CIVIL AERONAUTICS BOARD
WASHINGTON, D. C.

CIVIL AIR REGULATIONS

PART 15 - AIRCRAFT EQUIPMENT AIRWORTHINESS
As amended to April 15, 1944

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15.0 GENERAL

15.00 PROVISION FOR RATING. Pursuant to the provisions of the Civil Aeronautics Act of 1938, as amended, empowering and requiring the Civil Aeronautics Board to prescribe such minimum standards governing appliances, including instruments, equipment, apparatus, parts, appurtenances or accessories of whatever description, which are used, or are capable of being or intended to be used, in the navigation, operation, or control of aircraft in flight (including parachutes and communication equipment and any other mechanism installed in or attached to aircraft during flight), as may be required in the interest of safety, and to provide for the rating of aircraft and such appliances as to their airworthiness, the requirements hereinafter set forth shall be used as the minimum standards for establishing such rating of aircraft appliances for use in certificated aircraft.

15.01 SCOPE OF REGULATIONS.

15.010 These regulations shall apply to all important items of equipment which are manufactured as complete units and purchased by aircraft manufacturers and operators for use on certificated aircraft, except engines and propellers which are treated separately in Parts 13 and 14 respectively.

15.011 For the purpose of these regulations an item of equipment shall be considered important if, by malfunctioning, it can endanger the safety of the aircraft, or the cargo or passengers in the aircraft or persons or property beneath the aircraft.

15.012 Because the development of aircraft specialties is constantly increasing in scope and variety, there undoubtedly will be developed, from time.

to time, important items of equipment for which specific provision is not made in these regulations. In such cases the general procedure for certification will be in accordance with these regulations and the manufacturer of the item in question shall apply to the Administrator for special rulings particularly applicable to it.

15.013 The general requirements for the issuance of a type certificate are set forth in Part 02. The procedure relative to type certification is set forth in § 15.05.

15.014 The requirements for the issuance of a production certificate are set forth in Part 02.

15.02 CLASSIFICATION OF ITEMS OF EQUIPMENT.

15.020 In view of the diversity of items of equipment and the variety of their uses, such items are herein grouped in two major classifications dependent upon the certification procedure applicable to the particular item.

15.0200 The certification procedure to be followed is similar for all items and differs only in detail in accordance with the classification within which a particular item lies.

15.0201 The specific installations in certificated aircraft of certificated items of equipment, irrespective of the classification herein used, are subject in all cases to approval by the Administrator.

15.021 It is desirable to certify a series of similar models of an item of equipment under one certification in order to eliminate as much clerical and identification work as possible. This may be done for some types of wheels, position lights, and other items, a series of which are similar in construction and differ only in size and relatively unimportant structural details. This procedure may be applied to any item to which the manufacturer can show the procedure applicable.

15.022 Items of equipment are classified as follows:

(a) Items of such design that they may be installed and used in any type or model of certificated aircraft, and for which type and production certificates, as defined in Part 02, may be issued to manufacturers.

(b) Items of such design that they necessarily vary to suit one or more types or models of certificated aircraft in which they may be used. Type and production certificates will not be issued for such items. They will be specially approved as integral parts of the aircraft in which they are installed.

15.023 Under § 15.022 (a) are included items such as the following: landing gear wheels, seaplane floats, excluding wing-tip floats; skis, including pedestals; position lights, landing flares, safety belts, parachutes, certain types of special flight and engine control units, control wheels, certain types of tail wheel knuckles, certain types of self-locking bolts and nuts, and parts of that general character.

15.024 Under § 15.022 (b) are included items such as the following: automatic pilots, de-icing equipment, landing gear shock absorber units, autogiro rotor hubs, wing ribs, fuel and oil tanks, engine cowls, wheel streamlines, propeller hub spinners and other special cowling; wing-tip floats, structures attaching seaplane floats to aircraft, special structures attaching skis to aircraft, heating and ventilating systems.

15.03 FACTORS AFFECTING CERTIFICATION OR SPECIAL APPROVAL.

15.030 All items of equipment falling within the meaning of these regulations irrespective of their classification shall:

(a) satisfactorily fulfill the purpose for which they are intended,

(b) be free from undue hazard, both in themselves and in their method of operation.

(c) be constructed of suitable and dependable materials, and

(d) be manufactured and installed in accordance with the Civil Air Regulations so far as those regulations pertain to the particular item.

15.031 Certain of the above-mentioned factors may be demonstrated by drawings and analyses, others by drawings and tests, and others by visual inspection.

15.04 IDENTIFICATION DATA.

15.040 Each type or model of an item of equipment for which certification is requested shall be assigned a model name or model number by the manufacturer such that it may be distinguished from all other types or models of items of equipment.

15.041 Each unit of a certificated or specially approved type or model of equipment item shall be plainly and suitably marked to indicate that it has been certificated or specially approved. The applicable one of the following two methods shall be used to indicate this:

15.0410 (a) If a type certificate has been issued to the manufacturer for the particular item, each unit shall bear the number of this type certificate.

15.0411 (b) If a type certificate has not been issued to the manufacturer for the particular item, each unit shall bear the words "Administrator of Civil Aeronautics Approved" or an abbreviation thereof (A.C.A.A.).

