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AEROSPACE STANDARD

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SKID CONTROL EQUIPMENT

1. PURPOSE

To specify minimum requirements for aircraft skid control equipment for civil aircraft applications.

2. SCOPE

This standard covers minimum requirements for skid control equipment for use on all types and models of civil aircraft. It shall be the responsibility of the applicant to determine the compatibility of these requirements with the application aircraft and to specify requirements in excess of these minimums as necessary.

3. REQUIREMENTS

3.1 Definitions: For definitions of terms used in this specification, see Section 6.

3.2 Testing: This standard defines minimum requirements for skid control equipment for use with MLG brakes on all types commercial airplanes.

3.3 Design and Construction: Detail design and construction of the components and/or systems shall conform to the requirements herein except as modified by the contractor prepared Systems Procurement Specification (SPS). Prime consideration in system design should be consistent and reliable performance.

3.4 System Features: The following features are required for Systems in addition to the basic skid control functions depending upon the aircraft configuration and landing distance requirements. The SPS will define the type of system and the performance criteria required.

3.4.1 Touchdown Protection: Where there is the possibility of applying brake pressure before wheels are on ground, rotating, and ready for braking, the System shall provide continuous release of brake pressure. Strut compression with wheel rotation override intelligence is normally employed to determine the aircraft is on the ground and wheels are rotating and ready for braking. In selecting touchdown protection, the probability of introducing additional failure modes and failure points should be considered.

3.4.2 Locked Wheel Protection: When any wheel is rolling some large preset amount less the synchronous wheel speed of the aircraft, the system shall provide continuous release of brake pressure to that wheel. The system shall be configured to preclude brake releases resulting from normal turning maneuvers.

3.5 Failure Detection/Failure Mode: The failure detection circuit shall be of the "passive" type; that is, it will function to provide failure indication, visual or audio, without altering remaining skid control capability. The skid control system shall fail with "brake pressure as metered by the pilot," except for systems with four or more control valves, where the affected wheel may be isolated.

3.6 Cockpit Warning Light: A cockpit warning light(s), when required, shall be mounted preferably in a prominent location within the pilot's field of vision during the landing and braking phase of flight, to indicate that there has been a system malfunction.

3.7 Emergency Operation: The skid control system need function only on the normal braking system. The backup brake system, if used, would meet the minimum requirements as stated in the SPS. It should be possible to stop the airplane with the skid control system turned off.

3.8 Performance: The System shall perform to the level of efficiency defined in the SPS. The system shall, within the limits of the aircraft braking environment, stop the airplane safely in the required runway length and width, with an acceptable level of runway contamination. The System shall control brake pressure to maintain wheel rotation and to provide the required performance levels under all conditions except that of total tire hydro-planning. The System shall provide wheel control without lockup or unreasonable loss of brakes throughout the airplane velocity envelope from the maximum velocity, V(6.1.3) to zero velocity or the velocity specified in SPS. This control shall be available during all taxi, turning and parking maneuvers.

The System shall allow operation of the brakes to the requirements of SPS or AS 227 and TSO-C26 or the applicable brake specification to the limits of the aircraft braking environment. The system shall perform in the aircraft temperature, vibration, shock environment as specified by the airframe contractor in the SPS. The System shall not induce airframe dynamic instability, gear walk, chatter, etc., which shall be demonstrated on the aircraft throughout the airplane ground operating spectrum. The level of performance in terms of specific efficiency levels and/or stopping distances shall be specified by the SPS. Below the control speed range, braking pressure shall automatically revert to "brake pressure as metered by the pilot" unless it can be shown that there is no possible control action that will interfere with the pilot's ability to bring the aircraft to a complete stop at a predetermined point.

3.9 Interface Requirements: The skid control system shall be designed to meet the interface requirements as defined by SPS for the applicable aircraft.

As an alternate the following interface requirements will be considered.
(a) Brake torque characteristics.
(b) The brake metering system and its components (including line sizes, etc.)
(c) Hydraulic flow requirements.
(d) Aircraft dynamic characteristics including strut, brake, and tire dynamics.
(e) Total aircraft stopping performance requirements.
(f) Dimensional limits.
(g) Various tire physical characteristics.
(h) Aircraft electrical/electronic systems as required.
(i) Component and aircraft mounting environment.

