



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: Identification, marking, and placarding of aircraft issued special airworthiness certificates in the light-sport category (S-LSA) and aircraft issued experimental certificates for the purpose of operating light-sport aircraft (E-LSA)

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Initiated by: AIR-200

AC No: 45-4

- 1. What is the purpose of this Advisory Circular (AC)?** This AC describes an acceptable means, but not the only means, to comply with the requirements for identifying S-LSA and E-LSA with identification (ID) plates, displaying nationality and registration marks, and displaying placards. This AC also provides marking guidance for instruments necessary for the safety of flight.
- 2. Who does this AC apply to?** This AC is directed to manufacturers of aircraft intended for certification as S-LSA, manufacturers of light-sport aircraft kits intended for certification as E-LSA, applicants seeking S-LSA and E-LSA airworthiness certificates, and persons who operate and maintain S-LSA and E-LSA.
- 3. What is the effective date of this AC?** This AC will be effective on 11/16/2012.
- 4. How is this AC organized?** This AC has been written to consolidate and discuss the topics of identification, marking, and placarding of S-LSA and E-LSA through a question-and-answer format. The AC begins with a series of questions addressing the topic of aircraft identification and its requirements for both S-LSA and E-LSA. Following the identification topic, a series of questions discuss S-LSA and E-LSA displays of the nationality and registration marks and the display of the words “light-sport” and “experimental.” Answers address what marks need to be displayed, how marks are displayed, and where the marks are located. Following the marking topic, S-LSA and E-LSA placards are discussed. Answers to the placard questions include what placards are specified by aircraft class, how placards are to be displayed, and where placards are to be located on the aircraft. S-LSA and E-LSA instrument markings are the final topic discussed in this AC.
- 5. What is an aircraft identification (ID) plate?** An aircraft ID plate is a permanently marked plate made of a fireproof material, affixed to an aircraft that contains the data required by Title 14 of the Code of Federal Regulations (14 CFR) § 45.13(a), Identification data. Permanently marked data should be etched, stamped, or engraved into the plate. The fireproof plate material should be able to withstand the heat produced by a fire at least as well as steel. Stainless steel, of

a sufficient thickness, would be an acceptable example of a fireproof material used to make an ID plate. The aircraft ID plate must be secured to the aircraft in such a manner that it will not likely be defaced or removed during normal service, or lost or destroyed in an accident.

6. What information is required on an ID plate attached to an S-LSA or E-LSA? The ID plate must have (1) the manufacturer's (builder's) name, (2) model designation, and (3) manufacturer's (builder's) serial number. Refer to § 45.13(a). Since S-LSA and E-LSA do not have type certificates and are not manufactured under a production certificate, ID plates need not contain a type certificate number or production certificate number. If an aircraft ID plate provides headings for "type certificate number" or "production certificate number" with spaces available for that data, both data spaces should be marked with "NONE." The builder may add other data on the plate but this data cannot be confused with the information required to be listed on the ID plate.

7. Where must an ID plate be attached to an S-LSA or E-LSA? The ID plate must be secured to the aircraft fuselage exterior so it is legible to a person on the ground. While the ID plate for gliders is not required to be on the fuselage exterior, we recommend the ID plate be located there and legible to a person on the ground. For airplanes and airships, the location must be either adjacent to and aft of the rear-most entrance door or on the fuselage surface near the tail surfaces. For manned free balloons, the ID plate must be secured to the balloon envelope and be located, if practicable, where it is legible to the user when the balloon is inflated. In addition to the balloon envelope ID plate, the basket and heater assembly must be permanently and legibly marked with the manufacturer's name, part number (or equivalent), and serial number (or equivalent). Refer to § 45.11(a)(3), Marking of products.

8. What markings are required on articles and components installed on S-LSA and E-LSA? Articles and components having a replacement time, inspection interval, or other time-related procedure as identified in the manufacturer's maintenance manual and inspection procedures should be marked with a part number (or equivalent) and a serial number (or equivalent). The markings are to be permanent and legible.

9. What language should be used for S-LSA and E-LSA markings and placards? All marking and placard information should be in the English language.

10. What external markings must be displayed on an S-LSA or E-LSA before U.S. airworthiness certification? The following markings must be displayed before an airworthiness certificate is issued.

a. The nationality registration markings or "N" numbers matching the U.S. registration documentation for the aircraft must be displayed. The "N" in Roman capital letter is the first character of the registration, designating U.S. registry, and the rest of the numbers or letters designate the registration number. Refer to § 45.23(a), Display of marks; general.

b. An S-LSA must display the word “light-sport.” The word “light-sport” is displayed on those aircraft to be certificated in the special light-sport aircraft category. When an S-LSA certification changes to an E-LSA certification, the word “experimental” must be displayed on the aircraft. Refer to § 45.23(b).

c. An E-LSA must display the word “experimental.” Refer to § 45.23(b).

