Boeing and the FAA allow the use of equivalent tools and equipment in airplane and component maintenance manuals.

Understanding Tools and Equipment Equivalency

Operators often contact Boeing asking whether commercial tools and equipment from different vendors or with different part numbers are equivalent to those listed in Boeing airplane maintenance manuals (AMMs). In general, if the specifications of the tool or equipment meet or exceed the specifications of the AMM procedures, they are considered to be equivalent to the commercial tool or equipment recommended in the AMM.

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Being able to quickly determine the equivalency of commercial tools and equipment can reduce or eliminate related airplane maintenance delays for operators.

This article explains how to determine the equivalency of commercial tools, as well as the equivalency of special tools and equipment. It also addresses general equivalency issues about tools, equipment, and ground-support equipment.

While most of the equivalency questions received by Boeing deal with commercial tools and equipment in Boeing AMMs, the same questions and resolutions can be applied to commercial tools and equipment in component maintenance manuals (CMMs), Boeing fault isolation manuals, and the Boeing standard wiring practices manual.

Standard tools are those not normally found in a mechanic's toolbox but are required to perform airplane maintenance. These items, such as oil resistant buckets and torque wrenches, do not have vendor part numbers. Because there are not many equivalency questions about these tools, they are not discussed in this article.

BASIS FOR EQUIVALENCY

The use of equivalent tools and equipment has been established by Boeing, original equipment manufacturers (OEMs), and the U.S. Federal Aviation Administration (FAA):

- Boeing allows the use of equivalent tools and equipment throughout AMM procedures, including the introduction to AMM Part II (Practices and Procedures) and the Tools/Equipment sections.
- OEMs such as airplane component suppliers allow the use of equivalent tools and equipment in the Testing and Fault Isolation and Special Tools, Fixtures, and Equipment sections of their CMM.
- The FAA allows the use of equivalent tools and equipment as stated in Title 14 Code of Federal Regulations Part 145.109 (c) and in Federal Aviation Regulation 43.13(a).

ESTABLISHING EQUIVALENCY FOR COMMERCIAL TOOLS AND EQUIPMENT

Most commercial tools and equipment used in AMMs and CMMs are generic in nature and are designed to make measurements that are not unique to any specific test procedure in AMMs or CMMs. They are used across different test procedures as applicable and are referred to as commercial-off-the-shelf tools and equipment. They are available from multiple vendors with different part numbers and physical attributes and perform the same or different functions. They may include industry standard tools and equipment such as wrenches, multimeters, and sockets that are manufactured to a recognized industry standard.

To determine equivalency of commercial tools and equipment, users should first ensure that the tool or equipment falls under the definition of commercial tools and equipment as discussed above. (All commercial tools and equipment in the AMMs are identified by Boeing internal reference numbers beginning with the prefix "COM," which stands for commercial. These reference numbers are listed in a table in the introduction section of the AMMs and throughout the tools and equipment sections of the AMM procedures.) Commercial tools and equipment listed in AMMs include:

- Multimeters, ammeters, megohmmeters, bonding meters, and Inductance Capacitance Resistance (i.e., LCR) meters.
- Decade resistance boxes, gauges, borescopes, and frequency counters.
- Aeronautical Radio Incorporated (ARINC) 429/629 data loaders and ARINC 429/629 data bus analyzers.
- Tools (including crimping and swaging tools).
- Jacks (including tripod, axle, and hydraulic).

The key criterion for equivalency between commercial tools and equipment is their function: an equivalent commercial tool or equipment must perform the same function and deliver the same result in a given AMM task procedure as the recommended commercial tool or equipment. To establish equivalency for commercial tools and equipment, locate and identify the airplane test or measurement specifications in the AMM procedures and compare them to the specifications of the proposed equivalent tool or equipment. If the specifications of the tool or equipment meet or exceed the specifications of all applicable AMM procedures, they are considered to be equivalent to the commercial tool or equipment recommended in the AMM procedure.

Do not use direct comparisons of commercial tools and equipment specifications as a method for determining equivalency. Although commercial tools and equipment with identical specifications would be considered equivalent, they are not *required* to have identical specifications to be equivalent. For example, it is often possible for two different digital multimeters made by different vendors and having different specifications to satisfy the measurement or test requirements of a given AMM procedure. In this case, both multimeters meet the equivalency criterion for the specific AMM procedure without being identical in their specifications, looks, and dimensions. The equivalent commercial tool or equipment specifications must only satisfy the measurement or test requirements in the AMM procedures. This is how functional equivalency is established between the commercial tools and equipment in question and those recommended in the AMM procedures.

