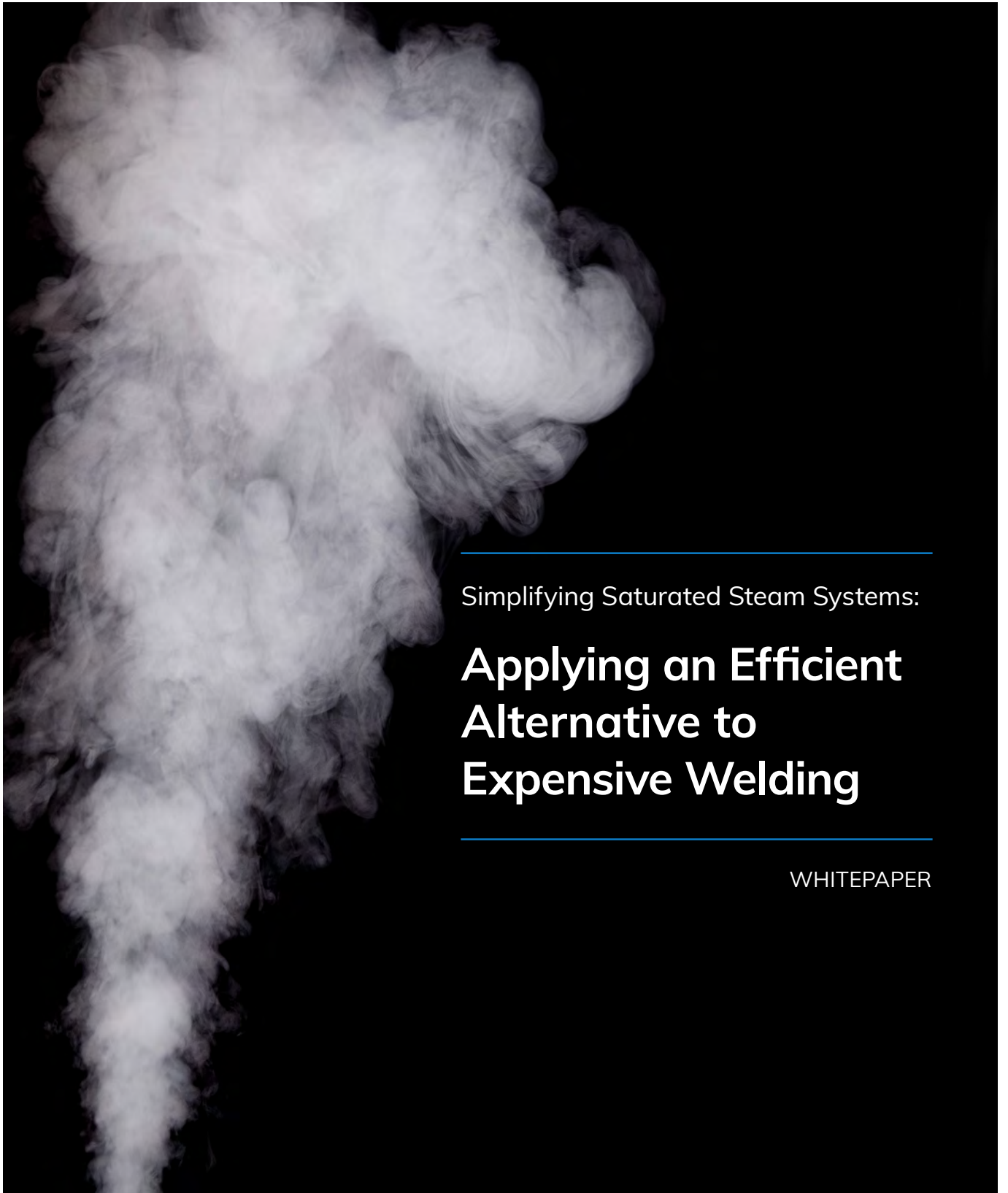


CONNECTIONS MADE EASY, BUILT TO LAST



Simplifying Saturated Steam Systems:

Applying an Efficient Alternative to Expensive Welding

WHITEPAPER

Saturated steam systems are hot – but make sure you don't get burned



FOOD PRODUCTION

Sometimes, a piping system must carry high heat – and a lot of it. A saturated steam system can strain a piping system, especially the vulnerable points where pipes connect. This paper will explore the virtues and challenges of saturated steam system construction, including:

- What is “saturated steam” and what are its major applications?
- Why conventional welding is often impractical, excessively expensive, and time consuming.
- How contractors can leverage alternative connecting solutions to their advantage.

Finally, *Simplifying Saturated Steam Systems* proposes an alternative pipe connectivity solution – mechanical versus welding – that produces safe, easily-maintained systems at a considerable savings in time and money.