15.042 Each unit of a certificated or specially approved type or model of equipment item shall bear the following identification data:

(a) manufacturer's name,

(b) model number or model name,

(c) the serial number or date of manufacture of the particular unit, except that parachutes shall bear at least the date of manufacture,

(d) Administrator of Civil Aeronautics Type Certificate (or A.C.A.T.C.) No. _____, or Administrator of Civil Aeronautics Approved (or A.C.A.A.),

(e) such additional information as is specifically provided for in the following regulations.

15.043 The data prescribed in § 15.042 shall be displayed in a conspicuous place on the unit and in such a manner that it may not be easily erased, disfigured, or obscured. Any other information may be added by the manufacturer at his discretion.

15.05 PROCEDURE RELATIVE TO CERTIFICATION OR SPECIAL APPROVAL.

15.050 A request for certification or approval of a type or model, or when possible, of a series of similar models of an item of equipment, shall be supported by the data hereinafter specified.

15.0500 A complete set of drawings descriptive of the item. Drawings of small standard commercial parts need not be submitted, but all other drawings applying to the item, including assembly drawings and, when necessary, installation drawings, shall be submitted. The drawings shall contain all dimensions and material specifications of the item. Material shall be specified by reference to a specification number of the Army, Navy, S.A.E., or other such recognized standard whenever possible. If reference is made to material specifications which are not recognized standards, complete details of such specifications shall be submitted. Revision blocks on drawings shall designate the revision by letter and shall state the nature of the revision, the date and, when serial numbers are used, the serial number of the first

unit manufactured in accordance with the revision. Title blocks on drawings shall contain the date of the original issue of the drawing and the drawing number. All drawings shall be folded to a size approximately 9 by 12 inches with the title block showing. In order to eliminate a possible source of controversy, the Administrator will not accept drawings which may be altered after approval. Blueprints, photostats, or their equivalent are satisfactory. These shall not contain pencil or ink notations. If certain of the drawings required for a particular model are identical with drawings previously submitted and approved in connection with a prior model made by the same manufacturer, such identical drawings need not again be submitted.

15.0501 A list, in duplicate, of all drawings applicable to the item. Such list shall include all drawings previously submitted and approved in connection with prior models made by the same manufacturer, which also apply to the model in question without change. The list shall be arranged in numerical order and shall designate each drawing by number, title, original date of issue, latest revision letter, and the model designation of the item for which the drawing was previously and originally submitted if for other than the model in question. Manufacturers' parts lists, if containing the information specified herein, are acceptable as drawing lists.

15.0502 Such additional data as are hereinafter prescribed for specific cases.

15.0503 The list specified in § 15.0501 need not be submitted if the item for which certification is requested is described by only one or two drawings. In such a case, however, the drawings specified in § 15.0500 shall be submitted in duplicate.

15.051 If the item falls within the classification covered by § 15.022 (a), the data submitted shall include a properly executed formal application for type certificate in accordance with Part 02.

15.052 If the item falls within the classification covered by § 15.022 (b), complete information as to the make and model or makes and models of aircraft in which the item is to be installed shall be furnished, together with an application for special approval on a form which will be supplied for the purpose by the Administrator. If specific aircraft are involved, the information to be furnished shall include also the serial numbers and aircraft certificate numbers of the aircraft in question.

15.053 Items of equipment which comply with the regulations herein prescribed to the satisfaction of the Administrator may be certificated or approved, as the case may be, for use in certificated aircraft.

15.054 If application for a type certificate has been made, certification is also contingent upon compliance with Part 02 to the satisfaction of the Administrator.

15.055 Certification is subject to the provisions and restrictions stated on the type certificate and on the specification for the item issued as part of the type certificate, and approval is subject to the provisions and restrictions stated on the specification issued for the aircraft in which the item is installed.

15.056 All manufactured units of a certificated or approved item of equipment shall be in exact accordance with the approved drawings and specifications.

15.057 Changes or modifications to a certificated or approved item of equipment shall be approved by the Administrator in advance.

15.056 A request for approval of a change or modification to a certificated or approved item of equipment shall be supported by revised or new drawings showing the changes; revised drawing list pages, in duplicate, showing the revised or new drawings; and technical data, including reports of any necessary tests, sufficient to demonstrate to the satisfaction of the Administrator that the changed or modified item is airworthy.

15.06 PREVIOUSLY APPROVED ITEMS OF EQUIPMENT. These regulations supersede the requirements for approval of items of equipment set forth in previous regulations. However, items of equipment rated as suitable for use in approved aircraft in accordance with previous requirements may be used in certificated aircraft at the discretion of the administrator.

15.1 LANDING GEAR EQUIPMENT.

15.10 LANDING GEAR WHEELS.

15.100 Main landing gear wheels will be certificated for a maximum static load which will be determined from the strength of the wheel. Tail wheels will not be certificated.

15.1000 For the purpose of these regulations main landing gear wheels are considered as those nearest the airplane center of gravity with respect to fore-and-aft location.

15.1001 For the purpose of these regulations a tail wheel is considered as one which supports the tail of a conventional airplane in the three-point landing attitude.

15.101 For wheels other than main landing or tail wheels, application shall be made to the Administrator for special rulings particularly applicable to the cases in question.

