ETSO-2C208

ED Decision 2022/018/R

ELECTRICAL HOIST EQUIPMENT

1 Applicability

This ETSO provides the requirements for electrical hoist equipment that is designed and manufactured on or after the date of this ETSO.

To be eligible for the ETSO, the hoist equipment shall be equipped with an overload protection device.

Hoist equipment includes the hoist itself, load attachment means (cable, hook, etc.), control and monitoring interfaces, a structural interface to attach the hoist to the boom/rotorcraft structure and the overload protection device. The boom itself is not considered to be a part of the hoist equipment.

Electrical hoist equipment designed in accordance with this ETSO must be identified with the applicable ETSO marking.

This hoist ETSO covers articles which are intended to be operated in the complete range of possible hoist missions.

2 Procedures

2.1 General

The applicable procedures are detailed in CS-ETSO, Subpart A.

2.2 Specific

None.

3 Technical Conditions

3.1 Basic

3.1.1 Minimum Performance Standard

The applicable standard for hoist equipment is provided in SAE Aerospace Standard (AS) 6342, Minimum Operation Performance Standard for Helicopter Hoist Systems, dated December 2020, as modified by Appendix 1 to this ETSO.

Whenever the term ‘hoist’ is used in this SAE document, it is equivalent to the hoist equipment.

3.1.2 Environmental Standard

See CS-ETSO, Subpart A, paragraph 2.1.

3.1.3 Software

See CS-ETSO, Subpart A, paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, Subpart A, paragraph 2.3.

3.1.5 Development Assurance

See CS-ETSO, Subpart A, paragraph 2.4.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, Subpart A, paragraph 2.4.

The failure of the function defined in paragraph 3.1.1 of this ETSO is:

- Catastrophic for loss or malfunction of the hoist equipment (including the overload protection device), which could lead to serious injuries or a fatality (including the HEC).

In addition, no single failure of the hoist equipment shall result in a Catastrophic Failure Condition.

For the compliance demonstration of structural parts / structural elements, the single failure criteria should be addressed through, but not limited to, static, fatigue, damage tolerance and critical parts requirements.

Supporting information is provided in AMC 27/29.865(c)(2) and CS 27/29.1309.

3.2.2 Equipment Safety Assessment

The hoist manufacturer shall conduct an Equipment Safety Assessment, including a systematic, comprehensive evaluation of the hoist equipment to show that the safety objectives from the Functional Hazard Assessment (FHA) of the ETSO article and the derived safety requirements are met.

The latest revision of SAE ARP4761 provides guidance for the safety assessment process. Any assumptions taken by the hoist manufacturer shall be documented in the safety assessment. See also CS-ETSO, Subpart A, paragraph 2.4.

Note: Particular aircraft installations will drive additional, and more stringent, safety requirements for the hoist equipment. The ETSO applicant may elect to comply with these more severe aircraft installation requirements for the hoist equipment in the ETSO article FHA. If this option is selected, this shall be identified in the ETSO Certification programme, and demonstrated within the ETSO data package. Compliance with non-ETSO requirements will also be assessed during the approval (TC/STC) of the installation.

3.2.3 Installation Manual

The applicant shall document in an installation manual all information needed to substantiate the installation of the hoist equipment on a rotorcraft, including the following:

— Electrical interface definition and structural interface loads from the hoist system to the rotorcraft hoist attachment;

— Definition of the control and monitoring interfaces (per Appendix 1, Section 3.4.1.1);

— Maximum permanent deformation of the hoist after the application of the crash load factor (per Appendix 1 — Table 1 Section 3.6);

— Impact speed for the bird strike test (per Appendix 1 — Table 1 Section 3.6);

— Control means for the PQRS and BQRS (per Appendix 1 — Table 1 Section 4.6).

— The maximum rated load.

4 Marking

4.1 General

See CS-ETSO, Subpart A, paragraph 1.2.

4.2 Specific

5 Availability of Referenced Documents

See CS-ETSO, Subpart A, paragraph 3.

[Amdt ETSO/17]

APPENDIX 1 TO ETSO-2C208 — ELECTRICAL HOIST EQUIPMENT

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Appendix 1 identifies sections, paragraphs, figures or sentences from the SAE AS 6342 standard that are not applicable as minimum performance standards (MPS), and identifies requirements that are applicable in lieu of the referenced SAE text, or that are added to some sections of the SAE AS6342 standard. The information is provided in the form of three tables:

— Table 1 presents the amended text or additional text.

