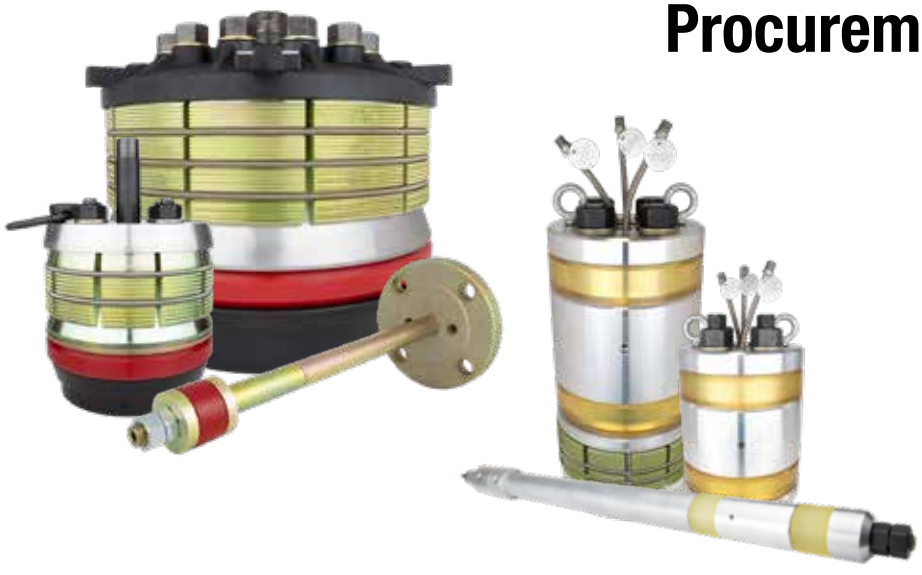
CURTISS-WRIGHT

EST Group

GripTight®

Test & Isolation Plugs for Engineering, Procurement & Construction



Curtiss-Wright Corporation

With a proud legacy spanning 95 years, Curtiss-Wright Corporation is a global innovative company that delivers highly engineered, critical function products and services to the commercial, industrial, defense and energy markets. Building on the heritage of Glenn Curtiss & the Wright brothers, we have a long tradition of providing reliable solutions through trusted customer relationships.

EST Group

Established in 1968 and headquartered in Hatfield, Pennsylvania, USA, EST Group specializes in the development and manufacturing of tools and systems that greatly simplify the maintenance of shell & tube and air-cooled heat exchangers, as well as test plug systems to expedite in-service inspection of open-end pipe, piping systems, tubing, and pressure vessels.

Our GripTight® line of Test & Isolation plugs provide customers with safe and effective solutions for high pressure hydrostatic testing and isolation of open-end pipe, piping systems, tubing, and pressure vessels at working pressures up to 15,000 PsiG (1034 BarG).

Additionally, EST Group provides a range of Field Services & Product Training, including heat exchanger tube testing, inspection, cleaning, partial retubing, and pipe & pressure vessel inspection and testing to customers in power generation, petrochemical and refining, fine chemical and pharmaceutical, oil and gas production, shipbuilding, and engineering and construction industries worldwide.

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ISO 9001:2015
registered facility

Sample Business Case

Challenge/Goal

In the ever demanding market of EPC deliverables, project schedules are becoming tighter and more efficient. Ultimately clients look for their projects to be delivered “on-time” and “on-budget” in order to “go to market” at the most opportune time for their stakeholders and shareholders.

Key objective of the EPC is to maintain the prime business interests for all partners involved in the realization of the capital projects. Proper allocation of materials and trade field personnel is critical in mitigating potential delays, costs and liquidating damages (LD’s). Welders are such a field trade that carries an expensive cost tag (per hour) particularly in modular fabrication.

Identifying technologies and implementing cost/time saving strategies to significantly speed up the construction process are critical to achieving this goal.

Solution

Curtiss-Wright EST Group offers the GripTight MAX range of pressure test & isolation plugs which have been proven to save up to 85% of the time spent pressure testing pipe spools in modular build projects. Construction managers at module yards have reported over 500% increase in productivity and completed test packages per week.

