.498
2. Tool diameter (X.XXX) is manufactured 0.001 to 0.002 less than X.XXX callout. For example: if X.XXX is called out as 0.498, the tool's manufactured diameter is Ø0.497 to Ø0.496
3. With tool in relaxed state (smaller nut is not tight and fingers of collet are closed), insert though drill jig so that fingers are in chip clearance area.
4. After tool is inserted through jig, partially expand tool (partially tighten smaller nut) to enable possitive location against edge of hole.
5. Fully tighten smaller nut to lock tool into hole.
6. Fully tighten larger nut to clamp jig to engineering structure.
7. Not all sized designed - for requests not shown in table, call with request for engineering support.

EXAMPLE TOOL CODE:

BSCL-0.845-4.5

=> LSL for engineering hole diamter is 0.845
=>Tool will apply clamp to stack heights between 4.5 inch thick and 3.38 inch thick.
=> Tool manufacted diameter will be between Ø0.844 to Ø0.843

TOLERANCE .XXX ±.005 .XX ±.02 &2°

SHEET 1 OF 1
Ordering form and usage sheet

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BSCL - XXX - X.X

Temporary fastener for blind holes

SCALE: 1:2 & NOTED

MACHINING NOTES:
√64 Surface finish or better
Break sharp edges and corner unless otherwise stated.

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Adapter for Battery Powered Tools

Adapters

- Connects directly to electric torque source.
- Holds the hex key in place magnetically.
- Will work with multiple sizes of temporary fasteners through the use of multiple quick connect sockets.
- Can be made to fit any type of torque source.

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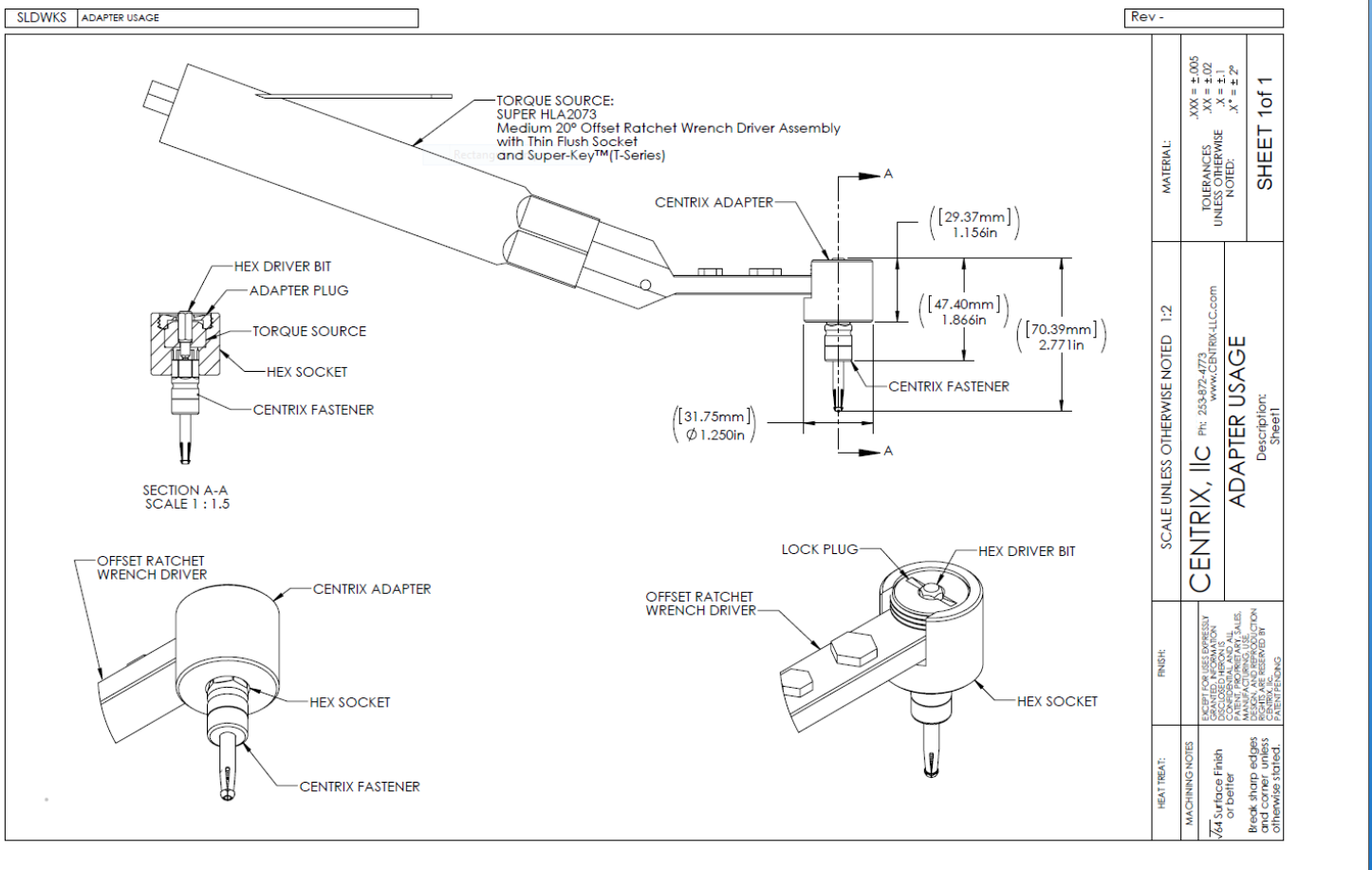
Adapters

