



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

# Advisory Circular

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**Subject:** Installation Guidance for Domestic  
Flight Information Service - Broadcast

**Date:** 12/21/15  
**Initiated By:** AIR-100

**AC No:** 20-149B

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## 1 PURPOSE.

- 1.1 This advisory circular (AC) supports the use of Flight Information Services-Broadcast (FIS-B) weather and other aeronautical data link products for enhanced situation awareness of flight conditions. In this AC, the Federal Aviation Administration (FAA) recommends one way to gain airworthiness approval for the installation of FIS-B avionics equipment. We identify safety and installation requirements for continued airworthiness of aircraft FIS-B avionics equipment, systems, and applications. This AC is not mandatory and does not constitute a regulation. This AC describes an acceptable means, but not the only means, to gain airworthiness approval for your FIS-B avionics equipment. However, if you use the means described in this AC, you must follow it in its entirety.
- 1.2 The FAA introduced FIS-B to improve safety and to increase the utility, efficiency, and capacity of the National Airspace System (NAS). Timely delivery of quality, accurate, and consistent information assists pilots in making operational decisions.
- 1.3 We revised this AC to align this installation guidance with the recently published Technical Standard Order (TSO)-C157b, *Flight Information Services-Broadcast (FIS-B) Equipment*, dated May 28, 2015.

## 2 AUDIENCE.

This AC is for manufacturers and installers of FIS-B avionics equipment and software, FIS-B providers, applicants for FAA design approval of FIS-B systems, and FAA Aircraft Certification Office (ACO) staff who assess FIS-B system installations.

### 3 RELATED PUBLICATIONS.

#### 3.1 FAA Advisory Circulars.

- AC 00-45G, *Aviation Weather Services*, Changes 1 and 2, dated October 2014.
- AC 20-136B, *Aircraft Electrical and Electronic System Lightning Protection*, dated September 7, 2011.
- AC 20-184, *Guidance on Testing and Installation of Rechargeable Lithium Battery and Battery Systems on Aircraft*, dated October 15, 2015.
- AC 21-16G, *RTCA Document DO-160 versions D, E, F, and G, "Environmental Conditions and Test Procedures for Airborne Equipment"*, dated June 22, 2011.
- AC 23.1309-1E, *System Safety Analysis and Assessment for Part 23 Airplanes*, dated November 17, 2011.
- AC 23.1311-1C, *Installation of Electronic Display in Part 23 Airplanes*, dated November 17, 2011.
- AC 23.1419-2D, *Certification of Part 23 Airplanes for Flight in Icing Conditions*, dated April 19, 2007, with Change 1, dated June 28, 2007 incorporated.
- AC 25-11B, *Electronic Flight Displays*, dated October 7, 2014.
- AC 25-28, *Compliance of Transport Category Airplanes with Certification Requirements for Flight in Icing Conditions*, dated October 27, 2014.
- AC 25.1309-1A, *System Design and Analysis*, dated June 21, 1988.
- AC 25.1322-1, *Flight Crew Alerting*, dated December 13, 2010.
- AC 27.1309, *Equipment, Systems, and Installations*, found in master AC 27-1B, *Certification of Normal Category Rotorcraft*, Changes 1-5, dated June 13, 2014.
- AC 27.1419, *Ice Protection*, found in master AC 27-1B, *Certification of Normal - Category Rotorcraft*, Changes 1-5, dated June 13, 2014.
- AC 29.1309, *Equipment, Systems, and Installations*, found in master AC 29-2C, *Certification of Transport Category Rotorcraft*, Changes 1-5, dated June 13, 2014.
- AC 29.1419, *Ice Protection*, found in master AC 29-2C, *Certification of Transport Category Rotorcraft*, Changes 1-5, dated June 13, 2014.

- AC 43.13-2B, *Acceptable Methods, Techniques, and Practices - Aircraft Alterations*, dated March 3, 2008.
- AC 120-76C, *Guidelines for the Certification, Airworthiness, and Operational Use of Electronic Flight Bags*, dated May 9, 2014.