11. How are markings of “N” numbers and the words “light-sport” or “experimental” on S-LSA and E-LSA displayed?

a. For all fixed-wing S-LSA and E-LSA, the marking height of characters (numbers and letters) must be uniform. Markings also must be uniform in width and thickness. Refer to § 45.29(g), Size of marks.

b. The width of the characters must be two-thirds as wide as the characters are high, except the number “1,” which is one-sixth as wide as it is high. Refer to § 45.29(c).

c. The letters “M” and “W” may be as wide as they are high. Refer to § 45.29(c).

d. Characters must be formed by solid filled lines, one-sixth as thick as the character is high. Refer to § 45.29(d).

e. The space between each character may not be less than one-fourth the width of the character. Refer to § 45.29(e).

f. The marking displays of characters or the numbers and letters must have no ornamentation. Refer to § 45.21(c)(2), General. Nationality and registration markings should be displayed consistently (as in letter style, font, and color). The words “light-sport” and “experimental” should also be displayed consistently (as in letter style, font, and color).

g. Nationality and registration marking colors must contrast with the background (for example, black characters on white background). The words “light-sport” and “experimental” should contrast with the background. Refer to § 45.21(c)(3).

h. Characters may be painted on, or affixed by any other means with a similar degree of permanence. Refer to § 45.21(c)(1).

i. “N” numbers must be a 12-inch minimum height for airplanes except for E-LSA airplanes, where the minimum height is 3 inches. The height minimum for powered parachute, weight-shift control, gliders, airships, and balloons (spherical and non-spherical) is 3 inches. Refer to § 45.29.

j. When either the words “light-sport” and/or “experimental” must be displayed, this marking must be displayed at a 2-inch minimum to no more than 6-inch maximum height. Refer to § 45.23(b).

k. When “N” numbers are displayed on a fixed-wing aircraft’s vertical tail, they must be displayed horizontally except when marks at least 3 inches high are displayed vertically on the vertical tail surfaces. Refer to § 45.25, Location of marks on fixed-wing aircraft. The registration markings and the words “light-sport” and “experimental” when displayed horizontally should read from left to right.

12. Where are the markings of “N” numbers and the words “light-sport” or “experimental” on S-LSA or E-LSA displayed? There are various marking locations for N-numbers and the words “light-sport” or “experimental.” Because specific marking locations are required by regulation, marking locations will vary because of light-sport aircraft class, the available space on the aircraft for displaying these markings, and the type of airworthiness certification being sought. The Roman capital letter “N” and nationality registration numbers are displayed on the exterior surfaces of the aircraft so they can be seen by a person on the ground. We recommend the words “light-sport” or “experimental” also be displayed on the exterior surfaces of the aircraft.

a. For airplanes and gliders, the regulations require the following:

(1) The “N” numbers must be located on either the vertical tail surfaces or the sides of the fuselage. Refer to § 45.25(a).

(2) For aircraft with a single vertical tail, marks must be displayed on both sides. Aircraft with multiple tails must display the marks on the outermost surfaces. Refer to § 45.25(b)(1).

(3) For aircraft where the “N” numbers are located on the fuselage, the marks must be horizontal and on both sides between the wing’s trailing edge and horizontal stabilizer’s leading edge. However, if engine pods or other appurtenances are located in this area and are an integral part of the fuselage side surfaces, the operator may place the marks on those pods or appurtenances. Refer to § 45.25(b)(2).

(4) When applicable, the words “light-sport” or “experimental” must be displayed on the aircraft located near each entrance to the cabin, cockpit, or pilot station. Refer to § 45.23(b).

(5) If the provisions of subparagraphs 12a(1) or 12a(2) cannot be met and one surface is large enough to display the required full-size marks and the other is not, the full-size marks must be displayed on the larger surface. Additionally, if neither surface is large enough for full-size “N” number marks, marks as large as practicable must be displayed on the larger surface. Refer to § 45.29(f).

b. For powered parachutes and weight-shift control aircraft, the regulations require the following:

(1) The “N” numbers must be displayed externally in two diametrically opposite positions on either the fuselage, a structural member, or component of the aircraft. The marks must be visible from the side of the aircraft. Refer to § 45.27(e), Location of marks; nonfixed-wing aircraft.

(2) The words “light-sport” or “experimental” as applicable must be displayed on the aircraft located near each entrance to the cabin, cockpit, or pilot station. Refer to § 45.23(b).

c. For manned free balloons, the regulations require the following:

(1) For light-sport spherical balloons, the registration markings must be displayed in two places diametrically opposite and near the maximum circumference of that balloon. Refer to § 45.27(c).

