32470 01 8601

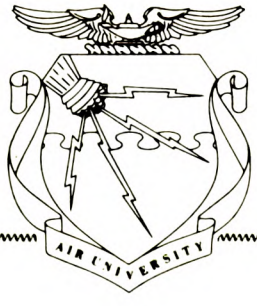
CDC 32470

PRECISION MEASUREMENT EQUIPMENT LABORATORY TECHNICIAN

(AFSC 32470)

Volume 1

Precision Measurement Career Development



Extension Course Institute
Air University

Prepared by
MSgt Glen W. Medley

Reviewed by
Pamela G. Brown

Edited by
Beverly S. Barnes

3450TH TECHNICAL TRAINING GROUP (AVIONICS)
3400TH TECHNICAL TRAINING WING (ATC)
LOWRY AIR FORCE BASE, COLORADO 80230-5100

EXTENSION COURSE INSTITUTE (AU)
GUNTER AIR FORCE STATION, ALABAMA 36118-5643

Preface

THE TECHNICAL knowledge and measurement principles you need to operate, repair, and calibrate precision measuring equipment are included in this CDC. This information will help you develop the skills you need for 7-level performance in the base precision measuring equipment laboratory (PMEL). These skills are identified in the specialty training standard (STS) for the Precision Measuring Equipment (PME) career field.

This volume of your CDC is entitled *Precision Measurement Career Development,* because it teaches career-oriented skills and presents information required for your career progression, as opposed to job- or task-oriented skills and information taught in the remaining volumes of this CDC. This volume teaches skills, knowledge, and principles related to the Air Force career program, proficiency advancement in the 324X0 career ladder, duties assigned a PME (metrology) technician, personnel and shop safety principles and practices, and the USAF Calibration Program.

A glossary of terms used in this course is included at the end of this volume.

Code numbers appearing on figures are for preparing agency identification only.

The inclusion of names of any specific commercial product, commodity, or service in this publication is for information purposes only and does not imply indorsement by the Air Force.

To get an *immediate response* to your questions concerning subject matter in this course, call the author at AV 926–4270 between 0700 and 1600 (MT), Monday through Friday. Otherwise, write the author at 3450 TCHTG/TTMYM, Lowry AFB CO 80230–5100 to point out technical errors you find in the text, volume review exercises, or course examination. Sending subject matter questions to ECI slows response time.

NOTE: Do not use the Suggestion Program to submit changes to this course.

Consult your education officer, training officer, or NCO if you have questions on course enrollment or administration, Your Key to a Successful Course, and irregularities (possible scoring errors, printing errors, etc.) on the volume review exercises and course examination. Send questions these people can't answer to ECI, Gunter AFS AL 36118–5643, on ECI Form 17, Student Request for Assistance.

This volume is valued at 15 hours (5 points).

Material in this volume is reviewed annually for technical accuracy, adequacy, and currency. For SKT purposes the examinee should check the Index of ECI Study Reference Material to determine the correct references to study.

Contents

NOTE: This course teaches through numbered lesson segments, each containing a behavioral objective, text, and exercises. The objective sets your learning goal. The text gives you the information you need to reach that goal, and the exercises let you check your achievement. When you complete each segment, see whether your answers match those in the back of the volume. If your response to an exercise is incorrect, review the objective and its text.

Career Ladder Progression

PROGRESSION to the 7-level AFSC of the precision measuring equipment (PME) Air Force specialty (AFS) requires that you increase job-related knowledge and skills in areas of the Air Force career development, security, safety, maintenance management, supervision, training, and metrology laboratory practices. As you increase your knowledge and skills in accordance with the Specialty Training Standard (STS) proficiency levels, your job performance should approach that of the 7-level proficiencies. Also, the probability of your obtaining a better score on the SKT should increase.

1-1. Classification Structure

During your training in the resident course, you learned that you were selected for assignment in the PME AFS by means of the Air Force Airman Classification System. As you progress to the 7-level of your AFS, job requirements and the 3-level specialists you train will generate questions about the operations of the airman classification structure. As a prospective PME laboratory supervisor, you must know how the classification system affects your progress and the progress of those specialists and technicians you must assists, train, and supervise. For this reason, let's examine some of the principles applied in the operation of the classification system as they relate to your career progression and the progression of the subordinates you train.

001. State how personnel are selected for classification.

Functional Groupings. The military personnel classification system of the Air Force groups related positions on the basis of similarity of knowledge, education, training, experience, and other abilities. You and other PME specialists and technicians are in the same functional group because of similarities in your backgrounds. These functional groups permit the development of Air Force specialties. Functional groupings produces the following advantages:

- Provides a personnel classification system that will remain stable, regardless of changes in organizational structures.
- Provides a personnel classification and utilization system adaptable and responsive to changes in Air Force skill requirements.
- Facilitates selective procurement and assignment of personnel.
- Provides a framework for developing both specialized and broadly experienced personnel.

Initial Classification Procedures. Let's review some of the basic classification principles that applied when you enlisted in the Air Force. To determine the aptitude area in which you were best qualified for training, you were tested. The tests evaluated four general abilities termed "aptitude clusters". These clusters were used to predict the likelihood of your success in the selected career field. The four aptitude clusters are:

(1) Mechanical. This is a measure of mechanical knowledge and understanding. It contains tests of verbal and nonverbal comprehension and visualization.

(2) Administrative. This is a measure of quantitative experience with stress on speed of response to verbal and quantitative symbols.

(3) Electronics. This is the most technical of the aptitude clusters and is a measure of engineering technical aptitude. It depends on electrical knowledge and comprehension, reasoning, visualization, and the ability to extract and understand technical material.

(4) General. This is essentially a measure of general learning ability or intelligence based on reasoning, vocabulary, and visualization.

The aptitude clusters formed from your test scores are a basis for the aptitude indexes developed for you. AFR 39–1, *Airman Classification,* contains the aptitude scores that are mandatory for entry into specific career fields and career field subdivisions. Experience has shown that airmen achieving the required scores are more likely to be successful in certain fields. The mandatory aptitude score for entry into the avionics systems career field (32) is 60 or above in the electronics aptitude cluster. In selecting the specific career field for training, the following factors are considered:

a. Minimum aptitude scores. Airmen possessing at least the minimum aptitude scores for a career field are the ones most likely to succeed.

b. Biographical data. This includes your education, occupational experience (if any), avocations and hobbies, physical condition, and eligibility for security clearance.

c. Your expressed preference.

d. Air Force manpower requirements.

When these factors were considered, you were recommended for classification and assignment in this career field.

Exercises (001):

1. How are personnel grouped in functional groupings?

2. List the basic factors that were considered before you were selected for the 32 career field.

002. Cite the purpose of the digits of an AFSC.

Airman Coding System. The airman coding system requires that the five digits in your Air Force specialty code (AFSC) identify your Air Force specialty (AFS) and skill level. Although you have already reached the 5-level of your AFSC and know what your AFSC represents, we want to be sure that you recall the purpose of each of the digits:

a. The first two digits identify the career field.

b. The third digit, combined with the first two, identifies the career field subdivision.

c. The fourth digit identifies the skill level of the AFS.

d. The fifth digit, combined with the other four, identifies the specific AFS.

e. A letter prefix identifies an ability, skill, special qualification, or system designator not restricted to a single AFS. For example, instructors in the PME school have a "T" prefix preceding their AFSC.

f. A letter suffix identifies positions associated with particular equipment or functions within an AFS.

Exercises (002):

1. In an airman coding system, which digits identify the career field?

2. What does the fourth digit in an AFSC identify?

3. How many digits are needed to complete a specialty code?

4. Why are prefixes and suffixes used with AFSCs?

003. Differentiate between the primary, secondary, and control AFSCs.

Classification for Assignment. You have learned some of the principles applied in the initial classification of personnel. You have studied the Air Force coding system and how an AFSC identifies airmen who are grouped functionally in a specific AFS. Let's see if there is a relationship between AFSCs, AFSs, and Air Force manpower requirements and assignments. Some of the terms and definitions that you must know are:

a. Awarded Air Force specialty code (awarded AFSC). You get an authorized AFSC following certification of your ability to perform the duties of an AFS at a specific skill level.

b. Primary Air Force specialty code (primary AFSC or PAFSC). This is the awarded specialty in which you have the highest skill level. If you hold more than one AFSC at the highest level, the AFSC in which you are most qualified to perform duty is designated as primary.

c. Secondary Air Force specialty code (secondary AFSC or 2AFSC). This is the awarded specialty representing your second best qualification. *Exception:* Where an airman possesses an imbalanced specialty that is not identified as primary, it is reflected as secondary.

d. Duty Air Force specialty code (duty AFSC or DAFSC). This is the authorized manning document AFSC that identifies the position to which you are officially assigned.

e. Control Air Force specialty code (CAFSC). This code is established to effect airman assignments and to assist in the identification and control of training requirements. The CAFSC is a management tool to control individual airman assignments and the equitable distribution of airmen by grade and skill against manning requirements.

