Tool[1] Tethering System Selection

A tethering system is used to restrict the fall of tools which are dropped while being used "at heights". The system is comprised of four components: the tool (which includes all items attached to the tool – i.e., accessories, inserts, and, if applicable, batteries); the tool attachment point (a connection point on the tool to which the tether is attached); the tether[2]; and the anchor point (human or structure to which the tether is attached and relied upon to restrict a tool from falling).

When a tool is dropped, it creates a shock load on the tethering system. The longer the tether, the stiffer the tether, and the greater the weight of the tool, the higher the shock load. As a result, as a general principle, the shortest tether which meets the application needs should be selected. If any component of the tethering system is unable to absorb the shock load, the tool will free-fall. It is therefore imperative that all four components be properly matched to create an effective tethering system.

1. Tool

Not all tools are designed to be tethered. Several aspects of the tool's construction must have sufficient integrity to survive the shock load from a drop. These include the location where the tool attachment point connects, the connection between the tool body and any batteries or accessories, and the clamping of the insert in the tool. And just as with the tool attachment point, it is important to know whether there is a configuration where the tool/battery/accessory/insert will not remain intact during a drop and is therefore not suitable for tethering applications.

The maximum tool weight includes the tool body, accessories (e.g., dust removal systems), inserts (e.g., bits, blades…), attachments (e.g. handle) and for cordless tools the largest battery that will be used.

2. Tool Attachment Point

The tool attachment point may be supplied by the tool manufacturer (OEM), or aftermarket; and may be integral to the tool (i.e., not intended to be removed during normal use), or detachable. The tool attachment point rated load capacity (i.e., maximum allowable tool weight), maximum tether length, and any limitations

[1] "Tools" is used herein as small (<25 lbs.) hand-carried objects, such as hand or power tools, containers, etc., which must be transferred and used at heights. It does **not** include personnel, which are otherwise addressed by fall protection standards and guidelines.

[2] Tethers are also referred to as lanyards.

on the make/model/type of tether, must be determined. When selecting an aftermarket tool attachment point, it is also important to verify its suitability for the tool to be tethered, without interfering with the tool's or tool attachment point's safe operation.

Obviously, the total weight of the tool cannot exceed the tool attachment point capacity. If a configuration results in the tool attachment point capacity being exceeded, additional measures must be taken to avoid use of the tethering system with that configuration.

3. Tether

Per ANSI-ISEA 121-2018, a tether must be labeled with its rated load capacity (i.e., maximum allowable tool weight), and its length[3]. As discussed above, the "stiffness" of the tether can also be an important factor. A rigid, or fixed length, tether (e.g., a steel or stiff nylon material), generates significantly higher shock loads compared to an elastic, or extendable, tether. In addition, the stiffness of elastic tethers varies by make/model – meaning the shock load they generate also varies. Tether selection must therefore take into consideration the rating of the other system components – anchor and tool attachment points, and the weight of the tool – as well as any tether limitations (e.g., elastic only, length restrictions, etc.) imposed by the other components in the tethering system (e.g. Tool, Tool Attachment Point, Anchor Point).

4. Anchor Point

An anchor point must be selected which has the necessary strength to absorb the shock loads. When tethering to a human, while there are no standards, many guidelines suggest limiting this practice to tool systems weighing no more than 6 pounds.[4] This can be further limited if the person is unable to maintain a firm, stable stance, or if the shock load may lead to dangerous imbalance (e.g., working on a ladder).

5. Summary

A weak link in a tethering system can lead to failure during a drop incident. Proper component selection requires more than "tether capacity ≥ tool weight" – it requires matching and coordination of all four components. Obtaining a system (tool, tool attachment point, and tether), from a single manufacturer who has already performed the above analysis can help avoid mis-matched components.

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[3] For elastic tethers, the length is measured when the maximum rated load is applied.

[4] https://ohsonline.com/articles/2019/12/02/standard-for-dropped-objects.aspx