



ADVISORY CIRCULAR

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TASK RESOURCE ANALYSIS (TRA) AND OPERATIONAL REQUIREMENTS FOR AERODROME RESCUE FIREFIGHTING SERVICES

1. PURPOSE

This Advisory Circular (AC) provides guidance and information for compliance with requirements for Aircraft Rescue and Firefighting Services (ARFFS).

2. APPLICATION

The material contained in this AC is applicable for use on all categories of civil aerodromes except where otherwise specified. The guidance contained in this AC is recommended to be used for Aircraft Rescue and Firefighting Services.

3. REFERENCES

3.1 Civil Aviation (Aerodromes) Regulations as amended

3.2 ICAO Airport Services Manual Doc 9137:

- Part 7: Airport Emergency Planning
- Part 1: Rescue and Fire Fighting
- Part 5: Removal of Disabled Aircraft

3.3 Human Factors Training Manual. ICAO Doc 9683

3.4 ICAO Doc 9284 Technical Instruction for safe Carriage of Dangerous Goods by Air

3.5 ICAO Doc 7192 Training Manual Part E-2 Aerodrome Fire Services Personnel

3.6 ICAO Annex 19 Safety Management System

3.7 ICAO Doc 9734 Safety Oversight Manual

3.8 ICAO Doc 9774 Manual on Certification of Aerodromes

4. REQUIREMENTS FOR CERTIFICATED AERODROMES

The Civil Aviation (Aerodromes) Regulations, require that: *“an operator shall ensure that there is an adequate number of qualified and skilled personnel to perform the activities for aerodrome operation and maintenance and establish preventive maintenance to maintain a facility in a condition that does not impair the safety , regularity and effectiveness of air navigation ”*

5. PERSONNEL LEVELS

The objective of providing an adequate level of competent personnel is to have available sufficient staff at all responsibility levels to ensure that:

- a. the ARFFS is capable of achieving the principal objective
- b. all vehicles and equipment can be operated effectively and safely
- c. continuous agent application at the appropriate rate(s) can be fully maintained (as determined in Civil Aviation Regulation for the applicable category)
- d. sufficient supervisory can implement a coordinated incident management system
- e. the ARFFS elements of the AEP can be effectively achieved.

The ARFFS vehicles/appliances should be staffed so as to ensure their ability to discharge at their maximum capability, extinguishing agents both principal and complimentary, effectively and safely at an aircraft accident / incident.

Any control room or communications facility operated by, and serving the ARFFS can continue to provide this service until alternative arrangements to undertake this function are initiated by the AEP.

In determining the minimum number of rescue and firefighting personnel and supervisory levels required, a task and resource analysis (TRA) should be completed, and the level of staffing and supervisory control are documented or referenced in the aerodrome exposition.

6. TASK RESOURCE ANALYSIS (TRA)

A TRA should be completed to establish justification as to the minimum number of competent personnel required to deliver an effective airport RFFS.

When carrying out a TRA, it is essential to fully understand the complexity of the various roles an individual is required to do in terms of actions, in order to achieve the principal objective of the ARFFS.

The task analysis should observe human factor principles to obtain optimum response by all existing agencies participating in emergency operations. The principles should include the

effect of human performance due to workload, capabilities, functions, decision aids, environmental constraints, team versus individual performance and training effectiveness.

When assigning operational duties to ARFFS personnel enroute to the incident attention should be given to the following.

- a. There is a need to approach the scene with extreme caution and watch for evacuating occupants, wreckage debris, fuel ponding, and other hazards. Avoid driving through any smoke which obscures your vision and potential evacuees. Avoid driving over any aircraft wreckage
- b. The monitor-operator is able to assume the operating position while the vehicle is in motion and operate the monitor through at least 60 degrees either side of the central axis of the vehicle.

