Referenced to Nigerian Regulations

Advisory Circular

NCAA-AC-ARD007-2

NIGERIAN CIVIL AVIATION AUTHORITY (NCAA)
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AIRCRAFT HANGAR FIRE PROTECTION REQUIREMENTS

1.0 GENERAL

Nigerian Civil Aviation Authority Advisory Circulars from Aerodrome Standards Department contain information about standards, practices and procedures that the Authority has found to be an Acceptable Means of Compliance (AMC) with the associated Regulations. An AMC is not intended to be the only means of compliance with a regulation, and consideration will be given to other methods of compliance that may be presented to the Authority.

2.0 PURPOSE

This Advisory Circular provides methods, acceptable to the Authority, for showing compliance with minimum Fire Protection requirements to be provided at Aircraft Hangars in accordance with Nig. CARs Part 12.6.16, 12.6.5 (2015) and ASM and as well as other explanatory and interpretative material to assist in showing compliance. The AC also contains specifications and guidance for the storage and maintenance of aircraft at hangars which will assist aerodrome operators and aircraft hangar owners/operators in ensuring compliance with applicable requirements.

3.0 APPLICATION

The material contained in this Advisory Circular applies to aerodrome and aircraft operators who are involved in aircraft storage, aircraft maintenance and other aircraft repair activities at aerodromes.

4.0 REFERENCE

The Advisory Circular relates specifically to part 12.6.5, part **12.6.16.** of Nig.CARs Part 12, 2014. And ASM 13.2.12.

5.0 STATUS OF THE AC

This is the first issue of the AC on this subject.

APPROVAL PAGE

AIRCRAFT HANGAR FIRE PROTECTION REQUIREMENTS

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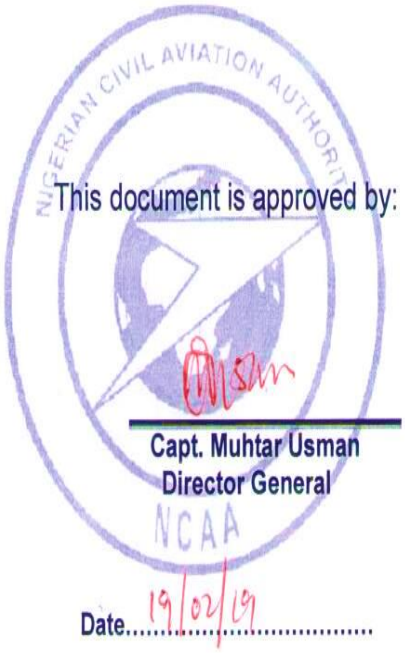

AMENDMENT PROCEDURES

The Director, Aerodrome and Airspace Standards is responsible for the development, issuance and control of amendments to this document. The Document Controller is responsible for distribution of amended copies of the AC to Departmental staff and technical library and in making it available on NCAA website: ncaa.gov.ng for public use.

Each page will show the document number, issue number/amendment number, issue date and page number at the base of the page.

All amendments must be recorded in the Record of Amendments.

Any observation made or contribution to the content of this document by the user should be directed to the following address for consideration and adoption:

Nigerian Civil Aviation Authority
Aviation House
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RECORD OF AMENDMENTS

Issue No/ Amendment No	Page(s) Affected	Date Entered	Entered By	Signature

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FOREWORD

The Directorate of Aerodrome and Airspace Standards of the Nigerian Civil Aviation Authority was established to be responsible for the safety regulation of aircraft operating environment (aerodrome and airspace). The Authority is also responsible for developing and promulgating appropriate, clear and concise aviation safety standards.

This Advisory Circular – Fire Protection for Aircraft Hangars is published pursuant to Part 12.6.5 and Part 12.6.16 of Nig.CAR, 2014 and related documents. It spells out the minimum requirements to be met for the establishment and maintenance of aircraft hangars at Nigerian aerodromes. The document further give out procedures to follow by aerodrome operators to ensure that aircraft hangar operators comply with applicable requirements during storage and maintenance of aircraft in the interest of safe aerodrome operations.