Core products include:

- **GripTight MAX® Test Plugs** – for high pressure hydrostatic testing of pipe, pipelines, and pressure vessels. Safe and effective at working pressures to 15000 PsiG (1034 BarG). Pipe OD and ID sealing solutions available
- **GripTight® Test & Isolation Plugs** – positively isolate pipe end hot work from potentially explosive upstream vapors; then weld and test the flange to pipe connection all with one tool

Benefits (Scenario) Test Plugs vs Weled End Caps

Equipment required to install test plugs

Scaffolding

1 - Crane (8” plugs and up)

1 - Forklift / Bobcat

1 - Torque wrench

1 - Pipe fitter

Equipment required to install test caps (welded)*

Scaffolding (hoarding and heat may be required based on ambient temp)

Pre-heat & PWHT equipment AND cold cut equipment

1 - Crane (8” caps c/w 2’ pipe and up)

1 - Forklift / Bobcat

1 - Clamshell (1 required for each pipe size)

1 - Welding fixture

1 - Welding equipment

1 - Welder (2 required on larger pipe sizes and wall thicknesses - 12” and up)

1 - Fitter / helper

**Hoarding and heat may be required based on ambient temp*

Typical Installation & Removal Times

NPS (DN)	Schedule	GripTight Test Plugs				Welded Caps				Labor Hours Saved per Pipe End (1)
		Personnel Required	Installation Labor Hours	Removal Labor Hours	Total Labor Hours	Personnel Required (Welders & Fitters)	Installation Welding & Prep Time	Removal Cut Time	Total Labor Hours	
10" (DN250)	Std	1 fitter	0.4	0.4	**0.8**	1-2	5.6	1.2	**6.8**	**6.0**
	Sch 120	1 fitter	0.4	0.4	**0.8**	1-2	16.6	2.4	**19.0**	**18.2**
20" (DN500)	Std	1 fitter	0.7	0.7	**1.4**	2-3	11.8	3.2	**15.0**	**13.6**
	Sch 120	1 fitter	0.7	0.7	**1.4**	2-3	44.6	6.2	**50.8**	**49.4**
36" (DN900)	Std	1 fitter	1	1	**2**	2-3	26.6	12.9	**39.4**	**37.4**
	Sch 40	1 fitter	1	1	**2**	2-3	30.7	16.5	**47.2**	**45.2**

Note: 1. Man Hours savings shown does not include pre-heat, post-weld stress relieving, or erection of hording which is essential in inclement weather

Pros and Cons

PROS	
CW - EST Plugs	**Welded Caps**
Fast – saves 85% time, frees up welders	Cost of welded caps
Ease of installation	Re-usable – Limited life cycle
Ease of removal	
Re-usable	
No special prep required	
Eliminates Welding	
Eliminates Fixtures	
Eliminates Pre-Heat & PWHT (HAZ)	
Reduced Manpower	

CONS	
CW - EST Plugs	**Welded Caps**
Requires special handling: Larger sizes	Requires special handling: Larger sizes
	Cost of installation (welding, prepping, consumables)
	Cost of removal (Clamshells)

Conclusion

GripTight plugs pay for themselves quickly providing lowest cost per test.

Any time there is a tight schedule there is no question plugs are an asset.

Application Experience

EST Group's Hydrostatic Test & Isolation Plugs provide products and services to facilitate pressure-testing open end pipe, piping systems, tubing and pressure vessels and their components.

EST Group strives to build a strong relationship with our customers by offering top quality workmanship, excellent customer service and competitive pricing.

Industries Served

Curtiss-Wright EST Group is dedicated to providing a complete range of lifecycle products and services for maintenance and repair of open end pipe, piping systems, tubing and pressure vessels for the following industries worldwide.