— Table 2 presents the additional definitions necessary for the ETSO.

— Table 3 presents the additional list of acronyms.

Table 1 — Modifications of requirements for the ETSO

When reading SAE AS6342 section	Apply the following:
2.3	Add to the HOIST definition the following: The hoist is equivalent to the hoist equipment. Hoist equipment includes the hoist itself, load attachment means (cable, hook, etc.), control and monitoring interfaces (including pendants, controllers and their interconnecting wires), a structural interface to attach the hoist to the boom/rotorcraft structure and the overload protection device. The boom itself is not considered to be a part of the hoist equipment.
	Replace the HOIST SYSTEM definition as follows: The system, inclusive of the hoist and ancillary components. For clarification, the hoist system includes the hoist equipment and other systems needed for integration to the rotorcraft and operation of the hoist. This includes but is not limited to, displays, controls within the cockpit and cabin, boom, rotorcraft wiring and the power supply.
	Add at the beginning of the LIMIT LOAD definition the following: Limit loads are the maximum loads to be expected in service.
	Add at the end of the Limit Load Factor definition: Note: For structure requirements, and systems such as OLPD, the static limit load factor of 3.5g can be reduced to the maximum load factor the rotorcraft can reach within the hoist operational envelope, but not less than 2.5g.
	Add at the beginning of the ULTIMATE LOAD definition the following: Ultimate Loads are the limit loads multiplied by the prescribed factor of safety.
	Add Table 2 of Appendix 1 (see further below) to the section.
2.4	Add Table 3 of Appendix 1 (see further below) to the section.
3.1	Replace the section with the following: Specific installation requirements additional to this minimum operation standard shall be defined in the ETSO certification programme.
3.3.2	Replace the section with the following:

When reading SAE AS6342 section	Apply the following:
	The hoist shall have a system to manage the reeling out and reeling in of the cable, minimising the possibilities of jamming, fouling, kinking, or excessive wear on the cable.
3.3.2.2	Replace the section with the following: The storage provision (e.g. drum) shall be able to attach the cable end, and store all the usable cable. The storage provision shall minimise wear affecting either the cable or the storage provision. The design shall account for prevention of unravelling and damage of the cable on the drum. Potential environmental conditions such as vibration shall be taken into account. A means shall be provided to visibly check/inspect the storage of the cable. All reference to storage visibility shall be for maintenance on the ground, not necessarily for hoisting operations.
3.3.4 2nd paragraph	Replace the paragraph with the following: Cable rebound shall be characterised through testing by the hoist manufacturer, and a characterisation report shall be provided as part of the certification application. The rebound characterisation report shall include information about the influence of the different loading conditions and the influence of the different cable lengths related to the rebound behaviour.
3.3.4 3rd paragraph	Replace the paragraph with the following: For the structural substantiation, any damage threats and manufacturing flaws that can be encountered during manufacturing and in service, shall be taken into account.
3.3.4 6th paragraph	Replace the paragraph with the following: The cable is a life-limited part. Cable fatigue characteristics shall be determined by the hoist manufacturer. Methods for cable life calculation shall be defined. Cable inspection and acceptance criteria shall be defined by the hoist manufacturer and shall be provided in the maintenance manual. See 3.6.2.
3.3.5 1st paragraph	Replace the paragraph with the following: If a mis-wrap event can lead to a complete loss of hoisting function or to a loss of load, the hoist shall be provided with a cable foul/mis-wrap system that shall stop the hoist if a cable foul/mis-wrap develops. The system shall protect the cable from the effects of continued running when fouled or jammed.
3.3.5 2nd paragraph	Replace the paragraph with the following: Once initiated, the mis-wrap protection system may be capable of being overridden. The risk for continued hoist operation when overriding shall be identified by the hoist manufacturer.
3.3.6	Replace the section with the following: Load Attachment Means A load attachment means, such as a hook, shall be part of the hoist equipment. The load attachment means (i.e. hook) shall be attached such that it can freely rotate through 360 degrees in either direction. The load attachment means assembly shall be designed to mitigate the risk of entanglement on obstacles. Mechanism(s) shall be incorporated to avoid the possibility of unintentional load release. The mechanism(s) shall be designed to prevent tip loading and dynamic rollout.

