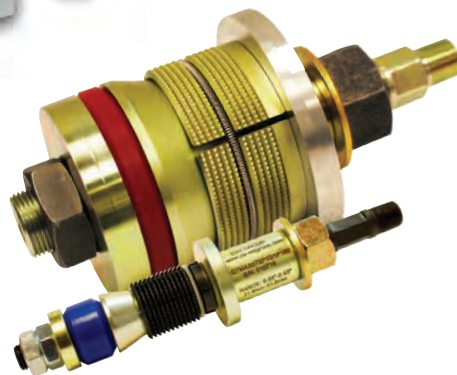
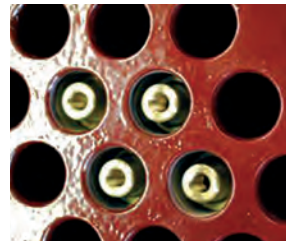
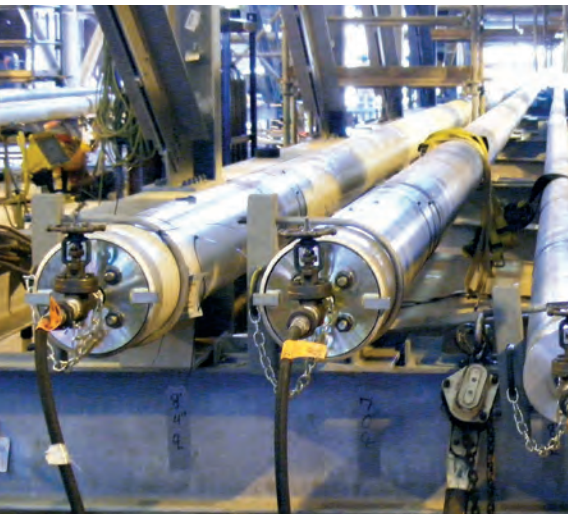


**CURTISS -  
WRIGHT**

**EST Group**



# Product Information Guide

Heat Exchanger Testing & Plugging

Heat Exchanger Repair

Hydrostatic Testing & Isolation

Plumber's Tools

Field Services



# CURTISS - WRIGHT



## EST Group

EST Group is a business unit of Curtiss-Wright Company and is headquartered in Hatfield, PA. EST Group is a global manufacturer and designer of pipe and tube pressure testing and plugging equipment.

Since 1968, EST Group has specialized in the development, manufacturing and marketing of tools and systems that greatly simplify the maintenance of shell and tube and air-cooled heat exchangers. EST Group also offers test plug systems that speed-up the in-service inspection of pipe, pipelines, piping systems and pressure vessels.

Our plugging and testing systems have saved our customers millions of dollars in maintenance and downtime.

We serve the power generation, upstream oil and gas, refining, petrochemical, fine chemical, pharmaceutical and shipbuilding industries worldwide.

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Quality Assurance System:  
Manufactured under QA program certified to ISO-9001-2008.  
Can be supplied under ANSI N45.2, 10CFR50 Appendix B.



## EST Group History and Qualifications

- Invented & patented the Pop-A-Plug® Tube Plugging System
- Is a Nuclear Procurement Issues Committee (NUPIC) - audited and approved company serving the Nuclear Industry worldwide
- Maintains Quality Assurance programs - Including: ISO 9001:2008, ASME NQA-1, 10 CFR 50 Appx. B and ANSI N45.2
- Has designed and manufactured quality plugging products since 1968
- Maintains a large inventory of Pop-A-Plug® Tube Plugs to meet your application needs
- When Pop-A-Plug® tube plugs are not in stock, EST Group provides 24/7 emergency manufacturing to get your plant back on line quickly



## Pop-A-Plug® Heat Exchanger Tube Plugging System Overview

- Eliminates the need for welding in tube plugs
- Identified as an approved tube plugging method in ASME PCC-2 - Article 3.12
- Offers the lowest life cycle cost when compared to alternative tube plugging methods
- Was developed and introduced by EST Group in 1981 and is protected under US Patent Number 5,437,310
- Widely used by US Navy on Nuclear Class surface ships and submarines
- Is a safe, engineered solution that will not degrade and leak like rubber plugs
- Has been independently reviewed and certified by TUV Rheinland
- Has gained worldwide industry acceptance as a safe, reliable and easy to install heat exchanger tube plugging method
- Is available in more than 35 different alloys to match your heat exchanger tube material and mitigate corrosion and thermal expansion issues
- Has been approved by Canada's Technical Standards and Safety Authority (TSSA) as a qualified heat exchanger tube plug for Nuclear and non-Nuclear applications - CRN numbers available upon request
- Used in more than 94% of North American Nuclear Power Plants
- Used in 100% of French Nuclear Power Plants
- Is recognized worldwide as a best practice repair method by many power, refining, chemical and petrochemical companies worldwide - Including: ExxonMobil, Shell, Dow, LyondellBasell, Exelon, EDF, and the US Navy

# Heat Exchanger Tube Plugs

## Pop-A-Plug® P2

A proven long-term performer in thermal and nuclear power generating stations, the Pop-A-Plug® P2 tube plug features patented internally serrated rings designed to maintain a leak tight seal under extreme thermal and pressure cycling. The Pop-A-Plug® P2 tube plugging system reduces downtime, eliminates welding and explosives, and will not damage your tubes, tubejoints or tubesheet. Working pressures to 7,000 PsiG (480 BarG). Sizes to fit 0.400"

to 1.460" (10.16mm to 37.08mm) tube I.D. Proven helium leak tight to  $1 \times 10^{-10}$  cc/sec. Breakaway ensures quick, easy and tightly controlled installation force eliminating damage to tube joints and epoxy coated tube sheets. Larger and smaller sizes available. Pop-A-Plug® P2 tube plug sizing lower limit is 0.215" (5.46mm). Removable for retubing. Compliant with several quality assurance systems including; ANSI N45.2, 10 CFR 50 Appx. B, 10 CFR 21.



## Pop-A-Plug® CPI/Perma

Designed as a fast and safe way to seal leaking heat exchanger and condenser tubes. Pop-A-Plug® CPI/Perma tube plugs are resistant to thermal cycling and are able to provide a seal that is helium leak tight. Pop-A-Plug® CPI/Perma tube plugs install using a controlled force. This protects against damage to tubesheet ligaments and adjacent tubesheet joints, extending the

life of your heat exchanger and reducing total operating cost. Operating pressures to 1000 PsiG (68.9 BarG). Tube sizes for 0.472" to 2.067" (11.99mm to 52.50mm) I.D. tubes. Helium leak tight to  $1 \times 10^{-6}$  cc/sec. Larger sizes available. Removable for retubing. Compliant with several quality assurance systems including; ANSI N45.2, 10 CFR 50 Appx. B, 10 CFR 21.



# Quick Facts

Updated ASME PCC-2 Repair of Pressure Equipment & Piping cites EST Group's Pop-A-Plug® tube plug for heat exchanger tube plugging.

# Heat Exchanger Tube Plugs and Tools

## Vibra Proof Condenser Plugs

A metal, expandable elastomer condenser plug, ideal for temporary tube plugging applications. Available for tube I.D. ranges from 0.280" to 1.309" (7.11mm to 33.25mm). Maximum

pressure rating is 150 PsiG (10.3 BarG). Brass or stainless steel with elastomers of neoprene, silicone, or fluoroelastomer seal materials.



