APP MANUFACTURING

THE COMPLETE GUIDE TO

Pipe Restraints

Pipe restraints are an essential tool for pipe maintenance and on-site safety. This guide covers the full range of applications, advantages, and best practices for pipe restraints.

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CHAPTER 1

Piping Industry: The Lurking Need for Pipe Restraints

There has always been a dangerous contradiction in the piping world. Damaged pipes can turn into catastrophic destruction, on-site tragedies, or completely ruined projects. However, the underlying cause is subtle. It's slow, creeping, and invisible.

The risk of corrosion and damage is built into piping. Pipes carry naturally corrosive materials, and they're exposed to erosion, humidity, and constant pressure. What's more, they're susceptible to ongoing vibration, temperature changes, and friction. All of this contributes to stress, weakened pipes, and corrosion.

WHAT COULD GO WRONG?

As you've probably guessed from that gloomy intro, a lot can go wrong in the piping industry. Luckily, knowing where pipes and their surrounding structures fail is the first step toward stopping on-site disasters. And there are some common, preventable hazards in the piping industry.

Galvanic Corrosion

Galvanic corrosion is when one metal causes another metal to corrode and break down. For this type of corrosion to start, there need to be three things: an anode (one metal), a cathode (a second metal), and an electrolyte (water is a common one).

Some metals are more likely to give their electrons away, and others are more eager to pull in extra electrons. That means combining dissimilar metals in electrolyte-heavy environments causes one metal to hand its electrons over to the other. When a metal gives away electrons, galvanic corrosion starts, and the metal rusts.

Fitting Failures

Pipe restraints and fittings play a big role in stopping disasters, but it is possible to rely on them too much. If installation isn't well-planned, fittings can snap. If too much stress builds on specific parts and those parts break, things can tumble out of control.

A common misconception is that restraints or fittings are designed simply to hold piping down without a liner. This thinking is a problem, especially when a system features reciprocating compressors or other heavy vibration producers. If the restraint doesn't let the pipe move axially, or through the restraint, those vibrations don't go away. They're just refocused on the fitting or support beam meant to harness vibrations.

Using the wrong material can lead to broken fittings, too. For instance, it's not unheard of to see U-bolts, without anticorrosion protection, on offshore rigs. Humidity and salt can eat away at unprotected restraints. And when they break, pipes can break along with everything around them.

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Sloppy Installation

All too often, disasters are a product of poor installation. Older or inherited systems can be especially vulnerable to breakdowns.

One common problem is getting sloppy with materials. If an installer picks the wrong materials for insulation, that can corrode metals even worse. And even if the right liner is acting as a buffer, it needs to stay in place. All too often, an installer will rush through measurements. From there, liners can work their way out, and incompatible metals will rub against one another.

Ruptured Pipes

With every rusted piece and weakened section, pressure mounts. When a pipe finally snaps, the damage can be punishing. This becomes a stronger danger when you're working with compressors that magnify pressure. When a pipe bursts in these powerful systems, it can be disastrous.

For engineers who work with piping, the deck may seem stacked against you. However, the industry does have access to a powerful equalizer: pipe restraints. When used correctly, pipe restraints cut out these natural hazards and stop corrosion.

HOW PIPE RESTRAINTS FIGHT BACK

They Add Stabilization

Broken fittings and ruptured pipes tend to happen because pipes are moving. Untouched, they bounce, vibrate, and grind on other structures. Pipe restraints can refocus movement axially. That means pipes can still move through the restraint without bouncing and breaking.

When pipes are exposed to heavy vibrations, a high-quality liner can absorb vibrations. That puts the pressure on the liners that are designed to handle it and relieves the fittings themselves.

They Insulate Metals

Not all metals get along. And pairing the wrong metals can lead to galvanic corrosion and rust. Pipe restraints can add a much-needed buffer between metals.

That's how pipe restraints can help fight off danger, but understanding the precise roles of pipe restraints requires a deeper look.

CHAPTER 2

What Is a Pipe Restraint?

“Pipe restraint” is a broad term used for tools that control the movement of pipes. It’s worth noting that they control movement; they don’t stop movement. This is a key, once overlooked, function of the pipe restraint. It also helps explain the advantages and disadvantages of using pipe restraints.

HOW PIPE RESTRAINTS WORK

Pipe restraints usually have two common requirements. They need to have a curved portion that folds around the pipe. A simple example of this is the curved “u” shape of a U-bolt.

