FLIGHT SAFETY FOUNDATION

Aviation Mechanics Bulletin

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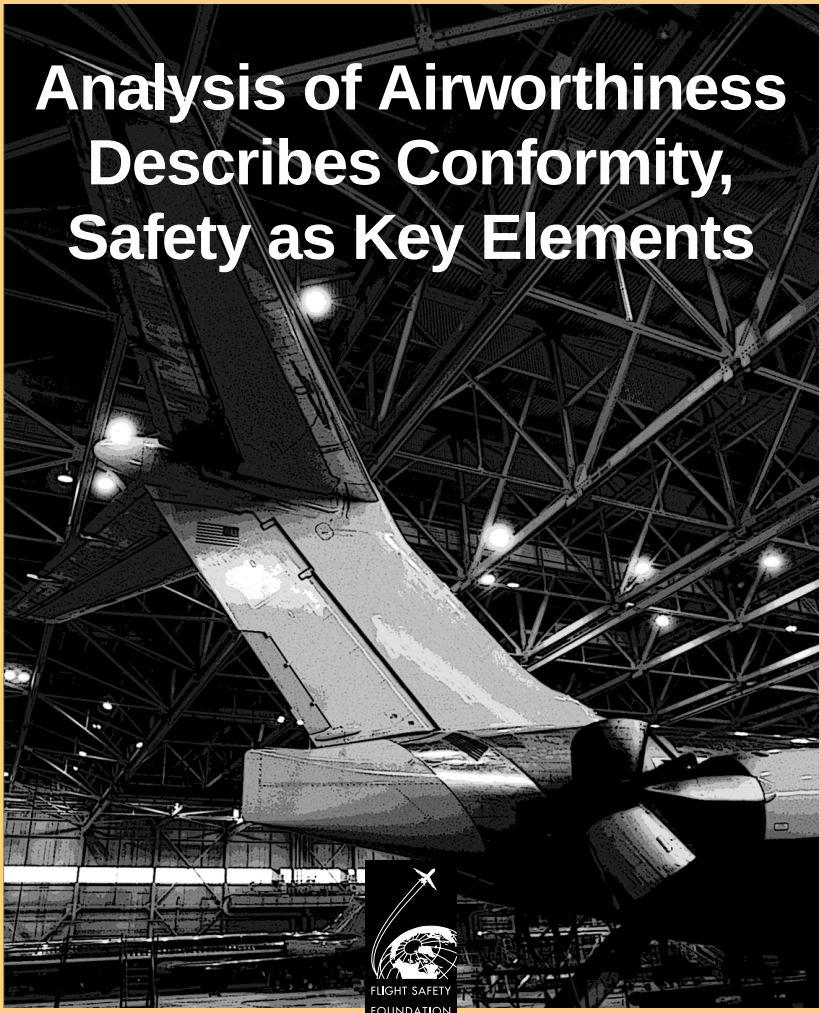
Analysis of Airworthiness Describes Conformity, Safety as Key Elements



FLIGHT SAFETY FOUNDATION

Aviation Mechanics Bulletin

Dedicated to the aviation mechanic whose knowledge, craftsmanship and integrity form the core of air safety.

Robert A. Feeler, editorial coordinator

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Analysis of Airworthiness Describes Conformity, Safety as Key Elements

Meeting standards depends on regulatory authorities and manufacturers, as well as the maintenance community.

—

Jack Hessburg

Practical interpretations of airworthiness — and the development of airworthiness standards — are the responsibility of government regulatory authorities, most of which base their regulations on the standards and recommendations of the International Civil Aviation Organization (ICAO).