## Pop-A-Plug® Tube Stabilizers

Effectively stabilizes weakened or fractured heat exchanger and condenser tubes. Ideal for any type of shell and tube heat exchanger from high pressure feedwater heaters to surface

condensers. Sizes to fit tubes ranging from 0.501" to 0.960" I.D. (12.73mm to 24.38mm). Available in either rod or cable type configuration. Available in any length.



## Pop-A-Plug® System Ram Packages

There is no better way to install Pop-A-Plug® tube plugs than with our hydraulic installation equipment. Our Small and Large Ram Packages are designed to hydraulically install Pop-A-Plug® tube plugs in seconds. The rams are compact, lightweight and easy to use. Install

Pop-A-Plug® tube plugs quickly, safely and easily. Ram packages include a hydraulic ram, pump, pressure gauge, high pressure hose and a metal storage tool box.



## Pop-A-Plug® Close Quarters Ram (CQR)

The Close Quarters Ram lets you install Pop-A-Plug® tube plugs even when there's minimal clearance around the tube end.

Ideal for tubes in the outermost row of closed head feedwater heaters or for tubes adjacent to a pass partition or divider plate.



## Pop-A-Plug® Manual Installation Tool (MIT)

Providing fast, reliable installation in situations where air or electricity are not available. Each MIT comes complete with a Pull Rod and Positioner to install the size and style Pop-A-Plug® tube plug identified in the tool's model number. By interchanging pull rods and plug positioners, the

MIT body can be used to install P2's up to 1.160" (29.46mm) and CPI/Perma Plugs™ up to 1.149" (29.18mm). The MIT can be used with manual wrenches or sockets, as well as with electric or pneumatic impact wrenches.



# Quick Facts

Unique to EST Group's Pop-A-Plug® tube plugging system, the Through-The-Tube Plugging™ procedure allows a tube plug to be passed through the length of a straight through-tube heat exchanger without having to remove the bundle or far end cover. Contact Customer Service for more information.

# Installation and Removal Tools

## Pull Rod Assemblies

EST Group maintains a significant inventory of Pull Rod Assemblies, Channel Head assemblies and extensions for both near end and

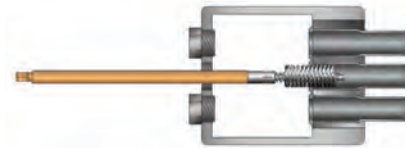
Through-The-Tube Plugging™ in Shell and Tube Heat Exchangers and Air Cooled Heat Exchangers.



## Pull Rod Assemblies for Air Cooled Heat Exchangers (ACHE)

EST Group offers a line of Pull Rod assemblies, Channel Head assemblies and extensions for the preparation and plugging of all types of Air Cooled Heat Exchangers. These tools eliminate the need for hammer in or welded plugs that can damage the tube and/or tubesheet and cause unexpected ejections.

Pull Rods, Go/No-Go Gages, Reamers and Brushes are all available with extension rods to easily reach the tube sheet through the plug header to do the repairs in minutes instead of hours.



## Brush Kits

Tube preparation is vital to successful tube plugging. EST Group's full complement of unique tube preparation brushes deliver fast, consistent tube preparation. The tube preparation brushes size the hole and make it round, quickly remove

surface defects that cause leaks and provide a roughened surface. This improves the Pop-A-Plug® tube plug's pressure holding capability and leak tight integrity.



## Tapered Reamers

Needed when weld droop obstructs a tube opening and prevents proper measurement of tube I.D. The tapered design allows for the precise removal of weld droop or other

obstructions when fitted into a hand-held power drill. Offered in various sizes for use with both Pop-A-Plug® CPI/Perma tube plugs and Pop-A-Plug® P2 tube plugs.



## Pop-A-Plug® Removal Tool (PRT)

Quickly and easily remove installed Pop-A-Plug® tube plugs with the dual functioning Removal Tool. The PRT features a nose piece that threads into the pin of an installed plug, enabling you to drive the pin from the ring. The tool retains the

pin while a serrated spear grabs the ring's I.D. An integral slide hammer then allows you to pull out the ring and pin in one operation. Also available in extended models for Pop-A-Plug® Air Cooled Heat Exchanger tube plugging systems.



# Heat Exchanger Tube Testers

## G-150 / G-150A Tube Testing Guns

Designed to pneumatically test individual heat exchanger tubes for leaks. Either the entire tube bundle or an isolated number of tubes in the bundle can be tested using standard plant compressed air supplies. Interchangeable seal and washer sets allow the G-150's to test tube I.D. sizes from 0.28" to 1.23" (7.1mm to 31.2mm). The larger G-150A Testing Guns will operate on tube I.D. sizes to 2.50" (63.5mm).

The G-150 Tube Testing Gun Set includes one G-150 Air Injection Gun and one G-150 Tube Plugging Gun. The G-150 Air Injection Gun and G-150 Plugging Guns weigh less than 2.4 lbs. each. Replacement Seal and Washer sets, Channel Head Extensions, and Digital Pressure Gauges are also available.



## G-250 Vacuum Tube Tester

Designed to quickly seal off and evacuate individual heat exchanger tubes to test the tube for leakage. The G-250 set is supplied with a Vacuum Test Gun, Plugging Tool, and two sizes of interchangeable Conical Seal and Washer Sets in a compact toolbox. The seal and washer sets allow the G-250 to be utilized to test heat exchanger tube I.D.s ranging from 0.28" to 1.45"

(7.1mm to 36.8mm). The G-250 gun is machined from high strength aluminum alloy reducing the fatigue associated with using heavier testing equipment. Each G-250 set weighs less than 2.5 lbs. (1.1kg). Optional Seal Sets are available to test tubes to 2.50" (63.5mm). Replacement Seal and Washer Sets, Channel Head Extensions and Digital Pressure Gauges are also available.



## From The Field



### Pop-A-Plug® Tube Plugging System for Air-Cooled Heat Exchangers

Curtiss Wright's EST Group has introduced a solution to simplify the testing, maintenance and repair of Air-Cooled Heat Exchangers. EST Group's Pop-A-Plug® Tube Plugging System and G-Series Tube Testing System provide easy-to-use tools for leak-testing and installing permanent but removable plugs into leaking tubes. These tools are designed to test and plug the tubes through the plug sheet holes, directly accessing the tube sheet. Testing and installation can be done in minutes, not the hours previously needed to do repairs. Pop-A-Plug® tube plugs are offered in a variety of materials to match your tube material, I.D. and pressure. Pop-A-Plug® tube plugs are rated up to 7000 PsiG (480 BarG) Look at the results one customer reported using EST Group's Pop-A-Plug® tube plugging system:

- 20 tubes were plugged and exchanger was back in operation in 1 hour using the Pop-A-Plug® system vs 18-26 hours of downtime using hammer and welded plugs
- Average installation time: 2 minutes per plug
- No weld permits required
- No expert welders required
- No damage to plug sheet threads
- Tube plugs can be easily removed with one tool when re-tubing is required



## Quick Facts

EST Group's Pop-A-Plug® tube plugging system is uniquely qualified to be used in fertilizer processing plants due to matching the unique corrosion resistant alloys used in such environments to Pop-A-Plug material construction. This system is easier to install, more reliable and lasts longer than any other plug type or system. Contact Customer Service for more information.



