



Fire Department • City of New York
Bureau of Fire Prevention
9 MetroTech Center
Brooklyn, NY 11201

TM-ARCS-2 - Supplement #1

ARC System Visual and Functional Testing Procedures

1. General

Functional testing and visual inspection of the ARC System must be conducted in compliance with this document.

A log must be maintained on the premises in which all testing and inspection conducted on the ARC System is documented.

FDNY reserves the right at any time to inspect the logs and verify that the system is maintained in accordance with NYC Fire Code and NYC Fire Department Rules.

Testing shall be performed only on designated FDNY channels and during dates/times that have been previously communicated and acknowledged by FDNY by emailing request to ARCradios@fdny.nyc.gov. Channels specified for use on the ARC System are live operational channels and could be needed for FDNY operations at any time.

When transmissions on ARC System channels are required, ARC System professionals are asked to exercise caution. If an ARC System professional hears FDNY operational traffic on an ARC System channel, all testing of the ARC System requiring transmissions must be discontinued immediately.

2. Testing Procedures

2.1 Dedicated Radio Console

2.1.1 Console Testing - At a minimum, radio control console equipment must be tested to verify correct input and output signals and associated audio levels, Emergency Alert and ID information, display information (such as LEDs or alpha numeric display), and overall fitness of the primary and auxiliary power supply.

2.1.2 Radio Console - Verify location and condition.

2.1.3 Lamps and LEDs - Lamps and LEDs must be illuminated. Record result (i.e. functional, non-functional with LED description).

2.1.4 Transmission and Audio Level Testing

The following testing procedure must be carried out for each of the radio channels within the ARC System:

- (1) Select a radio channel for testing. Lift the handset of the radio desk-set and depress the Push-to-Talk switch (PTT). Verify on portable radio that the

base-station/repeater is transmitting. Provide a five count and determine if transmit audio can be heard on the portable radio, determine the Delivered Audio Quality (DAQ) and record level.

- (2) Connect an audio meter to the line output of the radio desk-set. While transmitting, measure the audio level from the radio desk-set (console) Record audio level (in dB).
- (3) Depress the PTT on the portable radio. Verify on the radio desk-set that the transmitted audio is heard in the handset, determine the DAQ and record level.
- (4) In the case of a simplex-type system, verify that unit ID is displayed on the radio desk-set.
- (5) Depress the emergency button on the portable radio:
 - a. In the case of a simplex-type system, verify that the emergency alert and corresponding unit ID is received and displayed on the radio desk-set.
 - b. In the case of a repeater-type system, verify on a second portable radio that the emergency alert and corresponding unit ID is received and displayed.
- (6) Place the handset back into its resting position (on-hook or hung up). Depress the PTT on the portable radio. Check that audio is present on the speaker of the radio desk-set.
- (7) Connect audio meter to the line input of the radio desk-set. Measure the received audio from the base-station/repeater. Record audio level (in dB).
- (8) Perform a lamp/LED test on all components of the console where applicable.
- (9) Repeat steps 1 – 8 for all radio channels associated with the ARC System.

2.2 Base-Station or Repeater Testing

2.2.1 Wireless Signals - Transmit and measure and record the following transmit functions:

- (1) Power output;
- (2) Voltage standing wave ratio (VSWR);
- (3) Channel frequency;
- (4) Transmit and PL deviation;
- (5) With Continuous Tone Coded Squelch Signal (CTCSS) [where applicable];

- (6) Without Continuous Tone Coded Squelch Signal (CTCSS) [where applicable];
- (7) DC voltage under load;
- (8) For repeater-type ARC System, repeat for all radio channels;
- (9) Receive, measure and record the following receive functions:
 - a. Receiver sensitivity at 12 dB SINAD (Signal + Noise And Distortion);
 - b. Squelch release (μ volts);
 - c. Audio output (to console) in dB under 1 kHz deviation 1 μ volt on frequency signal injected into receiver;
 - d. For repeater-type ARC System, repeat for all radio channels.

2.2.2 ID and Emergency Alert Pass-Through Testing - In the case of repeater deployment for ARC System it is necessary to test the pass-through of the Emergency Alert and Radio ID, and record the results:

- (1) Radio ID:
 - a. Place two portable radios designated Portable "A" and Portable "B" on the same repeater channel.
 - b. PTT on portable radio A and verify that the proper ID is displayed on radio "B".
 - c. Reverse the process and PTT on radio "B" and verify that the proper ID is displayed on radio "A".
- (2) Emergency Alert:
 - a. Depress the Emergency Alert button on radio "A" and verify that the Emergency Alert activated radio "B".
 - b. Clear the Emergency Alert signal in all portable radios.
 - c. Depress the Emergency Alert button on Radio "B" and verify that the Emergency Alert activated radio "A". Record Results.
- (3) Repeat for all radio channels on repeaters.

2.2.3 System performance test for repeater systems - The test is to simultaneously transmit on the console to the portable on one repeater channel, while transmitting on a second portable radio to the console on the other repeater channel.

- (1) System must be operated with portable radios handsets simultaneously.
- (2) Voice quality and clarity must be verified.
- (3) As part of the system performance testing, audio testing from the console to the portable radio and audio testing from the portable radio to the console is necessary. The results must be recorded in DAQ and the reverse test should be performed.