### 3.2 Industry Documents.

- RTCA, Inc., Document No. RTCA/DO-267A, *Minimum Aviation System Performance Standards (MASPS) for Flight Information Services-Broadcast (FIS-B) Data Link*, dated April 29, 2004.
- RTCA, Inc., Document No. RTCA/DO-358, *Minimum Operational Performance Standards (MOPS) for Flight Information Services-Broadcast (FIS-B) with Universal Access Transceiver (UAT)*, dated March 24, 2015.

## 4 DEFINITION OF KEY TERMS.

- **Airline Operations Control Center (AOCC):** An air carrier dispatch service, or other operator's aeronautical weather and operational information service.
- **Broadcast Data Link:** A data link transmission with no requirement for an initiating request from the receiving station. Further, the broadcast data link transmission, as defined in RTCA/DO-267A, does not contain message recipient address information.
- **Broadcast Message:** A message using a broadcast protocol that does not depend on a request from the receiver. This AC specifically refers to the broadcast protocol in RTCA/DO-267A and RTCA/DO-358.
- **Flight Information Services (FIS):** The International Civil Aviation Organization (ICAO) defines FIS in the 15th Edition of ICAO Doc 4444-ATM/501, *Procedures for Air Navigation Services: Air Traffic Management*, dated November 22, 2007, as a service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flight. Further, ICAO has defined specific request-reply data link services found in ICAO Doc 9705AN/956, *Manual of Technical Provisions for the Aeronautical Telecommunication Network (ATN)*. However, the term "FIS" in this AC includes a much broader scope of services, applications, and formats: FIS includes near real-time advisories and warnings that may affect flight safety and flight information planning services used in strategic flight planning. Additionally, FIS is limited to broadcast data link services that do not require request-reply.
- **Flight Information Services-Broadcast (FIS-B):** A means of disseminating FIS by broadcast (a non-directed transmission intended to be received by all stations).

- **Flight Information Service Provider (FAA):** The Surveillance and Broadcast Services (SBS) vendor that provides FAA FIS-B on the Automatic Dependent Surveillance-Broadcast (ADS-B) 978 MHz UAT data link under an agreement with the FAA.
- **Flight Information Service Provider (Non-FAA):** An organization that operates a commercial data link service providing aviation weather and operational information independent of a vendor service agreement with the FAA.
- **Graphical Product:** A FIS product composed of graphics with associated supporting text.
- **Next Generation Weather Radar (NEXRAD):** A Doppler weather radar system developed and deployed as a tri-agency program by the Department of Transportation (FAA), the Department of Commerce, and the Department of Defense. NEXRAD provides surface weather radar coverage and is an essential input to various aviation weather products. NEXRAD radar systems are designated Weather Surveillance Radar, 1988 Doppler (WSR-88D).
- **Text Product:** A FIS product composed of text only.
- **Universal Access Transceiver (UAT):** A transceiver that operates on the 978 MHz frequency and supports ADS-B, FIS-B and Traffic Information Services-Broadcast (TIS-B) services.
- **Value-Added Product:** A product offered by a non-FAA FIS provider for a fee.

## 5 BACKGROUND.

There are two methods of receiving FIS-B products on the flight deck. The FAA provides FIS-B through the SBS over the 978 MHz frequency. Aircraft can receive this data through a UAT for domestic operations below 24,000 feet MSL. The second method is made available through commercial, non-FAA FIS providers. To provide for these two methods, this AC recognizes two different FIS-B equipment classes. They are identified in TSO-C157b and defined in table 1 below.

**Table 1. Equipment Classes for FIS-B**

Equipment		
1	FIS-B Equipment Using UAT and Interoperable with the SBS Provider	RTCA, Inc., Document No. RTCA/DO-358, <i>Minimum Operational Performance Standards (MOPS) for Flight Information Services-Broadcast (FIS-B) with Universal Access Transceiver (UAT)</i> , dated March 24, 2015, section 2.2

2	FIS-B Equipment Interoperable with Commercial Provider and Not Interoperable with the SBS Provider	RTCA/DO-267A, <i>Minimum Aviation System Performance Standards for Flight Information Service - Broadcast</i> , dated April 29, 2004, section 2 (except 2.1.4, 2.2.12, and 2.2.13) and section 3.8
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5.1 The FAA SBS FIS-B provider broadcasts a basic set of free weather and aeronautical products for use by UAT-equipped aircraft. The FAA SBS FIS-B set of products includes—

