What Happens When The Alarm Bell Sounds?

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It is imperative that maintenance technicians and managers be prepared to deal with any emergency that might occur in daily operations.

What would you do if the fire alarm bell in your hangar sounded right now? How would you react if one of your fellow technicians fainted from exposure to a toxic chemical in use in your facility? Who would you call if a potentially corrosive chemical was spilled in the cargo bin of an aircraft? What action would you take if a technician suffered an electrical shock and was rendered unconscious?

These are just a few of the very real emergencies that could occur in your hangar or shop. By their very nature, nearly all maintenance facilities have items that pose significant risks to personal injury and property damage. They include:

- Thousands of gallons of highly flammable jet fuel and/or avgas within an enclosed space;
- High-pressure hydraulic and air systems;
- High-voltage electrical systems;

- Open-flame and/or arc-welding equipment;
- Massive weights for jacking and hoisting operations;
- Elevated scaffolds and stands;
- Toxic chemicals and solvents;
- High-noise environments; and,
- Workers' proximity to moving or operating machinery.

Although the overall safety record in aviation maintenance activities is good, accidents do happen. Unless you are prepared to respond quickly and effectively, a minor injury may become life-threatening or minor property damage could become a major catastrophe.

Without a definite plan of action, individual responses may conflict or there may be a complete lack of any effective response. Therefore, one of the most important aspects of dealing with an emergency is to have an overall plan.

In devising a plan to fit a specific operation, several factors need to be considered:

- What equipment is immediately available in the hangar?
- What is the response time of the local fire department and/or ambulance with paramedics?
- How far is the nearest hospital or major medical facility?
- How many individuals in the organization would be available to assist with an emergency *if they were properly trained and qualified?*

The answers to these questions will help determine how to deal with various emergencies. For example, if you have only small hand-held fire extinguishers in the hangar and there are only two or three people on duty at most times, it would be inappropriate to have a plan directing them to attempt to extinguish a major hangar fire. On the other hand, if the hangar is equipped with sprinkler systems and large high-volume turret nozzles that can be manned by a sufficient number of trained individuals (a fire brigade), then it may be practical to have a plan calling for them to man the equipment and fight the fire before the professional fire fighters arrive.

The first step in emergency planning should be to develop a plan for responding to a fire or explosion within the hangar.

1. Sound the alarm!

2. Call the fire department!

3. Evacuate the hangar!

You should not make any attempt to fight the fire unless you have a trained fire brigade with adequate fire-fighting equipment on hand. It is a common reaction to try and save equipment and facilities when a fire breaks out. But all too often these attempts at saving an airplane or preserving some piece of equipment result in injury to personnel or further damage to the equipment. It is critical, therefore, that an evacuation plan be developed and prominently posted.

Evacuation plans should illustrate primary routes of escape and alternate routes, if available. A safe assembly point, well away from the fire danger, should be identified so that all personnel in the hangar can quickly be accounted for. It is a good practice to appoint one person (such as the foreman on duty) to perform a head count at the assembly point.

The location of the fire alarm buttons should be identified on a chart, and the number of the local fire department should be prominently displayed at each telephone within the facility. Fire blankets should be mounted at strategic locations within the facility and these locations should be depicted on a fire/evacuation chart.

The fire/evacuation plan should be practiced periodically to assure that all personnel understand it and know how to respond. These drills should be conducted at random intervals and at various times of day so that all work shifts (if any) are included.

Plan Should Include Procedures to Deal with Injured Personnel

How do you intend to cope with an injured worker? Although medical assistance may be available within only 10 or 15 minutes, first aid is just what the term implies. First aid rendered within the first few minutes after an injury occurs can greatly reduce the risk of an injury becoming more serious or life-threatening.

Aircraft hangars/maintenance facilities can be in isolated areas some distance from the closest professional medical assistance. In a small facility where only a few people are on duty, it is good practice to have all technicians trained and qualified in first aid and cardiopulmonary resuscitation (CPR). In larger facilities having more than 10 people on a shift, it may be sufficient to have only supervisory staff trained, thereby ensuring that at least one qualified individual will be on hand at any time.

First aid kits or cabinets should be reviewed with consideration given to your facility's particular exposure.

In addition to the minimum industrial first aid kit supplies, many shops have chosen to include an inflatable or wire splint unit and an airway or resuscitation mask. If toxic chemicals or potential sources of harmful fumes or vapors are often present, a portable oxygen unit may be advisable.