STEAM STERILIZATION



Popular applications for saturated steam:

- ✓ Cooking/food preparation
- ✓ Food processing and packaging, including beverages and dairy
- ✓ Industrial cleaning/clean-in-place (CIP)
- ✓ Steam sterilization/sanitary cleaning for medical care (hospitals) and pharmaceutical manufacturing
- ✓ District heating systems/heat exchange systems
- ✓ Industrial steam cleaning, steam-in-place (SIP), industrial steam cleaning equipment
- ✓ Paper and pulp industry
- ✓ Wood bending/wood drying

Meeting system design challenges

At sea-level atmospheric pressure, water shifts phase from liquid to gas (in other words, it boils) at 100 °C. If the steam is to maintain its integrity, pressure must increase at the right ratio with temperature. Should the pressure be too high, steam reverts to hot water; if it's too low, it becomes overheated or superheated steam.

Maintaining saturation is not merely a matter of efficiency – it's an urgent safety issue. Should overheated steam meet pockets of condensation, the resulting vaporization expands rapidly, leading to potential pipe system damage or worse: catastrophic explosion.

For these reasons, saturated steam piping systems must be designed to:

- Maintain integrity under high heat
- Sustain pressures that can be significantly above atmospheric pressure
- Provide for the drainage of condensate; drainage points include pipeline low points, pipeline end points, at every elbow, and every 100m along straight distribution lines
- Allow for the repair and replacement of pipe sections, as needed

Traditionally, welding has been the favored practice for joining saturated steam pipes. Welds are strong, durable, and can withstand high temperatures and pressures.

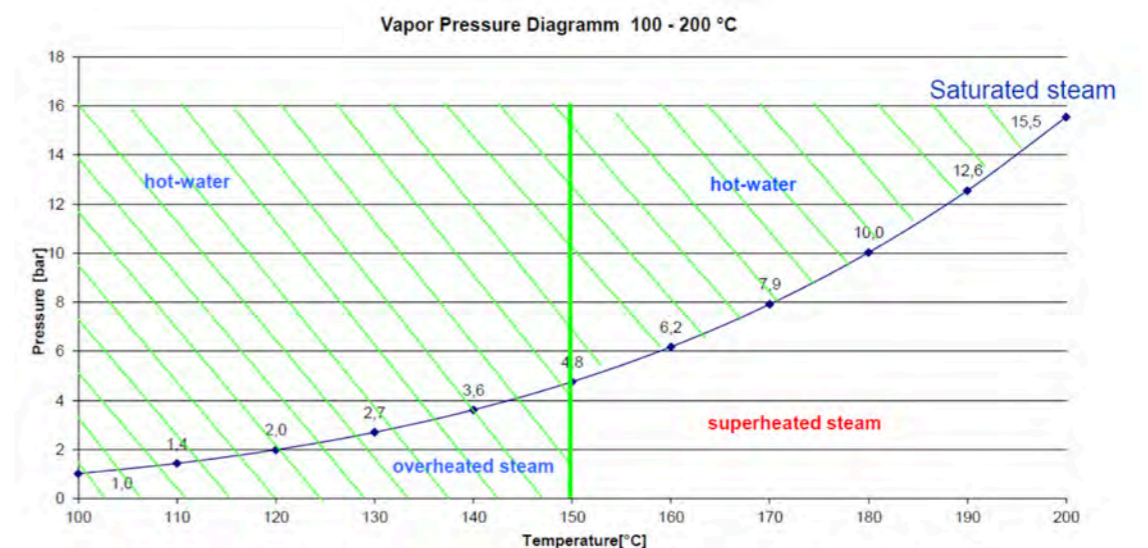
But welding introduces other problems that can make it less than ideal. For starters, welding can be expensive and slow. Welding typically requires hot work permits and/or fire watches; welding in tight or otherwise constricted work areas can be difficult or impossible.

Finally, even when other criteria may be met, progress can be delayed by a shortage of available welders.

For example, according to *City & Guilds*, half of the United Kingdom's welders are expected to retire by 2027, generating a demand for 36,000 new welders. In the United States, the *American Welding Society* projects a need for 400,000 new welders by 2024. In France, the welding shortage is so severe that EDF, a major power supplier, had to fly in 100 welders to reduce construction delays in its nuclear facilities.

Given that there are no immediate means for recruiting and educating the number of necessary welders, it's imperative that alternative connection methods be available to contractors.

Saturated steam exists when the steam shares a state of equilibrium with water; the rate at which water is vaporized is equal to the rate of its condensation.



Saturated steam is created along a precise balance of temperature and pressure.