# Heat Exchanger Tube Testers

## G-450 Tube Tester

Designed to allow testing of straight tube heat exchangers when access is restricted to one end of the tube. Ideal for testing tubes in floating head heat exchanger applications with the tube bundles in place. The G-450 utilizes standard plant compressed air supplies.

Its interchangeable Support Rod, Tube Extension Assemblies and Seal & Washer Sets allow the G-450 to test tube I.D. sizes from 0.5" to 1.23" (12.7mm to 31.2mm). Digital Pressure Gauges are also available.



## G-650 Vacuum Joint Testing Gun

Designed to quickly test expanded tube-to-tubesheet joints for leakage. Ideal for heat exchanger manufacturers or companies performing retubing operations. The G-650 gun seals the tube I.D. and the tubesheet face, then evacuates the tube end at the joint. A loss of vacuum indicates a leaky tube joint. The G-650 gun operates on standard plant compressed air supplies. A highly efficient venturi typically creates 21 to 24 in-Hg (707 to 808 mBar) vacuum on an inlet air supply of 100 PsiG (6.8 BarG) and 10 SCFM.

Interchangeable manifolds and Seal and Washer Sets allow the G-650 to test tube-to-tubesheet joints on 3/8" to 1 1/4" (9.5mm to 31.8mm) O.D. tubes. The larger G-650A Joint Testing Gun will accommodate tube O.D. sizes from 1 1/2" to 2 1/2" (38.1mm to 63.5mm). The G-650 guns are not suitable for testing excessively belled / flared tube ends, or tubes with welded tube-to-tubesheet joints. Digital Pressure Gauges are also available.



## From The Field

### Change out your old elastomeric plugs, minimize plant downtime

In power generating stations, any forced outage is costly, especially at the peak of the generating season. All plants that support the base load of energy need to do everything possible to maximize uptime. As an example of the costs associated with unplanned outages, a coal-fired generation plant incurred almost \$10.9 million in losses due to almost 1369 hours (over 8 weeks) of downtime due to process water contamination. Causes for the failures were varied but one of the single largest (34%) was due to the failure of previously installed rubber condenser plugs!



These outages call for the proactive change out of old rubber/elastomer tube plugs to the Pop-A-Plug® Tube Plugging System for reliable, permanent and easy sealing of leaking and degraded tube plugs. The Pop-A-Plug® tube plug is proven to provide the lowest lifecycle cost for all types of plug systems used in heat exchanger maintenance.

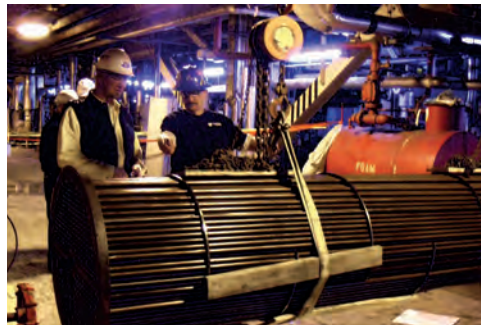
All Pop-A-Plug® tube plugging kits are readily available with 24/7 emergency service available for any unplanned outage that may arise – anywhere. EST Group also offers outage job box kits for large plants needing a variety of plugs for their condenser systems.



**REPLACE THIS:**  
Old elastomeric plugs which break down and become unreliable



**WITH THIS:**  
Pop-A-Plug® Tube Plug: the most reliable solution with the lowest lifecycle cost available for any plugging system



## EST Group Field Services

Expert Field Services & Technical Support, 24/7, 365 days a year

With industry wide reduction in plant maintenance personnel, it is more important than ever to work with a skilled and experienced provider of heat exchanger and hydrostatic testing services. From inspection to repair services, when you work with EST Group, you know the job is done right.

EST Group Field Services provides a complete range of on-site services for your shell and tube heat exchangers, condensers air cooled heat exchangers and oil coolers. We also provide hydrostatic testing services for pipe, piping systems, and flange connections. Our trained service technicians have the experience and know-how to handle the most demanding jobs, safely, competently and on-time.

Our technicians quickly respond and meet the tightest repair schedules. Join our growing list of satisfied customers in the power generation, chemical, petrochemical, oil refining, pharmaceutical, industrial gas, shipbuilding, and boiler manufacturing industries.

### Services

- Pop-A-Plug® Tube Plugging and Through-The-Tube™ Plugging
- Tube Testing & Tube Joint Testing
- Tube Sleeving & Lining
- Tube Cleaning
- Tube Sample Removal
- Visual Tube Inspection
- Hydrostatic Testing
  - GripTight® full line testing
  - GripTight® Reverse Pressure flange weld testing
  - Double Block and Bleed Isolation
  - GripTight® Isolation weld testing with back pressure isolation
- Field Supervision & Technical Support



### EST Group Product Training

- Certified Training Program
- Pop-A-Plug® Installation Training
- Test Plug Installation and Plug Maintenance Training



# GripTight® Test Plug Background

EST Group engineers and manufactures a wide variety of high pressure testing and isolation plugs for standard industry and specialty applications.

- The GripTight® product line was developed to improve the safety of high pressure testing
- Maintains Quality Assurance programs, including: ISO 9001:2008, ASME NQA-1, 10 CFR 50 Appx. B and ANSI N45.2
- Designed, manufactured, and identified as a quality pressure testing solution since 1968
- Field service, factory training and certification programs available for all test and isolation products
- Maintains a large inventory of pressure testing and isolation plugs to meet your application needs. If equipment is not in stock, EST Group provides 24/7 emergency manufacturing to meet your schedule
- Used by the largest shipbuilders in the world
- Have extreme pressure holding capabilities up to 15000 PsiG (1034 BarG)
- Use proven self-gripping technology - the greater the pressure, the greater the grip
- Provides the safest method for performing full-line pressure tests, flange weld integrity tests and line isolation for hot work
- Recognized in numerous plain end and flange weld testing best practices worldwide, including: ExxonMobil, BP, ConocoPhillips, Bechtel and Fluor Constructors applications
- Facilitate pressure testing – hydrostatic or pneumatic – of pressure piping systems under ASME B31.1, B31.3 and ASME PCC-2
- Preferred and used by plant construction projects in the power generation, refining, chemical, petrochemical and LNG markets worldwide



GripTight MAX®



GripTight®



GripTight® Elbow



O.D. GripTight®

# Pressure Test & Isolation Plugs

## GripTight MAX®

EST Group's GripTight MAX® Test Plug is a revolutionary new plug design that significantly increases the range of pipe materials that can be tested at higher pressures.

It is highly effective for testing down hole / well-head piping, high pressure steam systems and high alloy hardened pipe materials used in refineries and chemical plants.

*Also shown to be effective for testing non-metallic materials including Fiberglass Reinforced Plastic (FRP) and Glass Reinforced Epoxy (GRP). Contact EST Group customer service to inquire about a specific application.*

## Features & Benefits

- Patent-pending dual-serrated gripper design provides more gripping points on inside pipe surfaces
- Test pressures to 15000 PsiG (1034 BarG)
- Extended service life
- Sizes from 3/8" to 24" (9.525mm to 609.6mm) are available. Larger sizes available upon request
- Safe and reliable testing at higher pressures
- Saves up to 80% in testing time vs. welded-on end cap testing procedures
- Facilitates testing in accordance with ASME PCC-2 and ASME Boiler and Pressure Vessel Codes



## GripTight®

A standard in the industry, the GripTight® High Pressure Test Plug uses test pressure to grip and seal more securely against the pipe's inner diameter. The greater the pressure, the greater the grip! The result is a quicker installation, better sealing and all around safer testing. GripTight® test plugs eliminate the time consuming practice of welding on / cutting off end caps. The GripTight®

test plug is reusable and is compatible with hydrostatic or pneumatic testing. Operating pressures to 13900 PsiG (960 BarG), depending on plug size. Sizes from 1" to 24" (25.4mm to 609.6mm) in stock. Larger sizes through 42" NPS (DN 1150) available. For smaller sizes, see SQ2 test plugs.