3.10 Electrical-Electronic Requirements:

3.10.1 Electronic Components: All electronic assemblies shall be designed in accordance with SPS or ARINC 404. Special attention shall be given to the following: moisture-proofing of assemblies, including connectors; providing system component and tolerance compatibility throughout the extremes of the aircraft temperature environment and maintenance requirements; and tolerance to the electromagnetic interference environment.

3.10.2 Electric Power Requirements: When designed for electrical operation, the skid control system shall conform to all applicable requirements of SPS or MIL-STD-704, category B, and shall give specified performance from the power source configuration specified in the detail specification. During power interruption, as defined in MIL-STD-704, category B, normal steady state limits, the system shall not fail or revert to "brake pressure as metered by the pilot." Control system performance, after reapplication of power, is to be defined by the SPS. Sufficient redundancy and isolation shall be maintained to minimize total system and asymmetrical failures.

3.10.3 Wiring: External wiring shall be installed in accordance with MIL-W-5088 and shall be of the type specified in SPS or MIL-W-81381. Internal wiring shall be compatible with accepted industry standards and the configuration.

3.10.4 Relays: Relays used in the brake control system shall conform to the applicable requirements of SPS or MIL-R-6106 and MIL-R-5757.

3.10.5 Connectors: Component external connectors shall be in accordance with MIL-C-26500 (threaded type with lock wire if required by SPS) or MIL-C-83723 (Series 3).

3.11 Hydraulic-Pneumatic Components:

3.11.1 Hydraulic Equipment-General: Hydraulic components shall conform to the applicable requirements of MIL-H-5440, MIL-H-8775, MIL-H-8890, and MIL-H-8891.

3.11.2 Solenoid-Operated Control Valves: Solenoid-operated control valves shall conform to the applicable requirements of SPS or MIL-V-7915 or MIL-V-5529. Design of the solenoid shall conform to the applicable requirements of MIL-S-4040, with the exception that solenoids employing multiple windings will be permitted.

3.11.3 Pressure-Modulating Valves: Pressure-modulating valves shall be designed in accordance with the applicable requirements of SPS or MIL-V-27162 and ARP 490 and shall be suitable for the brake control system environment with special emphasis upon contamination tolerance, stability with life and temperature, tolerance to service handling and moisture sealing.

3.11.4 Pneumatic Equipment: Pneumatic components shall conform to the applicable requirements of SPS or MIL-P-5518 and MIL-P-8564.

3.11.5 Lubrication: Lubrication shall be in accordance with SPS or MIL-G-81322.

3.12 Electro-Mechanical:

3.12.1 Lubrication: Lubrication in accrodance with SPS or MIL-G-3278 will be permitted on the wheel-driven unit consistent with normal maintenance practices. The contractor and customer will review the procedure and grant approval of the lubricant practice prior to final acceptance.

3.13 Materials: Materials used in the manufacture of System components shall be of high quality, suitable for the purpose intended, and shall conform to applicable Government specifications as specified herein.

3.13.1 Finishes and Protective Treatments:

3.13.1.1 Aluminum alloy: Aluminum alloy external surfaces shall be anodized in accordance with MIL-A-8625.

3.13.1.2 Steel: Steel shall be of stainless composition or shall be plated in accordance with QQ-P-416, Type II, Class I, Alternate protective treatments may be used if approved by the procuring activity and dictated by performance requirements.

3.13.2 Dissimilar Metals: The use of dissimilar metals in contact, as defined in MIL-STD-889, shall be avoided. Where complete compliance proves impractical, electrolytic action shall be minimized by plating or some other suitable method of dissimilar surface isolation.

3.13.3 Corrosion Resistance: Corrosion prevention is of prime importance and material selection shall be made accordingly.

3.14 Selection of Specification and Standards: Specifications and standards for all materials, parts, and customer certification and approval of processes and equipment, which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with procedures established by the procuring activity, except as provided in SPS.

3.14.1 Standard Parts: Standard parts should be used wherever they are suitable for the purpose, and will be identified on the drawing by their part number. MS or AN utility parts, such as screws, bolts, nuts, cotter pins, etc. may be used, provided they conform to all requirements of this specification.