ICAO adopted *Annex 8, International Standards and Recommended Practices for the Airworthiness of Aircraft,* in 1949 and has revised the annex several times.[1] The standards include a broad outline of requirements for aircraft structures, design and construction, operating limitations, flight characteristics, engines, propellers, instruments and other equipment. The standards also require that every regulatory authority either should establish its own airworthiness code, as the U.S. Federal Aviation Administration (FAA) did, or should base its code on another code already established by an ICAO contracting state, as the Joint Aviation Authorities (JAA) did when it modeled airworthiness regulations largely on those established by FAA.[2]

Airworthiness regulations established by FAA, JAA, Transport Canada and the Civil Aviation Safety Authority in Australia are largely

similar, and representatives of the four authorities are further harmonizing their regulations by developing standard language in some areas where differences remain, said Nagwa El-Aasar, technical officer in ICAO's operations and airworthiness department.[3]

The foreword to *Annex 8* said that ICAO standards are intended "to define, for application by the competent national authorities, the minimum level of airworthiness constituting the international basis for the recognition by states … of certificates of airworthiness for the purpose of the flight of aircraft of other states into or over their territories."[4]

In the United States, the administrator of the FAA sets the standards for airworthiness. The Federal Aviation Act of 1958, Section 601, said, "The administrator … shall promote safe flight … by prescribing … standards required in the interest of safety for appliances and for the design, material, construction, quality of work, and performance of aircraft, aircraft engines, and propellers."

U.S. Federal Aviation Regulations (FARs), in Part 21.183 and in numerous other references to airworthiness, outline the two conditions that generally are understood to constitute the FAA's definition of airworthiness: that the aircraft "conform to the type design" and that the aircraft "is in condition for safe operation." (Conformity to the type design includes conformity to applicable supplemental type design. Assuring a condition for safe operation, in part, requires compliance with applicable airworthiness directives [ADs] as outlined in FARs Part 39.)

The basis of certification is established before the certification process begins for any aircraft design and defines which FARs are applicable, and — possibly — which special conditions and exemptions the manufacturer will use to demonstrate the airworthiness of an aircraft design. During the certification process, the manufacturer demonstrates the conformity (or airworthiness) of the design by showing how devices, systems, features or performance in the design fulfill the applicable requirements. The regulatory basis of certification then is cited in the aircraft, power plant or propeller type-certification data sheet**.**

Conformity to the type-certification standards is at the heart of aircraft airworthiness. Assuring continued airworthiness is a key function of the maintenance community.

Safe operation in the conduct of a given flight is the responsibility of the pilot-in-command[5] (or, in some instances, the concurrent responsibility of the pilot-in-command, a certificated dispatcher and air traffic controllers).

In terms of airworthiness, safe operation depends upon:

- Whether the aircraft is airworthy. The aircraft must be in full conformity with applicable airworthiness standards. Certificated maintenance personnel make this determination and convey it to the pilot-in-command;
- Whether the aircraft is capable of safe flight. The aircraft may be in full conformity with airworthiness standards and still may not be capable of safe flight. An example is an airplane coated with ice and snow; and,
- Whether the aircraft is properly equipped for the proposed operation. Examples include having operative anti-icing equipment for flight into areas of known icing; equipment for extended-range twin-engine operations (ETOPS), including verification that the aircraft meets requirements for ETOPS; navigation equipment appropriate for the route to be flown and for the planned type of landing approach, perhaps including verification that the aircraft is capable of operation at lower minimums (Category II or Category III instrument landing system instrument approach procedures, for example); and communications equipment appropriate for the planned route of flight, such as a high-frequency radio for extended overwater operations.

Safe operation also is determined by such factors as the aircraft's takeoff performance, en route performance and landing performance; the aircraft's weight and center of gravity; weather conditions during takeoff, while en route and during landing, including whether instrument approach minimums are within limits; a properly prepared flight plan, including fuel requirements; and the flight crew's knowledge of the current status of navigation aids that will be used.

Practical factors affect airworthiness after the aircraft's original type certification. Maintenance technicians must have current information to enable themselves to answer several practical questions: How is conformity lost, and regained? Who is responsible for aircraft airworthiness? Who may perform maintenance? Who may declare an aircraft airworthy?

Continued airworthiness is a more prominent issue than ever, partly because transport aircraft may remain in service for 30 years or longer. During that period, the aircraft may have several owners in countries with different operating and maintenance standards and may be subject to airworthiness authorities with different regulatory standards.[6]

In the United States, continued airworthiness is defined in the "Instructions for Continued Airworthiness" in the FARs (see "Instructions for Continuing Airworthiness"). The JARs contain similar standards for continued airworthiness.

