ToolQuest
Innovative Tools for Woodworkers

WoodAnchor™

Adjustable Fixturing System Instructions

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Introduction

WoodAnchor™ sliding nuts enable heavy-duty adjustable fixturing for woodworkers, using fixturing slots milled directly into wooden jigs, fixtures, and worktops. No metal T-track is required. Fixturing slots are easily milled with the WoodAnchor router bit, and intersections are automatically created anywhere that two slots cross.

A WoodAnchor sliding nut and fixturing slot

WoodAnchor sliding nuts are compatible with any ¼”-20 threaded fasteners. For your convenience, ToolQuest offers a range of fasteners that are ideal for implementing standard configurations. WoodAnchor system components covered in this document include:

Part Number	Component Description
WA-32	WoodAnchor sliding nut
RB0141	WoodAnchor fixturing-slot router bit
FS0110-1.125	Load-distribution washer, 1-1/8” OD x 1/8” thick, stainless steel
FS0111-x.xxx	Button-head screw, 1/4"-20, x.xxx" long, stainless steel
FS0112	Clamp-base washer, 2-3/16” OD x 0.060” thick, stainless steel
FS0113-1.250	Threaded stud, 1/4"-20, 1.250" long
FS0114-x.xxx	Ergonomic clamp knob, 1/4-20 male, 1.58" OD, x.xxx" long stud

Part Number	Component Description
FS0115	Ergonomic clamp knob, 1/4-20 female, 1.58" OD
FS0116-1/32	Fixturing-slot washer, 15/32” OD, 1/32” thick, stainless steel
FS0116-1/16	Fixturing-slot washer, 15/32” OD, 1/16” thick, stainless steel
FS0118-0.500	WoodAnchor alignment pin, 3/32” OD, 0.5" long, stainless steel
FS0120-0.625	General purpose washer, 5/8” OD, stainless steel

Note: Parts with “x.xxx” in the part number are available in multiple part lengths.

Theory of operation

Ordinary T-slot fasteners are designed to be used in metal T-track. When used in wooden T-slots, their small heads will crush wood-based materials long before the fastener reaches its design load. As for dovetail nuts, their steep wedge shape can jam the nut and/or distort the fixture under even modest clamping forces.

The clamping surfaces of WoodAnchor™ sliding nuts are more than three times as large as those of conventional T-slot fasteners. This greatly reduces the pressure on the fixture material. To further improve available workholding force, the clamping surfaces of WoodAnchor sliding nuts are designed with an 18° taper angle. This increases strength without increasing fixturing-slot depth, and without causing wedging or fixture distortion.

For fixturing slots milled in typical hardwoods, WoodAnchor sliding nuts can safely be used at their full rated working load of 500 lb. Even in softwoods, sliding-nut loads of several hundred pounds can be used without crushing the slot.

CAUTION: WoodAnchor sliding nuts are designed for clamping in one direction only. Do not apply reverse screw loads that could extract the brass threaded insert from the bottom of the sliding-nut body.

Clamping configurations

Fixed-height clamping

Either screws or male clamping knobs may be used to securely fasten fixed-height components anywhere along the length of a fixturing slot. Each fastener type has certain advantages.

- Clamp knobs provide tool-free operation, which can be desirable for frequently adjusted components.
- Screw heads have a lower profile. In fact, they can be typically be recessed completely into the clamped component, if desired. Screws are also more economical, enable higher clamping forces, and are available in a greater selection of standard lengths.

A fixed-height clamping assembly, with a male clamp knob

When clamping a wooden fixture component, use a load-distribution washer beneath the clamp screw or knob. A washer of at least 7/8” in diameter is required to equal the clamping-surface area of a WoodAnchor sliding nut. Typical fender washers are too thin for the job, and will deform into a cone shape under high clamping forces. WoodAnchor FS0110-1.125 load-distribution washers are 1-1/8” in diameter and a full 1/8” thick, providing maximum protection to wooden fixture surfaces.

Threaded posts

Some fixtures, most notably hold-down clamps, require an adjustable fastener length in order to accommodate a range of workpiece thicknesses. A WoodAnchor sliding nut plus a threaded stud creates a threaded post that is ideal for these applications.