3.15 Maintenance: The design shall be such as to accommodate to the greatest extent, disassembly, reassembly, and service maintenance by means of those tools and items of maintenance equipment that are normally available as commercial standard. Design requiring specially designed items of maintenance tools and equipment shall be kept to a minimum and should be included in the original proposal.

3.15.1 Special Support Equipment: Special support equipment if required shall be designed to the requirements of the SPS and shall include flight line fault isolation capability of line replaceable items without breaking aircraft wiring connections.

3.16 Identification of Product: Equipment, assemblies, and parts shall be marked for identification in accordance with Standard MIL-STD-130 or per requirements of SPS.

3.17 Workmanship: Workmanship shall be of the quality necessary to produce Systems free from all defects that will affect proper functioning in service. Particular attention shall be given to thoroughness of assembly, alignment of parts, tightness of screws and bolts, marking of parts, protective finish and removal of burrs and sharp edges.

3.18 Strength: The structural strength of all the units of the brake control shall be such that, when installed, operation is not impaired, and no part of the device or its mounting shall give evidence of failure under the maximum imposed mechanical operating loads, accelerations, or wrench torque loads required for making connections.

3.19 Interchangeability: All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other with respect to installation and performance. Changes in the manufacturer's part numbers shall be governed by the drawing number requirements of MIL-STD-100 or as otherwise specified.

3.20 Safety: Safety requirements shall be established in accordance with MIL-STD-882.

3.21 Physical Characteristic:

3.21.1 Weight Limits: The production weight limits of the brake control system shall be specified by component in the SPS.

3.21.2 Dimensional Limitations: Critical dimensional limitations shall be specified in the SPS.

3.22 Environment: The environment tests to which the components are subjected shall be compatible with the aircraft installation environment as specified in SPS.

3.22.1 Operating Temperatures: The components shall satisfactorily withstand operation at temperatures from -54° to +71° C (-65° to +160°F) (220° - 345°K). Requirements for individual components which may be subjected to extreme temperatures shall be specified in the SPS. Such components or systems shall operate within performance limits which will provide the specific system performance.

3.22.2 Salt Fog: The skid control system shall operate satisfactorily when conditions are imposed which duplicate the environment of sea coast regions.

3.22.3 Humidity: The skid control system shall function satisfactorily in an environment of relative humidity up to 100 percent, including conditions in which condensation occurs in the form of water or frost.

3.22.4 Pressure: The skid control system shall operate satisfactorily when subjected to pressure variations associated with altitude ranging from 1300 ft (396 m) below sea level to the maximum landing altitude of the aircraft. The system shall operate satisfactorily following exposure to the maximum operational altitude of the aircraft.

3.22.5 Dust: The skid control system shall operate satisfactorily under conditions consisting of blowing sand and dust particles as encountered in desert areas.

3.22.6 Explosive Atmosphere: The skid control system equipment shall not cause ignition of an explosive atmosphere when operated in such an atmosphere.

3.22.7 Acceleration: The skid control system shall function properly when exposed to translational accelerations consistent with that encountered on the aircraft.

3.22.8 Acoustical Noise: The brake control system shall function properly when exposed to the acoustical environment encountered in the region on the aircraft where the hardware is mounted.

3.22.9 Vibration: The brake control system shall function properly when exposed to vibration in addition to acoustical noise which realistically will be encountered on the aircraft.

3.22.10 Shock: The brake control system shall withstand any shock loading expected in operation, handling, or transportation.

3.22.11 Fungus: The brake control system shall perform satisfactorily when exposed to fungus conditions as encountered in tropical climates.

3.23 Safety of Flight:

3.23.1 Performance and Compatibility Analysis: An analysis of brake control system performance under various antiskid, aircraft (including wing lift), runway surface conditions, and various pilot metering valve pressures shall be prepared. The recommended method for analysis is described under 4.3.1. Any other method must be approved by the procuring activity. The initial analysis shall be prepared prior to flight test of the first unit. A final analysis shall be prepared at the conclusion of the flight test evaluation of the system and shall be based on flight test information.