Your CAFSC may, or may not be, your primary AFSC. It may be an additional AFSC you possess, or one you are training toward that the Air Force needs at the moment. A shortage in the skills represented by your additional AFSC makes them your highest usable skills at the moment. Your additional AGSC, therefore, becomes your control AFSC.

Exercises (003):

1. What is your primary Air Force specialty code (PAFSC)?

2. What is the difference between the primary AFSC and the secondary AFSC?

3. What is the difference between a duty AFSC and a control AFSC?

004. Cite the factors that affect award of the 7 skill level of your AFSC.

Classification Procedures at Using Activities. Classifying personnel is a continuing process. Your job-related skills are examined constantly to insure that the Air Force receives the maximum benefit from your abilities. The Air Force charges your immediate supervisor, unit commander, personnel officer, and personnel specialists with the responsibility of awarding or changing your AFSC.

When you are considered for the award of the 7-skill-level AFSC, you will be placed on OJT for a minimum of 12 months, and your job-related knowledge will be

measured by the 7-level CDC examination. Course Examinations (CEs) do not measure performance on the job, but they are used in skill-level upgrading in connection with other criteria. These other criteria include such things as experience, demonstrate proficiency on the job, and recommendation by your supervisor with final approval by the appropriate commander. A satisfactory score on the CE does not automatically result in upgrading. Course Examination scores merely indicate the degree of job-related knowledge about a specialty. For upgrading, they serve their purpose only when considered along with other criteria.

Figure 1-1 shows the criteria for award of airman AFSCs. Since the award of an AFSC is important to each person's progression, study the chart and know the regulation from which it is extracted. An airman will not be awarded any AFSC unless such action is the direct result of initial classification, normal upgrade, downgrade skill level, AFSC conversion, or approved retraining.

Exercises (004):

1. List four requirements you must satisfy for AFSC 32470.

2. What does your CDC examination score reflect?

1-2. Duties in the Career Field

As you progress in the career field, your duties and responsibilities also increase. First, we will list the duties of the PME specialist; second, we will list the duties of the PME technician.

005. Cite the duties of a PME Laboratory Technician.

PME Technician Duties. Now let's look at the list of 7-level duties and responsibilities from AFR 39–1. Since you are training for this AFSC, it is important that you realize what your added duties and responsibilities are.

Troubleshoots and isolates malfunctions in TMDE (test measurement and diagnostic equipment) including laboratory standards, and manual and automatic test equipment (ATE) designated as laboratory responsibility. Analyzes complex and unusual maintenance problems in TMDE, including laboratory standards. Uses theories of operation, block diagrams, schematics, pictorial drawings, logic, trees, and software diagnostics. Traces circuits and isolates malfunctions, using diagnostic test equipment. Analyzes and isolates malfunctions in complex TMDE. Helps specialists analyze and isolate malfunctions in complex equipment.

Inspects, modifies, overhauls, repairs, and aligns TMDE. Inspects TMDE for compliance with preventive maintenance, cleanliness, and safety requirements. Overhauls and modifies intricate assemblies, subassemblies, and all laboratory standards. Removes failed components and installs replacement parts in equipment. Performs intricate and complex equipment maintenance using handtools, special tools, high reliability soldering techniques, and technical data. Interprets maintenance policy and procedures in manufacturers handbooks, technical orders, and organizational maintenance directives for TMDE, including laboratory standards.

Inspects, calibrates, and certifies TMDE, including laboratory standards. Insures operational accuracy of equipment by performing intricate and complex laboratory and on-site calibrations. Uses laboratory working standards, reference standards, transportable field calibration unit (TFCU), portable automatic test equipment calibrator (PATEC), engine test stand calibrator (ETSC), and electrical standards set (ESS). Certifies equipment accuracy to technical data or uses calibration charts. Verifies USAF base reference standards accuracy by intercomparison techniques.

Supervises TMDE branch and laboratory personnel. Plans and schedules work assignments. Establishes work methods, production controls, quality assurance, and performance standards. Helps specialists to prepare calibration responsibility determinations, material deficiency reports, technical order improvement reports, requests for special training, training quality reports, and modification proposals. Prepares, verifies, and analyzes maintenance data collection (MDC) documentation. Establishes requirements for maintenance, personnel, equipment, tools, and spare parts. Accomplishes technical data verification, operational tests, and evaluation of new equipment. Identifies and requisitions equipment required for maximum base level self-sufficiency. Coordinates lateral support, command certification, or contract services. Resolves equipment logistics problems with Air Force Logistics Command (AFLC) material managers. Develops and evaluates organizational charts, job descriptions, policies, operating instructions, budget requirements, logistics support agreements, and safety and security programs. Evaluates Air Force suggestions.

Inventories equipment, tools, parts, and supplies. Evaluates facilities, use of work space and equipment, and procedures for storage, inventory, and inspection of property. Implements workload plans. Determines disposition of TMDE workload; places TMDE in work; defers work for lack of resources; places TMDE in awaiting maintenance; and obtains lateral support or seeks command certification. Establishes priority, assigns work, and monitors workflow status. Resolves production problems. Determines course of action on quality assurance inspection failures. Establishes work methods and performance standards. Conducts on-the-job training program for precision measurement laboratory personnel.

Implements quality assurance program. Implements the TMDE quality assurance program by performing personnel evaluations and equipment inspections. Analyzes and interprets trends. Recommends corrective actions. Provides technical and training assistance to TMDE users.

Plans and organizes laboratory activities. Helps superintendent plan and coordinate TMDE mission support requirements in the geographical area. Evaluates workload inputs, training requirements, laboratory environmental conditions, and the availability of skills and equipment. Identifies scheduled mission-essential TMDE and its impact on workload. Helps superintendent develop workload plans, budgets, interservice and interdepartmental support agreements, special reports, and isotype permits.

Exercises (005):

1. What does the acronym TMDE stand for and for what reasons does a PME technician inspect equipment (TMDE)?

2. What does the acronym ATE stand for?

RULE	A	B
	If airman	then airman is qualified for award of AFSC at
1	is assigned permanent duty or training in helper AFSC; demonstrates potential to progress in ladder; and meets special qualifications for AFS listed in AFM 39-1	1-skill level (note 5)
2	qualifies as bypass specialist	3-skill level (notes 1 & 5)
3	completes a formal basic or lateral course; or special training designated in USAF Technical Training Program (PTT) as Category R training; and meets requirements in para 3e, specialty description	3-skill level (note 5)
4	has satisfactorily performed in the 3-level AFSC; successfully completes all training requirements; passes AKT or 3-level CDC CE appropriate to AFSC; is recommended by supervisor; and meets mandatory requirements in para 3e, specialty description	3-skill level (notes 4 & 5)
5	has satisfactorily performed in the 5-level AFSC for a minimum of 6 months; successfully completes all training requirements; is recommended by supervisor; and meets mandatory requirements or equivalents	5-skill level (notes 2, 4 & 5)
6	has satisfactorily performed in the 7-level AFSC for a minimum of 1 year; successfully completes all training requirements including management training required by AFM 50-23; is in grade E-5 or above; is recommended by supervisor; and meets mandatory requirements or equivalents	7-skill level (notes 3, 4 & 5)
7	is promoted to E-8 or selected for promotion to E-8 (note 6)	9-skill level (note 5)
8	is in pay grade E-7; possesses 7-level AFSC, which is normal input source into 9-level AFSC; achieves a qualifying score on the USAFSE; has satisfactorily performed in the 9-skill level AFSC for a minimum of 6 months and is recommended by supervisor	9-skill level (notes 5 & 7)
9	is in grade E-8 or E-9; is retraining outside 9-skill level in which promoted; and has been awarded new AFSC at 7-skill level	9-skill level (note 5)

NOTES: 1. Award of an AFSC as a bypassed specialist normally is restricted to initial classification actions. Award of a semiskilled AFSC as a bypassed specialist subsequent to initial classification will not be made solely as the result of qualification on the AKT, and will be considered in accordance with AFR 39-4.

