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MILITARY SPECIFICATION

TRANSMISSION SYSTEMS, VTOL-STOL, GENERAL REQUIREMENTS FOR

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 This specification covers the general requirements for the design and testing of transmission system components intended for the transmission of primary engine power to lift and propulsion devices and accessories of an aircraft (see 6.3.1 and 6.3.2).

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

PPP-B-601	Boxes, Wood, Cleated-Plywood
PPP-B-621	Boxes, Wood, Nailed and Lock-Corner
PPP-T-60	Tape: Pressure-Sensitive Adhesive, Waterproof, for Packaging

Military

MIL-P-116	Preservation, Methods of
MIL-B-121	Barrier Material, Greaseproofed, Waterproofed, Flexible
MIL-D-3464	Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification
MIL-C-5584	Containers; Shipping, Aircraft Engine, Metal
MIL-D-6054	Drum, Metal - Shipping and Storage
MIL-D-6055	Drums, Metal Reusable, Shipping and Storage (Cap. from 88 to 510 Cubic Inches)
MIL-F-7179	Finishes and Coatings, General Specification for Protection of Aerospace Weapons Systems, Structures and Parts
MIL-C-7769	Cushioning Material, Uncompressed Bound Fiber for Packaging

MIL-S-8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter, General Specification for
MIL-E-8970	Engine and Related Propulsion and Power Equipment, Aircraft, Acceptance Tests of, Sampling Plan for, Statistical
MIL-C-16173	Corrosion Preventive Compound, Solvent Cutback, Cold-Application
MIL-C-38373	Cap, Fluid Tank Filler

STANDARDS

Military

MIL-STD-100	Engineering Drawing Practices
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of US Military Property
MIL-STD-480	Configuration Control - Engineering Changes, Deviations and Waivers
MIL-STD-889	Dissimilar Metals
MS33633	Insert, Screw Threaded, Design and Usage Limitations for
MS33649	Bosses, Fluid Connection-Internal Straight Thread
MS33666	Packing, Preformed-Aeronautical, Elastomeric, Range of Sizes
MS33668	Packing, Preformed-Tube Fitting, Elastomeric, Range of Sizes
MS33786	Fitting Installation, Flared Tube and Hose, Swivel

Air Force-Navy Aeronautical

AN100036	Cover-Type XI Engine Accessory Drive
AN100038	Cover-Type X Engine Accessory Drive
AN100041	Cover-Type XII, XIV-A, XIV-B, XIV-E, XVII-A, and XVII-B Engine Accessory Drive
AN100043	Cover-Type X and XV Engine Accessory Drive
AN100044	Cover-Type XVI, XVII-C, D, E, and F Engine Accessory Drive
AND10064	Fitting - Installation of Flared Tube, Straight Thread Connectors
AND10065	Connection Assembly - Flexible, Fluid, Standard Design of

Publications

Air Force-Navy Aeronautical Bulletins

343	Specifications and Standards Applicable to Aircraft Engines and Propellers, use of
438	Age Controls of Age-Sensitive Elastomeric Items

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Preproduction. This specification makes provisions for preproduction testing.

3.2 Materials and processes. Materials and processes used in the manufacture of transmission systems shall conform to the applicable specifications listed in ANA Bulletin No. 343. When a manufacturer's specifications are used for materials and processes, such specifications shall be submitted to the Government for review prior to starting preproduction testing and unless specifically disapproved, will be considered released upon satisfactory completion of the tests. The use of nongovernmental specifications shall not constitute waiver of Government inspection.

3.2.1 AGE control. AGE control of all synthetic rubber parts shall be in accordance with ANA bulletin No. 438.

3.2.2 Metals. Metals shall be of the corrosion resistant type or suitably treated to resist corrosion likely to be encountered during storage or service use.

3.2.2.1 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals shall not be used in intimate contact with each other. Dissimilar metals are defined in MIL-STD-889.

3.2.2.2 Castings. Castings shall be clean, sound, and free from blow holes, porosity, cracks, and other defects that might reduce their physical properties below specification requirements.