Offset Adapter

- Complete Low Profile Installation Solution.
- Connects to electric torque source.
- Transfers 100% of torque from the torque source to the fastener.



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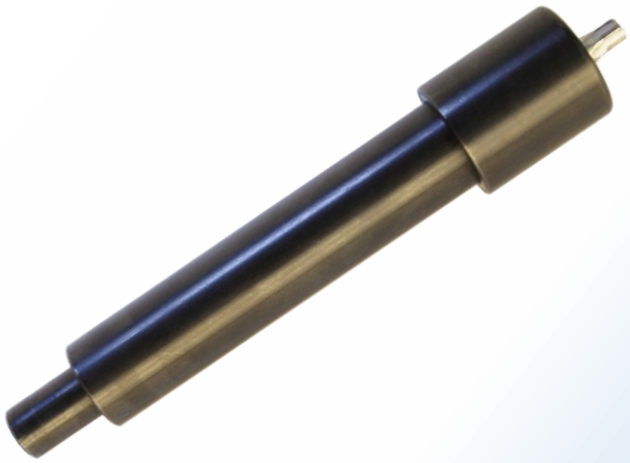
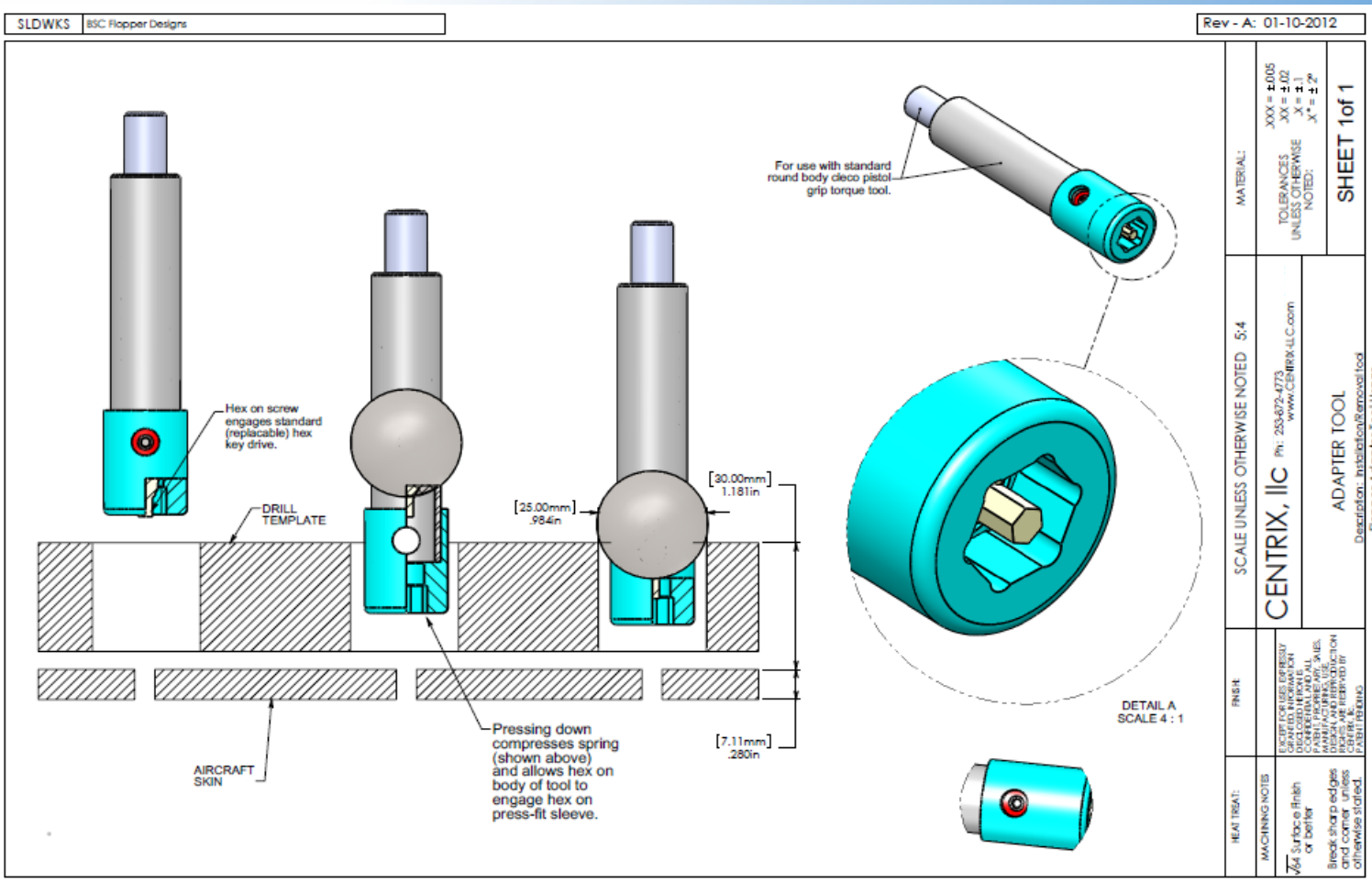
Adapters