Instructions for Continued Airworthiness

- U.S. Federal Aviation Regulations (FARs) Part 23.1529 and Appendix G for normal, utility, acrobatic and commuter category aircraft
- FARs Part 25.1529 and Appendix H for transport category aircraft
- FARs Part 27.1529 and Appendix A for normal category rotorcraft
- FARs Part 29.1529 and Appendix A for transport category rotorcraft
- FARs Part 31.82 and Appendix A for manned free balloons
- FARs Part 33.4 and Appendix A for powerplants
- FARs Part 35.4 and Appendix A for propellers

Source: U.S. Federal Aviation Administration

Among the items included in the FARs instructions are:

- Recommended and mandatory (airworthiness limitation) periods setting forth replacement time for component and structural items (life-limited parts);
- An inspection program that includes the inspections necessary to provide for continued airworthiness of the aircraft. This includes scheduling information that specifies the recommended periods during which components, systems and structures should be cleaned, inspected, adjusted, tested, lubricated or overhauled and establishes structural inspection intervals; and,
- Maintenance instructions, including information on troubleshooting; removing and installing systems and components; servicing; rigging; weighing and determining the center of gravity; lifting and shoring; and storing. The instructions also require procedures for testing systems and components, applicable wear tolerances and operating tolerances, and special inspection methods such as radiographic or ultrasonic inspections.

The airworthiness limitations section of a manufacturer's maintenance manual specifies mandatory inspection times and replacement times required under FARs Part 43.16 and Part 91.409 or an FAA-approved large-aircraft maintenance-inspection program.

The implications for maintenance professionals are clear:

- If the required inspections, checks and replacements defined in the instructions are not accomplished, the aircraft is not airworthy;

- If a component, system or item of structure does not meet the allowable wear limits and damage limits defined in the instructions, that component, system or item of structure is not airworthy; and,

- If an item exceeds its replacement time (life limit), that item is not airworthy.

The presence of an airworthiness certificate aboard the aircraft does not ensure that the aircraft is airworthy; the certificate is valid only as long as the aircraft conforms to its basis of certification. There must be evidence that the aircraft has had the required maintenance performed — and is in compliance with applicable ADs — to keep the aircraft in conformity.

When an unsafe condition is found in a certified aeronautical product, FAA issues an AD. An unsafe condition is defined as a state that was not foreseen in the original certification of the product. The AD identifies the disparity, explains in detail the unsafe condition and establishes limitations for inspection, repair or alteration under which the product may continue to be operated. Compliance with an AD is mandatory. An aircraft that is not in compliance with an applicable AD is not airworthy.

The FARs specify that all installed aircraft equipment required by the airworthiness regulations must be operative for an aircraft to conform. Nevertheless, under defined circumstances, the FARs allow an aircraft to be operated with inoperative equipment. Experience has shown that, given the varying levels of redundancy designed into aircraft, not every system or installed component must be operative, as long as the remaining operative equipment provides an acceptable level of safety. A minimum equipment list (MEL), developed for each aircraft type, identifies the items of equipment that may be inoperative. (Similarly, a configuration deviation list identifies minor fairings and cover panels that may be missing from the aircraft under controlled conditions.)

The intent of the MEL regulations is to permit operation of an aircraft, for a limited time, by allowing deferral of repairs or deferred replacement of defective equipment. Flight operations under an approved MEL are not considered contrary to the requirements of airworthiness.

Nevertheless, nothing in the MEL concept supersedes the authority of the pilot-in-command. Within the scope of responsibility of the pilot for safe flight operations, pilots may require that any item covered by the MEL be repaired or replaced before flight.

Standards for conducting maintenance are defined by the criteria established

in FARs Part 91 Subpart E and Part 43. These standards are applicable for all operators. Exceptions are permitted from some of these regulations, however, for operators other than general aviation operators. For example, air carrier maintenance is governed by maintenance programs (see "Basic Maintenance Requirements") mandated in FARs Part 121, Part 125, Part 129 and Part 135. Regardless of the FAA maintenance program followed, the specifics can be traced to the "Instructions for Continued Airworthiness."

