FAR's For Aviation Mechanics Under One Cover

The 1988 edition of the book *Federal Aviation Regulations For Mechanics* is now available. This publication offers the mechanic all of the needed FAA regulations under one cover, a convenience that eliminates the need to maintain a hefty library. That fact, together with the convenience of having an index, makes it worth the price.

The publication is available from International Aviation Publishers, Inc., P.O. Box 10000, Casper, WY, 82602, U.S.; or call toll-free, 800-443-9250. The price is $15.95 plus $3.00 for shipping and handling.

Where Can I Purchase NDT Equipment?

Recently, while observing the use of nondestructive testing equipment during a special inspection at a prominent fixed base operator's facilities, I was approached by several mechanics who asked the question: Where do you shop for NDT equipment? The equipment being used for this inspection was aboard a scrubbed-clean windowless van conversion, and most of the equipment was very portable. Some of the read-out screens were permanently mounted in the van, others were portable with the equipment. The van was parked in the hangar, next to the aircraft being inspected, and electrically plugged into a convenient wall outlet for its 110V electrical needs. Most of the portable inspection devices were self-powered. The entire operation was owned and operated by an aviation mechanic who specialized in this type work. His work schedule was booked in advance for the next six months except for emergencies. This desirable self-owned maintenance facility on wheels, fully booked, required a sizeable investment.

The procurement question was answered by the operator himself. He stated that once you show interest, and send for the equipment manufacturer's catalogs from ads in the aviation magazines, your mailbox will be flooded with the details that you need. In fact he added, "there is an outfit in Georgia that has a newsletter containing equipment classifieds of used and new NDT equipment for sale." His copy on hand had this address: Quality Testing Technologies, Inc., 595-1 Roswell Street, Marietta, GA 30066, U.S. I sent for a copy and found a listing of new, used, surplus NDT equipment at seemingly affordable prices. Their mailings reach over 7,000 interested people around the country. Their classifieds included such equipment as ultrasonics, remote viewing, surface roughness, eddy current, bond testing, ultraviolet inspection, magnetic particle, liquid penetrant, borescopes, in all new and used status.

Available — A Comprehensive Guide To Aircraft Maintenance Tools

The next time the Snap-On tool truck calls at your facility, ask the operator for a free copy of *A Comprehensive Guide To Aircraft Maintenance Tools.* There are over 68 pages of information you need to professionally service transport, passenger, military, cargo, business and utility aircraft, including helicopters. It illustrates the right tool for the right job. You can get it immediately from Snap-On Tools Corp., Dept. 8115-I, Kenosha, WI 53140.

Lightweight High-Speed Buffer

One of the most sought after and least available tools for the mechanic is a lightweight buffer that can operate at high rpm. There is one now available on the market that is designed to maintain the luster of already polished aircraft surfaces. The Aircrafter buffer was developed in conjunction with the Aluminum Company of America (Alcoa), the producer of major aluminum skin applications for the aviation industry. The tool is available in single or double buffer models powered by a 1.6 hp air motor that produces buffing speeds of up to 4,500 rpm.

The buffer serves a variety of polishing needs from heavy-duty sanding to delicate polishing. The buffs can be changed to suit finishing requirements on the spot, going from one type requirement to the other.

New Corrosion Treatment Developed

A new corrosion treatment process called ACF-50 is now in use. The product is designed to arrest corrosion or prevent it from occurring.

A clear material, this product reportedly leaves no undesirable odor, or gummy or waxy residue. It reportedly will not deteriorate seals, gaskets, or electrical components.

The application system uses a high-pressure pump that atomizes the liquid into a wet type foggy mist that clings to the metal. Then through capillary action, the liquid seemingly fuses into skin formations and around rivets to drive moisture from the aircraft. If corrosion exists, this product penetrates the corrosion cells, removes the moisture present, and terminates the electrolysis.

