



U.S. Department  
of Transportation

Federal Aviation  
Administration

# Advisory Circular

**Subject:** GUIDE SPECIFICATION  
FOR AIRCRAFT RESCUE AND FIRE  
FIGHTING VEHICLES

**Date:** DRAFT  
**Initiated by:** AAS-100

**AC No.:** 150/5220-10D  
**Change:**

**1. PURPOSE.** This advisory circular (AC) contains information, references and guidelines for a family of aircraft rescue and fire fighting (ARFF) vehicles. This AC sets the policy for federally funded vehicles that meet Title 14 Code of Federal Regulations (CFR) Part 139 Certification of Airports requirements for airport response to aircraft fire fighting.

**2. CANCELLATION.** AC 150/5220-10C, *Guide Specification for Water/Foam Aircraft Rescue and Fire Fighting Vehicles*, dated February 18, 2002, and AC 150/5220-19, *Guide Specification for Small, Dual Agent Aircraft Rescue and Firefighting Vehicles*, dated December 7, 1993, are canceled.

**3. APPLICATION.** The Federal Aviation Administration (FAA) recommends the use of National Fire Protection Association Standard (NFPA) 414, *Standard for Aircraft Rescue and Fire-Fighting Vehicles* (2007) and this publication for the preparation of ARFF vehicle specifications. For airport projects receiving Federal grant-in-aid assistance, the use of these standards is mandatory. In the event of a conflict, Title 14, CFR Part 139 takes precedence over all other documents identified in the AC. Features or design details not listed as required or optional in this document are not considered necessary unless a justification acceptable to the FAA is provided. If there are no additions, exceptions or amendments noted, then the standards of NFPA 414, are applicable.

#### **4. PRINCIPAL CHANGES.**

- a. AC 150/5220-19, *Guide Specification for Small, Dual Agent Aircraft Rescue and Fire Fighting Vehicles*, has been incorporated into AC 150/5220-10.
- b. NFPA 414 has been adopted by reference.
- c. Foam/dry chemical/clean agent simultaneous delivery systems and compressed air foam systems have been incorporated.
- d. Remanufactured ARFF Vehicle Standards are incorporated.
- e. Clothing and tools have been removed.
- f. Training devices have been incorporated.
- g. Interior Access Vehicles have been incorporated.

**5. METRIC UNITS.** To promote an orderly transition to metric units, this AC contains both English and metric dimensions. The metric conversions may not be exact metric equivalents and, until there is an official changeover to the metric system, the English dimensions will govern.

**6. COPIES OF THIS AC.** The Office of Airport Safety and Standards makes ACs available to the public through the Internet. These ACs may be found through the FAA home page ([www.faa.gov](http://www.faa.gov)). A printed copy of this and other ACs can be ordered from the U.S. Department of Transportation, Subsequent Business Office, Ardmore East Business Center, 3341 Q 75<sup>th</sup> Avenue, Landover, Maryland, 20785.

DAVID L. BENNETT  
Director of Airport Safety and Standards

## CHAPTER ONE: ADMINISTRATION

### ADDITION: 1.1

All remanufactured ARFF vehicles must meet the standards of this AC. Remanufactured ARFF vehicles must not exceed 75% of the cost of new manufactured vehicles of the same class with comparable options. Remanufacturing costs that exceed 75% of a new vehicle are not considered best value engineering for federal funding.

### ADDITION: 1.3.4

Vehicles must be painted and marked per the standards of AC 150/5210-5, *Painting, Marking, and Lighting of Vehicles Used on an Airport*.

## CHAPTER TWO: REFERENCE PUBLICATIONS

## CHAPTER THREE: DEFINITIONS

### ADDITION:

#### 1. Specific terms that apply to this AC are listed below:

- **ADDITION:** A new item has been added to the standard in the reference document.
- **EXCEPTION:** A restriction has been imposed on the standard in the reference document.
- **AMENDMENT:** Subject matter has been rewritten to modify part or all of the original text of the reference document.

#### 2. Vehicle Classes:

- Performance requirements for classes 1, 2 and 3 vehicles follow the NFPA 414 Performance requirements for  $\geq 120$  and  $\leq 528$ (gallons).
- Performance requirements for class 4 vehicles follow the NFPA 414 Performance requirements for  $\geq 528$  and  $\leq 1585$ (gallons).
- Performance requirements for class 5 vehicles follow the NFPA 414 Performance requirements for  $\geq 1585$ (gallons).

