



AEROSPACE STANDARD

AS6342™

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Minimum Operational Performance Standard (MOPS) for Helicopter Hoist Systems

RATIONALE

This standard provides a minimum operational performance standard for helicopter hoists. Helicopter hoists have to comply with it and the related 14 CFR Part 27 and 14 CFR Part 29 requirements.

FOREWORD

Industry has determined a need to create a standard for the helicopter hoist industry. This document will address the Minimum Operational Performance Standard (MOPS) in connection with related 14 CFR Part 27 and 14 CFR Part 29 requirements required for compliance of a helicopter hoist to be installed on helicopter airframes. It will define some terms to create consistency between hoist manufacturers for the industry.

INTRODUCTION

Helicopter hoists are used mostly for search and rescue and medical evacuation activities. Operators for helicopter hoist include, but are not limited to, Coast Guard, law enforcement, emergency medical response services, firefighting, offshore windfarm maintenance, transferring harbor pilots, power line maintenance, and cargo delivery.

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1. SCOPE

This SAE Aerospace Standard (AS) specifies minimum operation performance requirements for helicopter hoists. This document covers criteria for hoist systems that are intended for use on helicopter platforms for a variety of missions, including but not limited to, search and rescue (SAR) operations, fire control/support, offshore windfarm maintenance, transferring harbor pilots, and power line maintenance. Helicopter hoist minimum performance characteristics are specified for standard and other environmental conditions for the purpose of product qualification. Compliance with this standard is not considered approval for installation on any aircraft.

1.1 Purpose

The purpose of this standard is to provide information required for newly designed hoists to meet a minimum set of operating requirements, providing a common framework to address new certification applications for hoists.

This document is written for electric hoist designs only.

This standard covers partial requirements necessary to certify a hoist. Further minimum safety requirements coming from 14 CFR Part 27 and 14 CFR Part 29 have to be fulfilled if the hoist is intended to be installed on a helicopter.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 Regulatory Publications

FAA AC-() documents are available from the U.S. Department of Transportation, Subsequent Distribution Office M-30, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785, www.faa.gov/regulations_policies.

FAA AC 27-1B Certification of Normal Category Rotorcraft

FAA AC 29-2C Certification of Transport Category Rotorcraft

14 CFR Part 27 Airworthiness Standards: Normal Category Rotorcraft

14 CFR Part 29 Airworthiness Standards: Transport Category Rotorcraft

2.1.2 European Aviation Regulations

Available from European Aviation Safety Agency, Postfach 10 12 53, D-50452 Cologne, Germany, Tel: +49-221-8999-000, www.easa.eu.int.

CS-27 Certification Specifications for Small Rotorcraft

CS-29 Certification Specifications for Large Rotorcraft

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 RTCA/EUROCAE Publications

Available from RTCA, Inc., 1150 18th Street, NW, Suite 910, Washington, DC 20036, Tel: 202-833-9339, www.rtca.org.

Available from EUROCAE Secretariat, 102 rue Etienne Dolet, 92240 Malakoff, France, Tel: +33 1 40 92 79 30, www.eurocae.net.

DO-160G/ED-14G Environmental Conditions and Test Procedures for Airborne Equipment

DO-178C/ED-12C Software Considerations in Airborne Systems and Equipment Certification

DO-254/ED-80 Design Assurance Guidance for Airborne Electronic Hardware

2.3 Definitions

The use of “shall,” “should,” “must,” “will,” and “may” within this standard shall observe the following rules:

The word SHALL in the text denotes a mandatory requirement.

The word SHOULD in the text denotes a recommendation or advice on implementing such a requirement of the document. Such recommendations or advice is expected to be followed unless good reasons are stated for not doing so.

The word MUST in the text is used for legislative or regulatory requirements (e.g., health and safety) and shall be complied with. It is not used to express a requirement of this standard.

The word WILL in the text denotes a provision or service or an intention in connection with a requirement of this standard.

The word MAY in the text denotes a permissible practice or action. It does not express a requirement.

APPLICANT: TSO applicant

HUMAN EXTERNAL CARGO (HEC): A person(s) that at some point in the operation is carried external to the rotorcraft.

HOIST: A hoist is a device that exerts a vertical pull, usually through a cable and drum system (i.e., a pull that does not typically exceed a 30 degree cone).