2.3 Base-station/Repeater Failure Monitoring Testing

Functional testing for the base-station/repeater consists of the following tests. Record all results:

2.3.1 Low Transmit Power

- (1) Simulate low transmit power from the base-station/repeater
- (2) Key the base-station/repeater
- (3) Verify the low transmit power alarm is activated

2.3.2 Over Temperature

- (1) Simulate over temperature at the base-station/repeater (procedure dependent on manufacturer)
- (2) Verify the over temperature alarm is activated

2.3.3 High VSWR

- (1) Un-terminate the antenna from the base-station/repeater
- (2) Key the base-station/repeater
- (3) Verify that the high VSWR alarm is activated

2.3.4 Loss of primary power source

- (1) Disconnect AC power or other primary power source on the base-station/repeater
- (2) Verify that the AC power or primary power source alarm has activated

2.3.5 Low Battery Capacity

- (1) Disconnect battery from base-station/repeater
- (2) Simulate a low battery capacity condition
- (3) Verify that the low battery capacity alarm has activated

2.3.6 Antenna Failure (where applicable)

- (1) Simulate an antenna failure within the system
- (2) Verify the antenna failure alarm has activated

2.3.7 Signal Amplification (where applicable)

- (1) Simulate a signal amplification failure
- (2) Verify the signal amplification alarm has activated

2.3.8 Tamper Switch

- (1) Secure the base-station/repeater cabinet door (or other access panel)
- (2) Verify that no tamper switch alarm is active
- (3) Open the base-station/repeater cabinet door (or other access panel)
- (4) Verify that the tamper switch alarm is active

2.4 Power Supplies Primary (Power) Supply Testing

- 2.4.1 Primary Power - All primary (main) power supplies must be disconnected, and the occurrence of required trouble indication for loss of primary power must be verified.

- a. The system's standby and alarm current demand must be measured or verified, and, using manufacturer's data, the ability of batteries to meet standby and alarm requirements shall be verified.
- b. The system must be operated for a minimum of 15 minutes. Primary (main) power supply must be reconnected at end of test.

2.4.2 Secondary (Standby) Power Supply Testing

- a. All secondary (standby) power must be disconnected and tested under maximum load, including all active components requiring simultaneous operation.
- b. All secondary (standby) power must be reconnected at end of test. For redundant power supplies, each power supply must be tested separately.

2.4.3 Engine-driven generator Testing

If an engine-driven generator dedicated to the system is used as a required power source, operation of the generator must be verified in accordance with NFPA 110, Standard for Emergency and Standby Power Systems, by the building owner.

2.5 Batteries – General

2.5.1 General - Batteries must be replaced in accordance with the recommendations of the equipment manufacturer or when the recharged battery voltage or current falls below the manufacturer's recommendations. Batteries must be inspected for corrosion or leakage. Tightness of connections shall be checked and ensured. If necessary, battery terminals or connections must be cleaned and coated. Electrolyte level in lead-acid batteries must be visually inspected.

2.5.2 Charger Test - Operation of battery charger must be checked in accordance with charger test for the specific type of battery.

2.5.3 Discharge Test - With the battery charger disconnected, the batteries must be load tested following the manufacturer's recommendations. The voltage level must not fall below the levels specified. Exception: An artificial load equal to the full system load connected to the battery must be permitted to be used in conducting this test.

2.5.4 Load Voltage Test - With the battery charger disconnected, the terminal voltage must be measured while supplying the maximum load required by its application. The voltage level must not fall below the levels specified for the specific type of battery. If the voltage falls below the level specified, corrective action must be taken and the batteries must be retested. (Exception: An artificial load equal to the full system load connected to the battery must be permitted to be used in conducting this test.)

2.6 Batteries – Specific

2.6.1 Primary battery load voltage test - The maximum load for a No. 6 primary battery must not be more than 2 amperes per cell. An individual (1.5 volt) cell must be replaced when a load of 1 ohm reduces the voltage below 1 volt. A 6volt assembly shall be replaced when a test load of 4 ohms reduces the voltage below 4 volts.

2.6.2 Lead Acid type

- (1) *Charger test* - With the batteries fully charged and connected to the charger, the voltage across the batteries must be measured with a voltmeter. The voltage must be 2.30 volts per cell ± 0.02 volts at 77°F (25°C) or as specified by the equipment manufacturer.
- (2) *Load voltage test* - Under load, the battery must not fall below 2.05 volts per cell.
- (3) *Specific gravity* - The specific gravity of the liquid in the pilot cell or all of the cells must be measured as required. The specific gravity must be within the range specified by the manufacturer. Although the specified specific gravity varies from manufacturer to manufacturer, a range of 1.205-1.220 is typical for regular lead-acid batteries, while 1.240-1.260 is typical for high-performance batteries. A hydrometer that shows only a pass or fail condition of the battery and does not indicate the specific gravity shall not be used, because such a reading does not give a true indication of the battery condition.

2.6.3 Nickel-cadmium type

- (1) *Charger test* - With the batteries fully charged and connected to the charger, an ampere meter shall be placed in series with the battery under charge. The charging current must be in accordance with the manufacturer's recommendations for the type of battery used. In the absence of specific information, 1/20 to 1/25 of the battery rating must be used.
- (2) *Load voltage test* - Under load, the float voltage for the entire battery shall be 1.42 volts per cell, nominal. If possible, cells must be measured individually.

2.6.4 Sealed lead-acid type

- (1) *Charger test* - With the batteries fully charged and connected to the charger, the voltage across the batteries must be measured with a voltmeter. The voltage shall be 2.30 volts per cell ± 0.02 volts at 77°C (25°C) or as specified by the equipment manufacturer.
- (2) *Load voltage test* - Under load, the battery must perform in accordance with the battery manufacturer's specifications.