- Aviation Routine Weather Reports (METAR),
- Aviation Selected Special Weather Reports (SPECI),
- Terminal Area Forecasts (TAF) and their amendments,
- Significant Meteorological Information (SIGMET),
- Convective SIGMETs,
- Airman’s Meteorological Information (AIRMET),
- Pilot Reports (PIREP),
- NEXRAD Reflectivity (Continental United States [CONUS]),
- NEXRAD Reflectivity (Regional),
- Notices to Airmen (NOTAM/Flight Data Center [FDC]),
- Temporary Flight Restrictions (TFR), and,
- Winds and Temperatures Aloft.

**Note:** For installed TSO-C157b Class 1 equipment only, FIS-B uplink is an FAA-approved source for METAR (including SPECI), TAF, winds, PIREPs, NEXRAD, AIRMET, SIGMET, and temporary flight restriction (TFR) information subject to the range limits for the broadcast of these products. FIS-B uplink is not an FAA-approved source for NOTAMs. Although Class 1 equipment is considered an FAA-approved source for these products, FIS-B information must not be used in place of a standard preflight briefing.

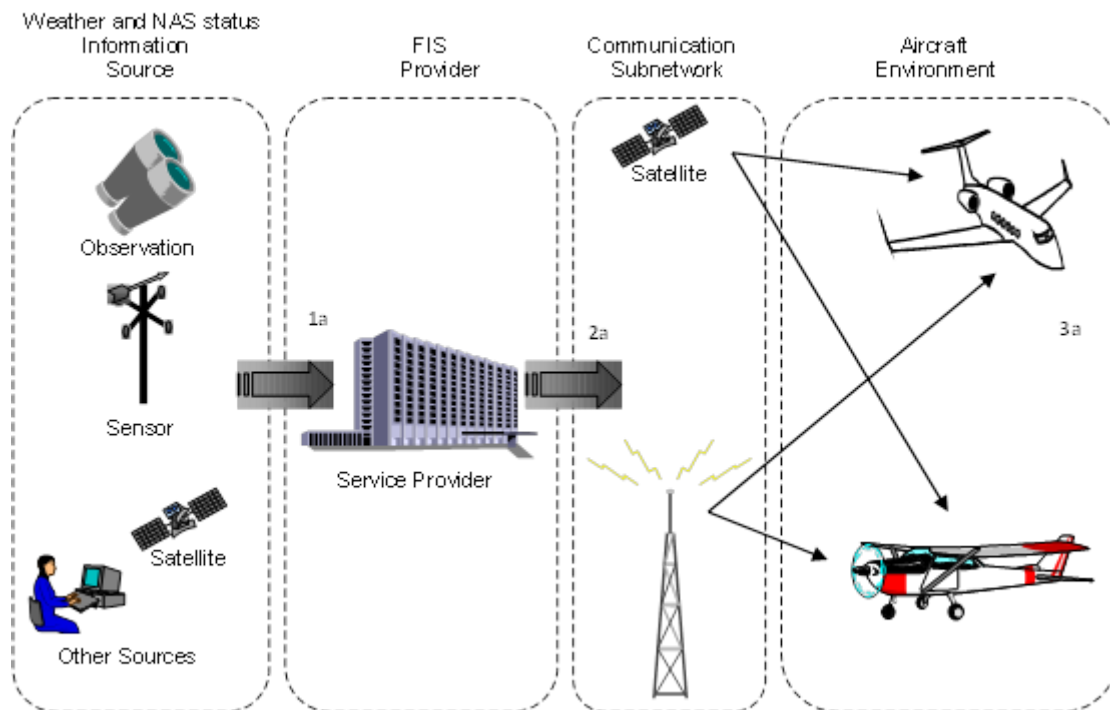
5.2 FIS-B value-added services for Class 2 equipment are provider-unique products for paid subscribers. Value-added services may offer more data content and format than the basic requirements listed above. These services may include—

- Precipitation maps based on NEXRAD mosaics,

- Graphical presentations of in-flight icing conditions and turbulence depictions,
- NOTAMs, and
- Special Use Airspace (SUA) depictions.