The supplies within the first aid kit should be inventoried and a list of the contents posted within the unit so that it can be reviewed at periodic intervals. If the kit is used, the contents should be immediately replaced. If there has been no known use, the contents should be inventoried at least quarterly to ensure that nothing is missing. Commonly used items such as eyewash, burn ointment and bandages should be kept in spare supplies for easy replacement.

If an injury occurs, someone qualified in first aid should be assigned to treat the injured person while another individual summons medical assistance.

Toxic/Hazardous Chemicals Pose Special Personnel Hazards

The majority of fluids and solvents in an aircraft maintenance facility have some toxic or hazardous characteristics; even jet fuel is considered a toxic chemical. Every maintenance facility should have the material safety data sheet (MSDS) for each toxic or hazardous chemical used within the facility. It is important not only that you have the MSDS for each chemical, but that you understand the terms and limitations so that you can take the proper precautions and be aware of the first aid and emergency treatment in the event of excessive or inadvertent exposure to the product. Just having the MSDS is of little use if you are not prepared to deal with the hazards.

It is especially important to study the "health hazard data" section for each toxic or hazardous chemical present in the facility. The contents of the first aid kit should be reviewed to ensure that it includes the proper antidotes or treatment directions for the hazards of each chemical, and that facility personnel have been trained in giving the indicated treatments.

In reviewing the MSDS for each chemical, you must understand the following acronyms:

> **OSHA PEL** — This is the U.S. Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit, which may be expressed as a time-weighted average or as a ceiling exposure limit.

ACGIH TLV — This is the American Conference of Governmental Industrial Hygienists' Threshold Limit Value, which is the ceiling exposure limit or the concentration that should not be exceeded, even momentarily.

These limits should be reviewed, and personnel must be trained to deal with the hazards associated with the particular chemicals.

Another aspect of toxic and hazardous chemicals that is often overlooked is the damage that they might cause to aircraft structures or the hazards that they might pose to personnel if they are spilled or dumped while being handled or transported. This concern was recognized by the U.S. Chemical Manufacturer's Association (CMA) many years ago. In 1971, the CMA, in cooperation with the transportation industry, medical professionals and chemical industry experts, established the Chemtrec Center in Washington, D.C.

The Chemtrec Center was developed both as a resource for obtaining immediate emergency response information to prevent and lessen the impact of accidental chemical releases, and as a means for emergency responders to obtain technical assistance from chemical industry product safety specialists, emergency response coordinators, toxicologists, physicians and other industry experts to safely deal with incidents involving chemicals.

The Chemtrec Center operates 24 hours a day, seven days a week. The center has a vast reference library that includes MSDSs on more than one million products. In addition, they can contact directly the majority of major chemical manufacturers to access information necessary to deal with chemical spills or accidents.

Chemtrec can provide pertinent information and guidance in situations when given the name of the product or the nature of the problem. Be prepared to provide as much of the following information as possible:

- Your name and call-back telephone number;
- Location of the incident;
- Shipper's or manufacturer's name;
- Container type;
- Airplane/flight, truck or railcar number;
- Carrier name;
- Consignee; and,
- Local conditions and circumstances of the incident.

Chemtrec also has a lending library of audiovisual training programs for hazardous materials emergencies.

Getting prepared is a four-step process.

- Assess your risks and evaluate the potential hazards;
- Develop a plan to cope with any emergency;
- Train your staff to deal with various categories of emergencies and provide the necessary equipment to cope with those hazards appropriate to your operation; and,
- Conduct periodic drills or exercises to assure that the emergency response plan is effective and understood by all personnel. ♦

Mechanic's License Suspended for Eight Months for False Record Entries

The U.S. National Transportation Safety Board (NTSB) recently reviewed an appeal by a U.S. Federal Aviation Administration (FAA)-certificated airframe and powerplant (A&P) mechanic whose license had been revoked for allegedly falsifying a logbook entry. In reviewing the case, the NTSB upheld the violation but ordered an eight-month suspension rather than revocation of the license.

The violations that formed the basis of the complaint occurred during a 10-month period when the mechanic had repaired and ultimately consolidated parts of two light aircraft of the same type into one aircraft. The mechanic had repaired an extensively damaged light aircraft using parts, including the fuselage, wings, horizontal stabilizer, landing gear and instrument panel, from another aircraft.