The following items will assist in determining the basic contents of a TRA:

- (a) Description of the aerodrome(s) including the number of runways.
- (b) Promulgated ARFFS categories (Aeronautical Information Publication).
- (c) Response time criteria (area, times and number of fire stations).
- (d) Current and future types of aircraft movements.
- (e) Operational hours.
- (f) Level of supervision for each operational crew.
- (g) ARFFS qualifications/competence (training program and facilities).
- (h) Extraneous duties (to include domestic and first aid response)
- (i) Communications and ARFFS alerting system including extraneous duties.
- (j) Appliances and extinguishing agents available.
- (k) Specialist equipment: fast rescue craft, hovercraft, water carrier, hose layer, extending boom technology and high reach extendable turret technology.
- (l) Initial emergency medical aid- role and responsibility.
- (m) Medical facilities: role and responsibility.
- (n) Pre-determined attendance- local council authority services, police, fire and ambulances, etc.
- (o) Incident task analysis- feasible worst case scenarios, workload assessment, human performance/factors. It should include:
 - i. mobilization
 - ii. deployment to scene

- iii. scene management
- iv. firefighting
 - v. suppression and extinguishment
 - vi. application of complementary agents
 - vii. post fire security/control
- viii. personnel protective equipment (PPE)
 - ix. rescue teams
 - x. aircraft evacuation
 - xi. extinguishing agent replenishment (note: the aim is to identify any pinch points within the current workload and proposed workload).
- (p) Appraisal of existing ARFFS provision
- (q) Future requirements-aerodrome development and expansion
- (r) Enclosures could include- airport maps, event trees to explain tasks and functions conducted by the ARFFS.
- (s) AEP and procedures.

Note: The above is not exhaustive and should only act as a guide.

At aerodromes serving international routes, a fully trained senior rescue fire officer should arrive at the scene of the incident no later than the first responding ARFFS vehicle. This will allow an early appraisal of conditions to assess and direct firefighting operations.

At aerodromes serving domestic routes only, a fully trained senior fire officer or a suitably trained fire officer should arrive at the scene of the incident no later than the first responding ARFFS vehicle. This will allow an early appraisal of conditions to assess and direct firefighting operations.

6.1 Phases of Task Resource Analysis

6.1.1 Phase 1

The airport operator must be clear as to the aims and objectives for the ARFFS, and the required tasks that personnel are expected to carry out.

Aim

To maintain a dedicated ARFFS of qualified and competent personnel equipped with vehicles and specialized equipment to make an immediate response to an aircraft incident/ accident on or in the immediate vicinity of the airport within the specified response time criteria

Principal objective of ARFFS

The principal objective of ARFFS is to save lives in the event of an aircraft accident or incident. For this reason, the provision of means of dealing with an aircraft accident or incident occurring at, or in the immediate vicinity of an aerodrome assumes primary importance because it is within this area that there are the greatest opportunities for saving lives. This must assume at all times the possibility of, and need for extinguishing a fire that may occur either immediately following an aircraft accident or incident, or at any time during rescue operations.

Tasks

1. Meet the required response time
2. Extinguish an external fire
3. Protect escape slides and exit routes
4. Assist in self-evacuation of the aircraft
5. Create a survivable situation/ condition
6. Rescue trapped persons
7. Maintain post fire control
8. Preserve evidence

Note:

The Task Resource Analysis should identify the optimum time when additional resources will be available to support and or replace resources supplied by ARFFS (Aerodrome Emergency Plan)

Stated objectives for ARFFS

1. Instigate Aerodrome Emergency Plan

2. Respond within the required response time
3. Select appropriate routes and communications
4. Position appliances in optimum position and operate effectively
5. Instigate Incident Command System (ICS)
6. Suppress/ extinguish any fires
7. Assist in self-evacuation of the aircraft
8. If appropriate extinguish any external fire
9. If required ventilate aircraft to create survivable conditions
10. Maintain post fire control of the critical area
11. Preserve evidence

6.1.2 Phase 2

Identify a selection of representative realistic, feasible accidents that may occur at the airport, this can be achieved by a statistical analysis of previous accidents on airports and by analyzing data from both International National & Local sources.

6.1.3 Phase 3

Identify the types of aircraft commonly in use at the airport; this is important as the type of aircraft and its configuration has a direct bearing on the resources required in meeting Phase 1 above, it may be necessary to group the aircraft types in relation to common aircraft configurations for ease of analysis or identify precise aircraft type that may have a unique configuration.

