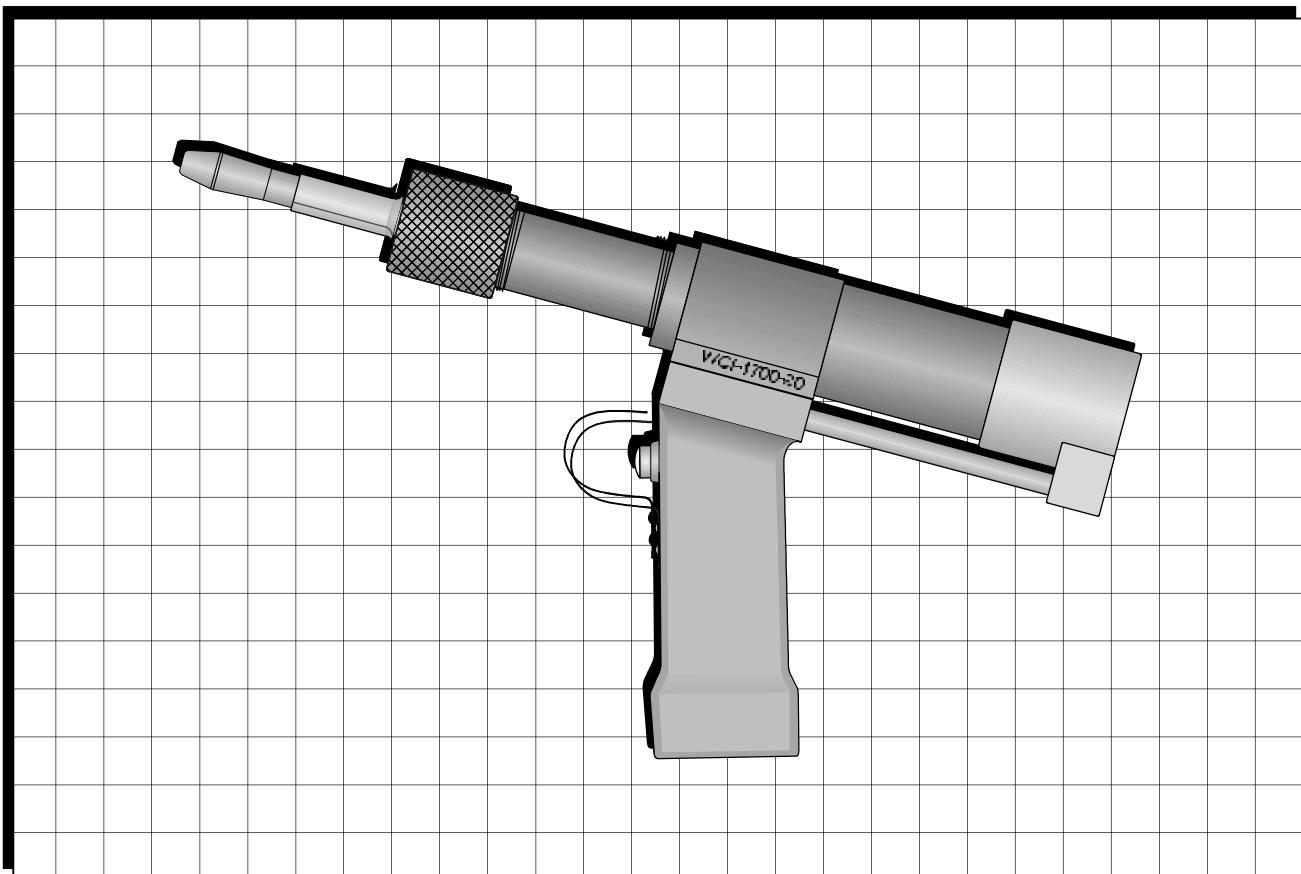


Fatigue Enhancement Solutions



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About West Coast Industries

During the 1960's, the aerospace technical community was presented a solution to the problem of metal fatigue at fastener holes. The process was simple, yet effective. Termed mandrelizing, it was utilized by the leading aircraft manufacturers, and at that time entailed pulling a tapered mandrel through a fastener hole in a two-sided operation. The hole increased in size, resulting in compressive stresses around the hole. A pre-lubricated split sleeve was developed by the Boeing Company in the early 1970's, which allowed for a one-sided operation and greater fatigue life improvement.

The next major advancement in the state of the art occurred with the introduction, in 1983, of the split mandrel process. This WCI-patented design offers tremendous cost savings with the elimination of the disposable split sleeve and lower labor costs. The only system to be cost-effectively automated, the split mandrel process provides equal or greater fatigue life enhancement, and is being implemented worldwide.

WCI has supplied "coldwork" tooling throughout the aerospace industry since 1970, and now has the most complete line of tooling available in the world. We count as our customers most major airframe manufacturers, and are a major provider of Commercial Service Bulletin coldwork kits to the world's airlines and service centers.

With a firm commitment to quality, WCI has introduced Statistical Process Control to insure the highest quality and reliability. Our equipment is manufactured to the most exacting tolerances in the industry to insure your fatigue enhancement needs are met.

Our technical engineering staff stands ready to help you with your specific fatigue enhancement problem. Please feel free to contact us with your application.

Specialized Tooling

West Coast Industries routinely develops specialized tooling to meet unique customer needs. If you do not find the specific tooling required for your application, call our technical engineering department. Some of the special projects for which WCI has been asked to develop tooling are: special access restriction problems which require a special hydraulic offset puller, $\frac{5}{8}$ " diameter holes with a 2" stackup and 5 $\frac{1}{2}$ " working area; large, (2 $\frac{1}{2}$ " dia.) holes in thin-wall titanium and 3 $\frac{1}{2}$ " dia. holes in Aluminum Alloys. Our Engineering Staff will be happy to discuss your tooling requirements with you in order to better meet your particular needs.

Ordering From WCI

All tooling listed in this catalog may be ordered individually, subject to minimum order quantities, or in kit form with all tooling needed for a particular job included with a mobile tool cabinet (see Section IV). After finding the capital tooling in Section II, or expendable tooling in Section III, refer to the appropriate tables in Sections V-VIII for CB, CA, CR and CW tooling, respectively.

Product Improvement

West Coast Industries maintains a continuous program of ongoing product improvement. Therefore, WCI reserves the right to change any of the specifications in this catalog, without notice, at anytime.

Industry Standards

Coldwork tooling and processes have been defined within the industry for some time. West Coast Industries manufactures its tooling to conform to the following industry process specifications:

- Bell Helicopter BPS-4592*
- Boeing BAC 5973 & BAC 5768*
- Douglas Aircraft DPS 3.67-74*
- Lockheed Ft. Worth FPS-3030*
- Lockheed Ft. Worth FPS-3064*
- Lockheed Ft. Worth FPS-3066*
- Lockheed Aeronautical Systems STP52-715*
- McDonnell Aircraft PS. 19180*
- Northrup FH-56*

The world's aircraft manufacturers have long depended upon WCI as a source for coldwork tooling. Some of the manufacturers we serve include:

- Bell Helicopter*
- Boeing*
- Bristol Aerospace*
- British Aerospace*
- Douglas Aircraft Corporation*
- Grumman*
- Lockheed Aeronautical Systems*
- Lockheed Ft. Worth (General Dynamics)*
- McDonnell Aircraft*
- Northrup*
- Rockwell*
- Vought*

In addition, we are a major supplier of commercial service bulletin coldwork kits to the world's airlines and aircraft service centers. We sell all the necessary equipment needed to perform service bulletin work, and the customer may even rent the capital tooling, if desired.

Split Sleeve and Split Mandrel Process Description

Split-sleeve coldworking was developed in the early 1970's as a way to improve joint fatigue performance by expanding or compressing the material around the fastener hole. In the split-sleeve process, this is accomplished by inserting a mandrel that has been prefitted with a disposable sleeve, through a fastener hole, and pulling the mandrel back through the sleeve. The internal surface of the sleeve is pre-lubricated with a special dry lubricant, protecting the mandrel from excessive wear, and reducing the amount of force required to pull the mandrel.

The WCI patented split-mandrel process, as introduced in 1983, does not use a disposable sleeve. Instead, it uses an automatically lubricated, longitudinally split mandrel, allowing it to partially collapse to facilitate insertion into the hole. After insertion, a small pilot is pushed through the inner diameter of the mandrel, retaining the splits of the mandrel in a solid position as it is withdrawn back through the hole.

Split Sleeve Process

1. Drill start hole with start drill.
2. Ream hole to proper starting size with start hole reamer.
3. Verify start hole with hole gage.
4. Inspect mandrel with No-Go gage.
5. Slide sleeve over the mandrel.
6. Start pass-thru of hole.
7. Place nosecap flush against workpiece.
8. Coldwork hole by drawing the mandrel back through the sleeve and hole.
9. Remove used sleeve and discard.
10. The hole has been coldworked.
11. Inspect coldworked hole with hole gage.
12. Ream hole to final size with piloted reamer.
13. Inspect final reamed hole with hole gage. Countersink if necessary.

As the mandrel passes through the hole with either the split sleeve or split mandrel process:

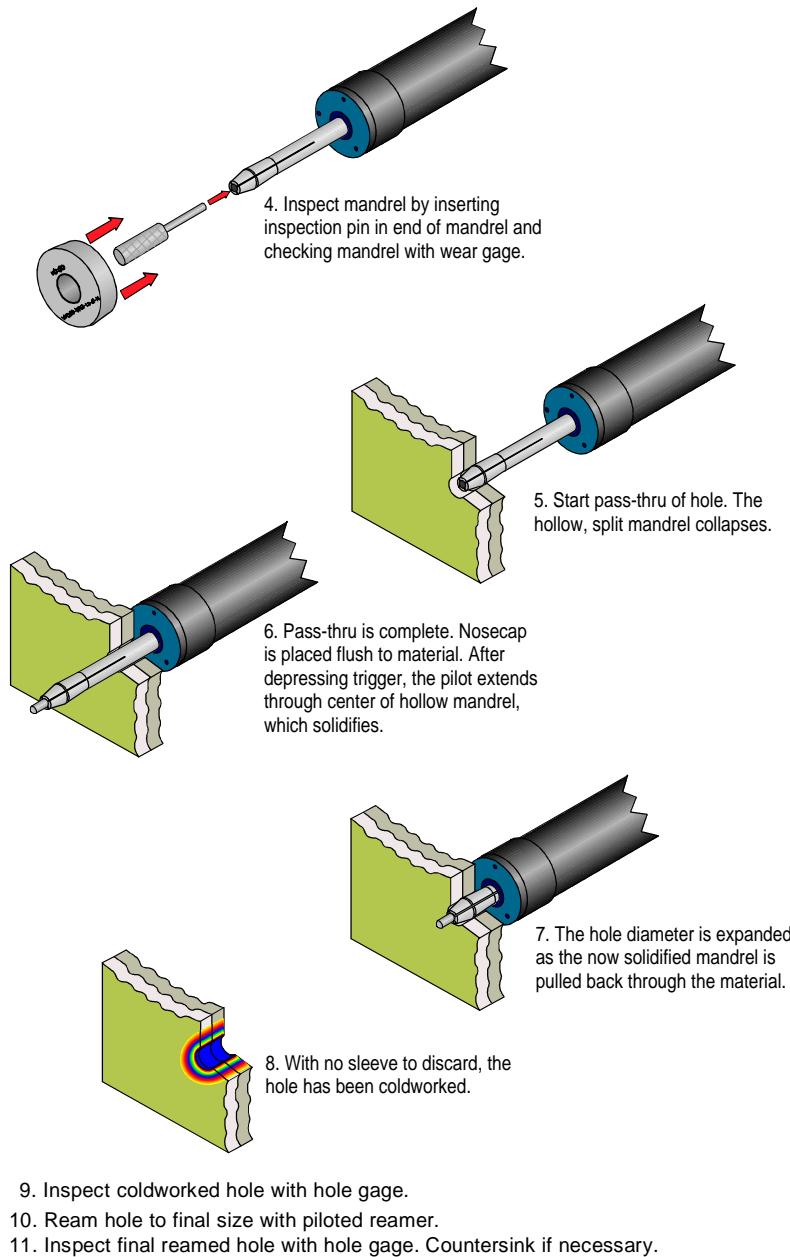
- The material preceding the major diameter of the mandrel is compressed into the surrounding area (*applied expansion*).
- As the major diameter passes through the hole, the material behind the major diameter *partially* resumes its original configuration (*retained expansion*).

This combination creates residual compressive stresses radially around the hole. Generally speaking, the fatigue life extension of the coldworked structure is extended several times, with life extension being reduced as the applied stress approaches the tensile strength of the material.

For a further description of these processes, please call our technical sales department and ask for engineering handout, WCI-EH-9201 (split sleeve) or WCI-EH-9202 (split mandrel).

Split Mandrel Process

1. Drill start hole with start drill.
2. Ream hole to proper starting size with start hole reamer.
3. Verify start hole with hole gage.



Sleeve Coldworking Processes

Several sleeve coldworking process are available, depending upon the material to be coldworked, the interference level desired and the particular application:

CB Tooling

Class I. Used in production and rework applications with aluminum and mild steel, it is commonly specified for aircraft service bulletins, and is available in standard sizes ranging from $\frac{1}{8}$ " through $1\frac{5}{64}$ " (3.1–45.6 mm) in $\frac{1}{64}$ " increments. Provided applied expansion ranges from 3-6% (4% nominal—*high interference*). See Section V for tooling tables. CB tooling is available in tooling kits, CWORK-1 and CWORK-3. See Section IV.

CA Tooling

Specifically designed for high strength steel and titanium applications, CA tooling has a slightly higher level of applied expansion. Due to the nature of the material being coldworked, the mandrels are special high strength materials. Available sizes range from $\frac{1}{8}$ " to $\frac{45}{64}$ " (3.1–17.9 mm) in $\frac{1}{64}$ " increments. Applied expansion ranges from 3.6 to 6.1% (5% nominal). See Section VI for tooling tables.

CR Tooling

The CR series was originally developed for rework applications, but can also be used for new fastener holes ranging from $\frac{3}{16}$ " to $\frac{13}{32}$ " (4.8–10.3). When coldworking a previously countersunk hole, the hole should be processed using the next larger tool size. See Section VII for tooling tables. Applied expansion is higher than CB tooling, which allows the use of fewer tool sets to coldwork a range of holes. A full set of CR tooling is available in kit form as the CWORK-2B. See Section IV.

CW Tooling

Class II. Used in aluminum and mild steel applications, the CW process provides approximately 3% applied expansion, (*low interference*) for moderately stressed areas. See Section VIII for tooling tables.

Application Specific Tooling

Due to our customers' unique configurations and requirements, WCI has designed and developed tooling to specific applications. Customized applied expansion tooling may be required under these circumstances. Please contact our technical engineering staff for an evaluation.

Information Required for Placing an Order

Before ordering from WCI, please make sure to have the following information available to further expedite your order:

1. Part number of tooling to be ordered.
2. Order quantity.
3. Details of specific application, as applicable:
 - Stackup thickness
 - Material to be coldworked
 - Any special access problems (*ref. pg. II-4*)
 - Puller units the tools will be used with
 - Whether the tool(s) will be used with competitive equipment
4. Date order is required.
5. Purchase order number.
6. Ship to address.
7. Bill to address.
8. Number of copies of invoice needed.

To facilitate ordering, WCI's **cage number** is 66136

How to Use This Catalog

This catalog is broken into several sections to make it easy to find specific information. Note that sections II-VIII deal exclusively with the split sleeve coldworking system.

Section II

Sleeve system Capital Tooling (pullers, offset adapters, hydraulic offsets, hose assemblies and power paks).

Section III

Expendable Tooling (sleeves, mandrels, nosecaps, jawsets, drills, reamers, and gages).

Section IV

Tooling Kits for rework applications. Also includes **CRACKARRESTOR**, our system for stop drill repair.

Sections V-VIII

Tooling Selection Charts for CB, CA, CR and CW tooling. Use these tables to find the normal tooling and part numbers used for a particular hole size. The first page of each section shows the formation of the mandrel tool code designation, and the pullers that may be used with a given tool size.

Section IX

Sleeveless Coldworking, including the WCI patented Split Mandrel Process.

Section X

Index.

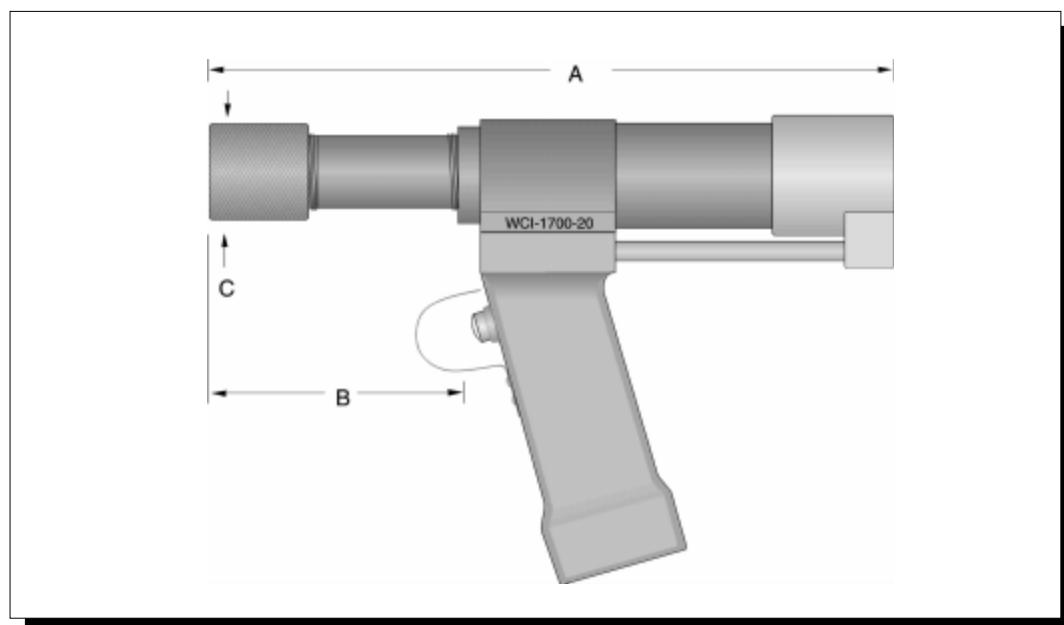
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Puller Guns

Puller guns are hydraulically powered units used to pull a mandrel through the workpiece. The majority of holes under $\frac{9}{16}$ " (14.3 mm) diameter in aluminum can be coldworked with the smallest gun, the WCI-1700. Larger holes require bigger guns as pull force is proportional to hole size, material strength, and stackup thickness.

1700 Puller Gun

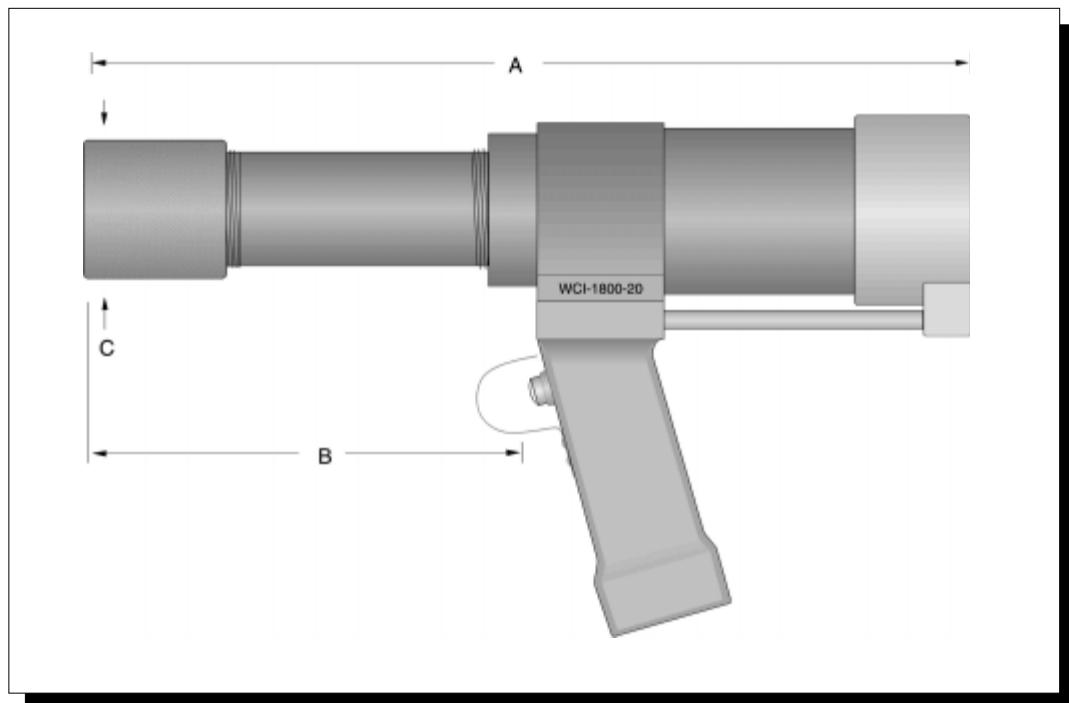


Puller Model No.		Stackup In (cm)	A In (cm)	B In (cm)	C In (cm)
WCI-1700 For mandrel sizes 4-0-N through 16-3-N	-10	1.0 (2.5)	9.7 (24.6)	3.0 (7.6)	1.5 (3.8)
	-15	1.5 (3.8)	10.7 (27.2)	3.5 (8.9)	1.5 (3.8)
	-20	2.0 (5.1)	11.7 (29.7)	4.0 (10.2)	1.5 (3.8)
	-25	2.5 (6.4)	12.7 (32.3)	4.5 (11.4)	1.5 (3.8)
	-30	3.0 (7.6)	13.7 (34.8)	5.0 (12.7)	1.5 (3.8)
	-35	3.5 (8.9)	14.7 (37.3)	5.5 (14.0)	1.5 (3.8)

- 9,200 lbs pull force at 10,000 psi hydraulic pressure (4,200 DaN @ 691 Bar)
- Used to pull up to a $\frac{35}{64}$ " (13.9mm) diameter mandrel in aluminum
- Trigger guard for greater worker safety
- Weight: approximately 6 lbs. (2.7 Kg)

Puller Guns

1800 Puller Gun

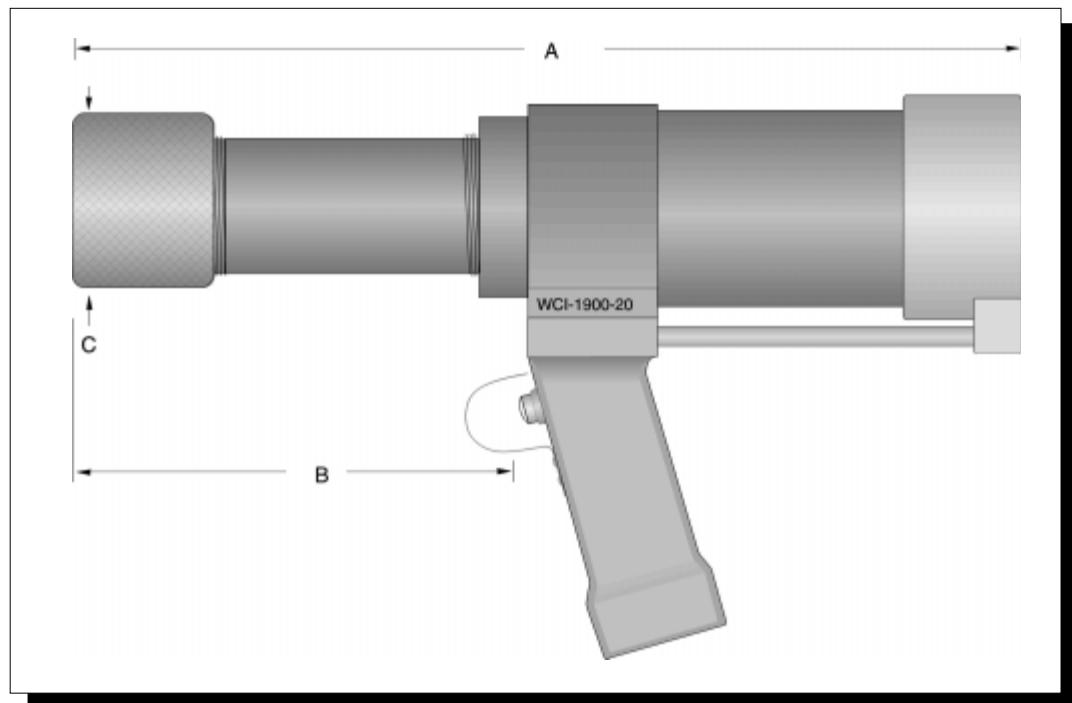


Puller Model No.	Stackup In (cm)	A In (cm)	B In (cm)	C In (cm)
WCI-1800	-10	1.0 (2.5)	12.6 (32.0)	5.2 (13.2)
For mandrel sizes 14-0-N through 30-3-N	-15	1.5 (3.8)	13.6 (34.5)	5.7 (14.5)
	-20	2.0 (5.1)	14.6 (37.1)	6.2 (15.7)
	-25	2.5 (6.4)	15.6 (39.6)	6.7 (17.0)
	-30	3.0 (7.6)	16.6 (42.2)	7.2 (18.3)
	-70	7.0 (17.8)	24.6 (62.5)	11.2 (28.4)
				2.12 (5.4)

- 27,600 lbs. pull force at 10,000 psi hydraulic pressure (12,500 DaN @ 691 Bar)
- Used to pull up to a $63/64"$ (25mm) diameter mandrel
- Trigger guard for greater worker safety
- Weight: approximately 13 lbs. (5.9 Kg.)