3.3 STANDARDS

3.3.1 Standard parts. AN or MS standard parts shall be used and identified by their standard part numbers, unless they are determined by the manufacturer to be unsuitable for the purpose. In particular, the military standard parts developed specifically for use in aircraft engines (released for use by ANA Bulletin No. 343) are preferred and will be considered for use prior to consideration of any other parts. Where general purpose standards, as defined by envelope dimensions or Qualified Products List (QPL'S), are used in critical or high strength applications, parts shall be identified by the vendor's or manufacturer's part number. Parts derived from general purpose standards solely on an inspection or selection basis shall be identified by contractor part numbers and all previous identification marks shall be removed.

3.3.1.1 Parts list. The list of parts that have successfully completed the preproduction tests shall constitute the approved list for parts used in subsequent transmission systems of the same model (see 6.2).

3.3.1.2 Design changes. Changes in the design or material of parts listed in the approved parts list shall not be made except when such changes are approved in accordance with MIL-STD-480.

3.3.1.3 Change in vendor. A listing of all transmission parts which require substantiation in event of a change in vendor or fabrication source shall be prepared by the contractor and submitted to the procuring activity for approval. The listing shall identify the testing required for approval.

3.3.1.4 Changes in manufacturing processes. When changes in manufacturing processes become necessary, data substantiating the changes shall be submitted to the Government for review and approval before such changes are effected.

3.3.1.5 O-ring seals and packings. All nonmetallic O-ring seals and packings used in the design of transmission systems shall conform to the applicable dimensions and tolerances shown on MS33666 and MS33668.

3.3.2 Design standards. MS and AND design standards shall be used whenever applicable.

3.3.3 Standardization. Standardization principles shall be applied at all phases of initial design and to all design changes. Since these principles have, as final objectives, the reduction of varieties of components (e.g., materials, sizes, design elements, need for special tools) both within a particular model, and between various models supplied to the Government, maximum use of military series standard parts (restricted to the minimum number of varieties within that series) will assure that such standardization is accomplished. When standard parts are determined to be unsuitable for use in a specific application, the variety of special parts used shall be minimumized. Under conditions wherein economics of production conflict with standardization objectives, the latter group will govern, or the using service shall be requested to select the component desired for use.

3.4 Design and construction

3.4.1 Airframe fluid line connections. Bosses for fluid fittings shall be in accordance with AND10064 and AND10065.

3.4.2 Connection identification. Each transmission component shall be permanently marked to identify all instrumentation and oil connections.

3.4.3 Vibration. Prior to testing of the transmission components, the contractor shall submit either empirical or analytical data to show that neither linear nor torsional vibration of any component of the transmission system will result in a combined steady-state and alternating stress in excess of 50 percent of the ultimate strength of that component. These data shall also demonstrate stress stability of the engine and fuel control, rotor and propeller system, and all transmission components, including gears, as a combined dynamic system.

3.4.4 Bearing sleeves. Except where flanged bearing rings are used, sleeves of steel or other suitable material shall be incorporated in aluminum or magnesium housings. The sleeves shall be restrained from rotating by a positive locking means.

3.4.5 Securing of fastenings. Threaded fastenings and other connections shall be self locking or otherwise secured to prevent loosening under all operating conditions.

3.4.6 Inserts. Subject to the limitations of MS33633, inserts shall be used in magnesium and aluminum alloys for attachment of fittings.

3.4.7 Clutches. Clutches shall be provided in the transmission system to permit engagement or disengagement of rotors, propellers, engines, portions of the transmission system, or equipment as required for various modes of aircraft operation. The location of the clutches in the drive trains shall be such that the necessary functions of the transmission system for safe operation of the aircraft will continue to be performed for any combination of clutch engagements or disengagements. The clutches shall be so designed that engagement does not damage any components or parts. Clutches shall be capable of 200 engagements without adjustment and 2,400 engagements without replacement.

3.4.8 Drive shaft

3.4.8.1 Whirling critical speeds. There shall be no whirling critical speeds within 10 percent of any operational speed for any section of the shafting. Where shaft critical speeds below operational speed exist, the contractor shall demonstrate by tests that stress amplifications do not cause fatigue limits of the shaft material to be exceeded.

3.4.8.2 Torque limiter. If provided as part of the transmission system, means of limiting the torque shall be as specified in the aircraft detail specification.

3.4.8.3 Couplings. The torque and misalignment capacities of couplings shall be suitable for all operating conditions when installed in the aircraft at the maximum permissible misalignments. Lubrication shall not be required more often than each 100 hours flight time.