15.102 The strength of a main landing gear wheel shall be substantiated by the following two static tests:

(a) radical load test. (See §15.1020)
(b) side load test. (See §15.1021)

15.1020 The required radial test load is equal to -

$$(P)x(n)x(1.5)x(1.15)$$

where P is the maximum static load for which approval is requested, n is

$$2.80 + \frac{9000}{2P+4000}$$

and is the applied landing load factor for the corresponding airplane, 1.5 is the factor of safety, and 1.15 is a strength test material factor.

15.1021 The required side test load is equal to -

(0.35) (the radial test load).

15.1022 The radial and side loads shall be applied separately and the wheel shall be equipped with the correct size tire inflated to the proper pressure for the load for which certification is requested.

15.1023 The radial load shall be applied to the wheel in the place of the tire and may be distributed over a portion of the tire by allowing the tire to bear in a box of firm earth or sand.

15.1024 The side load shall be applied to the rim of the wheel at its maximum radius and may be distributed over an arc of not more than 30°. In order to insure sufficient strength in the retaining flanges of the rim, all the side load shall be applied to the inner flange in a direction such as to bend it away from the tire. In such case, the load must be increased so that its side component is equal to the load specified in § 15.1021. The wheel shall be restrained only by the axle.

15.103 A main landing gear wheel shall support the required loads before failure.

15.104 BRAKES.

15.1040 TESTING OF BRAKES FOR CERTIFICATION.

(a) A wheel-brake combination shall demonstrate satisfactory performance during 100 tests simulating the stopping of an airplane at an average deceleration of at least 10 feet per second, from a speed chosen by the applicant. The kinetic energy absorbed per stop shall be computed and the wheel-brake combination shall be certificated for a kinetic energy absorption not in excess of the amount so determined.

(b) To be eligible for use on airplanes certificated in accordance with the transport category requirements of Part 04, a wheel-brake combination shall further demonstrate satisfactory performance during three tests identical with those specified in paragraph (a) except that the speed shall be increased to obtain a kinetic energy absorption 125% of that determined under that paragraph.

15.1041-T ADAPTATION OF BRAKES TO AIRPLANES - Transport category.

(a) An airplane certificated in accordance with the transport category requirements of Part 04 shall make use of wheel-brake combinations for which the summation of the kinetic energy ratings of the brakes used in the main landing gear is at least equal to:

$K.E. = .0334\ W\ V_s^2$ where: K.E. = kinetic energy in foot-pounds.
W = the maximum landing weight of the airplane.
V_s = the power-off stalling speed of the airplane in miles per hour at sea level in standard air at maximum landing weight.

(b) The wheel-brake combinations used in such airplane shall have been tested, in determining the kinetic energy absorption under § 15.1040, from a speed lying between 80% and 100% of V_s.

15.1042 DESIGN. Brakes shall be free from any undue tendency to lock or jam, and shall be suitably shielded from water, mud, and oil.

15.1043 STATIC TORQUE. The maximum available static torque in reverse shall be at least 40% of the forward static torque when both are measured at the same applied pedal force.

15.1044 ADJUSTMENT. When necessary to insure satisfactory performance, the brake mechanism shall be equipped with suitable adjustment devices to compensate for disc or lining wear, heat, and other normal service effects.

15.1045 STRENGTH. The brake and all of its attachments to the wheel shall be designed with an ultimate strength sufficient to withstand a torque which is $1.6WR/B$. Where R is the rolling radius of the tire and B is the number of brakes, A static test of the brake and wheel shall demonstrate that

the assembly is capable of withstanding a torque which is 80% of the above without yielding to the point of impairing service operation.

15.1046 TEST LOG. A log of the test runs shall be submitted together with other calculations which are necessary to indicate compliance with the above brake regulations.

15.1047 IDENTIFICATION DATA. Each certificated brake shall bear the following identification as prescribed in §15.042 (e): The foot-pounds of kinetic energy for which it is approved.

15.105 The rim contour of a main landing gear wheel shall conform to the Tire and Rim Association's standards or recommendations unless the wheel is to be used in conjunction with a specially constructed tire.

15.106 A landing gear wheel may be equipped with any make or type of tire: Provided, that the tire is a proper fit on the rim of the wheel: And provided, that the tire rating of the Airplane Tire Committee of the Tire and Rim Association is not exceeded.

15.107 Each unit of a certificated model of main landing gear wheel shall bear the following additional identification data as prescribed in § 15.042 (e): The maximum static load for which certificated.

15.108 A request for certification of a type or model or series of models of main landing gear wheels shall be supported by the following additional data as prescribed in § 15.0502:

15.1080 A report of the static tests prescribed in §15.102. The report shall contain complete details of the tests, including records of wheel deflections and photographs of the test setups. The report shall be signed by the person making the tests, and shall be certified to unless the tests were witnessed by an inspector of the Administrator, in which case such inspector also will sign the report as a witness.

15.11 SEAPLANE FLOATS.

15.110 Main seaplane floats will be certificated for a maximum gross weight of airplane which will be determined in accordance with the applicable requirements prescribed in Part 04.

15.1100 Certification of a float does not include certification of the structure attaching it to the aircraft. Such structure is classified in accordance with § 15.022 (b).

15.1101 The installation of floats on aircraft shall be in accordance with the provisions of Part 04.

15.111 Each unit of a certificated model of main seaplane float shall bear the following additional identification data as prescribed in §15.042(e):

(a) the maximum gross weight of aircraft for which certificated,

(b) the number of floats per aircraft.