In addition, commercial tools and equipment are not required to have the same form (e.g., shape, appearance, weight, and dimensions) to be equivalent, nor must they be designed to specifically fit or interface with an airplane or its components. They can use adapters to interface with various products.

Some commercial tools and equipment, such as bonding meters, must be approved explosion proof and intrinsically safe to be operated around fueled airplanes. This special requirement is specified along with the equipment part numbers in the AMM equipment list section. Such special requirements are also highlighted in the vendor catalog of the commercial tools and equipment. To establish equivalency, any such additional special requirements must be consistently applied to the potentially equivalent tools and equipment, in addition to comparing the tools and equipment specification with the AMM procedure specifications.

Equivalent commercial tools and equipment in the AMM are identified and designated with a single generic grouping reference number, beginning with the prefix "COM" followed by sequence numbers, such as COM-591 (see fig. 1).

ESTABLISHING EQUIVALENCY FOR SPECIAL TOOLS AND EQUIPMENT

Special tools and equipment are designed solely to support specific airplane component or system maintenance task procedure(s) as specified in AMMs and CMMs. They have little or no commercial use except to support the specific product maintenance for which they are designed. Normally, there is no equivalent commercial tool or equipment available to perform the related specific maintenance functions. They are primarily designed by the OEM of the airplane or component on which they are used, not by third-party vendors. Examples include all Boeing-designed special tools and equipment used in Boeing AMMs and CMMs.

Equivalency for special tools and equipment is established by comparing the specifications of the recommended and equivalent tools or equipment. This goes beyond the functional equivalency criterion used for commercial tools and equipment. Potentially equivalent special tools and equipment must be proved to be equivalent in form and fit (i.e., interface) as well as function to those recommended in the applicable AMM procedures. This may include equivalency in accuracies, tolerances, safety (i.e., proof load), physical interface or appearance, and functional specifications.

In order to use equivalent special tools and equipment in place of those recommended in the AMM, equivalency must be established by following the detailed guidance provided in the ARINC Report 668, "Guidance for Tool and Test Equipment (TTE) Equivalency." This report is available from Aeronautical Radio, Inc., 2551 Riva Road Annapolis, MD 21401. This extremely detailed and extensive process is beyond the scope of this article. However, the importance of using the guide for this purpose cannot be overstated.

Figure 1: Example of commercial tools and equipment equivalency

In this table, the three equivalent bonding meters are represented by a single Boeing internal reference (i.e., grouping) number of COM-1550. In addition to designating equivalency, the COM prefix also indicates that the tools and equipment involved are commercial. Operators may procure and use any one of the three equivalent bonding meters in the specified AMM procedures. Any other potential equivalent bonding meters not listed in the AMM but available elsewhere can also be used instead of the three listed in this table. It is not possible to list all available equivalent bonding meters in the AMM. Only representative part numbers are listed to provide some sources for procurement. This approach can be applied to any equivalent commercial tools and equipment not listed in the AMM. Do not refer to the COM reference numbers, such as COM-1550 and COM-591, during procurement or technical questions. Instead, refer to the corresponding unique vendor part numbers of the tools and equipment as cross-referenced in the above table. COM numbers are only for Boeing internal use and are not known by commercial tool and equipment vendors.

Reference Number	Description	Part Numbers	Supplier Cage Code	Airplane Effectivity
COM-591	Multimeter — digital, handheld (volt dc/ac, ampere, and resistance measurements or equivalent)	189	89536	777-ALL
		287		
		87V		
		FLUKE 117		
		MODEL 27		
		Opt: 187		
COM-1550	Meter — bonding (approved explosion proof and intrinsically safe)	C15292 (MODEL T477W)	01014	777-ALL
		M1	3AD17	
		M1B		

Note: *Part numbers and grouping in this table are examples only. Refer to AMM for current and accurate part number and grouping information.*

Figure 2: Example of special tools and equipment equivalency

A single SPL reference number for different tool part numbers indicates that the related special tools are equivalent for the applicable specific airplane series AMM procedures. Special tools with the option (Opt) prefix in their part numbers are equivalent to the modified (new) versions of the old tool for use on the same airplane model series as the old tool.