(2) For light-sport non-spherical balloons, registration markings must be located on each side of the balloon near its maximum cross section circumference and immediately above either the rigging band or the points of attachment of the basket or cabin suspension cables. Refer to § 45.27(d).

(3) The words “light-sport” or “experimental” as applicable must be displayed on the aircraft located near each entrance to the cabin, cockpit, or pilot station. Refer to § 45.23(b).

d. For airships, the regulations require the following:

(1) Registration markings must be located on the upper external surface of the right horizontal stabilizer and on the under external surface of the left horizontal stabilizer. The marks must be oriented so the top of letter/number is toward the leading edge of each surface. With this orientation, the complete mark may be displayed anywhere on the surface. Refer to § 45.27(b)(1).

(2) Registration markings must be displayed on each side of the exterior bottom half surface of the vertical stabilizer. Refer to § 45.27(b)(2).

(3) The words “light-sport” or “experimental” must be displayed on the aircraft located near each entrance to the cabin, cockpit, or pilot station. Refer to § 45.23(b).

13. What placards are displayed on an S-LSA? S-LSA must be manufactured in accordance with an FAA-accepted consensus standard. Currently, only standards developed by ASTM International (ASTM) have been accepted for the manufacture of S-LSA. Placards affixed to aircraft contain warnings, operating limitations, and reference information. Placards are also to be documented in the Aircraft Operating Instructions (AOI)/Pilot’s Operating Handbook (POH). The AOI/POH should provide any additional information or explanation about the placard to communicate the safe operation of the aircraft. Placards listed in the AOI/POH should match those affixed to the aircraft. Placards should be marked in U.S. standard units.

a. For all classes of S-LSA, the FAA-accepted ASTM consensus standard specifies a passenger warning placard is to be displayed that states “THIS AIRCRAFT WAS MANUFACTURED IN ACCORDANCE WITH LIGHT-SPORT AIRCRAFT AIRWORTHINESS STANDARDS AND DOES NOT CONFORM TO STANDARD CATEGORY AIRWORTHINESS REQUIREMENTS.”

b. The FAA-accepted ASTM consensus standard specifies when placards are used to provide warnings, operating limitations, and reference information, the units of measure on the placard should match the corresponding equipment, instrument, AOI/POH, and maintenance manuals.

c. S-LSA aircraft with tandem seating normally have a limitation requiring solo flight to be made from the front seat or the rear seat. We recommend these seating limitations be noted by placard for all S-LSA classes. For additional information, refer to the FAA Aircraft Weight and Balance Handbook (FAA-H-8083-1A).

d. For S-LSA aircraft with engines, we recommend a placard be affixed near the aircraft fuel tank filler cap showing the fuel to be used. This fuel placard should match the fuel data in AOI/POH. We also recommend a placard display how to control the fuel flow with markings indicating fuel flow on and shutoff.

e. For S-LSA fixed-wing airplanes, the FAA-accepted ASTM consensus standard specifies that the following placards be displayed:

(1) When applicable, a “NO INTENTIONAL SPINS” placard is to be clearly displayed to the user.

(2) When towing gliders and unpowered ultralights, a placard is to be affixed to the aircraft displaying the maximum towing speed in indicated airspeed. The units of placarded speed and the airspeed indicator should match.

(3) Placards with operating limitations such as the aircraft empty weight, maximum takeoff weight, maximum and minimum weight of the crew, and allowable weight of the load in any luggage area are to be displayed.

(4) A user warning placard is to be displayed that specifies the kinds of operation to which the airplane is limited or from which it is prohibited. The consensus standard specifies limitations of flight operations to visual meteorological conditions (VMC) only, and flight operations in instrument meteorological conditions (IMC) are prohibited. The standard also specifies that other placards be displayed informing the user that the airplane is to be operated according to the limitations in the AOI/POH.

f. For S-LSA gliders, the FAA-accepted ASTM consensus standards specify that the following placards be displayed:

(1) Placards are to be displayed with operating limitations such as the aircraft empty weight, maximum takeoff weight, maximum and minimum weight of the crew, and allowable weight of the load in any luggage area.

(2) When applicable, a “NO INTENTIONAL SPINS” placard is to be displayed to the user.

(3) When applicable, a placard addressing fixed or removable ballast, or both, is to be displayed.

g. Placards with operating limitations (for example, total aircraft system weight at takeoff and a “not to exceed weight” note) are to be affixed to the aircraft.

h. For S-LSA weight-shift control aircraft, the FAA-accepted ASTM consensus standards specify that the following placards be displayed:

(1) A placard is to be affixed to the aircraft advising that the AOI/POH be carried with the aircraft and the occupants be familiar with information necessary for safe operation. The following is an example of the placard statement: “The aircraft operating instructions must be carried with the aircraft. Occupants must be familiar with information necessary for safe operation.”