Puller Guns

1900 Puller Gun



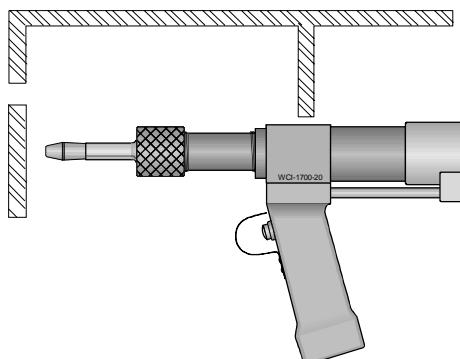
Puller Model No.	Stackup In (cm)	A In (cm)	B In (cm)	C In (cm)
WCI-1900	-20	2.0 (5.1)	15.6 (39.6)	6.8 (17.3)
For mandrel sizes 32-0-N-56-3-N	-30	3.0 (7.6)	17.6 (44.7)	7.8 (19.8)
	-70	7.0 (17.8)	25.6 (65.0)	11.8 (30.0)

- 38,000 lbs pull force at 10,000 psi hydraulic pressure (17,200 DaN @ 691 Bar)
- Used to pull up to a $1\frac{5}{16}$ " (46 mm) inch diameter mandrel
- Trigger guard for greater worker safety
- "A" model accepts $\frac{7}{8}$ -14 or 1-14 threaded mandrels (eg. WCI-1900-30A)
- Weight: approximately 27 lbs. (12.3 Kg.)

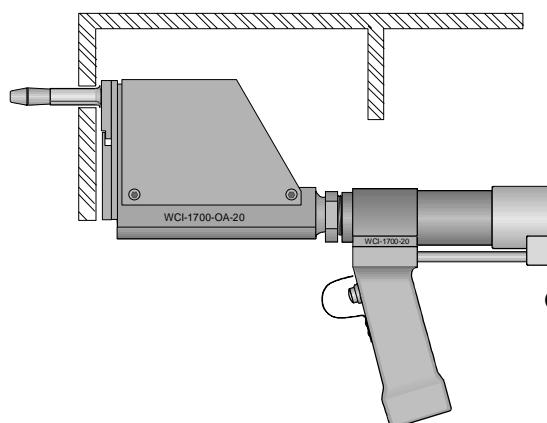
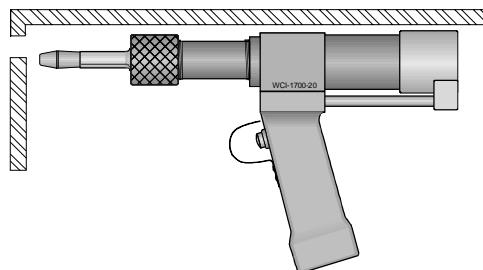
Restricted Access Problems

Certain situations may occur whereby frontside and/or lateral clearance is insufficient for a regular puller unit. WCI manufactures a complete selection of standard equipment to help solve these problems, or will work with you on your unique restricted access situations.

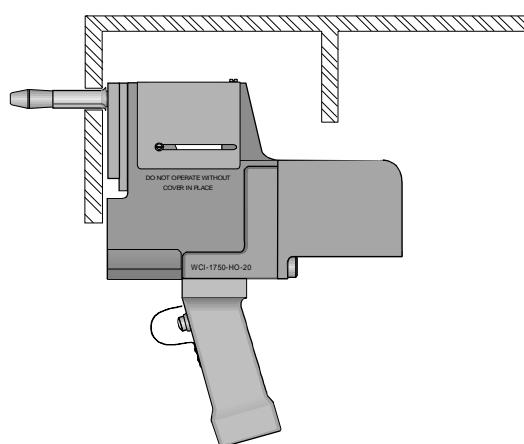
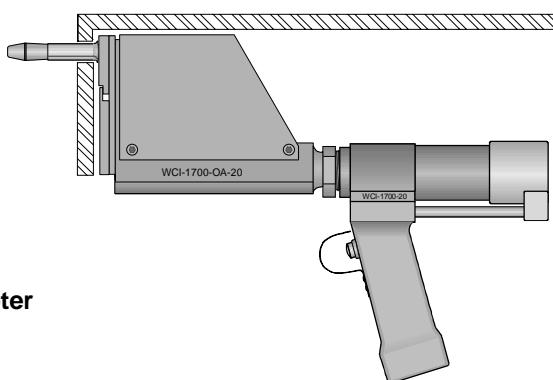
Restricted Frontside Clearance



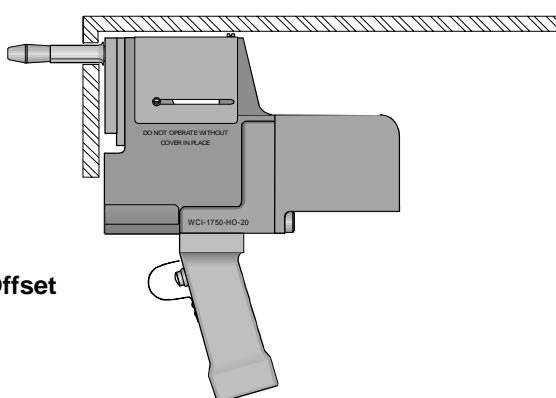
Restricted Lateral Clearance



Offset Adapter



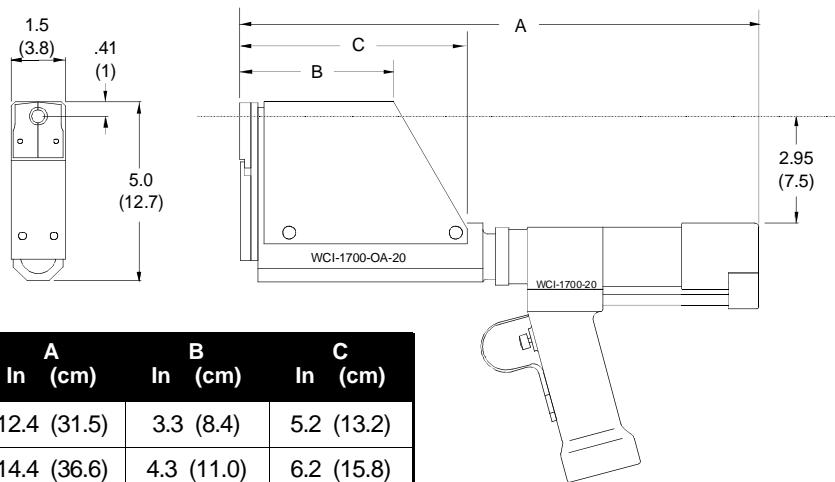
Hydraulic Offset



Restricted Access Solutions—Offset Adapters

Offset adapters are fitted to standard puller guns to increase frontside and lateral clearance. West Coast Industries offers two offset adapters, the 1700-OA for the 1700 puller, and the 1800-OA for the 1800 puller.

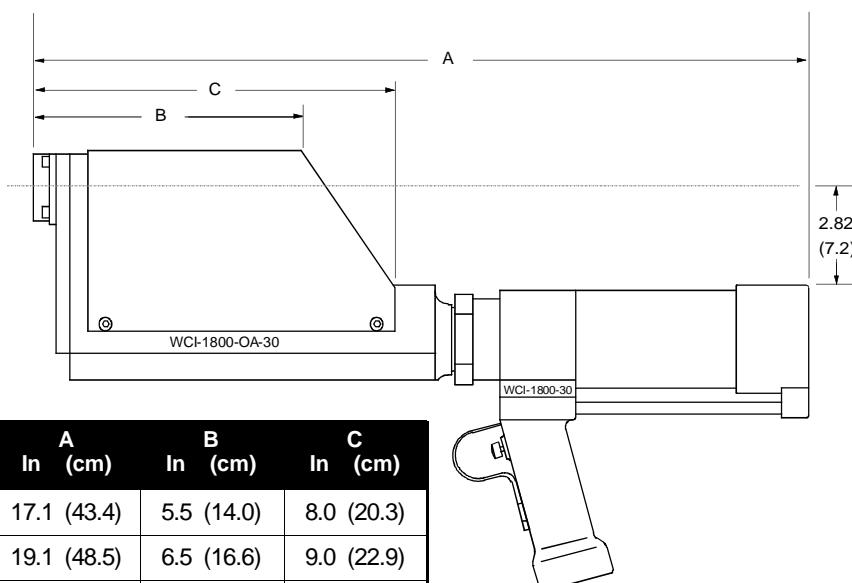
1700-OA



OA Model No.		Stackup In (cm)	A In (cm)	B In (cm)	C In (cm)
WCI-1700-OA	-10	1.0 (2.5)	12.4 (31.5)	3.3 (8.4)	5.2 (13.2)
	-20	2.0 (5.1)	14.4 (36.6)	4.3 (11.0)	6.2 (15.8)
	-30	3.0 (7.6)	16.4 (41.7)	5.3 (13.5)	7.2 (18.3)

Dimensions shown in inches and (centimeters)

1800-OA



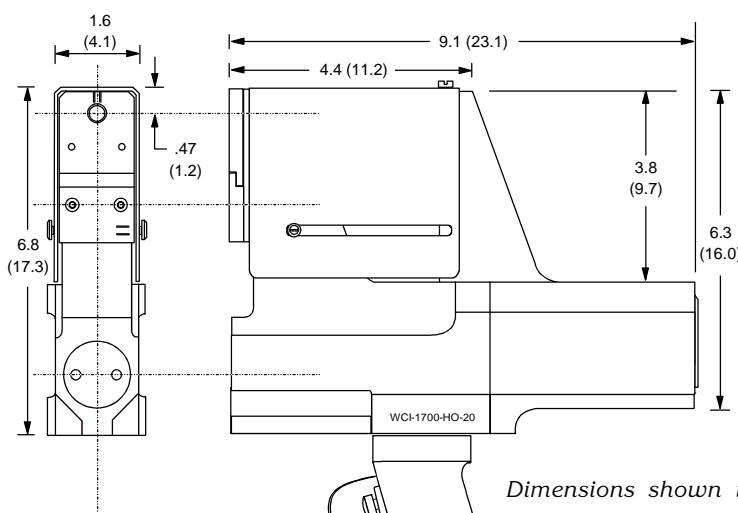
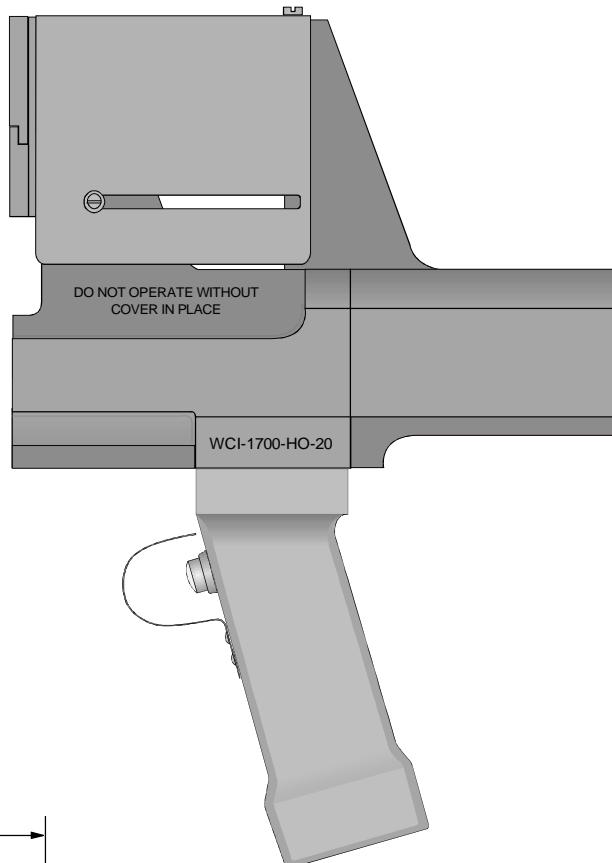
OA Model No.		Stackup In (cm)	A In (cm)	B In (cm)	C In (cm)
WCI-1800-OA	-10	1.0 (2.5)	17.1 (43.4)	5.5 (14.0)	8.0 (20.3)
	-20	2.0 (5.1)	19.1 (48.5)	6.5 (16.6)	9.0 (22.9)
	-30	3.0 (7.6)	21.1 (53.6)	7.5 (19.1)	10.0 (25.4)

Restricted Access Solutions—Hydraulic Offsets

1700-HO

The 1700-HO is one of the smallest of the hydraulic offsets offered by West Coast Industries, and is ideal for very tight restricted access situations, where the 3.8" (9.7 cm) jaw height can be invaluable.

- Supports mandrel sizes to 16-3-N ($\frac{35}{64}$ "") (14 mm)
- .47" (1.2 cm) lateral clearance
- Unique sliding cover over arm assembly allows frontside clearance of only $1\frac{3}{8}$ " (3.5 cm) plus mandrel protrusion
- Uses 1700-OA jaw sets/nose-caps



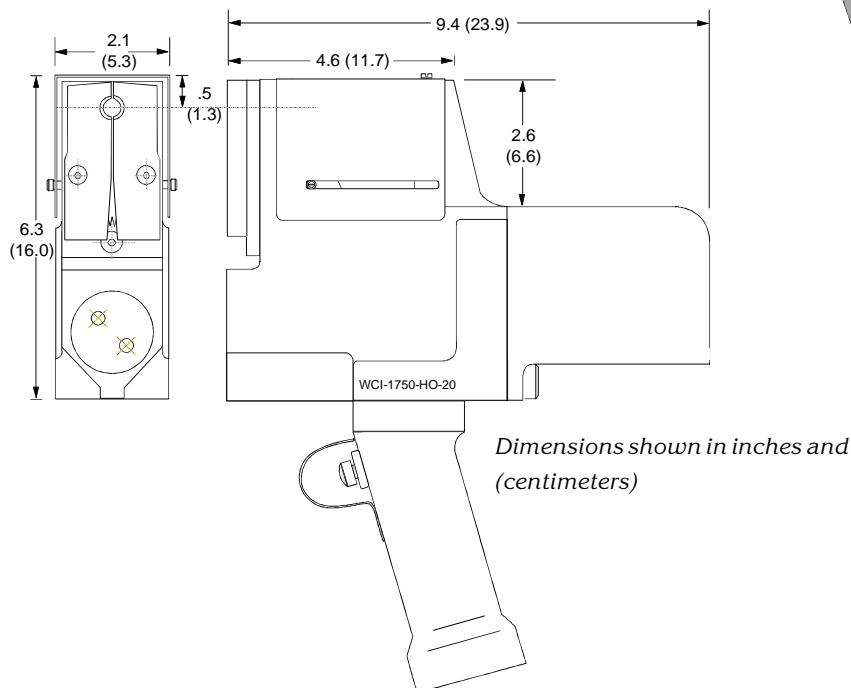
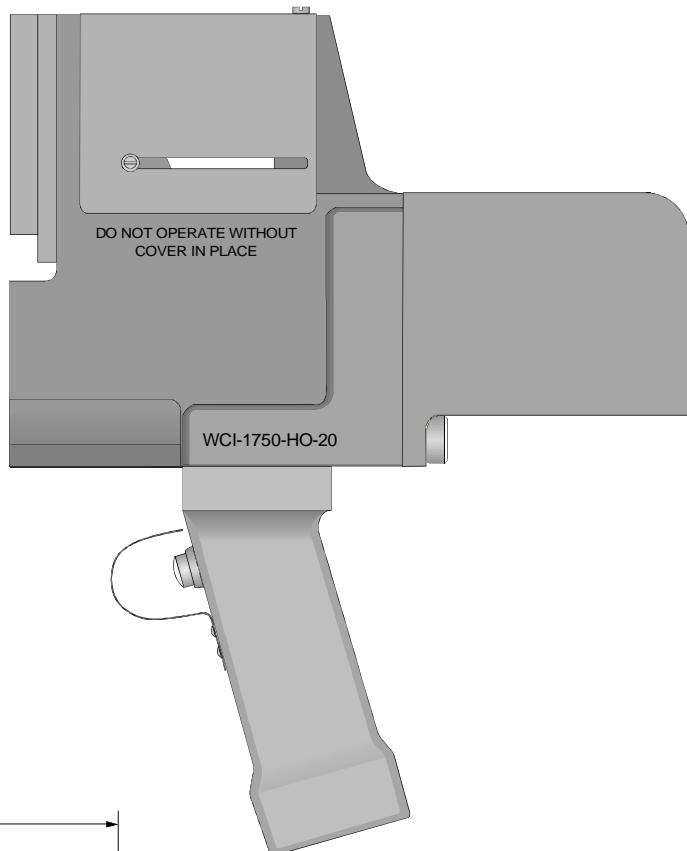
- Pull force of 9,900 lbs. at 10,000 psi (4,500 DaN @ 691 Bar)
- Uses standard mandrels
- Standard 2" stackup capability. Other stackups available
- Weight approximately 14 lbs. (6.4 Kg.)

Restricted Access Solutions—Hydraulic Offsets

1750-HO

The 1750-HO is a hydraulically operated puller, used in tight, restricted access situations to coldwork holes between $\frac{7}{16}$ and $\frac{51}{64}$ " (11.1 - 20.2 mm).

- Unique sliding cover allows for frontside clearance of only $1\frac{3}{4}$ " (4.5 cm) plus the length of the mandrel protrusion
- Lateral clearance of only $\frac{1}{2}$ " (1.3 cm)
- Integral jaw/nosecap
- Requires special short mandrels (WCI-HOM-XXX)



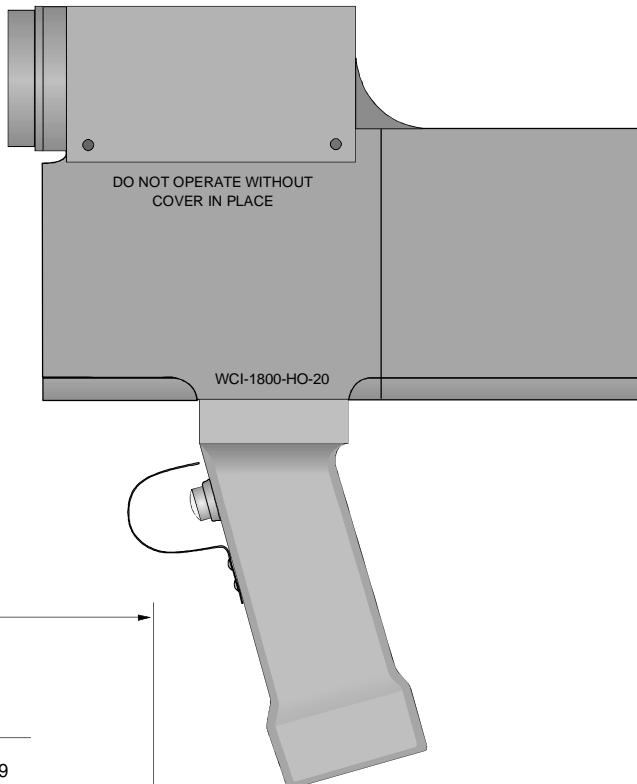
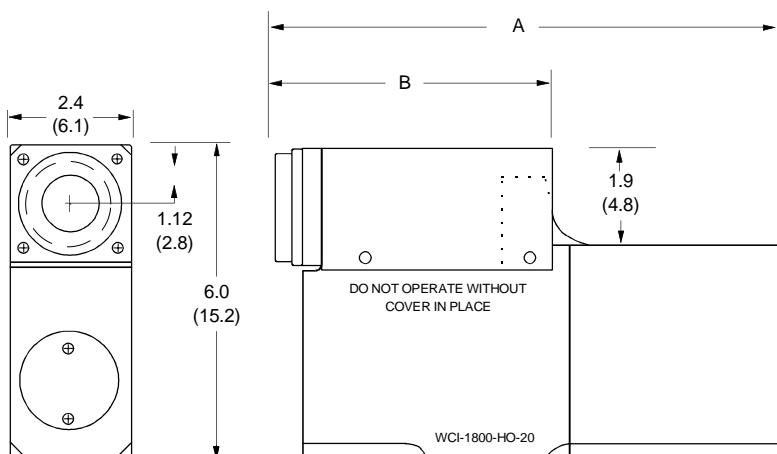
- Well balanced for greater worker productivity
- Standard 2" stackup. Other stackups available
- Pull force of 16,200 lbs at 10,000 psi (7,300 DaN @ 691 Bar)
- Greater height of arms allows access in situations no other puller of this capacity can reach
- Cover design and trigger guard minimize risk of injury
- Weight approximately 17 lbs. (7.7 Kg.)

Restricted Access Solutions—Hydraulic Offsets

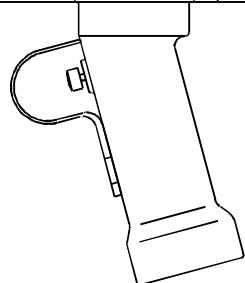
1800-HO

The compact dimensions of the 1800-HO, hydraulically operated puller, make it ideal for extremely tight situations where a large diameter hole must be coldworked.

- Used to pull from $\frac{7}{16}$ " to 1" (11.1-25.4 mm) in aluminum, and to $\frac{3}{4}$ " (19.1 mm) in titanium/steel



- Protective cover and trigger guard to protect worker.
- Generates 20,700 lbs of pull force at 10,000 psi hydraulic pressure (9,370 DaN @ 691 Bar)
- May be ordered with 1", 2" or 3.5" stackup.
- Weight: approximately 22 lbs. (10 Kg.)



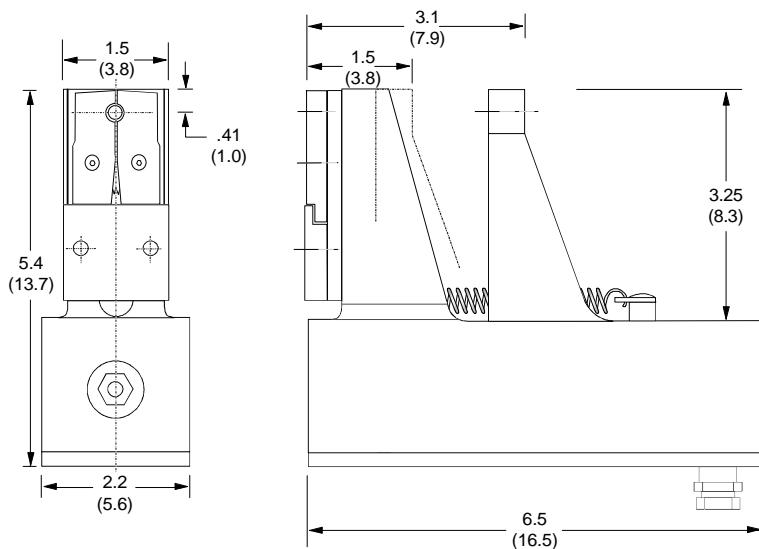
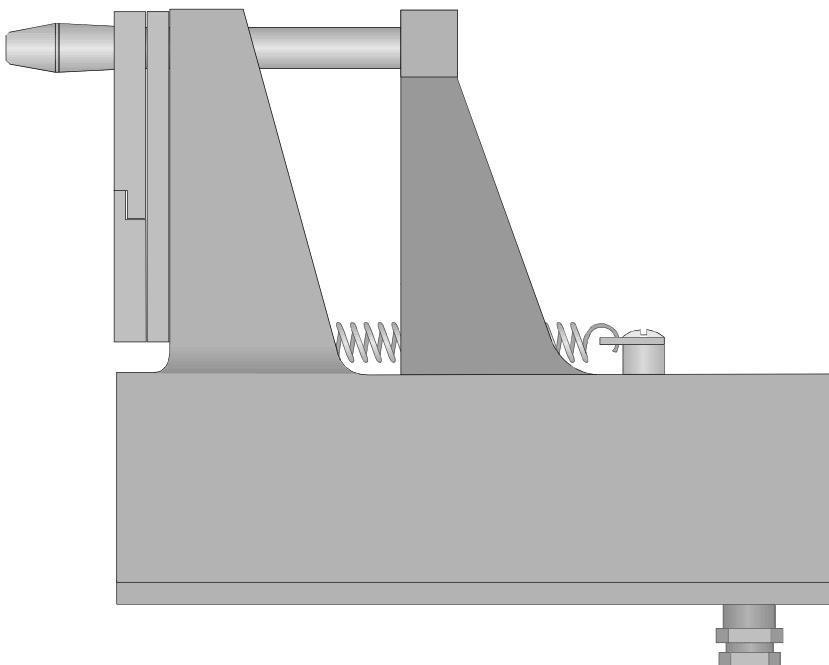
Hydraulic Offset Model No	Stackup In (cm)	A In (cm)	B In (cm)
WCI-1800-HO	-10	1.0 (2.5)	7.7 (19.6)
	-20	2.0 (5.1)	9.7 (24.6)
	-35	3.5 (8.9)	12.7 (32.3)

Restricted Access Solutions—Hydraulic Offsets

1600-HO

Packaged with compact external dimensions and light weight, the 1600-HO is useful in restricted access situations. The return spring results in simplicity of construction and a reduction of external dimensions.

- Uses standard mandrels
- Hand pump included
- Used only with the WCI-MP-392 hydraulic hand pump, the WCI-1600-HO produces up to 6,000 lbs pull force (2,700 DaN)
- Standard 1" stackup. May be ordered with other stackup capabilities



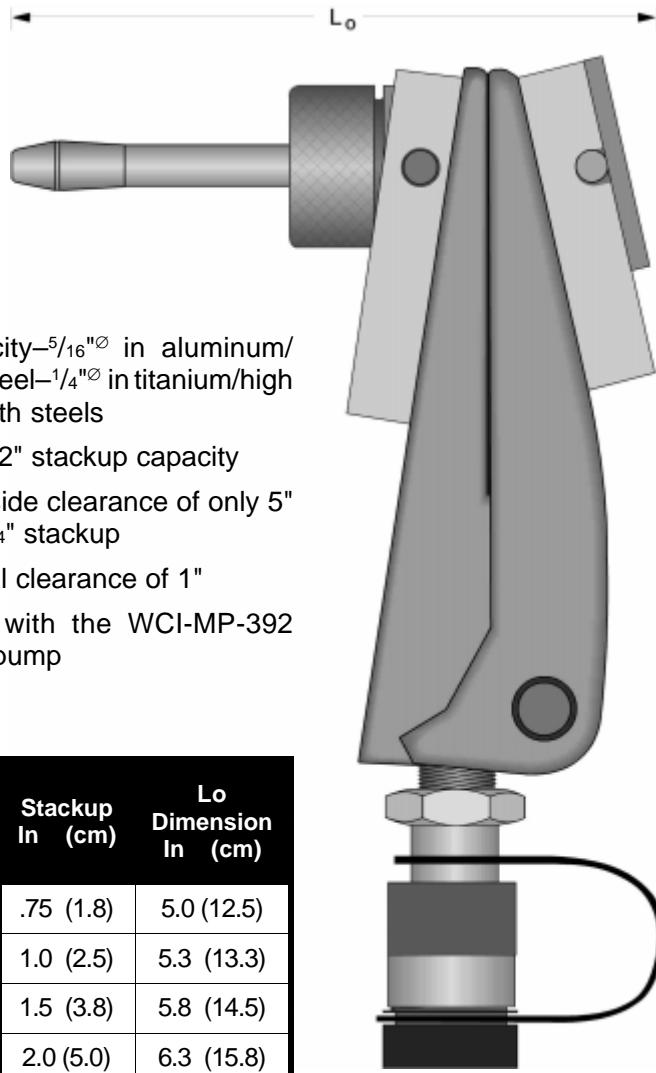
- Uses 1700-OA nosecap/jaw sets and extension nosecaps
- Useful for coldworking holes up to $\frac{3}{8}$ " (9.5 mm) in aluminum/mild steel and $\frac{5}{16}$ " (7.9 mm) in titanium
- Weight approximately 10 lbs. (4.5 Kg.)