HOIST CYCLE: The term "hoist cycle" is defined as an extension and subsequent retraction of the cable during flight, or on the ground, the extension and subsequent retraction of the cable equal or beyond 10 feet (3 m), regardless of the load used.

HOIST SYSTEM: The system, inclusive of the hoist and ancillary components (includes, but is not limited to, control panels, pendants, etc.).

LIMIT LOAD: The rated load multiplied by the limit load factor (example: 600 pounds (272 kg) x 3.5). The structure must be able to support limit load without detrimental or permanent deformation.

LIMIT LOAD FACTOR (HEC): The limit static load factor is equal to 3.5.

LIMIT LOAD FACTOR (NHEC): The limit static load factor is equal to 2.5.

MIS-WRAP: When the cable does not wind onto or unwind from the storage drum in its intended manner.

NONHUMAN EXTERNAL CARGO (NHEC): Any external cargo operation that does not at any time involve a person(s) carried external to the rotorcraft.

PILOT SPEED: The manufacturer defined speed that the hoist operates at when controlled by a Cockpit Mode Control device. The Cockpit Mode Control device overrides other hoist control devices. The speed is typically fixed at a value lower than rated hoist speed. This speed will be equal to or lesser than rated hoist speed.

RATED LOAD: The maximum load intended for operational use (example: 600 pounds (272 kg)).

RATED SPEED: The minimum acceptable speed at a defined load.

TEST CYCLE: The term “test cycle” is defined as an extension and subsequent retraction of the cable during endurance and other cable testing.

ULTIMATE LOAD: The limit load multiplied by the safety factor (example: 600 pounds (272 kg) x 3.5 x 1.5 = 3150 pounds (1429 kg)). The structure must be able to support ultimate load without failure for at least 3 seconds, unless a dynamic test simulates the actual load application.

2.4 Abbreviations

DAD: Dual Action Device

NVIS: Night Vision Imaging System

PQRS: Primary Quick Release System

TBO: Time Between Overhaul

3. GENERAL DESIGN REQUIREMENTS

3.1 Installation Considerations

Additional installation requirements outside of this minimum operation specification are to be defined in the TSO application.

3.2 Hoist Rated Load

The rated load shall be specified by the hoist manufacturer.

3.3 Major Components

The design and Design Assurance Level (DAL) of each hoist element must be based on the determined criticality of the conducted Functional Hazard Assessment.

3.3.1 Arresting/Holding System

An arresting system (brake, etc.) shall be provided that engages automatically when the hoist is stopped after raising or lowering or when power is removed (fail-safe).

3.3.2 Cable Assembly Management System

The hoist shall have a system to manage the reeling out and reeling in of the cable, minimizing the possibilities of fouling, kinking, or excessive wear on the cable.

3.3.2.1 Cable Assembly Protection

Means shall be provided to prevent unravelling of the cable on the drum.

When the cable is in the stowed position (cable fully retracted), means shall be provided to minimize cable damage from vibration.

3.3.2.2 Cable Assembly Storage System

The storage provision shall be able to attach the cable end, and store all the usable cable. The storage provision shall minimize wear affecting either the cable or the storage provision. 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.

3.3.3 Fairlead Mechanism

A cable guide shall be provided to fairlead the cable into the hoist.

3.3.4 Cable Assembly

The hoist cable assembly shall have minimum strength properties greater than the ultimate load of the hoist, for a newly manufactured cable with a minimum specified manufacturing quality.

Cable rebound shall be characterized through testing by the hoist manufacturer, and a characterization report shall be provided as part of the certification application.

Any damage threats and manufacturing flaws that can be encountered during manufacturing and in service, have to be taken into account.

The cable shall be capable of withstanding the following loads with the associated damages:

- Ultimate Load: Allowable damage that may go undetected by scheduled or directed field inspection and allowable manufacturing defects.
- Limit Load: Damage that can be reliably detected by scheduled or directed field inspections performed at specified intervals.

Means shall be applied to indicate both ends of the cable to the operator, to identify end of travel conditions.

The cable is a life-limited part. Cable life shall be determined by the hoist manufacturer. Means for cable life calculation shall be defined. Cable inspection interval and acceptance criteria shall be defined by the hoist manufacturer. See 3.6.2.

A path to provide electrostatic discharge to the hook shall be identified, or other means to prevent shock from electrostatic discharge shall be identified.