(2) When towing gliders and unpowered ultralights, a placard is to be affixed to the aircraft displaying the maximum towing speed in indicated airspeed. The airspeed units on the placard and the airspeed indicator should match.

i. For S-LSA lighter-than-air, the FAA-accepted ASTM consensus standards specify that the following placards be displayed:

(1) A placard is to be affixed to the aircraft displaying the maximum takeoff weight.

(2) When applicable, a placard is to be affixed to the aircraft displaying the maneuvering loads.

14. How are S-LSA placards displayed? The FAA-accepted ASTM consensus standard specifies placard lettering is to be clearly printed, large enough, and positioned so it is legible to the user.

15. Where are S-LSA placards located? The FAA-accepted ASTM consensus standard specifies that all documented placards be affixed to the aircraft so they are clearly displayed to the user and passenger. All placards and labels are to be placed on non-critical surfaces so they are not likely to be defaced and removed during normal service. Placards may inform the user of the proper and safe operation of an aircraft system or equipment. When a placard is used, it should be located near the aircraft system or equipment it describes.

16. What placards are required to be displayed for E-LSA? An E-LSA does not have the same requirements to display placards as S-LSA. However, as part of the operating limitations issued for all classes of aircraft certificated in the experimental category for the purpose of operating light-sport, the following placard must be displayed in the aircraft in full view of all occupants: “PASSENGER WARNING—THIS AIRCRAFT IS AN EXPERIMENTAL AIRCRAFT AND DOES NOT COMPLY WITH FEDERAL SAFETY REGULATIONS FOR STANDARD AIRCRAFT.” While not required for E-LSA, we recommend S-LSA placards specified by the regulations and consensus standards be installed in E-LSA except when not applicable.

17. What are the markings for S-LSA installed airframe emergency parachutes? An FAA-accepted ASTM consensus standard for airframe emergency parachutes specifies that when an S-LSA is equipped with one of these systems, the aircraft and parachute system is marked with the following:

a. A danger placard with explanatory text is to be attached to the aircraft describing the type of ballistic deployment device installed in the aircraft. A ballistic device may include rocket motor, mortar, explosive projectile, spring, or other stored energy device.

b. When a ballistically deployed parachute system is installed, a warning placard with explanatory text is to be attached to the aircraft describing the system.

c. An identifying placard is to be attached to the body of the extraction device (for example, the rocket body itself) so first responders and safety investigators can identify the device, should it become separated from the parachute.

d. When an emergency parachute system has not been serviced to its maintenance schedule, the system is marked as inoperative until the maintenance has been accomplished.

e. The FAA-accepted ASTM consensus standard specifies that placards affixed to the aircraft are to be documented in the AOI/POH. Placards identified in the AOI/POH should match those affixed to the aircraft.

f. While not required, we recommend E-LSA display the same markings for airframe emergency parachutes as specified for S-LSA.

18. How are S-LSA airframe emergency parachute markings to be installed? An FAA-accepted ASTM consensus standard for airframe emergency parachutes specifies the following:

a. Placards and labels are to be affixed on the aircraft exterior so they can be seen by first responders at accident and incident sites.

b. The warning and danger placards are to have a reflective background material for enhanced visibility in low light or obscured conditions.

c. Placards are to meet size dimensions and use color schemes referenced in the applicable consensus standard. Placards are also to be affixed to the aircraft, advising of the parachute system's functional and operational limitations.

d. The consensus standard specifies the parachute is to be marked with the manufacturer's identification, part number and revision, serial number, date of manufacture, service interval date, and contact information. The service interval date, often expressed as month/year, is a "not to be exceeded" date when the assembly is required to be serviced. The parachute manufacturer and the aircraft manufacturer working together determine the service interval date.

e. While not required, we recommend E-LSA display the same markings for airframe emergency parachutes as specified for S-LSA.

19. Where are S-LSA airframe emergency parachute markings as specified by the ASTM consensus standards to be installed? An FAA-accepted ASTM consensus standard for airframe emergency parachutes specifies the following:

a. A danger placard with explanatory text is to be placed adjacent to the parachute's egress point for installations not visible from the aircraft exterior. When the parachute system is external to the aircraft enclosure, a danger placard is to be applied directly on the ballistic extraction device so it is visible to first responders.

b. A warning placard with explanatory text is to be applied to the aircraft adjacent to a door or place where the occupants enter the aircraft or where rescue personnel can readily see it.

c. Placards and labels are to be placed on non-critical surfaces so they are not likely to be defaced, removed during normal service, or lost or destroyed in an accident.

d. While not required, we recommend E-LSA similarly display markings for airframe emergency parachutes as specified for S-LSA.