Dimensions shown in inches and (centimeters)

Restricted Access Solutions—Miniature Pullers

WCI-MP

The WCI-MP is a hydraulically actuated puller designed to reach areas not otherwise accessible. The MP uses special MP mandrels.



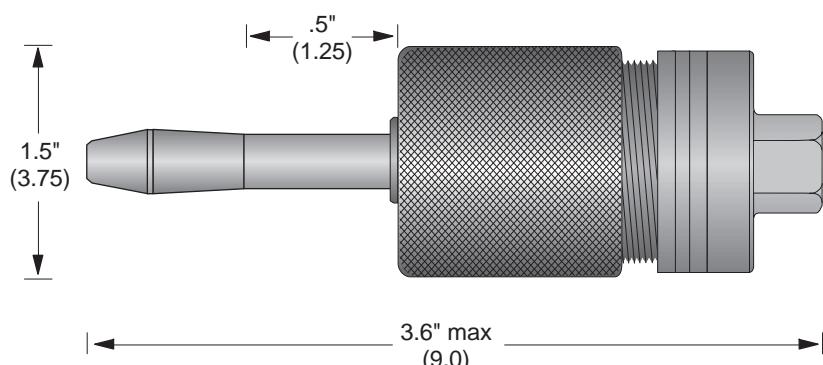
- Capacity— $5/16" \varnothing$ in aluminum/mild steel— $1/4" \varnothing$ in titanium/high strength steels
- Up to 2" stackup capacity
- Frontside clearance of only 5" with $3/4"$ stackup
- Lateral clearance of 1"
- Used with the WCI-MP-392 hand pump

WCI-MP	Stackup In (cm)	Lo Dimension In (cm)
4-0-N through 10-0-N (Aluminum)	.75 (1.8)	5.0 (12.5)
	1.0 (2.5)	5.3 (13.3)
A20 - A40 (Titanium & H.S. Steel)	1.5 (3.8)	5.8 (14.5)
	2.0 (5.0)	6.3 (15.8)

Restricted Access Solutions—Miniature Pullers

WCI-MHP

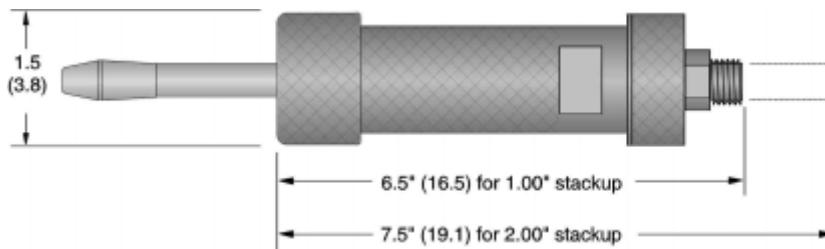
The WCI-MHP, Miniature Hand Puller, is used in severely restricted access areas. Like the WCI-HP-20, it is operated with a ratcheting wrench. The MHP is designed to coldwork $\frac{1}{2}$ " stackups, up to $\frac{5}{16}$ " diameter. It uses special MHP mandrels.



Restricted Access Solutions—Hand Pullers

Hand Puller

The WCI-HP-20 is a manually operated wrench-type puller for use where access is very limited or only a few holes need to be coldworked. It can pull stackups to 2", and uses standard 1700 series mandrels, jaws, and nosecaps, or extension nosecaps and mandrels. The WCI-HP-20 includes a storage box and ratcheting wrench.



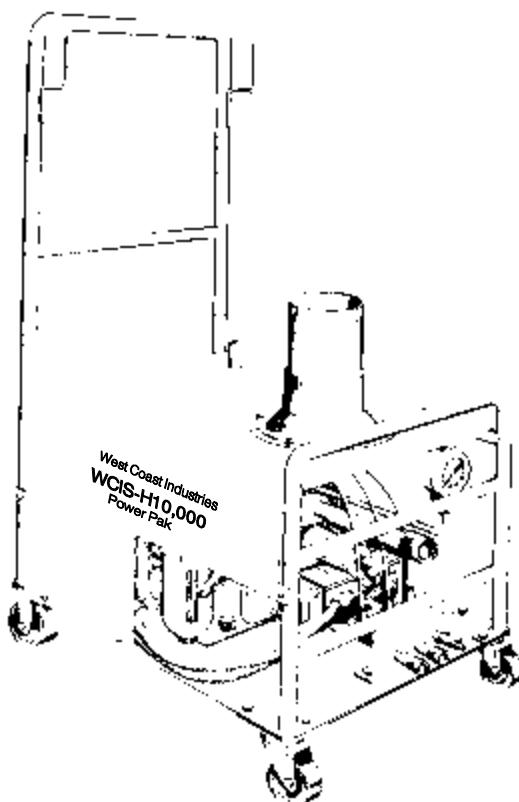
Dimensions shown in inches and (centimeters)

Power Pak Units

All puller guns, except the WCI-HP-20 hand puller, require a hydraulic power supply to operate. WCI offers two air powered units, the WCI-20, a small unit meant for low volume coldworking, and the WCIS-10000 units, offering greater speed and intended for higher volume applications. All power units, except the hand powered MP-392, are available with an optional automatic lubrication system for mandrel lubrication when using the split mandrel process.

WCIS-H10000

The WCIS-H10000 is a factory-oriented hydraulic power supply, able to pull a mandrel through the workpiece in less than one second. It is powered by a 2.2 HP air driven intensifier piston pump. The H10000 produces 10,000 psi (691 Bar).



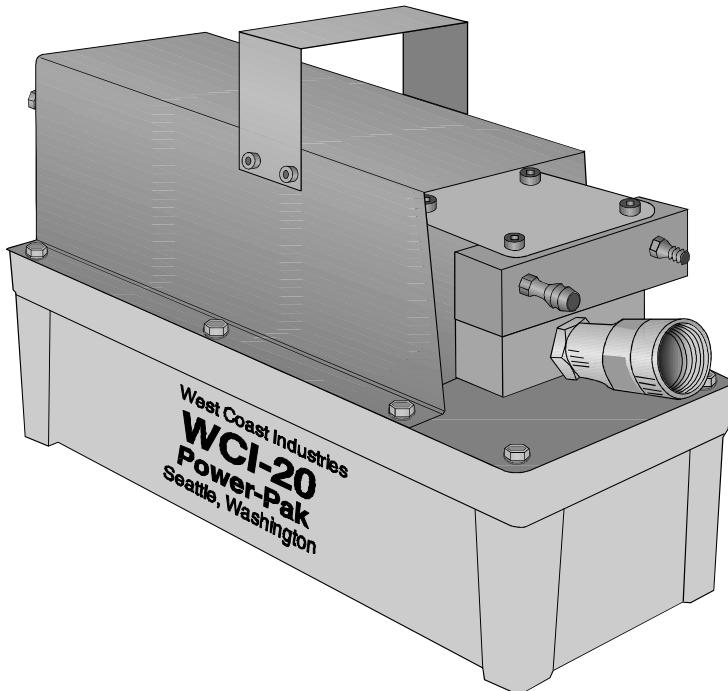
- Does not require air-line oiler
- Caster mounted for easy portability
- Fail-safe system—air leak in trigger system will cause the pump to cease to function
- Quiet—only 75 dBA max
- Air supply—70 CFM @ 90 psi (1,960 L/min @ 6.22 Bar), 1/2" or larger hose
- Dimensions—13½" wide x 18½" long x 18" tall (34.3 x 47 x 45.7 cm)
- Weight—77 lbs. (35 Kg.)

Power Pak Units (cont.)

WCI-20

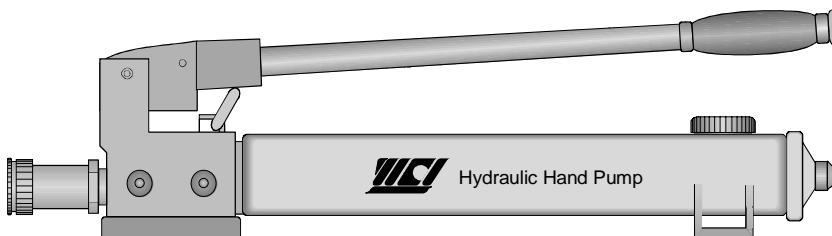
The WCI-20 is a small, economical unit designed for applications where only a few holes need to be coldworked, such as aircraft repair shops, or where mobility is a prime requirement, such as special access situations where a larger power pak would be cumbersome.

- Weighs only 19 pounds for easy portability
- Supplies up to 10,000 psi (691 Bar) hydraulic pressure
- Requires 90 psi (6.22 Bar) clean, dry air, $\frac{1}{4}$ " ID air line
- $\frac{1}{3}$ HP air motor
- Only 10" high, 5" wide and 15" long (25.4 x 12.7 x 38.1 cm)



WCI-MP-392

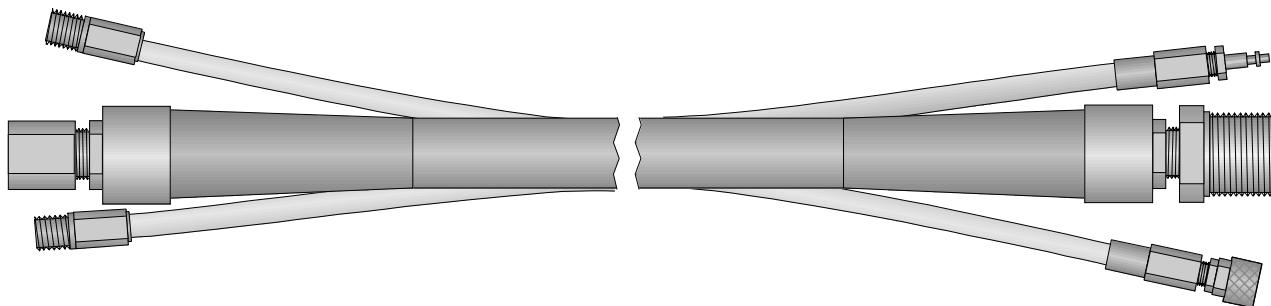
The MP-392 is a manually operated hand pump, providing the necessary hydraulic pressure to power any of the WCI pullers.



- Weight—9 lbs (4.1 Kg.) with oil
- Develops 10,000 psi (691 Bar) hydraulic pressure
- Standard with the 1600-HO
- Two speed operation to reduce handle strokes

Hose Assemblies

The hose assembly connects the puller gun to the power-pak. It consists of three hoses: a high pressure hydraulic hose and two low pressure air lines. Assemblies are available in standard lengths of 10', 15', and 20', (3, 4.5 and 6 m) or other lengths by special order. All necessary fittings are included.



Ordering Capital Tooling

Hose Assemblies

WCIS-10,000H-X

Hose Assembly Length in Feet
(10', 15' & 20' Standard)

eg. WCIS-10,000H-10 - 10' Hose assembly

Hydraulic Offsets

WCI-XX00-HO-XX

Puller Series Stackup in 1/10" increments. Available in 1/2" steps
Hydraulic Offset

eg. WCI-1800-HO-20 - 1800 series Hydraulic Offset Puller for 2" stackup

Offset Adapters

WCI-XX00-OA-XX

Puller Series Stackup in 1/10" increments. Available in 1/2" steps
Offset Adapter

eg. WCI-1800-OA-30 — Offset Adapter for 1800-30 puller with 3" stackup

Pullers

WCI-XX00-XX

Puller Series Stackup in 1/10" increments. Available in 1/2" steps
(If Hydraulic Offset, add HO)

eg. WCI-1700-30 — 1700 Series Puller for a 3" stackup

Expendable Tooling

Contents

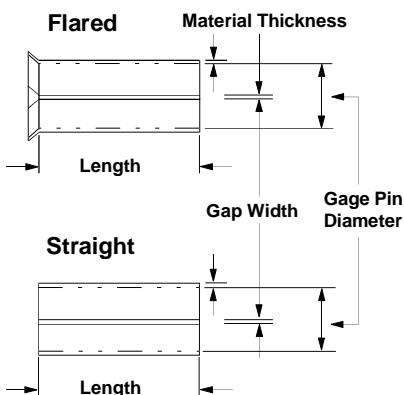
<i>Sleeves</i>	1
<i>Mandrels</i>	2
<i>Nosecaps</i>	
<i>Flush</i>	3
<i>Extension</i>	4
<i>Jaw Assemblies</i>	5
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<i>Mandrel Wear Gage</i>	9
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Sleeves

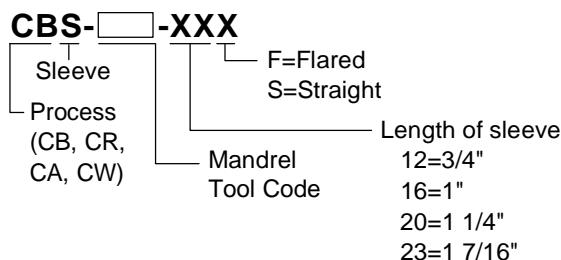


Sleeves are used, along with a mandrel, to coldwork a hole. Made from full hard stainless steel with a baked, dry-film lubricant on the inside surface, they prevent the mandrel from sticking to the hole being coldworked and can only be used once.

Flared sleeves are used when only one sleeve is necessary to coldwork the hole—for example, using a 16F sleeve to coldwork a $\frac{1}{2}$ " stackup. Straight sleeves are used when a deep stack is to be coldworked. As many as necessary are put onto the mandrel after the flared sleeve to build up the equivalent of one long sleeve. The maximum length of flared sleeves is three inches.



- Close tolerances result in consistent gap width
- Class I sleeves are used for high-interference coldworking, CB, CR, and CA processes
- Class II sleeves are for low-interference work commonly found on older aircraft (CW process)
- Total sleeve length must be at least $\frac{1}{32}$ " longer than the total stackup thickness
- Special order sizes are available



CBS-18-0-N-16F

CB Process, nominal $\frac{9}{16}$ " hole, 1" long, flared

CAS-A70-20S

CA Process, nominal $\frac{7}{16}$ " hole, 1 $\frac{1}{4}$ ", straight

CRS-R30-16F

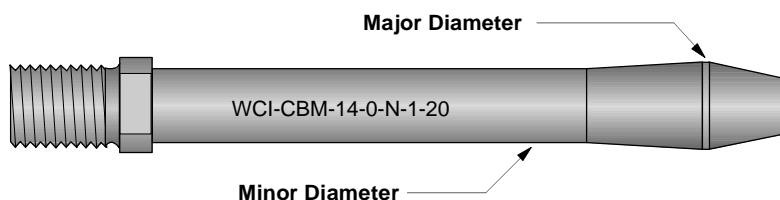
CR Process, $\frac{3}{16}$ " final hole diameter, 1" long, flared

CWS-B1267-20F

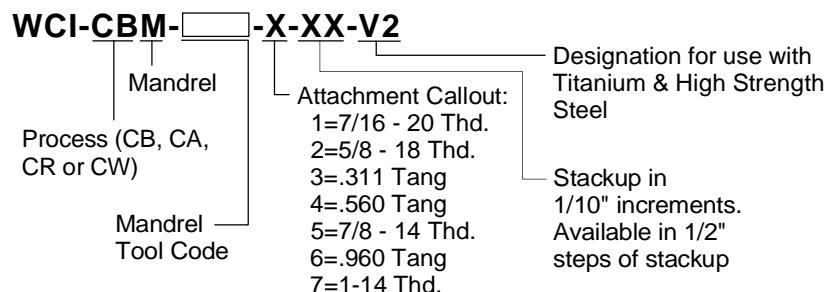
CW, low interference, $\frac{1}{8}$ " nominal bolt or open hole, 1 $\frac{1}{4}$ " long, flared

Mandrels

The mandrel, fitted with a sleeve, is used to coldwork the hole. West Coast Industries mandrels are made from highest quality vacuum-melted tool steel which has been double tempered and precision ground. Their useful life is related to the type and yield strength of the material to be coldworked, the amount of interference between the mandrel and the hole, wear due to a coldworking of the mandrel itself, and a slight abrasiveness of the lubricant on the inside of the sleeve.



- Mandrels are manufactured to be interchangeable with other manufacturer's coldworking equipment
- Available in both high interference (Class I) suitable for highly stressed areas, and low interference (Class II), used in moderately stressed conditions.
- Available in a number of lengths, based upon the stackup to be pulled. In addition, they are available in lengths to be used with flush nosecaps as well as extension nosecaps. The length designation of the mandrel is the total stackup length of the material to be coldworked, plus if applicable, the length of a nosecap extension
- Special sizes are available



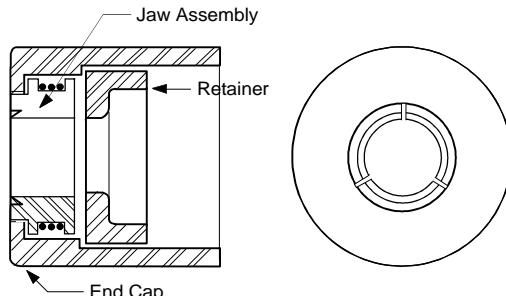
WCI-CBM-36-2-N-5-20	CB, 1 1/8" nominal, 7/8" attachment, 2" stackup
WCI-CAM-A20-1-30	CA, 1/8" nominal, 7/16" attachment, 3" stackup
WCI-CRM-R40-1-10	CR, 1/4" final hole size, 7/16" attachment, 1" stackup
WCI-CWM-B9874-5-10	CW, 63/64" nominal, bolt or open hole, 7/8" attachment, 1" stackup

Flush Nosecaps

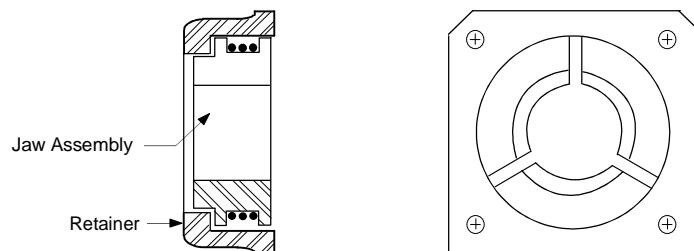
The flush nosecap retains the jaw assembly, which keeps the sleeve in the hole during coldworking. The nosecap consists of three parts—the end cap, the jaw retainer, and the jaw assembly.

Std. Flush Nosecap—

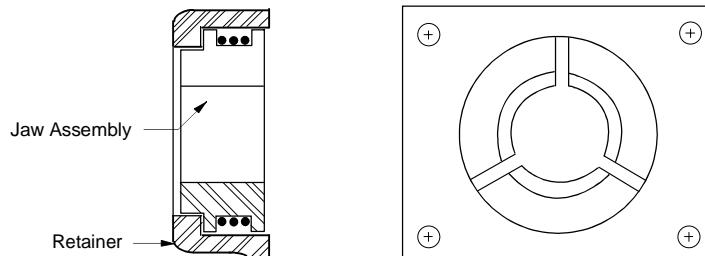
1700 / 1800 / 1900 Pullers



1800-HO Nosecap



1800-OA Flush Nosecap

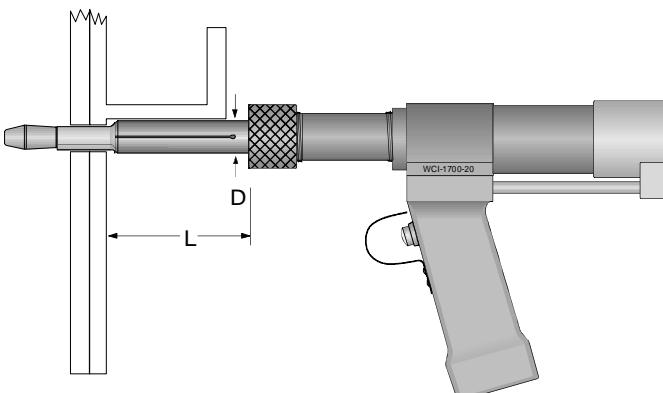
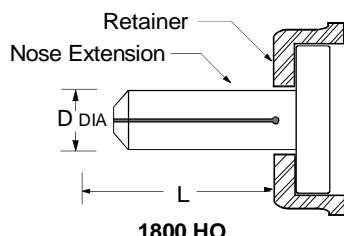
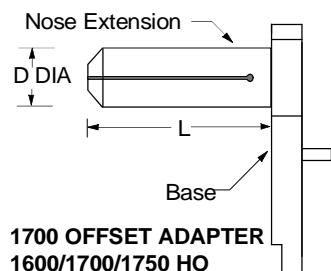
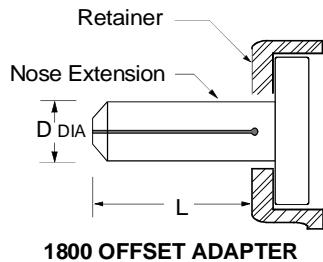
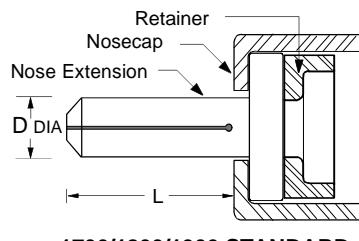


WCI-XXXX N-□ -X

Puller Model Number Nosecap (F)lared or (S)traight
 Mandrel Tool Code

WCI-1800N-18F	1800 puller nosecap, $\frac{9}{16}$ " hole size for use with flared sleeves
WCI-1800OAN-28S	1800 Offset Adapter nosecap, $\frac{7}{8}$ " hole, straight sleeve
WCI-1800HN-24F	1800 HO nosecap, $\frac{3}{4}$ " hole, flared sleeve
WCI-1700N-12F	1700 puller nosecap, $\frac{3}{8}$ " hole, flared sleeve

Extension Nosecaps



WCI-XXXX NE-□ - XX -XX-X

Puller Model Number Nosecap Extension Mandrel CB Tooling:
Mandrel Size Extension Length
Tool Code 01 for Nominal & 1st oversize
Code 23 for 2nd & 3rd oversize
See below and tooling tables for other processes

The extension nosecap enables coldworking in restricted access areas, such as next to a J-stringer, by providing a comparatively narrow diameter extension to the nosecap. The extension includes integral jaws. The nosecap may be ordered in a variety of lengths (L). Diameter (D) is dependent upon the mandrel size. An extension mandrel must be ordered with the extension nosecap.

Mandrel Size	1700 Series	1800 Series	D Dia
4-0-N - 8-3-N	0.45		
10-0-N - 10-2-N		0.57	
10-3-N - 12-3-N		0.57	
14-0-N - 14-3-N		0.69	
16-0-N - 16-3-N		0.73	
18-0-N - 20-1-N		0.82	
20-2-N - 20-3-N		0.90	
22-0-N - 22-1-N		1.00	
22-2-N - 22-3-N		1.03	
24-0-N - 26-3-N		1.07	
28-0-N - 30-3-N		1.19	

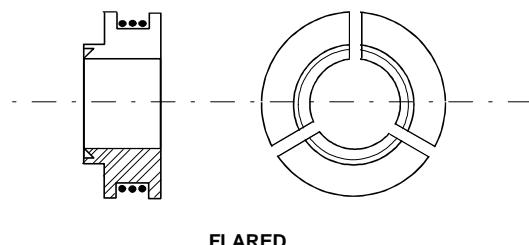
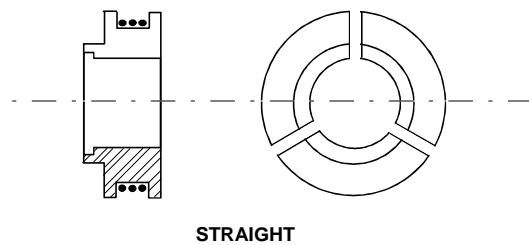
- WCI-1700NE-1401-20F CB, 2" extension for a 1700 puller, covering $\frac{7}{16}$ " and $\frac{29}{64}$ " hole sizes
- WCI-1700-ONE-A4041-30F CA, 3" extension for 1700 Offset Adapter, for $\frac{1}{4}$ " and $\frac{17}{64}$ " holes
- WCI-1700HNE-R30-20F CR, 2" extension for 1700HO, for a $\frac{3}{16}$ " hole
- WCI-1800NE-32-2-40F CW, 4" extension for 1800 puller, used for a 1" (B10030) hole

Expendable Tooling

Jaw Assemblies

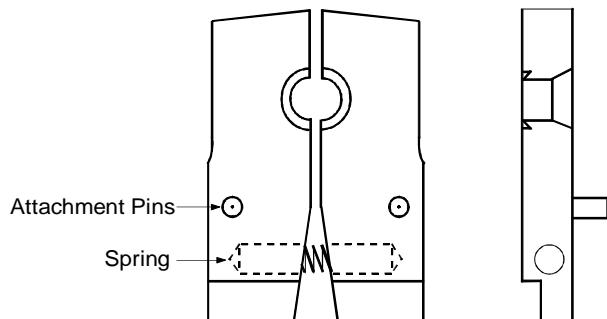
A jaw assembly is a set of three hardened steel ring segments that are held tightly to the mandrel minor diameter by O-rings. The jaws prevent the sleeve from coming out of the hole during coldworking. Jaw sets change as the mandrel size and sleeve type (flared or straight) change.

