

STAINLESS STEEL BRAIDED HOSES IN DATA CENTERS

Critical flex connections for liquid cooling
and air handling systems



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About Penflex

Founded in 1902, Penflex is an ISO 9001-certified manufacturer of flexible piping solutions, offering a broad range of metal hose assemblies and expansion joints that solve movement, pressure, temperature, corrosion, and reliability challenges. Through a focus on continuous improvement and customer satisfaction, we have set the standard for durable, corrosion resistant products and, with our global operations, support companies around the world across a range of industries. With headquarters and production based in Gilbertsville, PA, Penflex also maintains a warehouse in Houston, TX and operates a second manufacturing facility in Ho Chi Minh City, Vietnam.

Why metal hose is used in data centers

Benefits for data center operators, MEP and EPC firms, and OEMs

Data centers are designed to operate continuously and temperature control plays a critical role in supporting uptime goals. Near-perfect availability depends, in large part, on reliable components like hoses. The benefits of metal hose, which include cleanliness, material compatibility, structural integrity and flexibility, make them an ideal solution for fluid conveyance and air handling in data centers.

Clean components support contamination control

Coolant cleanliness is a critical performance factor. The longer the period between fluid reservicing and associated downtime the better.

The industry increasingly expects components to be clean and free of particulate, residue, or trapped contaminants that could impact coolant cleanliness and heat transfer efficiency and damage expensive equipment.

Stainless steel braided hoses are an ideal solution for applications where cleanliness is a top priority. While rubber and plastic alternatives see polymers leach into heat transfer fluids over time, this is not a concern with metal hoses.



Selection of Penflex hoses including Clean ID

Product showcase: Clean ID

Representing the latest innovation in metal forming technology, Penflex's Clean ID hose is manufactured without internal tooling, lubricants, or forming fluid, resulting in a final product that contains no trace of grease, moisture, oils, or particulates that are left behind through standard manufacturing processes.

With Clean ID, data centers can speed up, or even eliminate, post-production cleaning processes that slow delivery and increase costs.



Leak-tight connections protect uptime

Many failures are seen at connection points. While this means special attention is paid to seals and valves it also means special attention must be paid to the welds on a metal hose assembly.

All Penflex assembly welds are argon purged, a proven process that enhances weld quality by decreasing, even preventing oxidation, a reaction that weakens parent materials and increases a weld's susceptibility to chemical attack. Clean, leak-tight welds support component cleanliness as well as structural integrity.

Stainless steel is also the non-porous option, meaning operators need not be concerned with evaporation out of or moisture ingress into the system through hose material.

Designed to move without sacrificing strength

Kinked or cramped routing can restrict flow and create hot spots, stiff hoses complicate installation, and thermal stresses can fatigue hoses.

Metal hoses balance flexibility and strength. They accommodate movement without easily being displaced or kinked. For applications requiring increased flexibility, Penflex offers lighter-weight and compressed pitch hose options.

Featuring a more robust construction than non-metallic options, metal hoses are built to last. They are well equipped to accommodate thermal cycling and, unlike rubber hoses, they do not have a shelf life.

Corrosion resistance enhances service life

Corrosion resistance is one of the key benefits of stainless steel hoses. The austenitic steels (321, 316L) offer better corrosion resistance across a wider range of chemicals than most polymer-based alternatives. Both alloys are compatible with a wide range of heat transfer fluids, including glycol mixes and hydrocarbon and fluorocarbon dielectric fluids.

Using a non-compatible material will lead to faster material wear and, eventually, leaks, a major concern in lines adjacent to sensitive IT equipment.



Server racks in a data center

Where metal hoses are used in data centers

Stainless steel hose assemblies play a vital role across key data center applications.

Liquid cooling

Common metal hose applications in liquid cooling systems include cooling distribution units and rear door heat exchangers.

Cooling Distribution Units (CDUs)

CDUs circulate coolant between IT equipment and a facility's primary cooling infrastructure. They regulate coolant flow and temperature to prevent overheating and maintain stable operation. Flexible metal hoses connect pumps, heat exchangers, and manifolds inside CDUs where space is often constrained, and vibration absorption is important. They are also used as supply and return lines connecting CDUs to the secondary cooling loop.