2. If airman has been retrained from an awarded AFSC at 5 level or above, the 6 months' experience is not required. This exception also applies to reclassified airmen whose specialty was withdrawn for reasons outlined in paragraphs 6-25b(2) and 6-25c through 6-25f.

3. A minimum of 6 months' experience is required for NCOs. grades E-5 through E-7, who have been retrained from awarded 7-skill level AFSCs, or who are returning from Special Duty Identifiers. When change of CAFSC requires termination of upgrade training to the 7-skill level, up to 6 months' of former training time may be applied to the experience requirement for award of 7-skill level in different career ladder. No minimum experience requirements for NCOs, grades E-8 or E-9, who have been trained from awarded 9-skill level AFSC. Applies to reclassified airmen whose specialty was withdrawn for reasons outlined in paragraphs 6-25b(2) and 6-25c through 6-25f.

4. If the training requirement is accomplished through OJT, both parts of the dual channel program must be completed as explained in AFM 50-23.

5. Signature of unit commander or his designated representative required on all classification actions initiated.

6. Must accept promotion to E-8 in order to retrain 9-skill level.

7. Six months' minimum performance is not applicable to AFSC 10090.

Figure 1-1. Criteria for award of airman AFSCs.

3. How should you, as a technician, assist a PME specialist?

4. When does the superintendent need your assistance?

1-3. Laboratory Management

As a PME technician, you will eventually become more and more involved in management decisions that affect the laboratory to which you are assigned. This may be caused by PCS assignment, illness or attrition, or by virtue of the rank you hold. For whatever the reason, you'll be dealing in a multitude of areas that a bench technician normally isn't to concerned with. Therefore, the objectives that follow are included to familiarize you with those areas that will make you a better manager and insure the smoothest possible operation of your laboratory. Although you will not normally deal with the majority of the following offices on a daily basis, being in the lab means you are part of a bigger maintenance complex. As such, you should be aware of how the larger complex is set up. When we discuss Quality Control, you will see that we are working our way from the large complex into the laboratory and into the information that will help you become a better technician/supervisor.

006. Identify the responsibilities of the deputy commander for maintenance.

Deputy Commander for Maintenance. (DCM) The deputy commander for maintenance plans, organizes, coordinates, directs, and controls the maintenance effort and is responsible to the commander for the maintenance mission. The DCM is the executive manager of the maintenance organization with centralized control and direction of all functions of the activity. Maintenance staff agencies are outlined for assistants. The staff agencies act in the name of the deputy commander for maintenance on those matters for which they have been given responsibility. The maintenance manager concept (upon which this system is based) demands control from the DCM and staff functions. The intent of this system is to plan, control, and schedule maintenance. This work is done by the staff functions. For example, a highly skilled mechanic with special equipment is sent out to do a highly technical job. This obviously requires a system of scheduling, priority assignments, dispatch, and control action from a central agency—the DCM. This control agency uses its staff functions to direct the maintenance. Each established function will be discussed on an individual basis so that you can grasp the general concept and the necessity of that agency. Understanding the basic responsibilities within each organizational structure is a necessary part of the training of each officer, enlisted person, and civilian affiliated with the Air Force.

The deputy commander for maintenance runs the maintenance organization through policies and procedures outlined in AFR 66–1. The DCM applies the principles of leadership and management and expects the same from all appointed supervisory personnel. The DCM staff provides direction and guidance for all subordinates to implement. This direction complies with local and higher authority policies and instructions. The DCM estimates and programs facilities, equipment, manpower, and training requirements through study and analysis of the organization.

The planning, scheduling, controlling, and executive responsibilities of the deputy commander for maintenance are fulfilled through the action of the staff function under the DCM direct supervision. The maintenance control and quality control functions are responsible for management of the quantity and quality of maintenance production.

Exercises (006):

1. What is the DCM's overall responsibility?

2. How does the DCM fulfill responsibilities?

007. State the staff functions under the DCM.

Deputy Commander for Maintenance Special Staff. A special staff element, consisting of Administration, Production Analysis, Training Management, and Programs and Mobility is authorized to fulfill those administrative tasks not specifically associated with direct production efforts. The deputy commander for maintenance provides this staff with basic mission commitments and they, in turn, take the detailed actions necessary to the maintenance requirements. Let us look at the sections directly under the DCM.

Administration. The administrative center for the maintenance organization prepares and maintains reports, correspondence, local maintenance directives, and provides keypunch services. It is the focal point for all correspondence and reporting.

Production Analysis. Production Analysis is the primary management information source for the DCM. It operates as a data surveillance and statistical unit. The overall objective is to improve the maintenance operation by examining various maintenance management output products and reports to identify trends that are developing. All analysis personnel should be graduates of the maintenance analysis technician course. Raw data alone can be misleading and must be carefully analyzed by Production Analysis personnel before they are used by management.

Training Management. The purpose of this activity is to insure having a continuous, well-organized training program throughout the maintenance complex. A prime concern is having enough people in all skills and at the proper skill level to support the maintenance mission. The maintenance training program consists of qualification

aining, management training, and upgrade training JGT). Qualification training provides training for specific ›b requirements, while UGT provides the training to attain kill levels within an AFSC. Management training provides n understanding of maintenance management functions, elationships, and procedures. Training Management oordinates with unit training (in your squadron) regarding rogress and participation of maintenance personnel aining programs, but it does not conduct, administer, chedule, or maintain documents for such training.

Programs and Mobility. The DCM must have managerial upport in developing and maintaining programs and plans. 'rograms and Mobility is the single point of contact in the naintenance complex for collecting, assembling, and orwarding maintenance inputs to essential mission or upport plans. It also performs the management functions of inance, manning, and facilities for the DCM.

Logistic requirements for mission plans demand accurate ›lanning to insure the necessary maintenance support. The ogistics annex for a plan must list the maintenance esources that are needed for a successful plan. The kind of ›lans we are talking about are mobility, disaster ›reparedness, or contingency plans. Programs and mobility eviews these plans to insure that all elements of support equired for each maintenance task are included.

Mobility normally tops the list in the planning lepartment. The importance of maintaining a constant state ›f readiness to execute mobility plans demands that all activities involved be prepared to respond within the time specified in the plan. Programs and Mobility develops internal procedures to insure that the affected activity knows what is required of it. In coordination with the unit mobility supervisor, Programs and Mobility insures that each maintenance organization responsible for mobility participation:

a. Designates sufficient qualified maintenance personnel to meet mobility commitments.

b. Requires that maintenance personnel designated for mobility keep their personnel, immunization, and personal affairs documents current.

c. Identifies equipment and materials prescribed by the mobility plan.

d. Establishes procedures to insure that prescribed marking, packaging, and marshalling requirements are accomplished.

Next, let us look at the financial management angle of Programs and Mobility. The management of funds is assuming an ever-increasing role in managing the maintenance complex. The DCM is responsible for financial planning, preparation of budget requirements, and controlling expenditures against budget allocations. Programs and Mobility provides a financial manager to assist the DCM in managing maintenance financial resources.

The financial manager is responsible for:

a. Preparing and submitting the maintenance financial requirements for inclusion in the base-level financial plan, budget estimate, and operating budget.

b. Distributing budget allocations within the maintenance complex.

c. Monitoring the status of expenditures by cost center.

d. Keeping the DCM advised on the financial status of the maintenance complex.

Programs and Mobility also monitors the maintenance authorizations and serves as the focal point for managing facilities. Facilities management consists of identifying facilities requirements, submitting requirements for new or additional facilities (through command channels to the wing or equivalent real property resources review board), allocating assigned facilities to the maintenance staff and production activities, evaluating shop layout for economical and safe use of the space allocated, and monitoring requests for repair or modification to existing facilities.