15.112 A request for certification of a type or model or series of models of main seaplane floats shall be supported by the following additional data as prescribed in § 15.0502:

15.1120 The technical data required to prove compliance with the applicable structural and detail design requirements prescribed in Part 04.

15.12 SKIS.

15.120 Skis, including ski pedestals, will be certificated for a maximum static load which will be determined from the strength of the ski.

15.1200 Certification of a ski and its pedestal does not include certification of any special structure attaching it to the aircraft. Such structure is classified in accordance with § 15.022 (b).

15.1201 The installation of skis on aircraft shall be in accordance with the provisions of Part 04.

15.121 The strength of a ski, including the pedestal, shall be substantiated by a stress analysis or by static tests.

15.122 A ski, including the pedestal, shall be designed to carry the following loads without failure when supported at the pedestal bearing sleeve:

15.1220 A load upward, distributed uniformly along the ski bottom and symmetrically with respect to the pedestal bearing sleeve in the fore-and-aft direction, the front end of the ski carrying no load if it is at a greater distance from the bearing sleeve than the rear end. The required load is equal to-

$$(P)x(n)X(1.5)$$

where P is the maximum static load for which approval is requested, n is

$$2.80 \sqrt{\frac{9000}{2P+4000}}$$

and is the applied landing load factor for the corresponding airplane, and 1.5 is the factor of safety.

If the strength is substantiated by static test, the required test load is equal to -

$$(P)x(n)X(1.5)X(1.15)$$

where 1.15 is a strength test material factor.

15.1221 A load upward, applied to the ski bottom at a point directly under the pedestal bearing sleeve. The required load, or required test load, is equal to the load, or test load, specified in § 15.1220.

15.1222 A side load distributed uniformly along the edge of the ski bottom and symmetrically with respect to the pedestal bearing sleeve in the fore-and-aft direction, the front end of the ski carrying no load if it is at a greater distance from the bearing sleeve than the rear end. The required load, or required test load, is equal to 35% of the load, or test load, specified in § 15.1220. When the height of the aircraft axle from the ground with the ski installed is greater than the moment arm given in Figure 15-1 for the static load for which approval is requested, such side load may be reduced by the ratio of the moment arm given in Figure 15-1 to the height of the axle from the ground with the ski installed. (See page 17 for Figure 15-1)

15.1223 A side load applied to the edge of the ski bottom at a distance forward of the axle equal to three times the pedestal height, except that if the pedestal height is less than the moment arm given in Figure 15-1 for the static load for which approval is requested, then the distance shall be three times the moment arm given in Figure 15-1. This side load shall be one-third the side load specified in § 15.1222. (See page 17 for Figure 15-1)

15.123 Each unit of a certificated model ski shall bear the following additional identification data as prescribed in § 15.042 (c):

15.1230 The maximum static load for which certificated.

15.124 A request for certification of a type or model or series of models of skis shall be supported by the following additional data as prescribed in § 15.0502:

15.1240 (a) A stress analysis of the ski and pedestal showing compliance with § 15.122, if the strength of the ski and pedestal has been substantiated by a stress analysis. Such analysis shall be signed by the responsible engineer.

15.1241 (b) A report of the static tests showing compliance with §§ 15.122 if the strength of the ski and pedestal has been substantiated by static tests. The report shall contain complete load computations, complete details of the tests, and photographs of the test setups. The report shall be signed by the person making the tests and shall be certified to unless the tests were witnessed by an inspector of the Administrator, in which case such inspector also will sign the report as a witness.

15.2 NAVIGATION APPLIANCES.

15.20 POSITION LIGHTS.

15.200 GENERAL PROVISIONS. Position lights prescribed in Part 04 of the Civil Air Regulations in order to be certificated, shall be so constructed and capable of being so mounted as to comply with the regulations hereinafter prescribed.

15.2000 A request for certification and such supporting data as may be prescribed herein shall be accompanied by a complete set of lights described in the data. Such data shall include a copy of the instruction for the mounting of the lights in aircraft as furnished by the light manufacturer to purchasers.

15.2001 As the forward (right and left) lights are complementary they will be certificated as a unit. The rear (tail) light will be certificated as a separate unit.

15.2002 Forward lights are classified as follows:

(a) standard forward position lights,
(b) air carrier forward position lights,
(c) auxiliary position lights.

15.201 LIGHT DISTRIBUTION REQUIREMENTS. (See CAM 15 for diagrams.)

15.2010 DEFINITIONS. Three dihedral angles hereinafter referred to as dihedral angle L, dihedral angle R, and dihedral angle A, are defined as follows: dihedral angle L is formed by the intersection of two vertical planes, one passing through the forward axis of the light unit, as defined in the mounting instructions, and the other at an angle of 110 degrees to the first, measured to the left when looking away from the unit; dihedral angle R is formed by the intersection of two vertical planes, one passing through the forward axis of the light unit, as defined in the mounting instructions, and the other at an angle of 110 degrees to the first, measured to the right when looking away from the unit; and dihedral angle A (aft) is formed by the intersection of two vertical planes making dihedral angles of 70 degrees to the left and 70 degrees to the right, respectively, of a vertical plane passing through the rear axis of the light unit, as defined in the mounting instructions. Each dihedral angle shall be understood to include the bounding planes as well as the space between the planes.

