

Frequently Asked Questions

The Science of Heat Fusion

How long has heat fusion technology been around?

Heat fusion is by no means a new technology: we are just hearing about it a lot more as its popularity exponentially grows in the water and industrial markets as well as in gas distribution. In fact, fusion technology has been used in the US for over 30 years in natural gas distribution systems, where it has yielded an unbeatable safety record. As well, heat-welded PE pipe has been the predominant type of water system in Europe for nearly 50 years.

For our part, Connectra Fusion has 50 years of experience in the heat fusion field, more than any other supplier of heat fusion equipment.

What is butt fusion?

Simply put, butt fusion requires a portable heat fusing machine, which clamps the two end sections of PE pipe together and heats them to a temperature where the polyethylene melts and the molecules from both pipe ends mix together. Connectra's machine then uses force to keep the two ends together until the joint has totally fused and cooled, creating a seamless expanse of pipe.

In more detail, there are six steps to fusing pipe:

1. **securing and cleaning** the pipe
2. **"facing"** the pipe ends (this is the procedure of evenly cutting off pipe ends so that they are perfectly parallel to each other and clean of contaminants. Connectra equipment performs this facing as part of the fusion process.)
3. **aligning the pipes** so that they are perpendicular to the centerline of each pipe
4. **melting the pipe ends** by placing an electric plate between the faced ends that reaches an appropriate temperature to make the plastic pliable, and then quickly removing the heating plate
5. **joining** the molten pipe ends together
6. **holding under pressure** until the pipe cools. Only when completely cooled is the pipe removed from the welding machine.

Why do industry experts say heat-fused PE pipes are the way of the future for North America's major utilities?

The U.S. is currently facing a crisis in its crumbling utility pipe infrastructure, much of which was built in the period following World War II. In the next few years, most utilities will face huge replacement

costs as their traditional ductile iron and concrete pipe systems reach the end of their serviceable life spans.

Perhaps the utility facing the most critical need is the water industry. Each year, the U.S. spends \$36 billion rehabilitating defective water pipes and broken water mains and despite this, the system still loses billions of gallons of treated drinking water daily. The U.S. Environmental Protection Agency (EPA) estimates that the U.S. water infrastructure alone will require in excess of \$150 billion over the next 20 years.

Industry experts believe that the combined technologies of PE piping and heat fusion hold great promise for the water industry. PE pipe itself has a very high resistance to corrosion and bacterial build-ups, and its inherent flexibility allows it to withstand surges, freezing temperatures and even seismic activity. Heat fusing PE pipes provides a strong, leak proof connection that becomes an integral part of the pipe. The fused joints actually are stronger than the pipe itself.

Because PE pipes can be essentially fused into one piece, other types of connections such as gaskets and joints are only required at transition points, which greatly reduces the overall number of joints within a system, dramatically lowering leakage risks.

Since corrosion and leakage are the major reasons for pipe system failures, and the fact that PE doesn't corrode, it's no wonder the PE pipe industry is today poised to bring North America's crumbling utility system into the 21st century.

What factors should be taken into consideration before the fusion process takes place?

The technician must monitor several key parameters in order to ensure proper butt fusion, including the heating temperature, the fusion force and the heating and cooling times under pressure. In addition, the technician should ensure that

- the fusion equipment is in good working order and meets its manufacturer's specifications,
- the installation procedure and equipment are appropriate to the pipe size and type to be joined, and
- all external environmental factors (i.e. weather, temperature) have been considered and managed.

How long does the fusion process take?

The time it takes to make a joint depends on the pipe size, pipe wall thickness and specific worksite conditions such as temperature, the type of terrain and construction procedures. Connectra machines are equally or more efficient than more expensive, complicated machines.

What should a properly fused length of pipe look like?

A properly fused joint should show a double rollback bead on the outside of the pipe, which would demonstrate that the plastic was sufficiently molten, enough force applied and enough area was fused.

How does Connectra ensure pipe joint integrity?

The Plastics Pipe Institute's website at <http://www.plasticpipe.org/pdf/pubs/handbook/inspection.pdf>

outlines simple procedures, including the Bent Strap test, that help to determine the quality of both fusion joints and the fusion method.

Additionally, Connectra sells its DataConnect data recorder. This unit measures and records the critical machine parameters during a fusion. This data can be stored electronically or printed out to verify proper machine performance. Sometimes, particularly on very large diameter pipe or other special applications, a data recording device may be desirable.