Maintenance Control. Maintenance Control is the planning, scheduling, coordinating, and controlling center. As the "hub" around which all other control and productive elements operate, this activity controls all scheduling, workflow, material transactions, and the dispatching of personnel to work areas. Maintenance Control depends on the effective use of maintenance assets and the ability to evaluate the use all available information in its planning. Maintenance Control must gather, post, and record status information that is essential and significant to maintenance. Therefore, it must be located, equipped, and arranged to facilitate this work.

Maintenance Control is the point where all information is assembled, arranged, and weighed to find out necessary actions for completing objectives. Adequate and reliable communications must be set forth to guide the supervisors assigned to the maintenance effort. To fulfill these responsibilities, Maintenance Control is normally divided into three distinct functions: (1) Job Control, (2) Materiel Control, and (3) Plans, Scheduling, and Documentation (records).

Job control. The activity is organized to direct and control maintenance of aircraft, related support equipment, and services. Job Control implements the maintenance plan and schedules the accomplishment of unscheduled maintenance requirements. Job scheduling and controlling are the true payoff points of maintenance management. The overall effectiveness of management is realized from the results obtained through the operation of Job control. AFR 66–1 requires Job Control to:

(1) Maintain status of each aircraft, critical categories of ground equipment, work in progress, munitions loaded aircraft, designated unit transportation, tow vehicles, and training equipment.

(2) Maintain specialist availability.

(3) Authorize and assign jobs, work priorities, and start and completion times for unscheduled maintenance.

(4) Control all maintenance on assigned aircraft and equipment by real time implementation of maintenance plans.

(5) Supervise and control the transportation and communications system. Provide for effective transmission of information and delivery of materiel and maintenance personnel.

(6) Coordinate not operationally ready supply/not fully equipped (NORS/NFE) start and stop times, and reparable processing and production control priorities for in-shop work.

(7) Coordinate inspection schedule and functional check flight (FCF) requirements for aircraft with Quality Control.

(8) Coordinate with Materiel Control and Plans and Scheduling when prepositioned assets and parts allocated for specific jobs are required for unscheduled maintenance.

(9) Insure that no cannibalization actions are directed unless cannibalization has been properly authorized. Further, insure that every cannibalization action is accurately and completely recorded on AF Form 2414, Verification Worksheet, and AFTO Form 349, Maintenance Data Collection Record.

(10) Control aircraft parking locations and maintain parking locator board.

(11) Notify affected activities of changes in priorities, plans, and schedules.

(12) Act as the requesting agency in acquiring support services such as firefighting standby, fueling and defueling, civil engineer support, and control tower clearances for selected ground movement of aircraft and equipment.

(13) Develop, maintain, and when required, implement quick reaction checksheets.

(14) Establish internal procedures within Job Control to insure transfer to pertinent information from one shift to another.

Materiel Control. Materiel Control provides coordination between maintenance and supply managers, manages supply transactions for the maintenance complex, and manages production of assets in the repair cycle. Materiel Control also insures that required parts, tools, and equipment are available to the maintenance activities at the proper time. Maintenance capabilities depend on the ability to logistics managers to accurately forecast materiel requirements. Materiel Control provides the interface between the maintenance complex and the supply system management products and asset movement procedures. The efforts of Materiel Control must always be directed toward maintenance support.

Materiel control has grown from a minor additional duty of the mechanic, supervisor, and maintenance officer into a job of great magnitude and complexity. Coordination is the secret of successful control. Continual contact is maintained with each maintenance element and Base Supply for effective coordination and support of the maintenance mission.

Materiel Control keeps all maintenance activities informed of the overall supply situation, recommends improvements of supply support, and recommends equipment redistribution when inequalities exist. The efforts of this activity must be continually directed toward increasing the maintenance output. When materiel cannot be supplied through normal channels. Materiel Control, working with Supply and the Equipment Management Office, investigates all possible sources for required items.

A continuing study of supply action is conducted to locate factors that may cause supply delays. Each delay must be analyzed and brought to the attention of the appropriate personnel for correction. Every effort must be made to provide the required items at the work location at the proper time without loss of maintenance man-hours. Base supply keeps critical item lists in coordination with Material Control. These lists are reviewed periodically to aid Supply in determining supply and repair action. Critical item lists keep both Production Control and Supply informed as to the status of critical items in the repair cycle. Critical items may be designated by AFLC, major command, or by the local chief of supply. A critical item is identified by the word "Critical" appearing on the issue document from Supply. Any item identified as critical must be delivered promptly to Production Control upon removal from the end item. Production Control is then responsible for entering the item into the repair cycle with the proper priority.

Another category of supply property is the repair cycle assets. This category includes all equipment that requires bench checking and repair. Equipment that is bench-checked and found serviceable, or is repaired and restored to serviceable condition, is stored in supply warehouses or at other suitable supply points, determined by Base Supply in coordination with Materiel control. The primary purpose of these supply points is to facilitate maintenance support. The repair cycle assets are staffed and managed by Base Supply personnel. Materiel Control assists Supply in determining the line items and quantities to be on hand at the supply points, based on the need and frequency of need of a particular item as indicated by past usage. Maintenance personnel normally request (or order) repair cycle assets items directly from supply by telephone, radio, or document (request for issue form), as dictated by the urgency of the requirements.

The term "preplanned requirements" is applied to items, other than bench stocks, that are required for replacement during forthcoming periodic inspections. Normally, such items include those directed by technical orders for a time change, plus those known to require replacement but which have been carried forward to the periodic inspection. Preplanned requirements serve a twofold purpose in the overall support program. First, a standardized system is provided for forecasting a part of the maintenance requirements. This lets Supply personnel review available assets to determine the existence of sufficient stocks to meet a known requirement. Second, Supply personnel can submit special requisitions to depots well in advance of needs.

The records activity ascertains the time-change requirements and refers such information to Materiel Control. Materiel Control consolidates these time-change requirements and furnishes the data to Supply. It also determines the physical availability of items when such information must be considered in maintenance planning and scheduling. The items and quantities needed for time change are verified by the records activity representative. Thereby, items previously listed for change that have been replaced because of failure are removed from the list. Upon verification of these requirements, Materiel Control determines the availability of the items and notifies the DCM so that replacement items can be placed on the inspection sequence chart.

Another responsibility of Materiel Control is keeping records of cannibalization. Cannibalization is the authorized removal of a specific assembly, subassembly, or

component from one equipment end item for installation on another equipment end item. Cannibalization is only used to meet priority requirements, and then with an obligation to replace the removed items. Materiel Control has the responsibility of notifying Maintenance Control when the replacement equipment is available for issue by Base Supply. Then it becomes the responsibility of Maintenance Control to schedule the replacement.

Plans, Scheduling, and Documentation. Basically, the plans and scheduling section schedules the use and maintenance of aircraft and related equipment to meet mission commitments. This section conducts the quarterly, monthly, weekly, and daily planning meetings.

Planning and Scheduling also advises the DCM of maintenance capabilities and shortcomings, and it authorizes and assigns jobs in conjunction with Job Control. The section maintains job standards and coordinates the maintenance activity actions in support of unit plans for emergency war order (EWO), contingency, mobility, and weather evacuations. It maintains depot level maintenance input program schedules in support of major command planning and monitors the debriefing activity.

The documentation section maintains prescribed historical maintenance data. This office is normally adjacent to Plans and Scheduling. The documentation section is also responsible for review, evaluation, and storage of information essential to planning and scheduling maintenance actions. Yet another job of the documentation section is to review entries on maintenance documents for accuracy.

Quality Control. The mission of Quality Control is to determine the quality of maintenance. Personnel assigned to the inspection section of Quality Control are of the highest caliber. They have the experience and background to inspect any maintenance to determine whether it is consistent with established standards. Quality Control is also responsible for maintaining an up-to-date file of all technical orders, publications, and allied materials. This activity represents the final "tool" for safety, production effectiveness, and efficient operation under the control of the DCM. We will discuss the various responsibilities of Quality Control as they apply to the precision measurement equipment laboratory.