When reading SAE AS6342 section	Apply the following:
3.3.8	Replace the section with the following: The hoist shall be equipped with overload protection capability.
3.4.1.1	Replace the section with the following: The hoist equipment shall monitor the safe operation of the hoist, through specific parameters including but not limited to the weight of the load, the fleet angle, the temperature of the temperature-sensitive components. The hoist equipment shall provide the status information (I) to the aircrew. The hoist manufacturer should define the recorded information (R) that is to be stored until the next scheduled maintenance and made available before the next flight. This recording may be performed either by the hoist equipment itself or be provided as an output to the aircraft systems for recording. Typical information needed to ensure a safe operation of the hoist is, but not limited to, the following: • Hoist active (I) • End of travel (I) • Caution zone (I) • Quick-release system status (I+R) • Fleet angle exceedance (R) As a minimum, the flight crew shall be made aware of a fleet angle exceedance during post-flight check. • Activation of overload protection (I+R) • Load exceedance (I+R) (sampling rates need to be sufficient to capture shock loads) All operating limitations and other information necessary for safe operation must be provided as an output of the hoist equipment. The monitoring (I and R) shall be described in the installation manual. The display or recording of this information may be included in the ETSO article or may be handled as additional equipment by the STC or TC applicant for the installation. Note: in the latter case, the additional equipment to display or recording of the information in the cockpit are not considered as part of the ETSO function.
3.4.1.2	Replace the headline of the section with the following: Hoist Display and Recording Equipment
3.4.1.2.3	Replace the section with the following: In addition to 3.3.5, if a mis-wrap event can lead to a hoist failure, the hoist equipment shall have a mis-wrap indicator, indicating that a cable foul/mis-wrap has occurred.
3.4.1.2.4	Replace the section with the following: The hoist shall indicate and record when an over temperature condition is present. The hoist over temperature condition shall be defined by the hoist manufacturer, based on the specific design of the hoist equipment.

When reading SAE AS6342 section	Apply the following:
3.4.2 1st paragraph	Replace the section with the following: The hoist equipment shall be enabled to receive the following control signal inputs, with the following commands:
3.4.3 8th paragraph	Replace the paragraph with the following: The operator control shall meet the applicable environmental requirements, as stated in section 3.1.2. of the core part of the ETSO standard, for outside use. If the only storage position of the pendant is inside the cabin, the vibration level of chapter 4.9.5 of AS6342 for internally mounted equipment is sufficient.
3.4.3 End of paragraph	Complete the section with the following: The operator control may include a BQRS activation. The operator control shall be designed such that it minimises the inadvertent activation of critical functions during stowage.
3.4.9 2nd paragraph	Replace the paragraph with the following: A means to protect the hoist equipment from over-current (motor over torque) conditions shall be provided.
3.4.10	Replace the section with the following: The hoist shall have a means to measure and record the usage of the system. The usage shall be calculated in operating hours (time while the hoist drive is active), hoist cycles or other equivalent method.
3.5.1.1	Delete the section (covered by ETSO standard text Chapter 3.2.2).
3.5.4	Delete the section.
3.5.5	Delete the section.
3.5.6	Delete the section.
3.6	Complete the section with the following: Single critical load paths should be minimised. <u>Additional structural requirements</u> The hoist shall be able to withstand the most critical load factor expected in service. The load factors shall cover the entire rotorcraft operational envelope in which hoisting is allowed, including rapid direction reversal and rapid stops. • Static flight load factor The static flight load factor shall not be less than 2.5 g for HEC applications. The substantiated load factor shall be stated in the hoist limitations. • Dynamic load magnification factors Any significant dynamic load magnification factors should be taken into account. A dynamic load magnification factor is the difference between the static load factor (measured at the CG of the hoist) and the load factor at the load attachment means (e.g. hook). This occurs for example during maneuvering of the rotorcraft when the cable is at an angle compared to the hoist vertical axis.