Standard Flush Jaw Set



1700-OA Flush Jaw Set

1600/1700/1750 HO



WCI-XXXX J-[] -X
Puller Model Number Jawset Mandrel Tool Code
Model Number Jawset Mandrel Tool Code

WCI-1700J-04F

1700 puller jawset, used with a $\frac{1}{8}$ " hole and flared sleeves

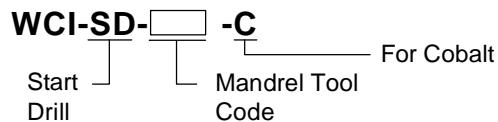
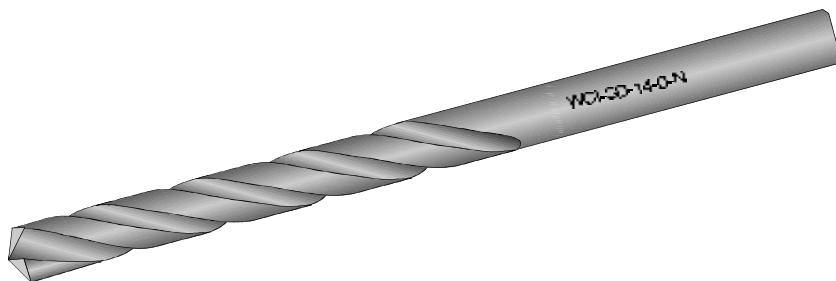
WCI-1700OAJ-1201F

1700OA jawset for a $\frac{3}{8}$ " hole and flared sleeve

Starting Drills

Starting drills create a hole ready for reaming to the pre-coldwork size.

- Manufactured from high speed steel or cobalt
- Used to create holes in new production work
- All drills under $\frac{1}{2}$ " have straight shank, larger sizes have a stepped-down shank to accept standard chucks.



WCI-SD-22-2-N	CB Process, $\frac{23}{32}$ " nominal hole size
WCI-SD-A42	CA Process, $\frac{9}{32}$ " nominal hole size
WCI-SD-R52	CR Process, $\frac{11}{32}$ " final hole size
WCI-SD-B3771	CW Process, bolt or open hole, $\frac{3}{8}$ " nominal hole size

Expendable Tooling

Reamers

Start Hole Size

Start hole reamers bring the hole to its pre-coldwork size. The non-cutting pilot helps guide the reamer into the pre-drilled pilot hole. Cobalt reamers are available in many sizes.

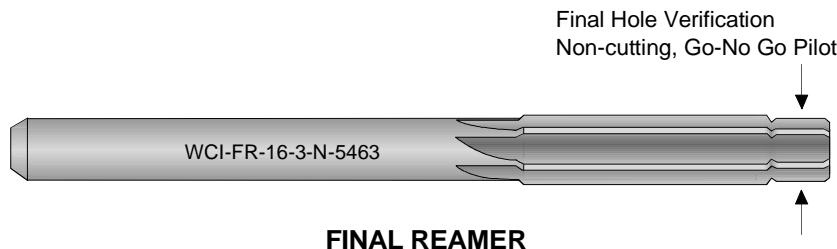
Pilot Hole Verification
Non-cutting, Go-No Go Pilot



WCI-SR-28-1-N	CB Process, start reamer for $\frac{57}{64}$ " hole size
WCI-SR-A100	CA Process, for $\frac{5}{8}$ " nominal hole size
WCI-SR-R50	CR Process for $\frac{5}{16}$ " final fastener size
WCI-SR-R3170	CW Process for rivet, $\frac{5}{16}$ " nominal

Final Size Reamers

The final size reamer cleans up the ridge left by the sleeve and leaves a smooth, round hole ready for countersinking or fastener installation. The non-cutting pilot is used both as a guide and to verify the hole has been coldworked.



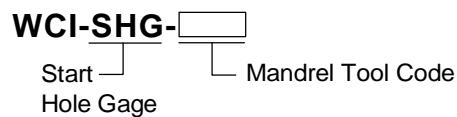
WCI-FR-24-0-N-7460	CB Process, $\frac{3}{4}$ " nominal, reaming to .7460"
WCI-FR-A30-2040	CA Process, $\frac{3}{16}$ " nominal hole size, reamed to .2040"
WCI-FR-R42-277	CR Process, $\frac{9}{32}$ " final hole size, reamed to .277" (CR reamer specified to thousandths)
WCI-FR-R2530-2570	CW Process, rivet, $\frac{1}{4}$ " nominal, reamed to .2570"

Go-No Go Gages

Go-No-Go gages can be purchased from West Coast Industries for on-line inspection of drilled start holes, reamed start holes, and final reamed holes.

Start Hole Gage

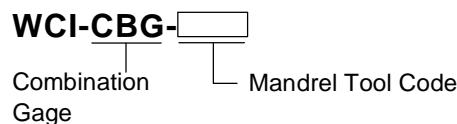
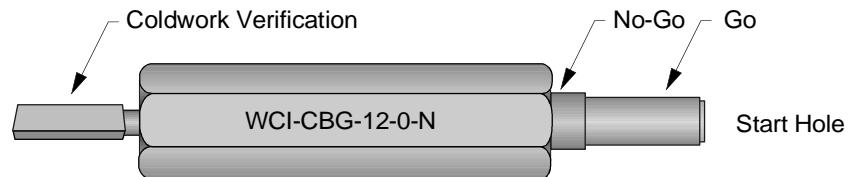
The start hole gage is used to verify the proper starting hole diameter. It features a stepped go-no go pin, or a two sided gage with the minimum and maximum start hole pin on either side, for easy inspection.



WCI-SHG-12-0-N	CB Process, to check a $\frac{3}{8}$ " nominal hole
WCI-SHG-A53	CA Process, checks a $\frac{23}{64}$ " nominal hole
WCI-SHG-R50	CR Process, checks the start size for a $\frac{5}{16}$ " nominal hole
WCI-SHG-B2676	CW Process, checks start size for a $\frac{17}{64}$ " nominal hole

Combination Gage

The combination gage is used to check the reamed, pre-cold-worked start hole, with a go-no go end, while the other end verifies the hole has been coldworked.

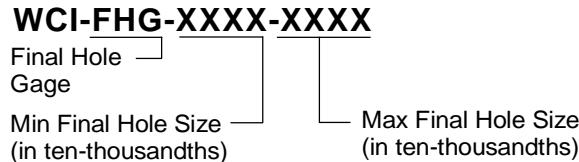


WCI-CBG-12-0-N	CB Process, to check a $\frac{3}{8}$ " nominal hole
WCI-CBG-A53	CA Process, checks a $\frac{23}{64}$ " nominal hole
WCI-CBG-R50	CR Process, checks the starting hole diameter for a $\frac{5}{16}$ " final hole diameter
WCI-CBG-B2676	CW Process, checks a $\frac{17}{64}$ " nominal hole

Gages (cont.)

Final Hole Gage

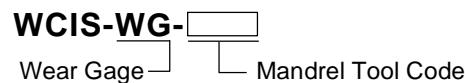
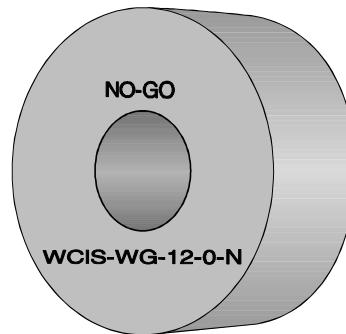
A final hole gage verifies that coldworked holes are reamed to proper tolerances.



WCI-FHG-3110-3140 All Processes—Go diameter of .3110, with a No-Go diameter of .3140

Mandrel Wear Gages

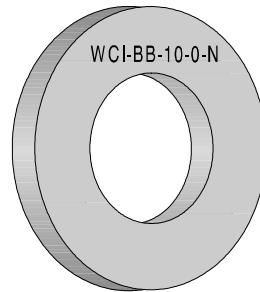
Mandrel wear gages are available for every mandrel size. If the mandrel major diameter passes through the No Go gage, the mandrel is worn beyond its limit.



WCIS-WG-12-0-N	CB Process, checks a 12-0-N mandrel
WCIS-WG-A32	CA Process, checks an A32 mandrel
WCIS-WG-R32	CR Process, checks an R-32 mandrel
WCIS-WG-H4340	CW Process, checks low interference, hex drive mandrel

Backup Blocks

Backup blocks are used to increase the stackup thickness, preventing material buckle in thin material. These blocks are commonly required for the coldworking of thin stackups and are used when the material stackup is less than one hole diameter in thickness. Made of aluminum, they are discarded after use.



WCI-BB- 
Backup Block Mandrel Tool Code

WCI-BB-18-0-N	CB Process for an 18-0-N mandrel, (9/16" nominal)
WCI-BB-A93	CA Process for an A93 mandrel, (39/64" nominal)
WCI-BB-R42	CR Process for an R42 mandrel (9/32" final hole size)
WCI-BB-R3780	CW Process for an R3780, class II mandrel for rivets, 3/8" nominal

Contents

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<i>Overhaul & Repair Kits</i>	4
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WCI Tooling & Service Bulletin Kits

West Coast Industries provides several tooling kits for overhaul and repair work. These include the **CRACKARRESTOR** for enhanced stop drilling, CWORK-2B which includes both capital and expendable CR tooling for existing fastener sizes between $\frac{5}{32}$ - $\frac{3}{8}$ ", and the CWORK-1 and the CWORK-3 kits containing CB tooling to coldwork holes ranging from $\frac{3}{16}$ - $\frac{13}{32}$ " and $\frac{5}{8}$ - 1" respectively.

We supply custom commercial Service Bulletin Kits to the world's airlines for specific rework applications. These contain both capital and expendable tooling, or the customer may rent the needed capital tooling. Complete on-site training is recommended to insure your personnel are completely certified in coldwork procedures. Custom configurations can be designed for most any rework application.

CRACKARRESTOR Tooling Kit

Stop drilling has long been used as an interim repair procedure. Most stop drills are not successful because the leading tip of the crack is missed. The **CRACKARRESTOR** system significantly enhances the stop drill process by cold expanding the stop drilled hole. Coldworking the stop drilled hole greatly enhances the chances that the very tip of the crack becomes protected in the zone of compressive residual stress induced around the stop drilled hole. As a result, the interim repair becomes more successful. Field and government tests have shown significant life improvement factors compared to stop drilling alone.

CRACKARRESTOR kits contain all tooling needed to stop drill $\frac{3}{16}$ ", $\frac{1}{4}$ ", and $\frac{17}{64}$ " oversize holes, and include a small hand puller unit, along with extension nosecaps for each size. The full kit contents are listed on the facing page.

CRACKARRESTOR Kit

Each CRACKARRESTOR tooling kit (P/N WCI-CAK-1A) contains the following:

3/16" NOMINAL TOOLING SET

WCI-SD-A30	Starting Drill
WCI-SR-A30	Starting Reamer
WCI-CBG-A30	Combination Gage
WCI-CAM-A30-1-25-V2	Mandrel
WCI-CAS-A30-8F	Split Sleeves
WCIS-WG-A30	Mandrel Wear Gage
WCI-FR-A30-1910	Final Reamer (for 3/16" aluminum rivet)
WCI-FR-A30-1870	Final Reamer (for 3/16" interference fit bolt)

1/4" NOMINAL TOOLING SET

WCI-SD-A40	Starting Drill
WCI-SR-A40	Starting Reamer
WCI-CBG-A40	Combination Gage
WCI-CAM-A40-1-25-V2	Mandrel
WCI-CAS-A40-8F	Split Sleeves
WCIS-WG-A40	Mandrel Wear Gage
WCI-FR-A40-2500	Final Reamer (for 1/4" aluminum rivet)
WCI-FR-A40-2470	Final Reamer (for 1/4" interference fit bolt)

17/64" OVERSIZE TOOLING SET

WCI-SR-A41	Starting Reamer
WCI-CBG-A41	Combination Gage
WCI-CAM-A41-1-25-V2	Mandrel
WCI-CAS-A41-8F	Split Sleeves
WCIS-WG-A41	Mandrel Wear Gage
WCI-FR-A41-2656	Final Reamer (for 17/64" aluminum rivet)
WCI-FR-A41-2626	Final Reamer (for 17/64" interference fit bolt)

CAPITAL TOOLING

WCI-HP-20	Hand Puller/Wrench
WCI-1700NE-A3031-20F	3/16" Extension Nosecap Assy.
WCI-1700NE-A4041-20F	1/4" & 17/64" Extension Nosecap Assy.

Operating instructions, tooling list, and reorder forms are included.

Overhaul and Repair Kits

Overhaul and repair facilities have special fatigue enhancement needs. WCI tooling kits meet these needs by providing all the equipment (capital and expendable) needed to coldwork 100 existing fasteners of any one size. The tooling is based upon West Coast Industries Process Specification, PS-9201. The **CRACKARRESTOR**, stop drill enhancement kit, is included with the CWORK-1 and CWORK-2B.

- All tooling is contained in a mobile, four drawer cabinet on casters
- Additional tooling sets may be placed in cabinet
- One day of on-site, or in plant training is provided with the purchase of each tool kit (excluding airfare)
- Tooling is specifically optimized for rework applications
- Nominal hole size and oversize tooling is provided
- Each hole size tooling set is contained within an individual high-impact plastic toolcase
- CWORK-1/CWORK-2B include the 1700-OA offset adapter and extension nosecaps for restricted access problems
- The 1700-20 puller gun and WCI-20 power unit are standard with the CWORK-1/CWORK-2B kits, while the 1800-30 is included in the CWORK-3 kit
- Additional tooling may be ordered at the same time at a substantial discount
- Dimensions 43½"H x 28½"W x 28½"D



Kit Contents

	Tooling	Expendable Kit Sizes				Capital Tooling
<u>CWORK-1B</u>	CB	$\frac{3}{16}$ $\frac{7}{32}$ $\frac{1}{4}$ $\frac{9}{32}$	4-4-N 6-2-N 8-0-N 8-2-N	$\frac{5}{16}$ $\frac{11}{32}$ $\frac{3}{8}$ $\frac{13}{32}$	10-0-N 10-2-N 12-0-N 12-2-N	WCI-1700-20 Puller WCI-1700-OA-20 Offset Adapter WCI-20 Power-Pak <i>CRACKARRESTOR</i> Stop Drill Kit
<u>CWORK-2B</u>	CR	$\frac{5}{32}$ $\frac{3}{16}$ $\frac{7}{32}$ $\frac{1}{4}$	($\frac{3}{16}$) R30 ($\frac{7}{32}$) R32 ($\frac{1}{4}$) R40 ($\frac{9}{32}$) R42	$\frac{9}{32}$ $\frac{5}{16}$ $\frac{11}{32}$ $\frac{3}{8}$	($\frac{5}{16}$) R50 ($\frac{11}{32}$) R52 ($\frac{3}{8}$) R60 ($\frac{13}{32}$) R62	WCI-1700-20 Puller WCI-1700-OA-20 Offset Adapter WCI-20 Power-Pak <i>CRACKARRESTOR</i> Stop Drill Kit
<u>CWORK-3</u>	CB	$\frac{7}{16}$ $\frac{1}{2}$ $\frac{9}{16}$ $\frac{5}{8}$	14-0-N 16-0-N 18-0-N 20-0-N	$\frac{3}{4}$ $\frac{7}{8}$ $\frac{15}{16}$ 1	24-0-N 28-0-N 30-0-N 32-0-N	WCI-1800-30 Puller WCI-20 Power-Pak
<u>CWORK-4</u>	CA	$\frac{3}{16}$ $\frac{7}{32}$ $\frac{1}{4}$ $\frac{9}{32}$ $\frac{5}{16}$ $\frac{11}{32}$	A30 A32 A40 A42 A50 A52	$\frac{3}{8}$ $\frac{13}{32}$ $\frac{7}{16}$ $\frac{15}{32}$ $\frac{1}{2}$ $\frac{17}{32}$	A60 A62 A70 A72 A80 A82	WCI-1700-20 Puller WCI-1800-30 Puller WCI-20 Power-Pak

Each of the toolsets listed above include the following expendable tooling:

- Starting Drills
- Starting Reamers
- Mandrels
- Combination Gage
- Mandrel Gage
- Nosecap Assembly (either extenension or offset adapter, depending upon the individual kit)
- Split Sleeves
- Finish Reamers
- Final Hole Gage
- High Impact Plastic Toolcase

CWORK-2B Kit

Each **CWORK-2B** tooling kit provides eight CR Tooling sets for the following existing hole sizes (and final fastener sizes) suitable for rework in aluminum:

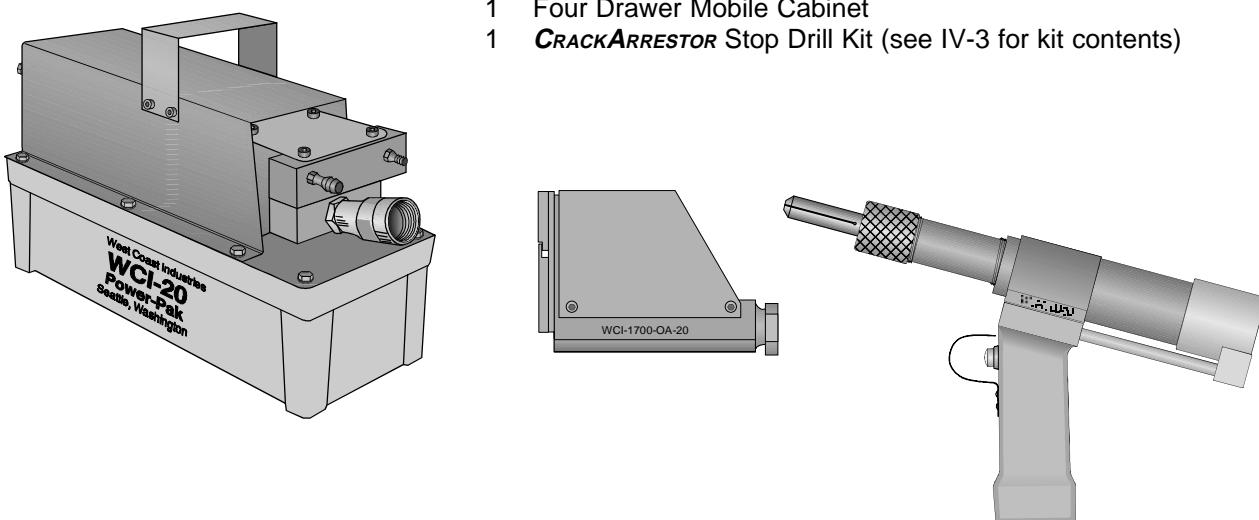
5/32	(3/16)	R30	9/32	(5/16)	R50
3/16	(7/32)	R32	5/16	(11/32)	R52
7/32	(1/4)	R40	11/32	(3/8)	R60
1/4	(9/32)	R42	3/8	(13/32)	R62

Each Tooling Set above contains:

- 2 Starting Drills
- 2 Starting Reamers
- 3 Mandrels
- 1 Combination Gage
- 1 Mandrel Gage
- 1 Extension Nosecap Assembly
- 100 Flared Split Sleeves
- 1 Offset Adapter Nosecap
- 2 Finish Reamers
- 1 Final Hole Gage
- 1 High Impact Plastic Toolcase

Each **CWORK-2B** kit contains:

- 1 WCI-1700-20 Puller Unit
- 1 WCI-20 Power Unit
- 1 WCI-1700-OA-20 Offset Adapter
- 1 Four Drawer Mobile Cabinet
- 1 **CRACKARRESTOR** Stop Drill Kit (see IV-3 for kit contents)



Capital equipment included with CWORK-2B kit: WCI-20 Power Pak, 1700-OA-20 Offset Adapter, 1700-20 Puller. Not shown: 4 drawer mobile cart

CWORK-3 Kit

Each **CWORK-3** tooling kit provides CB tooling sets for the following nominal hole sizes:

$\frac{7}{16}$	14-0-N	$\frac{3}{4}$	24-0-N
$\frac{1}{2}$	16-0-N	$\frac{7}{8}$	28-0-N
$\frac{9}{16}$	18-0-N	$\frac{15}{16}$	30-0-N
$\frac{5}{8}$	20-0-N		

Each of the tooling sets above contain:

- 2 Starting Drills
- 2 Starting Reamers
- 2 Mandrels
- 1 Combination Gage
- 1 Mandrel Gage
- 1 Flush Nosecap Assembly
- 50 Straight Split Sleeves
- 1 High Impact Plastic Toolcase

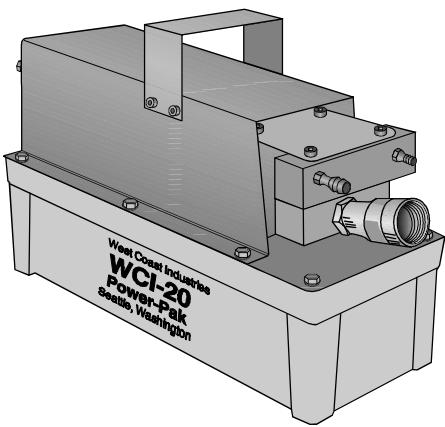
Note: Additional sized tooling sets may be ordered with the **CWORK-1**, and **CWORK-3** kits. Please contact our technical sales department for further information.

eg. 6-1-N Tool Set—This set contains all tooling necessary to coldwork a $\frac{3}{16}$ " hole, first oversize, and would most likely be ordered with the **CWORK-1**

18-2-N Tool Set—This complete set coldworks a $\frac{9}{16}$ " nominal hole, second oversize, and would be used with the **CWORK-3**

Each **CWORK-3** kit contains:

- 1 1800-30 Puller Unit
- 1 WCI-20 Power Unit
- 1 Four Drawer Mobile Cabinet



Contents

<i>CB Tooling Tables—Introduction</i>	1
<i>CB Tooling Tables—Mandrel Tool Code</i> 4-0-N thru 16-3-N	2-4
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<i>CB Tooling Tables—Mandrel Tool Code</i> 36-0-N thru 56-3-N	9-12
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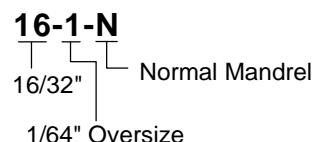
CB Tooling Tables

Providing high interference of between 3-6%, CB tooling is used in production and rework environments in aluminum and mild steel. It is available in standard sizes ranging from $\frac{1}{8}$ " to $1\frac{5}{16}$ " in $\frac{1}{64}$ " increments. CB Tooling is available as the CWORK-1 and CWORK-3 kits, packaged in four drawer mobile cabinets. See section IV for a complete description.

The tables on the following pages will help you to choose the proper tooling for a given hole size. In the table below, you may choose the proper puller, depending upon the range of hole sizes to be coldworked, and whether access is restricted.

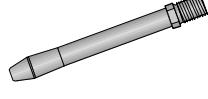
CB Mandrel Tool Code

The mandrel tool code for CB tooling is composed of three parts: the fastener size in $\frac{1}{32}$ " increments, hole oversize in $\frac{1}{64}$ " increments, and an "N" or "S" denoting a normal or special mandrel:



CB Process Pullers	
Puller	Mandrel Code Range
1700	4-0-N - 16-3-N
1800	14-0-N - 30-3-N
1900	32-0-N - 56-3-N
1600-HO	4-0-N - 12-3-N
1700-HO	4-0-N - 16-3-N
1750-HO	14-0-N - 24-3-N
1800-HO	14-0-N - 30-3-N

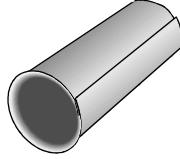
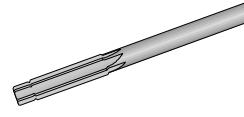
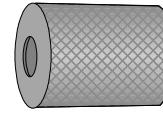
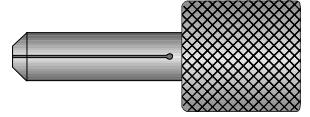
4-0-N thru 16-3-N

Nominal Hole Size	Mandrel Tool Code	Start Hole Range		Start Hole Drill	Start Reamer	Mandrel (1)
1/8	4-0-N	0.113	0.115	WCI-SD-4-0-N	WCI-SR-4-0-N	WCI-CBM-4-0-N-1-XX
9/64	4-1-N	0.128	0.130	WCI-SD-4-1-N	WCI-SR-4-1-N	WCI-CBM-4-1-N-1-XX
5/32	4-2-N	0.143	0.146	WCI-SD-4-2-N	WCI-SR-4-2-N	WCI-CBM-4-2-N-1-XX
11/64	4-3-N	0.159	0.162	WCI-SD-4-3-N	WCI-SR-4-3-N	WCI-CBM-4-3-N-1-XX
3/16 SPL	4-4-N	0.169	0.171	WCI-SD-4-4-N	WCI-SR-4-4-N	WCI-CBM-4-4-N-1-XX
3/16	6-0-N	0.177	0.180	WCI-SD-6-0-N	WCI-SR-6-0-N	WCI-CBM-6-0-N-1-XX
13/64	6-1-N	0.192	0.195	WCI-SD-6-1-N	WCI-SR-6-1-N	WCI-CBM-6-1-N-1-XX
7/32	6-2-N	0.209	0.212	WCI-SD-6-2-N	WCI-SR-6-2-N	WCI-CBM-6-2-N-1-XX
15/64	6-3-N	0.225	0.228	WCI-SD-6-3-N	WCI-SR-6-3-N	WCI-CBM-6-3-N-1-XX
1/4	8-0-N	0.235	0.238	WCI-SD-8-0-N	WCI-SR-8-0-N	WCI-CBM-8-0-N-1-XX
17/64	8-1-N	0.251	0.254	WCI-SD-8-1-N	WCI-SR-8-1-N	WCI-CBM-8-1-N-1-XX
9/32	8-2-N	0.266	0.269	WCI-SD-8-2-N	WCI-SR-8-2-N	WCI-CBM-8-2-N-1-XX
19/64	8-3-N	0.283	0.286	WCI-SD-8-3-N	WCI-SR-8-3-N	WCI-CBM-8-3-N-1-XX
5/16	10-0-N	0.297	0.300	WCI-SD-10-0-N	WCI-SR-10-0-N	WCI-CBM-10-0-N-1-XX
21/64	10-1-N	0.313	0.316	WCI-SD-10-1-N	WCI-SR-10-1-N	WCI-CBM-10-1-N-1-XX
11/32	10-2-N	0.328	0.331	WCI-SD-10-2-N	WCI-SR-10-2-N	WCI-CBM-10-2-N-1-XX
23/64	10-3-N	0.344	0.347	WCI-SD-10-3-N	WCI-SR-10-3-N	WCI-CBM-10-3-N-1-XX
3/8	12-0-N	0.359	0.362	WCI-SD-12-0-N	WCI-SR-12-0-N	WCI-CBM-12-0-N-1-XX
25/64	12-1-N	0.375	0.378	WCI-SD-12-1-N	WCI-SR-12-1-N	WCI-CBM-12-1-N-1-XX
13/32	12-2-N	0.391	0.394	WCI-SD-12-2-N	WCI-SR-12-2-N	WCI-CBM-12-2-N-1-XX
27/64	12-3-N	0.406	0.409	WCI-SD-12-3-N	WCI-SR-12-3-N	WCI-CBM-12-3-N-1-XX
7/16	14-0-N	0.421	0.424	WCI-SD-14-0-N	WCI-SR-14-0-N	WCI-CBM-14-0-N-*-XX
29/64	14-1-N	0.437	0.440	WCI-SD-14-1-N	WCI-SR-14-1-N	WCI-CBM-14-1-N-*-XX
15/32	14-2-N	0.450	0.453	WCI-SD-14-2-N	WCI-SR-14-2-N	WCI-CBM-14-2-N-*-XX
31/64	14-3-N	0.465	0.468	WCI-SD-14-3-N	WCI-SR-14-3-N	WCI-CBM-14-3-N-*-XX
1/2	16-0-N	0.474	0.477	WCI-SD-16-0-N	WCI-SR-16-0-N	WCI-CBM-16-0-N-*-XX
33/64	16-1-N	0.490	0.493	WCI-SD-16-1-N	WCI-SR-16-1-N	WCI-CBM-16-1-N-*-XX
17/32	16-2-N	0.505	0.508	WCI-SD-16-2-N	WCI-SR-16-2-N	WCI-CBM-16-2-N-*-XX
35/64	16-3-N	0.521	0.524	WCI-SD-16-3-N	WCI-SR-16-3-N	WCI-CBM-16-3-N-*-XX
						
						XX=Stackup Thickness * See Note

Note: 14-0-N through 16-3-N mandrels may be used with both the 1700 & 1800 series pullers. The 1700 uses a $7/16$ -20 attachment (1), while the 1800 puller uses a $5/8$ -18 attachment (2).