6.1.4 Phase 4

Every airport is unique in that the location, environment, runway and taxiway configuration, aircraft movements, airport infrastructure and boundary etc. may present specific additional risks.

In order that the feasible accident scenario can be modeled/simulated a major factor is to consider the probable location for the most realistic accident type that may occur.

To confirm the location of the scenario it is important that a facilitator using a team of experienced fire service personnel, who have knowledge of the airport and the locations in which an aircraft accident is likely to occur evaluate the scenario.

6.1.5 Phase 5

This Phase combines the accident types to be examined as described in Phase 2, with the aircraft identified in Phase 3 and the locations as described in Phase 4. The accident types should be correlated with the possible location, in some cases this could be in more than one location on an airport, for which a task and resource analysis needs to be carried out.

The above information is to be built into a complete accident scenario that can be analyzed by experienced supervisors & firefighters for the task and resource analysis in Phase 6.

6.1.6 Phase 6

By using a TRA facilitator with teams of experienced airport supervisors & firefighters the accident scenario(s) developed in Phase 5 are subject to a task and resource analysis carried out in a series of tabletop exercises/simulations.

7. FUNDAMENTAL REVIEW

Look at

1. Aims & Objectives
 - a. 2/3 minutes' response time
 - b. Continuous application
 - c. Assisted or self-rescue
2. Equipment, Vehicles
 - a. Size of vehicles
 - b. More effective media
 - c. More effective application
 - d. Access equipment
 - e. Ventilation
 - f. Passenger Evacuation Management Systems
3. Fire Fighting Tactics
 - a. New equipment – New tactics
 - b. Align to Objectives
 - c. Review SOP's
 - d. Train to tactics

- e. Always review and update
- 4. Rescue
 - a. What is the Rescue aim?
 - b. Self
 - c. Assisted
 - d. Offensive firefighting and rescue
 - e. Mutual Aid
 - f. Command
- 5. New Challenges
- 6. Tasks, who does what
 - a. Firefighting
 - b. Rescue
 - c. Supporting functions
 - d. Command
 - e. Passenger care
 - f. Aftercare
 - g. Review
- 7. Skills required
 - a. Requirements
 - b. National/ Regulations
 - c. Maintenance
 - d. Oversight
 - e. Review

8. LEVEL OF PROTECTION

The airport category for ARFF should be based on the overall length of the longest aeroplanes normally using the airport and their maximum fuselage width and aircraft movement in the busiest consecutive three months as determined in the table below.

Table 1: Airport category for ARFF

<i>Airport category</i>	<i>Aeroplane overall length</i>	<i>Maximum fuselage width</i>
(1)	(2)	(3)
1	0 up to but not including 9 m	2 m
2	9 m up to but not including 12 m	2 m
3	12 m up to but not including 18 m	3 m
4	18 m up to but not including 24 m	4 m
5	24 m up to but not including 28 m	4 m
6	28 m up to but not including 39 m	5 m
7	39 m up to but not including 49 m	5 m
8	49 m up to but not including 61 m	7 m
9	61 m up to but not including 76 m	7 m
10	76 m up to but not including 90 m	8 m

Note:

1. If after selecting the category appropriate to an aeroplane's overall length that aeroplane's fuselage width is greater than the maximum width in column (3) for that category, then the category for that aeroplane is actually one category higher.
2. when the number of movements of the aeroplanes in the highest category normally using the airport is 700 or greater in the busiest consecutive three months, then that category should be the airport category and
3. when the number of movements of the aeroplanes in the highest category normally using the airport is less than 700 in the busiest consecutive three months, then the airport category may be one less than the highest aeroplane category. It should be borne in mind that the level of protection provided based on the frequency of operations shall not be less than one category below the determined category

8.1 Cargo operations.

The level of protection at aerodromes used for all-cargo aeroplane operations may be reduced in accordance with Table below. This is based on the need to protect only the area around the cockpit of an all- cargo aeroplane in the critical area concept

Table 2: Airport category for all cargo aeroplanes

Aerodrome category	Reclassification of aerodrome category for all-cargo aeroplanes
1	1
2	2
3	3
4	4
5	5
6	5
7	6
8	6
9	7
10	7

Extinguishing Agents

Both principal and complementary agents should normally be provided at an airport.

