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Risks of Mixing OEM Scaffold Components

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The practice of mixing scaffold components of different original equipment manufacturers is raising safety concerns in the scaffold industry

The issues discussed in this article have been previously identified by the writer in a comprehensive study prepared for PERI Scaffolding Services Inc.

As temporary structures and proprietary designs for access scaffolding become more and more advanced, the practice of mixing components of different original equipment manufacturers (OEM) has become more common and is raising safety concerns in the scaffold industry. The following article describes the risks associated with mixing components of different OEM manufacturers in the same structure or scaffold and includes suggestions and recommendations for suppliers, users and designers of proprietary scaffold systems.

Overview

Most scaffolding systems in the industry today are constructed using custom designed and manufactured proprietary components and often have very specialized connections and structural configurations. Mixing these proprietary structural members from different original equipment manufacturers in the same scaffold may alter the structural characteristics of the overall structure.

There are a variety of reasons why users of scaffold systems want to mix OEM components but the most common reason is the availability of components. Contractors and other users may need additional components to complete the installation of a scaffold on a project or may have multiple OEM components in their inventory. Currently most manufacturers do not recommend mixing different OEM components in the same structure.

What is an OEM Manufacturer?

An original equipment manufacturer is the entity that conceptualizes the design of the structural system, analyzes and tests the components, produces the components, markets the products and provides technical support. Many code and standards require the OEM manufacturer to provide technical specifications, load ratings and in most cases assembly instructions for their products.

The OEM manufacturer should not be confused with the fabricator. Fabricators are often contracted by the OEM manufacturer to fabricate parts and components to the specifications provided by the OEM manufacturer. The term "OEM component" refers to a structural component and related accessories that are produced by or under the direction of the OEM manufacturer.

When we use the term "mixing OEM components" we refer to the connecting of different OEM modular components into one structural system whereby the components must structurally interact with each other.

Examples of Mixing OEM Components

The practice of mixing OEM components can be described in the following three categories:

1. OEM Compatible Components

OEM compatible components are generally scaffold components produced and supplied by recognized OEM manufacturers and are advertized and marketed as being compatible with other OEM brands. These components are most common with system scaffolds using a rosette and mouthpiece design for the vertical standard to ledger connection.

2. Generic Components

Generic components are generally available through independent suppliers and are marketed as being compatible with many other OEM brands. There is often no identified manufacturer and detailed technical specifications are not always available. Components may look the same as the OEM component and have similar geometric appearances but the material properties may differ.

3. Unauthorized Copies of OEM Components

These are components that are identified as a particular OEM brand but are not manufactured or recognized by the identified OEM manufacturer. They are essentially counterfeit copies of the original. Many of these products and components could infringe on current patents. The actual manufacturer or fabricator may be difficult to identify.

Risks of Mixing OEM Components

There are many aspects to be considered when assessing the risks mixing OEM components in a scaffold system such as liability issues, serviceability of products, and manufacturer's warranties. However, by far the most important issue is safety – the risk of structural failures or even complete collapse of the structure.

Connections

The connection between structural members or components of a structure is a critical feature of any structure and is often the most misunderstood. Quantitative data regarding connection performance is most important for modular system scaffolds since the overall analysis and design of these systems depends on the characteristics of the connections. Connection characteristics such as joint rotation and displacement under load, joint fixity, and load capacities will determine the load path throughout the structure from the applied loads to the ground.

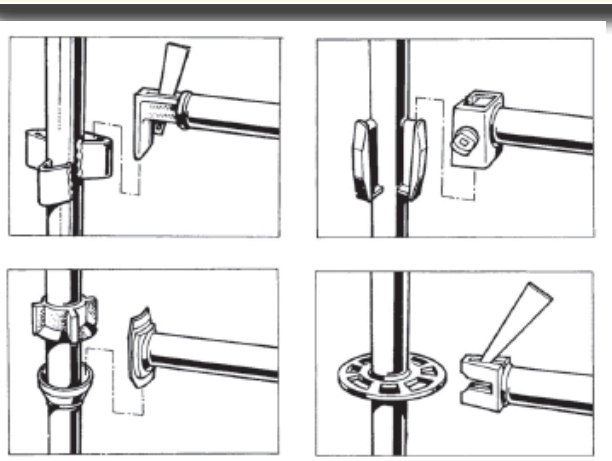
Risks of Mixing OEM Scaffold Components

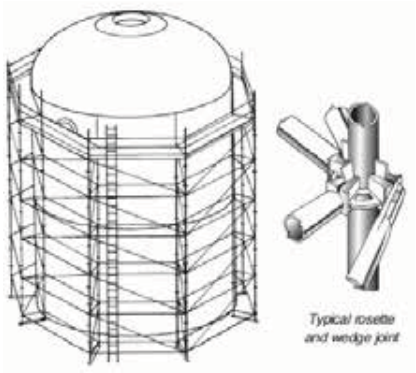
The proprietary connections developed by OEM anufacturers are required to be rigorously tested and the data obtained from the testing is crucial for the overall analysis and design of the structural system.

System Scaffolds

The term modular system scaffold (or more commonly "system scaffold") generally refers to a scaffold structure consisting of vertical uprights or columns called standards, horizontal members called ledgers and transoms, and a system of diagonal braces. The horizontal members are connected to the vertical standards connection provided by OEM manufacturers.at predetermined node points by a proprietary connection, the most common being a rosette and mouthpiece design. Diagonal braces are also connected at the node points.