## NEW! GripTight® Elbow

EST Group's GripTight® Elbow Test Plug is a revolutionary new plug designed for testing long radius elbows. Our patent-pending dual-serrated GripTight MAX™ grippers give this unique plug design enhanced holding power to 3350 PsiG (231 BarG) - providing a safe and effective solution for pipe spools and piping systems terminating in long radius elbows.

## Features & Benefits

- Orientation Free Installation - no need to align with elbow
- Patent-pending **dual-serrated gripper** design
- Test pressures to 3350 PsiG (231 BarG)
- Sizes for NPS ranging from 2" to 24" (DN50-DN600) available, larger sizes available upon request
- Fits all long radius elbows (45°, 90°, 180°)
- Saves up to 80% in testing time vs. welded-on end cap testing procedures



## O.D. GripTight®

The O.D. GripTight® uses EST Group's patented self-gripping, self-sealing design and reliable dual seal mechanism to provide unparalleled speed and safety in hydro-testing. The GripTight® design grips and seals along the pipe O.D. Since pipe O.D.'s are constant, one O.D. plug often replaces several

different sizes of I.D. sealing plugs providing an economic advantage and lower inventory.

Operating pressures to 5000 PsiG (343 BarG).  
1/4" to 4" ANSI pipe sizes (DN8 to DN100) and  
1/2" to 3½" (12.7 to 88.9 mm) O.D. tube sizes.



# Pressure Test & Isolation Plugs

## GripTight® Isolation Plug

The GripTight® Isolation Plug integrates a Double Block and Bleed Test Plug with GripTight® grippers. The upstream port allows operators to positively isolate and monitor potentially explosive vapors during hot work. The dual cavity port design allows water to be introduced to the section between the seals through the fill port while air is simultaneously evacuated through the vent port - creating a complete air-free barrier between the hotwork and residual upstream gases. After the hotwork is complete, the plug is repositioned to hydrotest the new weld connection.

GripTight® grippers enhance the operational safety minimizing the risk of accidental plug blowout /expulsion due to improper use of unexpected upstream pressure in the line. The GripTight® Isolation Plug is capable of withstanding test pressures to 2250 PsiG (155.1BarG) between the seals and upstream pressures up to 1500 PsiG (103 BarG). As upstream pressure increases, GripTight® grippers use the pressure to grip and seal more securely against the pipe's inner diameter. Designed for pipe sizes from 3/4" to 24" NPS (DN20 to DN600), larger sizes are available on request.



## Double Block and Bleed

The Double Block and Bleed Isolation plug utilizes a safe and effective three port design. The upstream port allows operators to positively isolate and monitor potentially explosive vapors during hot work. The dual cavity port design allows water to be introduced to the section between the seals through the fill port while air is simultaneously evacuated through the vent port - creating a complete air-free barrier between the hotwork and residual upstream gases. After the hotwork is complete the operator repositions the plug to effectively hydrotest the new weld

connection. The aluminum/steel construction makes this tool highly portable and easy to position. The volume of water required for testing is so small that testing can be accomplished using a simple hand pump. This greatly facilitates testing in remote areas of the facility. 3/4" through 24" NPS (DN20 through DN600) in STD wall, schedule 40 and 80 pipe sizes. Other sizes available. Pressure rated to 2250 PsiG (155.1 BarG) between the seals. Upstream pressure rated to 10 PsiG (0.7 BarG).



## GripTight® Reverse Pressure

The GripTight® Reverse Pressure test plug is the solution to the growing concern over inadequate longitudinal stress when testing welded flange connections. By isolating the test area between a test flange and the GripTight® Reverse Pressure test plug, the weld joint is subjected to both radial

and longitudinal stresses during hydrostatic testing. Operating pressures to 2250 PsiG (155.1 BarG). Available in sizes 2" to 12" - larger sizes also available. 4" and larger plugs provide up to 0.5" (12.7mm) pipe clearance.



## High Lift Flange Weld

The High Lift Flange Weld test plug allows you to monitor upstream conditions, isolate and purge the weld area, perform the weld, and hydro test the weld joint with one easy tool. No blind flanging upstream, no vacuum truck for evacuating the line, and no X-raying. Each test requires less than 2 gallons (8 Liters) of water, and there is no need to fill the entire line.

You will use less water and minimize your environmental impact. Operating pressures to ANSI B16.5 requirements. Pipe sizes from 3/4" to 24" (DN20 to DN600). Larger sizes also available. Flange classes 150 to 600 lb. Higher classes available. All flange types. High Lift seal design provides improved seal-to-pipe clearance.



# Pressure Test & Isolation Plugs

## SQ2

High pressure testing is faster and easier thanks to the SQ2 high pressure test plugs. The twin cone design allows our SQ2 plugs to be easily installed and removed without causing extensive damage to the pipe wall surface. Operating

pressures to 6500 PsiG (446 BarG). Sizes for pipe and tubing I.D.'s from 0.47" to 0.93" (11.9mm to 23.6mm). Ideal for pressure testing heat exchanger tubing and small bore piping.



## Socket Weld (SQS)

SQS test plugs are designed to facilitate testing socket weld fittings and couplings. During installation, the grippers expand within the socket holding the plug in position while the seal element expands and seals off the bore of the

fitting. Designed for ASTM A105 3000 LB carbon steel socket weld fittings. Sizes to fit 1/2" through 2" fittings, operating pressures to 5000 PsiG (344 BarG), depending on plug size. Larger sizes available.



## Auto GripTight® Testing System

The Auto GripTight® testing system speeds the plug installation and testing process. The system hydraulically energizes the test plug by simply activating a hydraulic pump, eliminating the need for manually tightening the plug. Ideal for testing

applications in pipe or tubing I.D.'s ranging from 0.50" to 4.34" (12.7mm to 110.2mm) and operating pressures to 13900 PsiG (958 BarG). Contact Customer Service and let us help you design a system.



## GripTight® PE

No more having to square and round pipe ends to fuse on end caps. Just slip the GripTight® PE plugs in the open ends of a section of pipe, tighten and begin testing. Testing can be performed on an installed pipe or while it is still on the spool. Available in 2", 3", 4", 6" and 8"

pipe sizes (DN50 to DN200). Plug sizes to cover 9 to 17 SDR applications in either HDPE or MDPE pipe - other sizes available. Patented dual seal design. Conservatively rated to 150% of maximum operating pressure required under 49 CFR 192.513.