The second piece that all pipe restraints have is a fastener. In the case of U-bolts, the fastener features two threaded ends and attachable nuts. More heavy-duty clamps are bolted into a plate. Either way, pipe restraints need to enclose the piping and hold it against a support.

BENEFITS OF PIPE RESTRAINTS

When used correctly, pipe restraints can lengthen the life of pipes and their surrounding systems. That's because they cut down vibrations and help guide piping. Every time a pipe hits a structure, there is wear and tear on either the pipe or the object it's hitting.

Pipe restraints start off by stopping piping from hopping, swinging, or banging into other objects. They simply stop pipes from swinging wildly and crashing into things.

However, they also prevent destruction on a more granular level. As a pipe vibrates, a pipe restraint can absorb currents. This is accomplished broadly through the curved piece of the restraint and more finely through materials that line the inside of the restraint.

At the same time, pipe restraints reduce natural friction. Pipes will naturally move along an axis. Pipe restraints that have a low coefficient of friction allow pipes to slide through them axially without allowing the pipes to bounce or vibrate off surrounding structures.

Still, the benefits of pipe restraints go even deeper—to a subatomic level. That's because they can stop galvanic corrosion. They can add a layer of protection and stop one dissimilar metal from corroding another.

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DISADVANTAGES OF PIPE RESTRAINTS

Pipe restraints can actually lead to fractured pipes and weakened structures if they're misused.

First, simply using restraints to clamp down on pipes can focus pressure on one spot. An uninsulated or inadequate restraint will drive those vibrations deep into the surrounding structure, damaging the structure itself or snapping the restraint.

This is why it's important to use restraints that have the proper lining or capacity to absorb, and dampen, vibrations.

Additionally, restraints aren't all-purpose or one-size-fits-all. So slapping some U-bolts onto a massive piping system probably won't cut it. Misfit restraints can cut into piping and lead to tears.

Finally, materials matter. If the restraint is made of a metal that doesn't get along with the piping it's fitted to, it can weaken or cause corrosion. For instance, if you use uninsulated U-bolts made of carbon steel on stainless steel pipes, the pipes will eat away at the bolts and cause rust.

Still, if pipe restraints are used properly, the pros will outweigh the cons. With these general functions in mind, the term "pipe restraint" remains a broad one. Underneath that umbrella, there's a range of pipe restraint types with different functions and unique uses.

CHAPTER 3

Types of Pipe Restraints

There are different types of pipe restraints that have unique properties, advantages, disadvantages, and functions. Generally, pipe restraints fall into three different families: bolts, straps, and clamps.

BOLTS

Bolts are probably the most recognizable and basic type of pipe restraint. They include U-bolts, which are curved in the shape of the letter "u." Bolts usually come with a pair of nuts on each end. That way, you can secure piping to beams.

They're a simple way to control pipes and keep them from swinging, sagging, and wearing. They can also help insulate piping from other metals. Just make sure to pay attention to their core materials and finishes.

Benefits

U-bolts are handy because they usually don't take much work to install. They're also relatively inexpensive. For smaller, more stable piping, these simple restraints can lower corrosion and boost the life span of systems.

Notable Products

Standard U-bolts: Standard U-bolts usually are made of carbon steel or variations of stainless steel. There are also finishes and coatings that can improve their durability, such as zinc plating, fluoropolymer coatings, or hot-dip galvanization.

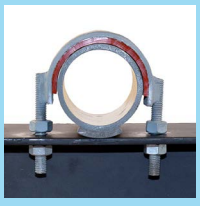
ProTek U-Bolts: The real nuance in U-bolts comes in versions with thermoplastic coatings. That's what makes a difference in products such as **ProTek U-Bolts**. The added material lets the pipe slide through the bolt while stopping it from bouncing and breaking.

Still, as handy as they might be, bolts aren't meant for heavy-duty piping or high vibrations.

STRAPS

Hold-down straps are a heavier technology than simple bolts. At their core, they're made of a U-shaped rod, like a U-bolt. However, they have an added cupped section that absorbs more shock than a standard U-bolt. These are the middleweights of the three restraints. They're the go-to when a U-bolt is too weak and a hold-down clamp is unnecessary.

Notable Products



U-straps: U-straps are a basic form of hold-down straps. They're usually made of steel. They fit directly on piping and feature holes on their leveled ends. These are the simplest form of straps, but they can be customized to include anticorrosion finishes and more complex liners.

Urethane-lined hold-down straps: **Urethane-lined hold-down straps** are an industry-leading option for middle-class pipe restraints. They have a urethane coating on the inside that insulates carbon steel pipes. That stops pipes from rubbing against other metals and corroding.