When reading SAE AS6342 section	Apply the following:
	• Crash load factors The hoist equipment shall withstand the following load factors without failure for at least 3 seconds during a static load test. The 3 seconds do not apply if the tests are performed dynamically to simulate actual loading application. (1) Upward – 1.5 g (2) Forward – 12 g (3) Sideward – 6 g (4) Downward – 12 g (5) Rearward – 1.5 g The hoist cable is expected to be fully stowed during load factor tests. The maximum permanent deformation resulting from the application of the load factors shall be documented in the installation manual. <u>Hoist-Critical Parts</u> A hoist-critical part is a part, the failure of which could lead to serious injuries or a fatality (including the HEC), and for which critical characteristics have been identified and must be controlled to ensure the required level of integrity. If the ETSO article includes hoist-critical parts, a list of the critical parts shall be established. Procedures shall be established to define the critical design characteristics, identify processes that affect those characteristics, and identify the design change and process change controls necessary for maintaining compliance with the ETSO standard. <u>Bird Strike</u> If the applicant has elected to demonstrate robustness against bird strike within the ETSO certification programme, an impact with a 1-kg bird, at a velocity compatible with the maximum allowed speed installed on a rotorcraft, shall not lead to the detachment of parts which could prevent continued safe flight and landing. Compliance must be shown by tests. The impact speed shall be documented in the installation manual. <u>Cable attachment</u> The cable shall be attached to the drum. The attachment shall be able to withstand limit load conditions, or if limit load carrying capability cannot be shown, alternative means shall be provided to minimise the possibility of losing the load. <u>Interactions Systems and Structures</u> For ETSO article equipped with systems that affect structural performance, either directly or as a result of a failure or malfunction, the influence of these systems and their

When reading SAE AS6342 section	Apply the following:
	failure conditions shall be taken into account when showing compliance with the requirements of this ETSO standard. Appendix K to the CS-25 Amendment that is current at the time of the application, or in any later revision, should be used to evaluate the structural performance of ETSO article equipped with these systems.
3.6.1 End of chapter	Complete the section with the following: For static strength substantiation of composite structure, AMC 20-29 provides further guidance. If a safety factor of 3.0 or more is used, it is acceptable to perform a standard static analysis to show compliance. The safety factor should be applied to the yield strength of the weakest component in the system (QRS, complex PCDS, and attachment load path). If a safety factor of less than 3.0 is used, both an analysis and a full-scale ultimate load test of the relevant parts of the system should be performed. Note: The static load factor at installation level depends on the performance of the rotorcraft, but in any case it cannot be less than 2.5g.
3.6.2 End of chapter	Complete the section with the following: For fatigue tolerance substantiation of composite structure, AMC 20-29 provides further guidance.
3.6.4.1 End of chapter	Complete the section with the following: Strength reduction factors such as environmental effects (see 3.6.4.3) of the cable can be included in the testing. Strength reduction factors that are used shall be established by individual tests. If separate strength reduction factors are used, they should not influence each other.
4.1	Replace the section with the following: The arresting system shall be designed to sustain ultimate load without cable reel out. If not otherwise protected, engaging the arresting system shall not lead to an overload of the hoist equipment structure and shall reasonably protect human cargo on the hook.
4.2	Replace the section with the following: The fairlead mechanism shall accommodate a 30-degree angle minimum in all directions from the vertical axis of the hoist. The fairlead mechanism shall be able to withstand a combination of angles not less than 30 degrees in all directions and with loads up to the static limit load without detrimental or permanent deformation or damage to the hoist or to the cable, and until ultimate load without failure.
4.3	Replace the section with the following: The load shall be applied in any direction making the maximum angle with the vertical of the hoist axis, but not less than 30° (60° cone). The most critical fleet angle in the most critical direction shall be taken into account for the static strength substantiation (Limit and Ultimate Load). Note: It may be necessary to substantiate greater angles than the hoist operational envelope, since the hoist might be installed at different angles on different airframes.
4.6	Replace the section with the following:

When reading SAE AS6342 section	Apply the following:
	The hoist shall have the capability of performing an emergency quick release of the attached load in all operating conditions. This QRS shall consist of a primary quick-release subsystem (PQRS) and a backup quick-release subsystem (BQRS). The intention of the PQRS is an intentional, instantaneous release of NHEC or HEC in a pre-set sequence by the QRS that is normally in an emergency to prevent a significant reduction in the safety margins for continued safe flight and landing of the rotorcraft. The following design features shall be considered: • The PQRS, BQRS and their load-release devices and subsystems (such as electronically actuated guillotines) shall be separated (e.g. physically, systematically, and functionally independent). • The controls for the PQRS shall be installed on the ETSO article at a location readily accessible to the hoist operator (e.g. the control pendant). Additionally, an independent means to control the PQRS shall be provided to the installer (for instance, to allow connection to a cockpit control). • The control means for the BQRS shall be described in the installation manual. They may be less sophisticated than those of the PQRS (e.g. manual cable cutters). • The PQRS shall release the external load in less than 5 seconds. The BQRS shall release the external load in less than 30 seconds. This time interval shall begin at the moment an emergency is declared and shall end when the load is released. During HEC operations, both the PQRS and BQRS are required to have a dual activation device (DAD) for external cargo release. The switch design shall be evaluated by ground test. Additional safety precautions (such as the use of a lock wire) should be considered for a remote hoist console in the cabin.
4.7	Replace the section with the following: The purpose of the overload protection is to protect the aircraft, its occupants and the person being hoisted. It provides to the crewmembers the possibility to either stabilise the aircraft or to safely activate the PQRS and release the external load in less than 5 seconds after the declared emergency (i.e. crew detects snagging of the cable/hook), as requested in AMC 27/29.865. The hoist shall be equipped with an overload protection capability, which needs to comply to the following requirements: • The overload protection system shall be capable of reliably withstanding the dynamic loads and the sustained overloads, as defined by the hoist manufacturer. It shall be designed to hold any static load coming from the cable up to the static limit load. • For dynamic overload events, the overload protection system may allow limited unspooling of the cable at lower loads, as long as the dynamic load holding capability does not fall below the maximum operational load with an adequate safety margin. An example for such dynamic load holding capability is the capability to absorb shock loads. • The load shall be arrested within a maximum of 10 m during a dynamic cable unspooling event. Limited unspooling of the cable for functions other than overload protection could be also accepted (e.g. for cargo vibration reduction).

When reading SAE AS6342 section	Apply the following:
	• If sustained overload resulting from an entanglement is still present after 5 seconds of cable unspooling, further unspooling is acceptable. • The person(s) being hoisted shall also be reasonably protected against serious injury (see 5.1.9.1.2). • An overload activation tolerance band shall be defined taking into account e.g. production and maintenance tolerances, variations due to the environment (e.g. temperature and humidity), and operations (i.e. length of cable paid out). The above-mentioned load holding requirements shall be met in the entire activation tolerance band. • With regard to aging effects, all functional elements of the overload protection that are subject to aging effects leading to potential degradation of the overload protection shall be considered. The corresponding tests in 5.1.9. provide the means of compliance for sustained overload and dynamic loads including demonstration that the person(s) being hoisted is (are) reasonably protected in the complete hoist envelope. NOTE: The OLPD static holding capability should be adjustable in order to adapt it to the specific rotorcraft capability within the hoist operational envelope defined by the installer.
4.9	Replace the section with the following: The hoist shall meet environmental test procedures per DO-160. For the DO-160 environmental standard, refer to Section 3.1.2 of the main part of the ETSO standard for acceptable ED-14/DO-160 revisions. The hoist shall meet all performance data included in Chapters 3.3, 3.4 and 4.1-4.7 under the below-stated environmental conditions. The operator control pendant shall meet the applicable environmental requirements for outside environmental conditions.
4.9.5	Add to the end of the section the following: Routing of electrical wires to the hoist interface shall include protection against chaffing or damage due to vibration introduced by the aircraft.
4.9.21	Replace the section with the following: The hoist equipment (including pendants, controllers, cable, and interconnecting wires) shall meet the requirements per RTCA DO-160 Section 25, Category A.
4.9.23	Replace the section with the following: The intent of the endurance requirement is to validate the interval for time between overhaul (TBO) and total time (TT). This shall be accomplished by running a full TBO test, with margin, that simulates actual use in a heavy usage environment. (See Chapter 5.1.3)
4.9.24 1st paragraph	Complete the section with the following. This duty cycle testing is to show the robustness of the hoist system and is not considered to be a fatigue or endurance test in their own right.
5.1.3 1st paragraph	Replace the paragraph with the following:

When reading SAE AS6342 section	Apply the following:
	The hoist manufacturer shall perform endurance testing and provide a formal test report. The test results from this testing may be used by the hoist manufacturer to define the overhaul period (TBO and TT).
5.1.3 3rd paragraph	Replace the paragraph with the following: The test cycle may be made up of a series of hoist cycles and in any order to minimise test set-up.
5.1.3 4th paragraph	Replace the paragraph with the following: Testing for endurance (the ability of parts moving relative to each other to continue to perform their intended function) should be sufficient to show: • that the assumptions used in demonstrating compliance with the required safety level are correct, and • via a test that the equipment is free from design errors, specifically when there is the introduction of a new technology to reach a compliance demonstration for full life, either by a full TT test or by X% TT test supported by analysis. Testing for performance can be included in endurance testing which should demonstrate the rates and responses required for proper system operation.
5.1.3 Table 2	Delete the table.
5.1.4	Replace the section with the following The hoist manufacturer shall perform duty cycle testing and provide formal test report.
5.1.5	Delete the last sentence of the section
5.1.7	Replace the section with the following: The mis-wrap detector shall be validated through test, and can be supported by analysis or simulations.
5.1.8 before 1st paragraph	Complete the section with the following before the paragraph: Jettison demonstrations, with different loading conditions, using the QRS shall be conducted.
5.1.9.1	Replace the section with the following: The following tests shall be performed.
5.1.9.1.1	Replace the section with the following: To show arresting capability after a sustained overload (e.g. entanglement / extreme manoeuvre), the hoist equipment including the overload protection device (OLPD) shall be able to arrest the cable in accordance with the following test. The OLPD activation point for the test shall be set at the most detrimental setting within the tolerance range. The test sequence should be as follows:

When reading SAE AS6342 section	Apply the following:
	1. Continuous pull with a speed of more than 2 m/s for 5 seconds. The load for the continuous pull must be between operational loads and limit load for the hoist equipment. 2. Deceleration of the cable to zero cable speed within 5 seconds by: a. reducing the pulling tension through the test equipment. The tension must always be greater than or equal to the rated load; or b. increase of the cable tension through the hoist. The cable tension must always be below limit load. The test shall be repeated 5 times. The OLPD may be reset after each pull (if reset function is available). After the completion of the test, the hoist equipment including the OLPD shall function normally.
5.1.9.1.2	Replace the section with the following: The hoist equipment including the OLPD shall be able to arrest the load with a limited height loss after a shock load event. The arresting capability shall be demonstrated by an instrumented drop test in accordance with the following criteria: • Rated load solid block • Free fall factor of 1 on 71 inches (180 cm) • Height loss <197 inches (500 cm) • For each hoisted person o maximum arresting force <1 798 lbf (8 kN) o A transient peak is acceptable. The force and duration shall be such that the person being hoisted is reasonably protected against serious injury (e.g. 12.5 kN for maximum of 30 ms) o Limit Load shall not be exceeded The above test shall be repeated for a 101.2 kg solid block. The above test must be repeated for a total of 5 times for each load level (rated load and 101.2 kg). The OLPD including the dampening device can be reset after each test, if a reset function is available. After each set of 5 tests the cable and OLPD can be replaced. The most detrimental setting within the OLPD activation tolerance band must be tested. The hoist must function normally (i.e. continues to lift at the rated load and speed) after completion of each set of 5 tests.
5.1.11	Replace the section with the following: Using a milliohm meter measure the bonding resistance between the hoist bonding location as indicated by the hoist manufacturer and the appropriate connector mounting block screw as indicated by the hoist manufacturer. Verify that the reading is compatible with the bonding requirements in Chapters 4.9.25 and 4.9.26.
5.2	Complete the section with the following:

When reading SAE AS6342 section	Apply the following:
	The cable shall sustain limit and ultimate load conditions. The test shall be performed at the hoist (with the OLPD locked) or a mock-up representing all influencing factors of the installation on the hoist. The load attachment end of the cable shall be able to swivel freely. The cable shall be tested at its most critical length and most critical fleet angle if this influences the static strength characteristics. The cable being tested shall represent the minimum manufacturing quality as specified by the cable manufacturer. This includes all foreseeable damage and manufacturing flaws which are not inspectable by scheduled maintenance or are allowed to remain in the cable. In addition, all material strength reduction factors shall be taken into account.
5.2.1 Headline	Replace the headline of the section with the following: Minimum Breaking (Rupture) Strength Test
5.2.2 Headline	Replace the headline of the section with the following: Cable Endurance and Fatigue Testing
5.2.2 1st paragraph	Replace the paragraph with the following: Fatigue and endurance testing of the hoist cable shall be conducted in laboratory tests. These tests shall be conducted to determine the suitability of the rescue hoist cable compared to several scenarios.
5.2.2 2nd paragraph	Replace the paragraph with the following: The manufacturer shall determine each hoist's maximum cable usage (MCU) which is a number used to determine the maximum number of hoist cycles, or maximum number of cable extensions, a cable can undergo in field usage before requiring replacement in order to preclude cable fatigue considerations. The manufacturer shall also determine and publish all inspection criteria related to the as-designed cable in the maintenance manual, and this inspection criteria shall be used in the following fatigue testing.
5.2.2 end of chapter	Complete the section with the following: In addition of the requirements of sections 3.6.2 and 5.1.5 of AS6342, section 5.2.2.1 and 5.2.2.2 are considered to be part of the cable fatigue testing. The cable bending and tension fatigue test should be performed to evaluate the fatigue life of the cable. The fatigue evaluation of the cable should be determined considering the effect of the worst of bending, tension or a combination of both applied simultaneously. The tests described in section 5.2.2.1 and 5.2.2.2 are not considered to generate the complete data set required for cable fatigue evaluation. 5.2.2.3, 5.2.2.4 and 5.2.2.5 are part of the cable endurance testing and in addition to the hoist endurance testing in section 4.9.23. and 5.1.3.
5.2.2.1 1st paragraph	Replace the paragraph with the following: A cyclic bending fatigue test shall be performed. The test configuration must be representative of the specific hoist design configuration (including diameter of sheaves and number of sheaves, the pressure of the crowder, and the internal routing of the cable such as number of bendings and reverse bendings) planned for certification.