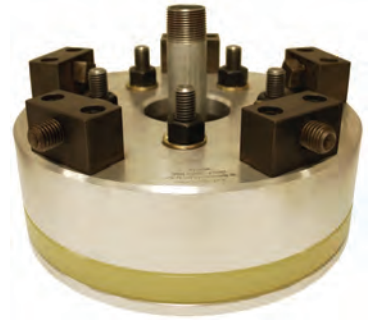


# Pressure Test & Isolation Plugs

## LW100 Series

LW100 Series Test Plugs offer a highly versatile, lightweight, and cost effective temporary sealing solution for low pressure applications. Lightweight aluminum construction substantially reduces manpower and heavy lifting equipment required for installation and removal,

resulting in lower costs per test. Safely test applications from 4" to 36" (101.6mm - 914.4mm) in diameter, with a pressure rating up to 100 PsiG (6.9 BarG). Larger sizes available upon request.



## Economy

Economy low pressure test plugs are designed for simple and reliable testing of pipe and tubing, without the tube wall damage associated with other test plugs. Our Economy plugs feature a neoprene seal - the only part of the plug that comes in contact with the tube I.D. Simply

install the Economy test plug into the open end of a pipe and/or tube, and tighten the wingnut (*2" to 4" sizes use a hex nut*) to expand the seal. Begin pressure testing. Operating pressures to 35 PsiG (2.4 BarG), depending on plug size. Sizes for 3/8" to 4" (9.525mm to 101.6mm).



## Bolt Type

The Bolt Type medium pressure test plugs are designed for simple and reliable testing of pipe and tubing, without the tube wall damage associated with other test plugs. Our Bolt Type plugs feature a neoprene seal - the only part of the plug that comes in contact with the tube I.D. To use, simply install into the open end of the pipe or tube

and tighten the large compression nut to expand the seal element; then begin testing. Operating pressures to 250 PsiG (17.2 BarG), depending on the plug size. Sizes for 0.28" to 10½" (7.11mm to 266.7mm). Shown with thread protector.



## Inflatable Stoppers: Round, Cylindrical, and Pillow

Used to seal gas lines, water lines, purge and containment. Available in sizes from 2" to 72" (DN 50 to DN 2400), depending on model stopper selected.

Operating pressure ratings from 1 to 69 PsiG (0.07 to 4.8 BarG), depending on size and style selected.



# Quick Facts

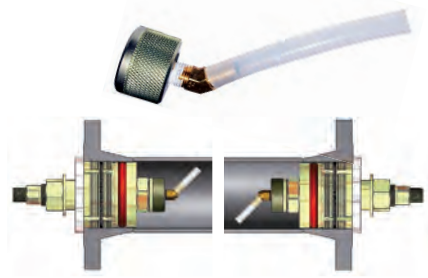
EST Group offers pipe vents for GripTight® and GripTight MAX™. Vents help displace trapped air or gases through plugs as the vessel or piping system is being filled for hydrostatic testing. Contact Customer Service for more information.

# Pressure Test & Isolation Plug Accessories

## GripTight® Vent Cap

Safely fill and drain pipes during hydrostatic testing. Vents are installed with tubes at high and low points in the area being tested in order to fill with

test medium and displace air/gases in the pipe being tested.



## Plug Safety Gags

EST Group Safety Gags are designed to prevent damage which may occur due to incorrectly installed plugs ejecting from the pipe during pressurization.

Gags are designed to quickly fasten to pipe OD and plug inlet and will deflect the plug if movement occurs.



## Test Plug Lifting Arm

Designed to work with larger test plugs to provide safe and easy placement and installation of plug into pipes. Lifting Arm fastens to the test plug and can be lifted into place with a crane, fork-lift

or other lifting mechanism designed to hold the weight of the plug and lifting tool. Rated to 1500 lbs (680.4 kg).



## From The Field

### GripTight MAX® - Revolutionary design in test plug technology for emerging needs

EST Group has developed a revolutionary test plug which is designed to work effectively at pressures up to 15000 PsiG (1034 BarG) in pipe materials with hardness values to HRC 32. The GripTight MAX® test plug is a natural extension to the fast, safe and reliable GripTight® product line but with significantly enhanced capability. All GripTight® test plugs are designed to facilitate pressure testing in accordance with ASME PCC-2 and ASME BPV Codes.

#### Background

A need emerged for a test plug design that could successfully hydro test hardened pipe systems. This posed a challenge due to limitations in existing test plug designs. An example of this need surfaced recently when an oil & gas facility experienced a devastating fire which was attributed to the failure of corroded service lines. Their solution was to upgrade the pipe materials with a newer anti-corrosive, high strength pipe material.

To meet the challenge, EST Group developed and tested a unique (patent-pending) dual-serrated gripper design which provided the grip needed to hold the plug consistently at higher pressures. Once the testing began, additional benefits were realized such as the elimination of gripper ridge marks on the pipe wall, faster installation times and increased usable life of the plug. Thus the GripTight MAX® was born.

#### Additional Benefits Realized

The GripTight MAX® test plug has also shown to be effective for testing non-metallic materials including Fiberglass Reinforced Plastic (FRP) and Glass Reinforced Epoxy (GRP). Contact EST Group customer service to inquire about a specific application.





# Hydrostatic Test Pumps

## P Series

Ideal for hydro testing heat exchanger tubes, pipe and pressure vessels in the field or in the shop. Available in two output pressures, 2,500 or 10000 PsiG (172.3 and 689.4 BarG). All wetted parts are stainless steel. Easy to read 4"

(100 mm) diameter pressure gauge. Completely enclosed in a lockable aluminum tool box. Supplied with 10ft (3.1 m) high pressure hose with quick couplings for air and water inlet connections.



## P Series Hand Pump

A self-contained and portable hand pump for testing tubes, pipes and pressure vessels. It is integrated into a 5 gallon attached reservoir which is easily refilled. The pump is hand operated, eliminating the need for compressed air. With the turn of a knob, the pressure output can be adjusted to either 1000 PsiG (68.9 BarG),

2000 PsiG (137.9 BarG) or 3000 PsiG (206.8 BarG) for the appropriate application. It has a silicone-filled gauge for all weather use and minimal moving parts for durability and longevity. High pressure bleed valve and hose with swivel fitting included.



## Blue Max 3

Suitable for all hydrostatic testing applications. Available in a number of output pressures ranging from 1000 to 10000 PsiG (68.6 to 686.3 BarG). Higher pressures available. The Blue Max 3 features include all stainless steel wetted components and an easy to read 4"

diameter (100 mm) pressure gauge. Supplied with mating quick connect couplings for air inlet, water inlet and high pressure outlet connections. The enclosed cabinet provides safe & quiet operation, and protects components from damage.



# Plumber's & Specialty Tools

## DutchFinger® Valve Changing Tools: O-Series, TBD Series, FPT Series

The **O-Series** is used to repair or replace a full port ball or gate valve while under pressure. Pipe sizes range from 1/2" to 4" (DN 15 to DN 100). Pressure ratings 15 to 200 PsiG (1 to 13.8 BarG). The **TBD Series** is used to repair full port ball or gate valves in piping systems under medium pressure. It incorporates a seal and a gripper to lock itself into position. Pipe sizes range from 1"

to 4". Pressure ratings are from 250 to 600 PsiG (17.2 to 41.4 BarG), depending on size. The **FPT Series** is used to repair and replace full port ball or gate valves on tanks and headers. This is an ideal tool to replace leaking tank bottom valves. Available in size ranges from 2" to 10" (DN 50 to DN 250). Pressure ratings from 600 to 250 psi (41.4 to 17.2 Bar), depending on size.



## DutchFinger® Watergate Tools

Prized by plumbers for simplifying soldering copper pipe. Available for 1/2" to 4" pipe sizes.