5.3 Figure 1 below represents a one-way, non-addressed, FIS-B service that uses either ground- or space-based data link systems. As this example shows, the FIS service provider assimilates weather and other information gathered from observations, weather sensors, instruments, and other data sources (step 1a below). Once formatted and processed, the service provider encodes and distributes that information to the broadcast communication subnetwork (step 2a below), which broadcasts the FIS-B data to the aircraft. The FIS-B data is displayed in cockpits of properly equipped aircraft (step 3a below).

**Figure 1. FIS-B System**



## 6 **SCOPE.**

Portable display systems do not require design approval and are outside the scope of this AC. Refer to AC 120-76C. Instead, this AC covers the following:

6.1 FIS providers are responsible for gathering weather and NAS status information from sources appropriate for the services they intend to provide. Once they gather this information, FIS providers then process it into a format suitable for data link. This formatted information is then encoded for distribution to their communication subnetwork. The guidance in this AC applies to any of the following:

- FIS-B services provided by the FAA that use the 978 MHz UAT, and
- Non-FAA FIS-B providers that use alternative data link methods and frequencies.

### 6.2 **Communication Subnetworks.**

This AC allows the FIS-B system to use a variety of ground- and space-based communication subnetworks.

### 6.3 **Aircraft Environment.**

The aircraft FIS-B system receives data from ground and spaceborne transmitters managed by a service provider. Depending on the FIS service in question, the aircraft's FIS-B avionics equipment will monitor the appropriate subnetwork for broadcast FIS services. The aircraft's FIS-B avionics are responsible for the control and display of FIS products in the flight deck.

## 7 **SAFETY ASSESSMENT CONSIDERATIONS.**

7.1 FIS-B information is intended to enhance pilot awareness of weather and airspace conditions. Therefore, the hazard classification should be no greater than minor, provided the flight crew uses the equipment in accordance with its operating instructions. You should conduct a safety assessment to ensure the minor classification is applicable to your FIS-B avionics equipment. The safety assessment should determine, classify, and evaluate failure conditions resulting from malfunction, loss of function, or design errors. The safety assessment should also evaluate failures or design errors of the FIS-B equipment that could cause or contribute to failure conditions of other systems. Refer to AC 23.1309-1E; AC 25.1309-1A; AC 27.1309 in master AC 27-1B, Changes 1-5; or AC 29.1309 in master AC 29-2C, Changes 1-5; as applicable, for guidance on conducting your safety assessment.

7.2 This AC is applicable for FIS-B avionics equipment when—

- The loss of the FIS-B function is no greater than a minor failure condition, or

- The effect of undetected errors in FIS-B products (such as messages received out of sequence, errors in message address, weather severity, displayed errors in weather and NOTAM location [offset] errors, and errors in the data compression technique) is no greater than a minor failure condition, or
- The corruption of FIS-B information intended for display to the pilot or flight crew during normal flight operations introduces no more than a marginal increase in pilot workload. This increase in pilot workload contributes to no more than a minor failure condition classification.

**Note 1:** FIS-B Class 1 equipment uplink is an FAA-approved source for METAR (including SPECI), TAF, winds, PIREPs, NEXRAD, AIRMET, SIGMET, and TFR information subject to the range limits for the broadcast of these products. FIS-B Class 1 equipment uplink is not an FAA-approved source for NOTAMs. Although we consider Class 1 equipment uplink an FAA-approved source for these products, FIS-B Class 1 equipment uplink information must not be used in place of a standard preflight briefing.

**Note 2:** FIS-B Class 2 equipment uplink is *not* an FAA-approved source for FIS products. FIS-B Class 2 equipment uplink supplements existing requirements for voice communication capability and does not replace or substitute the required preflight planning, air traffic control (ATC), Flight Service Station (FSS), or AOCC voice communications for aeronautical weather, SUA, NOTAM, or other operational information.

**Note 3:** To ensure safe operations, use of FIS-B must be as described in paragraph 8.1 above. The minor failure classification depends on following the operational and procedural constraints in the safety requirements (Airplane/Rotorcraft Flight Manual [A/RFM] normal procedures) found in paragraph 14 below.