3.4.8.4 Dephasing. Dephasing devices shall be provided with interlocks to prevent operation of the rotors unless they are positively locked in phase. Provision shall be included for remote indication that the rotors are locked in phase.

3.4.8.5 Propeller and rotor brakes. Brakes for propellers and rotors shall be capable of accomplishing 400 stops under conditions specified in the aircraft detail specification without requiring the replacement of any part. Brakes shall be so designed as to prevent rates of deceleration that could result in damage to components.

3.4.8.6 Antirotation. Means to prevent rotation of the rotor(s) or propeller shall be as specified in the aircraft detail specification.

3.4.8.7 Torquemeter. A means for sensing the torque shall be provided in the main power train and shall be as specified in the detail specification.

3.4.9 Gearboxes

3.4.9.1 Lubrication. Lubricants and lubrication service requirements shall be as specified in the aircraft detail specification.

3.4.9.2 Gearbox oil connections. The oil inlet and outlet connections shall conform to AND10064 or MS33786. The connections shall differ in size to prevent reverse connection of lines.

3.4.9.3 Gearbox breathers. The pressure within the gearbox shall not exceed 0.5 pound per square inch above static atmospheric pressure under any condition of operation. Breathers shall incorporate a 10-micron filter, shall be as small as practicable but not less than 0.75-inch in diameter, and shall be so located and arranged that oil will not be lost from the gearbox for all operational attitudes permitted by the pilot's handbook. Hose connection assemblies shall conform to AND10065.

3.4.9.4 Gearbox and oil supply tank vents. If an external oil supply is used, the gearbox shall be provided with a straight thread opening for an oil supply tank vent connection preferably located in the upper portion of the gearbox. The oil supply tank vents shall be located in relation to the breathers so that pressure in excess of 0.5 psi will not be applied to the oil tank vent connection. Connections shall be in such a location that the lubrication or scavenging of the gearbox will not be affected adversely.

3.4.9.5 Oil level indicators. Suitable means shall be provided for visually checking the oil quantity of each gearbox lubrication system without the use of tools. A readily accessible dipstick may be used if suitable provisions are included to prevent loss or breakage.

3.4.9.6 Oil temperature. Means shall be provided for measuring gearbox oil temperature as specified in the aircraft detail specification.

3.4.9.7 Oil system. Each gearbox shall have its own lubrication system. All oil passages and lines that connect points in the same gearbox shall be located within the gearbox. Gearboxes and gearbox driven accessories which are required to operate during autorotation of rotors shall be adequately lubricated for the autorotation condition. The normal operating oil temperature and pressures of the gearboxes shall be as specified in the aircraft detail specification. The oil pressure shall not fluctuate more than 10 percent during any stabilized operating condition.

3.4.9.7.1 Oil filter. A two-stage oil filter, sized to entrap all solid particles larger than 80 microns, shall be installed so that all oil passing through the gearbox pressure pump(s) shall immediately pass through the filter. A bypass valve shall be included in each stage to bypass the filter element of that stage in the event that the filter element becomes clogged. An indicator on each bypass valve shall be provided to show that the corresponding element has been bypassed. It shall be impossible to reset either indicator without removing the corresponding filter element. It shall be possible to remove the filter element without disturbing any other part of the oil system. The filter housings shall be designed and so oriented that entrapped contaminant and unfiltered oil within the filter housing are removed when the filter elements are removed.

3.4.9.7.2 Pressure pump(s). No air trap shall exist at the gearbox pump inlet(s). The oil pressure pump shall maintain the specified gearbox oil pressure at all altitudes up to and including the absolute altitude specified in the aircraft detail specification.

3.4.9.7.3 Relief valve. The relief valve shall be located downstream of the oil filter.

3.4.9.7.4 Pressure relief oil. When the pressure pump is submerged in a wet sump or below the normal oil level of a separate tank during the normal startup attitude, pressure relief oil bypassed from the relief valve may be returned to the pump inlet. When the pump is located above the oil level, the bypassed oil shall be returned directly to the sump or tank or to the inlet part of the pump.

3.4.9.7.5 Scavenging system. If a scavenging system is used, it shall scavenge the gearbox under all operating conditions. The system shall operate satisfactorily with back pressures up to 20 psi.