20. What instruments installed on an S-LSA and E-LSA should be marked? Flight instruments used on S-LSA are specified in the FAA-accepted ASTM consensus standard for the aircraft class and as found in the aircraft's AOI/POH. When the instruments described later in this AC are installed on S-LSA, you may use instruments manufactured in accordance with an FAA technical standard order (TSO) or instruments with markings as described in the following paragraphs. For more information about flight instruments, refer to the Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25). Flight instruments should be marked with U.S. standard units. While not required, we recommend E-LSA install the same flight instruments as specified for S-LSA and as found in the aircraft's AOI/POH.

21. What types of instrument displays may be installed in S-LSA and E-LSA aircraft? Instrument displays can be mechanical, electromechanical, or fully electronic screens. Mechanical and electromechanical indicators comprise round-dial, rotating-pointer instruments; vertical and horizontal scale instruments; translating pointer instruments; fixed-index, moving scale instruments; rotating-wheel counters; and combined analog-digital indicators. Electronic displays include cathode-ray tube (CRT), liquid-crystal display (LCD), light-emitting diode (LED), and electroluminescent (EL) or light-emitting film (LEF) displays. Electronic displays should usually depict scale readouts similar in appearance to electromechanical instruments.

22. How are S-LSA instruments marked?

a. The FAA-accepted ASTM consensus standard specifies—

(1) Instrument markings should be clearly printed, large enough, and positioned so they are legible to the user in all operating conditions.

(2) Aircraft instrument markings are to be documented in the AOI/POH. Instrument markings identified in the AOI/POH should match those installed to the aircraft.

(3) When an instrument's markings are on a transparent cover instead of on the instrument face, there should be an alignment method between the face and cover.

b. Federal Standard 595 colors or equivalent may be used on aircraft instruments.

c. When an instrument has a warning flag, the flag should be easily visible to the user in the event of a malfunction.

d. While not required, we recommend flight instruments in E-LSA be marked as specified for S-LSA.

23. How should the airspeed indicator be marked? The airspeed indicator provides indicated airspeed information to the pilot through an instrument or an electronic display. On the instrument face or display, important marked airspeeds and airspeed ranges relating to the aircraft's performance should be shown. For more information, refer to the regulations and applicable FAA-accepted consensus standard for the velocity speed definitions (for example, V_{SO} and V_{S1}). The FAA-accepted ASTM consensus standard for the light-sport fixed-wing airplane class specifies that the airspeed indicator display the markings listed below. For other light-sport aircraft classes such as gliders, weight-shift control aircraft, or powered parachutes, it is recommended the airspeed indicator also display the markings listed below.

a. The airspeed indicator range and line markings use standard colorations of white, green, yellow, and red on the instrument or display.

b. For aircraft equipped with flaps, a continuous white band range indicates the normal range of operating speeds with the flaps extended.

c. A continuous green band range indicates the normal range of operating speeds for an aircraft without flaps or a flap-equipped aircraft with the flaps retracted.

d. A continuous yellow band range indicates higher speeds at which the aircraft may be operated in smooth air, and then only with caution. The lower end of the yellow band range begins at the upper limit of the green band. The upper end of the yellow band range is to be bounded by the "never exceed" airspeed indicated with a red line or red highlight on the display.

e. A continuous yellow band range is optional in the low speed range between V_{SO} and V_{S1} .

f. A continuous red band range may be incorporated from 0 or a minimum number to V_{SO} .

24. How should the pitch/bank (attitude) indicator be marked? The attitude indicator should display a line representing the horizon, accompanied with both pitch and bank-angle marks. On the top half of the horizon line, the instrument should be blue, representing the sky, and the bottom half should be brown, representing the ground. The attitude indicator should show left or right banked angles tic marked with 10-, 20-, 30-, 45-, and 60-degree gradations.

The attitude indicator should show, at a minimum, pitch angles with tic marks up or down to 20 degrees with incremental angles marked, at a minimum, every 5 degrees. A small symbolic aircraft should be displayed so it appears to be flying relative to the horizon. Both analog and electronic displays should follow the same format.