FARs Part 91.403 clearly establishes responsibility for airworthiness: "The owner or operator of an aircraft is primarily responsible for maintaining that aircraft in an airworthy condition."

For air carriers, this responsibility is defined by separate regulations that specifically impose the same requirement upon air carrier certificate holders as the requirement contained in FARs Part 91.403.

FARs Part 43.3 specifies who is authorized to perform maintenance: the holder of a mechanic certificate under the limitations of the individual's certificate, the holder of a repairman certificate under the limitations of the individual's certificate, the holder of a repair station certificate under the limitations of the certificate, and the holder of an air carrier operating certificate under an approved maintenance program.

The standards for performance of maintenance are contained in FARs Part 43.13 and Part 43.15.

Basic Maintenance Requirements

- U.S. Federal Aviation Regulations (FARs) Part 91 Subpart E — *Maintenance, Preventive Maintenance and Alterations* defines the basic requirements for maintenance, including responsibility for maintenance
- FARs Part 43 — *Maintenance, Preventive Maintenance, Rebuilding and Alteration* defines the criteria for the performance of maintenance and the rules for return to service

Air Carriers and Operators for Compensation or Hire — Maintenance Requirements

- FARs Part 121 Subpart L — *Maintenance, Preventive Maintenance and Alterations*
- FARs Part 125 Subpart G — *Maintenance* (FARs Part 125 is not an air carrier regulation but is included in this table for completeness.)
- FARs Part 129.14 — *Maintenance program and minimum equipment list requirements for U.S.-registered aircraft* (This applies for foreign air carriers operating U.S.-registered aircraft.)
- FARs Part 135 Subpart J — *Maintenance, Preventive Maintenance and Alterations*

Source: U.S. Federal Aviation Administration

"Approval for return to service"[7] is the phrase used to identify an aircraft as airworthy after the performance of maintenance, rebuilding or alteration. Individuals authorized to return an aircraft to service after maintenance include the holder of a mechanic certificate or an inspection authorization, the holder of a repair station certificate and the holder of an air carrier operating certificate.[8]

When giving approval for return to service, an authorized person must make an entry in the maintenance record. For air carriers, this is a maintenance release, frequently called an "airworthiness release" or "logbook sign-off."

The record entry is the method of showing compliance with the regulations, regardless of the entry's specific phrasing. For example, an air carrier operating under FARs Part 121 or Part 135, when signing approval for return to service, attests that:

- The work was performed in accordance with approved or acceptable procedures, methods and materials;
- All items that were required to be inspected were, in fact, inspected by an authorized person who determined that the work was completed satisfactorily;
- No known condition exists that would make the aircraft unairworthy; and,
- Regarding the work performed, the aircraft is in condition for safe operation.

Airworthiness is never conditional. An aircraft either is in conformity with the regulations and in safe condition to be operated, or it is not.

The test for determining airworthiness is simple. If a given function, device or system is required for type certification conformity, then that function, device or system probably is an airworthiness item. This includes the performance of required maintenance defined in the "Instructions for Continued Airworthiness."

The variable methods for assuring continuing airworthiness sometimes are complex and difficult to understand. But the basic principle is easily understood. The principle simply requires assuring conformity to the basis of type certification. If conformity cannot be met because a given item is not working, then the item must be repaired or replaced, unless the repair or replacement is deferred under an approved MEL before further flight.

When performing maintenance, aircraft airworthiness will be assured if

maintenance technicians follow the maintenance manual and other approved documents that make up the "Instructions for Continued Airworthiness." In an approved air carrier maintenance program, the operator's maintenance manual and other documents that define the program must be followed. But no document or program is perfect. Therefore, maintenance technicians must rely on their professional judgment and their experience if they doubt conformity and do not have specific guidance for the situation.

