



MANUFACTURER'S RESPONSIBILITIES FOR INSPECTION OF AUTOMOTIVE FIRE APPARATUS

RESPONSIBILITY OF UL:

UL will supply a representative to witness all tests required under NFPA 1901. In the case of aerial device certification, NFPA 1901 references NFPA 1911; all applicable tests required in NFPA 1911 will be included in this case. The UL representative shall only certify test results for a system when all components of that system pass all tests outlined in the current edition of NFPA 1901.

There shall be no conditional, temporary, or partial certification of test results.

RESPONSIBILITY OF THE MANUFACTURER:

General Requirements for all Automotive Fire Apparatus:

- ❑ Arrange with a UL representative for a mutually satisfactory date on which to conduct the certification testing. These arrangements should be made as far in advance as the circumstances will permit so that the UL representative can be available at the desired time.
- ❑ The automotive fire apparatus to be tested shall be ready for test upon the arrival of the UL Representative. Loss of productive time due to changes in test dates or other delays will be charged to the manufacturer.
- ❑ Provide the appropriate documents detailed below under "Data Required Of Manufacturer" prior to the start of the certification testing.
- ❑ Complete a "Manufacturer's Record of Automotive Fire Apparatus Construction Details" (UL form or manufacturer's equivalent form) and give to the UL Representative before the start of the certification testing. For aerial device tests, this shall include all the technical information for inspections as required by NFPA 1911, "Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus," current edition.
- ❑ Supply the necessary test equipment and personnel. The manufacturer shall make arrangements for the UL representative to have free access to the test area, during normal factory operating hours.
- ❑ Manufacturer personnel shall be available at the test site to expeditiously set up each test condition and to operate the automotive fire apparatus.
- ❑ Calibrate the various items of test equipment at the frequency detailed under "Calibration of Test Equipment."

Additional Requirements for Pumping Tests:

- ❑ Tests shall be performed when ambient air temperature* (of the test site) is 0°F to 110°F, water temperature is 35°F to 90°F, and Barometric pressure is a minimum of 29 in. Hg. (corrected to sea level).

Note: It is up to the discretion of the manufacturer to proceed with the tests if the temperature requirements cannot be met on the day of testing. If it is necessary to perform the test outside the air or water temperature ranges noted, and the pump passes the certification test, the test results shall be acceptable.

- ❑ The test site shall be adjacent to a supply of clear water at least 4 ft (1.2 m) deep and close enough to allow the suction strainer to be submerged at least 2 ft (0.6 m) below the surface of the water when connected to the pump by 20 ft (6 m) of suction hose.
- ❑ If a pond or other open body of water is used it must be clean and sufficiently free of debris in order to avoid clogging the strainer. If underground tanks are used, they should provide a sufficient volume of water in order to reduce the increase of water temperature during testing. They should also be properly baffled in order to reduce the aeration of the water.

Note - All tests requiring the drafting of water shall have a minimum distance of 3 ft (1 m) from the surface of the water source to the center of the pump intake.

- ❑ An enclosed test building may be used provided that sufficient precautions are taken to prevent the accumulation of carbon monoxide. Foremost among these are proper ducting of exhaust from the engine and the installation of a CO detector.
- ❑ All engine driven accessories shall be properly installed and fully functioning at the time of certification testing.
- ❑ If the vehicle is equipped with a fixed power source it shall be properly installed and fully functioning at the time of certification testing.
- ❑ All structural enclosures such as floorboards, gratings, grills, heat shields, panels, etc. not furnished with a means for opening them in service shall be kept in place during the tests. Tilt cabs shall remain in the road travel position during the certification tests. Hinged hoods, covers, or access panels, which might be manually opened in service, may be opened during the certification pumping tests.

- ❑ It is the responsibility of the manufacturer to ensure that all nozzles are securely fastened to a stationary object. All discharge lines shall be secured with rope, straps, hose tools, or equivalent, as a safety measure.

Additional Requirements for Fixed Power Source Tests:

- ❑ Regardless of the type of automotive fire apparatus equipped with a fixed power source, and regardless of where it draws its power from (i.e. vehicle's engine or its own power source), the fixed power source must be subjected to the certification tests outlined in NFPA 1901, current Edition.

