AEROSPACE RECOMMENDED PRACTICE	ARP1507™	REV. B
	Issued 1985-09 Reaffirmed 1991-05 Revised 2022-06 Superseding ARP1507A	

Helicopter Engine/Airframe Interface Document and Checklist

RATIONALE

During the SAE Five-Year Review, it was identified that although the scope of ARP1507A stated that it provided "complete relevant information" on engine-airframe interfaces, it primarily covered mechanical interfaces and not electronic interfaces. The integration of the engine electronic systems with aircraft electronic systems has greatly expanded in the industry since last update of this document in 1997. Another SAE E-36 document, AIR6181, covers most of the needed information on electronic engine-aircraft interface. Rather than redundantly add this information to ARP1507, a reference to AIR6181 has been added in ARP1507 to point to the electronic interface information that it covers. Secondarily, there are additional mechanical interface considerations that have been added to ARP1507 document text and checklist.

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1. SCOPE

This SAE Aerospace Recommended Practice (ARP) provides a guide for the preparation of a helicopter engine/airframe interface document and checklist. This document and checklist should identify the information needed by the engine manufacturer and the aircraft manufacturer to integrate the engine design with the aircraft design and either provide this information or give reference to where this information is located. The intent is to assure that the engine manufacturer and the airframe manufacturer identify and make provision for this information so it can be easily accessible to either manufacturer as needed in the development stages of an engine-airframe integration project.

A related document, SAE Aerospace Information Report AIR6181, provides guidance on creating an interface control document (ICD) which addresses a subset of the aircraft-engine interface information concerning the physical and functional interfaces of the electronic engine control system (EECS) with the aircraft systems. This would include signal interfaces, digital data busses and integrated functionality with the aircraft electronic systems and avionics displays. The engine/airframe interface document should reference this EECS ICD rather than duplicate its information. Similarly, as information is documented in the engine installation manual or engine installation drawings, the engine/airframe interface document should make references to the engine installation manual or engine installation drawings, rather than duplicate the information. Typically, the engine/airframe interface document will be the initial document in the project to capture the interface information which can then transition to referenced information as the engine installation manual, EECS ICD, and engine installation drawings are developed.

2. REFERENCES

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 Applicable Documents

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AIR6181 Electronic Propulsion Control System/Aircraft Interface Control Documents

ARP996 Cooling of Turbine Engines in Helicopters

2.1.2 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

AC 20-128A Design Considerations for Minimizing Hazards Caused by Uncontained Turbine Engine and Auxiliary Power Unit Rotor Failure

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 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AIR947 Engine Erosion Protection

AIR984 Air Bleed Objective for Helicopter Turbine Engines

AIR1087	Aircraft Accessory Drag Torque During Engine Starts
AIR1160	Aircraft Engine and Accessory Drives and Flange Standards
AIR1191	Performance of Low Pressure Ratio Ejectors for Engine Nacelle Cooling
AIR1262	Aircraft Fire Protection for Helicopter Gas Turbine Powerplant and Related Systems Installations
AIR1286	Helicopter and V/STOL Aircraft Noise Measurement Problems
AIR1289	Evaluation of Helicopter Turbine Engine Linear Vibration Environment
AIR1423	Electromagnetic Compatibility on Gas Turbine Engines for Aircraft Propulsion
ARP704	Helicopter Engine - Rotor System Compatibility
ARP721	Turbine Drive Shaft Connection
ARP949	Turbine Engine Starting System Design Requirements
ARP1257	Gas Turbine Engine Transient Performance Presentation for Digital Computer Programs
ARP1279	Standard Indoor Method of Collection and Presentation of the Bare Turboshaft Engine Noise Data for Use in Helicopter Installations
ARP1420	Gas Turbine Engine Inlet Flow Distortion Guidelines
ARP1587	Aircraft Gas Turbine Engine Health Management System Guide
ARP1702	Defining and Measuring Factors Affecting Helicopter Turbine Engine Power Available
AS681	Gas Turbine Engine Performance Presentation for Computer Programs

2.3 Abbreviations

AIR	Aerospace Information Report
ARP	Aerospace Recommmended Practice
AEO	All Engines Operative
EECS	Electronic Engine Control System
IBF	Inlet Barrier Filter
ICD	Interface Control Document
LRU	Line Replaceable Unit
Nr	Helicopter Rotor Speed
OEI	One Engine Inoperative
SFC	Specific Fuel Consumption
SOAP	Spectrometric Oil Analysis Program
T1	Engine inlet Air Temperature

3. HELICOPTER ENGINE/AIRFRAME INTERFACE DOCUMENT AND CHECKLIST CONTENTS

The helicopter engine/airframe interface document and checklist should be organized into five sections: a general description of the aircraft and engine and relevant subsystems of each, engine functional characteristics, engine physical characteristics, installation drawings, and interface checklist.