FAA Announces New Series of Written Tests For A&P Mechanics

FAA Advisory Circular No. 60-20 dated 6/1/88 announces the availability of the new series written test question books for use in the airman certification program (Airframe and Powerplant Certificates).

The written test question books that have been in use since March 1, 1986, expired on September 1, 1988. On March 1, 1988, the FAA made available a new series of question books to replace the old books. Question selection sheets to be used with the new books will be distributed to the written test examiners by the designating district offices. Applicants for the Airframe & Powerplant mechanics certificates (A&P) are encouraged to study and prepare for the new tests which are more representative of the current aviation maintenance environment.

The new tests are available from the Superintendent Of Documents, U.S. Government Printing Office, Washington D.C. 20402.

When ordering, make your check or money order payable to "Superintendent Of Documents," and specify:

Title: Aviation Mechanic-General Question Book.
Identification: FAA-T-8080-10B
Stock Number: 050-007-00786-1
Price: $4.00

Title: Aviation Mechanic-Powerplant Question Book
Identification: FAA-T-8080-11B
Stock Number: 050-007-0788-4
Price: $5.00

Title: AviationMechanic-Airframe Question Book
Identification: FAA-T-8080-12B
Stock Number: 050-007-00781-7
Price: $5.00

B-747 APU Start: Transformer Rectifier Unit

An operator recently reported five cases of overheating of the APU Transformer Rectifier Unit (TRU) output terminal stud. In some of those cases, flat pressure washers had been installed beneath the terminal lugs.

The correct terminal hardware stack-up depends on whether the specific TRU uses plain nuts and lockwashers or self-locking nuts on the studs.

Until recently, some TRU drawings included two flat washers (stainless steel) on the terminal studs, inadvertently encouraging installation of a washer beneath the terminal lug. In **no** case should steel washers be installed beneath the terminal lugs. A washer in this location can cause resistance heating that can lead to destruction of the terminal.

The Ten Commandments of Electrical Safety

1. Beware of lightning that lurketh in an undischarged capacitor lest it cause thee to bounce upon thy buttocks in a most embarrassing manner.

2. Cause thou the switch that supplieth large quanitities of juice to be opened and thusly tagged, that thy days may be long on this earth.

3. Prove to thyself that all circuits that radiateth and upon which thou worketh are grounded and thusly tagged, lest they lift thee to a radio frequency potential and causeth thee to make like a radiator, too.

4. Tarry thou not amongst those fools that engage in intentional shocks, for they are not long for this world and are surely unbelievers.

5. Take care thou useth the proper method when thou taketh the measures of high voltage circuits so that thou dost not incinerate both thee and thy testmeter, for verily, though thou hast no stocknumber and may not be identified, thy testmeter has one and as a consequence will bringeth much woe unto the supply clerk.

6. Take care thou tamperest not with interlocks and safety devices, for this incurreth the wrath of thy supervisor and bringeth the fury of the Safety Department on his head.

7. Work thou not on energized equipment for if thou doest so, thy colleagues will surely gather around thy grave shortly after.

8. Verily, I say unto thee: never service equipment alone, for electrical cooking is a slow process and thou might sizzle for hours on end before thy Maker sees fit to end thy misery and drag thee into His fold.

9. Trifle thee not with radioactive tubes and like substances, lest thou commence to glow in the dark like a firefly and thy spouse be frustrated and have no further use for thee except for thy wages.

10. Thou shalt not make unauthorized modifications to equipment, but thou shall cause to be recorded all technical directives and authorized changes made by thee, lest thy successor rend his hair and go mad in his attempt to work out the tangled spaghetti in the wiring.

From *American Airlines Newsletter*

The Most Sold Airliner In The World —The Boeing 737

The Boeing 737 is by far, the most sold airliner in the world. The following set of numbers is quite impressive, and surely can stand as a tribute to the Boeing Company and a great aviation product.