## H-Series Hot Tap Kit

Allows manual or power tapping of existing lines and extends service without shutting off existing pressure. Available in individual tools or a variety

of kits from 1/2" to 6" (DN 15 to DN 150) line size. Max pressure for all tools is 150 PsiG (10.3 BarG).



## D-Series Tapping Tools

Ideal for decontamination and disposal (D&D) work, D-Series Tapping Tools facilitate tapping, sampling and draining the contents of pipe and pressure vessels. The large 3/4" NPT outlet on the tools' body provides sampling and drainage port. Simple bolt-on installation – no welding or

pyrotechnics are needed. All stainless steel construction with titanium nitride coated drill bit and GoreTex® gaskets. Available for pipe sizes from 1/4" through 3" at working pressures to 285 PsiG (19.7 BarG). Tubing sizes and larger pipe sizes are available.



## Threaded Pipe Stoppers

Ported hand tightened stoppers provide a face seal on NPT threaded connections without the use of sealants or hand tools. NPT size ranges

from 1/8" to 4". Operating pressure ratings vary by size and range, from 500 to 5000 PsiG (34.5 to 344.7 BarG).



# Toolkits and Job Boxes

## EST Group Job Box

EST Group's Job Box is perfect for anyone who is planning a large test and repair project and needs to have all their Pop-A-Plug® tube plugs, GripTight® test plugs and Installation tools in one

place. The Job Box is easily transported by fork truck or pallet jack and is all-steel construction. The Job Box can be securely locked to prevent theft of tools, plugs and other materials.



## Pipe Test Toolkit

Combined with your choice of GripTight® test plug, GripTight MAX® test plug or other EST Group Test and Isolation plugs, the Pipe Test Tool

kit is all you need to hydrostatically test your flange welds and other joint connections. All that's needed is the water!



## EST Group Testing Gun Toolkit

G150 tube testing kits are a great way to organize and protect your test guns and accessories to be ready when you need

them most. The heavy duty plastic box contains all you need to properly test for leaking tubes.



## Complete Tooling Packages



**Everything but the Water!**

## From The Field

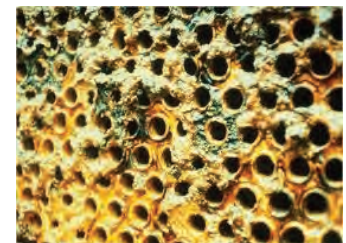
**Curtiss Wright EST Group Pop-A-Plug® Heat Exchanger Tube Plugs are recommended for use in highly corrosive Ammonia, UREA and Sulfuric Acid processing process environments.**

EST Group's Pop-A-Plug® tube plug has now established a proven track record in the fertilizer industry and in many cases is the standard recommended practice for plugging leaking or degraded tubes in highly critical and dangerous or corrosive environments such as Ammonia, UREA, and Sulfuric acid processing. In the past, plugging heat exchangers consisted of using hammered taper pin plugs or welded plugs. This practice would sometimes damage the tube sheet integrity causing more tubes to leak due to unacceptable stresses in the tube sheet.

In addition, hammered taper pin plugs or even welded plugs can turn into lethal projectiles posing a significant safety hazard for plant personnel, and welding can present an explosion hazard in many plant areas within this industry.



**ALL** of these problems can be eliminated while significantly reducing downtime using EST Group's Pop-A-Plug® technology. The Pop-A-Plug® tube plugging system is now available in a wide range of materials such as F11, F22 Zirconium and many other materials used in corrosive environments. Because these metals match the heat exchanger tube materials, Pop-A-Plug® tube plugs are resistant to thermal cycling and able to provide an excellent helium-leak tight seal.



As an example of the Pop-A-Plug® tube plugs effectiveness, a large producer of Ammonia and Urea in Germany decided to utilize the Pop-A-Plug® system for their leaking and cracked heat exchanger tubes in Ammonia Waste Heat Boilers<sup>1</sup>.

The leakage was caused by pitting and corrosion due to the caustic reactions within the heat exchanger. Repairs took between 48 to 72 hours to plug the tubes using welded plugs. With the Pop-A-Plug tube plugging system this was reduced to under 12 hours including opening and closing of the units. Ask us about our white paper on this application, or download it from our website at [www.cw-estgroup.com](http://www.cw-estgroup.com)

# Common Pipe Sizing Chart - English & Metric Sizing (inches / mm)

DN	PIPE SIZE	PIPE OD	SCH 5S	SCH 10S	SCH 10	SCH 20	SCH 30	STD	SCH 40	SCH 60	XS	SCH 80	SCH 100	SCH 120	SCH 140	SCH 160	XXS
6	1/8	0.405 (10.29)		0.307 (7.80)				0.269 (6.83)	0.289 (6.83)		0.215 (5.46)						
8	1/4	0.540 (13.72)		0.410 (10.41)				0.364 (9.25)	0.364 (9.25)		0.302 (7.67)						
10	3/8	0.675 (17.15)		0.545 (13.84)				0.493 (12.52)	0.493 (12.52)		0.423 (10.74)						
15	1/2	0.840 (21.34)	0.710 (18.03)	0.674 (17.12)				0.622 (15.80)	0.622 (15.80)		0.546 (13.87)					0.464 (11.79)	0.252 (6.40)
20	3/4	1.050 (26.67)	0.920 (23.37)	0.884 (22.45)				0.824 (20.93)	0.824 (20.93)		0.742 (18.85)					0.612 (15.54)	0.434 (11.02)
25	1	1.315 (33.40)	1.185 (30.10)	1.097 (27.86)				1.049 (26.64)	1.049 (26.64)		0.957 (24.31)					0.815 (20.70)	0.599 (15.21)
32	1-1/4	1.660 (42.16)	1.530 (38.86)	1.442 (36.63)				1.380 (35.05)	1.380 (35.05)		1.278 (32.46)					1.160 (29.46)	0.896 (22.76)
40	1-1/2	1.900 (48.26)	1.770 (44.96)	1.682 (42.72)				1.610 (40.89)	1.610 (40.89)		1.500 (38.10)					1.338 (33.99)	1.100 (27.94)
50	2	2.375 (60.33)	2.245 (57.02)	2.157 (54.79)				2.067 (52.50)	2.067 (52.50)		1.939 (49.25)					1.689 (42.90)	1.503 (38.18)
65	2-1/2	2.875 (73.03)	2.709 (68.81)	2.635 (66.93)				2.469 (62.71)	2.469 (62.71)		2.323 (59.00)					2.125 (53.98)	1.771 (44.98)
80	3	3.500 (88.90)	3.334 (84.66)	3.260 (82.80)				3.068 (77.93)	3.068 (77.93)		2.900 (73.66)					2.626 (66.70)	2.300 (58.42)
90	3-1/2	4.000 (101.60)	3.834 (97.36)	3.760 (95.50)				3.548 (90.12)	3.548 (90.12)		3.364 (85.45)						
100	4	4.500 (114.30)	4.334 (110.08)	4.260 (108.20)				4.026 (102.26)	4.026 (102.26)		3.826 (97.18)					3.626 (92.10)	
125	5	5.563 (141.30)	5.345 (135.76)	5.295 (134.49)				5.047 (128.19)	5.047 (128.19)		4.813 (122.25)					4.563 (115.90)	4.063 (103.20)
150	6	6.625 (168.28)	6.407 (162.74)	6.357 (161.47)				6.065 (154.05)	6.065 (154.05)		5.761 (146.33)					5.501 (139.73)	4.897 (124.38)
200	8	8.625 (219.08)	8.407 (213.54)	8.329 (211.56)				7.981 (202.72)	7.981 (202.72)		7.625 (193.68)					7.001 (177.83)	6.875 (174.63)
250	10	10.750 (273.05)	10.482 (266.24)	10.420 (264.87)				10.020 (254.51)	10.020 (254.51)		9.750 (247.65)					9.064 (230.23)	8.750 (222.25)
300	12	12.750 (323.85)	12.438 (315.83)	12.390 (314.71)				12.000 (304.80)	12.000 (304.80)		11.750 (298.45)					10.750 (273.05)	10.500 (266.70)
350	14	14.000 (355.60)	13.688 (347.68)	13.624 (346.05)				13.250 (336.55)	13.250 (336.55)		13.000 (330.20)					11.812 (300.02)	11.500 (292.10)
400	16	16.000 (406.40)	15.670 (398.02)	15.624 (396.85)				15.250 (387.35)	15.250 (387.35)		15.000 (381.00)					13.562 (344.47)	13.124 (333.55)
450	18	18.000 (457.20)	17.670 (448.82)	17.624 (447.65)				17.250 (438.15)	17.250 (438.15)		17.000 (431.80)					15.250 (387.35)	14.876 (377.85)
500	20	20.000 (508.00)	19.625 (498.48)	19.584 (496.83)				19.250 (488.95)	19.250 (488.95)		19.000 (482.60)					17.000 (431.80)	16.500 (419.10)
550	22	22.000 (558.80)	21.625 (549.28)	21.584 (547.73)				21.250 (538.75)	21.250 (538.75)		21.000 (533.40)					18.750 (476.25)	18.250 (463.55)
600	24	24.000 (609.60)	23.564 (598.53)	23.500 (596.90)				23.250 (590.55)	23.250 (590.55)		23.000 (584.20)					20.376 (517.55)	19.876 (504.85)
650	26	26.000 (660.40)		25.376 (644.55)				25.250 (641.35)	25.250 (641.35)		25.000 (635.00)						
700	28	28.000 (711.20)		27.376 (695.25)				27.250 (692.15)	27.250 (692.15)		27.000 (685.80)						
750	30	30.000 (762.00)	29.500 (749.30)	29.376 (746.15)				29.250 (742.95)	29.250 (742.95)		29.000 (736.60)						
800	32	32.000 (812.80)		31.376 (796.95)				31.250 (793.75)	31.250 (793.75)		31.000 (787.40)						
850	34	34.000 (863.60)		33.376 (847.75)				33.250 (844.55)	33.250 (844.55)		33.000 (838.20)						
900	36	36.000 (914.40)		35.376 (898.55)				35.250 (895.35)	35.250 (895.35)		35.000 (889.00)						
1000	42	42.000 (1066.8)						41.250 (1047.75)	41.250 (1047.75)		41.000 (1041.40)						