- Petrochemical & Refining
- Oil & Gas Production
- Power Generation
- Design & Build Projects
- Shipbuilding Industry

Customers Served

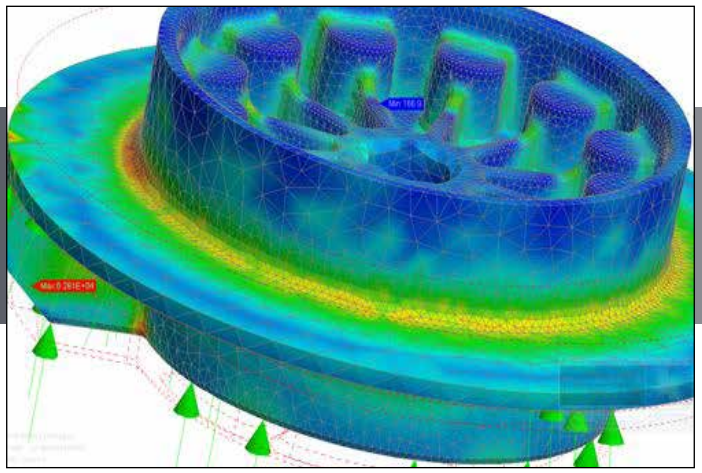
EST Group proudly serves both small and multinational companies such as:

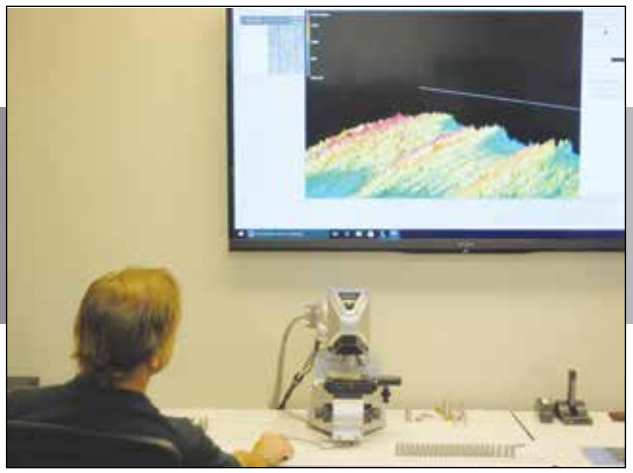
- AG&P
- AMEC/Foster Wheeler
- Bay Ltd
- Bechtel
- Cianbro
- Cimtas
- COOEC-Fluor Heavy Industries
- Dragados Offshore
- Dynamic Industries
- Ersai-Saipem
- Fluor
- Hyundai Heavy Industries
- ICA-Fluor
- KBR
- Kiewit
- McDermott
- Performance Contractors
- Samsung Heavy Industries
- SNC-Lavalin
- TechnipFMC
- Turner Industries
- Wison
- Worley
- Zachry Group, and many more...

"The usage of EST Group's plugs was hugely beneficial compared to traditional hydro test end caps, as welding and NDT of the end caps was avoided thus resulting in reduced preparation time and loop readiness. Hydro test work using the supplied plugs was carried out with no incidents."

Joe D., Sr. Construction Manager - COOEC Fluor China Heavy Industries

Save up to 85% in testing time vs. welded-on end cap procedures





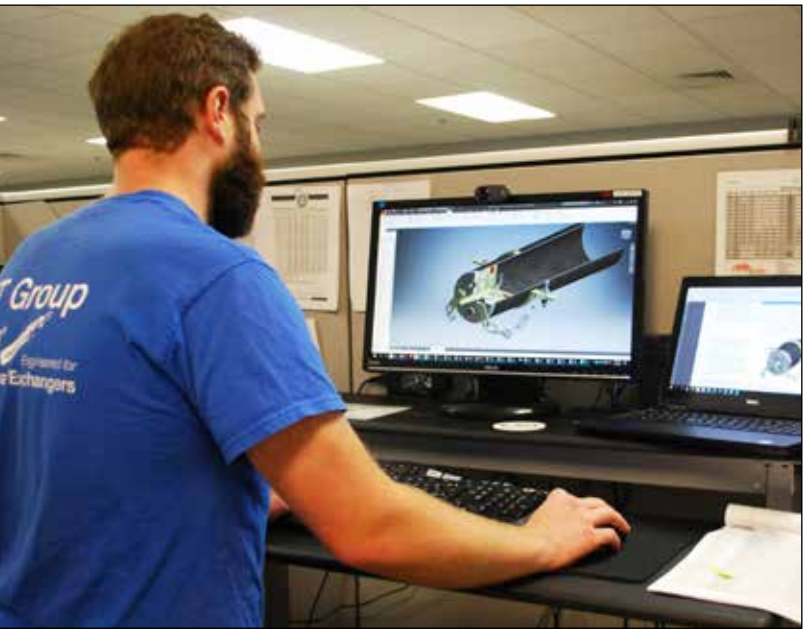
Engineering

Our Engineering team is devoted to providing innovative, precise, and cost-effective solutions to our customers. Extensive knowledge of applications and equipment within the industries we serve, allow our products and services to improve our customers' project scope through reduction in time and cost, while maintaining consistent dependability, and a safer work environment.

Our team continuously utilizes new techniques and technology to improve the quality of our products and influence the industry in a positive way. Precision engineering and expert application support make EST Group the best choice for solving complex pipe testing and isolation challenges.

Our Commitment to Customers

1. Reliability & performance
2. Same day quote response
3. Field support for customer applications



Why Choose Us?

- **Design & Manufacturing** – 50+ years of experience in tools and systems design & manufacturing that greatly simplify maintenance of shell & tube and air-cooled heat exchangers, as well as test plug systems that expedite in-service inspection of pipe, pipelines, piping systems, and pressure vessels
- **New Product Development** – Our commitment to technology development is critical for maintaining and strengthening technological leadership in the marketplace
- **Application Engineering & Custom Product Design** – When an application requires a solution beyond the capabilities of standard products, our Team of Application Engineers are ready to assist you. We will work to develop, design, and manufacture a custom solution to accomplish your goals.
- **State-of-the-Art Test Lab** – Equipped for 30,000 PsiG (2070 BarG) pressure testing capabilities, temperature cycling, fatigue analysis, creep testing, and data analysis.
- **Quality** – Our quality program is integrated into each element of our operation – manufacturing, supply chain, engineering, and sales. Each process is audited and reviewed to ensure our products exceed the demand of our customers. Compliant with several QA Systems, including:
  - ISO 9001:2015
  - ASME, ANSI N45.2,NQA-1, 10 CFR 50 App. B
  - U.S. Navy Level 1/SUBSAFE
- **Finite Element Analysis (FEA)** – Mechanical static and dynamic simulations, thermal and stress analysis, multiphysics and vibration
- Application analysis and concept development
- Conceptual and detail design: CAD 3D models, drawings, verifications
- Customer sales drawings

GripTight® Hydrostatic Pressure Testing & Isolation Plugs

Safe, Effective Solutions for Rapid Pipe Testing and Repairs

EST Group offers a complete line of Hydrostatic Pressure Test and Pipeline Isolation Plugs for pressure testing pipework, pipelines and pressure vessels. GripTight Test Plugs – for high pressure hydrostatic testing of open-end pipe, piping systems, tubing and pressure vessels. Safe and effective at working pressures to 15000 PsiG (1034 BarG). Pipe O.D. and ID sealing solutions available. GripTight Isolation Plugs – positively isolate pipe end hot work from potentially explosive upstream vapors; then weld and test the flange to pipe connection all with one tool.

- Test Open End Pipes, Pipelines, Tubes and Pressure Vessels
- Perform Flange-To-Pipe Weld Testing
- Isolate and Test Pipe Connections
- Facilitates testing in accordance with ASME PCC-2 and ASME Boiler & Pressure Vessel Codes

GripTight MAX® Plug

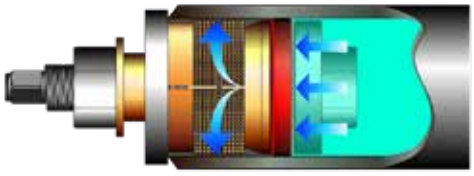
Significantly increase the range of pipe materials that can be tested at higher pressures.

Highly effective for testing high pressure steam systems, high alloy hardened pipe materials, and down hole/well-head piping. Also effective for testing non-metallic materials including Fiberglass Reinforced Plastic (FRP) and Glass Reinforced Epoxy (GRE).