25. How should the altimeter be marked?

a. For stand-alone electromechanical altimeters, the instrument face and the background should contrast, for example, white markings against a black or grey background. The user should be able to easily determine the unit of measure (feet and/or meters when applicable) and distinguish between values of hundreds and thousands. The instrument's calibration should be printed on the altimeter face or documented in the AOI/POH. The calibrated range should be printed using contrasting letters to the background when printed on the altimeter face. When applicable, the adjustable sea level reference pressure and its corresponding units should be displayed.

b. For electronic displays, the altitude value should be displayed. Linear tape displays should include index markings, numerical callouts, or distinctive symbology denoting standard 500 and 1,000 ft increments. The user should be able to easily determine the unit measure (feet and/or meters) if the display is capable of displaying both U.S. standard and metric units. The display should distinguish between values of hundreds and thousands. The AOI/POH should reference the instrument's calibration range. When applicable, the adjustable sea level reference pressure and its corresponding units should be displayed.

26. How should the rate of turn and slip-skid indicator be marked?

a. For analog instruments, the letters, numbers, and marks should be displayed with a contrasting foreground and background (for example, white letters on a black background). The rate of turn indicator should show marks with left or right standard rate turns and marks with level flight. The inclinometer or coordination ball should be marked using a ball and vertical lines showing the limits of coordinated flight. The indicator face should be labeled with "2 minutes" to indicate time for a standard rate turn.

b. The rate of turn or slip-skid indicator should also have printed on the instrument face the source of power (for example, "D.C. ELEC." meaning DC power). The words "TURN COORDINATOR" should be marked on the instrument face to distinguish between a turn coordinator and a turn-and-slip indicator. The words "No Pitch Information" should also be displayed. For electronic displays, the AOI/POH should detail how to interpret display symbols if they are different from the standard turn-and-slip or turn coordinator analog electromechanical instruments.

27. How should the magnetic direction indicator (magnetic compass) be marked?

a. An analog magnetic compass should have markings that include letters and/or numbers and tic marks. Markings should show the cardinal directions N, S, E, and W letters or their numerical heading equivalents on the compass card. For each 30 degrees interval off the cardinal

directions, the indicator should be marked with heading numbers and tic marks. Either the full heading number or the heading number omitting the final “0” may be used; for example, “60” or “6” would represent a 60-degree heading, and “330” or “33” would represent 330 degrees. Headings between the 30 degree intervals should be shown with tic marks for every 5 degrees. On the indicator, there should be a mark or reference line indicating to the user the current heading. The letters, numbers, and tic marks should be displayed with a contrasting foreground and background (for example, white letters and tic marks on a black background).

b. A digital magnetic compass should have markings (letters and/or numbers) indicating the current heading with a maximum of 5-degree increments. Omitting the final “0” in the heading is acceptable (for example, “3” = 30 degrees) as long as the value displayed would not cause confusion. For example, this means the user should be able to easily distinguish between a heading of 5 degrees and a heading of 50 degrees.

c. When a compass correction card is affixed either on or near the compass, compass readings should be taken with the engine operating and the radio receivers (if equipped) for both the on and off settings. Corrections should be displayed in 30-degree increments starting at 0 degrees and ending with 330 degrees.

d. If an aircraft compass deviates more than 10 degrees as a result of operating electrical equipment, a placard clearly positioned should be affixed near the compass. This placard should display to the user what electrical loads cause the compass deviation.

28. How should the directional gyro indicator be marked? The directional gyro indicator should have markings that include letters and/or numbers and tic marks. Markings should be displayed with a contrasting foreground and background (for example, white letters on a black background). Markings should show the cardinal directions N, S, E, and W letters or their numerical heading equivalents on the compass card. For each 30-degree interval off the cardinal directions, the indicator should be marked with heading numbers and tic marks. Either the full heading number or the heading number omitting the final “0” may be used; for example, “60” or “6” would represent a 60-degree heading, and “330” or “33” would represent 330 degrees. Headings between the 30-degree intervals should be shown with tic marks every 5 degrees. On the indicator, there should be a mark or reference line indicating to the user the current heading. An electronic display that integrates a directional gyro indicator should use similar markings to its analog equivalents and/or show the current heading value.

29. How should fuel quantity indicators be marked? Each fuel tank should have an indicator to report fuel quantity. An analog fuel quantity indicator should display to the operator the current fuel quantity and show a mark at the zero-fuel quantity. Zero-fuel quantity means zero quantity of useable fuel remaining in the tank. For a powered parachute and weight-shift control aircraft, the indicator could be as simple as a zero quantity marked site tube or translucent fuel tank. Electronic fuel quantity displays should use similar marking schemes as their analog equivalents. Other means to indicate fuel status would be acceptable if the operator is able to ascertain the current fuel quantity compared to the zero-fuel quantity. All markings, whether analog or electronic displays, should be explained in the AOI/POH.