Boeing 737s sold as of June 11, 1988 are: 737-100 (30-all delivered); 737-200 (1,114-all delivered); 737-300 (755); 737-400 (116-not yet in production); 737-500 (123-not yet in production). That makes a total of 2,138 of all versions, to which more than 200 options may be added. The production rate is 14 aircraft a month.

The second most aircraft sold is also a Boeing product. This is the 727 with a total of 1,832 built, after which production was stopped. There is however, still a possibility to have the

cockpit converted to a two-crew system and to have the aircraft re-engined (not a Boeing job, though).

Use & Care of Micro-Matic Torque Wrenches

Recently, a mechanic turned in a micro-matic (click type) torque wrench for calibration. The wrench was so far out of calibration that it had to be discarded. The reason was that the wrench had been stored with a high torque value still dialed in.

When the wrench is set to the desired reading, it compresses a spring to a calibrated tension against a break-away block. As torque is applied, the resistance on the head increases as the bolt gets tighter. When the bolt reaches the desired torque, the spring no longer has enough pressure to hold the block in place. At this point, the break-away block turns, compresses the spring, and causes the head of the wrench to click. The spring remains compressed at that previous setting. If the wrench is stored with the spring compressed, over time it will lose its resiliency and will not apply the same pressure to the break-away block for the same setting. In other words, it goes out of calibration.

Many mechanics, with varying experience levels, were not aware that this type of wrench should be stored at its lowest reading. Those who were aware could not recall why. Research in tool manuals and tool catalogs contained little or no information specifically on the proper use and care of micro-matic torque wrenches. The manufacturer's actual guide was a single sheet of paper but it did mention, in its basic instructions, to set the wrench at a low or lowest setting when not in use.

Check the micro-matic torque wrench in your tool room and see that the wrench is set at its lowest setting. If not, then calibration is in order.

Adapted from *Mech Magazine*, Naval Safety Center

Electric Heat Guns Should Be Used With Care

Electric heat guns have a variety of uses in today's maintenance operations. They have been used as hair dryers, as clothes dryers, and to speed up the cure time of certain adhesives. They have often been used to heat-shrink environmental splices while repairing aircraft wiring — on the aircraft!

Although all of the aforementioned uses will speed up the drying time, or hasten the repair time, or help you get ready for a date a bit faster, none of them constitute the recommended or intended use of electric heat guns. (Avionics personnel take special note). Using heat guns to repair wire on board aircraft is definitely hazardous. Generally, only hot-air guns are

used for this purpose. The electric heat guns use electric motors to force air over the heating element or to cool the heating element in the case of infra-red devices. In either case, the electric motors use brushes which arc or produce sparks. Air from the immediate work area is drawn in by the motor and passed over the heating element. You can picture the results if a combustible mixture is drawn into the device.

Although these motor driven heat guns are blatantly used in shops and aboard aircraft, you should discourage such practices in your shop.

Keep those electric heat guns in the inner shop areas and mark them "NOT FOR USE ON AIRCRAFT."

Adapted from *Mech Magazine*, Naval Safety Center.

MD-80, A Close Call

A mechanic was installing the nose landing gear drag strut, which was disconnected at the time of the incident. The nose landing gear (NLG) was pinned down and locked. Other personnel in the area were working on the brakes and requested permission to raise the gear handle. People working on the NLG double-checked that it was pinned down and gave permission.

When the gear handle was raised, the nose gear retracted approximately 90 percent of full retraction. The mechanic was on a ladder in the wheel well and the gear lifted him up into the top of the well while he was trying to scramble into the side tunnel. Towards the top of the stroke, his foot slipped off the tire and his right thigh was caught between the tire assembly and side structure. Fortunately, he escaped from this potentially deadly incident with only minor injuries.

WARNING: Be aware that the NLG **will retract** even when pinned, if the drag brace is disconnected.

From *American Airlines Newsletter.*

Hazard of Burns From Aircraft Cleaning Compounds

Aircraft cleaning compounds are injuring many mechanics. Eye burns are the most common injury caused by these chemicals. These burns were received because personnel engaged were not wearing eye protection devices or were wearing the wrong kind.