When reading SAE AS6342 section	Apply the following:
	One of the acceptable methods of testing for the determination of the bending fatigue characteristics of the cable is defined in MIL-DTL-83140B Figure 4, using the geometry and cable design required in this ETSO.
5.2.2.1 Figure 1	Delete the figure.
5.2.2.1 2nd to 4th paragraph	Delete the paragraphs.
5.2.2.1 5th paragraph	Replace the paragraph with the following: The total travel of the wire rope in one direction shall ensure that the test portion of the cable runs through the entire hoist configuration from the storage drum to the cable output. The application of lubricant to the fatigue test sample in addition to the lubricant applied during manufacture of the cable shall not be permitted.
5.2.2.1 6th paragraph	Delete the paragraph, including table 3.
5.2.2.1 7th paragraph	Replace the paragraph with the following: Following the fatigue testing described above, the test sample shall be inspected for damage and tested for minimum breaking strength. The minimum breaking strength shall be greater than the hoist's ultimate load (5.25 times the rated load).
5.2.2.2 1st paragraph	Replace the paragraph with the following: A cable sample representative of damage and flaws that could be encountered during manufacturing or in service shall be prepared with two end fittings identical to the cable assembly design requirements of the hook end and subjected to fluctuating cable loads between 1 to 2 g times the rated load in accordance with DIN EN14311-8 Section 5.2.2.3. The cable shall be tested for 75 000 test cycles (150 000 reversals) with one end of the cable attached to a free swivel.
5.2.2.2 2nd paragraph	Replace the paragraph with the following: Following the fatigue testing described above, the test sample shall be inspected for damage and tested for minimum breaking strength. The minimum breaking strength shall be greater than the hoist's ultimate load (5.25 times the rated load).
5.2.2.3 headline	Replace the headline of the section with the following: Unloaded Endurance Testing within Hoist
5.2.2.4 headline	Replace the headline of the section with the following: Loaded Endurance Testing within Hoist