3.23.2 System Fault Analysis: An analysis shall be conducted to determine the effects of various system part failures and submitted prior to first flight. All modes of failure shall be considered. Failures which cannot be adequately investigated by analysis alone shall be simulated by appropriate laboratory tests to allow preparation of a complete analysis. It shall be verified that operational checkout procedures can be developed to detect all failures. Verification of the requirements of 3.4.1, 3.6 and 3.7 of this standard shall be included: whenever any or all of the features described in these paragraphs are required in the SPS.

2.23.3 Safety of Flight: Prior to release for first flight, the following minimum anount of preproduction testing shall be successfully completed on the skid control systems and shall represent the safety of flight:

(a) Test sample No. 1:
(1) Examination of product
(2) Dust
(3) High and low temperature
(4) One-half (50 percent) of endurance tests
(5) Vibration

(b) Test sample No. 2:
(1) Examination of product
(2) Immersion altitude cycling
(3) Internal leakage
(4) External leakage
(5) Pressure drop
(6) Proof pressure
(7) Humidity
(8) Mechanical shock
(9) Explosive atmosphere

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 performance of the inspection requirements specified herein, unless disapproved by the applicant. The contractor may perform any of the inspection set forth in the standard where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of Tests: The testing of systems shall be classified as follows:
(a) Laboratory development tests.
(b) Aircraft performance/compatibility tests.
(c) Preproduction tests.
(d) Quality assurance tests.

4.3 Laboratory Development Tests:

4.3.1 Computer Simulation: Computer simulation may be employed at the option of the Supplier or as required by the SPS: to develop, and optimize the system performance prior to aircraft installation, to determine component tolerance compatibility, or to determine effects of system changes. It is recommended that actual system components be used where possible and the program upgraded as more airplane parameters are known.

4.3.1.1 The system performance, as defined in individual SPS, should be verified for a range of tire-ground coefficient of friction representing icy, wet, and dry runway conditions.

4.3.1.2 The various indices of performance, such as stopping distance efficiency, pressure efficiency, drag efficiency, skid index, etc., should be used to assess the performance. These are defined in 6.2.7.

4.3.1.3 The computer simulations should enable programmed variation of tire-ground coefficient of friction in order to simulate the effects of ice patches, puddles, and paint stripes on the runway.

4.3.2 Dynamometer Testing: Dynamometer simulation may be employed at the option of the supplier or as required by the SPS to determine system - aircraft compatibility and system performance. The use of airplane hardware (hydraulic simulation, tire, wheel, brake, strut, etc.) will improve aircraft simulation. Brake pressure efficiency, drag efficiency and torque efficiency may be used for performance comparison.

4.3.3 Flight Test Performance: When required by the SPS, analysis of aircraft tests data shall be used to verify aircraft system performance to required levels (for methodology see ARP 862).

4.4 Aircraft Performance/Compatibility Tests: Aircraft testing is the most reliable means of evaluating system performance. The method of measuring performance efficiency and the level of system performance efficiency required will be specified in the SPS depending upon the aircraft requirements. The following methods are available for System evaluation and are included for information only.

4.4.1 Method I Evaluation: The following aircraft instrumentation is considered a minimum; wheel speed, brake actuation pressure at the brakes, pressure and signal to the control valve(s). Perform taxi and flight tests on the various runway surfaces normally expected to be encountered in service (e.g. snow, dirt, gravel and grass runways) wet, dry and combinations of wet and dry surfaces, to determine that: the wheels never fully lock-up, the aircraft stopping directional control performance is as required, and the aircraft has acceptable crosswind capability.

4.4.2 Method II Evaluation: In addition to the instrumentation specified in 4.4.1, install brake torque and/or strut drag instrumentation. In addition to the qualitative evaluation described in 4.4.1, determine drag and/or brake torque efficiency (6.2.7). To evaluate System performance, the brake pressure available to the brake must be sufficient to result in brake torque exceeding the friction force level available at the tire-runway interface. The System shall demonstrate that it is seeking the required level of friction coefficient available, especially for sudden gross changes in runway friction levels, compatible with the airplane stopping, directional control and crosswind requirements.

4.5 Preproduction Tests: The System Supplier shall conduct preproduction tests as specified on a System manufactured to production drawings and processes.