Pneumatic Torque Source Adapters

Dedicated & Non-Dedicated



- Connects to standard pneumatic Cleco torque source.
- For use with Unrestricted Tack Fastener, robot driven fasteners under .313", and Flush Head fastener.
- Connects to nose piece of Cleco gun or directly threads onto the Cleco torque source.



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Adapters

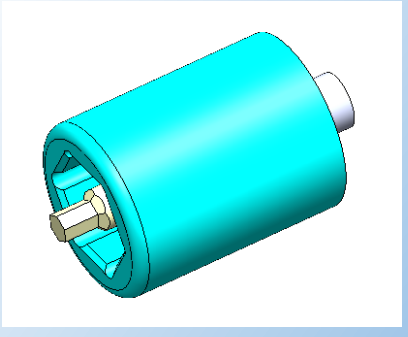
Pneumatic Torque Source Adapters
Dedicated & Non-Dedicated

Non-Dedicated Installation Adapter

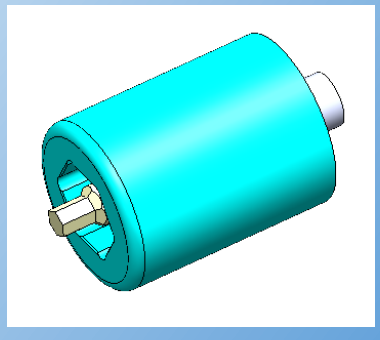
Pneumatic Cleco
Torque Source

Dedicated Installation Adapter

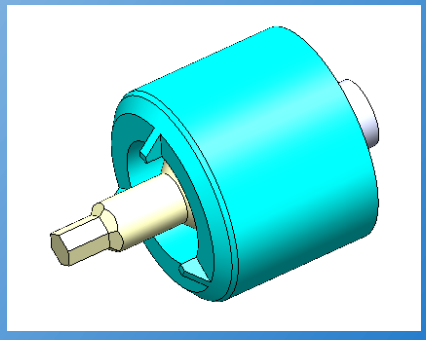
Hex Body Fastener



Unrestricted Fastener



Flush Head Fastener



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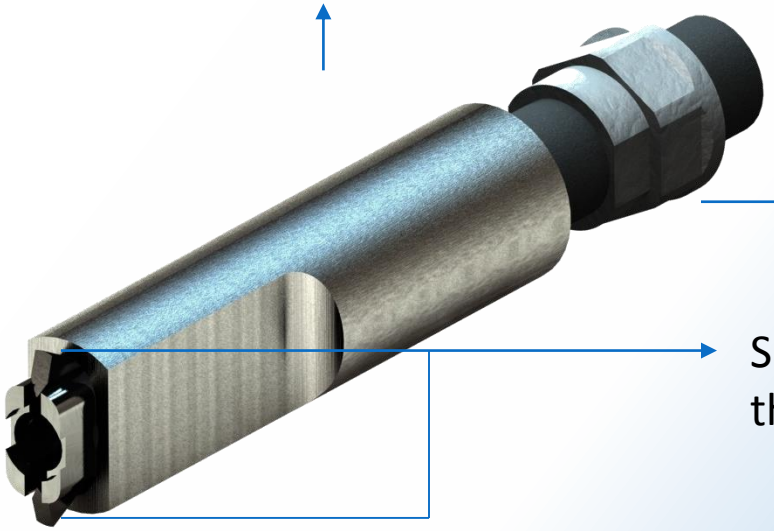
Lock-Bolt Collar Splitter

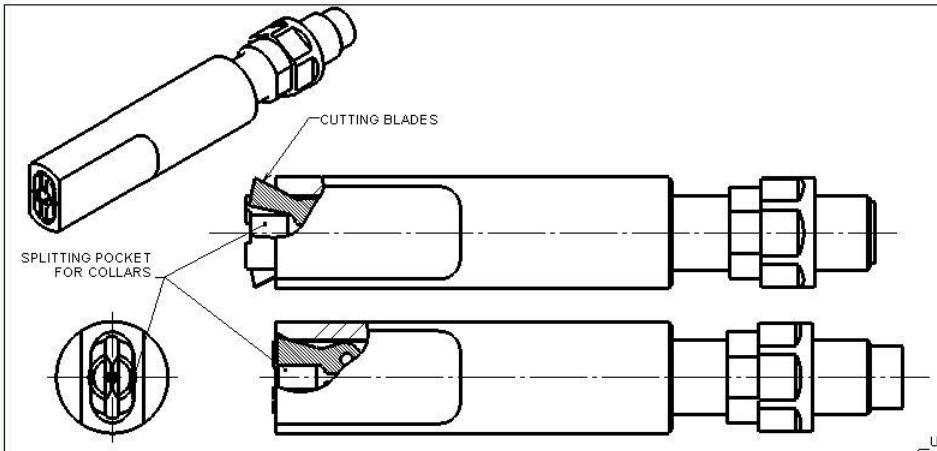
Specialty Tools



Works with standard installation tools. Threaded adjustment allows for easy compensation of blade wear.

Splits all collar materials. Easily replace the blades or re-sharpen while in place