Additional Requirements for Aerial Device Tests:

- ❑ The manufacturer of an aerial device shall provide a flat level surface of sufficient size to accommodate the full length of the apparatus while performing the 1.5 times rated capacity stability test.
- ❑ The manufacturer of an aerial device shall provide a five-degree slope test pad of sufficient size to accommodate the apparatus with the full length of the apparatus parallel to the slope. The five-degree slope should also be of sufficient span to accommodate the fully extended stabilizers on the slope while performing the 1-1/3 times rated capacity stability test.
- ❑ The test site (other than the five-degree slope test pad) should be flat and provide sufficient room to fully extend the aerial device at 0° elevation. This area should also allow either full rotation of the aerial or at least 180° at maximum horizontal reach.
- ❑ The test weights shall be suspended from the tip of the aerial ladder or from the platform of the elevating platform when it is in the position of least stability.
- ❑ An onboard fire pump, or an external water source, will be required for testing if the aerial device is equipped with a prepped waterway.
- ❑ Sufficient length of test hose that includes a flow line and a pressure line should be provided in order to monitor flow and nozzle pressure at the tip of the aerial device while standing on the ground. Electronic measurement devices may be used in lieu of the connection hoses.

DATA REQUIRED OF MANUFACTURER:

The manufacturer shall provide the following data to the UL Representative prior to the start of fire pump and industrial supply pump certification testing:

- ❑ Complete and accurate Manufacturer's Record of Automotive Fire Apparatus Construction Details form
- ❑ Barometric pressure (inches of Hg)
- ❑ Ambient temperature (°F)

Note - It is recommended that a thermometer and mercury barometer be provided to measure the ambient conditions at the test site on the day of testing. However, the local weather station, if nearby, may be used in lieu of the test equipment to determine this information.

- ❑ Elevation of test site (feet above sea level).
- ❑ Diameter (in.) and length (ft.) of hard suction hose(s) used.
- ❑ Height of pump centerline above water source (nearest foot).
- ❑ Temperature of water source (°F).
- ❑ Minimum continuous and total connected loads for the low voltage system.

Note: The preceding information is required in order to conduct the Alternator Performance Test at Full Load in conjunction with the 2-hour rated capacity pumping test. Although this test is part of the Low Voltage System Certification tests, the Standard requires that this test be conducted as part of the certification of the fire pump.

- ❑ Generator nameplate rating or continuous rated wattage of the line voltage generator (if applicable).

Note: This information is required in order to conduct the Line Voltage Continuous Operation Test in conjunction with the 2-hour rated capacity pumping test.

The manufacturer shall provide the following data to the UL Representative prior to the start of fixed power source certification testing:

- ❑ Complete and accurate Manufacturer's Record of Automotive Fire Apparatus Construction Details form
- ❑ Barometric pressure (inches of Hg)
- ❑ Ambient temperature (°F)

Note - It is recommended that a thermometer and mercury barometer be provided to measure the ambient conditions at the test site on the day of testing. However, the local weather station, if nearby, may be used in lieu of the test equipment to determine this information.

- ❑ Elevation of test site (feet above sea level).
- ❑ Generator nameplate rating or continuous rated wattage of the line voltage generator

The manufacturer shall provide the following to the UL Representative prior to the start of aerial certification testing:

- ❑ Complete and accurate Manufacturer's Record of Automotive Fire Apparatus Construction Details form, including all technical information for inspections to comply with NFPA 1911, current edition.
- ❑ If the manufacturer produces an apparatus with an aerial device that has multiple configurations, as an option, calculations may be submitted to UL Fire Equipment Services, which show the "worst case" overturning moment configuration. Stability testing, both on level ground and on a 5° slope, is required only on the "worst case" configuration rather than on all multiple configurations.
- ❑ Such "worst case" configuration calculations must be submitted at least 1 week prior the scheduled test date for the apparatus in order to allow time for the appropriate review.

- ❑ Systems that allow the aerial device to be operated over the side with the stabilizers not fully deployed shall be tested in three positions:
 - (1) Stabilizers at the minimum extension as defined by the manufacturer
 - (2) Stabilizers extended to midpoint of the minimum extension and full extension
 - (3) Stabilizers fully deployed
- ❑ Maximum deflection allowance for the horizontal load (side pull) test.