3.1 General Description

3.1.1 Aircraft Description

The aircraft description should provide a general explanation of the aircraft type, civil certification or military mission, weight and power class, single or multi-engine powerplant, and a description of the transmission and rotor system. It should include a high level description of key attributes such as engine compartment, inlet, exhaust, and other aircraft systems and features relevant to the propulsion system.

3.1.2 Engine Description

The engine description should include the inlet air flow class and a general identification of the compressor configuration, combustor configuration, number of turbine stages, exhaust configuration, and output shaft configuration with direction of rotation and speed. If the engine has a reduction gearbox, the speed reduction should be addressed. When an engine uses modular construction, the modules should be described. An engine cutaway illustration should be provided.

3.1.3 Engine Subsystem Description

Each engine subsystem such as fuel, control, oil, electrical, starting, compressor air bleed, induction, exhaust, condition monitoring, and diagnostics should be described. The descriptions should address the components in the subsystems, general operating characteristics, and unique features. Subsystems schematics should be provided.

3.2 Engine Functional Characteristics

3.2.1 Performance

A definition of uninstalled engine power ratings must be provided including normal and contingency or OEI ratings, as applicable. Tables are recommended which include engine performance at standard, sea level, static conditions at minimum rated delivered shaft power, rated delivered shaft speed, maximum specific fuel consumption, and measured gas temperature. Performance estimating procedures should be explained or adequate tables or figures provided. If the primary source of estimated performance is a computer program, the computer program should be identified and described.

A definition of installed performance requirements of the aircraft should be specified so the engine manufacturer can understand and assist the aircraft manufacturer’s installation and interface design to achieve these requirements.

3.2.2 Starting and Operating Envelope

The engine starting and operating envelope with any associated engine limitations necessitated by ambient conditions or flight speed must be described. Figure 1 depicts a typical starting and operating envelope. Any unique requirements for pilot start procedure should be identified. Critical speed range dwell limitations should be specified. Automatic start, abort, and auto re-light features should be described. Time limitations (for example, waiting period between start attempts) should be specified as applicable to engine or starting system. Tail wind starting limitations should be specified, if appplicable.

3.2.3 Idle Operation

A definition of idle operation speed range and idle output torque should be described as it can affect rotor brake capacity to stop and hold the rotor. On some aircraft it can affect the ability of rotor system droop stops to extend at idle rotor speeds prior to shutdown. In-flight idle speed and torque should be described over the flight envelope as it can affect ability for rotor speed (Nr) to go higher than power turbine speed in autorotative descent maneuvers. Any limitation on idle speed range operation of accessory pad driven generators and other accessories should be specified to assure compatibility with engine idle speed range. Idle customer bleed temperature and pressure should be described to determine sufficiency for cabin heating and anti-ice systems, if applicable.

Limitations on idle operation with locked power turbine (rotor brake engaged) should be specified. Interlock provisions to prevent acceleration to FLY with rotor brake engaged should be specified.

3.2.4 Shutdown

Engine shutdown function and necessary aircraft interfaces should be specified including normal shutdown, engine overspeed or emergency shutdown, and aircraft means of redundant shutdown such as firewall fuel cutoff. Any unique requirements in the shutdown procedure sequence, such as idle cool down period, should be explained. Engine windmilling restrictions should be identified, as applicable.

3.2.5 Operating Attitudes

The engine capability for continuous attitude operation and transient attitude operations must be described.

3.2.6 Mechanical and Thermal Limits

The gas generator speed, power turbine speed, output shaft torque, and measured gas temperature limits at rated powers and during transients must be stated.

Aircraft transmission steady state and transient speed and torque limits should be specified as necessary where the engine control maintains engine operation within these aircraft limitations.

3.2.7 Operating Flight Limit Loads

The engine flight limit loads must be identified including limits on gyroscopic moments. Figure 2 depicts a typical limit load envelope.

3.2.8 Vibration Limits

The engine vibration limits (engine induced and aircraft induced) must be identified and the installation drawing must identify the vibration pickup location. Steady state and transient limits provided over applicable ranges should be identified with explanatory definitions and criteria for steady state and transient limits and frequency/spectral range.

3.2.9 Control System

The control system philosophy, control modes, and characteristics should be described and/or references made as appropriate to the engine control system ICD (refer to AIR6181). Engine overspeed and emergency shutdown provisions should be described including necessary aircraft interfaces. This should include a description of the failure design such as fail off, fail fixed, fail idle, etc., and if there are auto re-light provisions for flameout.

Engine transient response characteristics should be described based upon control lever movement particularly prevention of torque or temperature exceedence during rotor run up acceleration from ground idle to flight condition. Also engine transient response requirements should be defined as necessary for aircraft handling qualities.

Control system lever(s) minimum and maximum torque required to rotate the levers should be stated. Information must be provided on the lever rotation dwell bands. Rigging method and tolerances for mechanical linkages should be specified. If the control system uses electrical inputs, the signal characteristics must be defined. Components may be added to the control system to enhance stability, i.e., stability accumulators. These components must be coordinated between the engine manufacturer and the helicopter manufacturer and the location, allowable loads, etc., shown on the installation drawing.

