

# CASE STUDY

## Fastener Assembly

**Process:**  
Metal Additive Manufacturing (AM)

**Material:**  
17-4 PH stainless steel

**Density:**  
> 99% of theoretical density

**Yield Strength:**  
800 MPa (116,000 psi)



*A 2023 Award of Distinction Winner in the Hardware/Appliances category for metal additive manufactured components.*

### End Use and Function

This fastener assembly attaches the inter-car baffles to retaining frames on bullet trains. It replaced 10 individual components and 4 rivets, eliminating riveting, welding, and grinding from the production process. The fastener must withstand a substantial transient bending moment in operation; be able to be rotated with a tool but tamper resistant to passengers; and resist unintended rotation due to train car motion and vibration. The one-piece design simplifies the manufacturing process, reduces supply chain part counts, and is easier to use in service.

### Fabrication

This assembly consists of 2 metal AM parts and 2 off-the-shelf parts. Utilizing a layer-by-layer hybrid approach, combining the flexibility of sinter-based 3D printing, the robustness and accuracy of CNC, with the scalability of MIM, these steps are repeated until the parts are fully formed. Proprietary de-binding and sintering

cycles provide dimensional stability. The 17-4 PH stainless steel parts require no post-processing: no HIP, support removal, surface finishing, or heat-treatment.

### Results

This is an end-use production part on a transportation (train) application. Using metal AM lowers total production effort, complexity, and cost by simplifying the assembly and installation process for the customer. This assembly is sustainable, and the design greatly simplifies the manufacturing process by eliminating several operations (welding, machining, finish grinding, riveting) and drastically reduces the assembly part count, while reducing the dependency on skilled labor and shortens the assembly & installation time. The assembly is easier to install, uninstall, maintain, and replace, making it a superior solution compared to traditional manufacturing.



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