3.4.9.7.6 Filling provisions. The contractor shall specify the arrangement and location of filling provision for the gearbox lubrication system. Pertinent information as to the type, grade, and quantity of lubrication shall be indicated on the filler cap or adjacent to it on the gearbox housing. The lubrication system filler arrangement shall be readily accessible and provided with a scupper and drain connection.

3.4.9.7.7 Filler cap. The filler cap shall be in accordance with MIL-C-38373.

3.4.9.7.8 Gearbox oil drain. The gearbox shall be provided with at least one oil drain opening located at the lowest point in the case or sump. The size of the gearbox drain opening shall be commensurate with the size and function of the gearbox. A drain plug shall be installed in each opening and properly secured.

3.4.9.7.9 Chip detector. A minimum of one magnetic plug, capable of removal for inspection without necessitating oil drainage, shall be provided for each gearbox. A remote indicating chip detector, preferably located in the oil flow path, shall be installed in such a way as to provide early indication of chip generation in the gearbox.

3.4.9.7.10 Oil sampling. Provisions shall be included to permit convenient removal of small quantities of oil for analysis. The location shall permit obtaining a true average sample.

3.4.9.8 Accessory pads and drives. Drives provided on the transmission system shall be so located that they will be driven whenever the rotor and/or propeller systems are rotating. The type and number of drives shall be as specified in the aircraft detail specification. All pads, except those for tachometer generators, shall provide for transmission oil to positively lubricate the drive splines.

3.4.9.9 Cover plates. Cover plates and gaskets for all drive openings shall be supplied with each transmission system and suitable provisions for covering or plugging all other openings shall be made. Cover plates for standard accessory drive pads which might not be used in operation shall be in accordance with AN100036, AN100038, AN100041, AN100043, or AN100044, as applicable.

3.4.10 Accessibility and maintainability. Components of the transmission system requiring routine service checking, adjustment, or replacement shall be made readily accessible without requiring removal of other parts. Each component shall be removable from the system without disassembly of the component. Parts subject to wear which require replacement or adjustment prior to the expected life of the system components shall be individually replaceable.

3.4.10.1 Tools. The transmission system shall be so designed and constructed that it can be assembled, disassembled, and maintained with tools and maintenance equipment normally available.

3.4.11 Assembly. The components of the system shall be so designed that they can not be incorrectly assembled or installed.

3.5 Performance

3.5.1 Environmental conditions. The system shall meet the environmental requirements specified in the detail specifications.

3.5.2 Endurance. The transmission system shall have a minimum operating service interval of 1,200 hours mean time between removals.

3.5.3 Ratings. For each gearbox in the transmission system, ratings in terms of input torque and speed versus limiting time intervals over which combinations of torque and speed may be used shall be as specified in the aircraft detail specification. Ratings shall be selected to reflect actual conditions of loading in the aircraft with the particular engine employed.

3.6 Part numbering of interchangeable parts. All parts having the same manufacturer's part numbers shall be functionally and dimensionally interchangeable. The item identification and part number requirements of MIL-STD-100 shall govern the manufacturer's part numbers and changes thereto.

3.7 Threads

3.7.1 Straight screw threads. Straight screw threads shall conform to MIL-S-8879.

3.7.2 Tapered threads. Taper threaded or other forms of plugs that tend to broach or otherwise deform the material into which they are inserted shall not be used in castings and nonferrous parts. Tapered pipe threads may be used only for permanent plugging of drilled passages or openings in steel provided the steel has not been heat treated beyond 240,000 psi tensile strength.

3.7.3 Special screw threads. Special screw thread forms shall be acceptable only when their use is justified by the contractor and approved by the procuring activity.

3.8 Finishes. All external metals surfaces shall be finished in accordance with the external finish system of the airframe as specified in MIL-F-7179. Gearbox surfaces that are external to the airframe shall be finished in accordance with the external finish of the aircraft.

3.9 Identification of product. Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130.

3.10 Workmanship. Workmanship shall be of sufficient quality to insure proper operation and service life of the components and systems.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of tests. The inspection and testing of transmission systems shall be classified as follows:

a. Preproduction tests

b. Quality conformance tests.

4.3 Test conditions and test data

4.3.1 Test stands. Test stands shall be capable of operating at variable speeds and of imposing all loads encountered under flight conditions.