Assurance of airworthiness depends on three groups performing three separate roles: The regulatory authority defines and enforces airworthiness type design and maintenance regulations, including ADs; manufacturers demonstrate conformity to type design standards and provide current instructions for continued airworthiness; and maintenance personnel inspect and maintain aircraft based on the airworthiness regulations, ADs and manufacturers' instructions.♦

Notes and References

1. International Civil Aviation Organization (ICAO). *Annex 8, Airworthiness of Aircraft.* Foreword. Eighth Edition. Montreal, Canada, 1988.

2. Joint Aviation Requirements (JARs) Part 25 says, "An existing airworthiness code (FAR [U.S. Federal Aviation Regulations] Part 25 of the Federal Aviation Administration of the United States of America) has been selected to form the basis of the JAR for Large Aeroplanes, and is referred to as the Basic Code." (A large airplane is one with a maximum certificated takeoff weight of more than 5,700 kilograms/ 12,500 pounds.)

3. El-Aasar, Nagwa. Telephone interview by Werfelman, Linda. Alexandria, Virginia, U.S., April 7, 2000. Flight Safety Foundation, Alexandria, Virginia, U.S.

4. ICAO.

5. FARs Part 91.7 says in part, "The pilot-in-command of a civil aircraft is responsible for determining whether that aircraft is in condition for safe flight."

6. International Federation of Airworthiness.

7. A manufacturer may approve an aircraft for return to service within certain limitations. FARs Part 43.5 and Part 43.7 contain requirements for approval for return to service.

8. An FAA inspection authorization is a variation of the mechanic's certificate that grants further privileges to a certificated mechanic. Individuals with inspection authorizations are employed in general aviation. Their services are not required in air carrier maintenance programs.

About the Author

Jack Hessburg retired in 1999 as chief mechanic, new airplanes, The Boeing Co. He has more than 40 years experience in air carrier maintenance and flight operations, including 26 years at Boeing. Hessburg is a mechanical engineer and a licensed airframe and powerplant mechanic. He received the Joe Chase Award from Flight Safety Foundation and the Professional Aviation Maintenance Association in 1994.

Further Reading From FSF Publications

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Crotty, B.J. "F-117A Accident during Air Show Flyover Caused by Omission of Fasteners in Wing-support Structure." *Aviation Mechanics Bulletin* Volume 46 (September–October 1998): 1–8.

Crotty, B.J. "Unrecorded Maintenance on Fokker 100 Lift-dumper System Leads to Wing-Surface Damage in Flight." *Aviation Mechanics Bulletin* Volume 46 (May–June 1998): 1–6.

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Feeler, R.A. "Maintenance Records: What Is Legal May Not Appear to Be Logical." *Aviation Mechanics Bulletin* Volume 42 (May–June 1994): 1–10.

Pope, J.A. "Missing Screws Send Commuter Plummeting." *Accident Prevention* Volume 50 (January 1993): 1–7.

King, J.L. "Continued Airworthiness of Aging Corporate Aircraft." *Aviation Mechanics Bulletin* Volume 18 (March–April 1990): 1–8.

FAA Orders Inspections Of Boeing 717-200 Integrated Standby Instrument System

The U.S. Federal Aviation Administration (FAA) has ordered immediate inspections of Boeing 717-200 series aircraft to check for electrical problems in the integrated standby instrument system (ISIS) altitude display and to modify the units before further flight. The order affects 14 B-717-200 aircraft.

Issuance of the airworthiness directive (AD) follows reports of two instances of intermittent loss of altitude data on the ISIS altitude display and on the primary flight display of the captain and first officer. In both instances, airspeed indication and altitude indication continued to operate, and the flights continued to their intended destinations without further incident.

The first B-717s went into service in 1999. The 14 aircraft affected by the AD are operated by Trans World Airlines and AirTran Airways. (The only other two B-717-200 aircraft are operated by Olympic Airways in Greece.)

The modification ordered by the AD is expected to require about two hours of labor per airplane. The modification calls for electrical cables between the cockpit glareshield control panel and the ISIS to be coiled and stowed and for other steps to be taken to isolate the ISIS from other cockpit instrumentation.