Some sample reports: during an aircraft wash, a worker received minor corneal burns to both eyes from a surface cleaning compound. He had been issued impact goggles instead of splash-proof goggles.

While an aircraft was being washed, some cleaning solvent entered the user's eyes, causing chemical burns to both eyes. Goggles were available but were not used.

A mechanic in rain clothing and eye goggles was washing the inside of a wheel well. His goggles became saturated and permitted soap chemicals to enter his eye.

While washing an aircraft, the user was wearing goggles that became soaked. Some of the detergent got into his eyes via the cloth-covered holes across the top of his goggles.

Two mechanics were under an aircraft on work creepers, scrubbing the aircraft over their heads. They wore goggles, but the goggles were not designed to keep fluids out.

A mechanic was washing an aircraft when soap splashed into his eyes. Goggles were available but not used.

Some of these goggles have ventilation holes to keep the inner surfaces from misting. Placing cloth over these holes to keep the chemicals out is in error since the cloth easily gets saturated and then floods the inner goggle surfaces with the chemicals.

Each of the above incidents could have been prevented if the mechanic used the proper goggles and checked their integrity several times during the operation. Some of these cleaning chemicals have a thin viscous property which will slide by many tight areas before being detected.

In summary, wear the proper type goggles, check them frequently during use, and be aware that cleaning compounds are not as mild as they appear. You only have two eyes forever.

Adapted from *Mech Magazine*, Naval Safety Center.

Bogus Parts Now Face Label Problems

Parts manufacturers no longer have to suffer the impact of product counterfeiting, diversion and tampering thanks to a new family of pressure sensitive labels that contain their own security capability.

These new security labels allow verification of an authentic part, and trace the part through distribution channels, further discouraging tampering.

This graphic labeling contains a word or phrase, or a specific design logo printed in an unreadable format on the label using a patented scrambling method. This scrambled message is visually decoded using a unique, handheld viewer. This controls the system through in-field verification.

Tampering with the labels is difficult since the labels are nontransferrable and are designed to self-destruct upon attempted removal.

The use of these labels on a large scale by the “genuine” manufacturer may restrain the bogus parts handlers to the point of extinction.

Portable Video Analyzer For Internal Borescopic Inspections

A new compact industrial video analyzer, presently on the market, is self-contained and can be hand-carried to any borescopic inspection site, and plugged into any 110 or 220 VAC or 12 VDC source for on-the- spot operation. The unit contains its own color camera and built-in 9 inch color monitor plus an 8mm video cassette recorder (VCR) and a membrane keyboard with the ability to digitize and freeze frame an image, store it in memory, add text (date, time, etc.), and make measurements of objects in the image. The unit avoids the nuisance of bringing all the separate items of equipment to the work site.

This unit can also be used for accurate measuring, either with a measuring scope or with an object of known size, for reference. It features movable cursors that are calibrated so the measurements are displayed in whatever units are desired. The cross-hair display offers accuracy of one in two thousand. With this device, an inspector is able to precisely quantify on the monitor, any defect size, part displacement, elongation or distortion. This video analyzer can be used with borescopes and fiberscopes.

B-747 Nose Gear Door Movement During Nose Wheel Steering Operation

An operator reported that while cycling the nose wheel steering system on two airplanes, the nose gear doors moved toward the door closed position. The doors had been opened using the ground door release handle and the nose gear torsion link was disconnected. The nose gear door locks had not been installed. On one airplane the doors moved to nearly the fully closed position and on another airplane the doors closed to the halfway position in two seconds. Both airplanes had Service Bulletin 747-32-2255 incorporated.

The investigation disclosed that hydraulic system return pressure created by nose gear steering system operation is blocked at a check valve in a P/N 60B00239-4 nose gear door safety module. With the return system blocked, there is a fluid path, unique to the P/N 60B00239-4 module, that allows enough pressure to build up between the check valve and the nose gear door actuator thus causing door motion. This emphasizes the importance of using a door lock to prevent door motion.