SCAN TO SEE IT IN ACTION

Features & Benefits

- Test pressures up to 15000 PsiG (1034 BarG)
- Size range 3/8" to 48" (DN10 - DN1200)
- Safe & reliable testing at higher pressures
- Saves up to 85% in testing time vs. welded-on end cap testing procedures
- Patented dual-serrated gripper design provides more gripping points on inside pipe surfaces

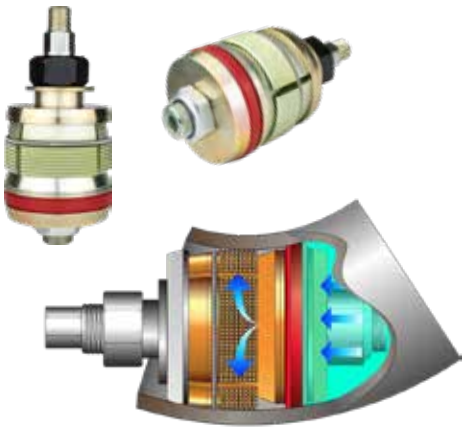


GripTight® Elbow Plug

Designed for testing long radius elbows. Our patented dual-serrated GripTight MAX grippers give this unique plug design pressure holding capabilities to 3350 PsiG (231 BarG) – providing a safe and effective solution for pipe spools and piping systems terminating in long radius elbows.

Features & Benefits

- Test pressures up to 3350 PsiG (231 BarG)
- Size range 2" to 48" (DN50-DN1200)
- Orientation Free Installation - no need to align with elbow - easier operation
- Patented dual-serrated gripper design
- Fits most long radius elbow
- Saves up to 85% in testing time vs. welded end cap/pup testing procedures



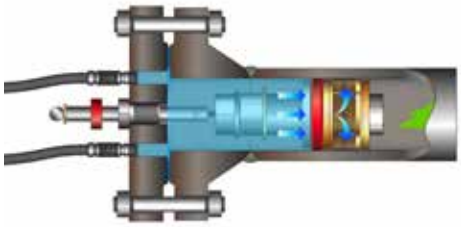
Pressure Test Plugs

GripTight® Reverse Pressure Plug

Pressure test flange-to-pipe welds with full radial, hoop and axial stresses – equivalent to the stresses that would be produced when using a blind to pressurize the entire piping system. Pressure testing can effectively verify the weld integrity providing the user confidence the flange and weld will properly function when placed into service. ASME PCC-2 (Article 503) Type I testing device. *Custom sizes available upon request. Standard Seal Material: Urethane*

Size Range
2" to 48" NPS (DN50 - DN1200)
Custom sizes available upon request

Test Pressure
2250 PsiG (155.1 BarG)



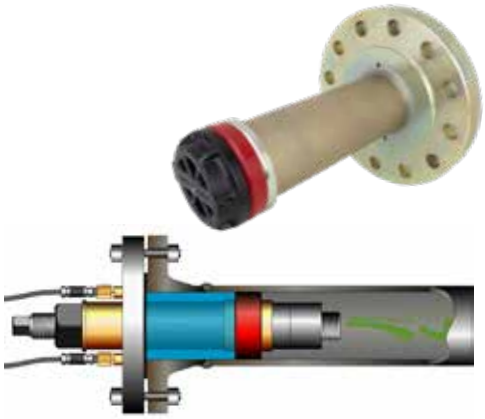
High Lift Flange Weld Plug

Monitor upstream conditions, isolate and purge weld area, perform hot work, and hydro test the weld joint with one easy-to-use tool. No blind flanging upstream, no vacuum truck for evacuating the line, and no X-raying. Each test requires a minimum amount of water, no need to fill the entire line. Use less water and minimize your environmental impact. High Lift seal design provides improved seal-to-pipe clearance. Operating pressures to ANSI B16.5 requirements. Flange classes 150 to 600 lb. All flange types. ASME PCC-2 (Article 503) Type III testing device. *Custom sizes available upon request. Standard Seal Material: Urethane*

Size Range
3/8" to 48" NPS (DN10 to DN1200)
Custom sizes available upon request

Test Pressure

150#	450 PsiG	(31.0 BarG)
300#	1125 PsiG	(77.6 BarG)
600#	2250 PsiG	(155.1 BarG)



O.D. GripTight® Plug

Uses 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. *Standard Seal Material: Urethane with Fluoroelastomer O-ring*

Size Range
1/4" to 4" ANSI pipe sizes (DN8 to DN100) &
1/2" to 3½" (12.7mm to 88.9mm) O.D. tube sizes

Test Pressure
Up to 5000 PsiG (344.7 BarG)