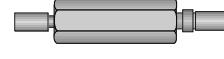
- When used with an extension nosecap, mandrel length is equal to stackup thickness, plus the length of the nosecap extension.

4-0-N thru 16-3-N

Mandrel Tool Code	Sleeve	Final Reamer	Flush Nosecap	Extension	Nosecap
4-0-N	CBS-4-0-N-XX *	WCI-FR-4-0-N-XXXX	WCI-1700N-04F	WCI-1700NE-0401-XXF	
4-1-N	CBS-4-1-N-XX *	WCI-FR-4-1-N-XXXX	WCI-1700N-04F	WCI-1700NE-0401-XXF	
4-2-N	CBS-4-2-N-XX *	WCI-FR-4-2-N-XXXX	WCI-1700N-04F	WCI-1700NE-0423-XXF	
4-3-N	CBS-4-3-N-XX *	WCI-FR-4-3-N-XXXX	WCI-1700N-04F	WCI-1700NE-0423-XXF	
4-4-N	CBS-4-4-N-XX *	WCI-FR-4-4-N-XXXX	WCI-1700N-06F	WCI-1700NE-0601-XXF	
6-0-N	CBS-6-0-N-XX *	WCI-FR-6-0-N-XXXX	WCI-1700N-06F	WCI-1700NE-0601-XXF	
6-1-N	CBS-6-1-N-XX *	WCI-FR-6-1-N-XXXX	WCI-1700N-06F	WCI-1700NE-0601-XXF	
6-2-N	CBS-6-2-N-XX *	WCI-FR-6-2-N-XXXX	WCI-1700N-06F	WCI-1700NE-0623-XXF	
6-3-N	CBS-6-3-N-XX *	WCI-FR-6-3-N-XXXX	WCI-1700N-06F	WCI-1700NE-0623-XXF	
8-0-N	CBS-8-0-N-XX *	WCI-FR-8-0-N-XXXX	WCI-1700N-08F	WCI-1700NE-0801-XXF	
8-1-N	CBS-8-1-N-XX *	WCI-FR-8-1-N-XXXX	WCI-1700N-08F	WCI-1700NE-0801-XXF	
8-2-N	CBS-8-2-N-XX *	WCI-FR-8-2-N-XXXX	WCI-1700N-08F	WCI-1700NE-0823-XXF	
8-3-N	CBS-8-3-N-XX *	WCI-FR-8-3-N-XXXX	WCI-1700N-08F	WCI-1700NE-0823-XXF	
10-0-N	CBS-10-0-N-XX *	WCI-FR-10-0-N-XXXX	WCI-1700N-10F	WCI-1700NE-1001-XXF	
10-1-N	CBS-10-1-N-XX *	WCI-FR-10-1-N-XXXX	WCI-1700N-10F	WCI-1700NE-1001-XXF	
10-2-N	CBS-10-2-N-XX *	WCI-FR-10-2-N-XXXX	WCI-1700N-10F	WCI-1700NE-1023-XXF	
10-3-N	CBS-10-3-N-XX *	WCI-FR-10-3-N-XXXX	WCI-1700N-10F	WCI-1700NE-1023-XXF	
12-0-N	CBS-12-0-N-XX *	WCI-FR-12-0-N-XXXX	WCI-1700N-12F	WCI-1700NE-1201-XXF	
12-1-N	CBS-12-1-N-XX *	WCI-FR-12-1-N-XXXX	WCI-1700N-12F	WCI-1700NE-1201-XXF	
12-2-N	CBS-12-2-N-XX *	WCI-FR-12-2-N-XXXX	WCI-1700N-12F	WCI-1700NE-1223-XXF	
12-3-N	CBS-12-3-N-XX *	WCI-FR-12-3-N-XXXX	WCI-1700N-12F	WCI-1700NE-1223-XXF	
14-0-N	CBS-14-0-N-XX *	WCI-FR-14-0-N-XXXX	WCI- **** N-14F	WCI- **** NE-1401-XXF	
14-1-N	CBS-14-1-N-XX *	WCI-FR-14-1-N-XXXX	WCI- **** N-14F	WCI- **** NE-1401-XXF	
14-2-N	CBS-14-2-N-XX *	WCI-FR-14-2-N-XXXX	WCI- **** N-14F	WCI- **** NE-1423-XXF	
14-3-N	CBS-14-3-N-XX *	WCI-FR-14-3-N-XXXX	WCI- **** N-14F	WCI- **** NE-1423-XXF	
16-0-N	CBS-16-0-N-XX *	WCI-FR-16-0-N-XXXX	WCI- **** N-16F	WCI- **** NE-1601-XXF	
16-1-N	CBS-16-1-N-XX *	WCI-FR-16-1-N-XXXX	WCI- **** N-16F	WCI- **** NE-1601-XXF	
16-2-N	CBS-16-2-N-XX *	WCI-FR-16-2-N-XXXX	WCI- **** N-16F	WCI- **** NE-1623-XXF	
16-3-N	CBS-16-3-N-XX *	WCI-FR-16-3-N-XXXX	WCI- **** N-16F	WCI- **** NE-1623-XXF	
					
	XX=Sleeve Length * = (F)lared or (S)leeve	XXXX=Final Hole Diameter	****=See Note	****=See Note XX=Extension Length	

**** Note: Substitute puller model number. Either the 1700 or 1800 puller may be used with 14-0-N to 16-3-N tooling.

4-0-N thru 16-3-N

Mandrel Tool Code	Start Hole Gage	Combination Gage	Mandrel Wear Gage	Final Hole Gage
4-0-N	WCI-SHG-4-0-N	WCI-CBG-4-0-N	WCIS-WG-4-0-N	WCI-FHG-****-XXXX
4-1-N	WCI-SHG-4-1-N	WCI-CBG-4-1-N	WCIS-WG-4-1-N	WCI-FHG-****-XXXX
4-2-N	WCI-SHG-4-2-N	WCI-CBG-4-2-N	WCIS-WG-4-2-N	WCI-FHG-****-XXXX
4-3-N	WCI-SHG-4-3-N	WCI-CBG-4-3-N	WCIS-WG-4-3-N	WCI-FHG-****-XXXX
4-4-N	WCI-SHG-4-4-N	WCI-CBG-4-4-N	WCIS-WG-4-4-N	WCI-FHG-****-XXXX
6-0-N	WCI-SHG-6-0-N	WCI-CBG-6-0-N	WCIS-WG-6-0-N	WCI-FHG-****-XXXX
6-1-N	WCI-SHG-6-1-N	WCI-CBG-6-1-N	WCIS-WG-6-1-N	WCI-FHG-****-XXXX
6-2-N	WCI-SHG-6-2-N	WCI-CBG-6-2-N	WCIS-WG-6-2-N	WCI-FHG-****-XXXX
6-3-N	WCI-SHG-6-3-N	WCI-CBG-6-3-N	WCIS-WG-6-3-N	WCI-FHG-****-XXXX
8-0-N	WCI-SHG-8-0-N	WCI-CBG-8-0-N	WCIS-WG-8-0-N	WCI-FHG-****-XXXX
8-1-N	WCI-SHG-8-1-N	WCI-CBG-8-1-N	WCIS-WG-8-1-N	WCI-FHG-****-XXXX
8-2-N	WCI-SHG-8-2-N	WCI-CBG-8-2-N	WCIS-WG-8-2-N	WCI-FHG-****-XXXX
8-3-N	WCI-SHG-8-3-N	WCI-CBG-8-3-N	WCIS-WG-8-3-N	WCI-FHG-****-XXXX
10-0-N	WCI-SHG-10-0-N	WCI-CBG-10-0-N	WCIS-WG-10-0-N	WCI-FHG-****-XXXX
10-1-N	WCI-SHG-10-1-N	WCI-CBG-10-1-N	WCIS-WG-10-1-N	WCI-FHG-****-XXXX
10-2-N	WCI-SHG-10-2-N	WCI-CBG-10-2-N	WCIS-WG-10-2-N	WCI-FHG-****-XXXX
10-3-N	WCI-SHG-10-3-N	WCI-CBG-10-3-N	WCIS-WG-10-3-N	WCI-FHG-****-XXXX
12-0-N	WCI-SHG-12-0-N	WCI-CBG-12-0-N	WCIS-WG-12-0-N	WCI-FHG-****-XXXX
12-1-N	WCI-SHG-12-1-N	WCI-CBG-12-1-N	WCIS-WG-12-1-N	WCI-FHG-****-XXXX
12-2-N	WCI-SHG-12-2-N	WCI-CBG-12-2-N	WCIS-WG-12-2-N	WCI-FHG-****-XXXX
12-3-N	WCI-SHG-12-3-N	WCI-CBG-12-3-N	WCIS-WG-12-3-N	WCI-FHG-****-XXXX
14-0-N	WCI-SHG-14-0-N	WCI-CBG-14-0-N	WCIS-WG-14-0-N	WCI-FHG-****-XXXX
14-1-N	WCI-SHG-14-1-N	WCI-CBG-14-1-N	WCIS-WG-14-1-N	WCI-FHG-****-XXXX
14-2-N	WCI-SHG-14-2-N	WCI-CBG-14-2-N	WCIS-WG-14-2-N	WCI-FHG-****-XXXX
14-3-N	WCI-SHG-14-3-N	WCI-CBG-14-3-N	WCIS-WG-14-3-N	WCI-FHG-****-XXXX
16-0-N	WCI-SHG-16-0-N	WCI-CBG-16-0-N	WCIS-WG-16-0-N	WCI-FHG-****-XXXX
16-1-N	WCI-SHG-16-1-N	WCI-CBG-16-1-N	WCIS-WG-16-1-N	WCI-FHG-****-XXXX
16-2-N	WCI-SHG-16-2-N	WCI-CBG-16-2-N	WCIS-WG-16-2-N	WCI-FHG-****-XXXX
16-3-N	WCI-SHG-16-3-N	WCI-CBG-16-3-N	WCIS-WG-16-3-N	WCI-FHG-****-XXXX
				
				**** = Go Diameter XXXX=No-Go Diameter

18-0-N thru 32-3-N

18-0-N thru 32-3-N

Nominal Hole Size	Mandrel Tool Code	Start Hole Range		Start Drill	Start Reamer	Mandrel (1)
9/16	18-0-N	0.537	0.540	WCI-SD-18-0-N	WCI-SR-18-0-N	WCI-CBM-18-0-N-2-XX
37/64	18-1-N	0.553	0.556	WCI-SD-18-1-N	WCI-SR-18-1-N	WCI-CBM-18-1-N-2-XX
19/32	18-2-N	0.568	0.571	WCI-SD-18-2-N	WCI-SR-18-2-N	WCI-CBM-18-2-N-2-XX
39/64	18-3-N	0.583	0.586	WCI-SD-18-3-N	WCI-SR-18-3-N	WCI-CBM-18-3-N-2-XX
5/8	20-0-N	0.597	0.600	WCI-SD-20-0-N	WCI-SR-20-0-N	WCI-CBM-20-0-N-2-XX
41/64	20-1-N	0.613	0.616	WCI-SD-20-1-N	WCI-SR-20-1-N	WCI-CBM-20-1-N-2-XX
21/32	20-2-N	0.631	0.634	WCI-SD-20-2-N	WCI-SR-20-2-N	WCI-CBM-20-2-N-2-XX
43/64	20-3-N	0.646	0.649	WCI-SD-20-3-N	WCI-SR-20-3-N	WCI-CBM-20-3-N-2-XX
11/16	22-0-N	0.659	0.662	WCI-SD-22-0-N	WCI-SR-22-0-N	WCI-CBM-22-0-N-2-XX
45/64	22-1-N	0.675	0.678	WCI-SD-22-1-N	WCI-SR-22-1-N	WCI-CBM-22-1-N-2-XX
23/32	22-2-N	0.690	0.693	WCI-SD-22-2-N	WCI-SR-22-2-N	WCI-CBM-22-2-N-2-XX
47/64	22-3-N	0.706	0.709	WCI-SD-22-3-N	WCI-SR-22-3-N	WCI-CBM-22-3-N-2-XX
3/4	24-0-N	0.718	0.721	WCI-SD-24-0-N	WCI-SR-24-0-N	WCI-CBM-24-0-N-2-XX
49/64	24-1-N	0.734	0.737	WCI-SD-24-1-N	WCI-SR-24-1-N	WCI-CBM-24-1-N-2-XX
25/32	24-2-N	0.749	0.752	WCI-SD-24-2-N	WCI-SR-24-2-N	WCI-CBM-24-2-N-2-XX
51/64	24-3-N	0.765	0.768	WCI-SD-24-3-N	WCI-SR-24-3-N	WCI-CBM-24-3-N-2-XX
13/16	26-0-N	0.782	0.785	WCI-SD-26-0-N	WCI-SR-26-0-N	WCI-CBM-26-0-N-2-XX
53/64	26-1-N	0.798	0.801	WCI-SD-26-1-N	WCI-SR-26-1-N	WCI-CBM-26-1-N-2-XX
27/32	26-2-N	0.811	0.814	WCI-SD-26-2-N	WCI-SR-26-2-N	WCI-CBM-26-2-N-2-XX
55/64	26-3-N	0.826	0.829	WCI-SD-26-3-N	WCI-SR-26-3-N	WCI-CBM-26-3-N-2-XX
7/8	28-0-N	0.841	0.844	WCI-SD-28-0-N	WCI-SR-28-0-N	WCI-CBM-28-0-N-2-XX
57/64	28-1-N	0.857	0.860	WCI-SD-28-1-N	WCI-SR-28-1-N	WCI-CBM-28-1-N-2-XX
29/32	28-2-N	0.879	0.882	WCI-SD-28-2-N	WCI-SR-28-2-N	WCI-CBM-28-2-N-2-XX
59/64	28-3-N	0.894	0.897	WCI-SD-28-3-N	WCI-SR-28-3-N	WCI-CBM-28-3-N-2-XX
15/16	30-0-N	0.901	0.904	WCI-SD-30-0-N	WCI-SR-30-0-N	WCI-CBM-30-0-N-2-XX
61/64	30-1-N	0.917	0.920	WCI-SD-30-1-N	WCI-SR-30-1-N	WCI-CBM-30-1-N-2-XX
31/32	30-2-N	0.933	0.936	WCI-SD-30-2-N	WCI-SR-30-2-N	WCI-CBM-30-2-N-2-XX
63/64	30-3-N	0.949	0.952	WCI-SD-30-3-N	WCI-SR-30-3-N	WCI-CBM-30-3-N-2-XX
1	32-0-N	0.965	0.968	WCI-SD-32-0-N	WCI-SR-32-0-N	WCI-CBM-32-0-N-*XX
1 1/64	32-1-N	0.981	0.984	WCI-SD-32-1-N	WCI-SR-32-1-N	WCI-CBM-32-1-N-*XX
1 1/32	32-2-N	0.997	1.000	WCI-SD-32-2-N	WCI-SR-32-2-N	WCI-CBM-32-2-N-*XX
1 3/64	32-3-N	1.013	1.016	WCI-SD-32-3-N	WCI-SR-32-3-N	WCI-CBM-32-3-N-*XX
						*=Attachment Callout (see III-2) XX=Stackup Thickness

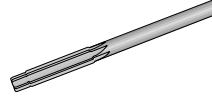
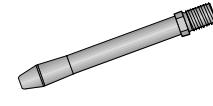
1) When used with an extension nosecap, mandrel length is equal to stackup thickness, plus the length of the nosecap extension.

18-0-N thru 32-3-N

Mandrel Tool Code	Start Hole Gage	Combination Gage	Mandrel Wear Gage	Final Hole Gage
18-0-N	WCI-SHG-18-0-N	WCI-CBG-18-0-N	WCIS-WG-18-0-N	WCI-FHG-****-XXXX
18-1-N	WCI-SHG-18-1-N	WCI-CBG-18-1-N	WCIS-WG-18-1-N	WCI-FHG-****-XXXX
18-2-N	WCI-SHG-18-2-N	WCI-CBG-18-2-N	WCIS-WG-18-2-N	WCI-FHG-****-XXXX
18-3-N	WCI-SHG-18-3-N	WCI-CBG-18-3-N	WCIS-WG-18-3-N	WCI-FHG-****-XXXX
20-0-N	WCI-SHG-20-0-N	WCI-CBG-20-0-N	WCIS-WG-20-0-N	WCI-FHG-****-XXXX
20-1-N	WCI-SHG-20-1-N	WCI-CBG-20-1-N	WCIS-WG-20-1-N	WCI-FHG-****-XXXX
20-2-N	WCI-SHG-20-2-N	WCI-CBG-20-2-N	WCIS-WG-20-2-N	WCI-FHG-****-XXXX
20-3-N	WCI-SHG-20-3-N	WCI-CBG-20-3-N	WCIS-WG-20-3-N	WCI-FHG-****-XXXX
22-0-N	WCI-SHG-22-0-N	WCI-CBG-22-0-N	WCIS-WG-22-0-N	WCI-FHG-****-XXXX
22-1-N	WCI-SHG-22-1-N	WCI-CBG-22-1-N	WCIS-WG-22-1-N	WCI-FHG-****-XXXX
22-2-N	WCI-SHG-22-2-N	WCI-CBG-22-2-N	WCIS-WG-22-2-N	WCI-FHG-****-XXXX
22-3-N	WCI-SHG-22-3-N	WCI-CBG-22-3-N	WCIS-WG-22-3-N	WCI-FHG-****-XXXX
24-0-N	WCI-SHG-24-0-N	WCI-CBG-24-0-N	WCIS-WG-24-0-N	WCI-FHG-****-XXXX
24-1-N	WCI-SHG-24-1-N	WCI-CBG-24-1-N	WCIS-WG-24-1-N	WCI-FHG-****-XXXX
24-2-N	WCI-SHG-24-2-N	WCI-CBG-24-2-N	WCIS-WG-24-2-N	WCI-FHG-****-XXXX
24-3-N	WCI-SHG-24-3-N	WCI-CBG-24-3-N	WCIS-WG-24-3-N	WCI-FHG-****-XXXX
26-0-N	WCI-SHG-26-0-N	WCI-CBG-26-0-N	WCIS-WG-26-0-N	WCI-FHG-****-XXXX
26-1-N	WCI-SHG-26-1-N	WCI-CBG-26-1-N	WCIS-WG-26-1-N	WCI-FHG-****-XXXX
26-2-N	WCI-SHG-26-2-N	WCI-CBG-26-2-N	WCIS-WG-26-2-N	WCI-FHG-****-XXXX
26-3-N	WCI-SHG-26-3-N	WCI-CBG-26-3-N	WCIS-WG-26-3-N	WCI-FHG-****-XXXX
28-0-N	WCI-SHG-28-0-N	WCI-CBG-28-0-N	WCIS-WG-28-0-N	WCI-FHG-****-XXXX
28-1-N	WCI-SHG-28-1-N	WCI-CBG-28-1-N	WCIS-WG-28-1-N	WCI-FHG-****-XXXX
28-2-N	WCI-SHG-28-2-N	WCI-CBG-28-2-N	WCIS-WG-28-2-N	WCI-FHG-****-XXXX
28-3-N	WCI-SHG-28-3-N	WCI-CBG-28-3-N	WCIS-WG-28-3-N	WCI-FHG-****-XXXX
30-0-N	WCI-SHG-30-0-N	WCI-CBG-30-0-N	WCIS-WG-30-0-N	WCI-FHG-****-XXXX
30-1-N	WCI-SHG-30-1-N	WCI-CBG-30-1-N	WCIS-WG-30-1-N	WCI-FHG-****-XXXX
30-2-N	WCI-SHG-30-2-N	WCI-CBG-30-2-N	WCIS-WG-30-2-N	WCI-FHG-****-XXXX
30-3-N	WCI-SHG-30-3-N	WCI-CBG-30-3-N	WCIS-WG-30-3-N	WCI-FHG-****-XXXX
32-0-N	WCI-SHG-32-0-N	WCI-CBG-32-0-N	WCIS-WG-32-0-N	WCI-FHG-****-XXXX
32-1-N	WCI-SHG-32-1-N	WCI-CBG-32-1-N	WCIS-WG-32-1-N	WCI-FHG-****-XXXX
32-2-N	WCI-SHG-32-2-N	WCI-CBG-32-2-N	WCIS-WG-32-2-N	WCI-FHG-****-XXXX
32-3-N	WCI-SHG-32-3-N	WCI-CBG-32-3-N	WCIS-WG-32-3-N	WCI-FHG-****-XXXX
				****=Go Diameter XXXX=No Go Diameter

36-0-N thru 56-3-N

36-0-N thru 56-3-N

Nominal Hole Size	Mandrel Tool Code	Start Hole Range	Start Hole Drill	Start Reamer	Mandrel (1)
1 1/8	36-0-N	1.075 1.078	WCI-SD-36-0-N	WCI-SR-36-0-N	WCI-CBM-36-0-N-*-XX
1 9/64	36-1-N	1.091 1.094	WCI-SD-36-1-N	WCI-SR-36-1-N	WCI-CBM-36-1-N-*-XX
1 5/32	36-2-N	1.107 1.110	WCI-SD-36-2-N	WCI-SR-36-2-N	WCI-CBM-36-2-N-*-XX
1 11/64	36-3-N	1.123 1.126	WCI-SD-36-3-N	WCI-SR-36-3-N	WCI-CBM-36-3-N-*-XX
1 3/16	38-0-N	1.136 1.140	WCI-SD-38-0-N	WCI-SR-38-0-N	WCI-CBM-38-0-N-*-XX
1 13/64	38-1-N	1.152 1.156	WCI-SD-38-1-N	WCI-SR-38-1-N	WCI-CBM-38-1-N-*-XX
1 7/32	38-2-N	1.168 1.172	WCI-SD-38-2-N	WCI-SR-38-2-N	WCI-CBM-38-2-N-*-XX
1 15/64	38-3-N	1.184 1.188	WCI-SD-38-3-N	WCI-SR-38-3-N	WCI-CBM-38-3-N-*-XX
1 1/4	40-0-N	1.199 1.203	WCI-SD-40-0-N	WCI-SR-40-0-N	WCI-CBM-40-0-N-*-XX
1 17/64	40-1-N	1.215 1.219	WCI-SD-40-1-N	WCI-SR-40-1-N	WCI-CBM-40-1-N-*-XX
1 9/32	40-2-N	1.231 1.235	WCI-SD-40-2-N	WCI-SR-40-2-N	WCI-CBM-40-2-N-*-XX
1 19/64	40-3-N	1.247 1.251	WCI-SD-40-3-N	WCI-SR-40-3-N	WCI-CBM-40-3-N-*-XX
1 3/8	44-0-N	1.316 1.320	WCI-SD-44-0-N	WCI-SR-44-0-N	WCI-CBM-44-0-N-*-XX
1 25/64	44-1-N	1.336 1.340	WCI-SD-44-1-N	WCI-SR-44-1-N	WCI-CBM-44-1-N-*-XX
1 13/32	44-2-N	1.352 1.356	WCI-SD-44-2-N	WCI-SR-44-2-N	WCI-CBM-44-2-N-*-XX
1 27/64	44-3-N	1.368 1.372	WCI-SD-44-3-N	WCI-SR-44-3-N	WCI-CBM-44-3-N-*-XX
1 1/2	48-0-N	1.427 1.431	WCI-SD-48-0-N	WCI-SR-48-0-N	WCI-CBM-48-0-N-*-XX
1 33/64	48-1-N	1.443 1.447	WCI-SD-48-1-N	WCI-SR-48-1-N	WCI-CBM-48-1-N-*-XX
1 17/32	48-2-N	1.459 1.463	WCI-SD-48-2-N	WCI-SR-48-2-N	WCI-CBM-48-2-N-*-XX
1 35/64	48-3-N	1.475 1.479	WCI-SD-48-3-N	WCI-SR-48-3-N	WCI-CBM-48-3-N-*-XX
1 5/8	52-0-N	1.559 1.563	WCI-SD-52-0-N	WCI-SR-52-0-N	WCI-CBM-52-0-N-*-XX
1 41/64	52-1-N	1.575 1.579	WCI-SD-52-1-N	WCI-SR-52-1-N	WCI-CBM-52-1-N-*-XX
1 21/32	52-2-N	1.591 1.595	WCI-SD-52-2-N	WCI-SR-52-2-N	WCI-CBM-52-2-N-*-XX
1 43/64	52-3-N	1.607 1.611	WCI-SD-52-3-N	WCI-SR-52-3-N	WCI-CBM-52-3-N-*-XX
1 3/4	56-0-N	1.696 1.700	WCI-SD-56-0-N	WCI-SR-56-0-N	WCI-CBM-56-0-N-*-XX
1 49/64	56-1-N	1.711 1.715	WCI-SD-56-1-N	WCI-SR-56-1-N	WCI-CBM-56-1-N-*-XX
1 25/32	56-2-N	1.726 1.730	WCI-SD-56-2-N	WCI-SR-56-2-N	WCI-CBM-56-2-N-*-XX
1 51/64	56-3-N	1.742 1.746	WCI-SD-56-3-N	WCI-SR-56-3-N	WCI-CBM-56-3-N-*-XX
					
					*=Attachment Callout (See III-2) XX=Stackup Thickness

1) When used with an extension nosecap, mandrel length is equal to stackup thickness, plus the length of the nosecap extension.

