

Taper Lock Tooling System

Taper Lock Tooling and For Drilling, Reaming, Countersinking, Tolerancing,

THE TAPER LOCK STORY and HELPFUL TIPS

The Taper Lock Fastener System builds structures together and simultaneously adds greatly to their fatigue life. Taper Lock is a complete system of tapered drills, tapered fasteners and tapered gauges.

Taper Lock Fastener holes can be accomplished quickly with a high degree of accuracy, confidence and security.

It is essential that the Taper Lock System be accompanied by excellent craftsmanship. Regardless of the higher degree of accuracy, engineering and quality, the ultimate result depends on who builds the product.

The Taper Lock System has its own built-in quality controls. Reasonable care installations will ensure proud finished products. By following this exceptional system, each conscientious craftsman will receive great satisfaction knowing that each Fastener has been installed accurately. The obvious results obtained from excellence is gratification.



Taper Locks have changed the equations in structural life computations. These Fasteners and Systems are composed of tapered conical shank fasteners. Tapered precision holes, together with preloads and interference are all uniformly controlled.

The advancement of the interference fit effectively impacts preload. Radial compression, static preload and peripheral tension, effectively reduce stress and

proportionately improve fatigue life.

The high performance of Taper Lock Fasteners will continually provide structural integrity in existing and future designed vehicles and products.

The term *Taper Lock* is derived from the fact that this tapered fastener is self-locking. When the tapered fastener is inserted into a correctly tapered hole, the interference fit secures the fastener and locks it. This prohibits it from turning, eliminating wrenches, other types of holding and special costly operations.

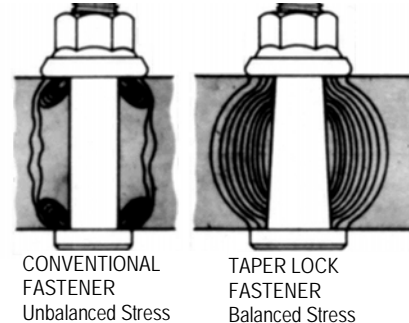
Taper Lock Fasteners have accurately ground

precision shanks inserted with a mating precision tapered hole and a mating Washernut® assembly. A washer and free turning nut make up the assembly that provides automatic washer centering. The "Washer Nut" is extremely strong. The washer is captured to the nut while allowing the nut to turn freely. These features eliminate the loss of washers or handling inventory and installations. Fumbling is eliminated.

Taper Lock's superiority is its controlled interference fit. Preload is induced at the wall of the hole and progresses through the material, diminishing to zero at some distance from the hole's edge.

Regular Fasteners must be driven or pressed the full length of the hole when attempting interference fits. This procedure forces the walls outward, tending to promote seizure, galling, plating damage and broaching the hole. The result is non-uniform preloading. This action creates areas of concentrated and near zero stress. Thus the fastener purpose is defeated.

The Taper Lock Fastener fits freely into the greatest portion of the hole and need travel only a short distance to become full interference, uniformly preloading as the walls expand. This provides longer wear and greater strength. This allows Taper



Locks to be removed without damage to the fastener or the hole.

Taper Lock's superior joint strength occurs through even load distribution and requires fewer fasteners. Closer hole spacing than other conventional fasteners is allowed. Nut height is reduced allowing greater wrenching freedom in inaccessible or tight places.

Two types of Taper Lock Fasteners exist—threaded and non-threaded. All threaded fasteners use the mating Washernut®.

Taper Lock Fasteners are available in grip lengths of 1/16 or 1/32 increments. Charts are provided by fastener manufacturers for the ranges of thickness for

The Taper Lock System

Depth Control, Guiding, Gauging & Fastener Installations

Taper Lock
Drilling System

each grip length.

The **100° Flush Head type fasteners** are measured from the top of the head to the end of the full conical portion of the shank. The **Protruding Head type fasteners** are measured from under the head to the end of the conical shank.

The **Taper Lock Drilling System** has many qualified positive feed power and motor drilling units available. Quackenbush provides In Line, Right Angle and Self Colleting tools. They compete favorably for business with Cooper Tools, Rockwell, Buckeye, Gardner Denver, Peck Drill, Doler, Dotco, Chicago Pneumatic and Winslow Spacematic products.

Quackenbush offers Q-Matic to Spacematic customers. Quackenbush has gained fairly broad acceptance for use with drilling Taper Lock holes. *UNITED's Helox® Shelox®* and Nurlock Adapter Systems complement Quackenbush Positive Feed Motors. *Helox® Shelox®* assures the user drilling accuracy and precision depth control with total SPC Gauging for Taper Lock drilling and installation.



UNITED Taper Lock Tooling Components adapt to Spacematic, Quackenbush, Chicago Pneumatic, Rockwell, Cooper, Keller, Buckeye, Dotco, Doler, and Gardner Denver drill motors.