TEST EQUIPMENT:

The following test equipment is to be furnished by the manufacturer in order to conduct the required tests and shall be available at the test site:

- ❑ Amp Clamp - Used to measure amperage for low or line voltage electrical tests.
- ❑ Discharge and Pitot Tube Pressure Gauges - Used for pumping tests.
- ❑ Pressure Gauges for Aerial Device Water System Testing - The manufacturer is encouraged to provide pressure gauges that read in increments of no more than 2 psi for monitoring purposes. Gauges reading to greater increments (ex. 5 psi) do not provide adequate accuracy.
- ❑ Connection Hoses for Aerial Device Water system Testing - Sufficient length of test hose that includes a flow line and a pressure line should be provided in order to monitor flow and nozzle pressure at the tip of the aerial device while standing on the ground. Electronic measuring device is permissible based on approval by the Fire Equipment Services office.
- ❑ Nozzles and Pitot Tube or Other Equivalent Flow Measuring Equipment – Used for pumping tests and aerial device waterway system tests. The nozzles shall be smooth bore and the inside diameter shall be from 3/4 to 2-1/2 inches. However, pumps over 1750 gpm may require larger nozzles. If nozzles and a pitot tube and pressure gauge are used to measure the flow rate in the water system, the orifice of the pitot tube shall be placed in the center of the stream.
- ❑ Weights - Used to load the ladder or platform during stability and horizontal load tests.
- ❑ Tank - Used to check the accuracy of the foam concentrate tank or the water tank.
- ❑ Deadweight Gauge Tester or Master Gauge - Used to check calibration of the test gauges or a master gauge, which are certified by the manufacturer as meeting the requirements for Grade 3A or 4A gauges as defined in ASME B40.100.
- ❑ Dynamometer (or Load Cell) – May be used to measure the weight applied to the ladder or boom for the horizontal load test.

- ❑ Engine Speed Measuring Equipment - Used to determine engine and pump speeds. This may be a nonadjustable tachometer supplied from the engine or transmission electronics, a digital hand held tachometer, a revolution counter on a checking shaft outlet and stopwatch, or other engine speed-measuring means that is accurate to within ± 50 rpm of actual speed.
- ❑ Load Bank – Used to apply continuous rated load to the electrical system of the apparatus.
- ❑ Mercury Manometer or Vacuum Gauge - Used to measure suction conditions. The mercury manometer is required to calibrate test vacuum gauges.
- ❑ Multimeter - Used to measures amperage, frequency, and voltage for low or line voltage electrical tests.
- ❑ Necessary Discharge Hose - Used for hose layout.
- ❑ Suction Hose and Strainer – Used to draft water from the water source into the fire pump.

Note – The appropriate suction hose size, number of suction hose, and lift for fire pumps according to NFPA 1901, current edition requirements should be used for the testing.

- ❑ Thermometer or Other Temperature Recording Devices - Used for measuring water source temperature, ambient temperature and various operating temperatures of the automotive fire apparatus.
- ❑ Voltmeter - Used to measure ac or dc voltage for low voltage electrical tests.

If the manufacturer desires to provide special or additional equipment, its suitability will be investigated by UL Fire Equipment Services staff. If it is found to be substantially equivalent to the equipment specified in this Procedure, its use will be permitted with the understanding that, in the event of question or disagreement as to the results obtained with such special equipment, reference tests shall be conducted (at one of the UL Offices, if necessary) with the equipment as specified herein.

CALIBRATION OF TEST EQUIPMENT:

All inspection, measuring and test equipment (IMTE) provided by the manufacturer shall be calibrated against a Standard traceable to the National Institute of Standards and Technology (NIST) as outlined below.

Weight scales used for vehicle weights can be calibrated and Certified by the US DOT, Canada DOT, or by the state or county. These scales should be able to be identified as such by evidence of a sticker on the scale or a Certificate. In these cases, Certificates may or may not be available. If available, the Calibration Certificate elements noted below for ISO-17025 Calibration providers or Non-ISO 17025 Calibration providers are not required.