36-0-N thru 56-3-N

Mandrel Tool Code	Sleeve	Final Reamer	Flush Nosecap	Extension Nosecap
36-0-N	CBS-36-0-N-XX *	WCI-FR-36-0-N-XXXX	WCI-1900N-36X	WCI-1900NE-36-0-XXF
36-1-N	CBS-36-1-N-XX *	WCI-FR-36-1-N-XXXX	WCI-1900N-36X	WCI-1900NE-36-1-XXF
36-2-N	CBS-36-2-N-XX *	WCI-FR-36-2-N-XXXX	WCI-1900N-36X	WCI-1900NE-36-2-XXF
36-3-N	CBS-36-3-N-XX *	WCI-FR-36-3-N-XXXX	WCI-1900N-36X	WCI-1900NE-36-3-XXF
38-0-N	CBS-38-0-N-XX *	WCI-FR-38-0-N-XXXX	WCI-1900N-38X	WCI-1900NE-38-0-XXF
38-1-N	CBS-38-1-N-XX *	WCI-FR-38-1-N-XXXX	WCI-1900N-38X	WCI-1900NE-38-1-XXF
38-2-N	CBS-38-2-N-XX *	WCI-FR-38-2-N-XXXX	WCI-1900N-38X	WCI-1900NE-38-2-XXF
38-3-N	CBS-38-3-N-XX *	WCI-FR-38-3-N-XXXX	WCI-1900N-38X	WCI-1900NE-38-3-XXF
40-0-N	CBS-40-0-N-XX *	WCI-FR-40-0-N-XXXX	WCI-1900N-40X	WCI-1900NE-40-0-XXF
40-1-N	CBS-40-1-N-XX *	WCI-FR-40-1-N-XXXX	WCI-1900N-40X	WCI-1900NE-40-1-XXF
40-2-N	CBS-40-2-N-XX *	WCI-FR-40-2-N-XXXX	WCI-1900N-40X	WCI-1900NE-40-2-XXF
40-3-N	CBS-40-3-N-XX *	WCI-FR-40-3-N-XXXX	WCI-1900N-40X	WCI-1900NE-40-3-XXF
44-0-N	CBS-44-0-N-XX *	WCI-FR-44-0-N-XXXX	WCI-1900N-44X	WCI-1900NE-44-0-XXF
44-1-N	CBS-44-1-N-XX *	WCI-FR-44-1-N-XXXX	WCI-1900N-44X	WCI-1900NE-44-1-XXF
44-2-N	CBS-44-2-N-XX *	WCI-FR-44-2-N-XXXX	WCI-1900N-44X	WCI-1900NE-44-2-XXF
44-3-N	CBS-44-3-N-XX *	WCI-FR-44-3-N-XXXX	WCI-1900N-44X	WCI-1900NE-44-3-XXF
48-0-N	CBS-48-0-N-XX *	WCI-FR-48-0-N-XXXX	WCI-1900N-48X	WCI-1900NE-48-0-XXF
48-1-N	CBS-48-1-N-XX *	WCI-FR-48-1-N-XXXX	WCI-1900N-48X	WCI-1900NE-48-1-XXF
48-2-N	CBS-48-2-N-XX *	WCI-FR-48-2-N-XXXX	WCI-1900N-48X	WCI-1900NE-48-2-XXF
48-3-N	CBS-48-3-N-XX *	WCI-FR-48-3-N-XXXX	WCI-1900N-48X	WCI-1900NE-48-3-XXF
52-0-N	CBS-52-0-N-XX *	WCI-FR-52-0-N-XXXX	WCI-1900N-52X	WCI-1900NE-52-0-XXF
52-1-N	CBS-52-1-N-XX *	WCI-FR-52-1-N-XXXX	WCI-1900N-52X	WCI-1900NE-52-1-XXF
52-2-N	CBS-52-2-N-XX *	WCI-FR-52-2-N-XXXX	WCI-1900N-52X	WCI-1900NE-52-2-XXF
52-3-N	CBS-52-3-N-XX *	WCI-FR-52-3-N-XXXX	WCI-1900N-52X	WCI-1900NE-52-3-XXF
56-0-N	CBS-56-0-N-XX *	WCI-FR-56-0-N-XXXX	WCI-1900N-56X	WCI-1900NE-56-0-XXF
56-1-N	CBS-56-1-N-XX *	WCI-FR-56-1-N-XXXX	WCI-1900N-56X	WCI-1900NE-56-1-XXF
56-2-N	CBS-56-2-N-XX *	WCI-FR-56-2-N-XXXX	WCI-1900N-56X	WCI-1900NE-56-2-XXF
56-3-N	CBS-56-3-N-XX *	WCI-FR-56-3-N-XXXX	WCI-1900N-56X	WCI-1900NE-56-3-XXF
	XX=Sleeve Length * = (F)lared or (S)traight	XXXX=Final Hole Diameter	X=(F)lared or (S)traight	XX=Extension Length

36-0-N thru 56-3-N

Mandrel Tool Code	Start Hole Gage	Combination Gage	Mandrel Wear Gage	Final Hole Gage
36-0-N	WCI-SHG-36-0-N	WCI-CBG-36-0-N	WCIS-WG-36-0-N	WCI-FHG-****-XXXX
36-1-N	WCI-SHG-36-1-N	WCI-CBG-36-1-N	WCIS-WG-36-1-N	WCI-FHG-****-XXXX
36-2-N	WCI-SHG-36-2-N	WCI-CBG-36-2-N	WCIS-WG-36-2-N	WCI-FHG-****-XXXX
36-3-N	WCI-SHG-36-3-N	WCI-CBG-36-3-N	WCIS-WG-36-3-N	WCI-FHG-****-XXXX
38-0-N	WCI-SHG-38-0-N	WCI-CBG-38-0-N	WCIS-WG-38-0-N	WCI-FHG-****-XXXX
38-1-N	WCI-SHG-38-1-N	WCI-CBG-38-1-N	WCIS-WG-38-1-N	WCI-FHG-****-XXXX
38-2-N	WCI-SHG-38-2-N	WCI-CBG-38-2-N	WCIS-WG-38-2-N	WCI-FHG-****-XXXX
38-3-N	WCI-SHG-38-3-N	WCI-CBG-38-3-N	WCIS-WG-38-3-N	WCI-FHG-****-XXXX
40-0-N	WCI-SHG-40-0-N	WCI-CBG-40-0-N	WCIS-WG-40-0-N	WCI-FHG-****-XXXX
40-1-N	WCI-SHG-40-1-N	WCI-CBG-40-1-N	WCIS-WG-40-1-N	WCI-FHG-****-XXXX
40-2-N	WCI-SHG-40-2-N	WCI-CBG-40-2-N	WCIS-WG-40-2-N	WCI-FHG-****-XXXX
40-3-N	WCI-SHG-40-3-N	WCI-CBG-40-3-N	WCIS-WG-40-3-N	WCI-FHG-****-XXXX
44-0-N	WCI-SHG-44-0-N	WCI-CBG-44-0-N	WCIS-WG-44-0-N	WCI-FHG-****-XXXX
44-1-N	WCI-SHG-44-1-N	WCI-CBG-44-1-N	WCIS-WG-44-1-N	WCI-FHG-****-XXXX
44-2-N	WCI-SHG-44-2-N	WCI-CBG-44-2-N	WCIS-WG-44-2-N	WCI-FHG-****-XXXX
44-3-N	WCI-SHG-44-3-N	WCI-CBG-44-3-N	WCIS-WG-44-3-N	WCI-FHG-****-XXXX
48-0-N	WCI-SHG-48-0-N	WCI-CBG-48-0-N	WCIS-WG-48-0-N	WCI-FHG-****-XXXX
48-1-N	WCI-SHG-48-1-N	WCI-CBG-48-1-N	WCIS-WG-48-1-N	WCI-FHG-****-XXXX
48-2-N	WCI-SHG-48-2-N	WCI-CBG-48-2-N	WCIS-WG-48-2-N	WCI-FHG-****-XXXX
48-3-N	WCI-SHG-48-3-N	WCI-CBG-48-3-N	WCIS-WG-48-3-N	WCI-FHG-****-XXXX
52-0-N	WCI-SHG-52-0-N	WCI-CBG-52-0-N	WCIS-WG-52-0-N	WCI-FHG-****-XXXX
52-1-N	WCI-SHG-52-1-N	WCI-CBG-52-1-N	WCIS-WG-52-1-N	WCI-FHG-****-XXXX
52-2-N	WCI-SHG-52-2-N	WCI-CBG-52-2-N	WCIS-WG-52-2-N	WCI-FHG-****-XXXX
52-3-N	WCI-SHG-52-3-N	WCI-CBG-52-3-N	WCIS-WG-52-3-N	WCI-FHG-****-XXXX
56-0-N	WCI-SHG-56-0-N	WCI-CBG-56-0-N	WCIS-WG-56-0-N	WCI-FHG-****-XXXX
56-1-N	WCI-SHG-56-1-N	WCI-CBG-56-1-N	WCIS-WG-56-1-N	WCI-FHG-****-XXXX
56-2-N	WCI-SHG-56-2-N	WCI-CBG-56-2-N	WCIS-WG-56-2-N	WCI-FHG-****-XXXX
56-3-N	WCI-SHG-56-3-N	WCI-CBG-56-3-N	WCIS-WG-56-3-N	WCI-FHG-****-XXXX
				****=Go Diameter XXXX=No Go Diameter

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<i>Metric Conversion Chart</i>	9

CA Tooling Tables

CA Tooling is specifically designed to coldwork in titanium and steel alloys. The applied expansion typically ranges from 3.6 to 6.1%. The currently available hole sizes range from $\frac{1}{8}$ " to $\frac{45}{64}$ " in $\frac{1}{64}$ " increments.

The tables on the following pages will help you to choose the proper tooling for a given hole size. In the table below, you may choose the proper puller, depending upon the size range of holes to be coldworked, and whether access is restricted.

CA Mandrel Tool Code

The mandrel tool code for CA tooling is designated by an "A", the final hole size in $\frac{1}{16}$ ths, and the hole oversize in $\frac{1}{64}$ ths (three oversizes are available for each nominal size):

A31
 1st 1/64" Oversize
(13/64")
CA
Tooling

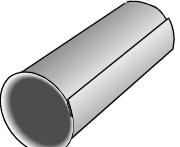
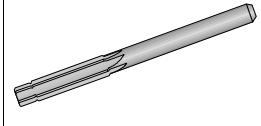
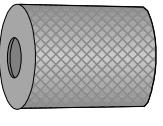
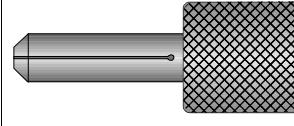
CA Process Pullers	
Puller	Mandrel Code Range
1700	A20 - A63
1800	A70 - A111
1600-HO	A20 - A63
1700-HO	A20 - A63
1750-HO	A70 - A111
1800-HO	A70 - A111

A20 thru A63

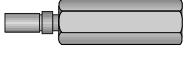
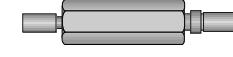
Nominal Hole Size	Mandrel Tool code	Start Hole Range	Start Hole Drill	Start Reamer	Mandrel (1)
1/8	A20	0.1100 0.1120	WCI-SD-A20	WCI-SR-A20	WCI-CAM-A20-1-XX-V2
9/64	A21	0.1250 0.1270	WCI-SD-A21	WCI-SR-A21	WCI-CAM-A21-1-XX-V2
5/32	A22	0.1400 0.1420	WCI-SD-A22	WCI-SR-A22	WCI-CAM-A22-1-XX-V2
11/64	A23	0.1560 0.1580	WCI-SD-A23	WCI-SR-A23	WCI-CAM-A23-1-XX-V2
3/16	A30	0.1700 0.1720	WCI-SD-A30	WCI-SR-A30	WCI-CAM-A30-1-XX-V2
13/64	A31	0.1850 0.1870	WCI-SD-A31	WCI-SR-A31	WCI-CAM-A31-1-XX-V2
7/32	A32	0.2000 0.2020	WCI-SD-A32	WCI-SR-A32	WCI-CAM-A32-1-XX-V2
15/64	A33	0.2160 0.2180	WCI-SD-A33	WCI-SR-A33	WCI-CAM-A33-1-XX-V2
1/4	A40	0.2310 0.2340	WCI-SD-A40	WCI-SR-A40	WCI-CAM-A40-1-XX-V2
17/64	A41	0.2460 0.2490	WCI-SD-A41	WCI-SR-A41	WCI-CAM-A41-1-XX-V2
9/32	A42	0.2610 0.2640	WCI-SD-A42	WCI-SR-A42	WCI-CAM-A42-1-XX-V2
19/64	A43	0.2770 0.2800	WCI-SD-A43	WCI-SR-A43	WCI-CAM-A43-1-XX-V2
5/16	A50	0.2870 0.2900	WCI-SD-A50	WCI-SR-A50	WCI-CAM-A50-1-XX-V2
21/64	A51	0.3020 0.3050	WCI-SD-A51	WCI-SR-A51	WCI-CAM-A51-1-XX-V2
11/32	A52	0.3180 0.3210	WCI-SD-A52	WCI-SR-A52	WCI-CAM-A52-1-XX-V2
23/64	A53	0.3330 0.3360	WCI-SD-A53	WCI-SR-A53	WCI-CAM-A53-1-XX-V2
3/8	A60	0.3480 0.3510	WCI-SD-A60	WCI-SR-A60	WCI-CAM-A60-2-XX-V2
25/64	A61	0.3630 0.3660	WCI-SD-A61	WCI-SR-A61	WCI-CAM-A61-2-XX-V2
13/32	A62	0.3790 0.3820	WCI-SD-A62	WCI-SR-A62	WCI-CAM-A62-2-XX-V2
27/64	A63	0.3940 0.3970	WCI-SD-A63	WCI-SR-A63	WCI-CAM-A63-2-XX-V2
					
					XX=Stackup Thickness

1) When using an extension nosecap, mandrel length is equal to stackup thickness plus the length of the nosecap extension.

A20 thru A63

Mandrel Tool Code	Sleeve	Final Reamer	Flush Nosecap	Extension Nosecap
A20	CAS-A20-XX *	WCI-FR-A20-XXXX	WCI-1700N-04X	WCI-1700NE-A2021-XXF
A21	CAS-A21-XX *	WCI-FR-A21-XXXX	WCI-1700N-04X	WCI-1700NE-A2021-XXF
A22	CAS-A22-XX *	WCI-FR-A22-XXXX	WCI-1700N-04X	WCI-1700NE-A2223-XXF
A23	CAS-A23-XX *	WCI-FR-A23-XXXX	WCI-1700N-04X	WCI-1700NE-A2223-XXF
A30	CAS-A30-XX *	WCI-FR-A30-XXXX	WCI-1700N-06X	WCI-1700NE-A3031-XXF
A31	CAS-A31-XX *	WCI-FR-A31-XXXX	WCI-1700N-06X	WCI-1700NE-A3031-XXF
A32	CAS-A32-XX *	WCI-FR-A32-XXXX	WCI-1700N-06X	WCI-1700NE-A3233-XXF
A33	CAS-A33-XX *	WCI-FR-A33-XXXX	WCI-1700N-06X	WCI-1700NE-A3233-XXF
A40	CAS-A40-XX *	WCI-FR-A40-XXXX	WCI-1700N-08X	WCI-1700NE-A4041-XXF
A41	CAS-A41-XX *	WCI-FR-A41-XXXX	WCI-1700N-08X	WCI-1700NE-A4041-XXF
A42	CAS-A42-XX *	WCI-FR-A42-XXXX	WCI-1700N-08X	WCI-1700NE-A4243-XXF
A43	CAS-A43-XX *	WCI-FR-A43-XXXX	WCI-1700N-08X	WCI-1700NE-A4243-XXF
A50	CAS-A50-XX *	WCI-FR-A50-XXXX	WCI-1700N-10X	WCI-1700NE-A5051-XXF
A51	CAS-A51-XX *	WCI-FR-A51-XXXX	WCI-1700N-10X	WCI-1700NE-A5051-XXF
A52	CAS-A52-XX *	WCI-FR-A52-XXXX	WCI-1700N-10X	WCI-1700NE-A5253-XXF
A53	CAS-A53-XX *	WCI-FR-A53-XXXX	WCI-1700N-10X	WCI-1700NE-A5253-XXF
A60	CAS-A60-XX *	WCI-FR-A60-XXXX	WCI-1800N-12X	WCI-1800NE-10-3-XXF
A61	CAS-A61-XX *	WCI-FR-A61-XXXX	WCI-1800N-12X	WCI-1800NE-12-0-XXF
A62	CAS-A62-XX *	WCI-FR-A62-XXXX	WCI-1800N-12X	WCI-1800NE-12-1-XXF
A63	CAS-A63-XX *	WCI-FR-A63-XXXX	WCI-1800N-12X	WCI-1800NE-12-2-XXF
				
	XX=Sleeve Length * = (F)lared or (S)traight	XXXX=Final Hole Diameter	X=(F)lared or (S)traight	XX=Extension Length

A20 thru A63

Mandrel Tool Code	Start Hole Gage	Combination Gage	Mandrel Wear Gage	Final Hole Gage
A20	WCI-SHG-A20	WCI-CBG-A20	WCIS-WG-A20	WCI-FHG-****-XXXX
A21	WCI-SHG-A21	WCI-CBG-A21	WCIS-WG-A21	WCI-FHG-****-XXXX
A22	WCI-SHG-A22	WCI-CBG-A22	WCIS-WG-A22	WCI-FHG-****-XXXX
A23	WCI-SHG-A23	WCI-CBG-A23	WCIS-WG-A23	WCI-FHG-****-XXXX
A30	WCI-SHG-A30	WCI-CBG-A30	WCIS-WG-A30	WCI-FHG-****-XXXX
A31	WCI-SHG-A31	WCI-CBG-A31	WCIS-WG-A31	WCI-FHG-****-XXXX
A32	WCI-SHG-A32	WCI-CBG-A32	WCIS-WG-A32	WCI-FHG-****-XXXX
A33	WCI-SHG-A33	WCI-CBG-A33	WCIS-WG-A33	WCI-FHG-****-XXXX
A40	WCI-SHG-A40	WCI-CBG-A40	WCIS-WG-A40	WCI-FHG-****-XXXX
A41	WCI-SHG-A41	WCI-CBG-A41	WCIS-WG-A41	WCI-FHG-****-XXXX
A42	WCI-SHG-A42	WCI-CBG-A42	WCIS-WG-A42	WCI-FHG-****-XXXX
A43	WCI-SHG-A43	WCI-CBG-A43	WCIS-WG-A43	WCI-FHG-****-XXXX
A50	WCI-SHG-A50	WCI-CBG-A50	WCIS-WG-A50	WCI-FHG-****-XXXX
A51	WCI-SHG-A51	WCI-CBG-A51	WCIS-WG-A51	WCI-FHG-****-XXXX
A52	WCI-SHG-A52	WCI-CBG-A52	WCIS-WG-A52	WCI-FHG-****-XXXX
A53	WCI-SHG-A53	WCI-CBG-A53	WCIS-WG-A53	WCI-FHG-****-XXXX
A60	WCI-SHG-A60	WCI-CBG-A60	WCIS-WG-A60	WCI-FHG-****-XXXX
A61	WCI-SHG-A61	WCI-CBG-A61	WCIS-WG-A61	WCI-FHG-****-XXXX
A62	WCI-SHG-A62	WCI-CBG-A62	WCIS-WG-A62	WCI-FHG-****-XXXX
A63	WCI-SHG-A63	WCI-CBG-A63	WCIS-WG-A63	WCI-FHG-****-XXXX
				
				****=Go Diameter XXXX=No Go Diameter

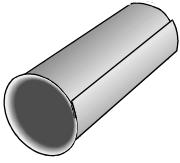
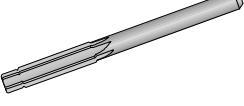
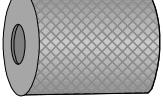
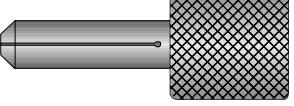
A70 ($7/16$) thru A111 ($45/64$)

A70 thru A111

Nominal Hole Size	Mandrel Tool Code	Start Hole Range	Start Hole Drill	Start Reamer	Mandrel (1)
7/16	A70	0.4090 0.4120	WCI-SD-A70	WCI-SR-A70	WCI-CAM-A70-2-XX-V2
29/64	A71	0.4240 0.4270	WCI-SD-A71	WCI-SR-A71	WCI-CAM-A71-2-XX-V2
15/32	A72	0.4400 0.4430	WCI-SD-A72	WCI-SR-A72	WCI-CAM-A72-2-XX-V2
31/64	A73	0.4550 0.4580	WCI-SD-A73	WCI-SR-A73	WCI-CAM-A73-2-XX-V2
1/2	A80	0.4700 0.4730	WCI-SD-A80	WCI-SR-A80	WCI-CAM-A80-2-XX-V2
33/64	A81	0.4860 0.4890	WCI-SD-A81	WCI-SR-A81	WCI-CAM-A81-2-XX-V2
17/32	A82	0.5010 0.5040	WCI-SD-A82	WCI-SR-A82	WCI-CAM-A82-2-XX-V2
35/64	A83	0.5160 0.5190	WCI-SD-A83	WCI-SR-A83	WCI-CAM-A83-2-XX-V2
9/16	A90	0.5310 0.5340	WCI-SD-A90	WCI-SR-A90	WCI-CAM-A90-2-XX-V2
37/64	A91	0.5470 0.5500	WCI-SD-A91	WCI-SR-A91	WCI-CAM-A91-2-XX-V2
19/32	A92	0.5620 0.5650	WCI-SD-A92	WCI-SR-A92	WCI-CAM-A92-2-XX-V2
39/64	A93	0.5770 0.5800	WCI-SD-A93	WCI-SR-A93	WCI-CAM-A93-2-XX-V2
5/8	A100	0.5920 0.5950	WCI-SD-A100	WCI-SR-A100	WCI-CAM-A100-5-XX-V2
41/64	A101	0.6080 0.6110	WCI-SD-A101	WCI-SR-A101	WCI-CAM-A101-5-XX-V2
21/32	A102	0.6230 0.6260	WCI-SD-A102	WCI-SR-A102	WCI-CAM-A102-5-XX-V2
43/64	A103	0.6380 0.6410	WCI-SD-A103	WCI-SR-A103	WCI-CAM-A103-5-XX-V2
11/16	A110	0.6530 0.6560	WCI-SD-A110	WCI-SR-A110	WCI-CAM-A110-5-XX-V2
45/64	A111	0.6690 0.6720	WCI-SD-A111	WCI-SR-A111	WCI-CAM-A111-5-XX-V2
					XX=Stackup Thickness

1) When using an extension nosecap, mandrel length is equal to stackup thickness plus the length of the nosecap extension.