Mechanical or electrical interfaces with aircraft collective pitch for engine control collective anticipation function should be described including rigging characteristics and collective signal versus rotor load characteristics specified. Typically, this information should capture the characteristic of rotor torque versus rotor speed versus collective position over the operating envelope plus how this collective position translates to the mechanical or electrical collective position signal provided at the engine interface. Some rotor system and flight control architectures may have variation on how rotor system load is translated to the engine control and how it is used for load anticipation.

3.2.10 Fuel System

The fuels for normal use and special use must be identified with any necessary restrictions. Fuel additives, if approved, should be identified.

Maximum fuel flow should be identified.

Fuel inlet conditions should be identified which address any required fuel system boost assist from the helicopter throughout the operating envelope, ground and air starting, vapor/liquid ratio capability, and any limitations on fuel inlet pressure at/after engine shutdown. Engine suction pump dry and wet lift capability should be specified. The capability to maintain fuel prime should be explained.

Fuel ecology provisions such as ecology collector, return to tank, etc., shall be specified including temperature and flow quantity.

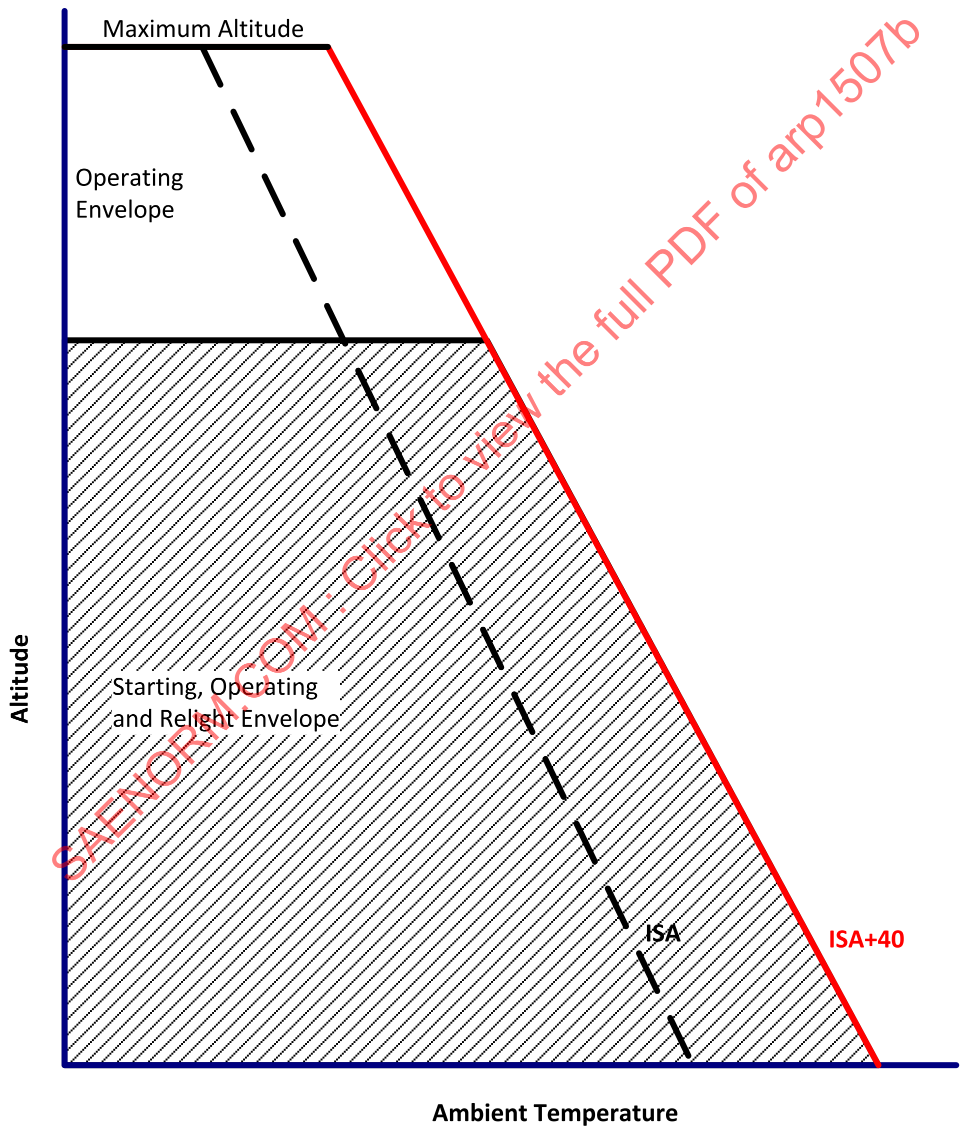
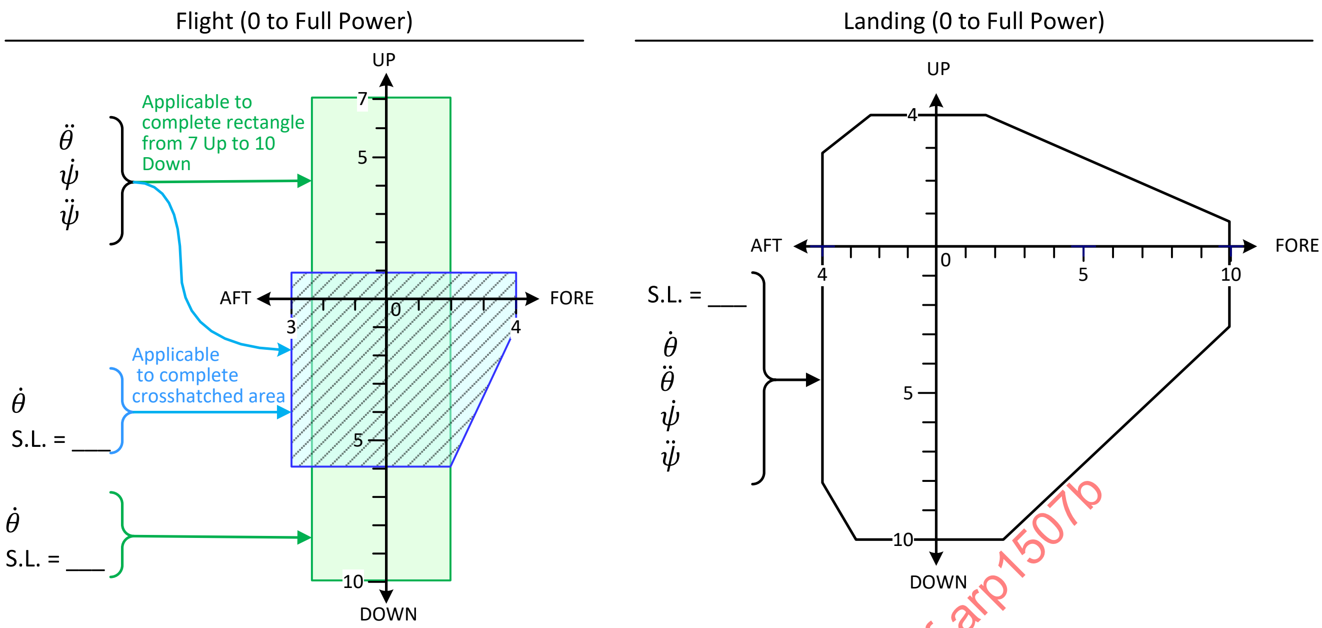