Changes Ordered in Components Of A300 Landing Gear

The Australian Civil Aviation Safety Authority (CASA) has issued an airworthiness directive (AD) to require modification of Airbus A300-600 landing-gear proximity-sensor electrical looms to prevent water and dirt from interfering with their operation.

The AD also requires modification of the landing-gear tachometer drive shaft to correct operation of the speed sensors.

Both actions were required to be taken before March 31, 2001, and both must be performed in accordance with service bulletins issued by Airbus Industrie (bulletin A300-32-6069 or A300-32-6069 Rev 01 and bulletin A300-32-6077 or A300-32-6077 Rev 01).

Issuance of the AD follows an incident in which an A300-600 overran a

runway on landing. CASA said that an investigation revealed that the incident was a result of degradation of the airplane's braking-system performance and the nonextension of spoiler 1 and spoiler 4. An analysis said that the poor condition of the electrical connectors and the improper operation of the tachometer drive shafts caused the landing-gear tachometers to supply incorrect speed signals.

New Latches Recommended For Eurocopter BK117s

The U.S. National Transportation Safety Board (NTSB) has recommended requiring operators of Eurocopter BK117s to install hook-type latches to prevent cowling-access doors from opening while the helicopters are in flight.

The recommendation to the U.S. Federal Aviation Administration (FAA) followed an Aug. 28, 1998, accident in which the no. 1 engine cowling and its access door separated during an approach to landing. None of the three occupants was injured, but the helicopter was substantially damaged in the accident, which occurred at the conclusion of a flight to test the no. 1 engine, which had been replaced.

The pilot said that the helicopter experienced a severe in-flight vibration, followed by a loud bang, before the accident. A postaccident inspection revealed that the no. 1 engine cowling and its access door had separated in flight and had struck the main-rotor blades and tail-rotor blades, causing tail-rotor imbalance and loss of the tail-rotor gear box. The inspection also revealed that the forward adjustable latch on the engine cowling-access door was deformed and that the aft adjustable latch was undamaged. All three wing-head stud fasteners were missing, and two forward wing-head stud-fastener holes were distorted. The report said that the access door had opened because the aft adjustable latch had not been secured properly and that, because the face of the latch covers the hook even when the hook is not engaged, flight crews can believe that the latches are secure when they are not.

NTSB recommended that FAA issue an airworthiness directive (AD) to require compliance with Eurocopter Service Bulletin MBB-BK 117-20-109 to "enhance safety and prevent the cowling-access doors from opening fully and coming in contact with the rotor blades in flight." Eurocopter issued the service bulletin in 1997, recommending that a hook-type latch be fitted onto cowling-access doors to prevent them from opening if adjustable latches failed or were secured improperly. Eurocopter's predecessor — Messerschmitt, Bolkow and Blohm — issued a service alert bulletin calling for replacement and relocation of

latches and installation of wing-head stud fasteners to ensure a secure fit of cowling-access doors in 1989, after several incidents involving in-flight separation of engine-cowling access doors or transmission-cowling access doors. Six years later, FAA issued an AD to make compliance with the service alert bulletin mandatory.

Cracks Reported in Torque Knee of King Air Landing Gear

A Beech King Air Model C-90 pulled to the right during a landing roll and traveled off the runway before stopping.

An investigation revealed three cracks in the upper half of the right-main landing-gear torque-knee assembly. (Total time for the part was 170 hours.) The cracks allowed the main-gear wheel assembly to rotate on the lower section of the strut, resulting in the loss of directional control.

Beech issued a service bulletin (32-3134) describing an inspection procedure and informing aircraft owners that the replacement parts will be constructed of a steel alloy; the torque-knee assemblies were constructed of aluminum.

Corrosion Found in Antiskid Transducer On Cessna Citation

A maintenance technician who was installing a right-main landing-gear assembly tried to position the brake antiskid transducer so that he could install axle nut locking screws. The antiskid transducer typically can be moved easily, but in this instance, tools were needed because the antiskid transducer was stuck inside the axle.

The maintenance technician removed the antiskid transducer and found corrosion on the unit, as well as on the wiring harness, plug assembly, expansion plug and interior lower surface of the inboard end of the axle. The technician said that water had entered the axle interior through the roll pin, which had been safety-wired but not sealed; other contaminants also may have entered through the roll pin.