Logbooks for the latter aircraft were not available, but the technician had the logbooks for the extensively damaged aircraft. On completing the repairs, he removed the data plate from the wrecked fuselage of the damaged aircraft and affixed it to the reconstructed combination of the two airframes. He also repainted the aircraft, using the registration and identification of the extensively damaged airplane.

The NTSB ruled that his actions created an inaccurate history of the aircraft and therefore violated U.S. Federal Aviation Regulations (FAR) pertaining to aircraft record entries. In its ruling, the NTSB said that the mechanic apparently chose to take these actions because he had only the logbooks for one aircraft and re-identifying the airplane would simplify his paperwork responsibilities.

Tougher Radiation Protection Standards Effective Jan. 1, 1994

The U.S. Nuclear Regulatory Commission has implemented more stringent radiation protection standards and procedures that took effect Jan. 1, 1994. These new standards decrease the annual allowed radiation exposure and could affect aviation maintenance facilities using x-ray equipment or radioactive sources of emission in their nondestructive testing and inspection activities.

The new standards are:

- Occupational radiation exposure is to be limited so that it is "as low as reasonably achievable." This standard is now the law.
- An annual review and complete documentation of a licensee's radiation protection program is required.
- Radiation surveys are required to ensure and demonstrate compliance with standards.

Any shop or facility using sources of radiation should obtain a copy of these new regulations and take steps to ensure that they are in compliance. ♦

MAINTENANCE ALERTS

This information is intended to provide an awareness of safety problems so that they may be prevented in the future. Maintenance alerts are based upon preliminary information from government agencies, aviation organizations, press information and other sources. The information may not be entirely accurate.

Metal Fatigue Causes Two Light Aircraft Landing-gear Failures

Early in 1992, the left main landing gear of a Piper PA-34-200 collapsed as it was landing at an airport in the United Kingdom. The primary failure in this accident was a fatigue of the wing structure. The airplane had accumulated about 3,235 flight hours, but records did not indicate the number of landings experienced during this period.

Metallurgical examination of the left main landing-gear swivel pin indicated that separate fatigue cracks had grown from both the inboard and outboard edges near the blending radius of the shank. The reverse bending loads experienced in normal operations caused the fatigue-initiated cracks to grow until only 40 percent of the shaft's cross-sectional area remained. The swivel pin then failed in overstress through the remaining area.

Additional examinations found that the fatigue cracks originated from corrosion pits in the surface of the shank and had grown during a large number of cycles. Analysis disclosed that this failure was virtually identical to another main landing-gear collapse that occurred a few years earlier on a similar aircraft. Similar cracking has been found on other models of Piper aircraft such as the PA-24, and the design of the swivel pin is essentially identical on PA-24/28/32 and 34 models. Inspections of other aircraft with similar or higher total operating times disclosed other instances of fatigue cracking in these swivel pins.

Because these pins cannot be adequately inspected in situ, the U.S. National Transportation Safety Board (NTSB) has issued a recommendation calling for the U.S. Federal Aviation Administration (FAA) to issue an airworthiness directive (AD) requiring the removal and nondestructive testing of these swivel pins on all Piper aircraft with retractable landing gear that have been in service for more than 2,000 hours. The recommendation calls for repetitive inspections to be conducted at appropriate intervals.

In a similar but unrelated incident, a Bellanca 17-30A airplane suffered substantial damage when the nose landing gear collapsed after landing at a mountain airport in Colorado, U.S. Inspection of the wreckage indicated that the nose-gear drag-strut bracket on the right side of the gear had separated from the firewall structure.

Metallurgical examination performed by the NTSB revealed that the drag-strut bracket had separated into three pieces from two fracture locations. Evidence indicated that the fractures progressed from fatigue cracks that initiated at multiple sites along the forward and aft faces of the bracket.

The inspection of these brackets had been the subject of a manufacturer's service letter (SL) nearly 20 years ago. The SL had called for a visual inspection using a 10-power magnifying glass in the vicinity of the three mounting bolt through-holes and in the bend radius of the inboard and outboard ears. The inspection was to be repeated every 100 hours until the bracket was replaced with a new part as specified in the SL. Repetitive inspections were not required after replacement with the later part.