Figure 1 - Starting and operating envelope



1. Load factors and angular velocities and accelerations should be taken at or about the C.G. of the engine.
2. Side Load Factors (S.L.) act to either side.
3. $\dot{\theta}$ and $\ddot{\theta}$ are pitching velocity and acceleration.
4. $\dot{\psi}$ and $\ddot{\psi}$ are yawing velocity and acceleration.
5. Downloads occur during pull out.
6. S.L., $\dot{\theta}$, $\ddot{\theta}$, $\dot{\psi}$ and $\ddot{\psi}$ must be stated

Figure 2 - Limit load envelope

3.2.11 Oil System

The following should be addressed:

a. The oil for normal use must be identified with any necessary restrictions.

b. Oil system operating pressures and temperature must be identified throughout the operating envelope and the location of sensors must be stated.

c. Oil system flow and cooling requirements must be identified for aircraft design if the engine requires a helicopter furnished engine oil cooling system or as necessary for aircraft interfaces for monitoring.

d. Oil quantity, flow, and consumption rate must be identified for aircraft design if the engine requires a helicopter furnished engine oil tank or as necessary for aircraft interfaces for monitoring.

e. Oil system vent requirements including location, maximum flow rates, and vent pressure restriction limits must be identified.

f. Oil filter location and characteristics such as type of filter, filtration capability, bypass, or impending bypass characteristic, etc., should be described.

g. Chip detector provisions and aircraft monitoring system interfaces should be described.

h. Oil drainage provision and connections for oil seals should be described including temperature and leak rate characteristics.

3.2.12 Start and Ignition System

The required starter torques and drive speeds will be stated and shown, such as Figure 3. The torque at the starter drive should include engine drag, breakaway torque, engine accessory drag, and customer accessory gearbox drag. The figure should show the effects of ambient temperatures and altitudes and alternate fuels. Starting times as a function of ambient temperatures must be addressed, and it is recommended that they be graphically depicted as a function of ambient temperature, such as shown in Figure 4. Starter cranking time limitations and cooling interval limitations shall be specified. Shear section requirements should be specified (i.e., prevent starter from jamming or damaging the engine accessory gearbox).

The maximum effective mass moment of inertia of engine rotating parts to be rotated by the starter, referred to the starter drive, and the speed ratio between the starter pad and the driven rotor system must be stated. The torsional spring constant for the engine starting drive system at the starter drive pad must be stated. The maximum backlash of the starting drive system in radians at the starter drive pad should be identified.