The principal extinguishing agent should be: -

- a) a foam meeting the minimum performance level A; or
- b) a foam meeting the minimum performance level B; or
- c) a foam meeting the minimum performance level C; or
- d) a combination of these agents

on the other hand, complementary agent should be: -

- a. dry chemical powders (classes B and C powders); or
- b. other extinguishing agents with at least the same firefighting capability.

8.2.1 Amount of extinguishing agents

The amounts of water for foam production and the complementary agents to be provided on the ARFF vehicles should be in accordance with the airport category determined and Table 3, except

that for airport categories 1 and 2, up to 100 per cent of the water may be substituted with a complementary agent.

Table 3: Minimum useable amounts of extinguishing agents

<i>Aerodrome</i>	<i>Water</i>	<i>Discharge rate foam solution/minute</i>	<i>Water</i>	<i>Discharge rate foam solution/minute</i>	<i>Water</i>	<i>Discharge rate foam solution/minute</i>	<i>Dry chemical powders</i>	<i>Discharge rate</i>
<i>category</i>	<i>(L)</i>	<i>(L)</i>	<i>(L)</i>	<i>(L)</i>	<i>(L)</i>	<i>(L)</i>	<i>(kg)</i>	<i>(kg/second)</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	350	350	230	230	160	160	45	2.25
2	1 000	800	670	550	460	360	90	2.25
3	1 800	1 300	1 200	900	820	630	135	2.25
4	3 600	2 600	2 400	1 800	1 700	1 100	135	2.25
5	8 100	4 500	5 400	3 000	3 900	2 200	180	2.25
6	11 800	6 000	7 900	4 000	5 800	2 900	225	2.25
7	18 200	7 900	12 100	5 300	8 800	3 800	225	2.25
8	27 300	10 800	18 200	7 200	12 800	5 100	450	4.5
9	36 400	13 500	24 300	9 000	17 100	6 300	450	4.5
10	48 200	16 600	32 300	11 200	22 800	7 900	450	4.5

8.1.2 Supply and storage of extinguishing agents

A reserve supply of foam concentrates and a complementary agent equivalent to 200 per cent and 100 percent respectively of the quantities of these agents identified in Table 3 should be maintained on the airport for vehicle replenishment purposes.

9. FIRE STATION

All RFF vehicles should normally be housed in a fire station. And whenever response time cannot be achieved from a single fire station, satellite stations should be provided.

10. COMMUNICATION AND ALERTING SYSTEM

A discrete communication system should be provided linking a fire station with the control tower, any other fire station on the airport and the ARFF vehicles. An alerting system for ARFF personnel should also be provided at a fire station, capable of being operated from that station, any other fire station on the airport and the airport control tower.

11. NUMBER OF FIRE VEHICLES (FOAM TENDERS)

The minimum number and types of conventional RFF vehicles provided at an airport so as to effectively deliver and deploy the agents specified for the airport category should be in accordance with Table 4.

Table 4: Minimum number of fire vehicles

<i>Airport category</i>	RFF vehicles
1	1
2	1
3	1
4	1
5	1
6	2
7	2
8	3
9	3
10	3

In addition to the above, suitable rescue equipment and services should be available at airports where the area to be covered by the service includes water, swamp or other difficult environments that cannot be fully served by conventional wheeled vehicles. This is particularly important where a significant portion of approach/departure operations takes place over this area. The purpose of these special vehicles is to rescue aircraft occupants at an aircraft accident that may occur in this area.

11.1 Specifications for Rescue and firefighting vehicles

Acquisition of vehicles for ARFF purposes requires a detailed study of a number of factors which includes the following: -

- a. consideration of the operational requirement,
- b. design and construction aspects and
- c. the overall compatibility of the completed vehicle fleet with the airport's RFF support services

Other features can be specified, above the minimum level, to facilitate operational handling, preventive maintenance or the visual appearance of a vehicle, without necessarily making a significant contribution to the effectiveness of the vehicle in its primary role.