4.5.1 Preproduction Samples and Tests: A minimum of two test samples consisting of all the component tests as described under 4.6.1.2.
The samples shall be subjected to the following tests:

(a) Test sample No. 1:
 (1) Examination of product
 (2) Immersion altitude cycling
 (3) Dust
 (4) High and low temperature
 (5) Endurance
 (6) Vibration

(b) Test sample No. 2:
 (1) Examination of product
 (2) Immersion altitude cycling
 (3) Internal leakage (valve)
 (4) External leakage (valve)
 (5) Pressure drop (valve)
 (6) Proof pressure (valve)
 (7) Electromagnetic interference
 (8) Humidity
 (9) Mechanical shock
 (10) Temperature shock cycling
 (11) Explosive atmosphere
 (12) Acoustical noise
 (13) Fungus
 (14) Salt fog
 (15) Burst pressure

4.5.2 Preproduction Test Sample for Procuring Activity: When required in the contract, specified skid control system hardware shall be submitted to the customer for evaluation.

4.6 Quality Assurance Tests: Quality assurance tests shall consist of:
(a) Examination of product for dimensional and weight conformance to supplier drawings.
(b) Acceptance performance to approved performance levels defined in Supplier prepared test procedures and approved by the Contractor. Each system shall be subjected to a suitable test of vibration, time and temperature cycling as specified in the SPS.
(c) Sampling Tests - if required by the contract abbreviated preproduction tests as defined in the SPS shall be conducted to demonstrate quality conformance rejection and retest.

4.6.1 Test Methods:

4.6.1.1 Examination of Product: Each complete skid control system shall be examined to determine compliance with the requirements of this specification, detail specification and vendor drawings with respect to materials, workmanship, dimensions, weight, and markings.

4.6.1.2 Component Tests: Unless specifically noted, all component tests shall be performed on a skid control system installed in a simulated aircraft hydraulic and electrical network, including production aircraft electrical and hydraulic connections. The system shall operate satisfactorily under the conditions specified in the following component tests. The degree of aircraft simulation shall be specified in the SPS.

4.6.2 Environment Tests: The complete skid control system shall be operated and performance monitored during all phases of the environmental tests without disturbing the installed components or the environment. If the components are hermetically sealed, satisfactory completion of the immersion altitude cycling test will eliminate the requirement for performing the humidity, dust, salt fog, and explosive atmosphere tests.

4.6.2.1 High and Low Temperature: The skid control system shall be subjected to high and low temperature tests in accordance with MIL-STD-810, procedure I of methods 501 and 502, respectively, except for components that are subjected to higher temperatures as specified in the detail specification. The system shall be exercised as follows:

(a) High Temperature - Wheel-speed-driven units for inertia or hubcap-driven alternating or direct-current generators shall be accelerated from 0 to 0.5V to 0 at the maximum rate possible on the aircraft as specified in the detail specification. This shall be considered one cycle. For systems having no moving parts in the speed sensor, an appropriate signal simulation may be employed as approved by the procuring activity. The time between cycles shall be such as to allow completion of the performance of all functions in the system. Two and one-half percent of the total cycles specified in 4.6.2.13 shall be performed at high temperature.

(b) Low Temperature - The acceleration and deceleration rates and velocities shall be the same as for the high temperature test. Two and one-half percent of the total number of cycles specified in 4.6.2.13 shall be required.

4.6.2.2 Temperature Shock Cycling: The skid control system components shall be subjected to 25 cycles of temperature shock in accordance with method 503, procedure I of MIL-STD-810 between the temperature limits of -65° to + 160°F (220° - 345°K) and at a rate of 100°F per minute (or .93°K/sec) ambient temperature change or to the temperature environment specified in the detail specification. After the test, cool components to -65°F (220°K), remove from chamber, let components reach room ambient temperature, components shall perform satisfactorily.

4.6.2.3 Mechanical Shock: The skid control system components shall be subjected to a mechanical shock test in accordance with MIL-STD-810, method 516, procedures I and III.

4.6.2.4 Acoustical Noise: The skid control system components shall be subjected to an acoustical noise test in accordance with MIL-STD-810, method 515, with test category as applicable to the installation on the aircraft.