Pilot controlled start and ignition functions such as selectable continuous ignition should be described.

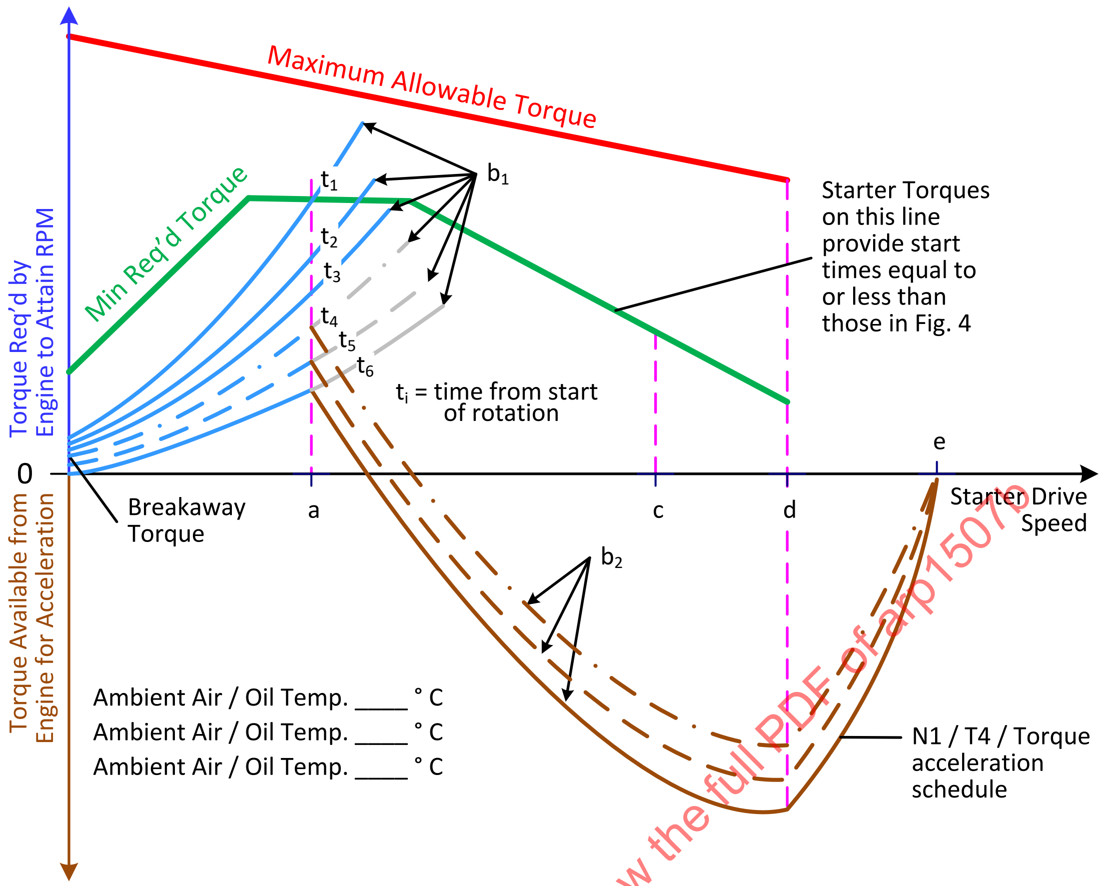
Wet and dry motoring provisions should be specified.

Ignition system function and aircraft interfaces such as start battery relays should be described including provisions to test ignitors and provision to disable ignition for dry and wet motoring.

3.2.13 Compressor Bleed Air

If a compressor bleed air source is available, the mounting type, location, dimensions, and limit loads must be identified. The maximum permissible bleed air must be identified as well as operating condition limitations such as use of bleed air at idle or with locked rotor. Bleed air temperature and pressure condition information over the operating envelope including ground idle should be provided to verify compatibility with aircraft cabin environmental systems and compatibility with anti-ice systems, if applicable. The bleed air purity must be stated. The responsibility for limiting the bleed air such as the bleed air port orifices must be established.

Bleed air exhaust interface requirements should be specified for engine compressor anti-surge bleeds, also known as operability or handling bleeds.



a. Required RPM before firing.
(Where applicable the engine manufacturer shall state the minimum time and the number of revolutions or any combination of conditions that must be satisfied before firing.)

b. Steady-State torque at the starter drive.

