



# ADVISORY CIRCULAR

## DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION

**SUBJECT:** MAINTENANCE AND HANDLING OF AIR-DRIVEN GYROSCOPIC INSTRUMENTS

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1. PURPOSE. This Advisory Circular is issued to advise operators of general aviation aircraft of the need for proper maintenance of air-driven gyroscopic instruments and associated air filters.
  2. BACKGROUND. The Federal Aviation Administration conducted an investigation of air-driven gyroscopic instrument malfunctions. The investigation was directed primarily to directional and attitude instruments. The major reasons for removal of gyro horizons were failure to erect and tumbling due to improper gyro speed; in directional gyros the reason was precession. Generally, dirty air filters were found to be the causes of malfunctions.
  3. GENERAL. A large number of general aviation operators are not aware of the importance of proper instrument maintenance. There are a number of simple operational checks that can be easily and quickly performed at any time and will give an indication of instrument malfunction and impending failure. Some of these checks are:
    - a. During preflight, inspect instruments for poor condition, mounting, marking, broken or loose knobs, bent or missing pointers, and (where applicable) improper operation.
    - b. Check power-off indications of instrument pointers, tape scales, and warning flags for proper indications.
    - c. Apply power during engine runup and check for excessive mechanical noise, erratic or intermittent operation, failure to indicate, sluggishness or indication of excessive friction.
    - d. Check that erection or warmup time is not excessive, caging functions are normal, and warning flags and indicating lights and test circuits are operable.
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- e. Check pneumatic tubing for leaks, corrosion, erosion, cracks, bends and pinching, and evidence of chafing.
  - f. Check for evidence of overheating. Dust, dirt, and lint contribute to overheating of equipment and malfunctioning. If contamination is present or suspected, check the air filter and clean or replace as necessary.
4. DISCUSSION. The FAA investigation determined that contaminated bearings are the major cause of air-driven gyro instrument malfunctions.
- a. Contamination is caused by foreign material induced into the instrument by the vacuum/pressure air system. Since the air to drive the gyro rotor passes through the rotor bearings, any dirt, tars, moisture, etc. passed by the filter will collect on the bearings. Contamination can result during operation due to the normal amount of contaminants in the air. Dirty bearings will cause reduced rotor speeds resulting in various types of malfunctions and can cause bearing failure.
  - b. Regular checks and maintenance must be performed in order for gyroscopic instruments to perform satisfactorily. Recommendations of instrument and aircraft manufacturers should be followed to assure that maximum performance, accuracy, and reliability are obtained from the instrument. Cleaning or replacement of air filters is important to maintaining reliable instrument operation, and should be accomplished at the intervals recommended by the manufacturer.
  - c. A number of filters for the air supply to gyroscopic instruments are available. If the instruments do not have an air filter system, the installation of one should be seriously considered. The aircraft owner should specify that it be installed in an accessible location so that it can be removed easily for checking or replacement. Some central air filters are panel-mounted for ease of maintenance.
  - d. Improper handling and packaging of gyroscopic instruments also contributes to malfunctions. Careless handling and packaging by un-informed personnel during removal, installation, and transporting can turn a minor repair into a major one.
  - e. Instruments should be checked for proper operation after installation and periodically thereafter. The suggested inspections and checks contained in paragraph 3 of this circular, if performed regularly in addition to those required by the Federal Aviation Regulations, will help to detect the early signs of instrument malfunctioning. Operations with malfunctioning instruments are hazards to flight.

  
acting Director  
Flight Standards Service