The quality assurance inspection of PME technicians assigned as augmentors to Quality Control. The DCM designates highly qualified PMEL personnel as quality control inspectors. The PMEL quality assurance program is used in lieu of unit maintenance standardization and evaluation program (MSEP) requirements. When a major command establishes an MSEP in lieu of the unit program, the PMEL quality assurance program is included as minimum criteria. Quality assurance inspections are over-the-shoulder evaluations and quality verification inspections. Over-the-shoulder evaluations are selected on the basis of one evaluation per month per five personnel performing certifications of precision measurement equipment. Quality verification inspections (QVIs) are selected from each technician output using the multilevel, continuous sampling procedure explained below. Minor discrepancies in physical condition such as cracked knobs, missing screws, loose handles, or chipped paint are not considered defects for the purposes of the quality assurance program. As item of PME is considered defective for the purposes of the quality assurance program if it does not meet technical order accuracies for functions certified or if it is unsafe or hazardous to use.

Quality verification inspections of PME are made using a multilevel continuous sampling procedure as derived from DOD Handbook H-106, *Multilevel Continuous Sampling Procedures and Tables for Inspection by Attributes.* The number of items selected for inspection depends on the quality of the items that previously were inspected and the results of the random selection process. When defective items are found, the number of items inspected is increased. If no defective items are found, the number of items inspected is decreased. This system insures an average outgoing quality of at least 95 percent defect-free items. Also, over a period of time, the system insures at least 6.25 percent of all items certified will be inspected even if no defects are found.

Quality Control inspects 100 percent of each technician's production for physical condition and documentation errors. All discrepancies are brought to the attention of the immediate supervisor of the certifying technician for appropriate action. Transportable field calibration unit (TFCU) production is inspected under the criteria of the quality assurance program with the following exceptions:

(1) When a Quality Control augmentor is not part of the TFCU team, the TFCU supervisor performs the duties.

(2) If the work the TFCU supervisor has done is selected for inspection, another qualified team member makes the inspections.

Upon completion of certification, completed AFTO Forms 349 are processed through the quality control inspector. The inspector randomly selects an item of PME using completed AFTO Forms 349 and the multilevel sampling techniques. A container is needed containing the number of like coins appropriate for the sample size required (fig 1-2). For example, at level one, use one coin; at level two, use two coins; and so forth. The container is shaken for each completed AFTO Form 349 with action taken codes J, F, or K. If one coin is used and it appears heads, the particular PME item represented by the AFTO Form 349 is inspected.

The following example is based on figure 1-2, and is used to implement the system. The process begins at level four with 6.25 percent of each technician's production being inspected. This is done by shaking the coin container with four coins inside for each AFTO Form 349, and each time four heads appear, that item is inspected. When a defect is found, go to state four. Inspect the next four items certified by that technician. If no defect is found before four items pass inspection, revert to level four. If a defect is found before four items pass inspection, go to state three and inspect the next four items certified by that technician. If no defect is found before items pass inspection, go to level three. At this level, 12.5 percent of the technician's output is inspected. This is done using three coins and shaking the container for each AFTO Form 349, and each time three heads appear, the item is inspected. If a defect is found before 18 successively inspected items pass

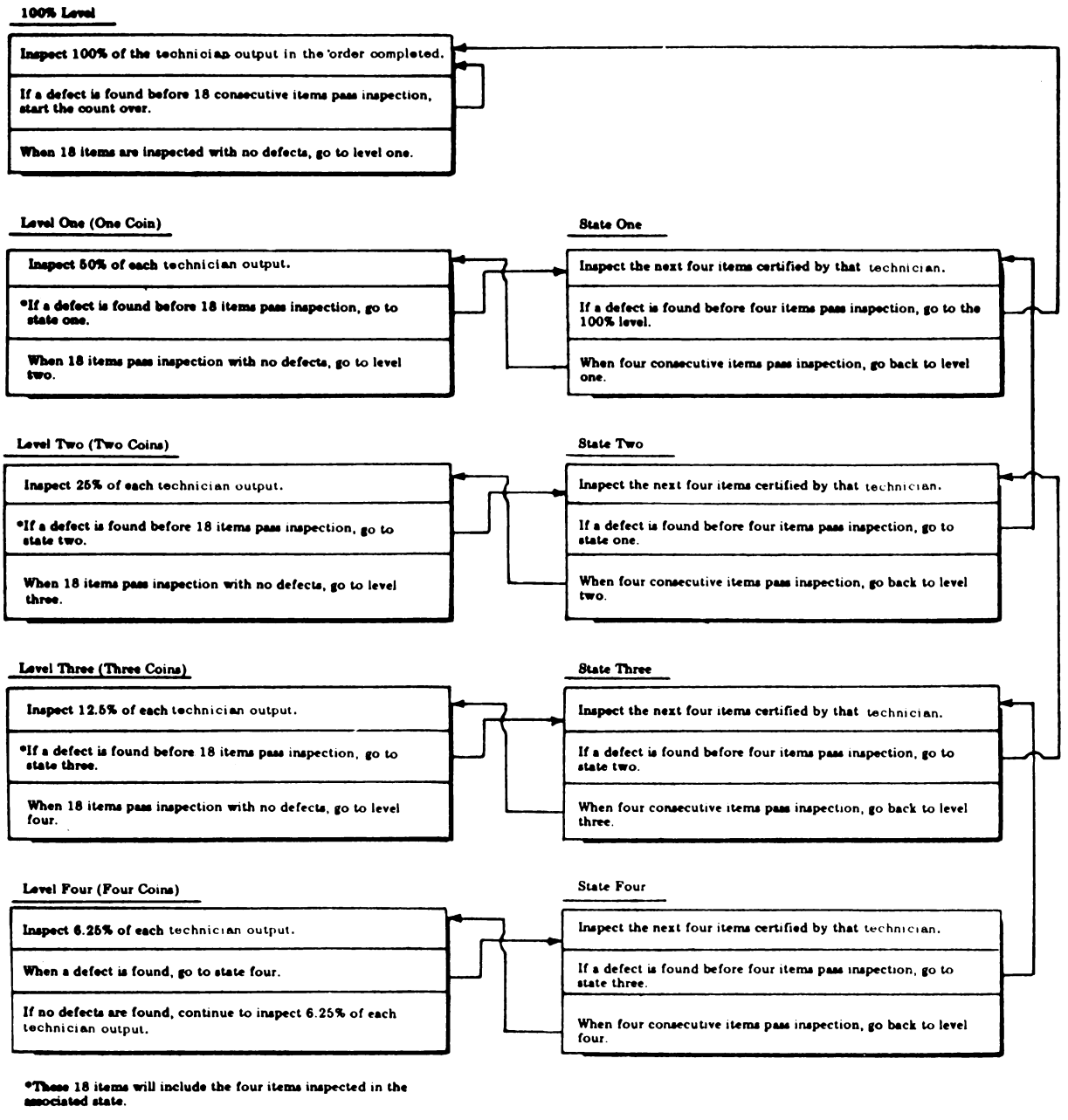


Figure 1–2. Flow process chart for multilevel continuous sampling.

inspection (including the four items that passed while in state three), return to state three. If, while at level three, 18 successively inspected items pass inspection, including the four items that passed while in state three, return four and resume random sampling at the 6.25 percent rate. If at any level a defective item is found before 18 successively inspected items are passes, inspect the next four items certified by that technician. If no defects are found in these four items, sampling is resumed at the same rate as when the defective item was found. If no defects are found in the next 18 randomly selected items, including the four consecutively inspected items, the sampling rate is dropped to the next level. If a defect is found before 18 successively inspected items are passed, revert immediately to the state indicated and inspect the next four items certified.

The immediate supervisor is made aware of the results of each item inspected. If defects are identified, the supervisor will observe the corrective actions by the certifying technician and insure required training is conducted if needed. If training is required that cannot be conducted concurrent with the repair action, the supervisor withdraws task qualification and insures training is scheduled. When training has been successfully completed, the technician is requalified on the specific rate level changes are brought to the immediate attention of the PMEL supervisor.

A technician status chart is used to indicate the level or state of each technician in the flow process. Information portrayed indicates the level or state that each technician is in and the number of items inspected in that level or state. The chart is updated as inspections are completed.

An AF Form 2442, Precision Measurement Equipment Inspection Report, is completed for each QVI and each over-the-shoulder inspection. The type inspection is indicated on AF Form 2442. Discrepancies also are entered on an AFTO Form 349. AF Form 2442, AFTO Form 349, and the defective items are returned to the certifying technician for corrective action. When an item is found acceptable, it is forwarded to the scheduler with AFTO Form 349 for normal processing.