15.2011 STANDARD FORWARD POSITION LIGHTS. Each standard forward position light shall have an intensity of not less than 3 candles in all directions in dihedral angle L for the left light and dihedral angle R for the right light. Within these dihedral angles, respectively, the intensity in all directions shall equal or exceed the minimum values given in Table I according to the angle between the direction of measurement and the forward axis of the unit.

Table I

Minimum permissible intensities in any plane through the forward axis of the unit

At angles from forward axis not exceeding	Intensity
60 degrees	4 candles
30 degrees	8 candles

In all directions in dihedral angle R for the left light and in dihedral angle L for the right light, a tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to not over 2 candles. In these same directions a further tolerance of an additional 10 degrees will be allowed in which the intensity shall be reduced to not more than 0.5 candle. In all directions in dihedral angle A a tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to a maximum intensity of 0.5 candle. In all directions outside the specified dihedral angle and the allowed tolerance angles for each unit, the stray light intensity shall not exceed 0.5 candle.

15.2012 AIR CARRIER FORWARD POSITION LIGHTS. Each air carrier forward position light shall have an intensity of not less than 3 candles in all directions in dihedral angle L for the left light and in dihedral angle R for the right light. Within these dihedral angles, respectively, the intensity in all directions shall equal or exceed the minimum values given in Table II according to the angle between the direction of measurement and the forward axis of the unit.

Table II

Minimum permissible intensities in any plane through the forward axis of the unit

At angles from forward axis not exceeding	Intensity
60 degrees	5 candles
30 degrees	10 candles
20 degrees	20 candles
15 degrees	30 candles
10 degrees	35 candles
5 degrees	40 candles

Within the same dihedral angles the intensities in the horizontal plane shall equal or exceed the minimum values given in Table III according to the angle between the direction of measurement and the forward axis of the unit.

Table III

Minimum permissible intensities in the horizontal plane through the forward axis of the unit

At angles from forward axis not exceeding	Intensity
60 degrees	5 candles
40 degrees	10 candles
30 degrees	20 candles
20 degrees	30 candles
10 degrees	40 candles

In all directions in dihedral angle R for the left light and in dihedral angle L for the right light, a tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to not over 10 candles. In these same directions a further tolerance of an additional 10 degrees will be allowed in which the intensity shall be reduced to not more than 1 candle. In all directions in dihedral angle A a tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to not more than 1 candle. In all directions outside the specified dihedral angle and the allowed tolerance angles for each unit, the stray light intensity shall not exceed 1 candle.

15.2013 AUXILIARY FORWARD POSITION LIGHTS. Each auxiliary forward position light shall have an intensity of not less than 20 candles in all directions not exceeding 30 degrees of the forward axis of the unit, measured in dihedral angle L for the left unit and in dihedral angle R for the right unit. Within the afore-described angles the intensity in all directions shall equal or exceed the minimum values given in Table IV according to the angle between the direction of the measurement and the forward axis of the unit.

Table IV
Minimum permissible intensities in any plane through the forward axis of the unit

At angles from forward axis not exceeding	Intensity
20 degrees	30 candles
10 degrees	40 candles

In all directions in dihedral angle R for the left light and in dihedral angle L for the right light, a tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to not over 8 candles. In these same directions a further tolerance of an additional 10 degrees will be allowed in which the intensity shall be reduced to not more than 0.5 candle. In all directions in dihedral angle A the maximum intensity shall be less than 0.5 candle. In all directions outside the specified dihedral angle and the allowed tolerance angles for each unit, the stray light intensity shall not exceed 0.5 candle.

15.2014 NON-AIR CARRIER AIRPLANE REAR POSITION LIGHTS. Each rear position light shall have an intensity of not less than 4 candles in dihedral angle A. Within this dihedral angle the intensity in all directions not exceeding 70 degrees from the rear axis of the unit, shall be not less than 8 candles. In all directions in dihedral angle L and in dihedral angle R, a tolerance of 20 degrees will be allowed in which the intensity of this light must be reduced to a maximum stray light intensity of 1 candle. In all directions outside the specified dihedral angle and the allowed tolerance angles, the stray light intensity shall not exceed 1 candle.

15.2015 AIR CARRIER AIRPLANE REAR POSITION LIGHTS. Air carrier airplane rear position lights shall emit an alternate aviation red and aviation white flash repeated at a frequency of 40 cycles a minute; each cycle shall have the following characteristics: 150 degrees white - 10 degrees dark - 150 degrees red - 50 degrees dark. A tolerance of plus or minus 10% will be allowed in the above figures. Both white and red lights shall be fitted with 32 candle-power lamps. The red and white units of the light may be separate units spaced as closely as possible. Each color of light shall be completely visible in di-

hedral angle A. If separate red and white units are used, certificated white tail lights may be converted into such units as follows: (a) the candlepower of the lamps shall conform to the requirements of this section, (b) the clear cover glass for the intended red unit shall be replaced by a red cover glass of the same design. No photometric tests of such converted lights will be considered necessary when the above changes are made. If the light is of a new type, it shall emit light in all directions in dihedral angle A as specified in § 15.204.