Freely sliding posts

To configure a freely-sliding threaded post, thread a jam nut onto one end of the threaded stud, add a WoodAnchor fixturing-slot washer, and then thread that same end of the stud into the sliding nut. A WoodAnchor fixturing slot serves as a handy "wrench" for holding the sliding nut while tightening the jam nut, and also serves as a maximum-depth gauge for the threaded stud. Alternatively, the threaded stud may be permanently assembled to the sliding nut by applying a thread-locking adhesive.

A freely sliding threaded-post assembly

Fixed mounting posts

To configure a heavy-duty fixed mounting post for hold-down clamps, thread a jam nut onto one end of the threaded stud, add a 2-3/16" diameter WoodAnchor clamp-base washer, and then thread that same end of the stud into the sliding nut. Slide the assembly to any desired position along a fixturing slot, and then tighten the jam nut to lock the post rigidly into position.

A fixed threaded-post assembly

A female clamp knob is ideal for actuating hold-down clamps, but a ¼-20 hex nut and washer can also be used. Under heavy clamping loads, the clamp-base washer prevents the heel of the hold-down clamp from denting the fixture base.

A knee-style hold-down clamp with a 2-1/2" threaded post

For taller workpieces, some hold-down clamps may be reversed and used with a 4" threaded stud. In this configuration, replace the 2-3/16" diameter clamp-base washer with a 1-1/8" load distribution. Due to the shorter

reach of the reversed hold-down clamp, a clamp-base washer may interfere with the workpiece.

A knee-style hold-down clamp with a 4” threaded post

Headed-fastener lengths

Headed fasteners such as screws and male clamp knobs are typically used for fixed-height clamping. For full-load capability, there must be a minimum of 4 fastener threads engaged in the WoodAnchor sliding nut. This dictates the minimum length of the fastener. The fastener also must not thread completely through the nut and hit the bottom of the fixturing slot. This dictates the maximum length of fastener. A “suitable fastener length” may be anywhere between the minimum and maximum lengths.

Typical applications

The following table provides suitable headed-fastener lengths for typical applications, when using a 1/8” thick load-distribution washer. If using the load-distribution washer alone as a low-profile stop, the fixture thickness is zero. Fastener lengths are measured from the underside of the head.

If fastener lengths on odd 1/8" intervals are not readily available, simply choose the next-longer 1/4”-interval fastener. Then use an extra 1/8" thick washer beneath the fastener head to compensate.

Suitable Headed-Fastener Lengths (in.)		Fixturing-slot depth (in.)		
		0.438	0.500	0.625
Fixture Thickness (in.)	0.000	0.500	0.500	0.625
	0.125	0.625	0.625	0.750
	0.250	0.750	0.750	0.875
	0.375	0.875	0.875	1.000
	0.500	1.000	1.000	1.125
	0.625	1.125	1.125	1.250
	0.750	1.250	1.250	1.375
	0.875	1.375	1.375	1.500
	1.000	1.500	1.500	1.625

Special applications

For special applications not addressed in the fastener-length chart, use the procedure below to determine a suitable fastener length.

Step #1: Determine the maximum fastener length:

- Option 1: Add the load-distribution washer thickness, the mounted-component thickness (less any counterbore depth), and the fixturing-slot depth. Then subtract 1/32” (0.031”) for slot bottom clearance.
- Option 2: Skip the math, and simply measure the distance from the top of the load-distribution washer to the bottom of the sliding nut.

Step #2: Determine the minimum fastener length:

- Subtract 1/8” (0.125”) from the maximum fastener length.

Step #3: Implement a suitable fastener length:

- Option 1: Round the maximum fastener length down to the nearest 1/8”, and use a standard fastener of that length.
- Option 2: Counterbore the mounting hole such that a readily available fastener length is suitable.
- Option 3: Use a longer fastener, but add washers beneath the fastener head to compensate.
- Option 4: Cut or grind a longer fastener to a suitable length.

WoodAnchor alignment pins

Overview

Removable fixture components that are mounted with ordinary T-nuts or T-bolts can be inconvenient to install, especially when the component blocks your view of the T-slot. Conventional fastener heads are free to rotate, so you must manually rotate each one into alignment with the T-slot before it can slide in.

WoodAnchor sliding nuts are designed to eliminate that hassle, by installing a simple alignment pin in the fixture component. The alignment pin then mates with a clearance hole in the WoodAnchor sliding nut. This ensures that the nut always oriented in the proper direction, greatly speeding fixture assembly.