   1. In an unfired engine. (Curves at -54 °C show drag torque after time from initiation of rotation)

   2. In a fired engine.

c. Minimum starter cutout speed ____ RPM.

d. Maximum starter cutout speed ___ RPM. (Maximum cutout speed should be at least 10 % above minimum cutout speed).

e. Engine IDLE speed

Figure 3 - Starting torque and speed requirements (sea level static conditions)

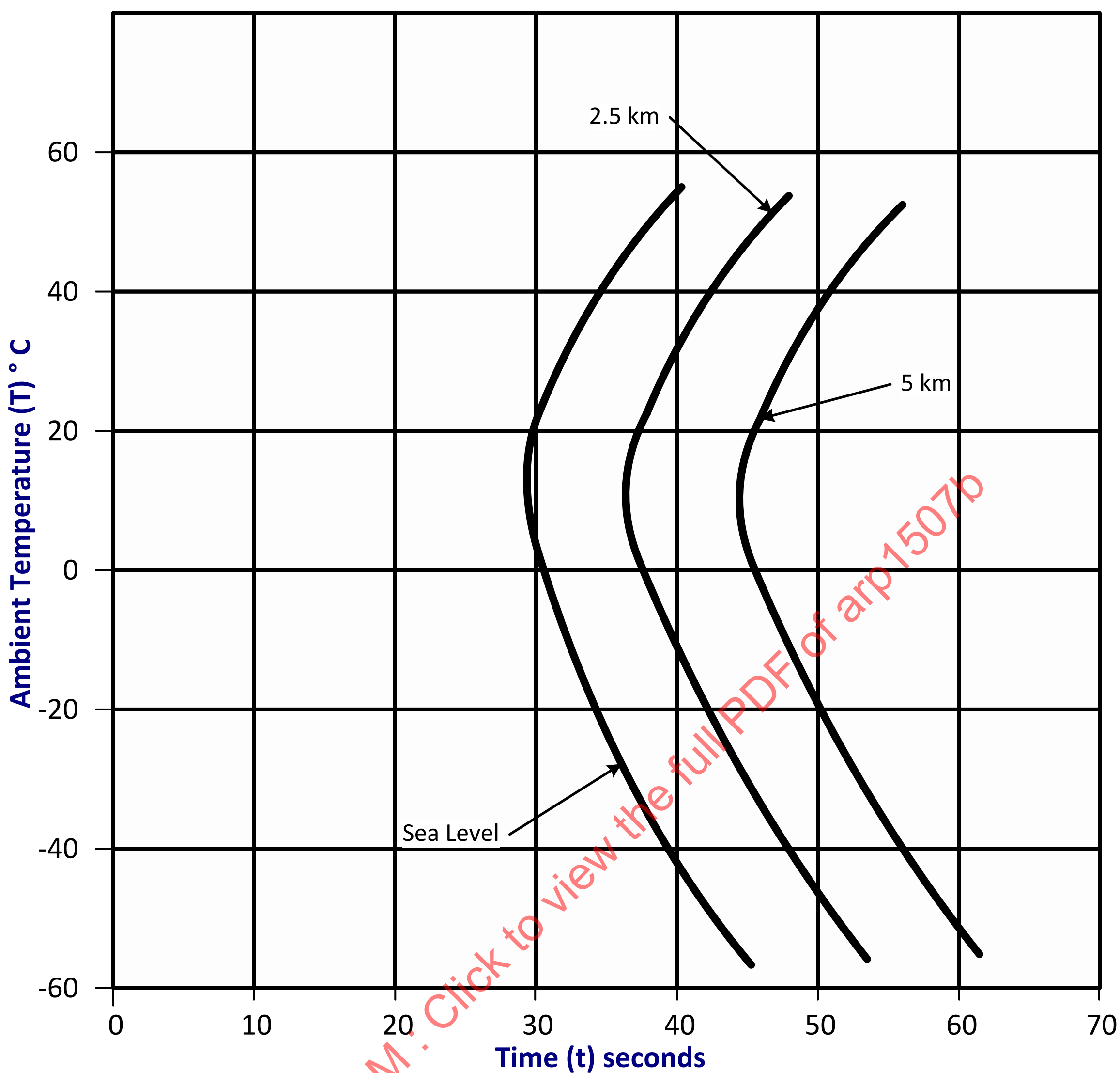


Figure 4 - Engine ground starting time versus ambient air temperature (static sea level to 5 km)

3.2.14 Engine Heat Rejection and Cooling

The engine heat rejection and cooling should be described as defined in ARP996.

If there are engine component limiting temperatures, the components and their temperature limits will be stated, and the installation drawing will identify the thermocouple location and type. Non-operating temperature limits should be identified if different from operating limits.

3.2.15 Electrical System

The electrical system must be described on the installation drawing. Individual engine component power requirements and power characteristics from the helicopter and requirement duration must be identified. The engine electrical output signals to the helicopter, signal characteristics and the signal duration must be identified.

Aircraft supplied power requirements for the engine shall be specified including stating electrical loads, steady state electrical loads, electrical load when alternator not fully supplying power, electrical load if alternator fails, power interrupt accommodation and limitations and low/high voltage thresholds. The engine alternator capability should be specified. This should include explanation at what gas generator speed the engine can operate independent of the aircraft power supply in the event airframe power is lost, and at what gas generator speed the engine will not draw any power from the aircraft when aircraft power is available (i.e., when the alternator voltage remains higher than airframe voltage with full engine electrical load).