Amendments to this Advisory Circular are the responsibility of the Director General, Nigerian Civil Aviation Authority. Readers should forward advice of errors, inconsistencies or suggestions for improvement to this document to the addressee as indicated herein.

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Nigerian Civil Aviation Authority,
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DEFINITIONS AND ABBREVIATIONS

Definitions

Advisory Circulars
Guidance material on the means of achieving the minimum compliance with the Nig.CARs.

Aerodrome
A defined area on land or water (including any building, any installation, and equipment) used or intended to be used, either wholly or in part, for the arrival, departure and surface movement of aircraft.

Aircraft
Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

Aircraft accident
An occurrence during the operation of an aircraft in which any person involved suffers death or serious injury or in which the aircraft receives substantial damage.

Aircraft fire fighting
The control or extinguishment of fire adjacent to or involving an aircraft following ground accident/incidents.

Aircraft incident
An occurrence, other than an accident, which affects or could affect the safe operation if not corrected and is associated with the operation of an aircraft.

Facility
One or more items of equipment essential to provide a discrete technical function or amenity.

Aircraft Hangar: A building or other structure where aircraft are housed

Aircraft storage and servicing area
The part of a hangar used for the storage and servicing of one or more aircraft, not including any adjacent or contiguous area or structures, such a shops, storage areas and offices.

Aircraft access door
Any opening through which any portion of the aircraft is passed to gain entry.

Detection system
A system consisting of detectors, controls, control panels, automatic and manual actuating mechanisms all wiring, piping and tubing, and all associated equipment that is used to actuate an extinguishing system.

Fire Barrier wall
A wall other than a firewall having a fire resistant rating

Fire Wall: A wall separating a building of fire resistance

Foam Water deluge system
A foam water sprinkler system employing open discharge devices, which are attached to a piping system that is connected to a water supply through a valve that is opened by the operation of a detection system, which is installed in the same areas as the discharge devices. When this valve opens, water flows into the piping system and discharges from all discharge devices attached thereto.

Hangar Fire area
An area with an aircraft hangar subject to loss by a single fire because of lack of internal subdivisions.

Membrane hangar
A hangar that uses flexible structural fabric or film that supports the imposed loads and transmits them to a supporting structure. The membrane carries only tension or shear in the plane of the membrane.

Paint Hangar
An aircraft hangar that is occupied primarily for the application of paint or other flammable or combustible liquids involving an entire aircraft or major portions of an aircraft.

Single hangar building
A building with one area for the storage and servicing of aircraft and any attached, adjoining or contiguous structure, such as lean to shop area, or parts storage area not separated.

Tail Height
The maximum tail height a specified in manufacturer's specification.

Unfuelled aircraft
An aircraft whose fuel system has had flammable or combustible liquid removed such that no tank, cell, or piping contains more than one-half or 1% of its volumetric capacity.

Wing area
Total projected area of clean wing (no projecting flaps, slats, and other items), including all controlling surfaces and the area of the fuselage, bounded by the leading and training

edges projected to the centre line. Net area excludes projected areas of fuselage, nacelles and other items.

Aircraft maintenance
Aircraft overhaul, repair, and service operations.

Aircraft repair
The modification of an aircraft, rebuilding of structural damage, correction of a system malfunction, or replacement of a major component or subassembly that requires an aircraft to be in out of fly status.

Air ventilation
The passing of undiluted air through an aircraft tank to render the atmosphere of the tank more suitable for human occupancy and to reduce the amount of flammable vapours in the tank to below the lower explosive limit of the fuel vapours involved.

Hot work
Work involving burning, welding, or a similar operation that is capable of initiating fires or explosions.

Fuel Tank
Bladder Fuel Tank: A fuel container that is both collapsible and self-sealing.

Integral Fuel Tank: A fuel container whose boundary composition is as close to 100% of the primary structure.

Metal Fuel Tank: AA fuel container that includes all metal types, including surge and vent tanks that can be removed from the aircraft for workshop or bench repair, but not including
a metal fuel container that is an integral part of the aircraft and that, under certain major overhaul conditions can be removed from the primary portion of the airframe.