15.202 COLOR. All left forward position lights shall be aviation red, all right forward position lights shall be aviation green, and all rear position lights for non-air carrier aircraft shall be aviation white. These colors are defined as follows:

(a) Aviation red is a color having the following ICI chromaticity coordinates:

y is not greater than 0.335 and
z is not greater than 0.002;

(b) Aviation green is a color having the following ICI chromaticity coordinates:

x is not greater than 0.440 - 0.320y
x is not greater than y - 0.170 and
y is not less than 0.390 - 0.170x;

(c) Aviation white is a color having the following ICI chromaticity coordinates:

x is not less than 0.350
x is not greater than 0.540
$y - y_c$ is not numerically greater than 0.01
y_c being the y coordinate of the Planckian radiator for which $x_c = x$.

15.203 LIGHT COVERS. The lamp and reflectors shall be protected by a cover which shall be of noncombustible material and so constructed that it will not change color or shape, or cloud, or suffer any considerable loss of transmission in normal use. The coloring of those portions which are intended to transmit light shall be completely diffused through the material.

15.21 LANDING FLARES.

15.210 Landing flares prescribed in Part 04, in order to be certificated, shall be so constructed and capable of being so mounted as to comply with the regulations hereinafter prescribed.

15.2100 The installation of landing flares in aircraft shall be in accordance with the provisions of Part 04 and the flare manufacturer's mounting instructions.

15.211 Landing flares will be certificated with respect to their light duration and light intensity. They are grouped in three classifications as follows:

(a) class 1 flares,
(b) class 2 flares,
(c) class 3 flares.

15.212 Class 1 flares shall have a light duration of at least 3 minutes, a light intensity of at least 200,000 candlepower, and a rate of descent not greater than 550 feet per minute.

15.213 Class 2 flares shall have a light duration of at least 1 1/2 minutes, a light intensity of at least 110,000 candlepower, and a rate of descent not greater than 550 feet per minute.

15.214 Class 3 flares shall have a light duration of at least 1 minute, a light intensity of at least 70,000 candlepower and a rate of descent not greater than 550 feet per minute.

15.215 Each unit of a certificated model landing flare shall bear the following additional identification data as prescribed in § 15.042 (c):

15.2150 The class for which certificated.

15.217 Upon satisfactory completion of the examination of the technical data submitted to the Administrator, five flares of each model described in the data, an airplane arranged for the complete installation of flares of each model, and operating personnel shall be made available for functional tests of the flares. These tests may be made at any location desired by the manufacturer.

15.2170 In the event that there is one failure out of the 5 flares subjected to functional tests, 5 additional flares shall be subjected to functional tests.

15.2171 Failure of two or more flares out of 10 dropped shall be sufficient grounds for denial of certification by the Administrator. Certification will be made only if all 5 original flares function satisfactorily or, in the event of one failure in the original 5, if the second 5 function satisfactorily.

15.3 SAFETY EQUIPMENT.

15.30 SAFETY BELTS.

15.300 Safety belts will be certificated for general aircraft use or for glider use dependent upon the strength of the belt.

15.3000 Certification of a safety belt does not include certification of its anchorages to the aircraft.

15.3001 The installation of safety belts in certificated aircraft shall be in accordance with the pertinent provisions of Part 04.

15.301 Safety belts shall be so designed as to be easily adjustable. Each belt shall be equipped with a quick-release mechanism so designed that it cannot be released inadvertently. The width of a certificated safety belt shall be at least 2 inches.

15.302 The strength of a safety belt shall be determined by static test.

15.303 Safety belts for general aircraft use will be certificated for one person or two adjacent persons dependent upon the strength of the belt.

15.3030 A safety belt for one person shall be capable of withstanding a load of 1,000 pounds applied in the same manner as a person's weight would be applied in a crash. The quick-release mechanism shall be capable of withstanding this load without undue distortion, so that when the load is relieved to 400 pounds, the mechanism shall be capable of being operated by hand.

15.3031 A safety belt for two persons shall be capable of withstanding a load of 2,000 pounds applied in the same manner as the weight of two persons would be applied in a crash. The quick-release mechanism shall be capable of withstanding this load without undue distortion, and when the load is relieved to 800 pounds, the mechanism shall be capable of being operated by hand.

15.304 Safety belts for glider use only will be certificated as such.

15.3040 A safety belt for glider use shall be capable of withstanding a load of 850 pounds applied in the same manner as a person's weight would be applied in a crash. The quick-release mechanism shall be capable of withstanding this load without undue distortion, and when the load is relieved to 400 pounds, the mechanism shall be capable of being operated by hand.

15.305 Each unit of a certificated model safety belt shall bear the following additional identification data as prescribed in § 15.042 (c):

15.3050 Whether for one person, two persons, or for glider use only

15.306 A request for certification of a type or model or series of models of safety belts shall be supported by the following additional data as prescribed in § 15.0502:

A report of the static tests showing compliance with §§15.3030, 15.3031, or 15.4030, as the case may be. The report shall contain complete details of the tests, including the hand operation of the quick-release mechanism under relieved load, and shall contain photographs of the test setup. The report shall be signed by the person making the tests and shall be certified to unless the tests were witnessed by an inspector of the Administrator in which case such inspector also will sign the report as a witness.

15.31 PARACHUTES.

15.310 Parachutes prescribed by the Civil Air Regulations, in order to be certificated, shall be so constructed as to comply with the following regulations

15.3100 All materials used shall be equivalent to or better than those specified by the United States Army or Navy for parachutes, or shall be proved satisfactory to the Administrator by technical data and practical tests.