3.2.16 Air Induction System

The following should be addressed:

a. The air induction system should be described including inlet connection. Engine air inlet protection from foreign objects should also be described whether it is integral to the engine design or if inlet protection is required to be provided by the helicopter.

b. The air induction anti-icing system should be described, especially system function with electrical supply failure and means to check ice, snow, or re-frozen melted accumulation before dispatch.

c. Inlet distortion limits should be identified including temperature and pressure distortion and swirl, as applicable.

d. Compressor surge overpressure should be specified (for inlet structural design).

e. Water wash/rinse provisions and interfaces should be described including fluid type/quantity for drainage aspects.

f. Drainage provisions should be specified, including drainage of rain during engine operating inlet pressure conditions, drainage of melted ice or snow, and prevention of re-freeze and ingestion of accumulated precipitation.

g. T1 (i.e., engine inlet air temperature) sensor mounting requirements (if not integral to engine) should be specified.

h. Engine limitations or considerations regarding installation of an inlet air particle separation system or inlet barrier filter system and associated bypass system should be described.

3.2.17 Exhaust System

The exhaust connection mounting type, location, dimensions, and limit loads must be identified. If an exhaust centerbody is required, the mounting type, location, dimensions, and limit loads must be identified. The engine manufacturer should identify a recommended exhaust configuration which is compatible with engine performance. Engine exhaust swirl (i.e., tangential velocity) as a function of power turbine radius should be described to assist in exhaust loss calculations.

3.2.18 Engine Noise

The plan for uninstalled and installed engine noise testing should be established as required per the noise limitations the aircraft is intended to meet. The engine manufacturer should address the plan for bare engine noise testing and the aircraft manufacturer should address installed engine noise testing as part of the overall aircraft noise testing.

3.2.19 Engine Condition Monitoring and Diagnostics

The condition monitoring and diagnostics capabilities should be described. If component power requirements exist, they should be identified in accordance with 3.2.15. The instrument range, system accuracy, time response, and electrical characteristics for each parameter that is required for safe engine operation and operation within established operating limits shall be presented in the helicopter engine/airframe interface document and checklist.

3.3 Engine Physical Characteristics

3.3.1 Weight

The engine dry weight must be stated. It is recommended that the weight of residual fuel and oil be identified when the engine is in a horizontal attitude. If engine components are off-engine mounted such as airframe mounted electronic fuel control, the weight must be specified and clearly explained if included in engine dry weight. Similarly, if there are other components furnished with an engine in addition to basic engine configuration, such as accumulators, fuel flow meters, etc., the component part number and weight should stated with clarification whether their weight is included in the engine dry weight.

3.3.2 Engine Dimensions

The engine dimensions must be on the installation drawings which must be a part of the helicopter engine/airframe interface document and checklist.

3.3.3 Engine Mounts

Any engine mounting considerations should be stated. For example, engine mount interfaces that are attached to airframe structure must be fireproof. Specific information on mount locations, dimensions, engine stiffness characteristics, and static, dynamic, and limit loads and moments must be identified. Ground handling lift and support characteristics should also be specified. It is recommended that this information be on the installation drawing.

3.3.4 Mass Moments of Inertia

The following should be stated:

a. The mass moment of inertia of the complete dry engine about three mutually perpendicular axes with the origin at the center of gravity should be stated.

b. The mass moment of inertia of each engine rotor system about the resultant rotational axis, together with the effective direction of rotation of the inertia and the direction and location of the resultant rotational axis should be stated. For engines with geared rotor systems, the shaft to which all inertias of each rotor system have been algebraically referred should be stated.

c. The mass moment of inertia of the complete power output system (including the reduction gear train) referred to the output shaft should be stated.

3.3.5 Output Shaft Interfaces with Aircraft Rotor System

The output shaft configuration, i.e., internal spline, external spline, coupling flange, etc., and the direction of rotation must be stated. Specific information on the output shaft pad location and limit loads of shear and overhung moments must be identified on the installation drawing. Any special consideration such as wetted spline oil control or angular misalignment should be identified. Provisions and or limitations on reverse power turbine rotation (i.e., during hand turning of rotor for hangar clearance) should be specified.

A torsional stability model should be jointly specified by the engine and aircraft manufacturer. This shall include rotational inertia, spring constants and damping factors of the aircraft and engine rotating components in the power train system from engine power turbine to aircraft rotors. This model is used to analyze engine power turbine control loop torsional stability.

3.3.6 Containment

The engine containment provisions and turbine burst fragment zones must be specified to assure independence of installed engines (if multiple engines) and integrity of flight critical aircraft components proximate to the engine(s). Engines with blade shed overspeed protection must specify characteristics of blade fragment discharge from the engine to avoid striking the rotor system or flight critical components. In addition, the engine manufacturer shall provide large fragment ±3 degrees, intermediate fragment ±5 degrees and small fragment ±15 degrees exit energies (mass, size, and speed) and geometry of the release path for every rotational critical part for the airframe manufacturer to conduct rotor burst safety analysis per Advisory Circular AC 20-128A.

