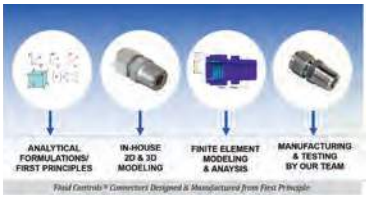
FLUID CONTROLS
ENGINEERING CONNECTIONS EVERYDAY

Engineering **Comprehensive Solutions** *for* **Rail** & **Metro Brake Piping**

Fluid Controls® Private Limited was established in 1974 by Dr. Y.E. Moochhala, a Ph.D. from Northwestern University, the USA with a vision to deliver high-quality & high-performance products which delight customers. Fluid Controls® is a "Vocal for Local" company with over 45 years of experience in engineering fittings and connections for rail & metro brake piping assemblies. We offer customers comprehensive **end-to-end "Make in India" solutions for locomotive and coach brake piping arrangements** – from design & engineering services to supply of high-performance connectors and installation services.

Design & Engineering Services



Fluid Controls® offers design services for brake piping arrangements and conversion engineering, including 3D modelling, FEA and prototyping via ANSYS and Solidworks. Our engineers work closely with customers to understand their requirements and develop effective solutions for them.

Our engineering and design strengths have ensured that millions of Fluid Controls® connectors have been successfully installed on electric and diesel locomotives, motorized and mainline coaches and metro cars, providing "fit and forget" assurance to customers.

Manufacturing and Supply Services



Fluid Controls® Connectors & Fittings

Fluid Controls® partners with customers to be a single source supplier for various connectors required for rail and metro applications. The 120,000 sq. ft. manufacturing facility is located at Chakhan, outside Pune, India.

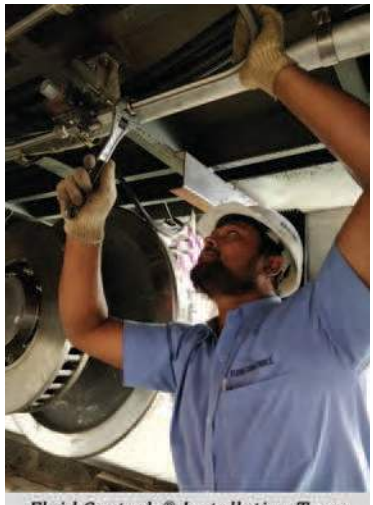
Our products include:

- **Double Ferrule Fittings** with multiple sealing points and high vibration resistance which have been design validated by ABS & performance validated to ASTM F1387-99 (2012)
- **DIN Single Ferrule Connectors** for metro and rail applications
- Bulkhead™ and Threaded Adaptors
- Hose End Connectors and crimping services
- FlexiGripT™ Connectors for misaligned pipe connections
- Quick Release Connectors
- Customised Connectors designed to client requirements
- Isolating Cocks and clamping accessories (DIN and customised)

Today, Fluid Controls® has over four decades of experience **supplying over 15 million connectors and delighting over 60 customers** in the Rail & Metro Industry. We are approved by all Indian Locomotive and Coach OEM's, Bombardier Transportation, Alstom Transport for Metro and E-Loco, and GE Transportation. We are also approved by brake equipment and other suppliers to the Rail & Metro industry.

Engineered Installation Solutions

To cater to a growing need for comprehensive solutions, Fluid Controls® has introduced engineered installation services. This service provides



Fluid Controls® Installation Team on Site

our customers with an end-to-end solution as they have a single source vendor for connectors supply and fitment.

Traditionally, the Indian Railways has sourced brake piping parts from individual suppliers, and the installation of the piping was carried out at the site by separate vendors. With the expansion in manufacture of carriage and locomotive rolling stock, it is imperative that the railways have zero-defect, leak-free connections in the pneumatic brake piping system as this is a critical safety item which requires superior materials and precise expert installation.

With our composite expertise of manufacturing connectors, our understanding of tube and end connector performance and our decades of experience of swaging and accurate tube bending, Fluid Controls® offers customers a complete end-to-end engineered supply and installation solution. Today, Fluid Controls® is executing "Supply & Apply" contracts for over 750 coaches in India.