An analysis of service difficulty reports confirmed that there had been several instances of these brackets cracking in the years subsequent to the issuance of the SL. As evidenced by these experiences, the new part number bracket is still subject to fatigue cracking. The NTSB has therefore issued a safety recommendation calling for the FAA to issue an AD requiring periodic inspections for cracks in the areas of the bend radius and bolt through-holes in the subject brackets on all aircraft of this type, regardless of the part number installed. It also recommended that these inspections be made a mandatory repetitive requirement.

Boeing 747 Engine Pylon Loss Shows Need For Closer Inspection Following Turbulence Reports

In March 1993, a Boeing 747 encountered severe turbulence shortly after takeoff at Anchorage, Alaska, U.S. After several pitch and roll oscillations, the No. 2 engine and pylon separated from the airplane. The aircraft returned to the airport, and there were no injuries to the crew of the cargo aircraft.

It was determined that the aircraft had encountered severe or possibly extreme turbulence that resulted in dynamic multi-axis loadings that exceeded the ultimate lateral load-carrying capability of the pylon. The load-carrying capability of this particular pylon was already reduced by the presence of a small fatigue crack near the forward end of the pylon's forward firewall web.

The other pylon fuse pins on the accident airplane were examined. In addition, the fuse pins on another similar aircraft that had departed earlier and had also reported encountering turbulence were also removed and examined. Other fuse pins were found with various degrees of deformation, but none had developed any actual cracks.

A number of steps have been taken about the reporting of turbulence and aircraft routing in areas of such reports. For maintenance technicians, however, the pertinent findings relate to inspection procedures following reports of turbulence in flight.

It was determined that encounters with severe turbulence in which the airplane experiences multi-axis loading can result in overloading of certain portions of the pylon structure. If an aircraft encounters such turbulence, the U.S. National Transportation Safety Board (NTSB) believes that the pylons should be inspected visually before the next flight. Within 500 flights, the midspar fuse pins on the B-747 series airplanes should be removed for inspection.

The NTSB has recommended that the U.S. Federal Aviation Administration (FAA) issue an airworthiness directive calling for the removal and inspection for deformation of midspar fuse pins following an encounter with severe turbulence in which the airplane experiences large variations in roll and yaw attitude. The Boeing B-747 maintenance manual, sections 5-51-03 and 5-51-06, has been revised to reflect these changes in inspection procedures.

Technicians involved in the maintenance and inspection of the B-747 series airplanes should ensure that they review the revised inspection procedures and that they are aware of the indications of deformation or overload on these fuse pins.

Blending of Propeller Blade Nicks Cited as Contributing Factor in Propeller Hub Failure

In April 1993, a Mitsubishi MU-2B experienced a fatal crash (see *Accident Prevention,* April 1994) following the failure of the Hartzell HC-B4TN-5GL propeller hub. While in cruise flight at 24,000 feet (7,320 meters), a hub arm on the airplane's left propeller failed, releasing the blade and a portion of that hub arm. The separation of the propeller blade damaged the engine, nacelle, wing and fuselage, thereby degrading the aircraft's performance to the extent that an emergency landing attempt was unsuccessful.

Another similar hub had failed on an MU-2B-60 in 1991. Nevertheless, that aircraft was able to make an emergency landing. Investigation of these failed hubs and another hub found cracked, disclosed that the hubs had fractured as a result of fatigue cracking initiating in multiple sites on the surface of the pilot tube hole. Examination of all the hubs disclosed that all had similar mixed microstructure and varying amounts of decarburization, corrosion and machining marks. The manufacturer has changed the heat treatment process and the machining process to minimize the reduction in fatigue resistance.

The investigation also disclosed that the fatigue cracks had initiated on the opposite side of the hub bore from that stressed in normal operation. This indicated that the propeller blades had suffered stresses that were due to resonant vibration occurring during operation at restricted rpm ranges. Tests conducted following the April 1993 failure provided further evidence to support the conclusion that the fatigue defect initiation was a result of exposure to these resonant vibration modes.

Further testing disclosed that despite precautions and limitations taken to avoid operating the propeller(s) in the rpm range that matches the reactionless (resonant frequency), the resonant frequency can increase to within the normal ground operating rpm range for the MU-2B when the propeller blades have been worn or repaired. The blades recovered from the 1991 accident were confirmed to have been "blended" at the tips to the extent that the resonant frequency of the propeller assembly was significantly higher than assumed in the initial certification. Two of the blades originally on the hub that failed in 1993 were also recovered, and testing demonstrated that these blades also had a resonant frequency that would be above the normal ground idle rpm.