Combustible Liquid: A liquid that has a closed-up flash point at or above 37.8^0C (100^0F)

Flammable Liquid: Any liquid having a flash point under 37.8^0C (100^0F) closed cup and having a vapour pressure not exceeding 40psia (2068.6mmHg) at 37.8^0C (100^0F)

Electric converter
A device used to convert line voltage alternating current to the voltage and frequency, or direct current, suitable for the aircraft power system.

Paint removal
The process of softening existing paint by applying appropriate solvents and spraying or brushing away the residue.

Purging
The removal of flammable vapour atmospheres or any residue capable of producing flammable vapours in the tank and connected distribution lines so that subsequent natural ventilation does not result in the reinstatement of a flammable atmosphere unless or until a flammable liquid is again introduced into the tank or its connected distributing lines.

Tanks
Service operations
Routine service checks, correction of flight crew complaints, and minor repair and maintenance performed while the aircraft is routinely in out flying status.

Aircraft access door height
Any opening through which any portion of the aircraft is passed to gain entry to the hangar.

Human performance
Human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations.

Pressure-fed fuel fires
Fires associated with fuel discharged under very high pressure from a ruptured fuel tank.

Abbreviations

AC	Advisory Circular
ARFF	Aerodrome Rescue and Fire Fighting
ARFFS	Aerodrome Rescue and Fire Fighting Services
ARFFT	Aerodrome Rescue and Fire Fighting Training
ASM	Aerodrome Standards Manual
BA	Breathing Apparatus
FGC	Fire Ground Commander
ICAO	International Civil Aviation Organization
LOA	Letter of Agreement
MOU	Memorandum of Understanding
NCAA	Nigerian Civil Aviation Authority (The Authority, as used in this document).
Nig.CARs	Nigeria Civil Aviation Regulations
NFPA	National Fire Protection Association
QAS	Quality Assurance System

CHAPTER 1:

INTRODUCTION

1.1 Aircraft storage and maintenance work are source of safety concerns if not done in accordance with stipulated requirements. Such activities which are normally carried out in aircraft hangars present significant fire hazards due to the quantity of fuel present and various ignition sources that may be available, and could create sizeable obstruction challenges for fire protection systems.

The purpose of this document is to identify and provide minimum baseline that must be maintained at aircraft hangars in terms of fire protection systems so as to ensure that safety of personnel, aircraft and the aerodrome at large is not compromised or endangered.

Aerodrome operators, airline operators and aircraft maintenance personnel all have a joint responsibility in ensuring that aircraft hangars are designed, approved and constructed to standards and that relevant fire protection systems are provided, maintained, tested and kept serviceable at all times. It shall be ensured that relevant personnel are trained in the operation and use of such systems.

1.2 This document is based mainly on compliance with the following documents:

(a) ICAO Annex 14 VOLUME I.

(b) AERODROME STANDARDS MANUAL.

(c) NATIONAL FIRE SAFETY CODE.

(d) NFPA 409 STANDARDS ON AIRCRAFT HANGARS

(e) NFPA 410 STANDARDS ON AIRCRAFT MAINTENANCE.

Where there is a difference between a requirement in this Advisory Circular and that of the above-mentioned documents, the requirement in this document shall prevail.

1.3 Aerodrome Operators, Airline Operators, Aircraft Hangar operators and Aircraft Maintenance Organisations should endeavour to comply with all the requirements in this Advisory Circular.

1.4 From time to time, the Authority may wish to supplement the requirements in the Nig. CARs. Where appropriate, such additions will be incorporated into this Advisory Circular by amendment.

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CHAPTER 2:

STANDARDS AND RESOURCES ON FIRE PROTECTION FOR AIRCRAFT HANGARS.

2.1 The NCAA uses the Standards contained in the National Fire Safety Code (First edition 2013), NFPA 409 Standards on Aircraft Hangars and NFPA 410 Standards on Aircraft maintenance to establish minimum requirements on Fire Protection systems to be provided at Aircraft Hangars.