A cutaway view showing a sliding-nut alignment pin

Installing alignment pins

Step 1: Insert a ¼"-20 fastener through the fixture component, and thread on a WoodAnchor sliding nut such that the bottom of the nut is against the component. (The alignment-pin clearance holes are slightly tapered, with the smaller end of the hole at the bottom of the nut, so an upside-down sliding nut offers the most accurate alignment-pin location.)

Step 2: Align the sliding nut to the fixture component, and then gently clamp it in place with the threaded fastener. *Do not over-torque the fastener, as this could extract the threaded insert from the bottom of the sliding nut.*

Step 3: Drill a 3/32" diameter pin-mounting hole ¼" deep into the fixture component.

- Option 1: Place a 3/32" transfer punch through one of the sliding nut's alignment-pin holes, and tap it with a small hammer to mark the hole location. Then remove the nut, and drill the pin-mounting hole with a drill press.
- Option 2: Drill the pin-mounting hole with the sliding nut clamped in place, using one of its alignment-pin clearance holes as a drill-bit guide.

Step 4: Remove the sliding nut from the fixture component. Hold the alignment pin with needle-nose pliers, align it with the pin-mounting hole, and tap it into the hole with a small hammer. The tapping sound will change noticeably when the pin is fully seated.

Step 5: The alignment pin will typically have a tight friction fit in the wooden fixture. If it doesn't, remove it, add a drop of glue to the hole, and reinstall the pin.

Linear slides

WoodAnchor sliding nuts can also be used to attach sliding fixture components. To create a linear slide, place one or more WoodAnchor fixture-slot washers between the sliding nut and the fixture component. The washers fit within the slot, directly atop the sliding nut, and are available in both 1/16" and 1/32" thicknesses. Make sure that the washer stack is thick enough to prevent the sliding nut from clamping to the fixturing slot when the threaded fastener is tightened.

To ensure that the sliding nuts do not rotate and bind in the fixturing slot when the threaded fastener is tightened, alignment pins should be installed for all linear-slide applications.

A linear slide assembly, using a fixture-slot washer only

Unless the sliding fixture component is made of a hard material, a larger washer should be installed atop the fixture-slot washers. This prevents them from forming a dent in the sliding component, which would affect the sliding clearance. A 5/8" diameter general-purpose washer is suitable for this purpose, and will not interfere with the alignment pins. If desired, the larger washer may be recessed flush with the bottom of the fixture component, to minimize the sliding clearance.

Slide assembly with general-purpose washer added

WoodAnchor fixturing slots

Material selection

Most materials typically used for shop-made jigs and fixtures work well for WoodAnchor fixturing slots. Almost any hardwood can be used at full rated sliding-nut load. High-quality hardwood plywood is another good material choice. In ultimate-strength testing, Baltic Birch plywood performed almost as well as solid red oak. Even SPF softwood construction lumber performed adequately when tested with a 500 lb. load in a minimum-depth fixturing slot.

MDF, in contrast, is not suitable for certain WoodAnchor fixturing-slot applications. Pulling on MDF in a direction perpendicular to the sheet surface will separate the internal wood-fiber layers at relatively low forces. MDF fixturing slots are therefore unsuitable for anchoring hold-down clamps and the like. However, MDF does have relatively good compression strength and shear strength. WoodAnchor fixturing slots in MDF are suitable for applications such as mounting stop blocks, where a flat-bottomed component is mounted directly against the fixturing slot, and the component does not pull outward on the fixturing slot.

CAUTION: Do not apply large upward-pulling loads to MDF fixturing slots.

A suitable clamping configuration for fixturing slots in MDF

For additional information on fixturing-slot material selection, see application note AN-0130, *WoodAnchor Fixturing-Slot Strength*.

Fixturing-slot depth

For adequate clearance between the top of a WoodAnchor sliding-nut and a flat clamped object, the minimum WoodAnchor fixturing-slot depth is 7/16". This depth provides sufficient strength for slots milled in hardwoods, and is shallow enough to be milled in ¾" thick material.

To increase the material-strength safety margin for softwoods, a fixturing-slot depth of 5/8” is preferred. In tests using SPF construction lumber, the ultimate strength of a 5/8” deep fixturing slot was more than twice that of a 7/16” deep slot.