The U.S. National Transportation Safety Board (NTSB) stated that the MU-2 is particularly susceptible to propeller operation in the resonant frequency because of the relatively small margin between the nominal propeller natural frequency and the lower limit of the ground idle speed range, and the liberal applications of the wear and repair limits for the blades prescribed in the manuals. A review of other aircraft models using the Hartzell HC-B4 hub disclosed that all of them have greater certification margins and blade repair limits.

The NTSB has recommended that the U.S. Federal Aviation Administration (FAA) undertake a study to determine the whereabouts of all four-bladed Hartzell propeller hubs that have been installed at any time on MU-2 airplanes. Technicians involved in maintenance and repair of the MU-2B series aircraft and any other aircraft using this model propeller should be alert to this potential problem. Blade repair and rework limits should be closely monitored to ensure that the natural vibration frequency is not adversely affected by field repairs.

Problems in Autopilot Mode Control Panels May Affect Several Aircraft Types

Following a runway excursion after landing by a Boeing 767 in Germany, the U.S. National Transportation Safety Board (NTSB) began investigating this and other control problems that appeared to be related to uncommanded control inputs.

In the 767 incident, the pilot had disconnected the autopilot at about 500 feet (152.5 meters) above the runway and was continuing the landing under manual control. After touchdown and just before the nosewheel settled to the runway, the rudder made an uncommanded input of 16-17 degrees to the right. The airplane left the runway, and a collision with another aircraft was narrowly averted before the pilots were able to regain control and return the aircraft to the runway.

An extensive investigation of this incident disclosed that other uncommanded control inputs had been experienced by the airline on Boeing 757/767 aircraft and possibly other aircraft types using similar autopilot mode control panels (MCPs). The manufacturer has recognized quality control problems with the MCPs and the "switchlights" used as push-button switches to control autopilot functions.

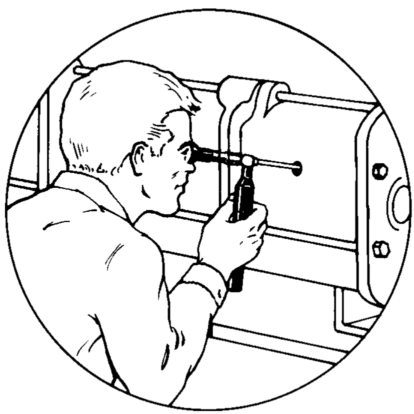
Until the exact cause of these uncommanded actuations can be resolved and corrected, technicians involved with maintenance and troubleshooting of these systems should be aware that autopilot MCP displays and switching functions may be erroneous. These problems may affect Boeing 757 and 767, 747-400 and Fokker 100 aircraft.♦

NEW PRODUCTS

Miniature Battery-Powered Borescope Available

The Titan Tool Supply Co. offers an inexpensive miniature borescope series that is said to have an unusually large field of view. The model 55 series of rigid borescopes has a 95-degree field of view, which creates a "fish-eye lens effect" for the user. It is available in a straightforward model that allows the user a 47.5-degree peripheral view, as well as an angular model that has a normal angle of 60-degrees, thus providing the user with a view of 12.5 to 107.5 degrees from the insertion angle.

The unit is self-contained with illumination provided by a Krypton bulb powered by two AA batteries in the handle. The tube is .21 inches (.55 centimeters) in diameter and slightly over six inches (15.2 centimeters) in length. An optionally available fiber bundle and halogen light source is also offered by the manufacturer. For more complete information on this inspection device, contact: Titan Tool Supply Co., Inc., P.O. Box 569, Buffalo, NY 14207, U.S. Telephone (716) 873-9907.