Socket Weld (SQS) Plug

SQS Test Plugs are designed to facilitate testing socket weld fittings and couplings. During installation, 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. *Custom sizes available upon request. Standard Seal Material: Urethane*

Size Range
1/2" to 2" NPS (DN15 to DN50)

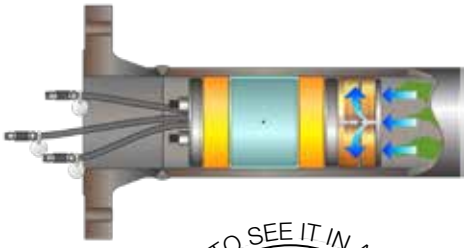
Test Pressure
Up to 5000 PsiG (344.7 BarG)
depending on plug size

Pipe Isolation Plugs

GripTight® Isolation Plug

GripTight Isolation Plugs integrate 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 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 positive pressure barrier between the hot work and residual upstream gases. After hot work is complete, the plug can be repositioned to hydrotest the new weld connection.

GripTight grippers improve the operational safety minimizing the risk of accidental plug blowout/expulsion due to improper use or unexpected upstream pressure in the line. As upstream pressure increases, GripTight grippers use the pressure to grip and seal more securely against the pipe's I.D. ASME PCC-2 (Article 503) Type IV testing device. *Standard Seal Material: Urethane*



Size Range
3/4" to 48" NPS (DN20 to DN1200)
Custom sizes available upon request

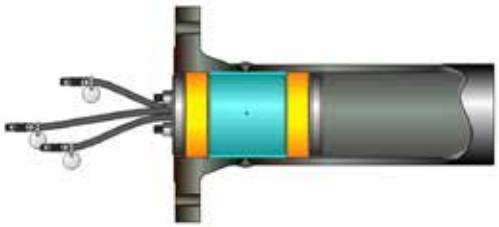
Test Pressure
Up to 2250 PsiG (155.1 BarG) between the seals
1500 PsiG (103 BarG) upstream

SCAN TO SEE IT IN ACTION

Double Block and Bleed Plug

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 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 positive pressure barrier between the hot work and residual upstream gases. After hot work is complete, plug can be repositioned to hydrotest new weld connections.

Durable aluminum/steel construction makes this tool lightweight and easy to maneuver. The volume of water required for testing is so small that testing can be accomplished using a simple hand pump, easily facilitating testing in remote areas of facilities. Multi-schedule capability. ASME PCC-2 (Article 503) Type IV testing device. *Standard Seal Material: Urethane*



Size Range
3/4" to 48" NPS (DN20 to DN1200)
Custom sizes available upon request

Test Pressure
Up to 2250 PsiG (155.1 BarG) between the seals
10 PsiG (0.7 BarG) upstream

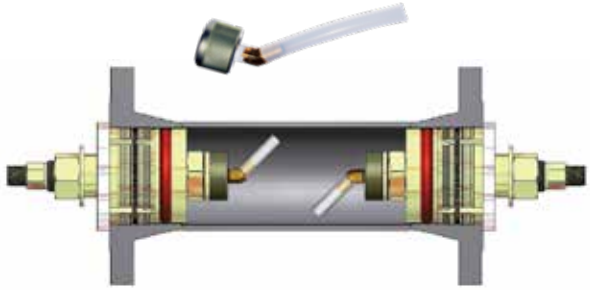
Accessories & Safety Devices

Plug Safety Gags

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 O.D. and plug inlet.

GripTight® Vent Assembly

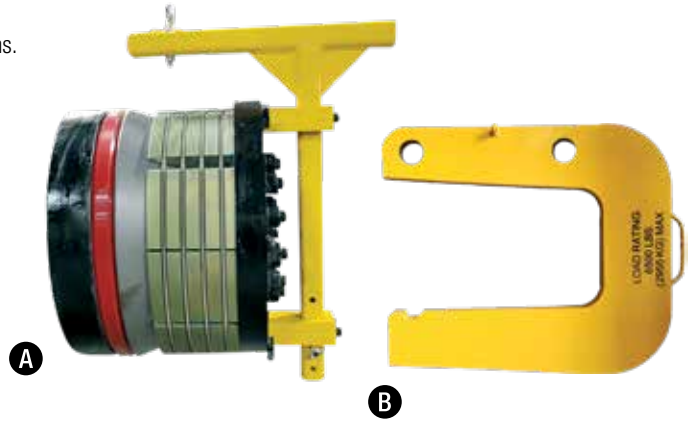
Safely fill and drain pipes during hydrostatic testing. Vents are installed with tubes at high and low points in the area being tested in order to fill with test medium and displace air/gases in the pipe being tested.