30. What colors and color schemes should powerplant instruments use? Powerplant instrument range markings are intended to provide status information to the operator about the powerplant. Powerplant instruments (displays) should show whether the current operations are normal, acceptable for a limited time, or unauthorized. These markings are based on the installed engine operating limits, which may not exceed (but are not necessarily equal to) those limits provided by the engine manufacturer. A powerplant instrument general color marking scheme consists of three colors: red, green, and yellow, in addition to white, which is generally used for numerals and graduation marks. Many powerplant instruments are electromechanical round-dial type with a graduated scale and a rotating needle indicator. Electronic displays may adopt similar presentations as their analog equivalents, use linear scales, or another means. The paragraphs below describe markings more closely related to round-dial instruments; however, when appropriate, electronic displays may incorporate the same guidelines. All markings whether a round-dial instrument or electronic display, should be explained in the AOI/POH.

a. When marking the instruments, the colored markings should be placed directly over the instrument graduations in a manner that does not obscure the graduations themselves. When in this position, if the markings interfere with the instrument's readability from the operator's position, adjustment of the colored markings above or below the graduations should be considered. The colored markings may be placed on the cover glass of the instrument provided the readability of the instrument is not compromised and there is a means to maintain the correct alignment of the cover glass with the dial face.

b. The color red indicates an operating condition beyond authorized limits and/or requires a specific action on the part of the operator. The specific action to be taken should be described in detail in the AOI/POH. Red radial lines should be used to identify only the established maximum and minimum safe operating limits (when applicable). Where appropriate, the maximum should be the limit for takeoff operation. Red radials should be located so the edge nearest the normal operating range is placed on the limit value. In use, when the needle point touches the edge of the red radial nearest the green arc, the limit is met. To minimize confusion the use of multiple red radials should be avoided, except for certain conditional limits. Multiple red radials can be displayed on electronic displays with switching accomplished automatically. If possible, multiple read radials should have distinguishing features, such as one solid line and one dashed line, or lines of different lengths.

c. A red arc requirement(s) may be satisfied by marking the applicable instruments for all speed ranges which are restricted because of the excessive vibration and other stresses induced by reciprocating masses such as the engine or propeller. This requirement applies to tachometers; however, the red arc may also be used on other powerplant instruments. The dial should not be marked to indicate restricted operating range when the restriction applies only under certain conditions (for example, a propeller vibratory stress restriction that applies only when the aircraft is in a specific configuration). Instead of a red arc, it may be satisfactory to provide an adjacent placard covering such restricted ranges.

d. The color green is used to indicate a normal condition for operation, both ground and flight. Where applicable, the high-value end of the green arc should indicate the maximum limit for normal operation, and the low-value end of the green arc should indicate the minimum limit for normal operation. Where appropriate, there may be blank gaps, or other colors, inserted into the green arc. Either the upper or lower end of the green arc may extend to the red radial or stop short of it as appropriate to the measurement being marked.

e. The color yellow is used to indicate either a takeoff or cautionary range where limited operation is permissible as directed by the applicable AOI/POH. An example of compliance with the precautionary range requirement is the yellow arc marking on the carburetor air temperature gauge to indicate the range of temperature where carburetor icing may occur.

f. Other informational markings (such as warranty ratings), may be included on the instrument face provided they are not red, yellow, or green marks and they would not be confused with other powerplant instrument markings. These types of marks should be explained satisfactorily in the AOI/POH.

g. Some displays may utilize a servo-driven indicator or electronic display with vertical or horizontal scale. The same basic color markings as a dial/rotating needle type should be used.

h. On a vertical or horizontal scale instrument, a red line or stripe applied across the scale to mark the maximum (and minimum, when applicable) authorized operating limit is comparable to the red radial line applied to round-dial instruments. Green, yellow, or red lines or stripes parallel to the scale with the ends of the lines at the specified range limit graduations are practical methods of conveying the same type of information as provided by the colored arcs on round-dial instruments. On a moving tape instrument, the operating range markings should be either placed on the face of the tape or affixed adjacent to the tape.

31. How should powerplant instruments be marked? Common powerplant instruments should display the general marking scheme as previously discussed. Common powerplant instruments such as the carburetor air temperature indicator, cylinder head temperature indicator, manifold pressure indicator, fuel pressure indicator, oil pressure and temperature indicator, tachometer, and torque indicator may be marked with color ranges and/or colored marks. Any additional markings to these instruments may be added as desired, provided the marking does not conflict with general marking scheme. All powerplant instrument markings should be detailed and explained in the AOI/POH. Other powerplant instruments not discussed may also need to be marked and should follow the general instrument marking schemes. Instruments using electronic displays should present information similarly to their corresponding analog equivalents. Arcs used in analog instruments to describe a range may be represented in electronic displays by using a linear tape scale or some other means.

a. Carburetor air temperature indicator.