Some of the standards and codes in the mentioned documents are therefore provided in this Advisory Circular and the reader may wish to refer to the full documents for more elaboration where necessary.

2.2 The responsibility for the serviceability and maintenance of these Fire Protection facilities and systems has been vested on the aircraft hangar owners/operators.

Aerodrome operators who assume full responsibility for the aerodrome safety are obliged and required to incorporate or reference these requirements in their aerodrome manual and shall request all users of such facilities to comply with those minimum laid down requirements. (Nig.CARS 12.6.5).

The aerodrome operator is further required to perform reasonable surveillance on this third parties so as to assess and evaluate their level of compliance with the requirements in this Advisory Circular and should also have appropriate procedure for resolving safety discrepancies and enforcement of corrective actions.

CHAPTER 3

FIRE PROTECTION REQUIREMENTS FOR AIRCRAFT HANGARS.

3.1 Introduction

The Nigerian National Fire Safety Code has classified aircraft hangars among High Hazard Buildings as they are used for the storage of materials which are likely to burn with extreme rapidity and may produce poisonous fumes or explosions.

In deciding and choosing the right fire protection systems for aircraft hangars, the class of the hangar or scope of operations to be performed must be first be determined or known. Generally, aircraft hangars are classified into four groups: GROUP I, II, III and IV

- **GROUP I AIRCRAFT HANGAR**: These are the type of aircraft hangars having at least one of the following features:

- An aircraft access door of height greater than 8.5m (20ft)
- Single fire area greater than 40,000 ft^2
- Provision for housing an aircraft with a tail height greater than 8.5m

- **GROUP II AIRCRAFT HANGAR**: These are the type of aircraft hangars having both the following features:
- Aircraft access door height of less than or equal to 8.5m
- Single fire area of less than or equal to 40,000 ft^2

- **GROUP III AIRCRAFT HANGAR**: These are aircraft hangars with the following features:
- Row hangar with multiple units
- An open bay hangar capable of housing many aircrafts.
- Group III hangars shall have both the following: An aircraft access door height less than or equal to 30,000 ft^2 and a single fire area of less than or equal to 30,000 ft^2.

- **GROUP IV AIRCRAFT HANGAR**: These are hangars of a structure constructed of a membrane or covered rigid frame.

3.2. **Design/safety requirements**:

The following design/safety requirements shall apply to all hangars:

SPACING: REQUIREMENTS:

- Aircraft storage and servicing areas should be well separated
- Clear space distance distance requirements around other hangars
- Ready accessibility to the hangar from all sides
- Separation between hangars and adjacent buildings to reduce fire exposure (15m-23m)
- The separation should not be blocked or starked with combustibles or construction.

HANGAR FLOORS

- Hangar floors shall be non-combustible
- The floor of servicing area should not be constructed to allow spill to drain to servicing area.

ROOFS AND COLUMNS

All roofs and columns should reasonably be fire resistant

DOORS

- All aircraft hangar doors should be of non-combustible or limited combustible material
- Power source should be independent

LANDING GEAR PITS AND TUNNELS

- Appropriate provision must be made for ventilation
- Drainage facilities should be provided

HEATING AND VENTILATION REQUIREMENTS

- In aircraft storage and servicing area, no heating and open flame shall be installed
LIGHTING AND ELECTRICAL SYSTEMS
- In aircraft storage and servicing area, main distribution panel, metering equipment and other electrical equipment shall be located in a room separated from aircraft storage and servicing area by a partition
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LIGHTENING PROTECTION

Lightening protection shall be provided

GROUNDING AND EARTHING

Provision for grounding and earthing for static electricity should be available

EXIT AND ACCESS

Provision for good exit and access requirements for fire protection equipment and airport fire engines.

Aircraft hangar design/permit and other operational requirements.