**Table 1. Usable Capacities**

Class of Vehicle	Water or Water/Foam Solution		Dry Chemical* or Approved Clean Agent Equivalent	
	Gallons (U.S.)	Liters	Pounds	Kilograms
1	120	454	500	225
2	300	1,136	500	225
3	500	1,900	500	225
4	1,500	5,685	See 14 CFR Part 139, Para 139.317	
5	3,000 and over in 500 gallon increments	11,370 and over	See 14 CFR Part 139, Para 139.317	

\*500 lbs of Sodium based dry chemical or the equivalent fire suppression capability of 450 lbs Potassium based dry chemical (i.e. Purple K Powder) or 468 lbs clean agent.

## **CHAPTER FOUR: AIRCRAFT RESCUE AND FIRE-FIGHTING VEHICLES**

14 CFR 139.317 requires at least one vehicle to be equipped with dry chemical and/or approved clean agent regardless of airport index. Approved equivalent complementary agent systems referenced in Chapter 3 are acceptable optional additions to the basic vehicle when dictated by local operational needs. However, the primary function of the vehicles described in this reference is to provide an optimum level of ARFF suppression capability for the lowest practical cost.

### **ADDITION: 4**

All moving parts requiring lubrication must have a means of providing for such lubrication. There must be no pressure lubrication fittings where their normal use would damage grease seals or other parts.

### **ADDITION: 4.2.2.3**

Class 4 and 5 vehicles must be provided with mirrors that effectively cover the blind spot area in front of the vehicle that is not within the operator's direct view.

### **ADDITION: 4.3**

The engine and transmission must operate efficiently and without detrimental effect to any drive train components when lubricated with standard, commercially available lubricants per the recommendations of the engine and transmission manufacturers.

The engine oil and transmission fluid filters must be of the full-flow type with a replaceable spin-on element.

**AMENDMENT: 4.3.3.5.1**

For class 1, 2 and 3 vehicles (refer to Table 1) sufficient capacity must be provided for a minimum of 100 miles (160 km) of highway travel at 60 MPH (97 kph) and 1 hour of pumping at the full rated discharge if the foam/water agent discharge system is engine driven.

**AMENDMENT: TABLE 4.1.1 (A) AND (B)**

Evasive Maneuver test must be conducted at 35 MPH (56 KPH).

**ADDITION: 4.6**

An off-road, high-mobility suspension system resulting in no more than 0.5 g rms acceleration at the cab seat of the vehicle when traversing an 8-inch (20 cm) diameter half round at 35 mph (56 kph) must be provided.

Anti-roll stability struts are approved.

**AMENDMENT: 4.11.5.1(3)**

Crew seats with individual retractable 3 point restraint seatbelts.

**ADDITION: 4.12**

Two towing hooks/eyes with shackles must be attached directly to the frame rails at the front and rear of the vehicle. The purchaser may request a pintle hook having a 30,000-pound (13,608 kg) capacity rating be attached to the rear frame cross member of the vehicle if its presence will not interfere with other components necessary for the required performance. The towing devices may be allowed to intrude into the 30-degree approach angle in order to provide ease of connection if needed.

**AMENDMENT: 4.12.6**

The height between steps must be less than 20 inches (51 cm). For class 1, 2, and 3 vehicles the lower steps must be no more 19 inches (49 cm) from the ground. The lowermost steps may extend below the angle of approach or departure or ground clearance limits if they are designed to swing clear. The tread of the bottom steps must be at least 8 inches (20 cm) in width and succeeding steps at least 16 inches (40 cm) in width. The full width of all steps must have at least 6 inches (15 cm) of unobstructed toe room or depth when measured from, and perpendicular to, the front edge of the weight-bearing surface of the step.

**ADDITION: 4.13**

**Foam/Dry Chemical/Clean Agent Simultaneous Delivery Systems:**

**Table 2. Foam/Dry Chemical/Clean Agent Simultaneous Delivery System**

<b>Hand Line and Turret Performance Criteria</b>	<b>Class 1, 2 &amp; 3</b>	<b>Class 4 &amp; 5</b> This technology has not been evaluated on class 4 & 5 vehicles
Dry Chemical Performance		
• Discharge rate with foam	≥8 lbs/sec	N/A
• Discharge rate with clean agent	≥6 lbs/sec	N/A
• Range	≥90 ft	N/A
• Width	≥17 ft	N/A
Clean Agent Performance		
• Discharge rate with dry chemical	≥1/3 lb/sec	N/A
• Discharge rate with foam	≥1 lb/sec	N/A

**NOTE:** *The agent delivery rates in this table are permissible as a result of independent third party demonstrated fire suppression capability of a Foam/Dry Chemical/Clean Agent simultaneous delivery. Otherwise, the standards of Tables 4.1.1(c) and 4.1.1(d) apply.*

**Compressed Air Foam System (CAFS):**

Compressed Air Foam System (CAFS) allows for improved fire suppression capability. CAFS must have expansion ratios of 6:1 to 10:1 with 8:1 being optimal. CAFS is currently restricted to Class 1, 2 and 3 vehicles as it has not been demonstrated on Class 4 and 5 vehicles.

**AMENDMENT: 4.18.6.6**

If an extendable turret is specified by the purchaser, a skin penetrating nozzle must be provided. The penetrating nozzle must be movable to allow for proper alignment of the penetrator to the aircraft fuselage for piercing operations. It must be capable of the minimum water/flow rate and pattern requirements of Tables 4.1.1(c) and 4.1.1(d).

**CHAPTER FIVE: INTERIOR ACCESS VEHICLE**

**ADDITION: CHAPTER 5**

The FAA has authorized the use of Airport Improvement Program (AIP) funds to purchase Interior Access Vehicles (IAV) that meet the requirements for CFR Part 139.317.

**AMENDMENT: 5.1.3**

The vehicle must provide access to sill heights of between 7 feet (2.3 meters) and at least the lower sills of aircraft operating at the airport. This sill height is sufficiently low enough to allow access to the lowest sill height aircraft currently in operation (e.g. DC9) that does not have its own integral stairs.

**ADDITION: 5.4**

While on a 15 degree tilt the platform and stairs must be able to be leveled as a unit to within 5 degrees of horizontal for operational use.

**AMENDMENT: 5.4.2**

The vehicle must pass a 15 degree tilt test with stairs fully extended without stabilizing equipment. However, the platform is not required to be fully loaded to the design weight capacity. Side wheel chocks may be used to prevent the vehicle from sliding on the table surface, but their height is not to exceed 5% of the tire diameter.

**NOTE:** *Testing completed by the FAA allows side wheel chocks to prevent a vehicle from sliding on a tilt table surface with a low coefficient of friction. These tests used a tilt table that followed standards from ANSI/ITSDF B56.6-2005 which allows chocking not to exceed 5% of the vehicle's tire diameter.*

**ADDITION: 5.5**

The vehicle shall meet the requirements of SAE ARP1247, Rev. C, Paragraphs:

**3.13.1.9** – Equipment Stability: The stability of the unit will be stated in terms of Stability Ratio. The Stability Ratio is defined as the ratio of the restoring moment to the overturning movement. If the ratio is greater than one, the unit is increasingly stable as the ratio increases. If the ratio is less than one, the unit will overturn.

**3.13.1.9.1** – The unit in operating condition, in its most unstable configuration, shall have a minimum stability ratio of at least 1.2 when exposed to a wind load or jet blast of 19.4 lb/ft<sup>2</sup> (928.9Pa) (80 mph) (128.7 km/h) applied from the direction most likely to cause instability. It must also withstand a wind load of 24.4 lb/ft<sup>2</sup> (1168.3Pa) (90 mph) (144.8 km/h) without overturning.

Wind or jet blast unit forces shall be based on:

$$F = 0.00252 V^2 C_D$$

Where:  $C_D$  is the drag coefficient, assumed to be 1.20,  $0.00252V^2$  is stagnation pressure of dry air at 68°F (20°C) and standard atmospheric pressure with velocity of  $V$  miles per hour, and  $F$  is the unit force in pounds per square foot.

**3.13.1.9.3** – If stabilizers, outriggers, and/or spring lockouts are used or combination of same or similar device to gain stability, calculations or test data shall be developed both with and without the devices.

**CHAPTER SIX: ACCEPTANCE CRITERIA****ADMENDMENT: 6.1**

The vehicle must be serviced prior to delivery with lubricants, brake and hydraulic fluids, and a cooling system fluid, all of which must be suitable for use in the temperature range expected at the airport.

The vehicle must be provided with all fire fighting agents and propellants to make it operational upon delivery.

**AMENDMENT: 6.1.5**

Upon delivery of the vehicle to the airport, the manufacturer must, at no additional cost, provide the services of a qualified technician for up to a maximum of 5 consecutive days (or up to 8 days for an extendable turret) for training. This is considered sufficient time under federal funding for the purchaser to adjust shift work schedules to get maximum employee attendance to training sessions at some point during the training period. During this time sufficient repetitive learning opportunities must be provided by the manufacturer to allow various shifts to complete the training requirements. The technician must provide thorough instruction in the operation and maintenance of the vehicle. This setup must include operator training for the primary operators, which will give them sufficient knowledge to train other personnel in the functional use of all fire fighting and vehicle operating systems. The technician should also provide initial adjustments to the vehicle for operational readiness and mount any ancillary appliances included as part of the vehicle that were not factory installed. Prior to leaving the vehicle, the technician should review the maintenance instructions with the purchaser's mechanical personnel to acquaint them with maintenance procedures as well as how to obtain support service for the vehicle. Training must include written operating instructions that depict the step-by-step operational use of the vehicle. Written instructions must include materials that can be used to train subsequent new operators.

**AMENDMENT: 6.3.2.6**

Evasive maneuver test must be conducted at 35 MPH (56 KPH).

**ANNEX A****AMENDMENT: A4.1.5**

All options listed in A4.1.5 are approved options unless specified below.

The following items from the options list A4.1.5 require justification to get ADO approval:

- 1f. Navigation System of Drivers enhanced vision system (DEVS).
- 2a. Added payload capacity (GVWR) to carry special equipment where the purchaser identifies added equipment.
- 2c. Audio-visual devices that meet or exceed the field of vision provided by wide-angled mirrors.
- 3a. Engine that operates at necessary performance above 2000 ft (609.6m) elevation.
- 3b. Radiator shutters.
- 3c. Engine coolant filter.
- 3d. Silicone coolant and heater hoses.
- 3e. Heated diesel fuel-water separator.
- 3f. Automatic drain(s) for the diesel fuel-water separator.
- 3g. Auxiliary fuel tank(s) commensurate with the need to meet local requirements.
- 3h. Stainless steel exhaust systems and muffler.
- 5a. Reduced under axle and underbody clearances to provide a more stable performance on pavement when the vehicle suspension is designed to permit instantaneous adjustment to the required height for off pavement travel.
- 5b. Tag or other non-powered axle(s) to assist weight distribution and/or stability requirements.
- 5c. Vehicle stability systems.

- 5d. Passive or active suspensions components to increase the stability of the vehicle while decreasing the rollover threshold.
- 5e. Spare tire(s)
- 5f. Bead locks on tires and rims.
- 7d. FLIR heads-up display located in the cab.
- 8d. Foam tank drain valves(s), drain line and hose that facilitate draining the tank into specified container(s) positioned on the ground within 10 ft. (3m) in either horizontal direction of the foam tank drainage system.

The following items from the options list A4.1.5 are not approved options for funding:

- 2b. Increased overall width of the vehicle to facilitate increased performance and maneuverability with no concern for movement on public highways(s).
- 5g. Run flat devices in all tires and wheels mounted on the vehicle.
- 8a. Water tank design that allows access with each baffled compartment of the tank for internal and external inspection/service.
- 8g. Turret controls located in the cab or on the roof platform.
- 8i. Turret(s) control(s) accessible both to the driver and the crew member.

**AMENDMENT: A4.2.1.**

Options 1-17 are not available for ARFF vehicle specification under this advisory circular.

**ANNEX E**

**EXCEPTION: ANNEX E.**

FAA Advisory Circular 150/5210-19 supersedes NFPA 414 Annex E.

## **APPENDIX A: TRAINING EQUIPMENT**

Only one each of the following training devices is eligible for federal funding assistance per location. Training devices are a physical Aircraft Skin Penetration Device and a Computer Based Simulation Training system.

### **1. AIRCRAFT SKIN PENETRATION TRAINING DEVICE**

The use of an aircraft skin penetration tool has been shown to be an effective firefighting device. The skill involved with the effective employment of this device increases dramatically with practical application. To train operators with these devices in locations where airport management and zoning and environmental requirements will not allow the use of a training fuselage, the FAA will fund an alternative training device. The training device must meet the following requirements:

A rigid frame structure with a cross-sectional, curved aluminum panel(s) can be specified to meet the following requirements:

- a. Aluminum panels must be comparable in thickness, hardness and curvature of the predominant type aircraft for the specific airport. Panels may be movable or replaceable to allow adjustments for different aircraft types.
- b. Panels must be located at a representative height to the predominant aircraft in use at the specific airport.
- c. Must be mounted on a structure (portable or stationary) that remains stable during training exercises.

### **2. COMPUTER TRAINING SYSTEM**

An eligible computer based simulator training program must be designed to increase and maintain proficiency in the employment of extendable turrets. The training package must include controls that simulate as closely as possible the actual cab environment (e.g. location of joystick, throttle, and steering wheel). The simulation software program must represent the actual maneuvering operation and controller interface of the actual operation of the elevated and extendable boom of the ARFF vehicle.

**APPENDIX B**

The following options are available in addition to those discussed above in NFPA 414 Annex A.

A. The following are approved options and require no further justification. Options not in this list are not authorized for the participation of federal funding.

\_\_\_\_\_  
 (Name and Title of FAA Approving Official)

**WORKSHEET FOR SUBSYSTEM COMPONENT SELECTION**

<b>Subsystem Description:</b>	<b>Rationale for Position:</b>	<b>Purchaser's Selection Class 1, 2 and 3</b>	<b>Purchaser's Selection Class 4 and 5</b>
Lubrication	Continuous duty cycle lubrication systems for suspension parts have shown the ability to extend the time before repair and costly maintenance is required on over-the-road as well as heavy excavation equipment. The installation of this type of system is in line with the FAA's goal of extending vehicle service life.		Yes _____ No _____
Air Conditioning,	The need for AC is subject to climatic, geographical, and operational considerations that are airport specific.	<u>Air conditioning required:</u> Yes _____ No _____	<u>Air conditioning required:</u> Yes _____ No _____
The election of a "pintle hook" in addition to "two towing eyes..."	Towing other vehicles with an ARFF vehicle is not a common practice. However, some operators believe that the pintle hook enhances operational flexibility. The substitution of it for the two rear-towing hooks/eyes, that are intended to facilitate ARFF vehicle recovery in the case of breakdown or a stuck vehicle, does not impact the vehicle's fire fighting performance or, to any great extent, its recoverability.	<u>Rear towing eyes:</u> _____  OR  <u>Pintle Hook:</u> Yes _____ No _____	<u>Pintle hook:</u> Yes _____ No _____

Subsystem Description:	Rationale for Position:	Purchaser's Selection Class 1, 2 and 3	Purchaser's Selection Class 4 and 5
Backup Monitor			<u>Backup monitor:</u> Yes _____ No _____
Heated Mirrors	The heated mirrors might be helpful to the driver/crew member to see clearly in the bad weather.		<u>Heated mirrors:</u> Yes _____ No _____
Means to keep brake system air reservoir up to operational pressure...	The selected method of reservoir pressurization must be considered based on the local resource requirement. However, cost effectiveness must also be considered so it does not impact the "as-built" vehicle performance. It is viewed as a local operational decision.		<u>100V or 220V auxiliary on-board compressor:</u> _____ or House air fitting: _____ Or both: _____
Windshield Deluge System			<u>Windshield deluge system:</u> Yes _____ No _____
Hoisting System	Aid in propellant cylinder change.		<u>Lift system required:</u> Manual: _____ Electric: _____

B. The following clarifications are specifically noted in the AC as purchaser options that require approval by the local FAA Airports District or Regional Office. They are approved as noted below:

\_\_\_\_\_  
 (Name and Title of FAA Approving Official)

**WORKSHEET FOR SUBSYSTEM COMPONENT SELECTION**

<b>Paragraph Title or Subsystem Description:</b>	<b>Rationale for Position:</b>	<b>Purchaser's Selection ≥60 to ≤528 Gal</b>	<b>Purchaser's Selection &gt;528 to &gt;1585 Gal</b>
Water Reservoir, Pump and Piping... Materials compatibility with local water characteristics.	This provision is not intended to involve the purchaser in the selection of materials. It is, however, intended to minimize the lifetime costs of vehicle ownership by alerting both the manufacturer and the purchaser of the need to identify the most likely sources of water to be used in the ARFF vehicle and to ensure that the properties of that water and the materials selected by the manufacturer for tank fabrication and the related piping are compatible.	<u>Airport ARFF water supply has unusual characteristics:</u>  Yes _____ No _____  Identify unusual properties:	<u>Airport ARFF water supply has unusual characteristics:</u>  Yes _____ No _____  Identify unusual properties:
More than two Crew positions...	The need for a seating configuration to accommodate more than two ARFF personnel per vehicle is a function of local operational practices. Therefore, it is included as an option available to the purchaser.	<u>Number of seats:</u> _____  <u>Justification:</u>	<u>Number of seats:</u> _____  <u>Justification:</u>
DEVS	The DEVS equipment can aid normal operations, improve emergency response time, and provide an additional margin of safety for airport rescue response during very low-visibility operations. FLIR camera of DEVS is required; however, the navigation and/or tracking subsystem is optional, and justifications are needed.	<u>Justification for:</u>  Navigation subsystem:   Tracking subsystem:	<u>Justification for:</u>  Navigation subsystem:   Tracking subsystem:
High-Reach Extendable Turret-Option	FAA will fund one extendable turret per station at each Index B through E airport.		<u>High-Reach Extendable Turret:</u>  Yes _____  No _____

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