A mechanical alternative that works

Fortunately, there is a practical alternative to welding that works for many saturated steam systems: mechanical pipe couplings constructed from steam- and pressure-resistant materials. These mechanical connectors offer a number of advantages over welding, including:

- ✓ **Less training:** It takes less expertise and experience to apply mechanical pipe connectors rather than welding;
- ✓ **Faster installation:** Installation can be completed in 80% less time; simple hand tools can do the job with less concern for exacting pipe alignments or pipe end treatments;
- ✓ **Easier maintenance and repair:** Mechanical connectors make replacing and/or repairing pipe segments much quicker and easier than cutting and rewelding;
- ✓ **Simpler system extensions:** Enlarging or extending pipe systems is much simpler with mechanical connectors.

With these advantages in mind, connecting saturated steam pipes with mechanical pipe connections (as opposed to welding, threading, or flanging) should be considered under the following work conditions:



Limited work area:

Constricted, enclosed environments where it would be impractical to use welding equipment.



Challenging environments:

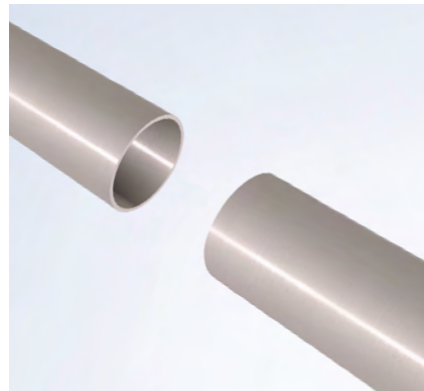
Outdoor, wet, or elevated spaces that may compromise safety and/or require the construction of welding platforms.



Hazardous materials:

Places exposed to flammable or hazardous materials, such as oxygen lines in hospitals.

How mechanical connectors work



1 Slide ready-to-fit coupling over the pipe ends.



2 Align and rotate the coupling to the correct position.



3 Tighten the connector bolts with a torque wrench.

Connecting saturated steam pipe joints with mechanical connectors can be easily done with common hand tools.

Compared to welding, threading, or flanging, mechanical pipe connectors **save up to 80%** of installation time.

NORMA has the mechanical connectors you need



The NORMACONNECT® FGR with the FKM sleeve couples pipes with OD 33.7 – 168.3 mm, and temperatures ranging -10 °C to +150 °C or up to +180 °C for liquid media.

For saturated steam pipes, not just any mechanical connector will suffice; installers must apply connectors constructed of materials that can withstand high temperatures and pressures over time.

Common EPDM (ethylene propylene diene monomer rubber) and NBR (nitrile rubber) sealing sleeves are NOT appropriate for saturated steam. To resist heat, pressure and humidity, contractors should rely on sleeves made of FKM (fluoroelastomer synthetic rubber) compounds especially developed for steam applications.

NORMA has a ready solution: the NORMACONNECT® FGR with the NORMA's unique FKM sealing sleeve. Our NORMACONNECT® Flex E and Grip E are ideal for joining metal pipes; the FKM sleeve allows it to function safely and reliably in steam systems up to 150 °C.

The NORMACONNECT® FGR with the FKM sealing sleeve comes with a strip insert and, depending on diameter, can compensate for imperfect pipe alignments: pipe gaps up to 35mm, axial movement up to 7.5mm, misalignments up to 3mm, and angular deflections of up to +/-2°.

Uses of the NORMACONNECT® FGR with FKM*

- ✓ Cleaning-in-place (CIP)
- ✓ Sterilization, cleaning, and disinfection,
- ✓ District heating, drying rooms
- ✓ Steam disinfection
- ✓ Steam distribution
- ✓ Hot water
- ✓ Ozone
- ✓ Oxygen
- ✓ Acids
- ✓ Alkalis
- ✓ Carbon hydrogens
- ✓ Multiple gases

* Consult a **NORMA product expert** or your regional sales contact to identify the ideal connector for your specific applications.



CONNECTIONS MADE EASY, BUILT TO LAST



Make the right connection

Designing and constructing saturated steam pipe systems no longer has to rely on expensive and time-consuming joint welding. Use the checklist below to see if the NORMACONNECT® FGR with the FKM sealing sleeve may be an ideal solution for your next saturated steam project:



- ✓ Your system will operate < 150 °C in temperature, 4.8 bar pressure
- ✓ Welding is impractical (enclosed environments, presence of hazardous materials)
- ✓ Welders are either unavailable or too expensive
- ✓ You wish to save up to 80% in installation time (as opposed to welding, threading, or flanging)
- ✓ Your system carries appropriate gases or liquids

The NORMACONNECT® FGR with the FKM sealing sleeve is available now to bring efficiency and safety to saturated steam pipe systems.

You want to know more?

Our expert will love to connect with you!
Heiko Foering - Product Manager & Trainer



[Contact Heiko](#)

Leverage our expertise!

Learn how to win time, save money and enjoy peace of mind when it comes to connecting pipes.



[Visit knowledge center](#)

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