Note: Care must be taken so that in providing any additional capability, the primary role of the vehicle in aircraft firefighting is not impaired

11.1.1 preliminary considerations

Minimum characteristics related to these vehicles are expressed in Table 5 below, must be considered when upgrading the airport ARFF vehicle fleet.

Table 5: suggested minimum Characteristics for fire vehicles

	<i>RFF vehicles up to 4 500 L</i>	<i>RFF vehicles over 4 500 L</i>
Monitor	Optional for categories 1 and 2 Required for categories 3 to 9	Required
Design feature	High discharge capacity	High and low discharge capacity
Range	Appropriate to longest aeroplane	Appropriate to longest aeroplane
Handlines	Required	Required
Under truck nozzles	Optional	Required
Bumper turret	Optional	Optional
Acceleration	80 km/h within 25 s at the normal operating temperature	80 km/h within 40 s at the normal operating temperature
Top speed	At least 105 km/h	At least 100 km/h
All-wheel drive capability	Required	Required
Automatic or semi-automatic transmission	Required	Required
Single rear-wheel configuration	Preferable for categories 1 and 2 Required for categories 3 to 9	Required
Minimum angle of approach and departure	30°	30°
Minimum angle of tilt (static)	30°	28°

11.1.2 Compatibility of new vehicles with existing fleet

In acquiring a new fire vehicle, it is essential to seek the incorporation of all improvements available from current technology. In securing these advantages it is essential to examine the extent to which they may impose new problems to personnel in the ARFF and support services.

11.1.3 Dimensional or loading limitations

The following should be considered in acquiring a new ARFF vehicles

- a. accommodation in the existing fire station.
- b. airport design
- c. the response area adjacent to the airport are important, including the dimensions of any tunnels, archways or subways through which the vehicle may be expected to pass in responding to an emergency.
- d. Overhead cables must also be considered, bridges, culverts and cattle-grids must be evaluated if the weight of a new vehicle is greater than that of previous types.

The length and width of the vehicle will be of significance in negotiating corners and in this connection it will be important to review the ability of any new vehicle to negotiate the emergency gates provided.

The design and construction of the vehicle should be suitable for carrying its full load over all types of roads and unimproved surfaces on, and in the vicinity of, the airport in all reasonable weather conditions.

Table 6: Guidance material related to Rescue equipment carried on ARFF vehicle

<i>Equipment scope</i>	<i>Equipment item</i>	<i>Airport category</i>				
		1-2	3-5	6-7	8-10	
Forcible entry tools	Prying tool (hooligan, biel type)	1	1	1	2	
	Crowbar 95 cm	1	1	1	2	
	Crowbar 1.65 m	1	1	1	2	
	Axe, rescue large non wedge type	1	1	1	2	
	Axe, rescue small non wedge or aircraft type	1	2	2	4	
	Cutter bolt 61 cm	1	1	2	2	
	Hammer 1.8 kg – lump or club type	1	1	2	2	
	Chisel cold 2.5 cm	1	1	2	2	
A suitable range of rescue/cut-in equipment including powered rescue tools	Hydraulic/electrical (or combination) portable rescue equipment	1	1	1	2	
	Powered rescue saw complete with minimum 406 mm diameter spare blades	1	1	1	2	
	Reciprocating/oscillating saw	1	1	1	2	
A range of equipment for the delivery of firefighting agent	Delivery hoses 30 m lengths x 50 and 64 mm diameters	6	10	16	22	
	Foam branches (nozzles)	1	1	2	3	
	Water branches (nozzles)	1	2	4	6	
	Coupling adaptors	1	1	2	3	
	Portable fire extinguishers	CO ²	1	1	2	3
		DCP	1	1	2	3
	Self-contained breathing apparatus – <i>sufficient to maintain prolonged internal operations</i> <i>Note: Ideally one BA set per crew member.</i>	Breathing apparatus (BA) set complete with facemask and air cylinder				
BA spare air cylinder						
BA spare facemask						
Respirators	Full faced respirators complete with filters	One per responding firefighter				