15.3101 The follow-through between parachute and rider shall be so engineered that all parts or fittings carrying a shock load are stronger than the combined strength of the suspension lines to which they are attached.

15.3102 All metal parts shall be designed to carry their full rated load without yielding.

15.3103 The fabric used in the canopy construction shall be free from gums, starches, and other foreign material. It shall also be free from avoidable imperfections in manufacture and from defects or blemishes affecting its strength or durability and shall have been finished without application of excessive heat. The surface of the fabric shall be smooth.

15.3104 Suspension lines shall be continuous, without splices, from connector link to connector link and shall contain no knots between these points.

15.3105 Before securing the suspension lines to the skirt, each line shall be put under 40 pounds tension and marked to show the point of attachment. The fabric shall be pulled out but not stretched.

15.3106 The machine sewing shall be made with a shuttle or plain stitch. All zigzag sewing shall be done on a 2-stitch sewing machine.

15.3107 The rip cord, including joints between the handle and the release, shall be designed to withstand a load of 300 pounds.

15.3108 The harness shall be so constructed that the rider can release himself and drop clear in case of a water landing, but a quick-attachable or quick-releasing device between the harness and the parachute is not mandatory.

15.3109 Each parachute outfit shall be provided with a suitable place for keeping a record card containing spaces for recording dates of repacking, reparrs, by whom made, and space for the manufacturer's recommendations as to repacking.

15.311 Deviations from §§ 15.3104, 15.3105, and 15.3106 shall be such as are acceptable to the United States Army or Navy, or shall be proved satisfactory to the Administrator by technical data and practical tests.

15.312 A request for certification of a type or model or series of models of parachutes shall be supported by the following additional data as prescribed in § 15.0502:

15.3120 (a) Data showing compliance with §§ 15.3100 to 15.3109 inclusive, These data may be references to drawings submitted if the drawings clearly show compliance with these regulations.

15.3121 (b) Data substantiating any deviations in accordance with §§ 15.311.

15.3122 (c) A detailed list of the material and strength specifications of all component parts of the parachutes described in the drawings. The list shall also specify the manufacturing practices employed in the assembly operations and shall satisfy the Administrator that all parts are properly pull-tested before assembly.

15.313 Upon satisfactory completion of the examination of the technical data submitted to the Administrator of Civil Aeronautics, parachutes of each model described in the data together with an airplane and operating personnel shall be made available for the following tests of the parachutes. These tests may be made at any location desired by the manufacturer.

15.3130 FUNCTIONAL TEST (NORMAL PACK). 12 drops from an airplane with a 170-pound dummy man from an altitude of not more than 500 feet. The indicated air speed of the airplane at the time of release shall be 70 miles per hour. No twists shall purposely be packed in the suspension lines. The parachute must be fully open within 3 seconds from time of release.

15.3131 FUNCTIONAL TEST (TWISTED LINES). 5 drops from an airplane with a 170-pound dummy man from an altitude of not more than 500 feet. The indicated air speed of the airplane at the time of release shall be 70 miles per hour. 3 twists shall purposely be packed in the suspension lines near the skirt. The parachute must be fully open within 4 seconds from time of release.

15.3132 STRENGTH TEST. 3 drops with the same parachute from an airplane with a 600-pound lead weight from an altitude of not more than 500 feet. The indicated air speed of the airplane at the time of release shall be 100 miles per hour. No twists shall purposely be packed in the suspension lines. The weight shall be attached to the harness. No external shock absorbers or material which may act as such shall be permitted. The parachute shall show no failure of any material.

15.3133 LIVE DROP TESTS. 2 live drops from an airplane with a 170-pound man from an altitude of 2,000 feet on a comparatively still day. An additional certificated auxiliary parachute shall be carried. The rider must suffer no discomfort from opening shock and must be able to disengage himself from the harness after landing.

15.3134 RATE OF DESCENT TEST. One drop from an airplane with a 170-pound dummy man from an altitude of 2,500 feet. The rate of descent shall not exceed 21 feet per second. The descent shall be timed from the time of full opening to the time of ground impact. The distance descended shall be assumed at 2,250 feet and the rate of descent shall be this distance divided by the time in seconds.

15.3135 100 percent performance shall be required in the tests specified in §§ 15.3130 through 15.3134 except in the case of an auxiliary parachute. (See § 15.315)

15.314 The tests specified in § 15.313 will not be required for parachutes previously approved by the United States Army Air Corps or by the Bureau of Aeronautics, Navy Department. In lieu of these tests, there shall be included in the supporting data submitted with a request for certification of such a parachute the following data:

15.3140 (a) A copy of the official report describing the drop tests and static tests which formed the basis of the Army or Navy approval, signed by the Army or Navy representatives who witnessed the tests.

15.3141 (b) A statement by an authorized representative of the Army or

Navy to the effect that the parachute is approved and accepted by the Army or Navy as the case may be.

15.315 A parachute to be certificated for use as an auxiliary parachute in combination with a certificated parachute need not comply with the rate of descent specified in § 15.3134 but shall have a rate of descent not exceeding 25 feet per second and shall comply with all of the other regulations herein prescribed.

15.3150 The technical data submitted in connection with an auxiliary parachute and the tests made to obtain its certification shall satisfactorily account for the combination of parachutes and not the auxiliary parachute alone.