Our services are offered by experienced professionals and include:

- Supply of zero-defect end connectors and pipes
- **On-site connector fitment services:** our expert resident team provides swaging services and ensures proper fitment of ferrules and performance of the connector
- **End-to-End installation services:** include on-site installation of brake pipelines on the shell underframe and bogie, including tube formation, connector fitment, mounting of piping and leakage testing
- **Pre-piped assemblies:** This begins with engineering support during the designing of the brake piping layouts supported by 3D modelling and FEA. The tube formation, end formation and swaging of connectors is done at our facility and the pre-piped assembly is shipped to the customer site. If required, Fluid Controls® team provides on-site fitment of these assemblies as well. These pre-piped assemblies facilitate customer inventory management and ensure faster turnarounds.

Engineering and R&D

Fluid Controls® is approved as an "In-House R&D Unit" by the Department of Scientific & Industrial Research (DSIR), Government of India.

Our state-of-the-art R&D center is located at Pune, Western India, where we offer clients customized solutions based on analytical formulations, 3D Modelling, and FEA.

- All Fluid Controls® products are designed from **FIRST PRINCIPLES**
- 2D and 3D model creation and Virtual Design Validation (VDV) using Finite Element Analysis
- Connector ferrules are case hardened by a **patented process** to ensure superior performance
- Rigorous design and performance certification program conducted by external agencies
- Total material traceability and a corporate policy of continuous improvement



Recognition of Fluid Controls® In-house R&D Unit

Fluid Controls® connectors are manufactured to the highest standards and our ferrule fittings are design validated and certified to international design and performance standards:

- **System certifications** of ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 **Double Ferrule Fittings** are design validated by American Bureau of Shipping. These connectors are performance validated as per ASTM F1387-99 (2012). Additional tests include vibration as per BS EN 61373, Salt Mist tests, seismic and non-seismic tests to nuclear standards
- **DIN Single Ferrule Connectors** are design validated to DIN 2353 and ISO 8434 standards. They are performance tested as per ISO 19879 with supplementary vibration and corrosion tests
- **DIN Clamps** are design validated as per DIN 3015

All validation and testing can be offered by us to customers (if required) at our test laboratory in Pune, where we have equipment which caters to the following:

- Hydrostatic pressure up to 58,000psi. Pneumatic testing up to 20,000psi
- In-house Spectro metallurgy
- SCADA Multi Test bench for Hydraulic Impulse and Vibration test, Temperature cycling, Corrosion Resistance of plating as per ASTM B840:2002 by salt spray method ASTM B117
- Stress Corrosion test as per ASTM F1387, including Flexure Fatigue, Rotary Flexure and Tensile Pull Test
- Vacuum and Cryogenic Test Ups
- In-house UTS, PMI and Rockwell & Vickers hardness testing

Response to the COVID-19 Pandemic

At Fluid Controls®, we ***Engineer Connections Everyday***. In the COVID-19 pandemic, we are also committed to ***Staying Safe Everyday*** to ensure business continuity as well as the health & safety of our employees, their families, our customers, and our business partners.

Fluid Controls® resumed its manufacturing operations with ***Operational Safety*** as our most important parameter, and we have planned our manufacturing with a systems and process focused approach. Some of the actions we have taken to ensure the safety of our community include:

- Setting in place detailed guidelines for operations and conducting extensive training of our employees. The core of our EPRP Protocol is the "Fluid Controls Focus Five" to ensure safety at home and work *(https://fluidcontrols.com/pdf/FC-Covid-Response-Manual.pdf)*
- Wide dissemination of our COVID protocols to our team through multi-media presentations, including a short film *(https://youtu.be/ArRN0O9MFU8)*
- Re-structuring of our facilities and offices to ensure we not only comply with government guidelines but go beyond them. Our facilities have thermal checks, oximeter checks, safe seating, area marking, foot-operated sanitizer dispensers and water dispensers, clear guidelines for behaviour within our facilities, and continuous disinfection and deep cleaning of all premises
- Re-structuring of our manufacturing processes to ensure safe material processing and safe inward and outward material handling

Individual PPE kits to every employee which are tailor made for their area of operation and each team member has been provided with adequate insurance cover

A Single Source for Brake Piping Connections

At Fluid Controls®, we ***Engineer Connections Everyday.*** Our corporate and product ethos is integrity and reliability and innovation, and we offer our customers unparalleled products and services to ensure a leak-free, reliable, "Fit and Forget" brake piping system.