4.3.1.1 Oils and lubricants. Oils and lubricants shall be as specified in the aircraft detail specification.

4.3.1.2 Oil temperature. The inlet oil or sump temperature shall be maintained at or above the maximum temperature specified in the aircraft detail specification.

4.3.1.3 Accessory drives. The accessory drives shall be loaded to their maximum continuous torque and overhung moment ratings as specified in the aircraft detail specification.

4.3.2 Test data

4.3.2.1 Accuracy of data. For all transmission systems and component tests, reported data shall have a steady state accuracy within the following tolerances. Automatic recording equipment and associated test apparatus shall have a static accuracy within 2 percent of the values obtained at the normal rating of the transmission system. Accuracy of transient data and the corresponding instrument calibration methods shall be subject to the approval of the authorized Government representatives. All instruments and equipment shall be calibrated as necessary to assure that the required degrees of accuracy is maintained.

a. Rotational speeds: ±0.5 percent of the value obtained at normal rating

b. Shaft torque: ±2.5 percent of the value obtained at normal rating

c. All other data: ±2.0 percent of the value obtained at normal rating

4.3.2.2 Data required. A complete log of all testing shall be maintained. The date, serial numbers of the components, test run and the desired power and rotational speed shall be recorded on each log sheet. The following items, where applicable, shall be recorded at intervals of not greater than 30 minutes:

a. Total test time

b. Actual time of day

c. Revolutions per minute of the gearbox input or output shaft

d. Ambient air temperature

e. Oil temperature out of each gearbox or in sump, °C

f. Oil temperature into each gearbox, °C

g. Oil pressure(s) gearbox

h. Oil flow rate

i. Gearcase pressure

j. Loads: torques, thrusts, moments, et cetera.

Notes shall be placed on the log sheets concerning all incidents of the test, such as special lubrication, leaks, vibrations, noise changes, and any other irregular functioning of the component or the test equipment, and the corrective measures taken.

4.3.2.3 Accreditable test time. Unless otherwise specified in the test program, test time shall not be credited in increments of less than 30 minutes.

4.4 Preproduction testing

4.4.1 Test sample. One system, or one component thereof, shall be used as a preproduction test sample. The sample shall be identified by the manufacturer's part number and such other information as required by the procuring activity.

4.4.2 Preproduction tests. The preproduction tests shall consist of all the tests specified under 4.6.

4.5 Quality conformance tests. Quality conformance tests shall consist of:

a. Individual tests

b. Sampling tests.

4.5.1 Individual tests. Each transmission system component or combination of components, except interconnecting shafts, shall be subjected to the following tests as described under 4.6:

a. Run-in

b. Maximum continuous rated power and speed

c. Maximum rated torque.

4.5.1.1 During the tests specified in 4.6.2 and 4.6.3, a stoppage for any cause may, at the option of the Government, require that the test be repeated. External leakage of oil or lubricant shall be considered as a reason for stopping the test. If, upon inspection at the completion of a test, oil or lubricant leaks are observed, a check at maximum continuous rated torque shall be made after corrective action has been completed.

4.5.1.2 Special features. Transmission systems or components thereof that possess special design, function or frequency of operation features shall be subjected to any additional tests as specified by the Government. Such test shall not materially increase the duration of quality conformance testing.

4.5.2 Sampling tests. Sampling of system components or a combination of components shall be in accordance with MIL-E-8970. Samples shall be subjected to the following tests as described under 4.6 in the order specified:

a. Maximum continuous rated torque and speed

b. Maximum torque and speed rating

c. Clutches and overrunning devices.

4.5.3 Rejection and retest. When, in the opinion of the Government, there is evidence of a malfunction or a component of the transmission system fails to meet the tests specified, the difficulty shall be investigated and corrected to the satisfaction of the Government before continuing the test. If such investigation requires disassembly of any internal moving parts of the transmission system or component thereof, the portion of the test in which the malfunction or failure occured shall, at the option of the Government, be repeated. Rejected items shall not be resubmitted for inspection for acceptance without full particulars being given the Government representative concerning previous rejection of the item.

4.5.3.1 Maximum hours of running. Any transmission system or component thereof which requires more than 15 hours of running at or above 90 percent of normal speed before running-in prior to the final test, or more than a total of 30 hours of running during the quality conformance tests, shall be rejected. Components which have been rejected may be used in other transmission systems being built provided these items are reconditioned sufficiently to enable them to pass the detailed inspection required for similar unused items.