3.3.7 Accessory Drives

The accessory drive pad locations, dimensions, and limit loads must be identified on the installation drawings. Horsepower and torque limitations of driven accessory loads must be identified including consideration of the horsepower extraction on engine operation, i.e., power availability, performance, and SFC.

A table similar to Table 1 must be included to describe the engine accessory drive characteristics. This table must address the installation characteristics for accessories that are installed by the aircraft manufacturer such as starters, generators, and blowers; however, the characteristics for accessories that are part of the engine manufacturer's basic engine design such as fuel pumps, hydromechanical fuel controls, and alternators may be included for reference.

Table 1 - Gearbox pads and drives

Name of Accessory or Component	Type of Drive[(1)]	Ratio of Pad to Spool[(2)] Speed	Direction of Rotation (Facing Pad)	Torque Rated	Torque Overload[(3)]	Torque Static	Overhung Moment

(1) Give the type of drive including applicable industry standard designation.
(2) Spool speed is normally compressor rpm for accessories driven by compressor spool. Add separate column for ratio to power turbine rpm if accessory is driven by power turbine spool.
(3) Specify duration and frequency of overload.

3.3.8 Fuel System and Control System

Fuel system and control system connection locations, dimensions, and limit loads must be identified.

Fuel filter location and characteristics should be described such as type of filter, filtration capability and efficiency, filter micro-rating, pressure drop, time to impending bypass or bypass based on a specified fuel contamination concentration, and any signal and its characteristics provided to indicate pending filter bypass or bypassing conditions. Any limitations on fuel line characteristics such as slope, line diameter, etc., must be described.

Airframe mounted engine component mounting, envelope and connections should be described.

Fuel flow meter installation provisions should be specified. Fuel flow meter pressure drop, and locked rotor (i.e., turbine flow meter) pressure drop should be specified.

3.3.9 Engine Servicing and Maintenance Provisions

Engine servicing and maintenance provisions should be described as necessary for the the aircraft installation to accommodate and provide access such as ground handling provisions, list of LRUs and associated remove and install characteristics, servicing, washing, boroscope, inspection, and other characteristics.

3.4 Drawings

The helicopter engine/airframe interface document and checklist should contain copies of the engine installation drawing and the engine electrical system drawing.

3.4.1 Installation Drawing

Installation drawing data should include:

a. Notes which address the following:

1. Dimensions, tolerances, and the temperatures which are used for basic dimensions (e.g., 15 °C or room temperature) including hot engine dimensions for mounts, exhaust flanges, etc.

2. Orientation or reference datums.

3. Engine center of gravity dry, including tolerances, and—if significantly different—serviced.

4. Vibration pickup locations and applicable vibration limits.

5. Mounting restrictions.

6. Maximum permissible loads on each connection point. For example, the maximum permissible loads on the accessory pads, exhaust connection, fuel inlet connection should be identified.

b. Tables which contain the information on installation connections and servicing points. Tables should address:

1. Item identification (number or symbol).

2. Item nomenclature.

3. Item description (view, description, etc.).

4. Sheet number and zone location of the item detailed description.

5. Item location (station, waterline, buttock line) coordinates.

c. An engine installation drawing may consist of several sheets. A suggested presentation of data for each sheet could be as follows:

1. Sheet 1: Presenting notes, tables, and left side view of the engine.

2. Sheet 2: Presenting the engine front view, right side view, and rear view.

3. Sheet 3: Presenting the engine envelope, access envelopes for removal and replacement of components, and access envelopes for the engine interface connections.

4. Sheet 4 and subsequent sheets: Presenting the detailed definition of all interface connections and specific installation requirements that are not defined by referenced standards.

3.4.2 Electrical System Drawing

The electrical system drawing data should include:

a. Notes which address the following:

1. Definition of all engine-provided signals and, if necessary, the required electrical characteristics of these signals, and the required electrical characteristics of circuits external to the engine.

2. Definition of all electrical power required by each separate power input circuit of the engine and the required electrical characteristics of this power.

3. Definition of the electromagnetic interference limits that may be introduced by airframe circuits or tests/checks that may be done to find problems. Grounding and bonding requirements should be specified.

b. Tables which contain the following information:

1. Connector reference designation.

2. Drawing zone location.

3. Shell size and insert arrangement.

4. Reference document for the shell size and insert arrangement.

5. Notes as required.

c. Schematic wiring diagram.

3.5 Interface Checklist

It is recommended that an interface checklist be used to assure complete coverage of all interface characteristics. A sample checklist is contained in Appendix A.

4. NOTES

4.1 Revision Procedures (Helicopter Engine/Airframe Interface Document and Checklist)

Instructions on procedures for engine and aircraft manufacturer mutally agreed updates to the document shall be specified.

It is recommended that a revision history be included in the initial pages of the interface document. A change bar (I) located in the left margin should be provided for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

4.2 Revision Indicator

A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

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