A70 thru A111

Mandrel Tool Code	Sleeve	Final Reamer	Flush Nosecap	Extension Nosecap
A70	CAS-A70-XX *	WCI-FR-A70-XXXX	WCI-1800N-14X	WCI-1800NE-12-3-XXF
A71	CAS-A71-XX *	WCI-FR-A71-XXXX	WCI-1800N-14X	WCI-1800NE-14-0-XXF
A72	CAS-A72-XX *	WCI-FR-A72-XXXX	WCI-1800N-14X	WCI-1800NE-14-1-XXF
A73	CAS-A73-XX *	WCI-FR-A73-XXXX	WCI-1800N-14X	WCI-1800NE-14-2-XXF
A80	CAS-A80-XX *	WCI-FR-A80-XXXX	WCI-1800N-16X	WCI-1800NE-14-3-XXF
A81	CAS-A81-XX *	WCI-FR-A81-XXXX	WCI-1800N-16X	WCI-1800NE-16-0-XXF
A82	CAS-A82-XX *	WCI-FR-A82-XXXX	WCI-1800N-16X	WCI-1800NE-16-1-XXF
A83	CAS-A83-XX *	WCI-FR-A83-XXXX	WCI-1800N-16X	WCI-1800NE-16-2-XXF
A90	CAS-A90-XX *	WCI-FR-A90-XXXX	WCI-1800N-18X	WCI-1800NE-16-3-XXF
A91	CAS-A91-XX *	WCI-FR-A91-XXXX	WCI-1800N-18X	WCI-1800NE-18-0-XXF
A92	CAS-A92-XX *	WCI-FR-A92-XXXX	WCI-1800N-18X	WCI-1800NE-18-1-XXF
A93	CAS-A93-XX *	WCI-FR-A93-XXXX	WCI-1800N-18X	WCI-1800NE-18-2-XXF
A100	CAS-A100-XX *	WCI-FR-A100-XXXX	WCI-1800N-20X	WCI-1800NE-18-3-XXF
A101	CAS-A101-XX *	WCI-FR-A101-XXXX	WCI-1800N-20X	WCI-1800NE-20-0-XXF
A102	CAS-A102-XX *	WCI-FR-A102-XXXX	WCI-1800N-20X	WCI-1800NE-20-1-XXF
A103	CAS-A103-XX *	WCI-FR-A103-XXXX	WCI-1800N-20X	WCI-1800NE-20-2-XXF
A110	CAS-A110-XX *	WCI-FR-A110-XXXX	WCI-1800N-22X	WCI-1800NE-20-3-XXF
A111	CAS-A111-XX *	WCI-FR-A111-XXXX	WCI-1800N-22X	WCI-1800NE-22-0-XXF
				
	XX=Sleeve Length * = (F)lared or (S)traight	XXXX=Final Hole Size	X=(F)lared or (S)traight	XX=Extension Length

A70 thru A111

Mandrel Tool Code	Start Hole Gage	Combination Gage	Mandrel Wear Gage	Final Hole Gage
A70	WCI-SHG-A70	WCI-CBG-A70	WCIS-WG-A70	WCI-FHG-****-XXXX
A71	WCI-SHG-A71	WCI-CBG-A71	WCIS-WG-A71	WCI-FHG-****-XXXX
A72	WCI-SHG-A72	WCI-CBG-A72	WCIS-WG-A72	WCI-FHG-****-XXXX
A73	WCI-SHG-A73	WCI-CBG-A73	WCIS-WG-A73	WCI-FHG-****-XXXX
A80	WCI-SHG-A80	WCI-CBG-A80	WCIS-WG-A80	WCI-FHG-****-XXXX
A81	WCI-SHG-A81	WCI-CBG-A81	WCIS-WG-A81	WCI-FHG-****-XXXX
A82	WCI-SHG-A82	WCI-CBG-A82	WCIS-WG-A82	WCI-FHG-****-XXXX
A83	WCI-SHG-A83	WCI-CBG-A83	WCIS-WG-A83	WCI-FHG-****-XXXX
A90	WCI-SHG-A90	WCI-CBG-A90	WCIS-WG-A90	WCI-FHG-****-XXXX
A91	WCI-SHG-A91	WCI-CBG-A91	WCIS-WG-A91	WCI-FHG-****-XXXX
A92	WCI-SHG-A92	WCI-CBG-A92	WCIS-WG-A92	WCI-FHG-****-XXXX
A93	WCI-SHG-A93	WCI-CBG-A93	WCIS-WG-A93	WCI-FHG-****-XXXX
A100	WCI-SHG-A100	WCI-CBG-A100	WCIS-WG-A100	WCI-FHG-****-XXXX
A101	WCI-SHG-A101	WCI-CBG-A101	WCIS-WG-A101	WCI-FHG-****-XXXX
A102	WCI-SHG-A102	WCI-CBG-A102	WCIS-WG-A102	WCI-FHG-****-XXXX
A103	WCI-SHG-A103	WCI-CBG-A103	WCIS-WG-A103	WCI-FHG-****-XXXX
A110	WCI-SHG-A110	WCI-CBG-A110	WCIS-WG-A110	WCI-FHG-****-XXXX
A111	WCI-SHG-A111	WCI-CBG-A111	WCIS-WG-A111	WCI-FHG-****-XXXX
				****=Go Diameter XXXX=No Go Diameter

Metric Conversion Chart—CA Tooling

Tool Code	Mandrel (mm)	Nominal Hole Size (1/64 in)	Minimum Start Hole Dia. (mm)
A-20	3.2	8	2.79
A21	3.6	9	3.18
A22	4.0	10	3.56
A23	4.4	11	3.96
A30	4.8	12	4.32
A31	5.2	13	4.70
A32	5.6	14	5.08
A33	6.0	15	5.49
A40	6.4	16	5.87
A41	6.8	17	6.25
A42	7.2	18	6.63
A43	7.6	19	7.04
A50	8.0	20	7.29
A51	8.4	21	7.67
A52	8.7	22	8.08
A53	9.1	23	8.46
A60	9.5	24	8.84
A61	9.9	25	9.22
A62	10.3	26	9.63
A63	10.7	27	10.01
A70	11.1	28	10.39
A71	11.5	29	10.77
A72	11.9	30	11.18
A73	12.3	31	11.56
A80	12.7	32	11.94
A81	13.1	33	12.34
A82	13.5	34	12.73
A83	13.9	35	13.11
A90	14.3	36	13.49
A91	14.7	37	13.89
A92	15.1	38	14.27
A93	15.5	39	14.66
A100	15.9	40	15.04
A101	16.3	41	15.44
A102	16.7	42	15.82
A103	17.1	43	16.21
A110	17.5	44	16.59
A111	17.9	45	16.99

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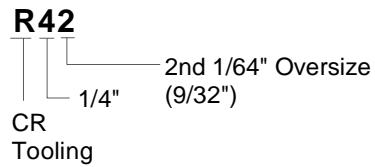
CR Tooling Tables

Specifically designed for rework applications, CR tooling is available in nominal existing hole sizes from $5/32"$ to $3/8"$, while post-coldwork reaming results in the hole accepting a nominal $1/32"$ oversize fastener. The CWORK-2B tooling kit contains CR tooling and is packaged in a four-drawer mobile cabinet. Please refer to Section IV for complete kit contents.

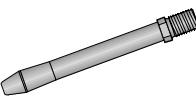
The tables on the following pages will help you to choose the proper tooling for a given hole size. In the table below, you may choose the proper puller, depending upon the size range of holes to be coldworked, and whether access is restricted.

CR Mandrel Tool Code

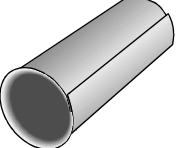
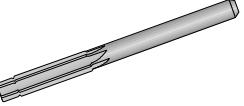
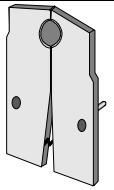
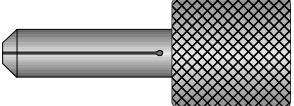
The mandrel tool code for CR tooling is composed of an "R", designating CR Tooling, hole size in $1/16$ ths, and oversize in $1/64$ ths (only the second oversize is available, i.e., $1/32"$ oversize):



CR Process Pullers	
Puller	Mandrel Code Range
1700 / 1700-OA-20	R30 - R62
1600-HO / 1700-HO	R30 - R62

Final Fastener Size	Mandrel Tool Code	Start Hole Range	Start Hole Drill	Start Reamer	Mandrel (1)
3/16	R30	0.1690 0.1710	WCI-SD-R30	WCI-SR-R30	WCI-CRM-R30-1-XX
7/32	R32	0.1990 0.2020	WCI-SD-R32	WCI-SR-R32	WCI-CRM-R32-1-XX
1/4	R40	0.2290 0.2320	WCI-SD-R40	WCI-SR-R40	WCI-CRM-R40-1-XX
9/32	R42	0.2600 0.2630	WCI-SD-R42	WCI-SR-R42	WCI-CRM-R42-1-XX
5/16	R50	0.2900 0.2930	WCI-SD-R50	WCI-SR-R50	WCI-CRM-R50-1-XX
11/32	R52	0.3220 0.3250	WCI-SD-R52	WCI-SR-R52	WCI-CRM-R52-1-XX
3/8	R60	0.3520 0.3550	WCI-SD-R60	WCI-SR-R60	WCI-CRM-R60-1-XX
13/32	R62	0.3830 0.3860	WCI-SD-R62	WCI-SR-R62	WCI-CRM-R62-1-XX
					
					XX=Stackup Thickness

- 1) When using an extension nosecap, mandrel length is equal to stackup thickness plus the length of the nosecap extension.

Mandrel Tool Code	Sleeve	Final Reamer	Offset Nosecap	Extension Nosecap
R30	CRS-R30-XX *	WCI-FR-R30-1860	WCI-1700OAJ-R30	WCI-1700NE-R30-XX-F
R32	CRS-R32-XX *	WCI-FR-R32-2150	WCI-1700OAJ-R32	WCI-1700NE-R32-XX-F
R40	CRS-R40-XX *	WCI-FR-R40-2460	WCI-1700OAJ-R40	WCI-1700NE-R40-XX-F
R42	CRS-R42-XX *	WCI-FR-R42-2770	WCI-1700OAJ-R42	WCI-1700NE-R42-XX-F
R50	CRS-R50-XX *	WCI-FR-R50-3080	WCI-1700OAJ-R50	WCI-1700NE-R50-XX-F
R52	CRS-R52-XX *	WCI-FR-R52-3400	WCI-1700OAJ-R52	WCI-1700NE-R52-XX-F
R60	CRS-R60-XX *	WCI-FR-R60-3710	WCI-1700OAJ-R60	WCI-1700NE-R60-XX-F
R62	CRS-R62-XX *	WCI-FR-R62-4020	WCI-1700OAJ-R62	WCI-1700NE-R62-XX-F
				
	XX=Sleeve Length * = (F)lared or (S)traight			XX=Extension Length

Mandrel Tool Code	Start Hole Gage	Combination Gage	Mandrel Wear Gage	Final Hole Gage
R30	WCI-SHG-R30	WCI-CBG-R30	WCIS-WG-R30	WCI-FHG-1860-1890
R32	WCI-SHG-R32	WCI-CBG-R32	WCIS-WG-R32	WCI-FHG-2150-2180
R40	WCI-SHG-R40	WCI-CBG-R40	WCIS-WG-R40	WCI-FHG-2460-2490
R42	WCI-SHG-R42	WCI-CBG-R42	WCIS-WG-R42	WCI-FHG-2770-2800
R50	WCI-SHG-R50	WCI-CBG-R50	WCIS-WG-R50	WCI-FHG-3080-3110
R52	WCI-SHG-R52	WCI-CBG-R52	WCIS-WG-R52	WCI-FHG-3400-3430
R60	WCI-SHG-R60	WCI-CBG-R60	WCIS-WG-R60	WCI-FHG-3710-3740
R62	WCI-SHG-R62	WCI-CBG-R62	WCIS-WG-R62	WCI-FHG-4020-4050

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CW Tooling Tables

CW tooling, another Boeing developed system, uses a lower applied expansion value (approximately 3%) than utilized in the CB system. CW tooling is used with aluminum and mild steel in moderately stressed areas.

The tables on the following pages will help you to choose the proper tooling for a given hole size. In the table below, you may choose the proper puller, depending upon the size range of holes to be coldworked, and whether access is restricted.

CW Mandrel Tool Code

The mandrel tool code for Class II, CW tooling is composed of the first letter indicating Bolt, Rivet, or Hex Drive holes, and a number representing the final hole size in ten thousandths:

R4410

| | Final Hole Diameter .4410"

B=Bolt/Open Hole
H=Hex Drive
R=Rivet Hole

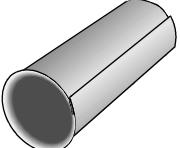
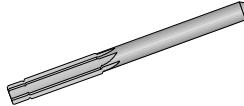
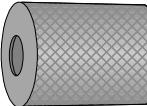
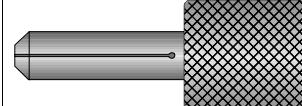
CW Process Pullers	
Puller	Mandrel Code Range
1700	1276 (1/8) - 5489 (35/64)
1800	5647 (9/16) - 10343 (1 1/32)
1600-HO	1267 (1/8) - 4241 (27/64)
1700-HO	1276 (1/8) - 5489 (35/64)
1750-HO	4396 (7/16) - 7995 (51/64)
1800-HO	4396 (7/16) - 10343 (1 1/32)

B1267 thru B5489

Nominal Hole Size	Mandrel Tool Code	Start Hole Range	Start Hole Drill	Start Reamer	Mandrel (1)
1/8	B1267	0.1225 0.1255	WCI-SD-B1267	WCI-SR-B1267	WCI-CWM-B1267-1-XX
9/64	B1423	0.1381 0.1411	WCI-SD-B1423	WCI-SR-B1423	WCI-CWM-B1423-1-XX
5/32	B1580	0.1537 0.1567	WCI-SD-B1580	WCI-SR-B1580	WCI-CWM-B1580-1-XX
11/64	B1737	0.1694 0.1724	WCI-SD-B1737	WCI-SR-B1737	WCI-CWM-B1737-1-XX
3/16	B1894	0.1850 0.1880	WCI-SD-B1894	WCI-SR-B1894	WCI-CWM-B1894-1-XX
13/64	B2050	0.2006 0.2036	WCI-SD-B2050	WCI-SR-B2050	WCI-CWM-B2050-1-XX
7/32	B2206	0.2162 0.2192	WCI-SD-B2206	WCI-SR-B2206	WCI-CBM-B2206-1-XW
15/64	B2364	0.2319 0.2349	WCI-SD-B2364	WCI-SR-B2364	WCI-CWM-B2364-1-XX
1/4	B2520	0.2475 0.2505	WCI-SD-B2520	WCI-SR-B2520	WCI-CWM-B2520-1-XX
17/64	B2676	0.2631 0.2661	WCI-SD-B2676	WCI-SR-B2676	WCI-CWM-B2676-1-XX
9/32	B2833	0.2787 0.2817	WCI-SD-B2833	WCI-SR-B2833	WCI-CWM-B2833-1-XX
19/64	B2990	0.2944 0.2974	WCI-SD-B2990	WCI-SR-B2990	WCI-CWM-B2990-1-XX
5/16	B3145	0.3100 0.3130	WCI-SD-B3145	WCI-SR-B3145	WCI-CWM-B3145-1-XX
21/64	B3301	0.3256 0.3286	WCI-SD-B3301	WCI-SR-B3301	WCI-CWM-B3301-1-XX
11/32	B3458	0.3412 0.3442	WCI-SD-B3458	WCI-SR-B3458	WCI-CWM-B3458-1-XX
23/64	B3615	0.3569 0.3599	WCI-SD-B3615	WCI-SR-B3615	WCI-CWM-B3615-1-XX
3/8	B3771	0.3725 0.3755	WCI-SD-B3771	WCI-SR-B3771	WCI-CWM-B3771-1-XX
25/64	B3928	0.3881 0.3911	WCI-SD-B3928	WCI-SR-B3928	WCI-CWM-B3928-1-XX
13/32	B4083	0.4037 0.4067	WCI-SD-B4083	WCI-SR-B4083	WCI-CWM-B4083-1-XX
27/64	B4241	0.4194 0.4224	WCI-SD-B4241	WCI-SR-B4241	WCI-CWM-B4241-1-XX
7/16	B4396	0.4350 0.4380	WCI-SD-B4396	WCI-SR-B4396	WCI-CWM-B4396-1-XX
29/64	B4551	0.4506 0.4536	WCI-SD-B4551	WCI-SR-B4551	WCI-CWM-B4551-1-XX
15/32	B4708	0.4662 0.4692	WCI-SD-B4708	WCI-SR-B4708	WCI-CWM-B4708-1-XX
31/64	B4865	0.4819 0.4849	WCI-SD-B4865	WCI-SR-B4865	WCI-CWM-B4865-1-XX
1/2	B5020	0.4975 0.5005	WCI-SD-B5020	WCI-SR-B5020	WCI-CWM-B5020-1-XX
33/64	B5176	0.5131 0.5161	WCI-SD-B5176	WCI-SR-B5176	WCI-CWM-B5176-1-XX
17/32	B5332	0.5287 0.5317	WCI-SD-B5332	WCI-SR-B5332	WCI-CWM-B5332-1-XX
35/64	B5489	0.5444 0.5474	WCI-SD-B5489	WCI-SR-B5489	WCI-CWM-B5489-2-XX
					
					XX=Stackup Thickness

1) When using an extension nosecap, mandrel length is equal to stackup thickness plus the length of the nosecap extension.

B1267 thru B5489

Mandrel Tool Code	Sleeve	Final Reamer	Flush Nosecap	Extension Nosecap
B1267	CWS-B1267-XX *	WCI-FR-B1267-XXXX	WCI-1700N-04F	WCI-1700NE-0401-XXF
B1423	CWS-B1423-XX *	WCI-FR-B1423-XXXX	WCI-1700N-04F	WCI-1700NE-0423-XXF
B1580	CWS-B1580-XX *	WCI-FR-B1580-XXXX	WCI-1700N-04F	WCI-1700NE-0423-XXF
B1737	CWS-B1737-XX *	WCI-FR-B1737-XXXX	WCI-1700N-06F	WCI-1700NE-0601-XXF
B1894	CWS-B1894-XX *	WCI-FR-B1894-XXXX	WCI-1700N-06F	WCI-1700NE-0601-XXF
B2050	CWS-B2050-XX *	WCI-FR-B2050-XXXX	WCI-1700N-06F	WCI-1700NE-0601-XXF
B2206	CWS-B2206-XX *	WCI-FR-B2206-XXXX	WCI-1700N-06F	WCI-1700NE-0623-XXF
B2364	CWS-B2364-XX *	WCI-FR-B2364-XXXX	WCI-1700N-08F	WCI-1700NE-0801-XXF
B2520	CWS-B2520-XX *	WCI-FR-B2520-XXXX	WCI-1700N-08F	WCI-1700NE-0801-XXF
B2676	CWS-B2676-XX *	WCI-FR-B2676-XXXX	WCI-1700N-08F	WCI-1700NE-0823-XXF
B2833	CWS-B2833-XX *	WCI-FR-B2833-XXXX	WCI-1700N-08F	WCI-1700NE-0823-XXF
B2990	CWS-B2990-XX *	WCI-FR-B2990-XXXX	WCI-1700N-10F	WCI-1700NE-1001-XXF
B3145	CWS-B3145-XX *	WCI-FR-B3145-XXXX	WCI-1700N-10F	WCI-1700NE-1001-XXF
B3301	CWS-B3301-XX *	WCI-FR-B3301-XXXX	WCI-1700N-10F	WCI-1700NE-1023-XXF
B3458	CWS-B3458-XX *	WCI-FR-B3458-XXXX	WCI-1700N-10F	WCI-1700NE-1023-XXF
B3615	CWS-B3615-XX *	WCI-FR-B3615-XXXX	WCI-1700N-12F	WCI-1700NE-1201-XXF
B3771	CWS-B3771-XX *	WCI-FR-B3771-XXXX	WCI-1700N-12F	WCI-1700NE-1201-XXF
B3928	CWS-B3928-XX *	WCI-FR-B3928-XXXX	WCI-1700N-12F	WCI-1700NE-1223-XXF
B4083	CWS-B4083-XX *	WCI-FR-B4083-XXXX	WCI-1700N-12F	WCI-1700NE-1223-XXF
B4241	CWS-B4241-XX *	WCI-FR-B4241-XXXX	WCI-1700N-14F	WCI-1700NE-1401-XXF
B4396	CWS-B4396-XX *	WCI-FR-B4396-XXXX	WCI-1700N-14F	WCI-1700NE-1401-XXF
B4551	CWS-B4551-XX *	WCI-FR-B4551-XXXX	WCI-1700N-14F	WCI-1700NE-1423-XXF
B4708	CWS-B4708-XX *	WCI-FR-B4708-XXXX	WCI-1700N-14F	WCI-1700NE-1423-XXF
B4865	CWS-B4865-XX *	WCI-FR-B4865-XXXX	WCI-1700N-16F	WCI-1700NE-1601-XXF
B5020	CWS-B5020-XX *	WCI-FR-B5020-XXXX	WCI-1700N-16F	WCI-1700NE-1601-XXF
B5176	CWS-B5176-XX *	WCI-FR-B5176-XXXX	WCI-1700N-16F	WCI-1700NE-1623-XXF
B5332	CWS-B5332-XX *	WCI-FR-B5332-XXXX	WCI-1700N-16F	WCI-1700NE-1623-XXF
B5489	CWS-B5489-XX *	WCI-FR-B5489-XXXX	WCI-1800N-18F	WCI-1800NE-18-0-XXF
				
	XX=Sleeve Length * = (F)lared or (S)traight	XXXX=Final Hole Diameter		XX=Extension Length

B1267 thru B5489

Mandrel Tool Code	Start Hole Gage	Combination Gage	Mandrel Wear Gage	Final Hole Gage
B1267	WCI-SHG-B1267	WCI-CBG-B1267	WCIS-WG-B1267	WCI-FHG-****-XXXX
B1423	WCI-SHG-B1423	WCI-CBG-B1423	WCIS-WG-B1423	WCI-FHG-****-XXXX
B1580	WCI-SHG-B1580	WCI-CBG-B1580	WCIS-WG-B1580	WCI-FHG-****-XXXX
B1737	WCI-SHG-B1737	WCI-CBG-B1737	WCIS-WG-B1737	WCI-FHG-****-XXXX
B1894	WCI-SHG-B1894	WCI-CBG-B1894	WCIS-WG-B1894	WCI-FHG-****-XXXX
B2050	WCI-SHG-B2050	WCI-CBG-B2050	WCIS-WG-B2050	WCI-FHG-****-XXXX
B2206	WCI-SHG-B2206	WCI-CBG-B2206	WCIS-WG-B2206	WCI-FHG-****-XXXX
B2364	WCI-SHG-B2364	WCI-CBG-B2364	WCIS-WG-B2364	WCI-FHG-****-XXXX
B2520	WCI-SHG-B2520	WCI-CBG-B2520	WCIS-WG-B2520	WCI-FHG-****-XXXX
B2676	WCI-SHG-B2676	WCI-CBG-B2676	WCIS-WG-B2676	WCI-FHG-****-XXXX
B2833	WCI-SHG-B2833	WCI-CBG-B2833	WCIS-WG-B2833	WCI-FHG-****-XXXX
B2990	WCI-SHG-B2990	WCI-CBG-B2990	WCIS-WG-B2990	WCI-FHG-****-XXXX
B3145	WCI-SHG-B3145	WCI-CBG-B3145	WCIS-WG-B3145	WCI-FHG-****-XXXX
B3301	WCI-SHG-B3301	WCI-CBG-B3301	WCIS-WG-B3301	WCI-FHG-****-XXXX
B3458	WCI-SHG-B3458	WCI-CBG-B3458	WCIS-WG-B3458	WCI-FHG-****-XXXX
B3615	WCI-SHG-B3615	WCI-CBG-B3615	WCIS-WG-B3615	WCI-FHG-****-XXXX
B3771	WCI-SHG-B3771	WCI-CBG-B3771	WCIS-WG-B3771	WCI-FHG-****-XXXX
B3928	WCI-SHG-B3928	WCI-CBG-B3928	WCIS-WG-B3928	WCI-FHG-****-XXXX
B4083	WCI-SHG-B4083	WCI-CBG-B4083	WCIS-WG-B4083	WCI-FHG-****-XXXX
B4241	WCI-SHG-B4241	WCI-CBG-B4241	WCIS-WG-B4241	WCI-FHG-****-XXXX
B4396	WCI-SHG-B4396	WCI-CBG-B4396	WCIS-WG-B4396	WCI-FHG-****-XXXX
B4551	WCI-SHG-B4551	WCI-CBG-B4551	WCIS-WG-B4551	WCI-FHG-****-XXXX
B4708	WCI-SHG-B4708	WCI-CBG-B4708	WCIS-WG-B4708	WCI-FHG-****-XXXX
B4865	WCI-SHG-B4865	WCI-CBG-B4865	WCIS-WG-B4865	WCI-FHG-****-XXXX
B5020	WCI-SHG-B5020	WCI-CBG-B5020	WCIS-WG-B5020	WCI-FHG-****-XXXX
B5176	WCI-SHG-B5176	WCI-CBG-B5176	WCIS-WG-B5176	WCI-FHG-****-XXXX
B5332	WCI-SHG-B5332	WCI-CBG-B5332	WCIS-WG-B5332	WCI-FHG-****-XXXX
B5489	WCI-SHG-B5489	WCI-CBG-B5489	WCIS-WG-B5489	WCI-FHG-****-XXXX
				
				****=Go Diameter XXXX=No Go Diameter

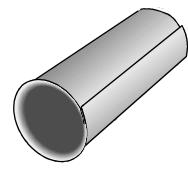
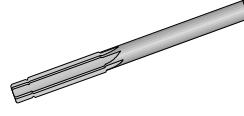
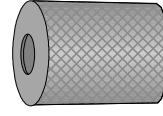
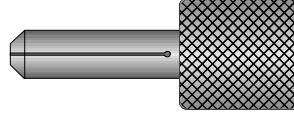
B5647 ($\frac{9}{16}$) thru B10343 ($1 \frac{1}{32}$)

B5647 thru B10343

Nominal Hole Size	Mandrel Tool Code	Start Hole Range	Start Hole Drill	Start Reamer	Mandrel (1)
9/16	B5647	0.5660 0.5630	WCI-SD-B5647	WCISR-B5647	WCI-CWM-B5647-2-XX
37/64	B5803	0.5756 0.5786	WCI-SD-B5803	WCI-SR-B5803	WCI-CWM-B5803-2-XX
19/32	B5959	0.5912 0.5942	WCI-SD-B5959	WCI-SR-B5959	WCI-CWM-B5959-2-XX
39/64	B6116	0.6069 0.6099	WCI-SD-B6116	WCI-SR-B6116	WCI-CBM-B6116-2-XX
5/8	B6272	0.6225 0.6255	WCI-SD-B6272	WCI-SR-B6272	WCI-CWM-B6272-2-XX
41/64	B6429	0.6381 0.6411	WCI-SD-B6429	WCI-SR-B6429	WCI-CWM-B6429-2-XX
21/32	B6585	0.6537 0.6567	WCI-SD-B6585	WCI-SR-B6585	WCI-CWM-B6585-2-XX
43/64	B6742	0.6694 0.6724	WCI-SD-B6742	WCI-SR-B6742	WCI-CWM-B6742-2-XX
11/16	B6899	0.6850 0.6880	WCI-SD-B6899	WCI-SR-B6899	WCI-CWM-B6899-2-XX
45/64	B7055	0.7006 0.7036	WCI-SD-B7055	WCI-SR-B7055	WCI-CWM-B7055-2-XX
23/32	B7212	0.7162 0.7192	WCI-SD-B7212	WCI-SR-B7212	WCI-CWM-B7212-2-XX
47/64	B7369	0.7319 0.7349	WCI-SD-B7369	WCI-SR-B7369	WCI-CWM-B7369-2-XX
3/4	B7525	0.7475 0.7505	WCI-SD-B7525	WCI-SR-B7525	WCI-CWM-B7525-2-XX
49/64	B7681	0.7631 0.7661	WCI-SD-B7681	WCI-SR-B7681	WCI-CWM-B7681-2-XX
25/32	B7837	0.7787 0.7817	WCI-SD-B7837	WCI-SR-B7837	WCI-CWM-B7837-2-XX
51/64	B7995	0.7944 0.7974	WCI-SD-B7995	WCI-SR-B7995	WCI-CWM-B7995-2-XX
13/16	B8151	0.8100 0.8130	WCI-SD-B8151	WCI-SR-B8151	WCI-CWM-B8151-2-XX
53/64	B8307	0.8256 0.8286	WCI-SD-B8307	WCI-SR-B8307	WCI-CWM-B8307-2-XX
27/32	B8464	0.8412 0.8442	WCI-SD-B8464	WCI-SR-B8464	WCI-CWM-B8464-2-XX
55/64	B8621	0.8569 0.8599	WCI-SD-B8621	WCI-SR-B8621	WCI-CWM-B8621-2-XX
7/8	B8778	0.8725 0.8755	WCI-SD-B8778	WCI-SR-B8778	WCI-CWM-B8778-2-XX
57/64	B8934	0.8881 0.8911	WCI-SD-B8934	WCI-SR-B8934	WCI-CWM-B8934-2-XX
29/32	B9091	0.9037 0.9067	WCI-SD-B9091	WCI-SR-B9091	WCI-CWM-B9091-2-XX
59/64	B9248	0.9194 0.9224	WCI-SD-B9248	WCI-SR-B9248	WCI-CWM-B9248-2-XX
15/16	B9404	0.9350 0.9380	WCI-SD-B9404	WCI-SR-B9404	WCI-CWM-B9404-2-XX
61/64	B9560	0.9506 0.9536	WCI-SD-B9560	WCI-SR-B9560	WCI-CWM-B9560-2-XX
31/32	B9716	0.9662 0.9692	WCI-SD-B9716	WCI-SR-B9716	WCI-CWM-B9716-2-XX
63/64	B9874	0.9819 0.9849	WCI-SD-B9874	WCI-SR-B9874	WCI-CWM-B9874-2-XX
1.0	B10030	0.9975 1.0005	WCI-SD-B10030	WCI-SR-B10030	WCI-CWM-B10030-2-XX
1 1/64	B10187	1.0131 1.0161	WCI-SD-B10187	WCI-SR-B10187	WCI-CWM-B10187-2-XX
1 1/32	B10343	1.0287 1.0317	WCI-SD-B10343	WCI-SR-B10343	WCI-CWM-B10343-2-XX
					XX=Stackup Thickness

1) When using an extension nosecap, mandrel length is equal to stackup thickness plus the length of the nosecap extension.