Rear Door Heat Exchangers (RDHx)

A rear door heat exchanger replaces or augments the rear rack door with a liquid-cooled heat exchanger that captures server exhaust heat before it enters the data hall. RDHx systems are often used as a middle-ground between air-cooled and fully liquid cooled rooms, enabling meaningful rack power density gains without redesigning the entire IT infrastructure. Hoses connect the heat exchanger with a facility's secondary cooling loop.

Facility cooling

Metal hoses are used at key interfaces throughout facility cooling systems. The following examples highlight common applications where hoses are used to manage vibration, accommodate thermal expansion and seismic movement, and resist corrosion in always-on environments.

Chiller connections

To support heat removal, metal hoses serve as supply and return lines connecting fixed and mobile chiller units to a facility's HVAC system.

Hot aisle containment connections

In air-cooled facilities, flexible connections are relied on to support the separation of hot and cold air, often to channel air from hot aisles back to the cooling system's return air intake.

V-loops and U-loops

V and U loops are designed to effectively absorb movement caused by thermal expansion, contraction, and seismic activity without taking up a lot of space.



Engineered metal hose solutions for data centers from Penflex

A partner to CDU manufacturers and data center MEP and EPC firms

While metal hoses are a relatively recent addition to data centers, Penflex brings over a century of expertise in fluid conveyance and metal forming technology to the table. We understand the critical features that make metal hoses perform—and excel—where it matters most.

Product highlights

- **Broad size and configuration range:** Assemblies are available from ¼” to 24” and can be configured to fit common OEM designs and facility interface needs.
- **Flexible:** We offer thin-wall and compressed pitch hose options to simplify installation in even the most confined or hard-to-reach spaces.
- **Corrosion resistance:** Known for superior corrosion resistance, metal hose’s compatibility with glycol-based refrigerants and other cooling fluids significantly extends their lifespan.
- **Quality welds:** High-quality welds are essential to hose integrity and long-term performance. At Penflex, we achieve this through TIG welding and argon purging, which together produce clean, strong welds without compromising corrosion resistance. Our team includes



Sets of cooling towers atop a data center facility

ASME Section IX–certified welders, on-site certified welding instructors, and non-destructive examination specialists, ensuring every assembly is tested and leak-tight before it leaves our facility.

- **Superior cleanliness:** In addition to our Clean ID options, we can accommodate customer-specified cleaning procedures upon request. To maintain cleanliness, all assemblies are individually bagged after preparation.
- **Sanitary fittings:** Penflex maintains a deep network of sanitary fitting suppliers to support hygienic connections commonly specified in data center liquid cooling systems.

Service beyond the product

We are dedicated to the service and success of our customers who count on us not only for a quality product, but also for expertise, responsive service, and resources to help them get the most out of their investment.

Dedicated engineering support

Whether you are involved in an air, liquid, or hybrid cooled data center, our sales engineers work closely with you from project prototype through delivery, helping define requirements for new products and replacements. A dedicated account manager means you have a single point of contact who understands your business and responds quickly with thoughtful solutions.

Domestic options with additional overseas capacity

We manufacture metal hose and braid and fabricate complete hose assemblies at our 100,000 sq. ft. factory in Gilbertsville, PA and have the ability to leverage the capacity of our similarly-sized Vietnam facility. With options to supply domestically and internationally, we can offer customers more dynamic sourcing solutions.

Practical technical resources

From online calculators and engineering bulletins to in-person and virtual training, we give designers, installers, and operators the tools to make thoughtful decisions and the information to support long hose service life.

Full quality documentation

On request, we provide complete record packs—including material test reports, leak and pressure test results, and cleaning procedure documentation—so you can meet compliance requirements and maintain full traceability.

Our commitment to service is reflected in our 99% customer retention rate and an average customer relationship of 20 years. We aim to make every interaction count, combining technical know-how with the kind of service that turns first-time buyers into long-time partners.



Penflex offers sanitary fittings, like these VCR connectors, on metal hose assemblies.



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