3.3.4.1 Cable Assembly Tension Carrying Element

The cable assembly shall consist of a tension carrying element (for example, a cable), that is terminated with the appropriate fittings (for example, a swaged ball) that meet or exceed the tension carrying element's breaking strength.

3.3.5 Mis-Wrap Detector

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.

Once initiated, the mis-wrap protection system may be capable of being overridden to allow for continued hoist operations.

If override activation is included in the hoist system, the override switch shall include a dual-action device.

3.3.6 Hook Assembly

A load attachment means, such as a hook, shall be part of the hoist system.

The hook shall be attached such that it is freely rotatable through 360 degrees in either direction. Latch and locking mechanisms shall be incorporated to avoid the possibility of unintentional releasing of the attached load. The hook assembly shall be designed and shaped to mitigate the risk of entanglement on obstacles. The latch shall be designed to prevent tip loading and dynamic rollout.

3.3.7 Primary Quick Release System

A primary quick release system (PQRS) shall release the load in less than 0.5 second after actuation.

3.3.8 Overload Protection

The hoist may be equipped with overload protection capability.

3.4 Control Interfaces

3.4.1 Hoist Status Information

3.4.1.1 General

The hoist shall have the ability to communicate information regarding hoist status and operating condition to the crew and equipment operators.

All information necessary for safe operation and operating limitations shall be available to the crew members. See 3.5.4.

The display or recording of this information may be handled by additional equipment provided by the hoist manufacturer or may be handled by the STC or TC applicant for the installation.

3.4.1.2 Display Equipment

3.4.1.2.1 End of Cable Travel Indicators

The hoist shall include a method to provide indications to identify extreme range of cable travel.

3.4.1.2.2 Cable Payout

The hoist may include a method to provide cable payout length or distance.

3.4.1.2.3 Mis-Wrap Detection

If a mis-wrap event can lead to a hoist failure, and if the hoist includes a mis-wrap system, the hoist system shall have a mis-wrap indicator, indicating a cable foul/mis-wrap has occurred.

3.4.1.2.4 Over Temperature Detection

The hoist shall indicate 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 system.

3.4.2 Cockpit Mode Control

The hoist system shall be enabled to be controlled remotely, with the following commands:

- Main ON/OFF (the ability to turn the hoist on and off).
- UP/DOWN control (the ability to control hoist motion up and down). The control circuitry shall allow the pilot to override the hoist operator in controlling the hoist operation. This may also include speed control.

- PQRS Activation.
- PQRS circuit test. A means to check the electrical circuits for the quick release system (if applicable) shall be made available.
- Boom IN/OUT, ability to extend and retract the hoist boom system, if applicable.

3.4.3 Operator Control (e.g., Pendant)

The operator control shall include a cable Up/Down switch.

The operator control shall include an over-temp indicator.

The operator control shall include a Cable Foul/Cable Mis-Wrap indicator (if equipped).

The operator control design may provide variable speed control.

The operator control may display cable payout indication, and end of travel caution indication.

The operator control may include ICS (Integrated Communication System) capability.

The operator control may meet lighting/NVIS requirements.

The operator control shall meet applicable environmental requirements.

The operator control shall have a feature allowing for operator control stowage.

The operator control may include other features as deemed necessary (such as hover control, searchlight control, etc.).

3.4.4 Acceleration/Deceleration Control

Minimum acceleration shall be 5 ft/s/s (1.5 m/s/s).

3.4.5 Signal Lag

The physical change of motion shall occur within 0.5 second after command.

3.4.6 Minimum Speed

The hoist shall have a minimum full speed of 150 fpm (0.8 mps) at rated load.

3.4.7 End of Travel Control

The hoist shall automatically slow speed in zones near the end of travel either in the pay-out (reelout) or take-up (reel-in) conditions, and stop when extreme range of travel has been reached.

Full in is the position where no cable is reeled out, where the cable is fully retracted. This is typically the stowage position used when hoisting operations are not being performed.

The up caution/slow zone is the distance of cable reel out between the full in point, and the point where the load is low enough to safely operate the hoist at maximum reeling speed. The up caution/slow zone shall be 5 feet (1.5 m) or greater.

Full out is the maximum amount of cable that can be reeled out during normal operations.

The down caution/slow zone is a zone that is defined to ensure that the operator is aware that the end of travel is being reached. The down caution/slow zone shall be 5 feet (1.5 m) or greater.