The AF Form 2442, identifying discrepancies is forwarded with an AF Form 2419, Routing and Review of Quality Control Reports. Minimum routing is to the maintenance supervisor, Quality Control, DCM, and back to the PME laboratory. The AF Form 2442 and 2419 are forwarded weekly or monthly, as determined by the DCM. AF Form 2419 also is used to include a summary of the inspection results for the period covered by the report. The summary includes, as a minimum, the total quantity of items inspected and the quantity and percentage of items rejected. The forms are filed in the PMEL and disposed of per AFM 12–50, *Disposition of Air Force Documentation*. The use of this information on the AF Form 2419 does not preclude the use of the base-level inquiry system or other data systems for providing summaries of defects for use in improving product quality.

Exercises (007):

1. What part does the administration function play in the maintenance management program?

2. What is the purpose of the production analysis function?

3. What three types of training are under the training management function?

4. Which function is responsible for mobility, disaster preparedness, and contingency plans?

5. What are the responsibilities of the individual maintenance organizations to the programs and mobility function?

6. What are the responsibilities of the financial manager of the plans and mobility function?

7. What are the three sections that make up Maintenance Control?

8. What is the function of Job Control?

9. What is the function of Materiel Control?

10. What is the function of Plans, Scheduling, and Documentation?

11. What are the responsibilities of Quality Control?

12. AF Forms 2442 and 2419 are routed to what activities?

008. Identify USAF supply documents and supply organizations and state what kind of information you need to prepare special requisitions and issue and turn-in forms.

Supply Administration. Many thousands of items of spare parts, special tools, maintenance equipment, pencils, paper clips, etc., are required for the Air Force mission. The cost runs into billions of dollars. This property is stored, issued, and reissued, or shipped—a cycle that may be repeated several times before an item is no longer usable and is sold for scrap. All personnel in the Air Force must treat this property as if it were their own. This applies to officers, airmen, and civilians, alike, but to avoid wastefulness and carelessness, definite responsibility must be assigned to assure that Government property is adequately safeguarded and efficiently used. As a supervisor, this will definitely be one of your primary responsibilities.

Special requisitions. Sometimes you may need to order parts that are not stocked by the base supply office (BASO). Items that are not identified by the Air Force supply system must be special ordered. To order such items, you must submit a special requisition that includes a description of the item and the manufacturer's name and part number, if possible. If you know this information about the item of equipment, refer to BASO for help in preparing the special requisition.

Equipment authorization. The equipment authorized for your unit is based on two general factors: the unit mission and the number of people. These factors are interrelated. For example, if the mission requires certain test items, then trained personnel must be authorized. As people are authorized, quantities of other types of equipment based on the number of people are affected.

The equipment authorized your unit is based on USAF allowance documents. These documents reflect the average minimum quantities of equipment items needed for the mission, but they do not necessarily reflect the exact quantities your unit will be authorized. Exact quantities are determined by major commands and base equipment management offices. They are influenced by such factors as the number of aircraft to be maintained, the size of the workload, the type of maintenance performed, the number of personnel, and the climate conditions. These allowance documents are called USAF Tables of Allowance (TAs). They list the items of equipment in the quantity normally required to support the mission of the Air Force activity. The applicable TA must be quoted in the request for issue of equipment. Repair parts are not listed in these tables. AFR 0–10, *Management Control and Authorization Program of Allowance Source Codes for USAF Activities,* is the index for TAs. Examples of TAs listed in the index are:

a. TA 016, *Special Purpose Clothing and Personal Equipment USAF* (for clothing of personnel).

b. TA 734, *Precision Measurement Equipment Laboratories (PMEL)*.

c. TA 757, *Aircraft Maintenance* (A–7, F–100, F–104, F–111, F–105, FB–111, T–28, T–33, and T–39 aircraft).

Expendable supplies. These are items that are either consumed or lose their original identity by incorporation into another assembly. Office supplies, such as paper and pencils, are examples of items consumed in use. Bench stock items, such as nuts, bulk hose, seals, and repair kits, are items that are incorporated into another assembly. Bench stock is a working stock of nonrecoverable items. It is required to provide uninterrupted operation and expedite maintenance. One shop bench stock may be authorized for each maintenance shop area, or the bench stock may be combined when two or more shops occupy the same area.

The equipment management office (EMO) controls the base equipment management system. So far as your unit is concerned, EMO is the source of supply. It also receives all equipment requests for nonexpendable items listed in the TA for your organization. Examples of these items are tools, machines, and clothing. The BASO controls and issues repair parts and maintenance items. These items fall into two categories: (1) bench stock (which consists of miscellaneous items of expendable hardware) and (2) repair cycle items. The BASO also issues local purchase items such as pencils and paper clips.

Issue and turn-in forms. For requesting supplies, you most likely will find local and Air Force forms used. For this reason, we do not discuss the form numbers. We list some of the information they require. Keep in mind that these forms have a dual purpose. They are used for either issue or turn-in of equipment or supplies. Turn-in is appropriate for excess or unserviceable property. Your unit supply custodian indicates which action is requested. The information on the form is the date of request and unit designation, the unit supply request number (for identification of followup action), the name and telephone number of the unit supply custodian, the equipment stock number or part number and name or description of the item, the justification of request (including the allowance documents applicable and a brief statement of circumstances), the quantity required, and the certification by the commander or a representative that the requirement is valid.

Exercises (008):

1. What information is required for a special requisition?

2. Which official USAF document must be quoted in the request for issue of a specific item of equipment?

3. Which supply organization on your base receives your unit request for nonexpendable items, such as tools, machines, and clothing?

4. Which supply organization handles your unit's request for repair parts and maintenance items?

5. What type information must be included on Air Force issue and turn-in forms?

009. Identify the forms and the entries on them that relieve persons from responsibility for lost, stolen, or damaged equipment when there is negligence and carelessness indicated.

Lost, Damaged, or Destroyed Property. The monetary loss of the Air Force must be accounted for in some manner when property is lost, damaged, or destroyed. The person with responsibility for the property must reimburse the Air Force. If not, the Air Force will stand the loss.

Two methods of being relieved of property responsibility involve the use of a DD Form 1131, Cash Collection Voucher, and a DD Form 362, Statement of Charges. These two forms are used to reimburse the Air Force when pecuniary liability is admitted. The damage to, or the list price of, the article cannot exceed $500 in order to use these methods. Keep in mind that even though the individual has paid for the loss, the property does not become the property of the individual.

The least troublesome way to settle a monetary obligation is to pay in some form of case. The DD Form 1131 is generally prepared by the responsible officer (or EMO) to cover the case collections for a particular period of time. Listed on the voucher are the names of airmen, the articles lost or damaged, and the amounts involved. The voucher shows the complete Air Force description of the items involved and the purpose for which collection was made. Negligence and carelessness may be indicated as the causes of damage to the property. The statement, "Used in lieu of report of survey," is an indication that pecuniary liability has been admitted. Before the money is turned in to the finance office, the voucher must be approved by the individual's commander. These vouchers are prepared by Supply personnel. What do we use to make the payment if we do not have the money with which to pay?

Airman and civilian employees use DD Form 362, Statement of Charges for Government Property Lost, Damaged, or Destroyed, when pecuniary liability is admitted, but a payroll deduction is desired. This is in lieu of a cash payment. Like the Cash Collection Voucher, the damaged item's price cannot exceed $500. The individual is charged the cost of the article or is allowed up to 25 percent description. This is why the actual cost may be less than the prices listed in the top section of the form. The Air Force considers an airman's or civilian's signature on a statement of charges in legal terms as an acknowledgement, an authorization, a waiver of right, an affirmation, and an agreement. However, the commander must certify this form before it is submitted for a payroll deduction. If an officer admits liability and cannot pay cash. DD Form 114, Military Pay Order, authorizes deduction of the amount involved in the officer's pay.

Exercises (009):

1. What two forms do we use to reimburse the Air Force for lost, damaged, or stolen property valued at or below $500 listed price?

2. Why might a price of #200 be listed at the top of a Statement of Charges form and $185 listed at the bottom?

3. What are some of the legal implications an individual agrees to by signing a Statement of Charges form?

010. State the purpose of the report of survey and the main factors affecting its preparation.

Report of Survey. A report of survey is an instrument for explaining and recording the circumstances that involve loss, damage, or destruction of Air Force property. It supports the dropping of property from the records, resolves questions of responsibility for loss, and fixes liability. In summary, when one individual will not admit liability or when the amount to be charged is over $500, a report of survey must be prepared.

Preparing the report of survey form is the first step. The person who has custodial responsibility for the property starts the process. A provision has been made for others to do this when it is impractical for the custodian to fill it out. Since the report of survey is a means for explaining the loss, the responsible individuals should include all pertinent facts and circumstances surrounding the loss. Remember, the information presented on the report of survey is the basis for deciding whether an investigation is necessary. It is important that the report of survey be initiated and processed within 30 days after the loss is discovered. The investigation must be made while the persons involved, including witnesses, are available and facts are still fresh. After the report is complete, it goes to the base appointing authority for review and appropriate action.

If the report of survey is approved, the individual will be relieved of responsibility for the individual equipment and need not reimburse the Air Force for the cost of the item. However, if the authorities decide the individual was negligent, the Air Force must be reimbursed.

Exercises (010):

1. What is the purpose of the report of survey?

2. Who prepares a report of survey?

3. Within how long after a loss is discovered must a report of survey be started?

011. State why a supervisor coordinates work with other shops and name the section in maintenance primarily responsible for coordination.

Coordination. Today's Air Force is made up of people with many AFSCs. Each of them is trained to work in a certain area of aircraft maintenance. To name a few, there are specialists in aircraft electrical, weapons, hydraulic, engine, and fuel systems, plus many others, as well as your own. During an inspection, many specialists and mechanics are required to work on the aircraft. Imagine the confusion if all of these people tried to do their work at the same time. To avoid this and still do the work in a timely manner, coordination with the other working shops is required. The coordination is usually done by Job Control. They schedule people, equipment, aircraft, and jobs.

Occasionally, in order to accomplish a specific task, you may require an assist from a technician who operates equipment in another shop. First, check the job, and then, through Job Control, arrange to have the needed technician dispatched from the user's shop. As a supervisor, you spend many hours in one or another phase of coordinating.

Training schedules, work programs, and assigning workers to jobs and shifts, all require coordination in order to result in a well-balanced, smoothly operating organization.

Exercises (011):

1. Which central agency is primarily tasked with coordination?

2. Why is a large part of a supervisor's time spend coordinating?

012. State the reasons and procedures for planning and scheduling work assignments and priorities.

Planning and Scheduling Work Assignments and Priorities. As the supervisor, you must run a shop that fully supports the mission of the base. The way your shop operates to support the mission is the result of your decision. Your decisions are affected by the size and shape of the shop facility, workload, capabilities of your people, type of equipment maintained, type of supply support, or to sum it up, your entire repair capability. As tasks requirements arise, you must plan and schedule work assignments and set priorities. In planning to meet your objectives, check your resources (manpower and equipment). Manpower is concerned with numbers as well as qualifications of personnel. For example, do not use 3-level personnel primarily for difficult tasks and 7-level personnel primarily for simple ones. Choose the right airman for the job. Equipment also is very important. You cannot complete a task without the proper tools. Past workloads help you plan the best use of your manpower and equipment.

When you plan an operation, consider scheduling. For example, you may have to schedule the use of test equipment among the specialists and technicians in the PME laboratory. Also, schedules must be planned for chow, shift work, etc. Always assign priorities when you plan and schedule. Your primary concern is to support the main purpose of your unit and to insure proper operation of the PME laboratory. In setting priorities, schedule your personnel according to daily commitments.

With the proper planning, scheduling, and setting of priorities, you, as a supervisor, will get the most out of your available resources. Of course, you may need to refine your schedule, but these changes can be made at the appropriate time. One important consideration occuring each year is annual leave. Remember, the priorities of the PME laboratory must be met. For example, you may have only two people qualified to work on the AN/UPM-141 radar test sets. If both want to take 30 days leave at the same time, you will have to make plans to cover the situation. You may train someone else for the job, deny leave to one of the trained workers, or work out a compromise between the two trained people.

Other items to consider in planning are the skill levels and number of people required for certain jobs. Also, you need more than the minimum of required qualified personnel in case of an emergency. If such conditions arise, qualified personnel are needed to fill in. All personnel must understand the workload to facilitate planning and scheduling. After your plans are made, if necessary, coordinate with other sections concerning equipment or laboratory assistance. After you schedule the work, monitor its progress to insure the success of your program.

Exercises (012):

1. What should you consider as task requirements arise?

2. What two resources must we consider in planning an operation?

3. Why is scheduling so important?

4. Why are priorities set?

013. State requirements for assigning personnel to maintenance and repair work.

Assigning Personnel to Tasks. You know by now that all of our tasks are not always the same, nor is everyone equally trained in all of the areas of responsibility. Therefore, as work orders are received and jobs assigned, carefully plan the assignment of workers. Assign a specialist or technician who can do the task without much trouble. Usually, we think of the 7-level technician as the most qualified person for any task. However, this is not true in every case. For example, a 3-level specialist who has been working with microwave systems may be more qualified to work on a new radar test set than a 7-level technician whose experience has been exclusively in the dimensional area.

Besides job knowledge, consider the many other areas concerning job assignments. There are schedules to meet and a priority system which governs duty assignments. Very often this causes a shift of people from one job to another. Avoid doing this as much as possible, but, again, remember the shop priorities. For example, when you have a high-priority job, place the lowest priority job (with qualified technicians) in "hold." Once you handle the emergency, resume the regular schedule.

Exercises (013):

1. Should you always select a 7-level technician over a 3-level specialist for a complicated task? Explain.

2. Differentiate between job knowledge and skill level for assigning personnel to tasks.

3. Besides job knowledge and skill level, what other important factor is considered in assigning people to an emergency work order?

014. State the supervisory responsibilities necessary to assure that personnel meet required inspection and maintenance standards, and evaluate hypothetical supervisory actions.

Supervision of Inspection and Maintenance Activities. The performance of inspection, maintenance, and repair activities is a primary responsibility of the PME specialist or technician. Success of these activities requires appropriate and adequate supervision, especially when new or inexperienced personnel are involved.

In supervising aircraft inspection, maintenance, and repair, the supervisor must assure that the airmen follow correct procedures and use the proper tools and equipment for each task. Workers must take proper care of and correctly handle and operate such intricate equipment as test sets and consoles. If the airmen are inexperienced at any part of a task, the supervisor should check frequently to insure that the job is being done properly. When help or advice is needed on any step of the procedure, the supervisor should not hesitate to assist as necessary.

Supervision of maintenance activities includes establishment of the requirements for the necessary equipment, tools, and spare parts. The supervisor must insure that the necessary equipment and tools are available when the workers need them. In most cases, they have the necessary tools in their toolkits, but some tasks require the use of special tools (such as a torque wrench for mounting bolts). If the TO calls for a special tool, the supervisor must assure that one is available. In short, both the supervisor and the workers must know which items of equipment, tools, and spare parts are needed for a job and how to obtain them. According to AFR 66–1, the PME branch chief must:

a. Insure the proper operation and maintenance of the highest echelon measurement standards assigned to the laboratory.

b. Insure the calibration and repair support for PME that is designated as a PMEL responsibility in TO 33K–1–100 or applicable calibration measurements summary for the host, tenant, and off-base supported activities, including Federal agencies, contractors, and security assistance program countries with established support agreements.

c. Implement the PMEL quality assurance program.

d. Establish a customer relations program that includes periodic visits to each activity supported by the PMEL to render technical assistance and advice on PME matters.

e. Use the guidelines of AFR 66–1, TO 00–20–14, TO 33K1–1–100, AFR 74–2, *Air Force Metrology and Calibration Program,* and Air Force 88–series directives to insure that the PMEL operation and facilities warrant certification.

f. Initiate action to correct any deficiencies that may affect PMEL certification.

g. Establish visitor access and control procedures.

h. Insure proper use of calibration forms and labels in accordance with TO 00–20–14 on PME processed by the laboratory.

i. Establish a program to monitor current TCTO compliance on all PME entering the laboratory.