## 8 DESIGN CONSIDERATIONS.

- 8.1 Aircraft FIS-B avionics equipment should meet the requirements in TSO-C157b.
- 8.2 To ensure compatibility and effectiveness across a wide variety of functions and applications, the applicant should apply the following principles when determining what, if any, features of FIS-B displays should be coded red, amber (yellow), and green. Use the following guidance instead of the color guidance found in RTCA/DO-267A, section 3.8 and table 3-2:
- 8.2.1 Color assignments should follow the “strategic display philosophy of increasing potential safety hazard” so the progression from green to amber (yellow) to red corresponds to increasing degrees of threat, hazard, safety criticality, or need for flight crew awareness or response.



- 8.2.2 The uses of red, amber (yellow), and green should be compatible, although not necessarily identical, across the various displays and indications to ensure they maintain their effectiveness and intended functions.
- 8.2.3 If used, red should be associated with conditions that represent serious near-term or potential threats to safety.
- 8.2.4 If used, amber (yellow) should be associated with conditions that represent moderate near-term or potential threats to safety.
- 8.2.5 If used, green should be associated with normal, safe operation.
- 8.2.6 At no time should a display simultaneously present color-coded information that requires immediate awareness and possible action in combination with like color-coded information that is advisory in nature.
- 8.2.7 The flight crew should be able to quickly, accurately, and consistently differentiate between time-critical information and dated, non-time-critical information.

**Note:** Guidance found in section 9.2 of this AC, AC 23.1311-1C or AC 25-11B, and AC 25.1322-1, should be used in place of the color guidance in RTCA/DO-267A, section 3.8 and table 3-2.

## 9 **ELECTROMAGNETIC COMPATIBILITY.**

Perform electromagnetic compatibility tests to demonstrate that the FIS-B avionics equipment is not adversely affected and does not adversely affect other aircraft systems, including required radio systems. The FAA recommends doing radio frequency (RF) emissions tests on the FIS-B avionics equipment using AC 21-16G. Section 21.0 of RTCA/DO-160 versions D (with Changes 1, 2, and 3 incorporated), E, F, and G contains the appropriate emission of RF energy test procedures.

## 10 **LIGHTNING PROTECTION.**

If you need to install a new external antenna to support the FIS-B system, then determine lightning zones and account for system lightning protection. You can find general guidance on lightning protection in AC 20-136B. Because of the minor failure effect of FIS-B avionics equipment, you do not need to consider the indirect effects of lightning.

## 11 **ADDITIONAL INSTALLATION CONSIDERATIONS.**

You can find general guidance on installations, including external antennas, in AC 43.13-2B.

- 11.1 Install the equipment in accordance with the manufacturer's installation instructions.
- 11.2 If your FIS-B avionics equipment contains a rechargeable lithium battery, you must address the flammability risk. Rechargeable lithium batteries must meet airworthiness standards appropriate for the battery size and intended function such as TSO-C179a, *Permanently Installed Rechargeable Lithium Cells, Batteries and Battery Systems*, dated April 19, 2011. AC 20-184, *Guidance on Testing and Installation of Rechargeable Lithium Battery and Battery Systems on Aircraft*, dated October 15, 2015, provides an acceptable means of compliance for installing rechargeable lithium batteries.
- 11.3 If your FIS-B avionics equipment includes an additional external antenna(s) and the aircraft has approval for flight in known icing conditions, you must evaluate the FIS-B antenna installation to ensure that the installation does not adversely affect the aircraft's icing approval. Specific concerns to evaluate include accumulation of harmful amounts of ice that may excessively degrade aerodynamic performance, stability, or controllability; or ice shedding that may go into an engine or propeller or create hazards to the structural integrity of the aircraft. The applicable ACs on certification of aircraft for flight in icing conditions (AC 23.1419-2D with Change 1; AC 25-28; AC 27.1419 in master AC 27-1B, Changes 1-5; or AC 29.1419 in master AC 29-2C, Changes 1-5) provide an acceptable means of performing this evaluation.