Manufacturers can also add specialized finishes, galvanization (which stops metal-on-metal corrosion), xylan coatings, and Teflon-based coatings. All of these materials help the metal fight corrosion and maintain its strength.

CLAMPS

Clamps are the heavy hitters when it comes to pipe restraints. They're built to take on powerful vibrations and pressure. These big dogs can take up to 20,000 pounds of pressure. They're also built to withstand extreme temperatures.

Clamps can be highly specialized and stand up to massive systems. That means they will have a higher cost than lower-grade pipe restraints and be more difficult to install. They're also overkill if you're working with small, stable piping systems.

Notable Products

VibraTek Hold Down Clamps: VibraTek Hold Down Clamps are built to withstand powerful vibrations, high pressure, and extreme temperatures. They can take the heavy stress that compressors and reciprocating equipment put on systems. Because of the combination of materials in the liner, VibraTek Hold Down Clamps can dampen vibrations and maintain a low coefficient of friction.

Once you have a grasp on what types of pipe restraints are out there, it's time to learn how to get the most out of them.

CHAPTER 4

Getting the Most Out of Pipe Restraints

Identifying the best type of pipe restraint for a job is important, but there are ways to get more out of pipe restraints. That includes installing them the right way, getting them at the right price, picking the right supplier, and knowing what products to couple them with.

INSTALLATION INSTRUCTIONS

How to Install Bolts

Here's how to install a standard U-bolt as a restraint:

1. Start by removing the nuts from the bolt.
2. Place the bolt around the pipe.
3. Run the bolt ends through the two holes in your support beam or structure.
4. Add nuts to each end of the U-bolt.
5. Hand-tighten the nuts that are closest to the beam.
6. Tighten the second set of nuts. This will lock the U-bolt in place.
7. Secure the nuts with a power tool or wrench.

If you're using your U-bolt as a guide, the installation process will be slightly different. Instead of tightening nuts on the outside of your support beam only, you'll want to have a pair of nuts on both the inside and outside of your beam. This way, you can lock the bolt in place and create a stable gap.

Here's how to install a U-bolt as a guide:

1. Start by removing the outer nut from each end of the U-bolt.
2. Place the bolt around the pipe.
3. Run the bolt ends through the two holes in your support beam or structure.
4. Measure the gap between your pipe and restraint to allow for the appropriate movement.
5. Add and adjust the nuts on the outside of the support beam to fit the spacing.
6. Tighten the nuts on both the inside and outside of the support beam to lock the gap in place.
7. Secure the nuts with a power tool or wrench.

How to Install Straps

U-straps are usually used on smaller, simpler piping systems. You can install a U-strap by fitting the strap around the pipe. From there, you can run screws or bolts through the strap's two outer holes. This will secure the strap to your support.

However, installing hold-down straps can be a completely different process. Like U-bolts, hold-down straps generally come with threaded ends. Yet, if they include vibration-dampening liners, they may be more difficult to install on a DIY basis. The main difference maker is the strap's fitting piece. Before installing, check with the manufacturer to make sure the curved strap fits your piping correctly.

How to Install Clamps

Clamps can be highly specialized, so the portion that clamps down over the pipe should fit precisely. Make sure to check product guidelines before installing. Here are some tips for installing clamps:

1. Pay attention to the metals you're using. You don't want to combine dissimilar metals that might cause corrosion.
2. Be meticulous as you measure. Make sure spacing fits the recommendations in your manufacturer's supply chart before you lock the clamp down.
3. Fasten the bolts with precision. Use torque calculators or engineering standards to make sure you aren't stripping bolts or leaving them dangerously loose.

WHAT TO LOOK FOR WHEN SELECTING A VENDOR

Pipe restraints can be the difference between a longer-lasting system and a catastrophe. There are some important, and often overlooked, things to consider as you pick out a manufacturer:

1. Delivery

What good is the perfect product if you don't have it in time to finish your job? As you choose a manufacturer, put your delivery needs at the forefront of your request. If they can't deliver on time to your site, it's smart to look elsewhere.

PRO TIP: Include delivery expectations in your request for quotation (RFQ). Communicate your needs and ask the vendor outright if it's doable.

2. Quality

Quality products are a must when it comes to pipe supports. If a pipe support breaks, it could cost millions in damages, completely stop a project, or cause injuries.

Ask potential vendors key questions about a product's quality:

- How is it regulating heat transfer?
- Is it cutting energy consumption?
- What metals and materials are built into the product?
- How does it stop corrosion?