# Approximate Tube Inside Diameters Before & After Roller Expansion (Inches)

Tube Inside Diameters As Manufactured														
Wall Thickness		Tube OD												
BWG	Decimal	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	2
8	0.165	0.045	0.170	0.295	0.420	0.545	0.670	0.795	0.920	1.045	1.170	1.295	1.420	1.670
9	0.148	0.079	0.204	0.329	0.454	0.579	0.704	0.829	0.954	1.079	1.204	1.329	1.454	1.704
10	0.134	0.107	0.232	0.357	0.482	0.607	0.732	0.857	0.982	1.107	1.232	1.357	1.482	1.732
11	0.120	0.135	0.260	0.385	0.510	0.635	0.760	0.885	1.010	1.135	1.260	1.385	1.510	1.760
12	0.109	0.157	0.282	0.407	0.532	0.657	0.782	0.907	1.032	1.157	1.282	1.407	1.532	1.782
13	0.095	0.185	0.310	0.435	0.560	0.685	0.810	0.935	1.060	1.185	1.310	1.435	1.560	1.810
14	0.083	0.209	0.334	0.459	0.584	0.709	0.834	0.959	1.084	1.209	1.334	1.459	1.584	1.834
15	0.072	0.231	0.356	0.481	0.606	0.731	0.856	0.981	1.106	1.231	1.356	1.481	1.606	1.856
16	0.065	0.245	0.370	0.495	0.620	0.745	0.870	0.995	1.120	1.245	1.370	1.495	1.620	1.870
17	0.058	0.259	0.384	0.509	0.634	0.759	0.884	1.009	1.134	1.259	1.384	1.509	1.634	1.884
18	0.049	0.277	0.402	0.527	0.652	0.777	0.902	1.027	1.152	1.277	1.402	1.527	1.652	1.902
19	0.042	0.291	0.416	0.541	0.666	0.791	0.916	1.041	1.166	1.291	1.416	1.541	1.666	1.916
20	0.035	0.305	0.430	0.555	0.680	0.805	0.930	1.055	1.180	1.305	1.430	1.555	1.680	1.930
21	0.032	0.311	0.436	0.561	0.686	0.811	0.936	1.061	1.186	1.311	1.436	1.561	1.686	1.936
22	0.028	0.319	0.444	0.569	0.694	0.819	0.944	1.069	1.194	1.319	1.444	1.569	1.694	1.944
23	0.025	0.325	0.450	0.575	0.700	0.825	0.950	1.075	1.200	1.325	1.450	1.575	1.700	1.950
24	0.022	0.331	0.456	0.581	0.706	0.831	0.956	1.081	1.206	1.331	1.456	1.581	1.706	1.956

Tube Inside Diameters After Roller Expansion														
Wall Thickness		Tube OD												
BWG	Decimal	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	2
8	0.165	0.078	0.203	0.328	0.453	0.578	0.703	0.828	0.953	1.078	1.203	1.328	1.453	1.703
9	0.148	0.109	0.234	0.359	0.484	0.609	0.734	0.859	0.984	1.109	1.234	1.359	1.484	1.734
10	0.134	0.134	0.259	0.384	0.509	0.634	0.759	0.884	1.009	1.134	1.259	1.384	1.509	1.759
11	0.120	0.159	0.284	0.409	0.534	0.659	0.784	0.909	1.034	1.159	1.284	1.409	1.534	1.784
12	0.109	0.179	0.304	0.429	0.554	0.679	0.804	0.929	1.054	1.179	1.304	1.429	1.554	1.804
13	0.095	0.204	0.329	0.454	0.579	0.704	0.829	0.954	1.079	1.204	1.329	1.454	1.579	1.829
14	0.083	0.226	0.351	0.476	0.601	0.726	0.851	0.976	1.101	1.226	1.351	1.476	1.601	1.851
15	0.072	0.245	0.370	0.495	0.620	0.745	0.870	0.995	1.120	1.245	1.370	1.495	1.620	1.870
16	0.065	0.258	0.383	0.508	0.633	0.758	0.883	1.008	1.133	1.258	1.383	1.508	1.633	1.883
17	0.058	0.271	0.396	0.521	0.646	0.771	0.896	1.021	1.146	1.271	1.396	1.521	1.646	1.896
18	0.049	0.287	0.412	0.537	0.662	0.787	0.912	1.037	1.162	1.287	1.412	1.537	1.662	1.912
19	0.042	0.299	0.424	0.549	0.674	0.799	0.924	1.049	1.174	1.299	1.424	1.549	1.674	1.924
20	0.035	0.312	0.437	0.562	0.687	0.812	0.937	1.062	1.187	1.312	1.437	1.562	1.687	1.937
21	0.032	0.317	0.442	0.567	0.692	0.817	0.942	1.067	1.192	1.317	1.442	1.567	1.692	1.942
22	0.028	0.325	0.450	0.575	0.700	0.825	0.950	1.075	1.200	1.325	1.450	1.575	1.700	1.950
23	0.025	0.330	0.455	0.580	0.705	0.830	0.955	1.080	1.205	1.330	1.455	1.580	1.705	1.955
24	0.022	0.335	0.460	0.585	0.710	0.835	0.960	1.085	1.210	1.335	1.460	1.585	1.710	1.960