4.5.3.2 Repetitive failures. Persistent repetitive failures of a transmission system component shall, at the option of the Government, require redesign or change in assembly procedures, fit, et cetera, of the effected parts or assemblies and the subjection of such parts to the testing required by this specification or portions thereof applicable to the components concerned.

4.6 Test methods

4.6.1 Run-in. The procedure and duration of run-in to be accomplished prior to initiation of testing shall be determined by the contractor.

4.6.2 Maximum continuous rated power and speed. The gearbox shall be operated for 1 hour at maximum continuous rated power and speed. For gearboxs using an external oil cooler, at least two determinations of oil flow rate and temperature rise will be required at specified maximum oil inlet-temperature conditions. Power takeoff drive(s) shall be loaded at torque and speed value(s) specified by the contractor and approved by the Government.

4.6.3 Maximum-rated torque. The transmission system or component thereof shall be subjected to one 5-minute maximum rated torque test.

4.6.4 Maximum torque and speed rating. If the gear box has a takeoff or military rating that is different from its maximum continuous rating, it shall be operated for three 5-minute periods at the highest torque and speed ratings. Each of the three periods shall be preceeded by a 1- to 5-minute period of operation at a reduced torque setting.

6.5 Clutches and overrunning devices

4.6.5.1 Clutch engagements. The clutch shall be engaged a minimum of five times under input power and speed conditions specified by the contractor and approved by the Government. For each engagement, the clutch output shaft shall be loaded in a manner simulating service operation. The final output speed and power absorbed shall be specified by the contractor and approved by the Government.

4.6.5.2 Overrunning devices. Overrunning devices shall be tested by simulating service operations such as starting, stopping, and autorotation for a minimum period of 5 minutes.

4.6.6 Endurance. The endurance test shall be sufficiently severe to demonstrate a potential mean-time-between-removals of 1,200 hours based on the cubic mean torque for the specified aircraft mission. For components with parts having critical speeds near operating speeds, the test shall demonstrate that stress levels will be within acceptable limits. The transmission system shall be tested a minimum of 200 hours When the test time is more than 200 hours, at least 80 percent of the time shall be at the maximum continuous torque rating of the component.

4.6.7 Tail rotor drive train. In addition to the test specified in 4.6.7, all gearing in the tail rotor drive trains shall be tested at the highest transient peak torque associated with sideward flight or maneuver with unfavorable wind direction and velocity or three times hover torque, whichever is greater. The number of test cycles shall be as specified by the contractor and approved by the procuring activity.

4.6.8 Clutches and brakes. Clutches, brakes, and other components that can not be tested suitably during the test specified in 4.6.7 shall be tested in accordance with a program proposed by the contractor and approved by the procuring activity.

4.6.9 Lubrication. It shall be demonstrated, either analytically or by testing, that lubrication is suitable for all steady-state operational attitudes with respect to gravity.

4.6.10 Teardown inspection. After completion of the preproduction tests, the components shall be completely disassembled and inspected visually, dimensionally, and by magnetic or fluorescent particle techniques. The contractor shall then

prepare the parts for detailed inspection by the Government. The contractor shall then prepare a discrepancy list which shall be available for review during inspection. In addition to test performance data, this inspection will be a basis for determining acceptability of the equipment.

5. PREPARATION FOR DELIVERY

5.1 Preservation

5.1.1 Gearboxes. Gearbox assemblies shall be preserved in accordance with method IId of MIL-P-116 after treatment as follows: Immediately upon completion of the quality conformance tests, the lubricant shall be drained from the gearbox. The gearbox shall then be refilled to the normal operating level with the lubricant specified by the contractor and approved by the Government. The gearbox shall then be operated 10 minutes at 75 percent rated speed after which it shall be drained.

5.1.2 Accessory pads and drives. If an accessory is installed, the application of a contact preservative to the accessory pad and drive will not be required. If an accessory is not installed, the pad and drive for that accessory shall be sprayed or dipped with corrosion-preventive compound and covered with a suitable closure or cap.