When reading SAE AS6342 section	Apply the following:
5.2.4	Replace the paragraph with the following: Cable robustness testing is intended to demonstrate the hoist load bearing wire rope (cable) robustness or resistance to catastrophic failure after unintended and incidental contact with ground objects and rotorcraft structure. The cable may sustain damage necessitating post-mission replacement but shall have residual structural integrity to safely complete the lift where the contact occurred, or safely return the HEC to the ground. The hoist manufacturer must test, and provide test results, for the scenarios identified below.
5.2.4.1 4th sentence	Replace the sentence with the following: The hoist cable may become damaged in such incident where the damage will be readily observable to the hoist operator or at post-flight inspection; however, the cable shall be of such construction as to provide robustness that it will not fail under load during the immediate rescue lift.
5.2.4.1.1	Replace the section with the following: The static cable (i.e. not reeling in or out) shall suspend the rated load. The cable shall be dragged over the A36 or equivalent standard steel plate edge for a total distance reasonably expected to occur in service with a load hanging freely on the hoist (note: multiple strokes may be used). The plate surface roughness and edge diameter should represent a severe scenario expected to be found in a ship construction. The angle between the vertical axis of the hoist and the cable should be at a minimum 30°. The force required to drag the cable shall be applied at least 1 foot (30 cm) higher than the edge. After exposure, damage is acceptable, if the cable damage is reliably detectable within a few hoist cycles, but the cable shall be able to support limit load without failure. The test shall be repeated with a load corresponding to the OLPD activation point to simulate an entanglement. The distance the cable slides along the steel plate shall reflect a distance which can be reasonably expected in such an event.
5.2.4.1.2	Replace the section with the following: The cable shall suspend a rated load below a A36 or equivalent standard steel plate edge. The plate surface roughness and edge diameter should represent a severe scenario expected to be found in a ship construction. The angle between the vertical axis and the cable should be at a minimum 30°. The cable shall be reeled in until achieving maximum speed (minimum cable reel-in length is 1.5 m) and then reeled out three times. After exposure, damage is acceptable, if the cable damage is reliably detectable within a few hoist cycles, but the cable shall be able to support limit load without failure.
5.2.4.2.1 Last sentence	Replace the sentence with the following: After testing the cable shall be demonstrated to support at least limit load without failure if cable damage is reliably detectable within a few hoist cycles. If no cable damage is detectable by operations or ramp maintenance personnel within a few hoist cycles, the cable shall be demonstrated to support ultimate load for at least 3 seconds without failure.

Table 2 — Additional definitions

Term	Definition
Backup quick-release subsystem (BQRS):	The secondary or 'second choice' subsystem used to perform a normal or emergency jettison of external cargo.
Cable	The means to suspend the external load being lowered and raised. The cable can be made of metallic and/or other materials.
Dual actuation device (DAD):	This is a sequential control that requires two distinct successive actions (e.g. thumb movements) to be completed for actuation. Examples of a DAD are the removal of a lock pin or opening of a guarded cover followed by the activation of a 'then free' switch for load release to occur or opening of a cover and activate an additional guarded switch with a distinguished separate thumb movement. In this scenario, a simple covered switch does not qualify as a DAD. Familiarity with covered switches allows the operator to both open the cover and activate the switch in one motion. This has led to inadvertent load release. Cover = a means to mask or cover a switch that can be either moved up or to the side (sometimes called a 'flip-guard') Guard = fix activation protection around/for a switch or cover like a small wall, recess, lock pin or lock wire Switch = lever or push button
Dynamic Load	A dynamic load is a load which occurs in a rapid manner, such as shock loads or vibration.
Emergency jettison (or complete load release)	The intentional, instantaneous release of NHEC or HEC in a pre-set sequence by the quick-release system (QRS) that is normally performed in an emergency to prevent a significant reduction in the safety margins to ensure continued safe flight and landing of the rotorcraft
Moving surface	A surface that is not fixed, such as heaving ships or water surface
Primary quick-release subsystem (PQRS):	The primary or 'first choice' subsystem used to perform a normal or emergency jettison of external cargo.
Quick-release system (QRS):	The entire release system for jettisonable external cargo (i.e. the sum total of both the primary and backup quick-release subsystem). The QRS consists of all the components including the controls, the release devices, and everything in between.
Serious injury	According to Annex 13 to the Convention on International Civil Aviation: Aircraft Accident and Incident Investigation. Ninth Edition - July 2001. Chapter 1 - Definitions: Serious injury. An injury which is sustained by a person in an accident and which: a) requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or b) results in a fracture of any bone (except simple fractures of fingers, toes, nose); or

Term	Definition
	c) involves lacerations which cause severe hemorrhage, nerve, muscle or tendon damage; or d) involves injury to any internal organ; or e) involves second- or third-degree burns, or any burns affecting more than 5 per cent of the body surface; or f) involves verified exposure to infectious substances or injurious radiation.
Stowage position	This is typically the hoist and/or cable position used when hoisting operations are not being performed.

Table 3 — Additional list of acronyms

Acronyms	Definition
AC	Advisory Circular (FAA)
AMC	acceptable means of compliance (EASA)
BQRS	Backup quick-release subsystem
CG	centre of gravity
CMR	certification maintenance requirements
CS	certification specification
DAL	design assurance level
ETSO	European Technical Standard Order
FMECA	Failure Modes Effects and Criticality Analysis
HEC	human external cargo
ICS	integrated communication system
kN	kilo Newton
MCU	Maximum Cable Usage
OLPD	Overload Protection Device
TT	Total Time

[Amdt ETSO/17]