The person who filed the report on the problem with the U.S. Federal Aviation Administration, who was not identified by name, suggested frequent inspections of the antiskid transducer and the axle interior. He also suggested that maintenance technicians ensure that the axle interior is sealed and repaired.♦

Sponge Speeds Application of Paint-Removers, Cleaners

U.S. Technology's SpongeBlast products are designed to speed the removal of paint from aircraft or the application of cleaning agents to aircraft and a variety of other equipment, said the manufacturer.

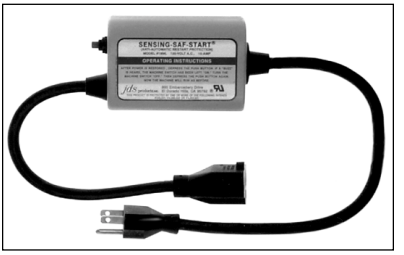
The new family of products is comprised of sponge particles embedded with abrasives or cleaning agents that are released when the sponge particles impact a surface. The products are used for removing paint, oil, film or other materials from large surfaces and are designed to limit the amount of dust generated by the process, said the manufacturer.

SpongeBlast

For more information: U.S. Technology, 220 Seventh Street SE, Canton, OH 44702, U.S. Telephone: (800) 634-9185 (U.S.) or +1 (330) 455-1181.

Devices Block Automatic Restarts of Small Machines After Power Outages

JDS Products' Sensing-Saf-Start replaces the power cords on small machines to prevent the machines from restarting automatically after a power interruption, said the manufacturer.



Sensing-Saf-Start

During electrical power outages, the device breaks electrical continuity to prevent equipment from restarting when electrical power is restored. The device requires the equipment's power switch to be turned off manually and then turned on manually to restore electrical continuity.

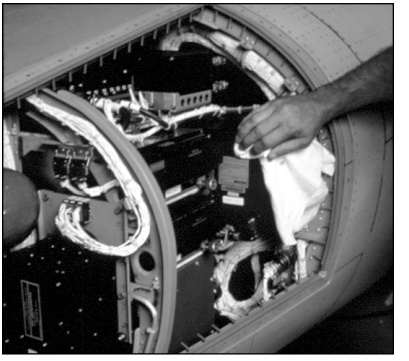
Sensing-Saf-Start devices are available in three 120-volt models and one 240-volt model.

For more information: JDS Products, 895 Embarcadero Drive, El Dorado Hills, CA 95762, U.S. Telephone: (800) 486-4993 (U.S.) and +1 (916) 933-2699.

Cleaning Wipe Reduces Lint, Won't Scratch Surfaces

DuPont's Sontara spunlaced fabric, a wipe made from wood pulp and polyester fibers, has been developed for use in aviation maintenance.

Sontara releases less lint than cloth rags, is more absorbent and has a higher wet-strength, said the manufacturer. The fabric will not scratch surfaces or become snagged on bolts or edges, the manufacturer said.



Sontara

For more information: Gish, Sherwood & Friends, 4235 Hillsboro Road, Nashville, TN 37215-3344, U.S. Telephone: +1 (615) 385-1100, ext. 274.

Hand-held Thickness Gauges Measure Fabricated Parts

Krautkramer Branson's CL3 and CL3 DL ultrasonic thickness gauges are hand-held, microprocessor-controlled measuring instruments designed for use on fabricated parts in which access is available to only one side, said the manufacturer.

Both instruments can be used to measure the thickness of incoming material, conduct quality control on finished parts and monitor machining operations, said the manufacturer.

The CL3 has five keys to control all instrument functions. The CL3 DL has additional keys for storage functions and transferring data files, as well as a data-logger to improve readability of test results, said the manufacturer.

For more information: Krautkramer Branson, 50 Industrial Park Road, Lewistown, PA 17044, U.S. Telephone: +1 (712) 242-0327.

Videoscope Developed For Aircraft-engine Inspections

A five-millimeter (0.2-inch) videoscope has been developed by Olympus America Industrial Products Group for use in inspections of small aircraft engines.

