DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

12 MAY 1971

WESTERN REGION
P.O. Box 92007, Worldway Postal Center
Los Angeles, California 90009

In Reply Refer To:
WE-120/8110 (CT3488WE-D)

The Boeing Company
Commercial Airplane Group
747 Division
P. O. Box 3707
Seattle, Washington 98124

Attention: R. J. Schroeru, M.S. OL-04
Manager, Certification Staff

Subject: Special Condition Applicable to Landing Gear System with Load Equalizer System Deleted - Model 747

Reference: Boeing letter 6-2010-E-4517 dated 31 March 1971

Gentlemen:

The referenced letter with the enclosed subject special condition has been reviewed. We concur that the revision to Airframe Special Condition A4 as proposed in your above referenced letter is a suitable certification basis for the landing gear with the load equalizer system deleted or inoperative.

Accordingly, the certification basis of the Model 747 airplane with the load evener system deleted or inoperative is identical to the certification basis of the Model 747-100/200B with the exception of the revised Airframe Special Condition A4 which is enclosed.

Sincerely,

for Rocco Lippis

ROBERT H. STANTON
Chief, Aircraft Engineering Division

Enclosure

ATTACHMENT TO FAA LETTER dated 12 May 1971 , revising the Boeing 747 Special Condition A-4 dated 15 February 1968.

AIRFRAME SPECIAL CONDITION FOR BOEING MODEL 747 SERIES AIRPLANES WITH THE LOAD EVENER SYSTEM DELETED OR INOPERABLE

4. FAR 21.21 (b)(2), FAR 25.471 through 25.511, FAR 25.573, FAR 25.721 through 25.727 - Landing Gear Criteria.

FAR 25.471 through 25.511, FAR 25.573, FAR 25.721 through 25.727 have been retained, modified or replaced by the following paragraphs:

(a) GENERAL

The general design criteria of FAR 25.471 is directly applicable. The basic landing gear dimensional data shall be expanded to include the additional main gear units.

(b) GROUND LOAD CONDITIONS AND ASSUMPTIONS

The criteria specified in FAR 25.473 is applicable for the design landing conditions except as noted in Paragraph (f).

(c) LANDING GEAR ARRANGEMENT

The multiple clec main gear configuration does not meet the "conventional arrangement" requirement of FAR 25.477, with respect to the application of Paragraph (d) through (g). The landing impact design conditions shall meet the structural intent of FAR 25.479 through 25.485.

(d) LEVEL LANDING CONDITIONS

The level landing criteria of FAR 25.479 shall be directly applicable. The four main gear units shall be assumed to contact the ground with the airplane longitudinal axis in a horizontal attitude.

(e) TAIL-DOWN LANDING CONDITIONS

The airplane shall be assumed to contact the ground in any tail down attitude between level and the maximum tail down attitude allowing clearance with the ground of each part of the airplane other than the main gear wheels. The airplane forward velocity component shall be the most critical value from V_{L_1} to 1.25 V_{L_2} where V_{L_1} and V_{L_2} are defined in FAR 25.481. Each main gear unit shall be designed for its most critical combination of vertical load and drag load. All other criteria in FAR 25.481, not superseded by the above criteria shall be directly applicable.

The distribution of loads between the gear units for the effects of critical combinations of spin-up and spring-back loadings on the main gear units must be considered for the gear units and their supporting structure.

(f) ONE-WHEEL LANDING CONDITION

Unless the airplane and landing gears are designed for equivalent or more critical conditions, the airplane will be assumed to land in a level pitch attitude at design landing weight with a descent velocity of 7 fps at the maximum roll angle attainable within the geometric limitations of the airplane with the contact velocities and gear loading conditions of FAR 25.479(a), (b) and (c).

NOTE: This condition need not be coupled with either a 6'/sec. landing at maximum take off weight or a 12'/sec. reserve energy drop test.

(g) SIDE LOAD CONDITIONS

On the main gear units, side loads of 0.8 of the vertical reaction (on one side) acting inward and 0.6 of the vertical reaction (on the other side) acting outward must be combined with one-half of the maximum vertical ground reactions obtained in the level landing, tail-down landing, or rolled attitude landing conditions. These loads shall be assumed applied at the ground contact point and to be resisted by the inertia of the airplane. Drag loads may be assumed to be zero.

(h) REBOUND LANDING CONDITION

The criteria of FAR 25.487 shall be directly applicable.

(i) GROUND HANDLING CONDITIONS

The criteria of FAR 25.489 shall be directly applicable. The effects of runway crown as defined in FAR 25.511, paragraph b-4 shall be considered in distributing the loads to the individual landing gear units.

(j) TAKE-OFF RUN

The criteria of FAR 25.491 shall be directly applicable.

The landing gear units and the landing gear support structure will be designed for a limit vertical load factor of 2.0 acting at the airplane center of gravity. The drag and side loads will be assumed zero.

(k) BRAKED ROLL CONDITIONS

The criteria of FAR 25.493 shall be directly applicable.

(l) TURNING

The criteria of FAR 25.495 shall be directly applicable.

(m) TAIL-WHEEL YAWING

Not applicable to this airplane.

(n) NOSE-WHEEL YAW

The criteria of FAR 25.499 shall be directly applicable. The terminology shall be interpreted to apply braking to all main gear wheels on one side of the airplane centerline.

(o) PIVOTING

The criteria of FAR 25.503 shall be applied individually to each wing main gear unit. In addition, all main gear units shall be designed for the scrubbing and/or torsion loads induced by pivoting about the most critical point consistent with the available main gear braking on one side of the airplane and the available thrust and torque on the airplane. Maximum static engine thrust must be considered only on the engines on the opposite side of the airplane centerline from the pivot point.

(p) REVERSED BRAKING

The criteria of FAR 25.507 shall be directly applicable.

(q) TOWING LOADS

The criteria of FAR 25.509 shall be directly applicable.

(r) GROUND LOAD: ASYMMETRICAL LOADS ON MULTIPLE-WHEEL UNITS

The criteria of FAR 25.511 shall be directly applicable.

(s) FATIGUE EVALUATION OF LANDING GEAR

The criteria of FAR 25.573 shall be directly applicable.

(t) SHOCK ABSORPTION TESTS

Existing nose gear, wing main gear and body main gear drop test data will be used to meet the requirements of FAR 25.721 through 25.727. This data will be modified by a rational analysis to show the effect of load equalizer system deletion. Distribution of effective weight on the wing or body main gear unit shall be made in a rational or conservative manner consistent with airplane attitude simulated.

NOTE: The wing landing gear need not be drop tested in the one-wheel landing condition coupled with the 6'/sec. maximum takeoff weight landing or the 12'/sec. reserve energy landing.

(u) Substantiation of the design criteria shall include a dynamic taxi and landing analysis.