SLDWKS | Centrix-CS-1 ORDERING FORM AND INSTRUCTIONS | Rev - B: 11-05-2008

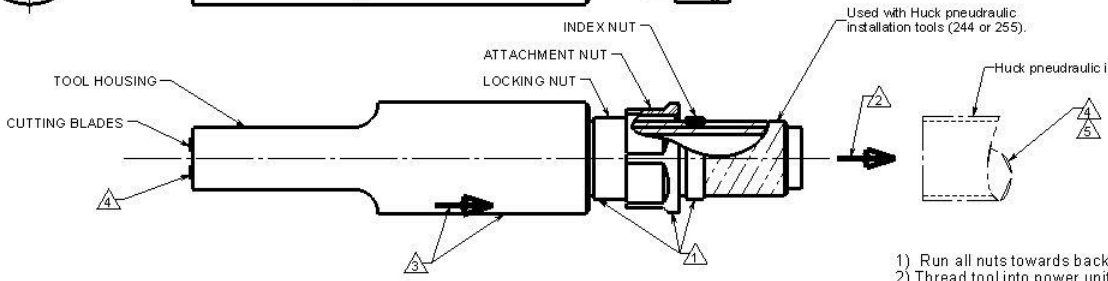


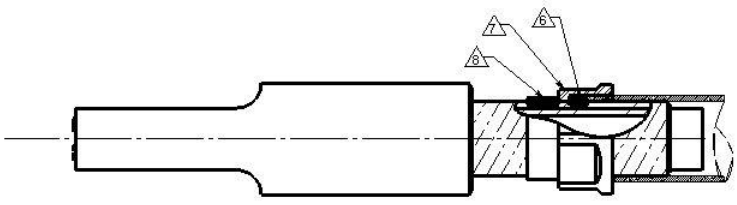
FUNCTION OF TOOL:
=> USED TO REMOVE LOCK BOLTS

TOOL ORDERING CODE:

CS-1-X
└ BASIC PART NUMBER. SEE TABLE BELOW.

BASIC PART NUMBER	SIZE OF COLLAR	CP PULLING TOOL	REPLACEMENT BLADES
-5	5/32	-244	BL-5
-5A	5/32	-245 & -255	BL-5
-6	3/16	-244	BL-6
-6A	3/16	-245 & -255	BL-6
-8	1/4	-244	BL-8
-8A	1/4	-245 & -255	BL-8
-10	5/16	-245 & -255	BL-10
-12	3/8	-245 & -255	BL-12





1) Run all nuts towards back of threads.
2) Thread tool into power unit Aproximatly 5 full revolutions (5 threads).
3) Insure tool housing is slid towards power unit as far as possible.
4) Pull trigger on power unit and check location of cutting blades. Cutting blades should be nearly flush with tool housing - to adjust, release trigger on power unit, re-visit step 3 above, and slightly thread tool into-or-out of power unit. Pull trigger and re-check cutting blades. Repeat as necessary.
5) Revisit step 3 above, then pull trigger on power unit.
6) Thread index nut until it contacts power unit.
7) Slide attachment nut forward and thread into power unit. Lightly tighten attachment nut.
8) Thread locking nut and tighten against attachment nut.

MATERIAL: SEE DETAIL PARTS
TOLERANCES UNLESS OTHERWISE NOTED: .XXX = ±.005 .XX = ±.02 .X = ±1 .X° = ±2°
SHEET 1 of 1
SCALE UNLESS OTHERWISE NOTED 1:1
CENTRIX, llc Ph: 253-872-4773 www.CENTRIX-LLC.com
CS-1-X
Description: SPLITS COLLARS
CS1
FINISH: SEE DETAIL PARTS
HEAT TREAT: SEE DETAIL PARTS
MACHINING NOTES
64 Surface finish or better
Break sharp edges and corner unless otherwise stated.