The National Fire Safety Code has further reiterated the following requirements during the storage of high combustible materials at aircraft hangars:

- Be orderly
- Have it storage area separated from heaters or heating devices by distance or shielding so that ignition cannot occur
- Not store combustible materials in boiler rooms, mechanical rooms, or electrical equipment rooms.
- Have ceiling clearance and maintain 610mm or more below the ceiling in areas of building not protected by a sprinkler, or a minimum of 657mm below sprinkler head defectors in areas protected by sprinkler system, and
- Have means of egress free of any obstruction

In addition, the code request Aircraft Hangar owners/operators to apply for Permit which shall authorise them to construct the hangar, store and carry out maintenance of aircraft. In this regard, before issuance of such permit, due consultation should be done by the aerodrome operator with relevant stakeholders involved with safety assessment conducted where necessary. NCAA shall review and approve such assessments.

In line with this, aerodrome operators should forward such hangar construction request with detail drawings and other specifications. Height approvals and related assessment must be done by NCAA before issuance of the permit. It is the responsibility of the aerodrome operator to ensure adequate and proper site selection, which include, but not limited to:

- Safe separation from aeronautical operational areas
- Outside runway clear zones
- Outside runway and taxiway safety areas
- Safe separation from airport properties
- Taking into account public and environmental protection. ASM 13.3

3.3 **GROUP I AIRCRAFT HANGAR FIRE PROTECTION REQUIREMENTS**.

The following fire protection systems should be provided:

- Fixed fire protection system in form of Foam water deluge system
- A combination of automatic sprinklers systems
- Automatic sprinkler systems when separate or additional shops are available
- Foam should be AFFF or FFFP
- Adequate water supply system for the system with media reserve.
- Wheeled and portable fire extinguishers (DCP or CO_2)
- Alarm/communication systems with relevant assisting agency

3.4 **GROUP II AIRCRAFT HANGAR FIRE PROTECTION REQUIREMENTS**

The following Fire Protection systems should be provided:

- Fixed fire protection system in form of Foam water deluge systems
- Automatic sprinkler system
- Low/High expansion foam
- Adequate water supply system and reserve
- Portable fire extinguishers
- Alarm/communication systems with relevant assisting agency

3.5 **GROUP III ARCRAFT HANGAR FIRE PROTECTION REQUIREMENTS**

- Fixed fire protection systems are not required unless hazardous activities are conducted
- Supplementary fire protection system may be provided if additional hazards exist
- Wheeled and portable fire extinguishers
- Alarm/communication systems

3.6 **GROUP IV AIRCRAFT HANGAR FIRE PROTECTION REQUIREMENTS**.

- Fixed fire protection systems may not be required unless hazardous operations are performed.
- Wheeled and portable fire extinguishers
- Alarm/communication systems
- Adequate water supply source and reserve media

3.7 **AIRCRAFT FUELLED HANGARS**

Additional protection requirements.

3.8 **EMERGENCY PROCEDURES REQUIREMENTS AT AIRCRAFT HANGARS**

Each Aircraft Hangar should have an emergency procedure: The emergency procedure should be boldly posted and as a minimum contain the following:

- Set of instructions to follow during emergency
- Emergency contact numbers

3.8 **MEDICAL FIRST AID KITS**

A minimum set of first aid kits should be provided at the Hangar.

CHAPTER 4:

INSPECTION, TESTING AND MAINTENANCE OF AIRCRAFT HANGAR FIRE PROTECTION SYSTEMS

4.1 Introduction

To ensure functionality and effectiveness of the Fire Protection systems in Aircraft Hangars, inspection and testing are of prime importance and vital. In this regard, it is the responsibility of the operator/owner of the hangar to maintain, inspect and test the system in accordance with the manufacturer specification. Adequate record of this self-inspection, test and maintenance of the fire protection systems must therefore be available.

4.2 Test Procedure

The following inspection/test should be carried out at regular intervals and appropriate records kept in accordance with Manufacturers specification.

- Visual Inspections
- Operational test with discharge
- Operational test with flow no discharge and
- Functional test.