The videoscope is an alternative to flexible fiberscopes, which have been

the main means of inspecting small engines, the manufacturer said. The IV5C6 videoscope transmits full-screen video images of small-engine turbine blades, vanes, compressors and other parts that cannot be accessed by scopes with larger diameters.

IV5C6 Videoscope

For more information: Olympus Industrial Products Group, Two Corporate Center Drive, Melville, NY 11747-3157, U.S. Telephone: (800) 446-5260 (U.S.) or +1 (516) 844-5888.

Cleaner Introduced For Aircraft Alloy Parts

Neutra-Green Neutral pH Cleaner/Degreaser is a biodegradable cleaner suitable for use on aircraft alloy parts. Neutra-Green can be used on hard surfaces to clean without caustics, butyl ethers, chlorinated solvents or other harsh ingredients, said the manufacturer.

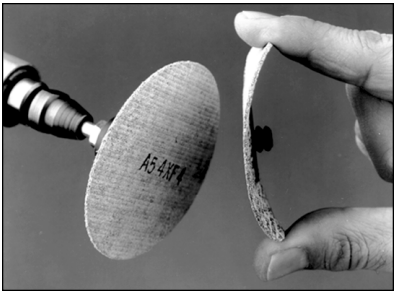
Neutra-Green is a concentrated cleaner that can be used on gold, silver, anodized aluminum, steel and other surfaces. The cleaner can be used in machine shops to remove lubricating oils and greases, said the manufacturer.

For more information: R.H. Blake, 26600 Renaissance Parkway, Cleveland, OH 44128, U.S. Telephone: +1 (215) 595-2400.

Quick-change Abrasive Discs Follow Contours

Quick-change cotton-fiber abrasive discs follow the contours of aluminum, composite, titanium and stainless steel structures without gouging, said the manufacturer.

Rex-Cut Extra Flexible Quick Change Discs are made of multiple layers of non-woven cotton fiber that contain abrasive grains. Fresh abrasives are released as the discs grind, blend and finish. They are available with two-inch (five-centimeter) and three-inch (7.6-centimeter) sizes with aluminum oxide or silicon carbide abrasives and various grits.



Extra Flexible Quick Change Discs

For more information: Rex-Cut Products, 960 Airport Road, P.O. Box 2109, Fall River, MA 02722, U.S. Telephone: (800) 225-8182 (U.S.) or (508) 678-1985.

MSDS Program Maintains Records on Hazardous Materials

The 3E Co. material safety data sheets (MSDS) compliance program maintains MSDS and chemical records to satisfy U.S. government requirements, said the company.

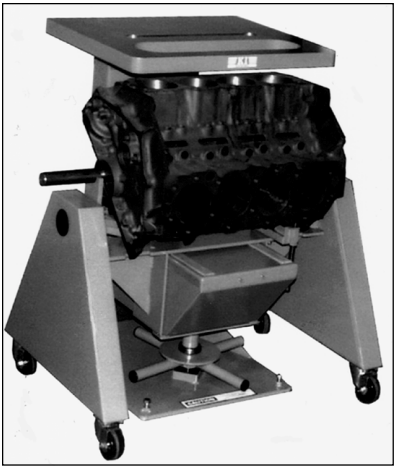
The MSDS on Demand program maintains a computerized record of a company's chemical inventory, performs needed updates and provides instant, 24-hour-a-day access to MSDS materials over the Internet or with a telephone call, said the company. Hazardous-materials specialists are available to help resolve specific problems.

For more information: 3E Co., 1905 Aston Ave., Carlsbad, CA 92008, U.S. Telephone: (800) 360-3220 (U.S.) or (760) 602-8700.

Device Makes Loading Of Engine Blocks Easier

Kansas Instruments' Block Shuttle is a moveable, block-loading fixture that attaches to the boring stand and makes loading and unloading engine blocks easier, said the manufacturer.

The fixture, designed for use in ground-equipment maintenance, allows the engine block to be rolled to another station in the shop after boring.



Block Shuttle

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