4.6.2.5 Vibration: Unless otherwise specified in the detail specification, the skid control system components shall be subjected to a vibration test in accordance with MIL-STD-810, method 514 and as specified herein. Mounting (mechanical, electrical, and hydraulic) shall simulate aircraft installation. Wheel-driven units shall include an axle-hubcap simulation. This test shall follow the successful completion of the safety of flight portion of the endurance test.

Note: An investigation shall be made to determine the magnitude of amplitudes, frequencies, and accelerations to which these units will be subjected and called for in SPS. In cases where these values are higher than those specified herein, the higher values shall be used and specified in the SPS.

4.6.2.6 Immersion Altitude Cycling: All gaskets, O-rings, or hermetically sealed components including appropriate aircraft wiring section, connectors, hydraulic fittings, and tubing sections located in unsheltered or unpressurized areas shall be subjected to immersion in a 20 percent by volume salt water solution evaluated to 70,000 ft (21280m) pressure for 10 minutes (600 seconds) and then increased to ambient pressure. This procedure shall be repeated 10 times. The components shall perform satisfactorily subsequent to the test and may be disassembled or weighed to prove no water has penetrated. The components shall be disassembled following completion of the component tests and checked for signs of moisture penetration and internal corrosion.

4.6.2.7 Humidity: All components, except those hermetically sealed, shall be subjected to a humidity test in accordance with method 507, procedure I or MIL-STD-810.

4.6.2.8 Fungus: All components shall be subjected to fungus test in accordance with method 508, procedure I of MIL-STD-810 unless documentation is provided which proves no fungus nutrients are used in the design.

4.6.2.9 Dust: All components not located in sheltered compartments shall be subjected to dust tests in accordance with method 510, procedure I of MIL-STD-810 and as specified herein. The airframe manufacturer will determine whether or not a component is in a sheltered compartment. For wheel-driven-units, inertia devices or alternating-or-direct-current generators shall be tested with the unit rotating at an equivalent wheel speed of 400 rpm or as specified in the detail specification. The unit shall be functionally checked after completion of the test.

4.6.2.10 Salt Fog: The components with aircraft connectors installed shall be subjected to a salt fog test in accordance with method 509, procedure of MIL-STD-810. The component performance shall be checked in the salt fog environment.

4.6.2.11 Explosive Atmosphere: All components with unsealed contacts shall be subjected to an explosive test in accordance with method 511, procedure I of MIL-STD-810.

4.6.2.12 Acceleration: All components fastened rigidly to the landing gear structure shall be subjected to translational accelerations of 50g in all principal directions while operating.

4.6.2.13 Endurance: The skid control system, installed in the simulated hydraulic and electrical network, shall be subjected to the following tests:

4.6.2.13.1 Transient Cycling: The skid control system components shall be subjected to 20,000 power-on transient cycles of electrical and hydraulic pressure impulse cycles at the rates specified in the detail specification.

4.6.13.2 Skid-Cycling: The skid control system shall be cycled to give a total equivalent to the maximum number of and character of cycles per landing experienced during testing of the system on the aircraft, multiplied by the maximum number of anticipated landings (if not specified, the number 8,000 shall be used). The number of cycles required under this and all subsequent endurance test paragraphs for components to be subjected to service temperatures in excess of 71°C (160°F) (345°K) may be reduced to reflect the adverse effects of the extreme temperature cycles which have been run previously. The cycles shall be run at room temperature to the oil temperature specified in the detail specification. For systems with wheel-speed detectors which do not have bearings, a suitable input system signal simulation, as approved by the airframe manufacturer, may be employed. (For systems having wheel-speed detectors with internal bearings, the detectors shall be subjected to the tests specified in SPS.)

4.6.2.14 Electromagnetic Interference (EMI): EMI tests in accordance with MIL-STD-461, as applicable, shall be performed on the skid control system installed in a simulated aircraft network.

4.6.2.15 Hydraulic Tests: The test fluids and level of filtration specified in MIL-H-8775 shall apply for the following tests:

4.6.2.15.1 Proof Pressure: The hydraulic components shall be subjected to proof pressure tests in accordance with MIL-H-8775.

4.6.2.15.2 Burst Pressure: The hydraulic components shall be subjected to burst pressure tests in accordance with MIL-H-8775.