4.3 Personnel Training

It is the responsibility of the aircraft hangar owner/operator to make sure that all personnel assigned safety critical task at the hangar are trained and could operate the applicable fire protection systems efficiently and safely. Safety Inspectors will require records/evidence of such training.

4.4 Inspection by aerodrome personnel

To ensure compliance by third parties with the safety provisions of this advisory circular, aerodrome operators should conduct inspection of aircraft hangars at least quarterly. This requirement can be incorporated into the aerodrome overall Safety Management System or assigned to a particular department.

CHAPTER 5:

AIRCARFT MAINTENANCE AT HANGARS

5.1 Introduction

It is important that aircraft maintenance at hangars are carried out in accordance with the highest level of standards due to the risk involved. Aircraft fuselage skin can be damaged in as little as 45 seconds after initial contact with a flame. It has therefore become necessary to ensure that appropriate maintenance procedures are approved and in place to protect human lives, the aircraft and other hangar activities.

Aircraft hangar owners/operators should have an approved aircraft hangar maintenance manual by the Authority. The maintenance procedure should cover fuelled, defueled aircrafts and other related hot works.

All equipment for aircraft maintenance should be properly maintained, personal trained and fully aware of all safety precautions.

5.2 Maintenance Requirements at Hangars

The following general maintenance standards shall apply:

- All electrical equipment such as power units aircraft electrical systems, chargers and any possible ignition sources must be kept separated from flammable fuel sources like fueling points, tank vents and fuel drain lines.
- Aircraft breathing systems presents an intrinsic risk of fire or explosion due to the presence of oxygen, so storage, maintenance and recharge should only be carried outside the hangar adopting additional precautions if any.
- Aircraft fuel system maintenance which require fuel transfer and storage is another fire risk. All these operations must be done outside.
- Aircraft welding must be completely isolated.
- Painting:

APPENDIX I

FIRE SAFETY CHECKLIST FOR AIRCRAFT HANGARS

Reference Document: National Fire Safety Code
NFPA 409 Aircraft Hangar Fire Protection
NFPA 410 Standards for Aircraft Maintenance

Name of Aerodrome:
Aircraft Hangar owner/Operator:
Name of Inspector(s):
Inspection Dates:

S/N	ITEM	YES	NO	N/A
	Aircraft Hangar group/ scope of operations			
	Are fire protection systems provided?			
	Are the fire protection system appropriate and in accordance with the aircraft hangar group?			
	Types of fixed fire protection system provided. • Water foam deluge system • Automatic sprinkler system • Other additional fire suppression systems:			
	Are the fire protection system operational?			
	Are adequate water			

	supply sources available for the fire protection system?			
	Are the fire protection system tested on recommended cycle and from time to time in accordance with the manufacturers specification?			
	Are test and maintenance records available?			
	Are employees trained on the use of the fire protection systems?			
	Are wheeled or portable fire extinguishers provided?			
	Are they appropriate and in accordance with the hazardous conditions/risks available?			
	Are they maintained, with good access and not obstructed?			
	Is appropriate provision made for earthing and grounding the hangar against static electricity?			

	Are lightening protection provided?			
	Is the separation of the hangar from other buildings in accordance with requirements?			
	Are waste (solid/liquid) properly disposed?			
	Is appropriate emergency /evacuation plan in place?			
	Are emergency contact numbers adequate and up-to-date?			
	Are appropriate alarm/notification systems provided?			
	Are link/communication to main airport ARFF facility provided?			
	Is there easy accessibility to the hangar by the airport ARFF vehicles			
	Is first aid provision made at the hangar?			

	Are records of accident/near miss kept?			
	Are inventories of hazardous chemicals at the hangar kept?			
	Are operational/maintenance personnel provided with appropriate PPE?			
	Do the aircraft hangar has an approved maintenance manual?			
	Other safety issues/House keeping			
	Do the aerodrome operator has a procedure to monitor compliance with fire protection requirements?			
Inspectors Remarks				

Inspectors Name	**Sign:**	**Date:**
Aerodrome operators representative name:	**Sign:**	**Date:**

Hangar Owner/Operator representatives name:	Sign:	Date: