

1. Purpose

The purpose of this document / certification criteria is to provide the minimum requirements for airworthiness (safety and security) of the UAS and permission to fly/ operate and enable the evaluation of UAS to these specific safety and security requirements and certification of UAS.

2. Scope of Application

This Certification Criteria is applicable to UAS being manufactured by indigenous manufacturers and importers of UAS in India. For the purpose of ease, indigenous manufacturers, importers and assemblers of UAS are being termed as manufacturer under this UAS Certification Scheme.

UAS has been classified based on maximum all-up weight including payload as follows:

Nano: Less than or equal to 250 grams*

Micro: Greater than 250 grams and less than or equal to 2 kg.

Small: Greater than 2 kg and less than or equal to 25 kg.

Medium Greater than 25 kg and less than or equal to 150 kg;

Large: Greater than 150 kg

Large: Greater than 150 kg* (to be processed on a case-by-case basis)

* Large drones greater than 500 Kg, shall be governed by Aircraft Rules, 1937.

Type certification is not required for model remotely piloted aircraft and nano unmanned aircraft system. All other UAS shall require type certification before their operation.

For the purpose of clarity, the certification bodies are the “authorised testing entity” mentioned in the Drone Rules 2021. The certification body / authorised testing entity means an entity authorised by the Director General or the Quality Council of India for the purpose of testing unmanned aircraft system for type certification.

3. Responsibility for Implementation

Certification manager and his team is responsible for implementation.

4. Maintenance

TIQ manager maintain this procedure.

5. References

Gazetted Reference Ministry of Aviation Notification S.O. 347(E)- Certification Scheme for Unmanned Aircraft Systems.

6. Normative References

The referenced documents (refer Annex B) are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

7. Competence Requirements

Competence Requirements for the Remote Pilot shall be as per Drone Rules 2021 & the gazette Requirements 26th Jan.2022.

8. Requirements

The UAS shall comply with the requirements as given in Table 1 at Annex A and evaluated as per methods of evaluation described in Table 1

**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|--|---|--|
| 1 | General | | | |
| 1.1 | (i) Classification of UAS | Micro / Small / Medium / Large | Stage 1: Verify the statement submitted by the manufacturer stating the classification of the UAS. | UAS is classified in accordance with maximum all up weight (including all compatible payloads and fully fuelled / charged power sources) and no additional weight will be permitted. |
| | (ii) Category of the UAS | (a) Aeroplane (b) Rotorcraft (c) Hybrid (A combination of Aeroplane and Rotorcraft categories) | Stage 1: Verify the statement submitted by the manufacturer. | |
| | (iii) Sub Category | (a) RPAS | Stage 1: Verify the statement submitted by the manufacturer. | |

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(b) Autonomous UAS

Table 1

Requirements (Technical Criteria) for UAS

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|--------|-----------------------------|---|---|--|
| 1.2 | Weight | i) Empty weight <ul style="list-style-type: none"> Weight without fuel / battery and without payload. Weight with integrated engine / battery but no fuel or payload. | Stage 1: Report of test by calibrated measurement equipment to be verified by certification body with respect to empty weight of the UAS. | Manufacturer to weigh the UAS sample with / without maximum fuel / battery, compatible payloads using calibrated measuring equipment and calibration certificate of the equipment to be submitted. Manufacturer to weigh the UAS sample with / without fuel / battery but no payload. |
| | | ii) Maximum all upweight <ul style="list-style-type: none"> Weight with maximum fuel/ largest battery and with all compatible payloads (Fixed + Variable) | Stage 1: Report of test by calibrated measurement equipment to be verified by certification body with respect to maximum all up weight of the UAS. | Manufacturer to weigh the UAS sample with maximum fuel / largest battery and compatible payloads using calibrated measuring equipment and calibration certificate of the equipment to be submitted. |

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UAS is categorized in accordance with maximum all up weight (including all compatible payloads) and no additional weight will be permitted.

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|--------|---|---|---|----------------------------------|
| | | iii) Relevant CG limits for each configuration. | Stage 1: Verification of appropriate analysis done by the manufacturers for calculating CG, for all configurations of the UAS, in the design documents submitted by the manufacturers. | |
| 1.3 | Type of Launch and/or Recovery Mechanism (If installed) | Launch and Recovery type (as applicable) | Stage 2: Physical inspection of the UAS to verify if the UAS type is as per the declaration of the manufacturer in the submitted design document. | |

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Stage 2: Physical inspection of the launch and recovery system to verify if the launch and recovery system is as per the declaration of the manufacturer in the submitted design document.

**Table 1
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| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|--|---|
| | | | 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | |
| 1.4 | Dimensions | Wing Span / MaxDiagonal Length | Stage 1: Measure the wing span / max diagonal length using calibrated measuring instruments and verify with submitted design documents. | Measure dimension of UAS in all configurations. Example: Folded, Ready to Launch, With and Without Payload etc. |
| 1.5 | Life of UAS | i) Airframe | Stage 1: Verification of design document determining the life of the airframe. | |

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| | ii) Engine | Stage 1: Verification of design document determining the life of the engine or Manufacturer to submit OEM documents giving details of life of the engine. | |
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| Table 1 Requirements (Technical Criteria) for UAS | | | | |
|--|-----------------------------|---|--|----------------------------------|
| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
| | | iii) Battery | 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | |
| | | | Stage 1: Cells and batteries used in UAS shall comply to the regulatory requirements of MeitY. Documentary evidence of IS Battery tests for battery used in UAS to be submitted for verification. | |

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| | | | Stage 2: Physical verification of the evidence submitted | |
| | | iv) Propeller / Rotor | Stage 1: Verification of design document determining the life of the propeller / rotor. | Additionally, validation of design results from manufacturer or through ground / bench tests with test bed values (if any) should also be submitted. |
| | | v) Number of Maximum Permissible Landings | Stage 1: Verification of design document determining the number of maximum permissible landings. | Additionally, validation of design results from manufacturer or through ground / bench tests (if any) should also be submitted. |

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|--------|-----------------------------|---|---|----------------------------------|
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| 1.6 | Payloads | CompatiblePayloadDetails | <p>Stage 1: Manufacturer to submit a list of all compatible payloads with complete details like weight, specifications, purpose of usage.</p> | <p>No other payload shall be permitted other than those approved by the certification body. Based on the recommendation of CB, DGCA may update the more compatible payloads in the Type Certificate provided that maximum all up weight of the UAS is not exceeded. Note: For the purpose of certification, payload does not include chemicals or other liquids used in spraying drones. Such liquids may be sprayed by following applicable rules and regulations. In such cases, the certification body shall assess the UAS with any one of the liquids intended to be used. Any agricultural chemical inputs in the market may be permitted to be used in the UAS by submitting authorization/undertaking by the user/manufacturer.</p> |
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**Table 1
Requirements (Technical Criteria) for UAS**

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|--------|-----------------------------|---|---|--|
| 2 | Performance | | | |
| 2.1 | Speeds | i) Minimum operating speed the minimum specified operating speed of UAS at standard sea level conditions shall be at least 10% above the actual stall speed | <p>Stage 2: To be witnessed during flight testing:</p> <p>a) Verify that minimum operating speed is at least 10% more than stall speed by design in the submitted design document.</p> <p>In case the concept of stall speed is not applicable, the minimum operating speed of the rotor should be considered which is needed for supporting the drone while airborne.</p> <p>b) OEM should demonstrate stable flight (without stall) at minimum operating speed (as applicable)</p> | Annexure D: Guidelines for flight test |
| | | ii) Determine maximum operating speed at standard sea level conditions | <p>Stage 2: To be witnessed during flight testing:</p> <p>Manufacturer to demonstrate flight with maximum speed as submitted in the design document.</p> | Annexure D: Guidelines for flight test |

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|--------|-----------------------------|---|--|---|
| | | iii) Determine that maximum kinetic energy on impact does not exceed 95 KJ at any combination of mass and speed | Stage 1: Verification of analysis submitted by the manufacturer showing maximum kinetic energy on impact does not exceed 95 KJ at any combination of mass and speed. Refer to the Annexure C prepared for the Kinetic Energy calculations with reference to limiting conditions of weight and speed. | Note 1: Calculation should be either of a freefall scenario from 400 ft with zero forward speed or maximum forward speed scenario by calculating $1.4 \times V_{max}$. Note 2: Drones having higher mass and velocity combinations resulting in higher than 95 KJ kinetic energy may need to incorporate appropriate drone recovery system to ensure that the limit of 95 KJ is not exceeded. |
| 2.2 | Range | Determine maximum range in still air | Stage 1: Verification of analysis submitted by manufacturer. Stage 2: Validation of the same during flight test. | To be verified through analysis by considering actual max demonstrated endurance and cruise speed, actual max distance from take-off location achieved validated during flight tests. Annexure D: Guidelines for flight test |

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|--------|-----------------------------|---|---|--|
| 2.3 | Endurance | a) Determine fuel and oil consumption and endurance (if applicable) | Stage 1: Manufacturer to submit necessary document of endurance test with fuel and oil consumption of a representative flight for verification. Stage 2: Verification of manufacturer's test results by witnessing flight testing while ensuring 10% spare fuel remaining in the tank after landing. | Annexure D: Guidelines for flight test |
| | | b) Determine endurance of the UAS with fully charged battery. | Stage 1: Manufacturer to submit necessary document of endurance test of a representative flight for verification. Stage 2: Verification of manufacturer's endurance test results by witnessing flight testing while ensuring less than 90% battery utilization of a fully | |

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| | | | charged battery after landing. | |
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**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|--|--|----------------------------------|
| 2.4 | Operational altitude | Determine maximum attainable altitude above mean sea level conditions as per standard atmospheric conditions | <p>Stage 1: Manufacturer to declare maximum attainable altitude above mean sea level condition as per standard atmospheric conditions by design and demonstrate restriction of maximum attainable altitude above ground level in GCS or firmware.</p> <p>Stage 2: Maximum attainable altitude above ground level to be verified during flight testing against the design document submitted by the manufacturer.</p> | |

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| 2.5 | Operational envelope | Determine boundaries of operational envelope within which safe flight, in normal and emergency conditions, can be demonstrated under combinations of weight, center of gravity (if applicable), altitude, temperature and airspeed | <p>Stage 1: Verification of design document details.</p> <p>Stage 2: Comparison with actual flight performance and parameters.</p> <p>Note: In case of medium and above categories of UAS, additionally, operational envelope to be demonstrated during flight test.</p> | <p>The manufacturer to submit documents that describe the rationale behind determination of the operational envelope and explain the method of verification.</p> <p>The UAS performance to be considered in both, normal and emergency conditions that are defined by the manufacturer.</p> <p>However, the standard / available environmental conditions are only to be considered during certification.</p> |
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|--------|-----------------------------|---|---|---|
| 2.6 | Ceiling height | Determine ceiling height over a range of weight, center of gravity (if applicable), altitude, Temperature and air speed | <p>Stage 1: Verification of design documents details.</p> <p>Stage 2: Comparison with actual flight performance and parameters.</p> | Manufacturer to declare the maximum attainable height above Mean Sea Level by design. |

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| 2.7 | Propeller speed and pitch for safe operation | a) Determine propeller speed and pitch (if multiple/variable pitch props are used or intended to be used in the design) limits that ensure safe operation under normal operating conditions. | Stage 1: Verification of the certificate/declaration provided by the manufacturer regarding propeller pitch and speed limits for safe operations. | For detachable or foldable propeller blades, test results of blade retention test at a load double the max centrifugal force should be part of the document submitted. |
| | | b) Determine integrity of propeller and its mounting at maximum rpm | Stage 1: Manufacturer to submit design documents determining the integrity of the propeller and its mounting at its maximum rpm or Stage 2: CB to witness bench test to determine the stated requirement. | Manufacturer to submit ground test procedure along with test results at their end. |

**Table 1
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| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|---|----------------------------------|
| | | | 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | |

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| 2.8 | Stability control and | a) Determine that UAS is able to maintain a stable flight without pilot input | <p>Stage 2: To be verified during flight testing:</p> <p>i. Manufacturer to demonstrate stable flight and sensor readings which should be longitudinally, directionally and laterally stable.</p> <p>ii. Similar tests to be carried out in Aeroplane category UAS.</p> <p>Note on Stability: The UAS should be tested in all its operating modes, both Flight Control System (FCS) augmented or manual (if available), including the Manufacturer provided demonstrable failsafe features must be longitudinally, directionally and laterally stable in any condition normally encountered in service.</p> | Annexure D: Guidelines for flight test |
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**Table 1
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|--------|------------------------------|---|---|---|
| | | b) Determine that pilot is able to control UAS with ease. | Stage 2: To be witnessed during flight: Manufacturer to demonstrate stable flight with minimal pilot inputs. | |
| 3 | Powerplant | | | |
| 3.1 | Powerplant (Engine Operated) | a) Determine that fan blade can withstand ultimate load of 1.5 times the centrifugal force resulting from operation | Stage 1: Verification of design analysis and relevant evaluation data of the stated requirement from manufacturer / OEM. | |
| | | b) Determine that engine installation is such that it prevents excessive vibration from any part | Stage 2: Vibration measurement test i.e. flight logs to be witnessed for verification of test reports submitted by the manufacturer. | Test report to be submitted by manufacturer as per the specifications given in the design document. |
| | | c) Ensure that exhaust is firmly mounted to the structure and free from any obstructions | Stage 2: Ascertain by physical inspection that exhaust is firmly mounted to the structure and free from any obstruction. | |

Table 1
Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-------------------------------|---|--|--|
| | | d) Determine that there is no fuel leak in the system under pressure during operational tests on ground | 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | |
| 3.2 | Powerplant (Battery Operated) | a) Determine that safe cell temperatures and pressures are maintained during charging / discharging cycle | Stage 2: Physical inspection and witness ground test by manufacturer to demonstrate fuel system integrity under pressure during ground test. Stage 1: Cells and batteries used in UAS shall comply to the regulatory requirements of MeitY. Documentary evidence of IS Tests of battery used in UAS to be submitted for verification. Stage 2: (i) Physical verification of the evidence submitted. To be verified during flight test. | Integrity of fuel system against leakage to be tested with a factor of safety e.g. 1.5 times the operating pressure of the system. Ground tests with electronic load matching the operating current profile may be conducted. Note: Safe cell temperature and pressure during charging and discharging is a safety and reliability parameter of battery. Regulatory requirement of MeitY is to use BIS registered batteries. If a battery is BIS registered, it automatically complies with this clause since the test would have already got covered within the scope of IS tests. |

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|--------|-----------------------------|--|--|------------------------------------|
| | | b) Determine that noexplosive or toxic gases are emitted in normal operation | <p>Stage 1: Cells and batteries used in UAS shall comply with the regulatory requirements of MeitY. Documentary evidence of IS Tests of battery used in UAS to be submitted for verification.</p> <p>Stage 2: (i) Physical verification of the evidence submitted. To be verified during flighttest.</p> | Note: Same as in 3.2 (a) |
| | | c) Determine that no corrosive fluid is discharged which may damage the surrounding structures / equipment | <p>Stage 1: Cells and batteries used in UAS shall comply with the regulatory requirements of MeitY. Documentary evidence of IS Tests of battery used in UAS to be submitted for verification.</p> <p>Stage 2: (i) Physical verification of the evidence submitted. (ii) To be verified during flight test.</p> | Note: Same as in 3.2 (a) |

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**Table 1
Requirements (Technical Criteria) for UAS**

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|--------|-----------------------------|---|---|--|
| | | d) Ensure that motor /motor controller has overcurrent / overheating protection | Stage 1: (i) Verify details of test bench for testing over current / overheating protection system of motor / motor controller and ascertain its suitability. (ii) Verify test report of over current / overheating protection system. Stage 2: Witness the test to verify the stated requirement. | Bench test to be performed on a suitable test bench for verification of the motor / motor controller over current / overheating protection system. |
| | | e) Battery Storage design and installation. | Stage 2: Physical inspection to be conducted to ascertain and verify the following as per design documents submitted by the manufacturer: 1. Batteries shall be stored in the manner as to prevent deterioration other than standard battery chemistry and Battery Management | To be verified from design document and relevant user manual |

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System (BMS) limitations.
Mechanisms for charging and logging of battery voltages should be provided.

**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|--|--|---|----------------------------------|
| 3.2.1 | Battery performance (energy, power capability) | Determine rate of discharge of battery as per manufacturers' Specifications (C-rate, cut off conditions, Ah and Wh, energy and power density). | 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | |
| | | | Stage 1: Verification of test reports from an accredited testing laboratory submitted by the manufacturer determining rate of discharge of battery with charge capacity more than 85% at all times. Stage 2: Verification of manufacturer's test results by witnessing flight testing while ensuring less than 90% battery utilization of a fully charged battery after landing. | |

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| 3.2.2 | Battery performance (life cycle) | Determine life cycle up to 80% Depth of Discharge (DoD) for various atmospheric conditions (flying conditions of drone). | <p>Stage 1: Verification of test reports from an accredited testing laboratory submitted by the manufacturer determining the mentioned specification.</p> <p>Stage 2: Verification of witnessing flight testing.</p> | |
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Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|--|--|
| 4 | Structure | | | |
| 4.1 | Strength requirements | a) Demonstrate that airframe structure shall be able to withstand flight limit loads without failure, malfunction or permanent deformation. | <p>Stage 1: Verification of static load test report/theoretical analysis (if applicable) and design documents as submitted by the manufacturer.</p> <p>Demonstration through static load test applicable for Medium and above categories.</p> <p>For all others theoretical analysis to</p> | <p>For determination of anticipated flight loads, appropriate standard software may be used.</p> <p>Static Structural Analysis may be done with Aircraft Handbook Calculation Methods or Finite Element Methods (FEA) (Software) can also be used.</p> |

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| | | | suffice. | Visual inspection to be conducted on engine / motor mounting and structure after the tests for deformation, if any. |
| | | b) Applicant has to provide analysis of the structure showing that a factor of safety of 1.5 has been used | Stage 1: Verification of analysis and design documents as submitted by the manufacturer. | Static test to limit load based on maximum all up weight. Static Structural Analysis may be done with Aircraft Handbook Calculation Methods or Finite Element Methods (FEA) (Software) can also be used. |

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|--|---|----------------------------------|
| | | c) Determine that each user removable bolt, screw, nut, pin or other fastener whose loss could jeopardize the safe operation of the UAS, shall incorporate a locking device or redundancy. | 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | |
| | | | Stage 1: Verification of Design Review Analysis Document to establish that Primary Structure Elements (PSEs) have been identified and their drawings or work instructions have provision of lock nuts or adhesive or other mechanisms as applicable. | |

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| | | | Stage 2: Physical verification to be conducted by the inspection agency on sample UAS. | |
| | | d) Determine that UAS is free from excessive vibrations under any operational speed and power condition. | Stage 1: Verify the submitted documents, regarding vibration measurement tests i.e. flight logs at manufacturer's end Stage 2: Witness the vibration measurement tests i.e flight logs | |
| | | e) Determine that propeller blade clearance is sufficient from structure and/or components, and from ground. | Stage 1: Verification of design documents details regarding blade tip clearances. Stage 2: Validation on sample UAS during physical inspection. | |

**Table 1
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|--------|-----------------------------|---|---|----------------------------------|
| | | | 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | |

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| 4.2 | Shock absorbing mechanism of UAS, if applicable | a) It must be shown that the limit load factors selected for design will not be exceeded. | Stage 1: Verification of design analysis submitted by the manufacturer. | Impact/Static Analysis Report of Landing gear using Finite Element Analysis (FEA) software can also be considered. |
| | | b) The landing gear may not fail, but may yield, in a test showing its reserved energy absorption capacity | Stage 1: Verify the design document. Stage 2: Witness the drop test. | Demonstration of safe landing of the aircraft when dropped from a height as determined by the manufacturer and demonstrated accordingly. This should also be reflected in operational limitations to be followed by the operator. |
| 5 | Material and Construction | | | |
| 5.1 | Type of material for construction | The suitability and durability of materials used for parts, the failure of which could adversely affect safety, must: a) be established on the basis of experience or tests; | Stage 1: Review of material test reports from accredited testing laboratory to ascertain the compliance criteria. However, in the absence of above documentation the manufacturer may submit appropriate analysis or Finite Element Analysis (FEA) whichever applicable. | Strength experimental analysis approved by ASTM / any other appropriate standard) to be carried out for the materials to find out the strength of the material. |

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|--------|-----------------------------|---|--|--|
| | | <p>The suitability and durability of materials used for parts, the failure of which could adversely affect safety, must:</p> <p>b) meet approved specifications, which will ensure that strength and other properties assumed in the design data are correct;</p> | <p>1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details)</p> <p>Stage 1: Review of material test reports from accredited testing laboratory (as per ISO/IEC 17025) to ascertain the compliance criteria.</p> <p>However, in the absence of above documentation the manufacturer may submit appropriate analysis or Finite Element Analysis (FEA) whichever applicable.</p> | <p>Strength experimental analysis approved by ASTM / any other appropriate standard) to be carried out for the materials to find out the strength of the material.</p> |
| | | <p>The suitability and durability of materials used for parts, the failure of which could adversely affect safety, must:</p> <p>c) take into account the effects of environmental conditions, such as temperature and humidity, expected in service.</p> | <p>Stage 1: Review of material test reports from accredited testing laboratory (as per ISO/IEC 17025) to ascertain the compliance criteria.</p> <p>However, in the absence of above documentation the OEM may submit appropriate analysis.</p> | <p>Strength experimental analysis approved by ASTM / any other appropriate standard) to be carried out for the materials to find out the strength of the material.</p> |
| 5.2 | Fabrication Method | <p>a) Methods of fabrication used must produce consistently sound structures</p> | <p>Stage 1: Review of QC process specification and/or procedures submitted by the manufacturer for establishing consistency in quality of fabrication.</p> <p>Stage 2: Additionally, physical inspection may be conducted to verify if such processes are in place adequately.</p> | <p>Design document from manufacturer should have description about fabrication and integration procedure in Manufacturing Process Record.</p> |

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|--|--|--|---|
| | | b) In a fabrication process, such as gluing, spot welding, heat- treating, etc. requires close control, the process must be performed according to an approved process specification. | Stage 1: Review of the approved QC process specification and/or procedures submitted by the manufacturer for establishing consistency in quality of fabrication. Stage 2: Additionally, physical inspection may be conducted to verify if such processes are in place adequately. | |
| | | c) Fabrication method must be substantiated by a test program Note: Requirement of a test program is applicable for a new fabrication method which is not yet established/proved in any industry. | Stage 1: Review of the test program, QC process specification and / or procedures submitted by the manufacturer. | |
| 5.3 | Means of protection against deterioration or loss of strength in operation due to any cause i.e. weathering, corrosion and | a) Effect of in-service wear on the loading of critical components should be determined | Stage 1: By design review or analysis Stage 2: Physical inspection after ground and flight tests. | Manufacturer to identify critical components for anticipated in-service wear. |

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| abrasion. | | | |
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Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|--|--|---|----------------------------------|
| | | b) Effect of temperature and moisture should be determined in computing the material design values | <p>Stage 1: Verification of test reports from accredited testing laboratory</p> <p>For Temperature: Verification of test reports from an accredited testing lab submitted by the manufacturer for temperature range of -10°C and +50°C, as per IS 9000 Part 2 & 3 or equivalent standard</p> <p>For Humidity: Verification of test reports from an accredited testing lab submitted by the manufacturer for 90% Relative Humidity at +40°C, as per IS 9000 Part 4 or IEC 60068 2 78 or equivalent standard</p> | Specimen / Coupon Tests |
| 5.4 | Fire resistant identification plate on UAS for inscribing UIN. | a) Determination of ID plate material which should be fire resistant | Stage 1: Review of the declared material type of the ID plate and supported by test reports from accredited testing laboratories. | |

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In case the manufacturer is,using certified fire-resistant materials, then a certificate and/or appropriate test report certifying the same from the material manufacturer may be accepted.

**Table 1
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| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|----------|---|---|--|--|
| | | b) Determine location of ID plate along with its secure fixing on UAS | 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | |
| 6 | Data Link | | | |
| 6.1 | Type of datalink used for communication (C2 data link, frequency band etc.) | a) Determine full functioning of data link communication | Stage 1: Verify the following from documents submitted by the manufacturer. i) Verification of ETA from WPC. ii) Verify that specification and full | Data link loss is declared if the link is lost for more than the time specified by the manufacturer or set by the user as per manufacturer's recommendations. Annexure D: Guidelines for flight test. |

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| | | | <p>functioning / characteristics of data link are clearly mentioned and described in the documents.</p> <p>iii) Verify associated test reports / results as applicable to ascertain implementation of full functionality of data link.</p> | <p>Note:</p> <p>1. Data link specifications and functionalities should be clearly described / explained / elucidated in the submitted documents.</p> |
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Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|--|----------------------------------|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p>2.1 On-site testing (Ground)</p> <p>2.2 Flight testing</p> <p>2.3 Laboratory test (with appropriate details)</p> | |
| | | | <p>Stage 1: Verify the following from documents submitted by the manufacturer.</p> <p>i. Verification of ETA from WPC.</p> <p>ii. Verify that specification and full functioning / characteristics of data link are clearly mentioned and described in the documents.</p> <p>ii. Verify associated test reports / results as applicable to ascertain implementation of full functionality</p> | |

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| | | | <p>of data link.</p> <p>Stage 2: Witness the test / demonstration of verification as per below compliance.</p> <p>i) Data submitted by the OEM/ Manufacturer to be verified during a distance communication test from all possible azimuth angles.</p> <p>ii) C2-Data Link capability vs performance comparison through</p> | |
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**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|--|----------------------------------|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> | |
| | | | <p>test cases need to be demonstrated by OEM.</p> <p>iii) Functional verification of Manufacturer's Specifications on Stability & Control, Redundancy (Single or dual channel) and Back Up, (if any).</p> <p>iv) Manufacturer to demonstrate the contingencies implemented</p> | |

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| | | | including return to home functionality when data link is lost or other applicable contingencies. | |
| | | b) Demonstration of system to alert the remote pilot with aural and visual signal, for any loss of command and control data link | <p>Stage 1: Verify from the description / explanation in documents (flight manual) submitted by the manufacturer.</p> <p>(a) That the system alerts the remote pilot with aural or visual signal for any loss of command and control data link.</p> | <p>Annexure D: Guidelines for flight test</p> <p>Note: 1. The functionalities of system alert to remote pilot with aural or visual warning for any loss of command and control of data link should be clearly described / explained in the submitted documents. Such functionality may be configurable as per the operational requirements.</p> |

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|--|--|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> | |
| | | | <p>Stage 2: Witness the test of verification as per below compliance.</p> <p>Verify by flight demonstration whether aural and visual signal to</p> | <p>2. All tests are to be carried out as per a test plans/test cases to test and demonstrate the Functionality for verification.</p> |

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| | | | alert the UAS Pilot during loss of command and control of data link is implemented satisfactorily. | |
| | | c) Determine that communication range is sufficient to have a permanent connection with the UAS | <p>Stage 1: Verify from the description / elucidation given in the documents submitted by the manufacturer.</p> <p>(a) That the communication range is sufficient to have a permanent connection with the UAS in all attitude and operational limits of the UAS specification.</p> | <p>Annexure D: Guidelines for flight test</p> <p>Note:</p> <p>1. Sufficiency of communication range to have permanent connection with UAS including under various battery power conditions should be clearly described / explained / elucidated in the submitted documents.</p> |

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|--|----------------------------------|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> | |

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| | | | <p>(b) Permanent connection with the UAS in all attitude and operational limits are maintained under various battery power conditions.</p> <p>(c) Verify associated test reports to ascertain implementation of the functionality.</p> <p>Stage 2: Witness the test / demonstration for verification as per below compliance.</p> <p>i) Manufacturer to demonstrate communication range between the UAS and C2 Data Link for positive, negative and boundary case distances from the GCS for having permanent connection in an environment free from interference.</p> <p>ii) Similar test to be performed under various battery /power conditions and performance demonstrated.</p> | <p>2. All tests are to be carried out as per a test plans/test cases to test and demonstrate the functionality for verification.</p> |
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**Table 1
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| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|--|--|---|
| | | d) Determine that when data link is lost or in other contingencies, the UAS follows a predefined path to ensure safe end of flight within the required area restrictions | <p>Stage 1: Verify from the description / elucidation in the documents submitted by the manufacturer.</p> <p>i) That the functionality and how it is implemented is described / explained in detail in the UAS flight manual.</p> <p>ii) Description of function performed in case of link loss or in other contingencies (Contingencies should be listed) clearly explained in UAS Flight Manual</p> <p>iii) CB to assess the sufficiency of contingency plan.</p> <p>iv) Verify associated test reports to ascertain implementation of the functionality.</p> | <p>Data link loss is declared if the link is lost for more than the time specified by the manufacturer or set by the user as per manufacturer's recommendations.</p> <p>Annexure D: Guidelines for flight test</p> <p>Note:</p> <p>1. In the event of data link loss or in other contingencies, the UAS follows a predefined path to ensure safe end of flight within the required area restrictions should be clearly described / explained / elucidated in the submitted documents.</p> <p>2. All tests are to be carried out as per a test plans/test cases to test and demonstrate the functionality for verification.</p> |

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|---|--|--|
| | | | <p>Stage 2: Witness the test / demonstration for verification as per below compliance.</p> <p>i) Demonstrate the contingencies implemented including return to home functionality when datalink is lost or other applicable contingencies.</p> | |
| | | <p>e) Determine the capability of system to inform remote pilot by means of a warning signal in the event of data link loss</p> | <p>Stage 1: Verify from the description / elucidation in documents (flight manual) submitted by the manufacturer:</p> <p>(a) That the system has capability to inform remote pilot by means of a warning signal in the event of data link loss.</p> <p>(b) Verify associated test reports to ascertain implementation of the functionality.</p> | <p>Annexure D: Guidelines for flight test Note:</p> <p>1. The capability of system to inform remote pilot by means of a configurable warning signal in the event of data link loss should be clearly described / explained / elucidated in the submitted documents.</p> <p>2. All tests are to be carried out as per test plans/test cases to test and demonstrate the functionality for verification.</p> |

Table 1
Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|--|---|--|
| | | | <p>Stage 2: Witness the test of verification as per below compliance.</p> <p>i) Demonstrate by flight whether aural and visual signals to alert the UAS Pilot during loss of data link is implemented satisfactorily.</p> | |
| | | <p>f) A command and control data link loss strategy must be established, approved and presented in the UAS Flight Manual</p> | <p>Stage 1: Verify from the documents submitted by the manufacturer.</p> <p>(a) That a command and control data link loss strategy has been included in the flight manual.</p> <p>(b) The strategies clearly explain the functions performed in case of link loss.</p> | <p>Note:</p> <p>1. Command and control data link loss strategy and its implementation should be clearly described / explained / elucidated in the submitted documents.</p> <p>2. All tests to be carried out as per test plans/test cases to test and demonstrate the functionality for verification.</p> |

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**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|---|---|---|----------------------------------|
| | | | 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | |
| | | | (c) CB to verify UAS flight manual and assess / ascertain the sufficiency. (d) Verify associated test reports to ascertain implementation of the strategy. 2. Witness the test of verification as per below compliance. (a) Demonstrate, implementation of the contingencies as per strategy when command control data link is lost. | |
| 7 | Secure Flight Module (FM) and Tracking Mechanism | | | |

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| 7.1 | Firmware tamper avoidance | <p>a) Protection of onboard computer firmware from tampering (software)</p> <p>UAS should not function if firmware is changed by any procedure other than authorized update procedure.</p> | <p>Stage 1: Verify the documents submitted by the manufacturer.</p> <p>Stage 2: Witness the test of verification as per below compliance.</p> | <p>Note:</p> <p>(i) Flight Module (FM) would be the building block on which the UAS tracking mechanism would be built. Building FM compliant with Clauses 7.1 and 7.2 would enable smoother transition to the tracking mechanism when mandated by Drone Rules.</p> |
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Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|---|----------------------------------|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> <p>A. Verification of Secure Boot:</p> <p>Manufacturer to produce a certificate of compliance indicating compliance with all conditions mentioned below:</p> <p>i) Flight Module Security Implementation</p> <p>a) Flight Module should have as defined in Annexure E.</p> <p>b) Flight modules should follow the communication requirement (if applicable) as defined in</p> | |

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| | | | Annexure E. c) FM should have a root of trust mechanism implemented (using, for example, TPM or TEE for Level 1 compliance) which is used to sign the data generated inside the FM. | |
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Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|---------------|------------------------------------|--|---|---|
| | | | 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | |
| | | | d) The verification key of the root of trust may be recorded and retained. (This key will also be used for verifying the origin of logs generated by the FM). ii) Calculation of Checksums a) Manufacturer to submit checksums of the firmware to the CB and these checksums may be called 'registered checksums'. | |

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| | | | <p>b) Code part and data part checksums to be calculated separately to enable updating of data/parameters in the future easily.</p> <p>c) All checksums should be calculated using a Secure Hash Algorithm (SHA2 or SHA3).</p> | |
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| <p align="center">Table 1 Requirements (Technical Criteria) for UAS</p> | | | | |
|--|-----------------------------|---|---|----------------------------------|
| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> | |
| | | | <p>d) Registered checksums should be stored securely in the flight module such that they cannot be updated without the authorisation of the manufacturer.</p> <p>e) These registered checksums may be digitally signed by the CB and retained.</p> <p>iii) Power on Self-Test (POST)</p> | |

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| | | | <p>a. Manufacturers should implement a Power On Self-Test (POST).</p> <p>b) It should include calculation of checksums of the firmware (code and data part) and the checksum should be matched with the registered checksum stored in the flight module which was supplied at the time of certification.</p> <p>c) The result of the POST should be logged.</p> <p>d) Mismatch of checksum should prevent the UAS from booting and be logged.</p> | |
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**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|---------------|------------------------------------|--|---|---|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> | |
| | | | <p>iv) Testing of Firmware protection (software)</p> <p>a) Attempt modifying the firmware (code and data) in an unauthorised manner. The firmware update should fail. In case the firmware</p> | |

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| | | | gets updated in an unauthorised manner, then verify that in UAS fails the POST. Test to be conducted in presence of the CB. | |
| | | b) Safety and security of firmware update | <p>Stage 1: Verify the certificates submitted by the manufacturer for ensuring safety and security of the firmware.</p> <p>Stage 2: Witness the firmware update process as per the process explained below.</p> <p>A. Secure Upgrade Test:</p> <p>i) The update should be permitted only if it is signed by the manufacturer's digital certificate.</p> | |

**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|--|----------------------------------|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> | |

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| | | | <p>ii) UAS should be able to verify the authenticity of the update by verifying it with the public key of the manufacturer.</p> <p>iii) Firmware change should be recorded in the logs.</p> <p>iv) After the UAS is upgraded, the registered checksum should be updated in the flight module securely.</p> <p>v) The checksums of the updated firmware (code and data) to be digitally signed by the CB and retained.</p> | |
| | | c) Secure change of flight parameters | Stage 1: Verify the documents submitted by the manufacturer citing the process for instituting a change in any given parameter. | This is not applicable if manufacturer has not defined an additional method of changing flight parameters and such parameters can be changed only via firm update. |

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|--------|-----------------------------|---|--|--|
| | | | <p>Stage 2: Witness the test for the change process as detailed below.</p> <p>A. Testing of Parameter Update:</p> <p>i) UAS should be able to verify the authenticity of the update by verifying it with the public key of the manufacturer.</p> <p>ii) Change should be recorded in the logs.</p> <p>iii) After the UAS is upgraded, the registered checksum should be updated in the flight module securely.</p> <p>iv) The checksums of the updated firmware (code and data) to be digitally signed by the CB for their records</p> | <p>1. Manufacturers should update parameters that do not affect compliance conditions using a Manufacturer's Standard Operating Procedure. Fore.g.: Using GCS, APIs, etc.</p> <p>Manufacturer may decide schedule for Firmware update if needed.</p> |

Table 1
Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|---|--|--|
| | | | v) Try to update the parameters that affect compliance conditions using the manufacturer's standard operating procedure. The parameter should remain unaffected. vi) Try to update the parameters in the firmware that affect compliance conditions using an invalid digital signature. The update should fail. | |
| 7.2 | Hardware Tamper Avoidance | a) Protection of onboard computer from tampering (physical) | Stage 1: Verify the documents submitted by the manufacturer explaining the tamper protection mechanism along with its justification. Stage 2: Witness the test for the tamper protection as detailed below. | 1. The onboard computer and its ports (USB, UART, bus, etc.) should not be accessible to unauthorised user. 2. Manufacturers may electronically pair crucial flight-critical components like radio, GPS, etc. with the flight controller and detect the use of unauthorised components. |

Table 1
Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|---|---|----------------------------------|
| | | | <p>A. Hardware Tamper Detection and Response:</p> <p>i) Verify the physical presence of tamper prevention, detection and response mechanisms by inspection of the UAS.</p> <p>ii) Replace crucial flight-critical components using unauthorised procedure and check if UAS is arming. Physical tampering should be detected by UAS and use of unauthorised flight critical components should be logged.</p> <p>iii) In case of unauthorised replacement of an electronically paired, flight-critical component, the UAS should not arm.</p> <p>iv) In case of non-electronically paired, flight-critical components,</p> | |

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verify by visual inspection if the manufacturer has implemented hardware protection mechanisms and designed UAS in a way to minimise tampering.

Table 1

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|--------|-----------------------------|--|---|---|
| | | b) Mechanism to replace crucial hardware like radio modules, GPS and flight controller | <p>Stage 1: Verify the documents submitted by the manufacturer explaining the process of replacement.</p> <p>Stage 2: Witness the test for the integrity of the hardware.</p> <p>A. Testing of Secure Hardware Change:</p> <p>i) In case of unauthorised replacement of an electronically paired, flight-critical component, the UAS should not arm.</p> <p>ii) In case of non-electronically paired, flight-critical components, verify by visual inspection if the</p> | <p>1. SOP for hardware change should also include verifying authenticity and functional integrity of the new component being introduced.</p> <p>2. Manufacturers should uniquely pair either electronically or non-electronically with a unique flight controller and record the same.</p> <p>3. Manufacturer should establish Standard Operating Procedure to replace hardware and should only enable the same via an authorised person.</p> <p>4. Every change of hardware should</p> |

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| | | | <p>manufacturer has implemented hardware protection mechanisms and designed UAS in a way to detect hardware change.</p> <p>iii) In case of secure hardware change, validate SOP by the manufacturer for completeness.</p> | <p>be recorded by the manufacturer and documents should be available to the CB or DGCA for inspection and surveillance.</p> |
|--|--|--|---|---|

**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|-----------|---|--|--|---|
| 8. | Instruments / Equipment | | | |
| 8.1 | All on-board electrical and electronics equipment's /components | <p>Following are to be complied in respect of all on-board electrical and electronics equipment:</p> <p>i) Adequate source of electrical energy, where electrical energy is necessary for operation of UAS</p> <p>ii) Wiring is installed in such a manner that operation of any equipment will not adversely affect the simultaneous operation of any other equipment</p> | <p>Stage 1: Verification of design documents submitted by the manufacturer:</p> <p>(a) Availability of wireframe diagram, wiring diagram, loom layout diagram. These diagrams should be included in the standard list of diagrams / drawings.</p> <p>b) Specification of the wires used (in the cables/looms) which carry heavy</p> | <p>1. Internal wiring shall be routed, supported, clamped or secured in a manner that reduces the likelihood of excessive strain on wire and on terminal connections; loosening of terminal connections; and damage of conductor insulation.</p> <p>2. For soldered terminations in safety critical circuits, the conductor shall be positioned or fixed so that reliance is not placed upon the soldering alone to</p> |

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| | | <p>iii) Wiring lay out is according to the wiring diagram</p> | <p>current and the equipment's where it is used CB to verify that the cables are suitable for the specified current.</p> <p>c) Verification of schemes used for cable terminations and cable joints. Soldering should not be used for connections between cables or termination of safety critical circuits.</p> | <p>maintain the conductor in position.</p> <p>3. An external terminal for charging shall be designed to prevent an inadvertent shorting and misalignment and a reverse polarity connection when connected to the charger.</p> |
|--|--|---|--|---|

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|--|--|--|
| | | <p>iv) All wiring is suitable for the current and voltage passing through it.</p> <p>v) No kinks in the wiring exist</p> <p>vi) Wiring routing is not along the sharp edges</p> <p>vii) Soldering connections between cables are not there</p> <p>viii) All equipment are connected with adequately secured connections to prevent loosening during vibrations</p> | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p>2.1 On-site testing (Ground)</p> <p>2.2 Flight testing</p> <p>2.3 Laboratory test (with appropriate details)</p> <p>(c) Verification of types of connectors used for cable termination of on-board</p> <p>(d) locking or has mechanism to prevent loosening due to vibration.</p> <p>(e) The external terminal for charging is designed to prevent inadvertent shorting, possibility of reverse polarity connection, misalignment etc.</p> | <p>4. For battery packs that are intended for removal from the UAS for external charging or replacement with a charged battery pack</p> <p>5. The external terminal for charging shall be designed to prevent inadvertent shorting, a reverse polarity connection, misalignment, or access by the user.</p> <p>Note:</p> <p>1. Manufacturer to suitably mention</p> |

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| | | <p>ix) Minimum operating voltage</p> <p>x) Maximum operating current</p> | <p>Stage 2: Physical verification / visual inspection of the following in the UAS:</p> <p>(a) Visual Inspection to be performed to ascertain that the UAS is built as per wire diagram. Internal wiring is as per the wiring and loom layout diagram.</p> <p>(b) Cable routing is supported, clamped or secured in a manner that reduces the likelihood of excessive strain on wire and on terminal connections</p> | <p>and explain incorporation of all above points in the design document.</p> <p>2. Standards (if applicable): IS 616 or IS 13252</p> |
|--|--|--|--|--|

**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|---|----------------------------------|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> | |
| | | | <p>(c) No kink in the wiring.</p> <p>(d) Wiring routing is not along the sharp edges.</p> <p>(e) Soldering connection between cables/wires is not there.</p> <p>(f) All equipment is connected with adequately secured connectors to prevent loosening during vibrations.</p> | |

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| | | | (g) The external terminal for charging is designed to prevent inadvertent shorting, possibility of reverse polarity connection, misalignment etc. | |
| | a) Global Navigation Satellite System (GNSS) receivers (if applicable) | Determine whether the capability of GPS receiver meets the requirements and functionality of the UAS | <p>Stage 1: Verification of the following from design documents submitted by the manufacturer</p> <p>a) Verify from documents specification of the GPS receiver and whether it meets the requirement of the UAS functionality.</p> | <p>Note:</p> <p>1. Specification and capability of GPS receivers should be clearly mentioned and described in the submitted documents.</p> <p>Functionality tests and demonstration to be carried out as per a test plans/test cases for verification.</p> |

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|--|----------------------------------|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> | |
| | | | <p>(b) Verification of the test report of the functionalities of GPS receiver</p> <p>Stage 2: Witness the test of verification as per below compliance.</p> <p>(a) Verification of GPS receiver</p> | |

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| | | | functionality by flight test. | |
| | <p>b) Flashing anti-collision strobe lights</p> <p>Mandatory for Night Flight Operations and Optional for Day Flight Operations</p> | Provision for flashing anti-collision light in the UAS | <p>Stage 1: Verification of the following from design / technical documents submitted by the manufacturer:</p> <p>(a) To be verified from documents if anti-collision lights are installed.</p> <p>(b) Verification of specification of anti-collision lights.</p> <p>Stage 2: Witness the test of verification as per below compliance.</p> <p>(a) Verification of operation of anti-collision lights during flight test.</p> | |

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|--|----------------------------------|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> | |

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|---|--|---|--|---|
| <p>c) Actuators</p> <p>d) Servo controller</p> <p>e) Other UAS components</p> | | <p>Determine whether Actuators, Servo controllers, and Other Components are installed in the UAS.</p> | <p>Stage 1: Verification of the following from design / technical documents submitted by the manufacturer:</p> <p>(a) To be verified from documents if Actuators, Servo controllers, and Other Components are installed in the UAS. Manufacturer to clearly mention the same in the documents.</p> <p>(b) If installed, verification of specification and detailed description of operation of these components from the documents.</p> <p>(c) Verify functional test reports of these components in various operating condition and operating envelope of the UAS</p> <p>Stage 2: Witness the test of verification as per below compliance.</p> <p>(a) Verification of operation of</p> | <p>Note:</p> <p>1. Specification and detailed operations of Actuators, Servo controllers, and Other flight control Components should be clearly mentioned and described / explained in the submitted documents.</p> <p>Functionality tests and demonstration to be carried out as per a test plans/test cases in respect of each component for verification.</p> |
| | | | | |
| <p>Table 1 Requirements (Technical Criteria) for UAS</p> | | | | |

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| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|---------------------------------------|--|--|---|
| | | | 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | |
| | | | Actuators, Servo controllers, and Other Components during flight test. | |
| | f) Geo-fencing capability (Mandatory) | Determine whether Geo-fencing capability has been implemented. | <p>Stage 1: Verify from the description / elucidation in the documents (flight manual) submitted by the manufacturer:</p> <p>(a) Detailed explanation of geo fencing capability and how it is implemented in the UAS to be verified from the documents.</p> <p>(b) UAS Pilot should be able to define a Geo-fence from the UAS GCS.</p> <p>(b) Verification from test reports the implementation of geo- fencing capabilities at different latitude and longitude of geo- fence points.</p> | <p>Manufacturer should be able to demonstrate that the UAS Pilot should be able to define a Geo-fence from the UAS GCS and should be able to demonstrate that the UAS does not breach the Geo- fence during flight</p> <p>Note:</p> <ol style="list-style-type: none"> Geo-fencing capabilities and how it is achieved in the UAS should be clearly described / explained / elucidated in the submitted documents (Flight Manual). All tests are to be carried out as per test plans/test cases to test geo-fencing capabilities at different latitude and longitude of geo-fence points |

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|---|--|--|----------------------------------|
| | | | <p>Stage 2: Witness the test of verification as per below compliance.</p> <p>(a) Witness demonstration that Remote Pilot is able to define a Geo-fence from the UAS GCS.</p> <p>(b) Demonstrate that the UAS does not breach the Geo-fence during flight.</p> | |
| | <p>g) SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment. Applicable for UAS intending to operate above 400 feet AGL.</p> | <p>Determine whether UAS has SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment.</p> <p>Justification: SSR transponder (Mode 'C' or 'S') is a secondary radar system. It enables the ATCO to identify and see the aircraft altitude or flight level automatically.</p> <p>ADS-B Out is onboard equipment. It works by broadcasting information</p> | | |

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about an aircraft's GPS location, altitude, ground speed and other data

**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|---|--|----------------------------------|
| | | <p>to groundstations and other aircraft. It enables ATCO precise tracking of aircraft.</p> <p>For safety and security, it is essential for ATCO to know details like location, altitude, ground speed etc. of all UAVs flying in the controlled airspace.</p> <p>Without knowing these, controlling of aircraft operation by ATC would be difficult and can lead to midair collision with disastrous consequences. That is why, SSR Transponder (Mode C or S) or ADS-B Out equipment is a mandatory requirement for many busy areas of controlled airspace.</p> | <p>To be demonstrated or validated as per applicable standards.</p> <p>Stage 1: Verify from the description / elucidation in the documents (flight manual) submitted by the manufacturer:</p> <p>(a) Manufacturer to declare if UAS has SSR transponder (Mode 'C' or 'S') or ADS-B OUT equipment.</p> <p>(b) If present, verify ETA copy and associated test reports as applicable.</p> | |

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|--|--|--|---|--|
| | | Therefore, UAVs operating in controlled airspace must have SSR Transponder (Mode C or S) or ADS-B Out equipment. | (c) Verify specification, technical description and principle of operations of the equipment from design document. (d) Verify functional characteristics and specification of the equipment from the test reports. | |
|--|--|--|---|--|

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|---|--|----------------------------------|
| | | | <p>Stage 2: Witness the test of verification as per below compliance.</p> <p>(a) Witness and verify functionality of the equipment during flight trial.</p> <p>(b) Verify original copy of the ETA</p> <p>Note: 1. Specification, detailed technical description and principle of operations of the equipment should</p> | |

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| | | | <p>be clearly described / explained / elucidated in the design documents.</p> <p>2. All tests to verify the equipment specifications and functionalities are to be carried out as per a test plans/test cases.</p> | |
|--|--|--|--|--|

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|---|--|---|---|
| | h) Detect and Avoid capability (Optional) | <p>Determine whether Detect and Avoid capability option has been implemented.</p> <p>Justification: There is no pilot physically onboard a UAS. The primary safety concern with drones is the inability of remote operators to “see and avoid” other aircraft. This can result in near-misses or midair collisions with dangerous consequences. This is more applicable to drones operating in high traffic density area (controlled airspace) and BVLOS category.</p> | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p>2.1 On-site testing (Ground)</p> <p>2.2 Flight testing</p> <p>2.3 Laboratory test (with appropriate details)</p> <p>Stage 1: Verify from the description / elucidation in the documents (flight manual) submitted by the manufacturer:</p> <p>(a) Manufacturer to specify if Detect and Avoid capability option has been implemented in the UAS.</p> <p>(b) If present, verify specification, technical description and principle of operations from design documents/ UAS Flight Manual.</p> <p>(c) Verify implementation of Detect and Avoid capability option from test</p> | <p>Note:</p> <p>1. Detailed technical description and principle of operations of Detect and Avoid capabilities should be clearly described / explained in the design documents / Flight Manual.</p> <p>All tests to verify detect and avoid capabilities are to be carried out as per a test plans/test cases.</p> |

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| | <p>Onboard Detect and Avoid system would enable the drone to detect any approaching aircrafts/drones and avoid.</p> <p>Detect and Avoid capability is therefore, recommended for Drones operating in controlled airspace and for BVLOS category.</p> | <p>reports.</p> <p>Stage 2: Witness the test of verification as per below compliance.</p> <p>(a) Manufacturer to demonstrate with flight the implementation of Detect and Avoid capability option.</p> | |
|--|--|--|--|

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|--|---|---|---|
| | i) Flight controller with flight data logging capability | Determine whether UAS has flight controller with flight data logging capability | <p>Stage 1: Verify from the description / elucidation in the documents (flight manual) submitted by the manufacturer:</p> <p>(a) Manufacturer to specify if UAS has flight controller with flight data logging capability.</p> <p>(b) If present, verify specifications and data logging capabilities from the design documents.</p> <p>(c) Verify data log of a</p> | <p>Note:</p> <p>1. Technical description of data logging capabilities should be clearly described / explained in the design documents.</p> |

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| | | | <p>representative flight</p> <p>Stage 2: Witness the test of verification as per below compliance.</p> <p>(a) Data log of a representative flight should be verified after conducting flight test.</p> | |
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Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|--|--|--|--|
| | j) Barometric equipment with capability for remote | <p>Determine whether UAS has Barometric equipment with capability for remote subscale setting.</p> <p>Justification: Barometric equipment in drone enables altitude tracking during flying and setting of flight level, altitude (QNH) and height (QFE). Remote subscale settings enable setting these parameters remotely from GCS.</p> | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> <p>Stage 1: Verify from the description / elucidation in the documents (flight manual) submitted by the manufacturer:</p> <p>Manufacturer to declare if UAS has Barometric equipment with capability for remote subscale setting</p> <p>(a) If present, verify specification,</p> | <p>Note:</p> <p>1. Detailed technical description and principle of operations of Barometric equipment should be clearly described / explained in the design documents.</p> <p>2. All tests to verify remote barometric Subscale setting capabilities are to be carried out as per a test plans/test cases</p> |

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| | <p>subscale setting</p> <p>Applicable for BVLOS operations.</p> | <p>Barometric equipment is a safety feature and required for safe operation, maintaining correct altitude separation in high density flying area and in BVLOS operation.</p> | <p>technical description and principle of operations from design documents/ UAS Flight Manual.</p> <p>(b) Verify from test reports the specifications and functionalities of Barometric equipment.</p> <p>Stage 2: Witness the test of verification as per below compliance.</p> <p>(a) Manufacturer to demonstrate with flight the Barometric equipment capability for remote subscale setting.</p> | |
|--|--|--|---|--|

**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|--|--|----------------------------------|
| | | <p>Failure to set the appropriate barometric sub-scale pressure may result in a significant deviation from the cleared altitude or FlightLevel which is unsafe.</p> <p>Barometric equipment with remote subscale setting is therefore recommended for drones operating</p> | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> | |

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| | | in controlled airspace and for BVLOS categories. | | |
| | k) RFID and GSM Sim Card (Optional) | <p>Determine whether UAS has provision for RFID and GSM SIM Card</p> <p>Justification: GSM or RFID tags are used for remote communication with drones. RFID tags are used to transmit the owner's name, phone number, registration number, GPS location and other information. RFID (reader) is also used for identification, locating and tracking of inventory spread over large areas.</p> | <p>Stage 1: Verify from the description in the documents submitted by the manufacturer:</p> <p>(a) Verify from design documents, whether the manufacturer has implemented RFID and GSM SIM card in the UAS.</p> <p>If implemented, RFID</p> <p>(b) Verification of specification of RFID from UAS design documents.</p> | <p>1. Independent tamper proof hardware in the UAS (air) unit should be implemented on the UAS</p> |

**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|--|----------------------------------|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> | |

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|----------|------------------------------|--|--|--|
| | | <p>The GSM antenna and SIM card is used to send to and receive data from UAV through GSM module.</p> <p>Presently, transmission of owner's name, phone number, registration number, GPS location etc. is not compulsory in existing drone rules.</p> <p>Hence, RFID is an optional feature. As regards to GSM, manufacturer to decide how the data would be sent and received from drone. Hence, GSM is also optional.</p> | <p>GSM SIM (c) Verify specification of GSMSIM from the documents</p> <p>Stage 2: Witness the test of verification as per below compliance.</p> <p>RFID (a) Manufacturer to show and demonstrate working of RFID on the UAS</p> <p>GSM SIM (b) Software dashboard to be provided to the regulators/ CB and real time demonstrated as per a test plan.</p> | |
| 9 | Qualification Testing | | | |
| 9.1 | Environmental tests | <p>Determine that instruments and equipment withstand the following:</p> <p>a) Effects of voltage spikes from power source;</p> | <p>Stage 1: If UAS is powered from an external source: Verification of test reports from an accredited testing lab submitted by the manufacturer for Surge Immunity as per</p> | |

**Table 1
Requirements (Technical Criteria) for UAS**

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| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|---|--|----------------------------------|
| | | | <p>ANSI/IEEE C62.41 / IEC 61000-4-5 / IS 14700 or equivalent standard.</p> <p>Stage 2: If UAS powered from on-board source:</p> <p>Review of design analysis report submitted by the manufacturer:</p> <p>(a) details of the nominal voltage and current range of the electrical power supply on-board the UAS at various load conditions including the payloads.</p> <p>(b) Details of peak voltage and current range of the electrical power supply on-board the UAS at various load conditions including the payloads in various flight conditions.</p> <p>The design analysis and technical analysis report should justify and</p> | |
| | | | | |

Table 1
Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|--|--|--|
| | | | and clearly bring out that there is no possibility of voltage spikes from the power source. | |
| | | <p>Determine that instruments and equipment withstand the following:</p> <p>b) Susceptibility toHIRF;</p> <p>Applicable if UAS is intended to be operated in environment withHIRF</p> | <p>Stage 1: Verify from the documents submitted by the manufacturer:</p> <p>(a) Verification of authenticated test reports from an accredited testing lab submitted by the manufacturer for Radiated Immunity as per IEC 61000-4-3 equivalent standard.</p> <p>(b) Manufacturer should ensure bonding of the components and grounding them properly to the airframe. The same should be verified from the documents.</p> <p>Stage 2: Verification of original test report.</p> <p>(a) Original test report should be verified during flight trial.</p> | As a safety feature, manufacturer should ensure bonding of the components and grounding them properly to the airframe. |

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| | | | (b) Bonding of components to be physically verified in the UAS. | |
|--|-----------------------------|--|---|---|
| Table 1 Requirements (Technical Criteria) for UAS | | | | |
| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
| | | Determine that Instruments and equipment withstand the following: c) Temperature and humidity variations; | 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Note: (a) Manufacturer to prepare a test plan across the full operational environmental range (temperature and humidity). (b) Based on the specification and design of the UAS, manufacturer to specify the temperature and humidity ranges and other requirements of testing in the test plan. At a minimum, tests should be carried out for temperature ranges of 0 to 50° C and 90% RH at 40° C. (c) UAS should be kept in serviceable condition (not storage) during the test. |

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| | | | <p>Stage 2: Verification of original test report. (a) Verify original copy of temperature and humidity test reports during flight trial</p> | <p>(d) The temperature test to be carried out as per IS 9000 Part 2 & 3 or equivalent standard. (d) The humidity test to be carried out as per IS 9000 Part 4 or IEC 60068 2 78 or equivalent standard.</p> |
|---|-----------------------------|--|---|--|
| <p>Table 1 Requirements (Technical Criteria) for UAS</p> | | | | |
| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
| | | | <p>1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details)</p> | |
| | | | | <p>(e) Authenticated test reports from an accredited testing lab should be submitted by the manufacturer.</p> |
| | | <p>Determine that Instruments and equipment withstand the following: d) Shock resistant, etc.</p> | <p>Stage 1: Verify from the documents submitted by the manufacturer: (a) Verification of authenticated test reports from an accredited testing lab submitted by the manufacturer for shock resistance, as per IEC 60068-2-27 or equivalent standard</p> | <p>Note: (a) The manufacturer to prepare a shock test profile and a test plan for the drone as per IEC 60068-2-27. (a) As per design and intended operating conditions / use of the UAS, manufacturer should specify shock test profile like repetition rate (number of shocks per second), shock severity, peak acceleration,</p> |

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| | | | <p>Stage 2: Verification of original test report. (a) Verify original copy of the shock test reports during flight trial.</p> | <p>duration along three axes, the pulse shape etc. (b) Carry out shocktest as per the test plan in an accredited lab. The test is to be carried out mounting the drone on a vibration table with the help of a fixture and without packing case. Mounting on the shock testing machine should be as per IEC 60068-2-47</p> |
|---|-----------------------------|--|--|--|
| <p>Table 1 Requirements (Technical Criteria) for UAS</p> | | | | |
| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
| | | | <p>1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details)</p> | |
| | | <p>Determine that instruments and equipment withstand the following: e) Ingress Protection (IP) Certification</p> | <p>Stage 1: Verify from the documents submitted by the manufacturer: (a) Verify whether the manufacturer has defined</p> | <p>(c) Carry out fullfunctional test after the drone has been subjected to the shocks. It should pass the functional test. (d) Submit authenticated lab (shock) test and functional test report.</p> |

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| | | | <p>IP certification.</p> <p>In case the manufacturer has defined IP Certification, verify from documents the details of specified ingress protections codes like water, dust, chemicals, fumes etc.</p> <p>(c) Verify test plan and test reports of IP parameters as per the codes.</p> <p>(d) The tests should be carried out in accredited lab.</p> | |
|--|--|--|---|--|

**Table 1
Requirements (Technical Criteria) for UAS**

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|--|--|--|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p>2.1 On-site testing (Ground)</p> <p>2.2 Flight testing</p> <p>2.3 Laboratory test (with appropriate details)</p> | |
| | | | <p>Stage 2: Verification of original test report.</p> <p>(a) Verify original copy of the IP test reports during flight trial.</p> | |
| 9.2 | EMI / EMC test | Determine that each electrical instrument and equipment is protected against EMI coming from the operational environment to ensure normal operation. | <p>Stage 1: Verify from the documents submitted by the manufacturer:</p> | <p>Note:</p> <p>(a) Manufacturer to prepare a test plan for Radiated Immunity test as per IEC 61000 / IS 14700 or equivalent</p> |

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| | | | <p>Verification of test reports from an accredited testing lab submitted by the manufacturer for Radiated Immunity, as per applicable Parts and Clauses of IEC 61000 / IS 14700 or equivalent standard.</p> <p>Stage 2: Verification of original test report.</p> <p>(a) Verify original copy of EMI/EMC test reports during flight trial.</p> | <p>standard</p> <p>(b) Frequency, power, test parameters, acceptance limits, test chambers etc. to be specified by the manufacturer in the test plan.</p> <p>(c) Test to be carried out as per the test plan in an accredited lab.</p> |
|--|--|--|--|---|

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|--|---|--|
| | | | <p>1. Verification of records</p> <p>2. Testing and verification</p> <p> 2.1 On-site testing (Ground)</p> <p> 2.2 Flight testing</p> <p> 2.3 Laboratory test (with appropriate details)</p> | |
| 9.3 | Software | a) Determine impact of loss of function and malfunction of UAS | <p>Stage 1: Verify from the documents submitted by the manufacturer:</p> <p>(a) Verification of Risk analysis statement of software submitted by</p> | IEC Standard for FMEA or SAE ARP4761 - System Safety Assessment may be followed as guidelines. |

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| | | | manufacturer. This should be accepted by Certification Body | |
| | | b) Determine that sufficient independence exists between software components with respect to both function and Design. | <p>Stage 1: Verify from the documents submitted by the manufacturer:</p> <p>(a) To verify statement of independence software issued by the manufacturer.</p> <p>(b) CB to approve the statement of independence.</p> <p>(c) Verify software independence test report carried out per the test plan (IV&V).</p> <p>Stage 2: If IV&V is done by manufacturer, CB to validate</p> | <p>Note:</p> <p>(a) Manufacturer to issue a Statement of Independence of software by design as well as functionality.</p> <p>(b) Having defined the independence, manufacturer should prepare a test plan / test cases to test the software independence.</p> <p>Submit IV&V report for verification.</p> |

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation | Guidance on method of evaluation |
|--------|-----------------------------|---|---|----------------------------------|
| | | | <ol style="list-style-type: none"> 1. Verification of records 2. Testing and verification <ol style="list-style-type: none"> 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | |

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| 9.4 | Hardware | a) Determination of hardware design life cycle through established quality control procedure, | <p>Stage 1: Verify from the documents submitted by the manufacturer:</p> <p>(a) Verify documents submitted by the manufacturer on Quality Control Procedure / Internal Quality Assurance procedures adopted during manufacturing of the UAS.</p> <p>Stage 2: Verification during flight trial.</p> <p>(a) Verify Quality Control Procedure / Internal Quality Assurance procedures followed by the manufacturer in their facility.</p> | <p>Note:</p> <p>(a) Manufacturer to prepare a document on Quality Control Procedure / Internal Quality Assurance procedures adopted during manufacturing of the UAS.</p> <p>(b) Manufacturer can follow the procedures mentioned in ISO 9001 for the above, even if they may not be ISO 9001 certified.</p> <p>(c) Quality Control Procedure / Internal Quality Assurance procedures shall be checked during site visit.</p> <p>Manufacturers are required to follow the procedures in ISO 9001 even if they may not necessarily be ISO 9001 certified.</p> |
| | | b) Component performance and reliability to be monitored on a continuous basis. | <p>Stage 1: Verify from the documents submitted by the manufacturer:</p> <p>(a) Verify component performance, monitoring process effectiveness submitted by the manufacturer.</p> | <p>Note:</p> <p>(a) Manufacturers should continuously monitor component performance during the design and development process.</p> |

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|--------|-----------------------------|---|---|--|
| | | | <p>(b) Check that component performance, monitoring process effectiveness has been documented in the UAS Maintenance Manual.</p> <p>Stage 2: Verification during flight trial.</p> <p>(a) Verify record of various failures observed during product development period, failure analysis, its impact on safety & reliability, rectification carried out and measures taken to ensure no recurrence of such failures etc.</p> | <p>(b) Manufacturer should carry out component performance process assessment effectiveness and document in the UAS Maintenance Manual.</p> <p>(c) A continuous monitoring standard should be established during the entire UAS Product Development cycle.</p> <p>(d) Manufacturer should prepare and submit record of various failures observed during product development period, failure analysis, its impact on safety & reliability, rectification carried out and measures taken to ensure no recurrence of such failures etc.</p> |

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|-----------|-----------------------------|---|---|----------------------------------|
| 10 | Documentation | | | |
| 10.1 | UAS Flight manual | UAS flight manual should contain the following information: 1) Limitations / operating conditions/ operating envelope 2) Normal Procedures, pre-flight checklist, etc. 3) Emergency procedures 4) Performance (at various combination of weight, altitude, temperature and wind conditions) 5) Any other relevant information required for safe operation of UAS | Stage 1: The certification body to review the submitted flight manual and approve the content for its applicability. | |
| 10.2 | UAS Maintenance Manual | UAS maintenance manual should consist of the following: 1) Maintenance procedures of the UAS. | Stage 1: The certification body to review the submitted maintenance manual and approve the content for its applicability. | |

**Table 1
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| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|--|--|--|
| | | 2) Continuous Monitoring process for UAS components. | | |
| 10.3 | UAS Log book | UAS log book should consist of the following: 1) Provision to maintain UAS Operation Logs Provision to maintain UAS Maintenance Logs | Stage 1: The certification body to review the submitted log book and approve the content for its applicability. | |
| 10.4 | Other design documents | 1. Bill of material and country of origin | Stage 1: Manufacturer to submit component/sub-system level Bill of Materials (BOM), key specifications (as per manufacturer), and declaration of country of origin. The documentation submitted to be version-controlled. Stage 2: CB to verify BOM submitted by manufacturer | All analysis reports as required for substantiation. Reports should have document number, rev no, release date, preparer/ reviewer / approver. |

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against design documents and purchase records.

Table 1

Requirements (Technical Criteria) for UAS

| S. No. | Parameter / Characteristics | Compliance Criteria (with Requirements) | Method of Evaluation 1. Verification of records 2. Testing and verification 2.1 On-site testing (Ground) 2.2 Flight testing 2.3 Laboratory test (with appropriate details) | Guidance on method of evaluation |
|--------|-----------------------------|---|---|--|
| | | 2. Analysis reports | Stage 1: Verify for appropriateness the version-controlled documents to be submitted along with application that are duly approved by the authorised signatory. | All analysis reports as required for substantiation. Reports should have document number, rev no, release date, preparer/ reviewer / approver. |
| | | 3. Test reports | Stage 1: Verify for appropriateness the version- controlled documents to be submitted along with application that are duly approved by the authorised signatory. | All test reports as required for substantiation. Reports should have document number, rev no, release date, preparer/ reviewer/approver |
| | | 4. Detailed drawings | Stage 1: Verify for appropriateness the version-controlled documents to be submitted along with application that are duly approved by the authorised signatory. | The manufacturer should establish a procedure for version control of design documents. Assembly level drawings showing parts list. Drawings should have document number, rev no, release date, |

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| | | | preparer/reviewer/approver. |
| | 5. Consolidated hardware and software independently verified and validated reports | Stage 1: Verify for appropriateness the version- controlled documents to be submitted along with application that are duly approved by the authorised signatory. | |

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|--------|-----------------------------|---|---|--|
| | | 6. Material procurement record | Stage 1: Verify for appropriateness the version- controlled documents to be submitted along with application that are duly approved by the authorised signatory. | |
| | | 7. Manufacturing process records | Stage 1: Verify for appropriateness the version- controlled documents to be submitted along with application that are duly approved by the authorised signatory. | May include manufacturing process root cards and process records |

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Annex B

Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

1. 14 CFR 35 - Airworthiness Standards: Propellers, Code of Federal Regulations (annual edition), Federal Aviation Administration
2. BS EN 61000-3-3:2013, Electromagnetic compatibility (EMC). Limits. Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection.
3. BS EN 61000-4-6:2014, Electromagnetic compatibility (EMC). Testing and measurement techniques. Immunity to conducted disturbances, induced by radio-frequency fields.
4. BIS IS 14599: 1999(R2014), Automotive Vehicles - Performance Requirements (Measurement of Power, SFC, Opacity) Of Positive and Compression Ignition Engines - Method of Test.
5. Aviation Regulations, Section 3 – Air Transport Series X Part I Issue I, Dated 27 August 2018.
6. DGCA UAS Guidance Manual, Revision 2 - 2020.
7. Drone Rules 2021, Ministry of Aviation dated 25 Aug. 2021
8. IEC 61000-3-3:2013+AMD1:2017 CSV, Consolidated version, Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection.
9. IEC 60068-2-6:2007, Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal).
10. IEC 61000-4-6:2013, Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields.
11. IEC CISPR 24, Information technology equipment – Immunity characteristics – Limits and methods of measurement.
12. IEC 60947-5-1:1990 (read in conjunction with IEC 947-1), Low-voltage switchgear and control gear. Part 5: Control circuit devices and switching elements - Section One: Electromechanical control circuit devices.
13. IEC 60529:1989, Degrees of protection provided by enclosures (IP Code).
14. ISO 12405-4:2018, Electrically propelled road vehicles — Test specification for lithium-ion traction battery packs and systems — Part 4: Performance testing.
15. ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories.
16. IS 616:2017/IEC 60065:2014 - Audio, Video and similar electronic apparatus- Safety requirements.
17. IS 9002-10-1: Equipment for Environmental Tests for Electronic and Electrical Items, Part 10: Shock Test Machine, Section 1: Free Fall Type.
18. IS 14700-4-1: Electromagnetic Compatibility (EMC), Part 4: Testing and Measurement Techniques, Section 1: Overview of IEC 61000-4 Series.

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19. IS 9002-6: Equipment for Environmental Tests for Electronic and Electrical Items, Part VI: Constant Relative Humidity Chamber (non-injection type).
20. IS 9000-16: Basic environmental testing procedures for electronic and electrical items 16 Driving rain test
21. IS 9000-4: Basic Environmental Testing Procedures for Electronic and Electrical Items, Part 4: Damp heat (Steady state).
22. IS 9000-11: Basic environmental testing procedures for electronic and electrical items, Part 11: Salt mist test.
23. IS 4691: 1985, Rotating electrical Machines Part 5 Degrees of protection provided by enclosure for rotating electrical machinery.
24. IS 12063: 1987, Classification of Degrees of Protection Provided by Enclosures of Electrical Equipment.
25. IS 13947: Part 1: 1993, Low-voltage Switchgear and Control gear - Part 1: General Rules
26. IS 14599: Automotive Vehicles - Performance Requirements (Measurement of Power, SFC, Opacity) of Positive and Compression Ignition Engines - Method of Test
27. IS 16046 (Part 1):2018 / IEC 62133-1:2017 Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes — Safety Requirements for Portable Sealed Secondary Cells and for Batteries Made from Them for Use in Portable Applications Part 1 Nickel Systems
28. IS 16046 (Part 2):2018 / IEC 62133-2:2017 Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes — Safety Requirements for Portable Sealed Secondary Cells and for Batteries Made from Them for Use in Portable Applications Part 2 Lithium Systems.
29. IS 6303-4: Primary Batteries, Part 4: Safety of Lithium Batteries.
30. IS 10000-2: Methods of tests for internal combustion engines, Part 2: Standard reference conditions.
31. JSS 50101: 1996, Environmental Test methods for Service Electronic Components (Group Class 5999).
32. JSS 55555 – Antifungal Test – Electronics.
33. MIL-STD-810 Testing, Environmental Engineering Considerations and Laboratory Tests, Vibration Testing Category 8 – Aircraft – Propeller.
34. NATO STANDARD AEP-83 Light Unmanned Aircraft Systems Airworthiness Requirements, Edition B Version 1 November 2016.
35. UK-CAA Policy for Light UAV Systems by D. R. Haddon, C. J. Whittaker Design & Production Standards Division, Aviation Authority, UK.