<i>Equipment scope</i>	<i>Equipment item</i>	<i>Airport category</i>			
		1-2	3-5	6-7	8-10
A range of ladders	Extension ladder, rescue and suitable for critical aircraft	-	1	2	3
	Ladder general purpose – rescue capable	1	1	1	2
Protective clothing	Firefighting helmet, coats, over trousers (complete with braces), boots and gloves as a minimum	One set per operational firefighter plus a percentage of reserve stock			
Additional items for personal protection	Protective goggles	1	1	2	3
	Flash hoods	One per operational firefighter			
	Surgical gloves	1 box	1 box	1 box	1 box
	Blanket fire resisting	1	1	2	2
Rope lines	Rope line rescue 45 m	1	1	2	2
	Rope line general use 30 m	1	1	2	2
	Rope line pocket 6 m	One per operational firefighter			
Communication equipment	Portable transceivers (hand held and intrinsically safe)	1	2	2	3
	Mobile transceivers (vehicle)	One for each fire vehicle			
A range of hand-held/portable lighting equipment	Hand-held flashlight (intrinsically safe)	1	2	4	4
	Portable lighting – spot or flood (intrinsically safe)	1	1	2	3
A range of general hand tools	Shovel overhaul	1	1	2	2
Rescue tool box and contents		1	1	2	3
	Hammer, claw 0.6 kg				
	Cutters, cable 1.6 cm				
	Socket set				
	Hacksaw, heavy duty complete with spare blades				
	Wrecking bar 30 cm				
	Screwdriver set – slotted and Phillips heads				
	Pliers, insulated Combination 20 cm Side cutting 20 cm Slip joint – multi-grip 25 cm				
Seat belt/harness cutting tool					

<i>Equipment scope</i>	<i>Equipment item</i>	<i>Airport category</i>			
		1-2	3-5	6-7	8-10
	Wrench, adjustable 30 cm				
	Spanners, combination 10 mm – 21 mm				
First aid equipment	Medical first-aid kit	1	1	2	3
	Automated External Defibrillator (AED)	1	1	2	3
	Oxygen Resuscitation Equipment (ORE)	1	1	2	3
Miscellaneous equipment	Chocks and wedges – various sizes				
	Tarpaulin – lightweight	1	1	2	3
	Thermal imaging camera	-	-	1	2

Local factors which may have effect on vehicular performance include:

- a. the altitude at which the vehicle is to operate. The performance of normally-aspirated engines may be affected at altitudes above 600 m and the use of turbochargers may be necessary to achieve acceleration and cruising speed specifications;
- b. any temperature extremes likely to be encountered by the vehicle. Very high temperatures may necessitate additional capacity in the engine cooling system. Very low temperatures may require protective equipment for the vehicle including the firefighting pump, associated plumbing and the water tank; and
- c. the presence of unusual quantities of sand or dust in the atmosphere, requiring augmented filtration in the induction system to the engine.

Note: All vehicles will require regular inspection of every aspect of their structure, systems and operational functions. Servicing and preventive maintenance will ensure, as far as is practicable, that the vehicle will remain effectively available.

12. Maintenance

A preventive maintenance plan should be derived to ensure maximum mechanical efficiency of the ARFF vehicles. In this connection, due regard should be made to the possible need to provide reserve vehicles to take the place of those which become temporarily unserviceable.

To ensure ongoing reliability and peak performance of any fire vehicle or item of rescue equipment is maintained, and to ensure that aerodrome rescue and firefighting (ARFF) services are provided at the required levels, all ARFF vehicles and rescue equipment need to have regular preventive maintenance conducted on them. And therefore the following provisions are necessary: -

- a. maintenance personnel;
- b. maintenance procedures;
- c. defect reporting system;
- d. designated maintenance work areas;
- e. tools;
- f. spare parts; and
- g. storage of maintenance records.

A maintenance program should take into account the following activities:

- a. original equipment manufacturer (OEM) maintenance recommendations;
- b. local environmental conditions, for example tropical heat versus cold winters;
- c. national or local regulatory requirements — for example certification of pressure vessels, hoses, roadworthiness certificates; and
- d. regular performance testing.

12.1 Personnel

All personnel conducting maintenance activities should be appropriately skilled, trained and equipped to undertake the designated and required maintenance activities they are tasked with in accordance with the organizational safety management systems.

Working on modern-day RFF fire vehicles and rescue equipment requires the following skill set or, as a minimum, a good practical working knowledge of: -

- a. heavy vehicle mechanical trade qualifications;
- b. fire pumps and foam systems;

- c. complementary agent systems;
- d. hydraulics/pneumatics;
- e. automotive electrical training;
- f. self-contained breathing apparatus (SCBA) systems/breathing air compressors;
- g. knowledge of regulatory requirements pertaining to the provision of ARFF; and
- h. knowledge of national or local regulations pertaining to maintenance activities.

Specialist training should be initially provided by the OEM with the delivery of the first type of fire vehicle or item(s) of rescue equipment.

12.2 Maintenance procedures

This should cover the following: -

- a. activities to be undertaken to ensure that disruption to RFF services are minimized. For example; bringing reserve fire vehicles into operational service to maintain category levels, or conducting maintenance during breaks in aircraft movements where a vehicle may be taken out of service without affecting category levels;
- b. the frequency of maintenance services;
- c. activities to be undertaken at each type of maintenance service as recommended by the original equipment manufacturer (OEM). For example, visual check, inspections & measurements;
- d. activities to be undertaken at each type of maintenance service as recommended by national or local regulations;
- e. arrangements for technical support from the OEM or the OEM's local agent;
- f. spare parts that should be held on site to enable regular maintenance to be conducted, for example, filters, belts, drier cartridges, lubricants, coolants, wiper blades;
- g. generically common spare parts should be held on site to minimize downtime, such as switches, light globes, relays, circuit breakers, bolts, nuts, washers, O-rings and seals;
- h. arrangements with OEM and local suppliers for all other parts to ensure downtime is kept to a minimum;
- i. tire replacement requirements;
- j. environmental procedures including appropriate disposal procedures for old parts as well as used lubricants and coolants;
- k. any special measures to ensure safety of maintenance personnel such as procedures for working at heights, confined space entry and working with high pressure liquids/gases;

and

1. the method of reporting and documenting any defects that have been identified with the fire vehicles or rescue equipment by operational and maintenance personnel.

12.3 Maintenance work area/ special tools

Provision of a work area for maintaining RFF fire vehicles should have due consideration to the following: -

- a. a sufficiently large enough area to work on and around the vehicle;
- b. environmental protection such as trade waste interceptor pits or bunding;
- c. lifting/jacking equipment;
- d. wheel lifters/tire changing cages;
- e. storage areas for lubricants, spare parts and tools;
- f. storage of technical documentation; and
- g. storage of maintenance records.

Provision of a work area for maintaining rescue equipment should have due consideration to the following: -

- a. a clean area to work on breathing apparatus (BA) sets/face masks;
- b. testing capability for fire hoses;
- c. a ventilated area for operating engine-powered tools, for example, portable saws or hydraulic rescue units; and
- d. ventilation for charging batteries.

12.4 Fire vehicles performance testing

While an ARFFS fire vehicle may pass its initial acceptance test for compliance against its specification, there is no guarantee that it will continue to do so throughout its service life. All ARFFS fire vehicles have parts that wear with time and as a result performance is lost. To ensure that the fire vehicle continues to have the ability to respond, and discharge firefighting agents at the required amounts, regular performance testing should be undertaken including quantitative checks of: -

- a. 0-80 km/h acceleration;
- b. braking;

- c. flow rate from high and low flow deliveries
- d. foam admixing percentages;
- e. monitor throw; and
- f. compressed air foam systems.

Records of any performance tests undertaken should be retained, as it is a record of the fire vehicle continuing to meet the specifications, and allows future review if performance starts to deteriorate.

12.5 Rescue equipment requirements

The maintenance requirements for rescue equipment should be in accordance with original equipment manufacturer (OEM) requirements. However, due to the nature of firefighting, equipment can sometimes unknowingly become damaged. Consequently, it can also be beneficial to check the following: -

- a. all items — regular daily or weekly checks to ensure functionality;
- b. breathing apparatus sets — maintained after every use and checked regularly when not used for safe operation;
- c. BA air quality — regularly checked (there may be national or local standards that the air quality must meet);
- d. short lines/long lines (rescue lines) — not frayed and are in good repair;
- e. portable fire extinguishers — full and charged with pressure;
- f. fire hoses — inspected and pressure checked on an annual or six monthly basis to ensure that the hoses do not leak and the couplings are functioning and securely fitted;
- g. nozzles/foam branches — inspected for damage;
- h. rescue tools — inspected to ensure that there is no damage to components. Under high forcing loads, damaged components can be very dangerous if they fail;
- i. general tools — inspected to ensure handles are not broken or damaged;
- j. first-aid kits — inspected at least weekly to ensure that items are maintained at the correct stock levels; and
- k. rescue tool box — checked to ensure all tools are present.

12.6 Maintenance documentation

A complete set of maintenance documentation should be delivered with the fire vehicle and rescue equipment during the procurement process. As a minimum this should include: -

- a. operating procedures;
- b. maintenance procedures;
- c. fault diagnosis and troubleshooting;
- d. adjustment procedures;
- e. removal/replacement of parts and repairable assemblies;
- f. instructions for disassembly and reassembly of repairable components;
- g. tolerances, specifications and capacities;
- h. illustrations and exploded views;
- i. schematic drawings, for example, electrical wiring circuits, pneumatic circuits, chassis air circuits or hydraulic circuits;
- j. special tools needed for repairing and adjusting; and
- k. spare parts catalogue providing exploded views of the entire fire vehicle.

Note: It is important that the technical documentation is in a format that can be easily read, understood and followed.

12.7 maintenance record keeping

A comprehensive set of maintenance records should be kept for each fire vehicle. Keeping such records has the following benefits: -

- a. provides a historical record of the maintenance of the fire vehicle/equipment — which may be an organizational requirement for legal or compliance reasons;
- b. provides evidence for any warranty claim that may be made against the OEM;
- c. can be referred to in the future (if a similar fault occurs); and
- d. provides evidence for any surveillance audit that may be undertaken for regulatory compliance.

Note: Maintenance and calibration certificates should be maintained in a register for all special tools and test equipment.

12.8 Protective clothing

Protective clothing normally includes, but is not limited to, turnout suits (jackets — overalls complete with suspenders), firefighting boots, gloves and helmet as a minimum. The proper care and preventive maintenance is normally the responsibility of the firefighter and the ARFFS.

Protective clothing needs to be inspected for serviceability on a regular basis:

- a. by the wearer prior to commencing duty;
- b. after use; and
- c. as required.

There are three levels of cleaning defined in National Fire Protection Association (NFPA 1851) — routine, advanced and specialized:

- a. routine cleaning is performed after any fire-ground use where soiling has occurred and may involve brushing debris from the clothing, rinsing it with water and/or applying spot cleaning as required;
- b. advanced cleaning is more thorough with a frequency dependent on the use and condition of the clothing;
- c. specialized cleaning may need to be conducted by an external agency; and
- d. any cleaning should consider and comply with the manufacturer's instructions.

Note: Minor repairs may be conducted at a local level, however, major repairs may need to be conducted by an external agency so that repair activities and/or materials do not compromise the protection standards of any protective clothing.

Storage of protective clothing is also a factor to be considered:

- a. storage should be away from direct light, especially sunlight;
- b. avoid contact with contaminants; and
- c. avoid storing near objects that could physically damage the protective clothing.

13. Depletion of the level of protection

There should be a procedure of reporting Particulars of the facilities, equipment, personnel and procedures for meeting the rescue and fire-fighting requirements, including the names and roles of the persons responsible for dealing with the rescue and fire-fighting services at the aerodrome. And in case of withdrawal of one of the fire tenders, appropriate Authority should be informed of the current level of protection who further notifies flying public through NOTAM.



A handwritten signature in blue ink, appearing to be 'Kass', is written over a horizontal line.

Director Safety, Security and Economic Regulation