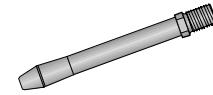
B5647 thru B10343

Mandrel Tool Code	Sleeve	Final Reamer	Flush Nosecap	Extension Nosecap
B5647	CWS-B5647-XX *	WCI-FR-B5647-XXXX	WCI-1800N-18F	WCI-1800NE-18-2-XXF
B5803	CWS-B5803-XX *	WCI-FR-B5803-XXXX	WCI-1800N-18F	WCI-1800NE-18-3-XXF
B5959	CWS-B5959-XX *	WCI-FR-B5959-XXXX	WCI-1800N-20F	WCI-1800NE-20-0-XXF
B6116	CWS-B6116-XX *	WCI-FR-B6116-XXXX	WCI-1800N-20F	WCI-1800NE-20-1-XXF
B6272	CWS-B6272-XX *	WCI-FR-B6272-XXXX	WCI-1800N-20F	WCI-1800NE-20-2-XXF
B6429	CWS-B6429-XX *	WCI-FR-B6429-XXXX	WCI-1800N-20F	WCI-1800NE-20-3-XXF
B6585	CWS-B6585-XX *	WCI-FR-B6585-XXXX	WCI-1800N-22F	WCI-1800NE-22-0-XXF
B6742	CWS-B6742-XX *	WCI-FR-B6742-XXXX	WCI-1800N-22F	WCI-1800NE-22-1-XXF
B6899	CWS-B6899-XX *	WCI-FR-B6899-XXXX	WCI-1800N-22F	WCI-1800NE-22-2-XXF
B7055	CWS-B7055-XX *	WCI-FR-B7055-XXXX	WCI-1800N-22F	WCI-1800NE-22-3-XXF
B7212	CWS-B7212-XX *	WCI-FR-B7212-XXXX	WCI-1800N-24F	WCI-1800NE-24-0-XXF
B7369	CWS-B7369-XX *	WCI-FR-B7369-XXXX	WCI-1800N-24F	WCI-1800NE-24-1-XXF
B7525	CWS-B7525-XX *	WCI-FR-B7525-XXXX	WCI-1800N-24F	WCI-1800NE-24-2-XXF
B7681	CWS-B7681-XX *	WCI-FR-B7681-XXXX	WCI-1800N-24F	WCI-1800NE-24-3-XXF
B7837	CWS-B7837-XX *	WCI-FR-B7837-XXXX	WCI-1800N-26F	WCI-1800NE-26-0-XXF
B7995	CWS-B7995-XX *	WCI-FR-B7995-XXXX	WCI-1800N-26F	WCI-1800NE-26-1-XXF
B8151	CWS-B8151-XX *	WCI-FR-B8151-XXXX	WCI-1800N-26F	WCI-1800NE-26-2-XXF
B8307	CWS-B8307-XX *	WCI-FR-B8307-XXXX	WCI-1800N-26F	WCI-1800NE-26-3-XXF
B8464	CWS-B8464-XX *	WCI-FR-B8464-XXXX	WCI-1800N-28F	WCI-1800NE-28-0-XXF
B8621	CWS-B8621-XX *	WCI-FR-B8621-XXXX	WCI-1800N-28F	WCI-1800NE-28-1-XXF
B8778	CWS-B8778-XX *	WCI-FR-B8778-XXXX	WCI-1800N-28F	WCI-1800NE-28-2-XXF
B8934	CWS-B8934-XX *	WCI-FR-B8934-XXXX	WCI-1800N-28F	WCI-1800NE-28-3-XXF
B9091	CWS-B9091-XX *	WCI-FR-B9091-XXXX	WCI-1800N-30F	WCI-1800NE-30-0-XXF
B9248	CWS-B9248-XX *	WCI-FR-B9248-XXXX	WCI-1800N-30F	WCI-1800NE-30-1-XXF
B9404	CWS-B9404-XX *	WCI-FR-B9404-XXXX	WCI-1800N-30F	WCI-1800NE-30-2-XXF
B9560	CWS-B9560-XX *	WCI-FR-B9560-XXXX	WCI-1800N-30F	WCI-1800NE-30-3-XXF
B9716	CWS-B9716-XX *	WCI-FR-B9716-XXXX	WCI-1800N-32F	WCI-1800NE-32-0-XXF
B9874	CWS-B9874-XX *	WCI-FR-B9874-XXXX	WCI-1800N-32F	WCI-1800NE-32-1-XXF
B10030	CWS-B10030-XX *	WCI-FR-B10030-XXXX	WCI-1800N-32F	WCI-1800NE-32-2-XXF
B10187	CWS-B10187-XX *	WCI-FR-B10187-XXXX	WCI-1800N-32F	WCI-1800NE-32-3-XXF
B10343	CWS-B10343-XX *	WCI-FR-B10343-XXXX	WCI-1800N-32F	WCI-1800NE-32-3-XXF
				
	XX=Sleeve Length *= (F)lared or (S)traight	XXXX=Final Hole Diameter		XX=Extension Length

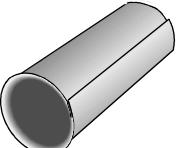
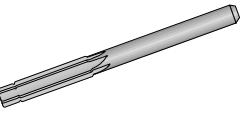
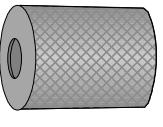
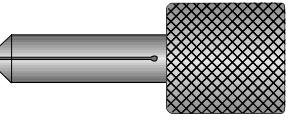
B5647 thru B10343

Mandrel Tool Code	Start Hole Gage	Combination Gage	Mandrel Wear Gage	Final Hole Gage
B5647	WCI-SHG-B5647	WCI-CBG-B5647	WCIS-WG-B5647	WCI-FHG-****-XXXX
B5803	WCI-SHG-B5803	WCI-CBG-B5803	WCIS-WG-B5803	WCI-FHG-****-XXXX
B5959	WCI-SHG-B5959	WCI-CBG-B5959	WCIS-WG-B5959	WCI-FHG-****-XXXX
B6116	WCI-SHG-B6116	WCI-CBG-B6116	WCIS-WG-B6116	WCI-FHG-****-XXXX
B6272	WCI-SHG-B6272	WCI-CBG-B6272	WCIS-WG-B6272	WCI-FHG-****-XXXX
B6429	WCI-SHG-B6429	WCI-CBG-B6429	WCIS-WG-B6429	WCI-FHG-****-XXXX
B6585	WCI-SHG-B6585	WCI-CBG-B6585	WCIS-WG-B6585	WCI-FHG-****-XXXX
B6742	WCI-SHG-B6742	WCI-CBG-B6742	WCIS-WG-B6742	WCI-FHG-****-XXXX
B6899	WCI-SHG-B6899	WCI-CBG-B6899	WCIS-WG-B6899	WCI-FHG-****-XXXX
B7055	WCI-SHG-B7055	WCI-CBG-B7055	WCIS-WG-B7055	WCI-FHG-****-XXXX
B7212	WCI-SHG-B7212	WCI-CBG-B7212	WCIS-WG-B7212	WCI-FHG-****-XXXX
B7369	WCI-SHG-B7369	WCI-CBG-B7369	WCIS-WG-B7369	WCI-FHG-****-XXXX
B7525	WCI-SHG-B7525	WCI-CBG-B7525	WCIS-WG-B7525	WCI-FHG-****-XXXX
B7681	WCI-SHG-B7681	WCI-CBG-B7681	WCIS-WG-B7681	WCI-FHG-****-XXXX
B7837	WCI-SHG-B7837	WCI-CBG-B7837	WCIS-WG-B7837	WCI-FHG-****-XXXX
B7995	WCI-SHG-B7995	WCI-CBG-B7995	WCIS-WG-B7995	WCI-FHG-****-XXXX
B8151	WCI-SHG-B8151	WCI-CBG-B8151	WCIS-WG-B8151	WCI-FHG-****-XXXX
B8307	WCI-SHG-B8307	WCI-CBG-B8307	WCIS-WG-B8307	WCI-FHG-****-XXXX
B8464	WCI-SHG-B8464	WCI-CBG-B8464	WCIS-WG-B8464	WCI-FHG-****-XXXX
B8621	WCI-SHG-B8621	WCI-CBG-B8621	WCIS-WG-B8621	WCI-FHG-****-XXXX
B8778	WCI-SHG-B8778	WCI-CBG-B8778	WCIS-WG-B8778	WCI-FHG-****-XXXX
B8934	WCI-SHG-B8934	WCI-CBG-B8934	WCIS-WG-B8934	WCI-FHG-****-XXXX
B9091	WCI-SHG-B9091	WCI-CBG-B9091	WCIS-WG-B9091	WCI-FHG-****-XXXX
B9248	WCI-SHG-B9248	WCI-CBG-B9248	WCIS-WG-B9248	WCI-FHG-****-XXXX
B9404	WCI-SHG-B9404	WCI-CBG-B9404	WCIS-WG-B9404	WCI-FHG-****-XXXX
B9560	WCI-SHG-B9560	WCI-CBG-B9560	WCIS-WG-B9560	WCI-FHG-****-XXXX
B9716	WCI-SHG-B9716	WCI-CBG-B9716	WCIS-WG-B9716	WCI-FHG-****-XXXX
B9874	WCI-SHG-B9874	WCI-CBG-B9874	WCIS-WG-B9874	WCI-FHG-****-XXXX
B10030	WCI-SHG-B10030	WCI-CBG-B10030	WCIS-WG-B10030	WCI-FHG-****-XXXX
B10187	WCI-SHG-B10187	WCI-CBG-B10187	WCIS-WG-B10187	WCI-FHG-****-XXXX
B10343	WCI-SHG-B10343	WCI-CBG-B10343	WCIS-WG-B10343	WCI-FHG-****-XXXX
				****=Go Diameter XXXX=No Go Diameter

Rivet and Hex Drive Type

Nominal Hole Size	Mandrel Tool Code	Start Hole Range	Start Hole Drill	Start Reamer	Mandrel (1)
"H" Type - Hex Drive					
3/16	H1870	0.1830 0.1860	WCI-SD-H1870	WCI-SR-H1870	WCI-CWM-H1870-1-XX
13/64	H2000	0.1960 0.1990	WCI-SD-H2000	WCI-SR-H2000	WCI-CWM-H2000-1-XX
7/32	H2160	0.2105 0.2135	WCI-SD-H2160	WCI-SR-H2160	WCI-CWM-H2160-1-XX
1/4	H2470	0.2430 0.2460	WCI-SD-H2470	WCI-SR-H2470	WCI-CWM-H2470-1-XX
17/64	H2630	0.2590 0.2620	WCI-SD-H2630	WCI-SR-H2630	WCI-CWM-H2630-1-XX
9/32	H2780	0.2725 0.2755	WCI-SD-H2780	WCI-SR-H2780	WCI-CWM-H2780-1-XX
5/16	H3090	0.3055 0.3085	WCI-SD-H3090	WCI-SR-H3090	WCI-CWM-H3090-1-XX
21/64	H3250	0.3205 0.3235	WCI-SD-H3250	WCI-SR-H3250	WCI-CWM-H3250-1-XX
11/32	H3410	0.3355 0.3385	WCI-SD-H3410	WCI-SR-H3410	WCI-CWM-H3410-1-XX
3/8	H3710	0.3670 0.3700	WCI-SD-H3710	WCI-SR-H3710	WCI-CWM-H3710-1-XX
25/64	H3880	0.3840 0.3870	WCI-SD-H3880	WCI-SR-H3880	WCI-CWM-H3880-1-XX
13/32	H4030	0.3990 0.4020	WCI-SD-H4030	WCI-SR-H4030	WCI-CWM-H4030-1-XX
7/16	H4340	0.4285 0.4315	WCI-SD-H4340	WCI-SR-H4340	WCI-CWM-H4340-1-XX
29/64	H4500	0.4435 0.4465	WCI-SD-H4500	WCI-SR-H4500	WCI-CWM-H4500-1-XX
15/32	H4660	0.4600 0.4630	WCI-SD-H4660	WCI-SR-H4660	WCI-CWM-H4660-1-XX
"R" Type - Rivet					
1/8	R1280	0.1245 0.1275	WCI-SD-R1280	WCI-SR-R1280	WCI-CWM-R1280-1-XX
5/32	R1590	0.1555 0.1585	WCI-SD-R1590	WCI-SR-R1590	WCI-CWM-R1590-1-XX
3/16	R1900	0.1865 0.1895	WCI-SD-R1900	WCI-SR-R1900	WCI-CWM-R1900-1-XX
7/32	R2200	0.2160 0.2190	WCI-SD-R2200	WCI-SR-R2200	WCI-CWM-R2200-1-XX
1/4	R2530	0.2495 0.2525	WCI-SD-R2530	WCI-SR-R2530	WCI-CWM-R2530-1-XX
9/32	R2830	0.2785 0.2815	WCI-SD-R2830	WCI-SR-R2830	WCI-CWM-R2830-1-XX
5/16	R3170	0.3115 0.3145	WCI-SD-R3170	WCI-SR-R3170	WCI-CWM-R3170-1-XX
11/32	R3450	0.3410 0.3440	WCI-SD-R3450	WCI-SR-R3450	WCI-CWM-R3450-1-XX
3/8	R3780	0.3725 0.3755	WCI-SD-R3780	WCI-SR-R3780	WCI-CWM-R3780-1-XX
13/32	R4080	0.4035 0.4065	WCI-SD-R4080	WCI-SR-R4080	WCI-CWM-R4080-1-XX
7/16	R4410	0.4340 0.4370	WCI-SD-R4410	WCI-SR-R4410	WCI-CWM-R4410-1-XX
					
					XX=Stackup Thickness

1) When using an extension nosecap, mandrel length is equal to stackup thickness plus the length of the nosecap extension.

Mandrel Tool Code	Sleeve	Final Reamer	Flush Nosecap	Extension Nosecap
"H" Type				
H1870	CWS-H1870-XX *	WCI-FR-H1870-XXXX	WCI-1700N-06F	WCI-1700NE-0601-XXF
H2000	CWS-H2000-XX *	WCI-FR-H2000-XXXX	WCI-1700N-06F	WCI-1700NE-0601-XXF
H2160	CWS-H2160-XX *	WCI-FR-H2160-XXXX	WCI-1700N-06F	WCI-1700NE-0623-XXF
H2470	CWS-H2470-XX *	WCI-FR-H2470-XXXX	WCI-1700N-08F	WCI-1700NE-0801-XXF
H2630	CWS-H2630-XX *	WCI-FR-H2630-XXXX	WCI-1700N-08F	WCI-1700NE-0801-XXF
H2780	CWS-H2780-XX *	WCI-FR-H2780-XXXX	WCI-1700N-08F	WCI-1700NE-0823-XXF
H3090	CWS-H3090-XX *	WCI-FR-H3090-XXXX	WCI-1700N-10F	WCI-1700NE-1001-XXF
H3250	CWS-H3250-XX *	WCI-FR-H3250-XXXX	WCI-1700N-10F	WCI-1700NE-1001-XXF
H3410	CWS-H3410-XX *	WCI-FR-H3410-XXXX	WCI-1700N-10F	WCI-1700NE-1023-XXF
H3710	CWS-H3710-XX *	WCI-FR-H3710-XXXX	WCI-1700N-12F	WCI-1700NE-1201-XXF
H3880	CWS-H3880-XX *	WCI-FR-H3880-XXXX	WCI-1700N-12F	WCI-1700NE-1201-XXF
H4030	CWS-H4030-XX *	WCI-FR-H4030-XXXX	WCI-1700N-12F	WCI-1700NE-1223-XXF
H4340	CWS-H4340-XX *	WCI-FR-H4340-XXXX	WCI-1700N-14F	WCI-1700NE-1401-XXF
H4500	CWS-H4500-XX *	WCI-FR-H4500-XXXX	WCI-1700N-14F	WCI-1700NE-1401-XXF
H4660	CWS-H4660-XX *	WCI-FR-H4660-XXXX	WCI-1700N-14F	WCI-1700NE-1423-XXF
"R" Type				
R1280	CWS-R1280-XX *	WCI-FR-R1280-XXXX	WCI-1700N-04F	WCI-1700NE-0401-XXF
R1590	CWS-R1590-XX *	WCI-FR-R1590-XXXX	WCI-1700N-04F	WCI-1700NE-0423-XXF
R1900	CWS-R1900-XX *	WCI-FR-R1900-XXXX	WCI-1700N-06F	WCI-1700NE-0601-XXF
R2200	CWS-R2200-XX *	WCI-FR-R2200-XXXX	WCI-1700N-06F	WCI-1700NE-0623-XXF
R2530	CWS-R2530-XX *	WCI-FR-R2530-XXXX	WCI-1700N-08F	WCI-1700NE-0801-XXF
R2830	CWS-R2830-XX *	WCI-FR-R2830-XXXX	WCI-1700N-08F	WCI-1700NE-0823-XXF
R3170	CWS-R3170-XX *	WCI-FR-R3170-XXXX	WCI-1700N-10F	WCI-1700NE-1001-XXF
R3450	CWS-R3450-XX *	WCI-FR-R3450-XXXX	WCI-1700N-10F	WCI-1700NE-1023-XXF
R3780	CWS-R3780-XX *	WCI-FR-R3780-XXXX	WCI-1700N-12F	WCI-1700NE-1201-XXF
R4080	CWS-R4080-XX *	WCI-FR-R4080-XXXX	WCI-1700N-12F	WCI-1700NE-1223-XXF
R4410	CWS-R4410-XX *	WCI-FR-R4410-XXXX	WCI-1700N-14F	WCI-1700NE-1401-XXF
				
	XX=Sleeve Length * = (F)lared or (S)traight	XXXX=Final Hole Size		XX=Extension Length

Mandrel Tool Code	Start Hole Gage	Combination Gage	Mandrel Wear Gage	Final Hole Gage
"H" Type				
H1870	WCI-SHG-H1870	WCI-CBG-H1870	WCIS-WG-H1870	WCI-FHG-****-XXXX
H2000	WCI-SHG-H2000	WCI-CBG-H2000	WCIS-WG-H2000	WCI-FHG-****-XXXX
H2160	WCI-SHG-H2160	WCI-CBG-H2160	WCIS-WG-H2160	WCI-FHG-****-XXXX
H2470	WCI-SHG-H2470	WCI-CBG-H2470	WCIS-WG-H2470	WCI-FHG-****-XXXX
H2630	WCI-SHG-H2630	WCI-CBG-H2630	WCIS-WG-H2630	WCI-FHG-****-XXXX
H2780	WCI-SHG-H2780	WCI-CBG-H2780	WCIS-WG-H2780	WCI-FHG-****-XXXX
H3090	WCI-SHG-H3090	WCI-CBG-H3090	WCIS-WG-H3090	WCI-FHG-****-XXXX
H3250	WCI-SHG-H3250	WCI-CBG-H3250	WCIS-WG-H3250	WCI-FHG-****-XXXX
H3410	WCI-SHG-H3410	WCI-CBG-H3410	WCIS-WG-H3410	WCI-FHG-****-XXXX
H3710	WCI-SHG-H3710	WCI-CBG-H3710	WCIS-WG-H3710	WCI-FHG-****-XXXX
H3880	WCI-SHG-H3880	WCI-CBG-H3880	WCIS-WG-H3880	WCI-FHG-****-XXXX
H4030	WCI-SHG-H4030	WCI-CBG-H4030	WCIS-WG-H4030	WCI-FHG-****-XXXX
H4340	WCI-SHG-H4340	WCI-CBG-H4340	WCIS-WG-H4340	WCI-FHG-****-XXXX
H4500	WCI-SHG-H4500	WCI-CBG-H4500	WCIS-WG-H4500	WCI-FHG-****-XXXX
H4660	WCI-SHG-H4660	WCI-CBG-H4660	WCIS-WG-H4660	WCI-FHG-****-XXXX
"R" Type				
R1280	WCI-SHG-R1280	WCI-CBG-R1280	WCIS-WG-R1280	WCI-FHG-****-XXXX
R1590	WCI-SHG-R1590	WCI-CBG-R1590	WCIS-WG-R1590	WCI-FHG-****-XXXX
R1900	WCI-SHG-R1900	WCI-CBG-R1900	WCIS-WG-R1900	WCI-FHG-****-XXXX
R2200	WCI-SHG-R2200	WCI-CBG-R2200	WCIS-WG-R2200	WCI-FHG-****-XXXX
R2530	WCI-SHG-R2530	WCI-CBG-R2530	WCIS-WG-R2530	WCI-FHG-****-XXXX
R2830	WCI-SHG-R2830	WCI-CBG-R2830	WCIS-WG-R2830	WCI-FHG-****-XXXX
R3170	WCI-SHG-R3170	WCI-CBG-R3170	WCIS-WG-R3170	WCI-FHG-****-XXXX
R3450	WCI-SHG-R3450	WCI-CBG-R3450	WCIS-WG-R3450	WCI-FHG-****-XXXX
R3780	WCI-SHG-R3780	WCI-CBG-R3780	WCIS-WG-R3780	WCI-FHG-****-XXXX
R4080	WCI-SHG-R4080	WCI-CBG-R4080	WCIS-WG-R4080	WCI-FHG-****-XXXX
R4410	WCI-SHG-R4410	WCI-CBG-R4410	WCIS-WG-R4410	WCI-FHG-****-XXXX
				****=Go Diameter XXXX=No Go Diameter

Metric Conversion Chart—CW Tooling

Mandrel	Nominal Hole Size	Minimum Start	
Tool Code	(mm)	(1/64 in)	Hole Dia. (mm)
B1267	3.2	8	3.11
B1423	3.6	9	3.51
B1580	4.0	10	3.90
B1737	4.4	11	4.30
B1894	4.8	12	4.70
B2050	5.2	13	5.10
B2206	5.6	14	5.49
B2364	6.0	15	5.89
B2520	6.4	16	6.29
B2676	6.8	17	6.68
B2833	7.2	18	7.08
B2990	7.6	19	7.48
B3145	8.0	20	7.87
B3301	8.4	21	8.27
B3458	8.7	22	8.67
B3615	9.1	23	9.07
B3771	9.5	24	9.46
B3928	9.9	25	9.86
B4083	10.3	26	10.25
B4241	10.7	27	10.65
B4396	11.1	28	11.05
B4551	11.5	29	11.45
B4708	11.9	30	11.84
B4865	12.3	31	12.24
B5020	12.7	32	12.64
B5176	13.1	33	13.03
B5332	13.5	34	13.43
B5489	13.9	35	13.83
B5647	14.3	36	14.38
B5803	14.7	37	14.62
B5959	15.1	38	15.02
B6116	15.5	39	15.42
B6272	15.9	40	15.81
B6429	16.3	41	16.21
B6585	16.7	42	16.60
B6742	17.1	43	17.00
B6899	17.5	44	17.40
B7055	17.9	45	17.80
B7212	18.3	46	18.19
B7369	18.7	47	18.59
B7525	19.1	48	18.99
B7681	19.4	49	19.38
B7837	19.8	50	19.78
B7995	20.2	51	20.18

Mandrel	Nominal Hole Size	Minimum Start	
Tool Code	(mm)	(1/64 in)	Hole Dia. (mm)
B8151	20.6	52	20.57
B8307	21.0	53	20.97
B8464	21.4	54	21.37
B8621	21.8	55	21.77
B8778	22.2	56	22.16
B8934	22.6	57	22.56
B9091	23.0	58	22.95
B9248	23.4	59	23.35
B9404	23.8	60	23.75
B9560	24.2	61	24.15
B9716	24.6	62	24.54
B9874	25.0	63	24.94
B10030	25.4	64	25.34
B10187	25.8	65	25.73
B10343	26.2	66	26.13
H1870	4.8	12	4.65
H2000	5.2	13	4.98
H2160	5.6	14	5.35
H2470	6.4	16	6.17
H2630	6.7	17	6.58
H2780	7.1	18	6.92
H3090	7.9	20	7.76
H3250	8.3	21	8.14
H3410	8.7	22	8.52
H3710	9.5	24	9.32
H3880	9.9	25	9.75
H4030	10.3	26	10.13
H4340	11.1	28	10.88
H4500	11.5	29	11.26
H4660	11.9	30	11.68
R1280	3.2	8	3.16
R1590	4.0	10	3.95
R1900	4.8	12	4.74
R2200	5.6	14	5.49
R2530	6.4	16	6.34
R2830	7.1	18	7.07
R3170	7.9	20	7.91
R3450	8.7	22	8.66
R3780	9.5	24	9.46
R4080	10.3	26	10.25
R4410	11.1	28	11.02

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