UNITED's Helox® Shelox® Depth Control and Sensor System designed for space saving drilling on irregular or contoured surfaces. *Helox® Shelox®* also adapts to these motors accurately guiding and directing cutters, coolant and controls to assure safe, secure and accurate Taper Lock drilling and fastener installation.



The **Spacematic**, a fast positive feed motor, is air operated with depth control. It requires ample operating room, but does not require pilot holes. Details are available in this section.

Chicago Pneumatic Power Motors are small air operated units and have maximum capability of 3/16

group 3 Taper Lock holes. These units can be used with *UNITED's* Micro Controlled Countersink Super Stops, also in this section. The Chicago Pneumatic Unit operates at 15000 r.p.m. Pilot holes are required for reaming.

Buckeye Power Units are medium size and air operated. Their units operate at 500 r.p.m. or more. Use *UNITED's* Micro Controlled Countersink Super Stop with Buckeye. They are shown in this section

Taper Lock Coolant and Cutting Fluids were explained by P.F.S. Omark Applications Engineering Laboratory as follows:

"ALUMINUM cutting fluids for drilling and reaming aluminum and other soft metals with high speed steel cutters are air, air and water mist, soluble oil in either mist or flooding forms, refrigerated air, liquefied Freon and light mixtures of mineral or lard oil. Soluble oil is most popular for a broad variety of applications when mixed in a ratio of 1:30 with water. Liquefied Freon is to be used with great care in well ventilated areas. This is due to high toxicity levels. Cetyl alcohol is suitable for hand reaming."

"TITANIUM and ALLOY STEEL Drilling and Reaming with M33 or M42 Cobalt high speed cutting uses air, air and water mist or flooding and liquefied Freon. Use liquefied Freon with great care and only in well ventilated areas. Beware of its high toxicity levels. For heavy duty drilling, sulphurized cutting oil containing only up to 2% active sulphur may be successfully used."

All types of Taper Lock Fasteners, with the exception of low interference type, do not require wrenching, sockets or other holding tools.

All Taper Locks are installed into a tapered hole simultaneously locking the fastener in the hole.

Seating the Taper Lock Threaded Fastener occurs through the transfer of torque onto the mating nut. Taper Lock Collars are swaged sealed with a rivet gun.

P.B. Fastener, Deutsch, SPS, Voi Shan and BlancAero all provide full and complete Taper Lock techniques and details for their respective fastener installation and removal.

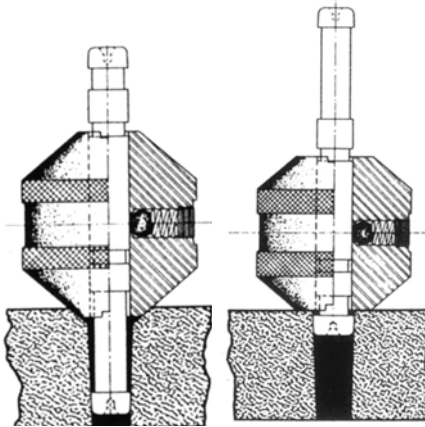
Taper Lock Gauging & Reaming

Taper Lock Tooling and For Drilling, Reaming, Countersinking, Tolerancing,

UNITED's commitment is to provide our industry Taper Lock quality tooling in line with our goal —

FIRST - ON TIME - FASTER - LOWER COST!

Taper Lock Gauges are provided by **UNITED** for checking hole diameters, countersinks, bearing, finish and depth.



UTLG-5100-A

UTLG-5100-B

The **UTLG-5100-A and -B Gauge Assemblies** check the hole diameter at two points for 100° countersink holes. Sleeve and Pin check 'B' charted diameter (lower check point) in the countersink hole. Reverse the bushing sleeve

and pin and check the upper 'B' diameter.

The **UTLG-5120 Countersink Depth Gauge** checks the depth at countersink holes and is used in setting up all drilling equipment to accurate depths.

Each Gauge is simple, accurate and a fast method of inspecting Taper Lock holes.

One advantage of the Taper Lock System is that the fastener itself acts as a gauge. Simply place this fastener in the hole by firm hand pressure and measure the protrusion of the head above the material. Divide the measurement by 48. The result is the exact interference between the fastener and the hole. **It is not possible to install the incorrect fastener in a Taper Lock hole.**

UNITED's Taper Lock Tooling System includes Air Motors, Depth Sensors, Drills, Drill Reamers, Micro Stop Cages, Guide Bushings, Fastener Installation and Removal Devices and all Product and Installation Gauges. **UNITED** conversion spindles



UTLG-5120

are available to adapt Spacematic, Q-matic and other air-powered tools to all **UNITED** tooling.

Selecting the correct Drill, Reamer, Countersink and hole sizes for Flush Head Fasteners or Protruding Head holes requires simple efficient operations.



Tapered tooling is provided for every Taper Lock size fastener.

The tapered tools are relieved on backout which eliminates chip galling and adds accuracy and smooth hole finishes. The famous Taper Lock Drill Reamer has cutting lips at the end of the tool and reamer flutes on the sides.

UNITED Taper Lock tools are manufactured to the highest standards of quality, precision and accuracy with the longevity required to complete your products on time the first time.

By using **UNITED's** precision tapered Depth Control and Gauge tooling, operator excellence can avoid these common pitfalls:

- A. Eccentricity from worn power tools, spindles or countersink cages
- B. Improper support of the power feed tools
- C. Forced feeding and excessive tool pressure
- D. Chip overload and galling
- E. Improperly sized pilot holes
- F. Incorrect tool feeds and speeds
- G. Dull tools causing crooked starts
- H. Improper drill alignment
- I. Inaccurate power feed, speed or stop adjustments
- J. Excessive dwell in the hole at the correct hole depth causing poor finish and oversized holes.

UNITED recommends these installation techniques:

- A. Hold the workpieces together clamped securely in place.
- B. Accurately drill pilot holes through precision Blocks and Drill Bars.
- C. Use correct Taper Drills, Drill Reamer Tools, Countersinks, Super Stop Cages and accurate Depth Control Units.
- D. Free the holes of chips and coolant before and after reaming.
- E. Press the fastener head down securely by hand

The Taper Lock System

Depth Control, Guiding, Gauging & Fastener Installations

**TL Installation, Removal
& Final Gauge Check**

- after placing in the hole.
- F. Check the head protrusion with the UTLG-5130 Gauge before installing the nut.
 - G. If head protrusion is accurate, install and tighten the nut with a rivet gun and bar.
 - H. Seat the fastener using a rivet gun and bucking bar with a hollow phenolic insert.
 - I. Place the aluminum swage collar over the fully seated grooved fastener end.
 - J. Place the gun with a rivet set over the collar with a bucking bar placed against the fastener head.
 - K. Apply rivet driving pressure and form the collar into the grooved end of the fastener.
 - L. When the fastener is fully seated, trim off any excess material.
 - M. The Taper Lock should now be fully swaged with a trimmed collar and tightly seated head.
 - N. The protrusion of the Taper Lock's fastener's threaded end must be within the specific protrusion limits.

The Taper Lock Fastener Removal Tool provides an easy means of removing the fastener. If the collar is improperly formed, cracked or loose, remove the fastener by first using a power tool with a hollow mill cutter until the cutter is seated on the fastener's end.



Remove the fastener with a sharp tap on **UNITED's Taper Lock Knock Out Tool** installed on the

fastener's threaded end without damaging the thread. (Refer to Taper Lock Knock Out Tool UDB-710255 in this section.) Clean the hole and reseal the fastener following **UNITED's** installation steps.

UNITED Micro Super Stop Drill Cages have indexing graduations which assure depth control within .001 inch. A Drill Bar Foot is provided which is placed flush to the workpiece surface to guide this Micro Super Stop precisely. This assures straight holes on size and normal to the workpiece.

When using **UNITED's Micro Controlled Countersink Super Stop**, be sure to keep the drill cage and drill bar perfectly flat against the structure before reaming commences.

Hold the unit firmly but allow a light feed pressure. Allowing your drill to dwell after the hole is completed will cause oversized holes. Withdraw while the motor is running.



Withdraw frequently to remove chips. Abnormal cutting or wobbling will also cause oversized holes. **When hand reaming or drilling, the pressure is of great importance. Less pressure and a "different feel" are required as compared to straight drilling.**

RECOMMENDED SPEEDS for DRILLING and REAMING			
GROUP	DIAMETER	RPM	CYCLE TIME
1	3/16 - 1/4	3000	8 - 12
1	5/16 - 3/8	1500	14 - 18

See the following speed recommendations in the chart. **UNITED Single Flute Taper Reamer—The Taper Scraper — The Final Finishing Tool** — is used to correct any slight irregularity in shape, size or finish of



Taper Lock holes drilled in sandwiched materials and checked with **UNITED** Taper Hole Gauges. The Single Flute Taper Reamer is best used with a T-Handle and is designed to remove only a few thousandths of material and creates a fine hole finish.

This tool should not be used where an actual hole enlargement is needed. If the tool needs to be sharpened, send it to us for re-sharpening.

Continue to check the hole with a **UNITED** Taper Hole Gauge. If it is found to be accurate, proceed with installation.



UTLG-5130-A

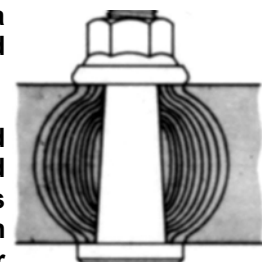


UTLG-5130-B

The **UTLG-5130 Protrusion Gauges** determine that the fasteners accurately fit the holes and have proper interference, flushness or protrusion.