However, use of a data recording device is costly and usually not necessary for most applications. Connectra believes that the best quality assurance for fusion remains the use of proper fusion procedures and careful visual inspection of all completed joints by trained personnel. The value of careful human observation can be exemplified by the natural gas industry, which has achieved an outstanding safety record over the past 30 years, based primarily on visual inspections.

How can I easily determine proper fusion pressure?

In simple terms, fusion pressure is determined by the size of pipe and selected interfacial pressure. PPI's generic fusion guidelines (TR33) give general recommendations on interfacial pressure, or they may be specified by the owner of the pipeline. Once the pipe size and DR are known, and interfacial pressure selected, one can use the calculator on our website (www.connectrafusion.com) to determine gauge pressure for any given machine.

Who sets the industry standards?

A set of generic fusion standards were developed by the Plastics Pipe Institute (PPI) in consultation with most major pipe manufacturers in the U.S..

What is the lifespan of fused polyethylene pipe?

Studies, test data, and actual experience indicate that it is reasonable to predict that PE pipelines, when properly applied, will have a lifetime of well over 100 years.

However, because it is the newest pipe product to emerge since the dawn of computers and automation, it's a fact that the structure, material and properties of PE pipe have been analyzed more than any other competing material. In fact, in a ground-breaking new study released by Drexel University on the life expectancy of, in particular, corrugated PE pipe, researchers predict that with variances to the deflection (PSI material stress in the wall), that particular type of PE pipe could last anywhere from 572 to 2800 years!

Is butt fusion foolproof?

No technology is foolproof; there is always the opportunity for human error or defective materials. However, heat fused PE pipes offer by far the lowest rate of leakage as well as the lowest maintenance requirements, compared to other pipe systems.



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About Connectra Fusion Technologies, LLC

How is Connectra's equipment different from its competitors?

Connectra's equipment is precision-made, yet is fairly simple to operate. Our equipment efficiently produces high-quality joints of no less quality than those made by higher-priced equipment with more "bells and whistles." Our strategy at Connectra Fusion is to create easy-to-operate, rugged machines that will do the job effectively and efficiently, with less room for human and mechanical error.

So far, this strategy has worked very well—in fact our customers report that they have less down time for maintenance, but equal or better productivity, when compared with more complicated equipment!

One specific area where Connectra is proud to differentiate itself is our emphasis on hand pump equipment.

Compare several of Connectra's fusion machines against the competition:
Links to comparison charts on the web.

What are the advantages of a hand pump fusion machine?

Hand pump machines, like electric machines, are hydraulically operated and offer precision fusion force control. However, they are simpler, highly reliable, and less costly to purchase and maintain. Because of their simplicity, training is vastly easier and faster. As for productivity, many of our customers report they can actually make more joints in a day with a hand pump than with an electric machine because there are fewer operational steps. Nor is it labour-intensive: operators report how easy it is to use.

How much training is required to operate Connectra fusion machines?

We design our machines to be simple to operate, which means that the training is significantly faster and easier than on more complicated machines that perform the exact same function.

As well, Connectra's machines can be easily operated by one person. Of course, additional equipment or labor may be needed to handle pipe or to transport equipment.

About Connectra Products

What pipe sizes are Connectra machines able to fuse?

Connectra's line of butt fusion machines will fuse pipe from _ " CTS to 42" IPS pipes.



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What do Connectra's model numbers mean?

The model numbers on our butt fusion equipment indicate the range of pipe sizes that the particular equipment will fuse. A 620 machine will fuse pipe between 6" IPS and 20" IPS in diameter; a 1442 will fuse pipe between 14" IPS and 42" IPS with more complex equipment.

We also use several machine-type designations:

- M - manual
- HP - a hand pump supplies the force necessary for fusion pressure
- EP - an electric pump supplies the force necessary for fusion pressure
- SC - self-contained-all equipment, including the generator required to supply electricity to the heater plate and electric pump, is onboard
- CQ - close-quarters, a compact design for use in tight trenches

Therefore, our 28EP has an electric pump and will fuse pipe between 2" and 8" DIPS in diameter.

For more detailed information on all Connectra's products, please see the Product section of our website (*install link here*).

Do Connectra machines require a generator?

If the Connectra equipment is designated SC (self-contained), then it includes a generator. Please review our Products (link) section to determine the capabilities of each piece of equipment.