Distance from fixture edges

For adequate fixturing-slot strength, sufficient material is required between the slot and the edge of the fixture component. Suggested minimum distances from the slot centerline to the edge of the fixture are as follows:

- Hardwood: 1”
- Softwood: 1-1/4”
- MDF: 1-1/2”

Milling WoodAnchor fixturing slots

WoodAnchor fixturing slots are milled to final shape with a WoodAnchor fixturing-slot router bit. The router must have a ½” collet, and must be capable of routing at 18,000 RPM or less. For safety and accuracy, the router must be guided while milling the slot. When milling intersecting slots, best results are obtained by milling the cross-grain slots first.

A WoodAnchor RB0141 fixturing-slot router bit

Step 1: For ease of routing, first mill a rectangular starter groove centered on the desired fixturing-slot location. The recommended groove width is 3/8” to 7/16”. The recommended groove depth is 1/16” less than the desired fixturing-slot depth. The chip-clearance groove can be milled with a straight router bit, with a dado blade, or with multiple passes of an ordinary saw blade. Note that a starter groove is not strictly necessary if using a machine-mounted router with adequate power and rigidity.

Step 2: Set up a router guide. A router table with a fence is ideal for smaller workpieces. For large workpieces, a handheld router may be used in combination with either an edge guide or a clamped-on fence or guide rail.

Step 3: Install the WoodAnchor fixturing-slot bit in your router, and set the router speed to 18,000 RPM or less.

Step 4: Set the router depth of cut to the desired fixturing-slot depth.

Step 5: Mill the WoodAnchor fixturing slot to final dimensions in a single routing pass.

WARNING: Do not attempt to free-hand route a WoodAnchor fixturing-slot.

Recommended tools

A 5/32” T-handle hex wrench is ideal for tightening ¼”-20 button-head clamp screws. If you keep a T-handle wrench handy, button-head clamp screws are almost as convenient as clamp knobs, and are much less expensive. High-quality T-handle hex wrenches are also inexpensive, so it may make sense to dedicate one to your WoodAnchor jigs and fixtures.

A 7/16” combination wrench is the best tool for locking ¼”-20 jam nuts on threaded posts. A “stubby” (short) wrench is ideal, as it fits into tight spaces and helps prevent over-torquing of the fasteners. This is also an inexpensive tool, so again you may wish to dedicate one to your WoodAnchor fasteners.

An F size (0.257”) drill bit is recommended for drilling clearance holes for ¼”-20 fasteners. The extra 0.007” of diameter provides just enough clearance for your fasteners to slide freely in the hole.

Specifications

Patent Pending

WoodAnchor sliding nut

Body

- Length: 1-1/4” (32 mm)
- Width: 1-5/64” (27.4 mm)
- Height: 3/8” (9.5 mm)
- Material: glass-fiber reinforced, engineering-grade thermoplastic
- Maximum working load: 500 lb.
- Ultimate strength: 2,000 lb.

Warning: WoodAnchor sliding nuts are not rated for lifting.

Caution: Using WoodAnchor sliding nuts above their rated working load may cause premature failure.

Threaded insert

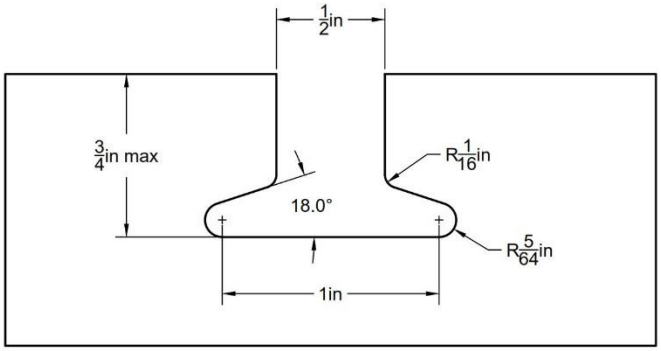
- Fastener size: ¼”-20
- Material: brass

Alignment pin holes

- For pin diameter: 3/32” (2.4 mm)
- Center distance from mounting screw: 25/64” (10 mm)

WoodAnchor fixturing slot

- Dimensions: see profile drawing
- Minimum depth: 7/16” (11 mm)



WoodAnchor Fixturing-Slot Profile

WoodAnchor fixturing-slot router bit {RB0141}

- Shank size: ½” (12.7 mm)
- Maximum speed: 18,000 RPM
- Maximum depth of cut: ¾” (19 mm)