15.3151 Each unit of a certificated model auxiliary parachute shall bear the following additional identification data as prescribed in §15.042 (e): "Auxiliary only."

15.4 CONTROL AND STRUCTURAL UNITS.

15.40 GENERAL.

15.400 Certain types of special units and structural units, such as those listed in § 15.023, so designed that they can be used in any type or model of aircraft without change or with only minor changes which in no way affect the operation or strength of the units, will be certificated provided that they comply with the regulations applicable to them prescribed in Part 04.

15.4000 The installation of such special units in aircraft shall be in accordance with the pertinent provisions of Part 04 and the instructions of the manufacturers of the units.

15.401 Before requesting certification of a type or model or series of models of a special control unit or structural unit, the manufacturer shall apply to the Administrator for a ruling as to the additional data to be submitted in accordance with §15.0502 to show compliance with the regulations applicable to the unit in question prescribed in Part 04. This application shall be accompanied by a description of the unit and a drawing, or drawings, sufficient to enable the Administrator to make a ruling particularly applicable to the unit in question.

15.8 EQUIPMENT ITEMS ADAPTED TO SPECIFIC AIRCRAFT MODELS.

15.80 EQUIPMENT ITEMS ADAPTED TO ONLY ONE AIRCRAFT MODEL.

15.800 Certain items of equipment, such as those listed in §15.024, so designed that they can be used only in one aircraft model will be specially approved as integral parts of the aircraft in which they are installed provided that they comply with the regulations applicable to them prescribed in Part 04.

15.801 A request for approval of such an item of equipment shall be supported by the following additional data as prescribed in § 15.0502.

15.8010 (a) Data showing compliance with the regulations applicable to the item in question prescribed in Part 04;

15.8011 (b) In lieu of the data specified in §15.801 (a), data in accordance with a special ruling made by the Administrator and obtained by the procedure prescribed in § 15.401.

15.802 The request for approval of such an item of equipment together with its supporting data shall be included with the approval request and supporting data for the aircraft model in which the item is installed.

15.81 EQUIPMENT ITEMS ADAPTED TO ANY AIRCRAFT MODEL BY MEANS OF DETAIL DESIGN CHANGES.

15.810 Certain items of equipment, such as those listed in §15.024, of such a nature that by means of detail design changes they can be used in any

aircraft model, will be specially approved as integral parts of the aircraft in which they are installed provided that they comply with the regulations applicable to them prescribed in Part 04.

15.811 If the manufacturer so desires, such an item of equipment may be considered as a series of items, each so designed that it can be used only in one aircraft model. Approval in such a case will be handled as prescribed in §§ 15.80.

15.812 If the procedure prescribed in §§ 15.811 is too cumbersome to suit a particular item, the item will be considered in two parts as follows:

(a) the unchanged basic structure,

(b) the variable structure.

15.813 If the basic structure is deemed satisfactory by the Administrator, only the variable structure need be considered in connection with the certification of each aircraft model in which the item is installed.

15.814 A request for examination of the basic structure of such an item of equipment shall be supported by the following additional data as prescribed in §§ 15.0502:

15.8140 (a) Data showing compliance with the regulations applicable to the item in question prescribed in Part 04;

15.8141 (b) In lieu of the data specified in §§ 15.8140 (a), data in accordance with a special ruling made by the Administrator and obtained by the procedure prescribed in §§ 15.401.

15.815 A request for approval of a complete item of equipment in this classification shall be supported by the following data:

15.8150 (a) Complete references to the data pertaining to the basic structure previously deemed satisfactory by the Administrator;

15.8151 (b) Data as prescribed in §§15.8140 (a) or 15.8141 (b), but pertaining only to the variable structure;

15.8152 (c) Any additional data which may have been prescribed by the Administrator at the time of his examination of the basic structure.

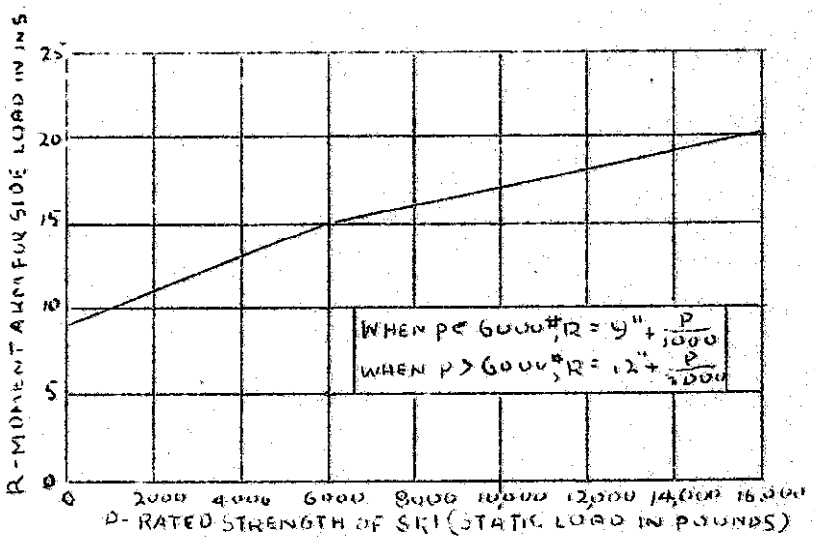

FIG. 15-1 SKI DESIGN MOMENT ARM