Manual Troubleshooting

The DC8 and DC9 are one generation older than most aircraft serving with

the major airlines nowadays. They are fairly simple aircraft and don't have the troubleshooting aids such as BITE (Built-In Test Equipment). So how do you troubleshoot on such an airplane? Very carefully, using other (human) aids like smell, hearing, feel and occasionally taste (as in OBCT-Onboard Morning Coffee Test). The maintenance manuals explain what the airplane is supposed to do when working properly, and do give some troubleshooting information. True to Murphy's law however, this is never the information that you need.

When solving complaints therefore, first ask yourself: "What is the function of this unit or system?" and next: "What does this unit need to perform its function?" Be careful with the latter, for a hydraulic or pneumatic valve almost inevitably needs an electrical signal more than it needs fluid or air.

Also, pondering the question helps to prevent lengthy explanatory talks with certain departments about pulling or setting of circuit breakers later on.

Next, you can investigate whether anything can be seen, heard, felt or smelled out of the ordinary and whether the complaint can be duplicated.

If it appears to be a lengthy job, start a written log of all actions and reactions.

Don't scribble on the back of a complaint slip, but use proper paper and number the pages. Check the notes frequently and try to shoot holes in your reasoning. Take care not to end up thinking in circles.

When it's time to go home, pass the log to your oncoming colleagues. They can review your notes, notice any procedures or tests missed and check your reasoning. Besides, it prevents doing double work.

For instance, does the unit feel abnormally warm; is there anything that looks strange or different (even for a split second, for a cable slack can point to the location of trouble); does everything sound right; is there vibration and is the operation smooth?

Causes of lengthy problems include:

1. Missing the problem by oversight.

2. Avoiding the problem by hoping that it is something other than a really nasty job and then squirming every which way to prove you made the right assessment.

3. Replacing components before troubleshooting is complete, or building on a faulty unit, thus introducing all sorts of new, weird complaints.

4. Skipping around rather than taking an orderly structured approach. With a control problem, start in the cockpit and work back; with follow-up complaints work the other way around.

On older aircraft, *you* are the external test equipment. The airplane will tell you what is wrong with it; listening to what it says is up to you!

Additions To The Aviation Technician's Vocabulary

During casual reading of current publications, which include maintenance and overhaul manuals for the present crop of aircraft, one comes across new words and new terminology. A graphic example surfaced when reading about the glass cockpit, a work station for system diagnosis developed by the Product Support section of Airbus Industrie. The opening paragraph stated that "Direction of airborne systems by software has an impact on flight and maintenance operations. Optimization of performance leads to fine-tuned control laws.

"These laws are implemented on system structures characterized by nesting of feedback control loops. Centralized maintenance systems and BITE (Built-In Test Equipment) facilitate failure diagnosis of these control loop networks. Although they are becoming rare, malfunctions still exist which can lead to ambiguous BITE information. . . ." The maintenance instructions went on to include many new words that must be understood.

To assist our readers, we have listed several of these new words and their meaning.

Software: The programs and instructions used to control a computer. Software is available in many forms and you can type in a program yourself tailored to your needs. Also, a program located elsewhere can be entered into your computer via telephone from another source, on a cassette, diskette, or cartridge.

Peripheral: Any device that connects to a computer. Printers, joysticks and modems are peripherals.

Nano: One billionth.

Mega: One million.

Loop: A series of programming instructions that repeat. The last instruction in the loop tells the computer to return to the first instruction.

Byte: A group of 8 bits usually treated as a unit. It takes one byte to store a unit of information such as the code for one character. For example: the word love requires 4 bytes.

Word Processor: A computer program that helps you manipulate text on the screen. You can write a document, fill a form, enter your findings, then insert or change words, paragraphs, or pages or any of the writings on those pieces, and then print your final entries.