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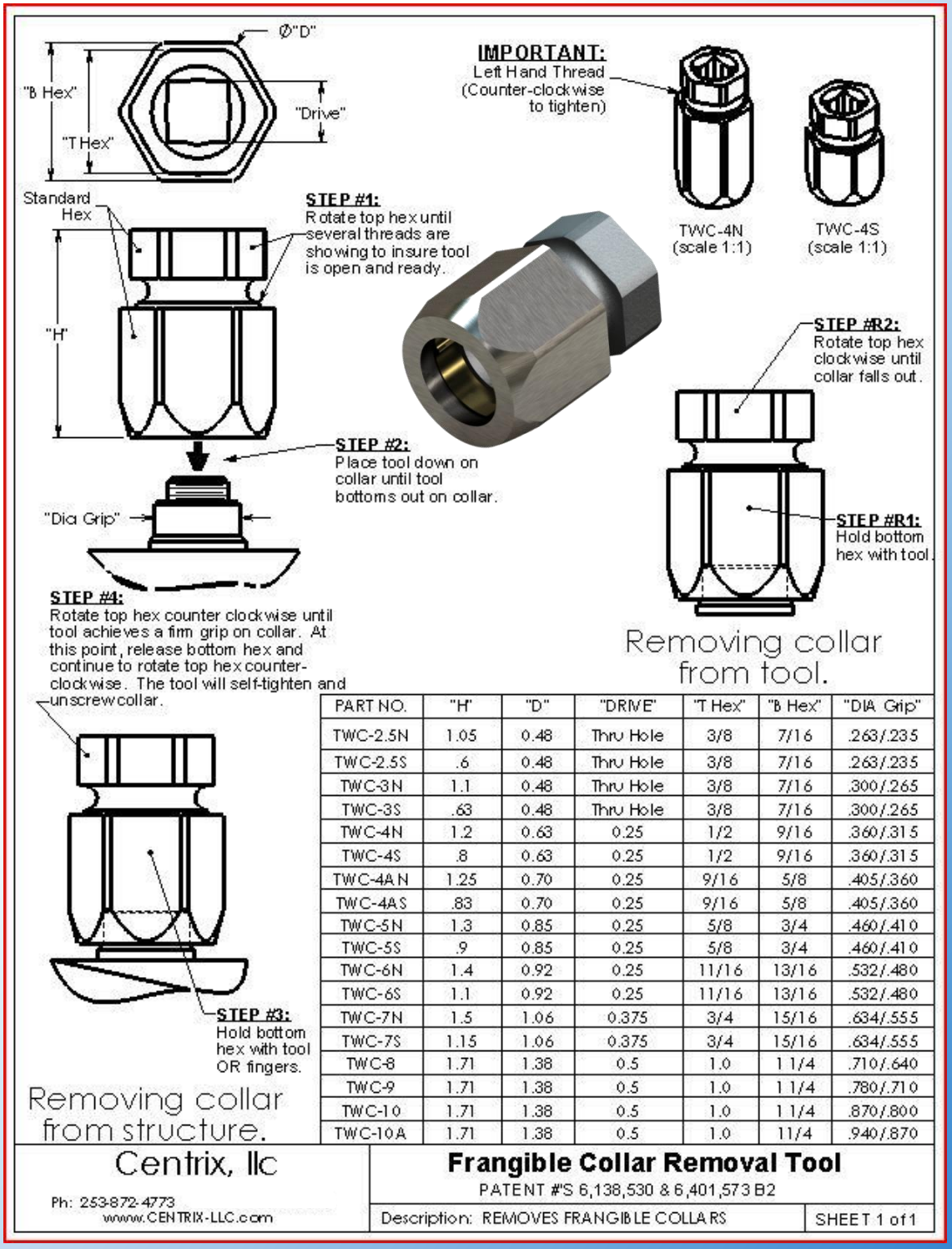
Frangible Collar Removal Tool

Specialty Tools



PART NO.	"H"	"D"	"DRIVE"	"T Hex"	"B Hex"	"DIA Grip"
TWC-2.5N	1.05	0.48	Thru Hole	3/8	7/16	.263/.235
TWC-2.5S	.6	0.48	Thru Hole	3/8	7/16	.263/.235
TWC-3N	1.1	0.48	Thru Hole	3/8	7/16	.300/.265
TWC-3S	.63	0.48	Thru Hole	3/8	7/16	.300/.265
TWC-4N	1.2	0.63	0.25	1/2	9/16	.360/.315
TWC-4S	.8	0.63	0.25	1/2	9/16	.360/.315
TWC-4AN	1.25	0.70	0.25	9/16	5/8	.405/.360
TWC-4AS	.83	0.70	0.25	9/16	5/8	.405/.360
TWC-5N	1.3	0.85	0.25	5/8	3/4	.460/.410
TWC-5S	.9	0.85	0.25	5/8	3/4	.460/.410
TWC-6N	1.4	0.92	0.25	11/16	13/16	.532/.480
TWC-6S	1.1	0.92	0.25	11/16	13/16	.532/.480
TWC-7N	1.5	1.06	0.375	3/4	15/16	.634/.555
TWC-7S	1.15	1.06	0.375	3/4	15/16	.634/.555
TWC-8	1.71	1.38	0.5	1.0	1 1/4	.710/.640
TWC-9	1.71	1.38	0.5	1.0	1 1/4	.780/.710
TWC-10	1.71	1.38	0.5	1.0	1 1/4	.870/.800
TWC-10A	1.71	1.38	0.5	1.0	1 1/4	.940/.870