Reference Number	Description	Part Numbers	Supplier Cage Code	Airplane Effectivity
SPL-1450	Adapter — Hoist, Air-Conditioning Pack	J21001-79	81205	777-ALL
		J21001-80		
		Opt: J21001-72		
		Opt: J21001-73		
SPL-1561	Jack — Hydraulic	B67554	36251	
		Opt: W93720	28047	
		HW93720	81205	
		J20009-38		
		Opt: J20009-78		

Note: *Part numbers and grouping in this table are examples only. Refer to AMM for current and accurate part number and grouping information.*

Boeing highly discourages substituting the special tools and equipment listed in the AMM with other equivalent tools or equipment for several reasons. Proving and achieving equivalency requires resources, engineering, and quality certification efforts that may exceed the price of the special tool or equipment. Additionally, configuration updates must be maintained on the equivalent tool or equipment with respect to the frequent revisions of the recommended special tool and equipment design drawings. Regulators such as the FAA are very strict regarding deviations from the use of special tools and equipment recommended in the AMM and may require documented proof of equivalency. After all of the time, money, and resources used to design or procure an equivalent special tool or equipment, it is possible that the local regulatory authority may not accept the equivalent tool or equipment. Some local regulatory authorities can be very restrictive and may not allow equivalency for special tools or equipment.

All special tools and equipment in the AMM are identified and designated with generic grouping reference numbers, beginning with the prefix "SPL" (for "special") followed by sequence numbers, such as SPL-1450 (see fig. 2).

SUPERSEDED AND REPLACED TOOLS AND EQUIPMENT

Because of confusion among some operators about the role of superseded and replaced tools in Boeing special tools and equipment equivalency, the following examples are provided to clarify the meaning of these terms.

Superseded tools

- If a special tool (for example, part number J24002-56) is superseded by a tool with a newer part number (J24002-73), the original tool (J24002 56) is invalid for use unless it is upgraded to the new design. A tool change bulletin is always issued by Boeing to advise customers to stop using superseded tools until the tool has been upgraded with the latest modifications. In this example, J24002 56 must either be substituted by the superseding new tool, J24002-73, or reworked to incorporate the design modifications that resulted in the new J24002-73 tool configuration, as shown in the latest design drawing of the J24002 tool on the MyBoeingFleet.com Web portal. Rework instructions are typically provided in the design drawings. In this particular case, the new design updated the J24002-56 tool to reflect airplane engineering changes.
- In general, superseded tool corrections resolve potential personnel safety issues and concerns about airplane or tool damages or proper fit and function of the tool. For this reason, superseded tool correction modifications are mandatory. Superseded and superseding tools are not considered to be equivalent.

Replaced tools

- If the tool design modifications do not involve personnel or equipment safety, proper fit, or function, the unmodified (old) tool is considered replaced by the modified (new) tool. However, the replaced tool can still be used, as is, within its usage effectivity on the same airplane series. For future procurement, only the new tool is recommended. The new tool modifications typically involve product improvement changes without affecting the configuration of the tool function and interface for the same airplane series usage as the old tool. For this reason, replaced tools are considered equivalent and optional (or "Opt") to the modified new tool within the usage effectivity of the same airplane series as the old tools.
- When the new tool adds new airplane series usage effectivity, the replaced old tool cannot be used on the newly added airplane series and, as a result, is not equivalent to the new tool for use on the newly added airplane series. In this case, the new tool is considered backward compatible for use on the old tool's airplane model series. But the old tool is not forward compatible for use on the new airplane series added to the new tool. In this situation, the replaced tool is not equivalent to the new tool.

Owners of Boeing special tools and equipment can rework their superseded and replaced tools into the configuration of the latest tool design drawings by simply comparing and matching the old tool wiring and mechanical assemblies to the modifications shown in the latest tool design drawings. Owners may have this rework done in-house, by a local vendor for the sole use of the operator, or by contacting the original tool manufacturer. Special tools and equipment modified and upgraded in this manner are considered the original tool or equipment, instead of equivalent tool or equipment. In this case, the use of the ARINC Report 668 to demonstrate equivalency is not required. However, if an operator or maintenance and repair organization alters tools or equipment designed by Boeing without coordinating with Boeing, or if they replace them with other tools or equipment designed by different manufacturers, they must establish and maintain equivalency by following the ARINC Report 668 guide.

Boeing does not manufacture special tools and equipment for sale, lease, or loan or perform physical tool modifications. Manufacturers licensed by Boeing are responsible for these tasks. Additionally, customer airlines are authorized by Boeing to fabricate special tools and equipment in-house or by local manufacturers under the condition that the tools and equipment are exclusively used by the customer airlines for maintenance of Boeing airplanes directly purchased from Boeing or leased through Boeing.

SUMMARY

Boeing and the FAA allow the use of equivalent tools and equipment in AMMs and CMMs. For commercial tools or equipment, equivalency is determined relative to the airplane test or measurement result specification stated in the respective AMM procedures. For special tools and equipment, establishing equivalency is a much more detailed process that involves ensuring that the proposed tool or equipment is equivalent to the recommended tool or equipment in form, fit, and function.

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