When your fastener checks within protrusion limits, you have a successful, secure and positive installation!

Operator excellence coupled with **UNITED** experience and quality in Taper Lock products gives your application balanced stress, greater strength and longer wear!



***In-Line and Right
Angle Positive Feed***

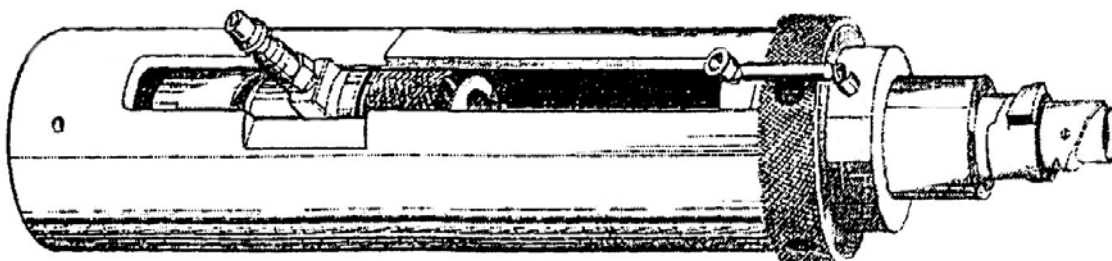
Precision Depth Sensors for Controlled Drilling

For In-Line and Right Angle Positive Feed Motors By Major Manufacturers

ARO, QUACKENBUSH, ROCKWELL and ZEPHYR TYPES



Full Scale Charts are available on request.



Precise Depth - Applications Coolant - Spindle - Dwell

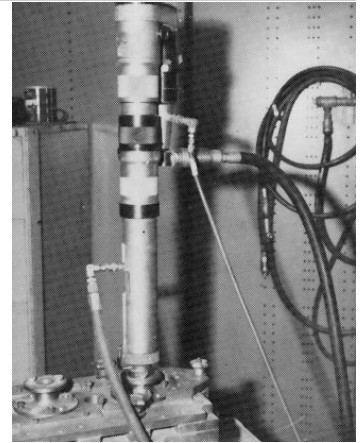
Technical
Information

DEPTH CONTROLLED - COOLANT APPLICATION - PRECISION SPINDLE - BUILT-IN DWELL

**UNITED'S FINEST
NOSE DEPTH SENSING
AND BUILT-IN DWELL ASSEMBLIES**
For use with Controlled Speed and Feed Drill Motors

- Precise depth within .0001★
- Built-in long wear coolant inducer
- Controlled Drill mechanism

Patent number 3,762,827



Features and Applications

- The UDB-756170 series was **designed to fit** Dresser-Quackenbush QDA-11, QDA-12, QDA-13 and QDP-27 models.
- Specify UDB-756171 for use with QDA-11, UDB-756173 for QDA-13 and UDB-756177 for QDP-27A, Rockwell 61-PA-PD and ARO models FP08 and FP02. These motors have **controlled feeds and speeds**.
- **Floating sensing sleeve** makes contact with the work surface regardless of fixture deflection.
- ★ The **angular sensing sleeve** will contact irregular or contoured surfaces and control drill and countersink depth within .0001 when using *UNITED's* Super Stop Fine adjusting nut.
- These depth sensing units are **self-compensating** with plus or minus 3/16" (a total of 3/8").
- The units herein can be equipped with **UNITED's Helox® Adapters for use with Shelox® Liners**. **UNITED's Nurlock Adapters and Bushing Tips** (Keller style) are also adaptable to these units.
- For best performance, **air-line pressure** should be 90 - 100 PSI. Maximum hose and fitting I.D.s are recommended.
- **Built-in coolant inducer** supplies coolant through the spindle to the cutting tools. Inducers incorporate fittings to suit "mistmatic" spray units which are recommended for use during drill-ream cycles.
- These units have **built-in dwell**. Each incorporates a precision adapter spindle which is internally threaded to suit standard Taper Lock drills, reamers and related cutting tools. Units are **positive locking and positioning**.
- A **two-step method** is generally used with these units when preparing holes for tapered fasteners: A pilot hole is first pre-drilled; then the pilot hole is taper drilled and reamed to full size. Suggested pre-drill holes sizes are available on request.
- A **four-step method** for tapered fastener hole preparation may also be used. Recommended sequence is as follows:
 1. Pre-drill pilot hole.
 2. Ream pilot hole to suit pilot on taper drill/ream cutters.
 3. Rough taper drill to approximately 90% of full size.
 4. Finish taper ream to full size.
- Detailed information is available by calling *UNITED*.