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Frangible Collar Removal Tool
PATENT #'S 6,138,530 & 6,401,573 B2
Description: REMOVES FRANGIBLE COLLARS
SHEET 1 of 1

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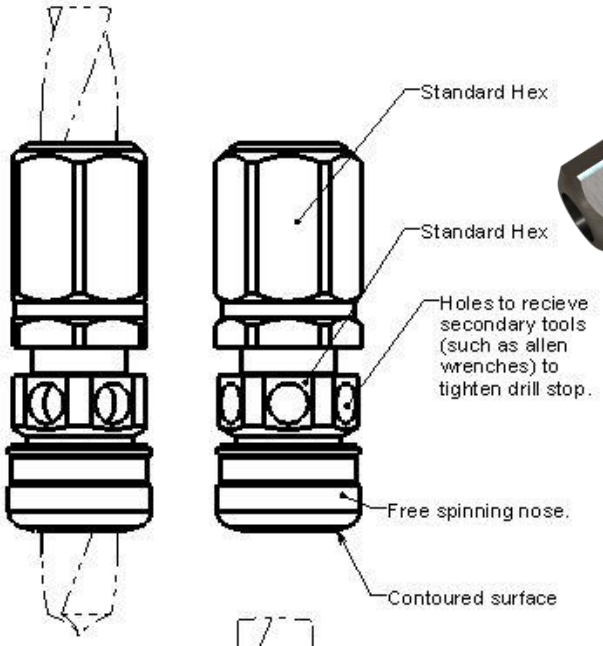
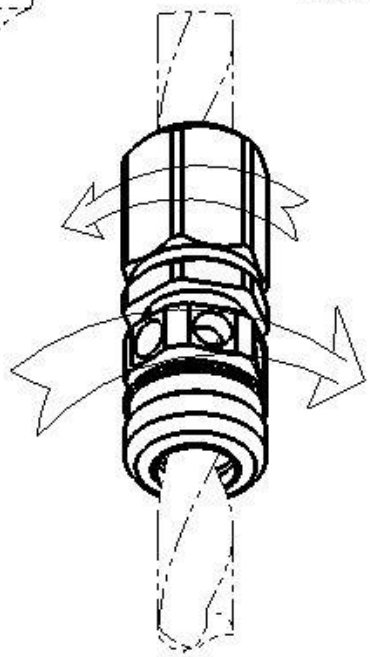
Drill-Stop Bushing

Specialty Tools



ADL-8
(scale 1:1)



TIGHTEN TOOL
(loosen tool - turn opposite of arrows)

- Grips tightly to any part of drill bit for a true "Hard Stop". Small tool size allows use in most areas.
- Free spinning nose acts as a bearing between tool and structure to prevent damage to structure.
- Internal non-metalic, low friction bushing doesn't need lubrication. Doesn't jam or bind from chips.
- Easy to use - finger tighten at desired depth. If needed, use common tools such as allen wrenches or pliers to snug tool down.

PART#	GRIP DIAMETERS (millimeters)	GRIP DIAMETERS (inches)
ADL-3	2.8 -- 2.5	0.115--0.098
ADL-4	3.3 -- 2.9	0.130--0.115
ADL-4L	3.6 -- 3.3	0.145--0.130
ADL-5	4.1 -- 3.7	0.165--0.146
ADL-5L	4.6 -- 4.2	0.180--0.165
ADL-6	5.0 -- 4.3	0.197--0.170
ADL-6L	5.5 -- 5.0	0.217--0.197
ADL-7	6.0 -- 5.3	0.237--0.210
ADL-8	6.7 -- 6.1	0.267--0.237
ADL-9	7.5 -- 6.8	0.295--0.265
ADL-10	8.2 -- 7.5	0.325--0.295
ADL-11	8.9 -- 8.3	0.350--0.325
ADL-12	9.7 -- 8.9	0.380--0.350

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DRILL STOP
PATENT # 6,401,573 B2

Description: Limits drilling depth. Part # Reference SHEET 1 of 1