(1) Red radial. At maximum permissible carburetor inlet air temperature as referenced in the AOI/POH.

(2) Green arc. Normal operating range for trouble-free operation with the upper limit at maximum permissible carburetor inlet air temperature and the lower limit at the point where icing may be anticipated. Additional green arc may be required in the temperature range below the icing range.

(3) Yellow arc. Range indicating where icing is most likely to be encountered.

b. Cylinder head temperature indicator.

(1) Red radial. At maximum permissible cylinder head temperature.

(2) Green arc. From maximum permissible temperature for continuous operation to minimum recommended for continuous operation, as referenced in the AOI/POH.

(3) Yellow arc. From maximum temperature for continuous operation to maximum permissible temperature.

c. Manifold pressure indicator.

(1) Red radial. At maximum permissible manifold absolute pressure for dry or wet operation, whichever is greater.

(2) Green arc. From maximum permissible manifold pressure for continuous operation to the minimum manifold pressure selected by the aircraft manufacturer for cruise power.

(3) Yellow arc. From maximum manifold pressure for continuous operation to maximum permissible manifold pressure.

(4) Red wedge shape. At normal takeoff rating, if less than maximum limit.

(5) Striped green arc. From the normal takeoff rating (red wedge shape) to the maximum limit (red radial).

d. Fuel pressure indicator.

(1) Red radial. At maximum and/or minimum permissible pressure as established in the engine operating limitations. For engines with variable minimum permissible pressure limits, the lower red radial should be placed at the highest minimum absolute pressure allowed.

(2) Green arc. Normal operating range.

(3) Yellow arc. Cautionary ranges indicating any potential hazard in the fuel system such as malfunction or icing.

e. Oil pressure indicator.

(1) Red radial. At maximum and/or minimum permissible pressure as established in the engine operating limitations.

(2) Green arc. Normal operating range.

(3) Yellow arc. Cautionary ranges indicating any potential hazard due to factors such as overpressure during cold start or low pressure during idle.

f. Oil temperature indicator.

(1) Red radial. At maximum and/or minimum permissible temperatures established as engine operating limitations.

(2) Green arc. Normal operating range.

(3) Yellow arc. Cautionary ranges indicating any potential hazard due to factors such as overheating or high viscosity at low temperature.

g. Tachometer.

(1) Red radial. At maximum permissible rotational speed (rpm).

(2) Green arc. From maximum rotational speed for continuous operation to minimum recommended for continuous operation (except in the restricted range, if any).

(3) Yellow arc. From maximum rotational speed for continuous operation to maximum permissible rotational speed.

(4) Red arc. Range(s) in which operation is restricted, except to pass through, for all operating conditions due to factors such as excessive stresses.

h. Torque indicator.

(1) Dashed red radial. At maximum permissible torque limit for conditional operation (if applicable).

(2) Red radial. At the normal maximum permissible torque limit.

(3) Green arc. From maximum torque limit for continuous operation to the minimum recommended torque value.

(4) Yellow arc. From maximum rotational speed for continuous operation to maximum permissible rotational speed.

32. Do the markings outlined in this AC for powerplant instruments apply to electric motors? No, the guidance in this AC applies to aircraft with reciprocating engines only. Refer to 14 CFR § 1.1, General definitions.

33. Where can I find this AC? You can find this AC at http://www.faa.gov/regulations_policies/advisory_circulars.



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Appendix A. Related 14 CFR Parts

1. **14 CFR part 1, Definitions.** Part 1 provides definitions for terms used in the regulations.
2. **14 CFR part 21, Certification Procedures for Products, Articles, and Parts.** Part 21 sets forth rules for the issuance of and change to type certificates, and issuance of production certificates, airworthiness certificates, and export airworthiness approvals. It also sets forth the rules governing the holders of these certificates and the approval of certain articles.
3. **14 CFR part 45, Identification and Registration Marking.** Part 45 sets forth rules for display of nationality and registration marks, display of special airworthiness classification marks, identification plates for products, and identification of certain replacement and critical aircraft articles.
4. **14 CFR part 47, Aircraft Registration.** Part 47 sets forth rules for registering an aircraft.
5. **14 CFR part 91, General Operating and Flight Rules.** Part 91 sets forth rules governing the operation of most aircraft within the United States.

Appendix B. Related Publications

FAA Order 8130.2, Airworthiness Certification of Aircraft and Related Products

AC 20-88A, Guidelines on the Marking and Aircraft Powerplant Instruments (Displays)

AC 45-2D, Identification and Registration Marking

FAA-H-8083-25, Pilot's Handbook of Aeronautical Knowledge

FAA-H-8083-1A, FAA Aircraft Weight and Balance Handbook