Customers must ensure that the IMTE selected for each measurement is capable of meeting measurement tolerances required by the standard

When inspection, measuring and test equipment with low precision capability, such as tape measures, steel rules, protractors, radius gauges, etc., are used customers have one of the two options below in place:

Option 1:

At a minimum, customers will have an appropriate accuracy statement from the manufacturer of a measuring device to certify or attest to a device's stated precision and accuracy capabilities. This information is important in demonstrating that equipment accuracy is capable of meeting required measurement tolerances. In addition, tape measures and similar low-precision inspection, measuring and test equipment shall undergo in-service checks. During an in-service check, the measuring device is validated prior to use to ensure it is capable of achieving the required measurement accuracy. Customers must specify the criteria, frequency and methods used to conduct these in-service checks, as well as the process for handling non-conformances.

Option 2:

Customers may choose to include tape measures and similar low-precision IMTE in their calibration system. This equipment will be calibrated or validated at regularly defined intervals, according to requirements defined in this document.

FREQUENCY OF CALIBRATION:

All IMTE utilized for testing shall be calibrated at least annually for their intended function and use unless noted otherwise in this document.

The inside diameter of the nozzles used for fire pump and aerial device water system flow tests shall be checked for damage.

The manufacturer shall provide a master gauge or a deadweight gauge tester for calibration of test gauges. The weights intended for use with the deadweight tester shall be checked annually against other weights or on a weighing device (scale), which has been calibrated in accordance with this document.

The test gauges shall be calibrated in the month preceding the test, or on a more frequent basis as deemed necessary by the manufacturer. For example, a pump test conducted on April 30 could require the gauges being calibrated as early as March first. If marginal test results are obtained, the test gauges shall be checked to verify accuracy with the deadweight gauge tester or master gauge. The manufacturer shall maintain gauge calibration sheets for use during these tests.

The weights used to load the aerial ladder or platform shall be calibrated once every two years using a scale, dynamometer or load cell that has been calibrated in accordance with this document.

MEASUREMENT STANDARDS:

Measurement standards used in the calibration of IMTE must also be calibrated and are to be used for calibration purposes only.

Weights and gauge blocks standards must be calibrated every **three years** or whenever the measurement standard has been subject to some form of abuse that may affect the measurement standard's fitness for use.

Other measurement standards, e.g., voltmeters, master gauges used to calibrate other gauges, etc., shall be calibrated **annually** or whenever the standard has been subject to some form of abuse that may affect the fitness of a standard.

Standards, including any related software, shall be protected from damage or deterioration and must be maintained according to the original equipment manufacturer's recommendations.

CALIBRATION IDENTIFICATION AND STATUS:

All IMTE being calibrated – as well as measurement standards used for calibrations – shall include evidence of calibration status, e.g., a label or other marking indicating the next calibration due date. If size limitations or usage environment prevents the use of a calibration label, alternate identification methods are acceptable, providing that the identification and calibration status can be readily determined. Each piece of calibrated IMTE must have a unique, unambiguous identifier such as manufacturer name and model number, serial number, identification number, asset number, etc.

CALIBRATION CERTIFICATES: ISO/IEC 17025 ACCREDITED CALIBRATION SERVICE PROVIDERS:

UL recommends using calibration service providers that are accredited to ISO/IEC 17025 through authorized signatories of an international accreditation body. Using an accredited calibration service provider expedites review of calibration records during a UL inspection visit: the calibration information that UL field representatives need to verify is limited due to calibrations being performed in accordance with a calibration service provider's accreditation requirements.

UL field representatives will periodically evaluate calibration records. Each calibration certificate from an accredited calibration service provider shall include at least the following information:

- ❑ Unambiguous identification of the calibrated item. Some examples are manufacturer name and model number, serial number, identification number, etc.
- ❑ Date(s) calibration was performed to determine that the IMTE has been calibrated within required frequency
- ❑ A valid accreditation body endorsement for the calibration performed.

UL field representatives will confirm that the inspection, measuring and testing equipment is within the defined calibration period. Additionally, UL field representatives will review calibration data to verify that inspection, measuring and test equipment has been calibrated for the measurements for which it will be used.