Modem: Telephone connection to the computer. Maintenance personnel can transmit their troubleshooting, parts numbers, diagrams, etc. to the computer location for rapid dissemination and use.

General Aviation Airworthiness Alerts

Beech Model F90 Super King Air: Landing Gear Actuator Support Brackets.

The landing gear actuator support brackets were found loose at their attaching points to the drag leg support rib. The attaching bolts could be turned 1/2 to 1-1/2 turns each. The submitter of this report advised that these loose bolts are difficult to detect unless the aircraft is on jacks and the gear is retracted enough to release the drag braces from their overcenter position. (Aircraft time was 6,435 hrs.).

Bellanca Model 17-30A Viking: Exhaust Muffler P/N 191485-30.

The engine quit running just after takeoff. Investigation revealed that the left muffler exhaust weld assembly had broken at the rear of the collector housing allowing the tail pipe and ball joint to fall away from the collector. The extreme heat coming from the end of the exhaust collector melted the electrical wire bundle routed up the left side of the engine mount to the firewall. Both "P" leads from the magnetos to the switch were found melted and the core wire was grounded to the external shielding of the wire. This disabled both magnetos by grounding out the leads.

Airworthiness Directive 76-23-03 R1 pertains to this subject and provides procedures for the inspection of the exhaust ball joints. The A.D. is repetitive every 100 hours or every annual inspection, whichever comes first.

Due to the way that the ball joint is welded into the back of the collector assembly, it is difficult to detect small cracks. The weld is actually internal around the end plate of the collector. The submitter recommends that the A.D. be revised to require that the tail pipes be disconnected to allow visual inspection of the weld with an inspection mirror and light. This would eliminate the possibility of missing a small crack.

Cessna Model 172RG, Cutlass RG: Gear Actuator Bolt P/N NAS464P5LA29.

The bolt in the right gear actuator assembly was found partially backed out of the bolt hole. This was the third time that the bolt had been found backing out. The submitter recommends drilled head bolts and safety wire to solve the problem.

Note: Similar articles have been published in previous Alerts. One submitter suggests the bolts be made a special inspection item every 100 hours on all retractable gear Cessna aircraft. A recent submitter advised bolts were installed with split lockwashers to possibly eliminate the backing out problem.

Gulfstream Model 112 Commander: Loose Wing.

The pilot advised of wing movement. Investigation disclosed the right wing forward attaching bolt had fallen out. Inspection of the left wing revealed the forward attaching bolt nut was missing.

The left wing had been replaced and the right wing repaired during December 1979. The submitter suspects the nuts were not properly torqued.

Learjet Models 20, 30 and 55 Series Aircraft: Plastic Spiral Wrap.

Plastic abrasion resistant spiral wrap was installed on some fuel, hydraulic, and pneumatic tubes at the factory to protect the tubing from chaffing. Recently, a stainless steel tube with spiral wrap installed on it failed, and investigation of the failure revealed corrosion of the tubing. Learjet Service Newsletter No. 112 (Fourth Quarter 1987) contains the following cautionary statement: "Plumbing in the wheel well and under the wing areas should be inspected to determine if spiral wrap has been installed on any aluminum or stainless steel tubing. The spiral wrap obscures the tubing making inspection difficult. If spiral wrap is installed, it should be removed from all aluminum and stainless steel tubing. Do not remove spiral wrap from flexible hoses or wire bundles. Inspect the tubing for corrosion and other defects and replace all suspect tubing. Do not reinstall spiral wrap. Ensure that all plumbing has adequate clearance and support."

Piper Model PA-23-250 Aztec: Cracked Flap Spars.

The flap spars were found cracked during an inspection conducted in accordance with Airworthiness Directive 81-04-05R1. Only one crack was visible without removing the hinge fitting from the spar. The remaining cracks were found by dye penetrant inspection after removal of the flap hinge fittings. This condition was found on two separate 2,500-hour aircraft.♦