



TURBO OIL DRAIN TUBES / FEED TUBES

Diesel thermal management and fluid conveyance solutions for light-duty, commercial, heavy-duty and off-highway applications.



www.seniorflexonicsUSA.com



Senior Flexonics Engineers, validates, and manufactures thermal management components and fluid conveyance systems for all I.C.E., Diesel, EV, HEV and Hydrogen powered vehicles.

Senior Flexonics offers unparalleled product design, development, testing and manufacturing capabilities. Bartlett is the primary North American design and development center for thermal management, fluid conveyance, heat exchangers and flexible connectors. Housed in a dedicated sales, research, development and prototyping site Senior Flexonics' program of continuous improvement and innovation has enabled the delivery of cost effective, high performance products for the rapidly developing marketplace.



TURBO OIL DRAIN TUBES

Turbo oil fill and drain tubes are a vital connection between the turbo and the oil lubrication system. Due to extreme heat, thermal expansion must be controlled to protect the turbo housing. The typical automotive engine compartment is a very hot and corrosive environment. The thermal expansion differences between the turbocharger and a short rigid pipe causes excessive loading against the turbo housing. The use of rubber hose is limited by temperature, adds assembly labor, and creates possible leak paths.

Senior Flexonics has developed turbo oil tube solutions, utilizing our thin-wall, flexible metal tubing technology, that address engine vibration and thermal dynamics issues to ensure total system durability while aiding in assembly. A large variety of end configurations is available to reduce assembly time and reduce the number of components. Our unique ability to manufacture a simple one-piece design can also reduce the number of joints that are often prone to failures with many other designs. Our design process includes many stages such as:

Initial Design

During the initial design stage of turbo oil feed tubes or drain tubes, we consider bolt access, clearance, orientation, and assembly to ensure there are no concerns. Temperature fluctuations and movement frequencies are all analyzed and contemplated so the correct engineering course is taken as well as the correct materials are utilized for a durable final product. Often specialized stainless steel metal bellows are utilized by Senior Flexonics in the final tube assembly to mitigate thermal expansion and contraction as well as inherent engine and external vibrations at high frequencies. This is one of many differentiators in our approach vs. a simple rigid tube supplier.

Knowledge and Expertise

Senior Flexonics is uniquely positioned in the industry as we have accumulated decades of field data regarding thermal management and movement characteristics. This valuable information is applied to our products. We understand metal characteristics and their inherent benefits of one type vs. the other. Having the necessary on-site testing facilities to do extensive durability analysis including FE analysis to study heat and movement means we can assist you with complex 3D geometries and customize the flexibility vs. stiffness of the tube to meet installation constraints.

Manufacturing Capabilities

Senior Flexonics' production facilities are equipped with an extensive range of dedicated tooling for bending, forming, and joining complete assemblies including advanced multi-axis Computer Numeric Control (CNC) bending machines, hydroforming and brazing to name a few. Some of these manufacturing cells are augmented by robotics for large production runs of OEM parts.

One Stop Shop

We are familiar with all standard turbo oil feed tube and turbo oil drain tube fittings (i.e. O-rings, heat shields, flanges) and can offer precision custom end fittings as required by the manufacturer. We further understand cleanliness requirements on feed and drain tubes are critical with extremely tight requirements that must be maintained. Our extensive experience with medical devices and strict ISO quality measures affords Senior Flexonics an additional industry leading advantage.



Turbo Oil Drain Tubes / Feed Tubes

Senior Flexonics supplies flexible stainless steel turbo oil drain tubes / feed tubes to many well-known vehicle brands. The turbo oil feed tube leads oil to the turbocharger of diesel and gasoline engines. Conversely, turbo oil drain tubes drain the oil from the turbocharger back into the block of diesel and gasoline engines. Our products are trusted by vehicle manufacturers because we understand the critical importance of:

Product Cleanliness Protocols

- Over 50 years manufacturing vehicle fuel components.
- We know that cleanliness is critical for reliability and service life.
- We have existing protocols and equipment in-place to perform this work.

Thermal Management

- Decades of advanced thermal management experience applied to new innovations.
- Flexible components on drain tubes designed, developed and manufactured in-house.

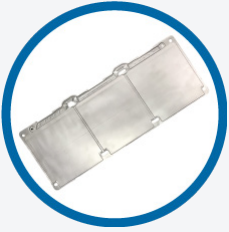
High Volume Production

- Specializing in high volume production of stainless steel tubing components from many of our worldwide locations.

KEY BENEFITS

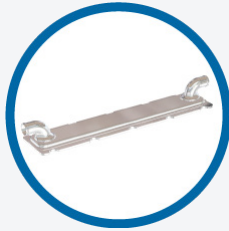
- » Full service supplier.
- » Full collaboration with customers to provide products.
- » A fully engineered solution, from design concept through to high volume manufacture.
- » Global production facilities, 30 operations in 13 countries.
- » Extensive range of thermal management solutions.
- » Programs managed using APQP framework.
- » Comprehensive fleet of FEA and CFD software.
- » Fully equipped test lab for validation testing.
- » Performance and durability test equipment.
- » ISO 9001 / 14001 and IATF 16949 certification.

Whether it's combustion, hybrid or electric drive-trains, battery cooling or fuel cell applications, we use our knowledge and expertise to meet our customers requirements.



Battery Thermal Management

Manufactured in a range of materials including stainless steel, aluminum, copper, and plastics, our systems are designed to maximize power density, while minimizing package space, weight, coolant pressure drop, and cost.



Electronics Cooling Plates

The main component inside the inverter is the IGBT (Insulated Gate Bipolar Transistor), and it generates heat. An effective method of cooling the IGBT is through a liquid cooled heat sink.



EGR Cooler

Senior Flexonics provides a wide range of EGR Heat Exchangers, including Shell & Tube, Plate & Fin and our patented Co-axial Cooler. Our heat exchangers are used in HEV engine systems and have up to 95% efficiency, are highly resistant to fouling and are scalable to match performance requirements.



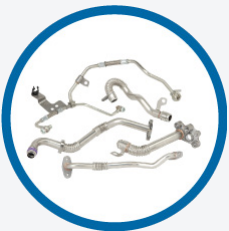
Flexible Connectors

We are an industry leading supplier of flexible connectors. We design, engineer and manufacture both long/soft and shorter self-supporting flex design options to meet customers unique platform requirements.



Hydrogen Thermal Management

Senior has developed high-efficiency condensers, recuperators, and cathode air pre-heaters capable of operating at extreme temperatures for prolonged periods of time.



Fluid Conveyance

Senior Flexonics has a long history of manufacturing tubing for a variety of fluid transfer applications. Used in isolation such as for an oil drain or fuel lines, or combined with our heat exchange plates, we offer expertly balanced and optimized systems to ensure customer needs are met.



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