Low Oil Sensing System Provides Warning of Fluid Loss

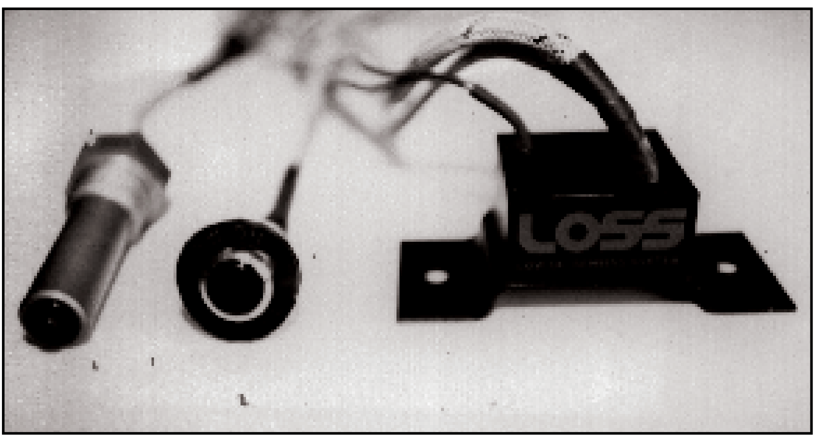
LOSS Inc. recently introduced a low oil sensing system (LOSS) that it claims can prevent costly engine or system failures because of loss of lubricating oil or fluids. The manufacturer states that the LOSS is an optically triggered warning device intended to alert the operator to a dangerously low level of lubricating fluid before other indications such as low oil pressure warnings are activated.

The company, along with a U.K.-based electronics and design firm, has applied for U.S. Federal Aviation Administration (FAA) supplemental type certificate approval for various aircraft engine installations. In addition, the system is said to have many applications in stationary equipment and motorized/hydraulic ground equipment.

For more information, contact: LOSS Inc., 1339 W. Washington Street, Orlando, FL 32805, U.S. Telephone (407) 422-0188.

SAFT Develops Ultra Low Maintenance Nicad Battery

The SAFT America Co. has introduced a new Nicad primary aircraft battery that the company claims requires markedly less maintenance and servicing than previous units. According to SAFT, the Ultra Low Maintenance (ULM) aircraft battery incorporates new technology with a



negative plastic-bonded electrode that replaces the previously used sintered plate electrode.

With the new electrode, the amount of water consumed on constant voltage overcharging is claimed to be drastically reduced, allowing design variations with optimization on either weight or electrolyte reserve. The ULM batteries are said to be fully interchangeable in form, fit and function with existing units.

SAFT states that the ULM battery effectively combines the inherent advantages of Nicad technology while substantially reducing battery maintenance requirements.

For more information, contact: SAFT America, 711 Industrial Blvd., Valdosta, GA 31601, U.S. Telephone (912) 247-2331.

Enzyme-based Surface Cleaner Replaces Toxic Solvents

The Enzymes Plus Co. has introduced an aircraft surface cleaner that it claims will replace nine of the 17 most commonly used solvents that have toxic characteristics. Among the nine substances that are commonly used in aircraft maintenance operations and that the company claims can be replaced by its UBIX product are MEK, toluene and trichloroethylene.

The company states that UBIX No. 0092 is a water-based, noncombustible, biodegradable, noncorrosive and nonpolluting product that can be used to prepare surfaces for repainting. It is now on the qualified products list under U.S. military specification MIL-C-83873A. The product is available in one- and five-gallon containers and 55-gallon drums.

For more information, contact: Anderson Affiliates Inc., Enzymes Plus Division, 1451 Sugar Creek Blvd., Sugar Land, TX 77478. Telephone (713) 242-7741.

Nonchlorinated, Low-odor Solvent Does Not Deplete Ozone

The Brulin Corp. has announced the availability of its Brulin MP No. 1793 solvent for many uses in aircraft maintenance operations. Specially developed to replace conventional ozone-depleting solvents previously used, the manufacturer states that this solvent has many applications.

The manufacturer reports that Brulin 1793 is ready to use, dries quickly, and is safe for use on most metals. It can be used to remove ink, grease, oil, adhesives, caulk or tar without leaving any residue. It may be sprayed on, wiped on with a cloth or brush, or used in dip or circulating cleaning units.

For additional information, request publication 304-910 from Brulin Corp., P.O. Box 270, Indianapolis, IN 46206-0270. Telephone (317) 923-3211.

Computer-Printable Labels Ease Identification of Lines/Bundles

Nelco Products Inc. has introduced a line of self-laminating computer-printable labels for identifying plumbing or wiring conduits. The labels can be supplied preprinted or plain for custom imprinting with various label-maker software on any personal computer with a pin-feed printer.

The manufacturer states that the labels are made of a self-laminating vinyl film that wraps around a round or flat surface to create a permanent label which is smearproof and waterproof. The labels are said to be resistant to oils, water and solvents commonly used in aircraft operations.

For more information, contact Nelco Products Inc., 77 Accord Park Drive, Norwell, MA 02061 Telephone (617) 871-3115. ♦