PRO TIP: Don't forget about future costs. Look into ways a product's added features, or lack thereof, could impact your wallet down the road.

3. Availability

When picking out a vendor, don't overlook its customer service patterns. Every company will say its customer service is top rate, but pay attention to its actions. This will be important when you need help throughout the process.

PRO TIP: Pay attention to clues during the bidding process. If the company is prompt and quick to reply, it's usually a good clue that it cares. If the company isn't keen on helping out during the bidding process, its customer service probably won't improve when you go to order a product.

PRICING FOR PIPE RESTRAINTS

It might be a tough truth for engineers, but pricing managers will tell you the cost of pipe restraints will affect your project. And even when the value is obvious, it's not always easy to nail down the price of pipe restraints. It would be impossible to list the pricing options for every restraint by every manufacturer out there, but we want to lift the veil off pricing as much as possible.

HERE ARE SOME GENERAL GUIDELINES FOR PIPE RESTRAINT PRICING:

Bolts

Compared to other types of restraints, bolts will generally be the least expensive. Still, even they can vary in price. Basic U-bolts tend to be in the $5-$10 range. However, higher-end U-bolts with corrosion-resistant coatings or additional features can go for hundreds of dollars. And, as simple as they may seem, the extra spending can be worth it.

Pricing tends to depend on the quality of the material the bolt is made of, which usually includes carbon steel, 304 stainless steel, or 316 stainless steel. From there, the type of finish that's applied will affect the cost. Finally, if the bolt has a friction-reducing feature, such as a thermoplastic coating, expect to spend a bit more than you would on a basic U-bolt.

Straps

Straps are the middleweights, and their prices usually fall between those of bolts and heavy clamps. Like bolts, their cost likely will depend on the materials they're made of and their finishes. However, unlike most bolts, straps tend to have more options when it comes to vibration-dampening liners.

Clamps

Clamps are the heavy hitters, and they're usually priced accordingly. However, they still can vary dramatically in price. That's because they tend to be capable of adding top-rated liners and some of the most effective anticorrosion technology out there.

USING STRAP AND CLAMP LINERS

Strap and clamp liners are a key feature that helps restraints resist heat, absorb vibrations, and fight off corrosion. They‘re made of protective materials that sit on the inside of the restraints.

Liners play several important roles in keeping pipes secure. First, they dampen vibrations so that stress doesn’t reach the pipe or restraint. They also can act as a buffer between the metal of the pipe and the restraint itself. They’re important friction regulators and help the pipe move fluently in the right direction. Finally, they help regulate heat and extreme cold. However, their ability to add this support largely depends on their makeup.

TYPES OF LINERS

Manufacturers are making rapid advancements in the quality of the materials they're able to design as liners. Here are some of the top liner types out there:

- Neoprene
- Rubber
- Silicone
- Urethane
- TICO
- Fabreeka®
- VibraTek
- Teflon (PTFE/FEP)

Neoprene, rubber, and silicone can be helpful lining materials, especially in systems that don't experience high amounts of friction. However, urethane tends to work best when you move from low to mid-level friction producers. This is why urethane is sometimes paired with middle-of-the-road restraints such as hold-down clamps.

If you use heavier restraints with more extreme temperatures, you'll want to choose a liner that's more advanced. This usually includes a Teflon-based material because polytetrafluoroethylene, or PTFE (the base ingredient of Teflon), has a low coefficient of friction and a melting point of 635 degrees Fahrenheit. High-end brands, such as Fabreeka, Tico, and VibraTek, all have advanced liners made of Teflon variations.

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CHAPTER 5

The Future of Pipe Restraints

Looking to the future, pipe restraint manufacturers are working to make extreme environments manageable. That means developing materials that can withstand devastating heat and cold. At the same time, products will need to fight corrosion in humid and saline environments.

Still, manufacturers are continuing to make advancements. Especially with the harsh vibrations that come from things such as reciprocating compressors, liners are needed to redirect pressure. In the future, we expect even more advanced liners to take on that task. The trick will be reducing friction, absorbing vibrations, and withstanding extreme temperatures.

Another area where manufacturers are innovating quickly is in outer coatings. High-end finishes with PTFE or xylan coatings are able to stop corrosion at high temperatures. PTFE's maximum operating temperature is 500 degrees Fahrenheit. Manufacturers are continuing to push the limits with the goal of developing products that remain effective at temperatures as high as 1,200 degrees Fahrenheit.