Test Plug Lifting Arms

Designed to maneuver larger test plugs securely with cranes, forklifts, or other lifting mechanisms. Provides greater stability and operator safety during installations.

Style	Size Ranges	Max. Capacity
A	10”-24” (DN250-DN600)	10”-24” - 1,500lbs. (680.4kg)
B	26”-36” (DN650-DN900)	26”-36” - 3,500lbs. (1,587.6kg)
B	38”-48” (DN950-DN1200)	38”-48” - 6,500lbs. (2,948.4kg)



Safe and Reliable Hydrostatic Testing Solution for EPC Projects

Plant Type

- Power Generation
- Petrochemical & Refining
- Oil & Gas Production
- Modular Plant Construction
- Design & Build Projects
- Ship & Rig Building

Key Personnel

- Construction Superintendents
- Construction Managers
- Pressure Testing Managers
- Pre-Commissioning Managers
- Commissioning Managers
- Test, Project & Piping Engineers
- Modularization
- Construction Technology

Applications

- Module Fabricators
- Pipe Spool & Piping System Fabricators
- Industrial Contractors
- Mechanical Contractors
- Greenfield/Brownfield Plant Construction

GripTight MAX® Test Plug

GripTight® Elbow Plug

Save Time & Money - Eliminate Costly Pre-Heat & Post-Weld Heat Treatment

Conventional methodology for pressure testing plain/bevel end pipe spools requires welding on end caps, performing the pressure test, then cutting off the end cap and re-beveling the pipe. Employing test plugs in lieu of welding end caps eliminates this time consuming cycle, as well as pre-heat, post-weld stress, and the heat affected zone (HAZ) at the spool's end.

GripTight MAX® Features/Benefits

Significantly improve project schedules and increase the range of pipe materials and pressures for testing.

- Safely complete testing in one-tenth of the time vs. welded-on end cap procedures
- Test pressures up to 15000 PsiG (1034 BarG)
- Standard sizes ranging from 3/8" to 48" NPS (DN10-DN1200) – *custom sizes available*
- Patented dual-serrated self-gripping design uses test pressure to increase holding capabilities
- Ideal for use in Carbon Steel, Stainless or High Alloy applications such as, Chromoly, Duplex, Hastelloy, Inconel & Clad
- Easy Installation - *no welding or hot work required*
- Test open-end pipe and tube up to HRC 32
- Facilitates testing in accordance to ASME Boiler and Pressure Vessel Codes
- Hardened shaft, grippers, and cone for increased durability
- Positioning washer prevents plug loss in pipe end
- Laser-marked top washer clearly identifies part number, size range, pressure rating, and document number for operating instructions

GripTight® Elbow Features/Benefits

Safely test pipe spools and piping systems terminating in long radius elbows.

- Orientation independent installation - *no need to align with elbow*
- Eliminates welding and time consuming pre-heat and post-weld heat treatment (PWHT)
- Test pressures up to 3350 PsiG (231 BarG) - *higher pressures available upon request*
- Standard sizes for NPS ranging from 2" thru 48" (DN50-DN1200) – *custom sizes available*
- Patented dual-serrated GripTight MAX gripper design
- Patented floating, self-aligning grippers & seal
- Designed to accommodate a large range of pipe materials including: Carbon Steel, Stainless Steel, Duplex, Inconel, Incoloy, Hastelloy, Chromoly, Clad, and Hardened Material
- Easy Installation - *no welding or hot work required*
- Self gripping design uses test pressure to increase holding capability
- Saves up to 85% in test time vs. welded-on end cap/test procedures
- Laser-marked top washer clearly identifies part number, size range, pressure rating, and document number for operating instructions

Contact Information

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CURTISS-WRIGHT

Product animations, instructions, and detailed technical information are available on our website: **www.cw-estgroup.com**