NOTE: TUBE INSIDE DIAMETERS AFTER ROLLER EXPANSION ARE ESTIMATED ASSUMING A 10% WALL THICKNESS LOSS, FORMULA = [ (OD - 2 \* (WT \* 0.9) ]

# Approximate Tube Inside Diameters Before & After Roller Expansion (mm)

Tube Inside Diameters As Manufactured																
Wall Thickness		Tube OD														
BWG	Decimal	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	2	2 1/4	2 1/2
8	4.19	1.14	4.32	7.49	10.67	13.84	17.02	20.19	23.37	26.54	29.72	32.89	36.07	42.42	48.77	55.12
9	3.76	2.01	5.18	8.36	11.53	14.71	17.88	21.06	24.23	27.41	30.58	33.76	36.93	43.28	49.63	55.98
10	3.40	2.72	5.89	9.07	12.24	15.42	18.59	21.77	24.94	28.12	31.29	34.47	37.64	43.99	50.34	56.69
11	3.05	3.43	6.60	9.78	12.95	16.13	19.30	22.48	25.65	28.83	32.00	35.18	38.35	44.70	51.05	57.40
12	2.77	3.99	7.16	10.34	13.51	16.69	19.86	23.04	26.21	29.39	32.56	35.74	38.91	45.26	51.61	57.96
13	2.41	4.70	7.87	11.05	14.22	17.40	20.57	23.75	26.92	30.10	33.27	36.45	39.62	45.97	52.32	58.67
14	2.11	5.31	8.48	11.66	14.83	18.01	21.18	24.36	27.53	30.71	33.88	37.06	40.23	46.58	52.93	59.28
15	1.83	5.87	9.04	12.22	15.39	18.57	21.74	24.92	28.09	31.27	34.44	37.62	40.79	47.14	53.49	59.84
16	1.65	6.22	9.40	12.57	15.75	18.92	22.10	25.27	28.45	31.62	34.80	37.97	41.15	47.50	53.85	60.20
17	1.47	6.58	9.75	12.93	16.10	19.28	22.45	25.63	28.80	31.98	35.15	38.33	41.50	47.85	54.20	60.55
18	1.25	7.04	10.21	13.39	16.56	19.74	22.91	26.09	29.26	32.44	35.61	38.79	41.96	48.31	54.66	61.01
19	1.07	7.39	10.57	13.74	16.92	20.09	23.27	26.44	29.62	32.79	35.97	39.14	42.32	48.67	55.02	61.37
20	0.89	7.75	10.92	14.10	17.27	20.45	23.62	26.80	29.97	33.15	36.32	39.50	42.67	49.02	55.37	61.72
21	0.81	7.90	11.07	14.25	17.42	20.60	23.77	26.95	30.12	33.30	36.47	39.65	42.82	49.17	55.52	61.87
22	0.71	8.10	11.28	14.45	17.63	20.80	23.98	27.15	30.33	33.50	36.68	39.85	43.03	49.38	55.73	62.08
23	0.64	8.26	11.43	14.61	17.78	20.96	24.13	27.31	30.48	33.66	36.83	40.01	43.18	49.53	55.88	62.23
24	0.56	8.41	11.58	14.76	17.93	21.11	24.28	27.46	30.63	33.81	36.98	40.16	43.33	49.68	56.03	62.38

Tube Inside Diameters After Roller Expansion																
Wall Thickness		Tube OD														
BWG	Decimal	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	2	2 1/4	2 1/2
8	4.19	1.98	5.16	8.33	11.51	14.68	17.86	21.03	24.21	27.38	30.56	33.73	36.91	43.26	49.61	55.96
9	3.76	2.76	5.93	9.11	12.28	15.46	18.63	21.81	24.98	28.16	31.33	34.51	37.68	44.03	50.38	56.73
10	3.40	3.40	6.57	9.75	12.92	16.10	19.27	22.45	25.62	28.80	31.97	35.15	38.32	44.67	51.02	57.37
11	3.05	4.04	7.21	10.39	13.56	16.74	19.91	23.09	26.26	29.44	32.61	35.79	38.96	45.31	51.66	58.01
12	2.77	4.54	7.72	10.89	14.07	17.24	20.42	23.59	26.77	29.94	33.12	36.29	39.47	45.82	52.17	58.52
13	2.41	5.18	8.36	11.53	14.71	17.88	21.06	24.23	27.41	30.58	33.76	36.93	40.11	46.46	52.81	59.16
14	2.11	5.73	8.91	12.08	15.26	18.43	21.61	24.78	27.96	31.13	34.31	37.48	40.66	47.01	53.36	59.71
15	1.83	6.23	9.41	12.58	15.76	18.93	22.11	25.28	28.46	31.63	34.81	37.98	41.16	47.51	53.86	60.21
16	1.65	6.55	9.73	12.90	16.08	19.25	22.43	25.60	28.78	31.95	35.13	38.30	41.48	47.83	54.18	60.53
17	1.47	6.87	10.05	13.22	16.40	19.57	22.75	25.92	29.10	32.27	35.45	38.62	41.80	48.15	54.50	60.85
18	1.25	7.28	10.46	13.63	16.81	19.98	23.16	26.33	29.51	32.68	35.86	39.03	42.21	48.56	54.91	61.26
19	1.07	7.60	10.78	13.95	17.13	20.30	23.48	26.65	29.83	33.00	36.18	39.35	42.53	48.88	55.23	61.58
20	0.89	7.92	11.10	14.27	17.45	20.62	23.80	26.97	30.15	33.32	36.50	39.67	42.85	49.20	55.55	61.90
21	0.81	8.06	11.24	14.41	17.59	20.76	23.94	27.11	30.29	33.46	36.64	39.81	42.99	49.34	55.69	62.04
22	0.71	8.25	11.42	14.60	17.77	20.95	24.12	27.30	30.47	33.65	36.82	40.00	43.17	49.52	55.87	62.22
23	0.64	8.38	11.56	14.73	17.91	21.08	24.26	27.43	30.61	33.78	36.96	40.13	43.31	49.66	56.01	62.36
24	0.56	8.52	11.69	14.87	18.04	21.22	24.39	27.57	30.74	33.92	37.09	40.27	43.44	49.79	56.14	62.49

**NOTE: TUBE INSIDE DIAMETERS AFTER ROLLER EXPANSION ARE ESTIMATED ASSUMING A 10% WALL THICKNESS LOSS, FORMULA = [ (OD - 2 \* (WT \* 0.9) ]**

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# **CURTISS - WRIGHT**

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Product animations, instructions, and detailed technical information are available on our website: [www.cw-estgroup.com](http://www.cw-estgroup.com)

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