5.1.3 Exposed drive shafts. Any exposed drive shafts shall be coated with grade 2 corrosion-preventive compound conforming to MIL-C-16173. Precautions shall be taken to properly clean the shaft and neutralize any fingerprints prior to application of the compound. The shaft shall then be wrapped with grade A, type III, class 2 barrier material conforming to MIL-B-121, and secured with type III, class 1 moisture-resistant tape conforming to PPP-T-60.

5.1.4 Gearbox openings. Plugs, caps, screens, or covers, as required, shall be installed over all gearbox openings. All closure devices shall be resistant to oil and moisture to prevent deterioration.

5.1.5 External surfaces. All excess oil shall be wiped from external surfaces.

5.1.6 Clutches and brakes. Exposed shafts shall be preserved as specified in 5.1.3. No other contact preservative shall be used in clutches and brakes.

5.1.7 Interconnecting shafts. The ends of all interconnecting shafts which have splines, couplings, or universal joints shall be preserved as specified in 5.1.3. No other preservation will be required.

5.2 Packaging and packing

5.2.1 Gearboxes, clutches, brakes. Gearboxes, clutches, and brakes shall be packaged separately in metal containers conforming to MIL-C-5584, MIL-D-6054, or MIL-D-6055, as applicable. Type II desiccant conforming to MIL-D-3464 shall be put in the appropriate holder, or, if there is no holder, the desiccant container shall be secured to the mounting frames. Desiccant shall not be tied to the item being packaged and shall not be allowed to come in contact with it. All attaching hardware shall be coated with a thin film of corrosion-preventive compound conforming to MIL-C-16173. The required amount of desiccant shall be determined by formula II of MIL-P-116. Pressurized containers shall be pressurized to 5 psig with clean, dry air. Closure bolts and nuts shall be coated with P-1 preservative upon completion of the closing operation.

5.2.2 Interconnecting shafts. Interconnecting shafts shall be packed in a cleated-plywood or nailed wood box conforming to PPP-B-601 or PPP-B-621. The shafts shall be blocked, braced, and cushioned within the box. Cushioning material shall conform to MIL-C-7769. A double thickness of grade A barrier material, type and class optional, conforming to MIL-B-121 shall be placed between the cushioning material and the shafts.

5.3 Marking of shipments. In addition to any special marking required by the contract or order, interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The transmission system is intended to be used for the transmission of rotative power from the airframe engine(s) to the rotor(s), propeller(s), and accessories.

6.2 Ordering data. Procurement documents should specify:

a. Title, number, and date of this specification

b. Approved parts list (see 3.3.1.1)

c. Preparation for delivery (see section 5).

6.3 Definitions

6.3.1 Transmission system. The transmission system includes all parts between the engine(s), propellers, and the main or auxiliary rotor hubs. This includes gearboxes, shafting, universal joints, coupling, rotor brake assembly, overrunning, friction, and dog clutches, supporting bearings for shafting, and any attendant accessory pads or drives. Transmission oil cooling fans are considered a part of the transmission system.

6.3.2 Component. A component is a unit of the transmission system, composing a logical assembly capable of independent operation, similar to a gearbox, separate clutch assembly, or universal joint.

6.3.3 Ratings. Normal rating is the maximum allowable torque input for continuous operation of the transmission system. Takeoff rating is the maximum allowable torque input for 10 minutes' operation of the transmission system. Military rating is the maximum allowable torque input for 30 minutes' operation of the transmission system.

6.3.4 Rotor system. The rotor system includes the rotor blades, rotor control, and rotor hub.

6.4 Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians:
Army - AV
Navy - AS
Air Force - 11

Reviewer activities:
Army -
Navy -
Air Force - 84

Preparing acitvity:
Air Force - 11

Project No. 1615-0002

SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 22-R255

INSTRUCTIONS: This sheet is to be filled out by personnel, either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments and suggestions submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or serve to amend contractual requirements.

SPECIFICATION

ORGANIZATION

CITY AND STATE

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

   A. GIVE PARAGRAPH NUMBER AND WORDING.

   B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

   ☐ YES ☐ NO *(If "yes", in what way?)*

4. REMARKS *(Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)*

SUBMITTED BY *(Printed or typed name and activity - Optional)*

DATE

DD FORM 1 JAN 66 1426

REPLACES EDITION OF 1 OCT 64 WHICH MAY BE USED.

AFLC–WPAFB–OCT 67 2M

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