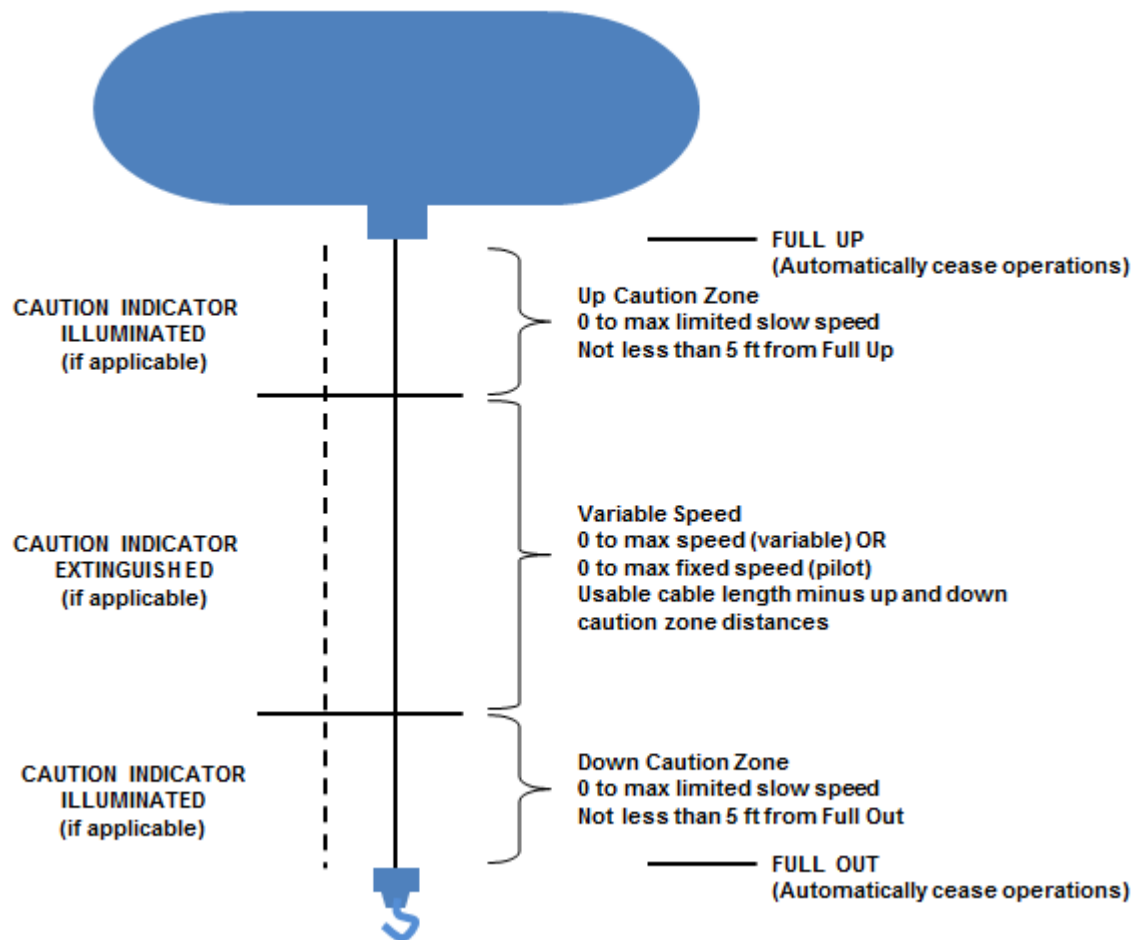


Figure 1 - Cable travel zones

Within the up and down caution zones, hook velocity of the cable shall be restricted to minimize damage to the hoist, cable, or load on the hook. The distance of the caution zones from the extreme ranges of travel shall be considered as part of the installation. The set points may be configurable to support varying installation requirements and be designed to minimize setting errors.

3.4.8 End of Travel Protection

A means to protect the hoist from damage or loss of load due to the cable reeling in and/or out at speed at the end of travel limits shall be provided.

3.4.9 Over Current Protection

The hoist shall have a means to limit current drawn from the aircraft (bus).

A means to protect the hoist system from over-current (motor over torque) conditions shall be provided.

3.4.10 Life Monitoring

The hoist shall have a means to measure the usage of the system. The usage shall be calculated in operating hours (time while the hoist drive is active), drum revolutions, or other equivalent method.