In addition to the diagonal bracing, system scaffolds rely on the moment capacities of the standard-to-ledger connection for their lateral stability. From a structural analysis perspective these are referred to as full or partial moment connections and create very complex structures that require consistent and predictable joint behaviour for the analysis and design assumptions to be valid.

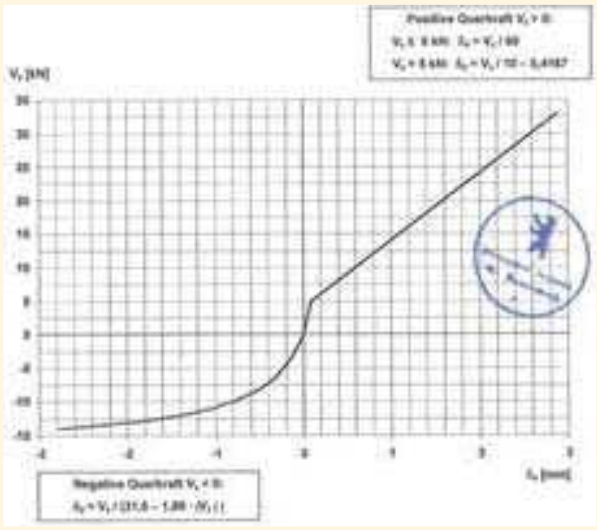




TYPICAL PROPRIETARY CONNECTIONS USED IN MODULAR SYSTEM SCAFFOLDS. COURTESY OF IHSA FORMERLY CONSTRUCTION SAFETY ASSOCIATION OF ONTARIO .

Many system scaffold manufacturers utilize similar connection designs between the horizontal and vertical components and although components from different OEM manufacturers may physically fit together (or be forced to fit !) they may not have been analyzed or tested to verify their safe capacity and their structural behavior under load.

The graph shown below is a typical example of the results of joint testing. Courtesey of PERI GmbH



Example of certified test data for standard-ledger connection provided by OEM manufacturers.

Even when different OEM components are dimensionally compatible and may fit together, variations in physical and material properties will often result in unpredictable load paths within the structure and may result in some components becoming overstressed. It should be noted that the accumulated effect of overstressing in a component could lead to eventual failure under normal loading conditions.

Frame Scaffolds and Tube & Clamp Scaffolds

Structural connection performance is also important for sectional frame and tube & clamp type scaffolds. Traditional frame type scaffolds consist of pin connected steel frames and cross braces. The frame-to-frame connections for these scaffolds are critical to the transfer of the vertical load between frames. Similarly, for tube & clamp scaffolds, predictable slip resistance and mechanical properties of the clamps are crucial in allowing the designer to accurately determine the structural performance of the scaffold. Mixing different OEM frames and connection components in the same structure could significantly alter the overall structural integrity of the scaffold.

Induced Stresses

Stresses due to improperly fitting components can be induced into a scaffold structure even before any other loads are applied.

Risks of Mixing OEM Scaffold Components

As covered earlier, many system scaffold manufacturers utilize similar connection designs between the horizontal and vertical components. This is particularly true for the rosette-mouthpiece type of connection. Although components from different OEM manufacturers may physically fit together, minor dimensional variations in the vertical standard or rosette can be magnified in large or heavily loaded structures to the point where excessive stresses could be induced into the structural components before any external loads are applied.

Most scaffold designers rely on the dimensional tolerances specified by the OEM manufacturer and they do not account for "fit induced stresses" in their designs. Accordingly, stresses due to improperly fitting components could create a risk of premature component failure particularly in large heavily loaded structures

Quality Assurance

Users and professional engineers designing scaffolds and other temporary structures require assurances (and usually documentation) that the quality of the material and fabrication of the structural components are consistent with the design assumptions. If OEM components from different manufacturers are used as part of the structural system of a scaffold, it will probably not be possible for one OEM manufacturer to verify the material and component quality of another. Accordingly, the responsibility for the quality of the overall structure would be shifted to the designer and user of the scaffold.

Recommendations

OEM Manufacturers

- If an OEM manufacturer intend their products or components to be compatible with other products or brands, it is recommended that the components be tested in all possible configurations to ensure the structural effects and behaviour of the overall structure are acceptable to each of the OEM manufactures involved.
- Compatible brands should be clearly identified in the literature and technical specifications of the OEM manufacturer so that independent designers and professional engineers are able to use the appropriate design assumptions for the overall structure.

Suppliers and Contractors

- Where suppliers carry multiple brands of scaffold components from different OEM manufacturers in their inventories, they should advise their customers and erectors not to mix different OEM components in the same structure.
- The brand or name of the OEM manufacturer should be identified on the components and appropriate documentation should be available to verify component specifications.
- Where users own or rent components of modular scaffold systems, it is recommended that only components of the same OEM manufacturer be used in the same structure. **Components of different OEM manufacturers should not be connected together in one structure.**
- Users should ensure that technical data and user manuals are provided by the OEM manufacturer. In North America most jurisdictions require that scaffolds, particularly modular system scaffolds, be erected in accordance with the manufacturers' instructions.

Scaffold Designers and Professional Engineers

- The OEM manufacturer should be clearly identified on the design drawings where a proprietary system is used. It is recommended that drawings contain a note that components from different OEM manufacturers should not be interconnected.
- If designers accept advertized OEM compatible components from different OEM manufacturers it is recommended that appropriate test information and certifications be provided by each of the manufacturers. An independent structural analysis should be carried out to ensure the compatibility of the components that may have different structural characteristics.

About the author;

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