ADVANCEMENTS IN CROSS-INDUSTRY TECHNOLOGY

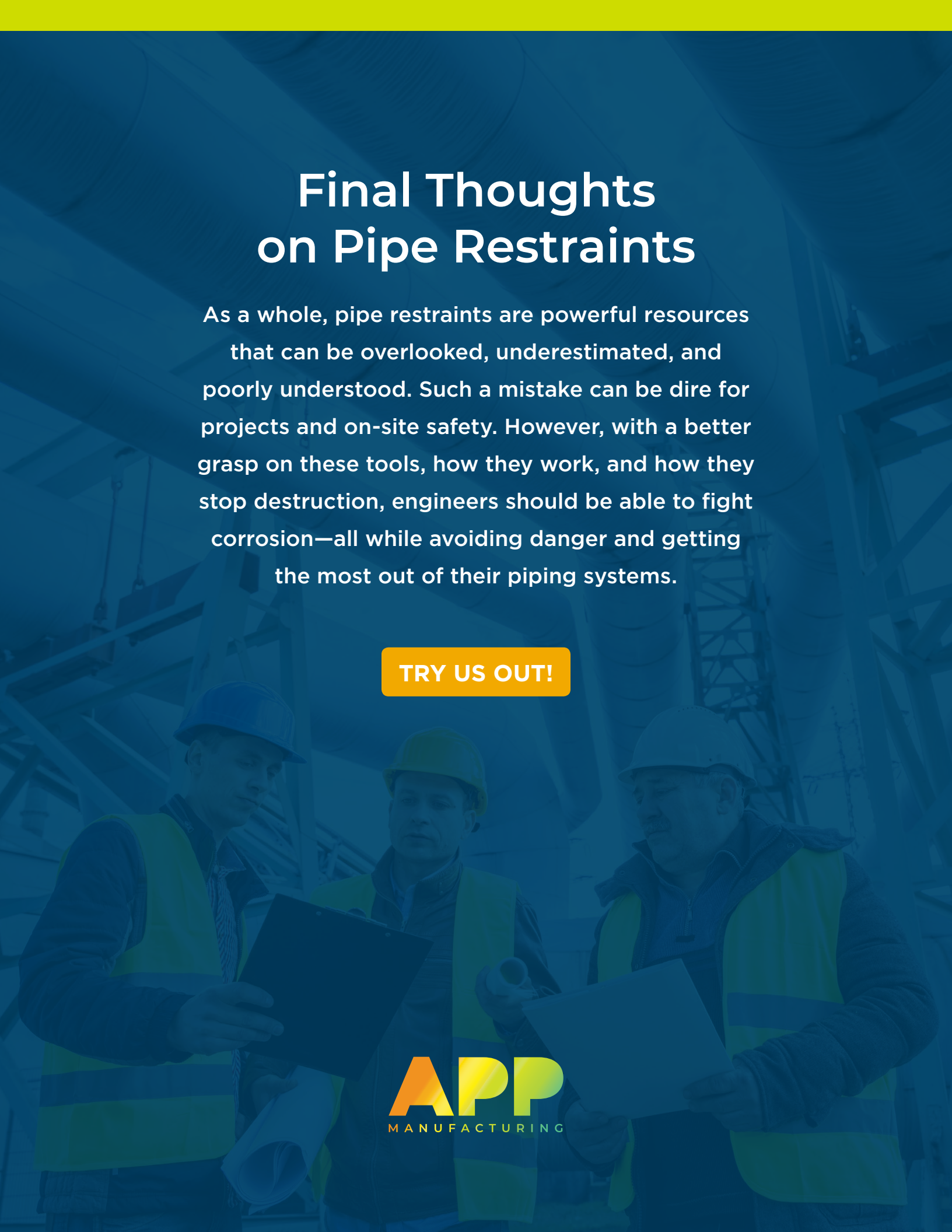
Beyond restraints themselves, automated systems are making restraint assembly more convenient. Companies are perfecting new weld studs that can fasten restraints in seconds and don't require traditional welding practices. This could simplify the installation process for heavy-duty restraints.

As technology advances, installers will be more precise and quicker. This should make it easier to avoid costly mishaps and to get the most out of pipe restraints, especially when it comes to products such as high-end clamps.

Final Thoughts on Pipe Restraints

As a whole, pipe restraints are powerful resources that can be overlooked, underestimated, and poorly understood. Such a mistake can be dire for projects and on-site safety. However, with a better grasp on these tools, how they work, and how they stop destruction, engineers should be able to fight corrosion—all while avoiding danger and getting the most out of their piping systems.

TRY US OUT!



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