If the above information is unavailable or cannot be verified, UL representatives will evaluate compliance with the requirements specified for non-ISO/IEC 17025 accredited calibration service providers or calibrations performed in-house.

CALIBRATION CERTIFICATES: NON-ISO/IEC 17025 ACCREDITED CALIBRATION SERVICE PROVIDERS OR CALIBRATIONS PERFORMED IN-HOUSE:

Certificates for calibrations performed by non-ISO/IEC 17025 accredited calibration service providers must include the following information:

1. Title, e.g., Calibration Certificate, Calibration Report, etc., or equivalent
2. Name and address of the calibration service provider
3. Location where the calibration was conducted, if different from the service provider address
4. Unambiguous identification of the specific piece of IMTE calibrated such as manufacturer name and model number, serial number, identification number, etc.
5. Unique identifier of the calibration record such as a serial number and the capability to match it to a specific piece of calibrated IMTE
6. Description of the condition of the item calibrated, i.e., the as-received condition, e.g., out of tolerance, in tolerance, damaged, etc.
7. Date(s) calibration was performed
8. Quantitative measured value(s) of the calibration results **when** out of calibration conditions are identified, i.e., when stated calibration tolerances have been exceeded
9. For IMTE capable of measuring multiple parameters, calibration records must include an attestation or statement confirming that the equipment's as found conditions and calibration results encompass all parameters for which it is being used. Examples of this type of equipment include digital multi-meters measuring voltage, amperage and resistance as well as 6" calipers measuring ID, OD and depth attributes
10. The name(s), functions(s) and signature(s) or equivalent identification of person(s) authorizing the calibration certificate. Note: Electronic signature/authorization is acceptable
11. Evidence that the measurements are traceable (to national or international standards). Note:
 - There should be **no** alteration to the calibration data/results without evidence of appropriate authorization, e.g., names, titles, dates, nature of alteration, etc.
 - When the certificate or report contains results of calibrations performed by subcontractors, these results shall be clearly identified

For calibrations performed in-house by customers, calibration results may be reported in a simplified manner. However, any information outlined in this section that is not included on the calibration certificate or report shall be *readily available* for review at the manufacturing location.

OUT OF CALIBRATION CONDITIONS:

When IMTE (before any adjustments are made) is found to be outside of required calibration tolerances, i.e., OEM accuracy specification, customers shall perform an analysis to determine if the out of calibration condition could have adversely affected inspection results. Similarly, this same analysis must be performed if equipment is determined to be non-operational, if it is discovered to be defective or if other conditions exist that would raise questions about the validity of previous measurements/test results.

The equipment in question must be removed from service by segregating or prominently labeling it. The customers shall:

- ❑ Evaluate **and** document the effects of the equipment on previous inspections or tests
- ❑ Evaluate if the condition of the equipment could have significantly affected previous inspections or test results and take corrective action, as appropriate. Customers **must** take action to correct product that does not comply with UL requirements

Corrective actions taken by customers should include a robust root cause analysis, containment actions, and long-term corrective actions to ensure that any nonconformance is not likely to recur.

TRACEABILITY:

All calibrated IMTE is to be calibrated using measurement standards traceable to a national metrological institute, e.g., National Institute of Standards and Technology in the United States or an officially recognized national metrology institute participating in Bureau International des Poids et Mesures (BIPM), either directly or through a regional group.

Note: Citation of a NIST test number, certification of the calibration lab to ISO 9001, or a simple statement of traceability to NIST or other international body by the calibration service provider are **not** acceptable as evidence of traceability. The calibration certificate and related records must provide evidence that a calibration service provider utilized calibration standards that are traceable to national standards.

CERTIFICATES AND OTHER RECORDS:

Customers must maintain records of calibration for at least one year. For equipment calibrated less frequently, e.g., every three years, calibration records shall be maintained at least for the current calibration cycle.

The content of the records must comply with the requirements defined in this document.

Records of analysis of out-of-calibration conditions shall also be maintained. The duration of records retention should be defined and documented by customers. UL also recommends that customers maintain records of in-service checks for low-precision equipment such as tape measures.