## 12 **GROUND AND FLIGHT TESTS.**

### 12.1 **Ground Tests.**

The ground tests for certification should—

- 12.1.1 Ensure the controls, displays, circuit breakers, annunciations, and any placards for the FIS-B system have an unobstructed view and are easily accessible.
- 12.1.2 Ensure any self-test features, failure mode displays, and annunciations display clearly when active.
- 12.1.3 Evaluate the system installation by ensuring clear identification, accessibility, and visibility during both day and night conditions.
- 12.1.4 Evaluate the integration of the system with other aircraft communication, navigation, and surveillance (CNS) systems ensuring proper operation of the integrated system, if applicable.
- 12.1.5 Include aircraft electromagnetic compatibility ground tests to ensure the FIS-B system is compatible with aircraft electrical and electronic systems. Perform these tests in accordance with the following guidelines:

- Conduct tests with the FIS-B avionics equipment powered by the aircraft electrical power system.
- Power on all aircraft safety-related and required electrical and electronic systems during the electromagnetic compatibility tests.
- Evaluate all reasonable combinations of control settings and operating modes for the FIS-B system and aircraft safety-related and required electrical and electronic systems. With FIS-B equipment energized on the ground, individually operate other electrically operated equipment and systems on the aircraft to demonstrate electromagnetic compatibility.

## 12.2 **Flight Tests.**

The flight tests for certification should—

- 12.2.1 Demonstrate FIS-B electromagnetic compatibility with aircraft safety-related and required electrical and electronic systems. If you could not adequately operate any aircraft safety-related and required electrical and electronic systems during the aircraft electromagnetic ground tests, you should specifically monitor those systems during the flight tests. You should monitor required aircraft radio receivers with receivers tuned to frequencies where you observed effects during the aircraft electromagnetic compatibility ground tests and where you recorded significant spurious or harmonic emissions during emissions tests (refer to paragraph 10).
- 12.2.2 Insert (simulate) failure modes for conditions that you could not test on the ground, as necessary, to verify aural and visual annunciation and assess additional pilot workload.

## 13 **AIRPLANE/ROTORCRAFT FLIGHT MANUAL (A/RFM) SUPPLEMENT.**

- 13.1 Provide an A/RFM or A/RFM supplement (A/RFMS), as applicable, with operating procedures for the FIS-B system. The A/RFM(S) Normal Operating Procedures section must include the following statements:

*“FIS-B information may be used for pilot planning decisions focused on updating the pilot’s awareness of the dynamic flight environment, including avoiding areas of inclement weather that are beyond visual range and pilot near-term decisions where poor visibility precludes visual acquisition of inclement weather. FIS-B weather and NAS status information may be used as follows:*

*(a) To promote pilot awareness of own ship location with respect to reported weather, including hazardous meteorological conditions, NAS status indicators to enhance pilot planning decisions, and pilot near-term decision making.*

*(b) To cue the pilot to communicate with air traffic control, a Flight Service Station specialist, operator dispatch, or an airline operations control center for general and mission critical meteorological information, NAS status conditions, or both.*

*FIS-B information, including weather information, NOTAMs, and TFR areas, are intended for the sole purpose of assisting in long-/near-term planning and decision making. The system lacks sufficient resolution and updating capability necessary for aerial maneuvering associated with immediate decisions. In particular, in extreme scenarios, the oldest weather radar data on the display can be up to 15 to 20 minutes older than the display's age indication for that weather radar data. Therefore, do not attempt to use FIS-B weather information to maneuver the aircraft at minimum safe distances from hazardous weather.*

*FIS-B information must not be used in place of a standard preflight briefing.”*

13.2 You may meet the requirement of this paragraph by attaching the equipment operating manual to the A/RFM(S), as long as the manual contains the above statements.

14 **WHERE TO FIND THIS AC.**

14.1 You may find this AC at [http://www.faa.gov/regulations\\_policies/advisory\\_circulars/](http://www.faa.gov/regulations_policies/advisory_circulars/).

14.2 If you have suggestions for improving this AC, you may use the Advisory Circular Feedback form at the end of this AC.



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## Advisory Circular Feedback

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by (1) emailing this form to [9-AWA-AVS-AIR500-Coord@faa.gov](mailto:9-AWA-AVS-AIR500-Coord@faa.gov) or (2) faxing it to the attention of the Aircraft Certification Service Directives Management Officer at (202) 267-3983.

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