4.6.2.15.3 External Leakage: The hydraulic components shall be subjected to external leakage tests in accordance with MIL-H-8775.

4.6.2.15.4 Internal Leakage: The hydraulic components shall be subjected to internal leakage tests in accordance with the paragraph entitled "Qualification or Production Tests" of MIL-H-8775.

4.6.2.15.5 Pressure Drop: A pressure drop evaluation shall be conducted on hydraulic components in accordance with MIL-H-8775.

4.6.2.16 Extreme Tolerance Analysis: The units used for preproduction component tests shall be physically measured and the electrical output determined. These measurements shall be compared with the proposed production tolerances. Based on performance of hydraulic leakage and electrical output exhibited during the component tests, the performance at the extreme shall be analytically determined. Performance at the extremes shall be within the limits identified in the detail specification.

5. PREPARATION FOR DELIVERY

5.1 Preservation, Packing, and Packaging: Components of the system shall be preserved, and packaged as specified in the detail specification.

5.2 Marking: All unit, intermediate, and shipping containers shall be marked in accordance with SPS. Marking of all containers shall include the date of manufacture.

6. DEFINITIONS

6.1 Definitions Unique to this Standard:

6.1.1 Individual Wheel Control: Individual wheel control refers to the feature where each braked wheel is controlled individually, as a function of its wheel speed. For this function each braked wheel requires its own wheel speed transducer, servovalve and control circuit.

6.1.2 Paired or Grouped Wheel Control: The skid control system may be configured to control brake pressure to two or more brakes when any one of the braked wheels require skid control. Pairing or grouping of wheels is a function of landing gear arrangement, performance required, and aircraft directional stability required and should be defined in the SPS.

6.1.3 Velocity(V): Velocity (V) denotes the maximum design system operating velocity and is the takeoff speed under maximum gross weight standard hot day, 8000 ft (2432m) altitude, or as defined by the SPS.

6.2 Definitions Common to the Antiskid Industry:

6.2.1 Skid Control System: The skid control system as used in this specification, refers to the components normally supplied by the skid control supplier, including but not limited to the following components: wheel-speed sensors, control valve(s), and control box.

6.2.2 Wheel Braking System: The wheel braking system refers to all elements associated with the antiskid control system, which coupled together provide deceleration of the aircraft due to wheel brakes. The elements include but are not limited to antiskid control components and associated hydraulic installation, wheel(s), tire(s), and brake(s).

6.2.3 Tire Rolling and Loaded Radius: The tire loaded radius is the instantaneous distance from the axle center to the tire-ground interface. This distance should be used in calculation of drag forces. In calculating the airplane synchronous velocity, however, use of rolling radius is recommended. This is often defined as:

$$R_r = R - \frac{\delta}{3}$$

The actual value may be higher due to tire growth at higher velocities.

where R = geometrical radius of tire

δ = tire deflection

R_r = rolling radius

6.2.4 Skid Control System Operating Environment: The skid control system operating environment is the environment which the skid control system feels in performing its function. The skid control operating environment includes the wheel braking system (see 6.4.2.), the airframe elastic structure (including struts), the wheel dynamic loading tire elastic properties, runway friction levels available, runway roughness, and ambient and hydraulic fluid temperature.

6.2.5 Aircraft Braking Environment: The aircraft braking environment is that environment the aircraft experiences during the landing and braking phase of operations including: runway length/width/surface texture/slope/crown/contamination level, wind conditions, temperature/pressure, touchdown velocity and alignment, and touchdown point proficiency.

6.2.6 Friction:

6.2.6.1 (μ) Coefficient of Friction: The tire-ground coefficient of friction in general terms is the ratio of drag force to the vertical force at the braked tire runway interface.

6.2.6.2 (μmax) Coefficient of Friction Maximum Instantaneous: μ max instantaneous tire-ground coefficient of friction for a given tire runway condition is the maximum measured while driving the braked wheel toward a lock-up. (μ slip)

6.2.7 Performance Index Definitions: The following definitions describe the various methods used to define system performance. Efficiency is measured over the full braking rollout. It should be noted that efficiencies determined by various methods are not necessarily directly comparable or stated in the order of importance.