The supervisor must assure the specialists or technicians have done the job completely and satisfactorily. If a specialist has very little experience on the task, the work must be checked thoroughly for at least two reasons. First, the equipment that has been worked on must operate properly and safely for the success for the mission. Second, inspection of completed work may be an excellent learning device for the airman in training. Your method or technique of reviewing completed work determines the inspection's usefulness as a teaching device. Where is a better place for the trainee to learn than on the equipment.

Reviewing a completed assignment requires a considerable amount of skill and tact, as well as thorough understanding of the job. As you talk to workers, stress both the strong and weak points of their work. Praise work that has been done skillfully, but do not tolerate substandard work. Avoid excessive criticism and any sarcasm or personal reference, since these comments may cut deeper than you realize and leave the worker with nothing but dislike for you. Do not use just words, but demonstrate the correct procedures and give workers the opportunity to correct their faults.

There is one other thing you should do. Check job progression. Do not wait until the job is finished. A job sometimes has to be redone if an error is found before the job is completed. Failure to check job progression may cause loss of time and work output. It can also lead to hard feelings and loss of ambition on the part of individuals who find their efforts wasted because they had to do the same job over.

Exercises (014):

1. What should a supervisor do to assure that job is being done correctly by relatively new or inexperienced workers?

2. Who must assure that a worker's equipment and tools are available to perform an assigned task?

3. State two reasons why a supervisor should thoroughly inspect a completed work assignment.

4. What should the supervisor do if inspection shows that a task has been done in an outstanding manner except that the holddown mount bolts are safety-wired backwards?

5. Why should you check a job several times while the work is being done rather than wait until it is finished?

015. State the use and purpose of maintenance and inspection reports and charts.

Maintenance and Inspection Reports and Charts. Maintenance and inspection reports are very important in the life of a supervisor. A supervisor has access to a variety of daily and monthly maintenance reports that can be used to analyze maintenance activities and determine work patterns of the personnel. These reports provide supervisors with the information they need to determine how each worker is employed and how much of a worker's time is spent on each maintenance activity. Maintenance reports are prepared from maintenance forms. In addition to maintenance reports, the squadron analysis section keeps a complete record of each writeup that is received from the aircraft crew members and ground crews. This information is also supplied by maintenance forms. Experienced supervisors have discovered that it is always good practice to check the past history of equipment. Remember that each technician does not work on every job assigned to the PME laboratory.

Charts and graphs also are useful in comparing two or more items of information, such as time versus failures, but they do have limitations. They must not be too complicated to read. A chart (such as a training chart) can have many training operations indicated and still be readable. However, if the supervisor starts adding leave schedules, annual shots, and other items of personnel information, then the training cannot be determined quickly. Graphs are more limited than charts. For example, a graph containing more than five items of information is considered to be difficult to read and understand.

Exercises (015):

1. How does the supervisor use maintenance and inspection reports and charts?

2. Why would the supervisor be interested in the time taken for a task as shown on maintenance reports?

3. How many goals would normally be used to show 11 items?

016. State the reason for establishing performance standards.

Performance Standards. Supervisors must see that their personnel carry out the responsibilities and perform the duties necessary to the unit mission. Before workers can be expected to fulfill these requirements, they must know their responsibilities and be familiar with applicable work methods and procedures. In addition, they must know to what degree of accuracy and completeness each duty or task must be performed.

The supervisor supplies the necessary guidance in the form of work methods, controls, and performance standards. The correct and most efficient way to do a particular duty or task is established as a work method. We regulate work assignments, schedules, and methods through established work controls. Success or failure of work methods and controls is evaluated or measured by performance standards. Only when established standards are met can the supervisor consider that the workers are fully accepting their responsibilities and doing their duties.

The performance standards for calibration of PMEL test equipment are established in the TO 33K- or 33L-series technical orders calibration procedures. These TOs prescribe procedures for each task. For even the simplest task, the supervisor must assure that the worker has the necessary technical data. The supervisor must enforce the standards for proper case and handling of test equipment, cleaning shop areas, safety around the PME laboratory, and proper dress and grooming, as outlined in AFR 35–10, *Dress and Personal Appearance of Air Force Personnel*. To assure that personnel are meeting required standards, the supervisor must make daily checks of all work activities.

If an area is falling below standard, the supervisor should set up a program to get it back up to standard quickly. You noticed that we used the work "quickly," which is important to the supervisor. If standards are allowed to drop for awhile because of other problems, substandard conditions may appear to be standard. The maintenance of standards is not only the responsibility of the supervisor,but everyone assigned to the organization. Thus, the supervisor looks to each subordinate worker to help in maintaining standards. If established standards are to be met, every worker must share the work equally.

Exercises (016):

1. What important management tools does the supervisor use to established work methods for quality control? How?

2. Why should a supervisor immediately correct a worker who performs an incorrect or hazardous procedure?

017. Cite methods used to justify personnel and equipment.

Justify Personnel and Equipment. You already know that to accomplish the mission you must have the necessary equipment and manpower. In today's Air Force, aircraft systems are being modified every day. Some systems may be removed, improved, or replaced with a complete new system. This may affect your manning and required maintenance equipment. Overtime required to support the mission may indicate undermanning or lack or training. There are many areas you check very closely as you justify personnel. For a starting point, look at the unit's mission. Ask yourself if you are doing tasks normally assigned to other sections? Has the wing been assigned additional flying hours? Has transit aircraft traffic increased? The final question: Are these going to be temporary or permanent conditions? Also check the unit detail listing (UDL) to see how many personnel are authorized. The UDL may authorize more people than are presently assigned. It should be brought to the attention of the commander that the mission cannot be supported properly.

Before personnel and equipment can be justified, it is important to have all the facts. The commander normally keeps close watch over the unit's manning and equipment authorization. It is possible, however, that you may supply one small fact that justifies an emergency manpower request. The same is true of equipment. Replacement for faulty equipment or that which is in limited supply and hard to repair may be justified. The commander may want to review the problem with you to insure that all of the facts are known before going to higher command for help.

Exercises (017):

1. List conditions that might affect manning and equipment authorization.

2. State two courses of action your commander could take to solve an immediate problem caused by undermanning in your section.

3. Why would the commander want to review your facts?

018. List areas of supervisory responsibility that can be assigned to subordinates and state how organizational and functional charts are used in assigning personnel to positions.

Assigning Positions. You can clearly see that you, as a supervisor, will have plenty to do. To ease some of your workload, you may begin assigning certain areas of responsibilities to your subordinates. Although you may assign tasks to others, you maintain the responsibility. As you assign these tasks, you delegate authority to do the task. Duties often assigned to subordinates are on-the-job trainer, equipment manager, section supervisor, safety supervisor, and assistant shop supervisor.

Organizational charts. By developing an organizational chart, you can show a picture of your organization. An organizational chart normally shows one level of supervision above and two levels below the charted position. As supervisor, your chart would show your position as the main position. One above would show your supervisor. Below your position would be your section supervisors and below them, perhaps, would be the technicians and specialists.

Figure 1-3 is an organizational chart that depicts a typical PME laboratory without much detail. Note that the block at the top is smaller than the one underneath with the branch name on it. This is the conventional way of showing that there are a number of higher echelons of command that may initiate and issue instructions to the branch, all of them following the normal chain of command. Units that are subordinate to the branch unit are indicated by appropriate blocks under the larger block, titled "PME laboratory." Directly connected to the block with the branch name on it are two staff units—"administration" and "training." The staff units consists of people who assist the branch chief and provide information and advice to the administrator of the whole branch. Information must flow along the lines shown—that it, only the lines leading to the branch administrator which flow downward along the lines shown to the units that do the actual work. Note that the information and inspection from the branch chief frequently are the result of communication from the higher echelons to the branch chief. The branch chief may or may not deem it advisable to consult with members of the staff. On significant matters, however, they are usually given information copies of communications from higher echelons.

It is important to note that no one in the administration or training units has any authority whatsoever to issue orders to either the electrical-electronics or physical dimensional areas. However, responsibility for certain phases of the activities of lower units and the authority to issue orders may be delegated by the branch chief. As a matter of fact, this is done quite frequently. It is a sound management practice, although the branch chief is still held responsible to higher authorities for the operation of the branch and its units. Note also that no one in either of the two lab areas had authority to issue orders to workers in the other areas. This does not mean that there can be no consultant between workers in the various lower units, with the view to more efficient scheduling of work in each area.

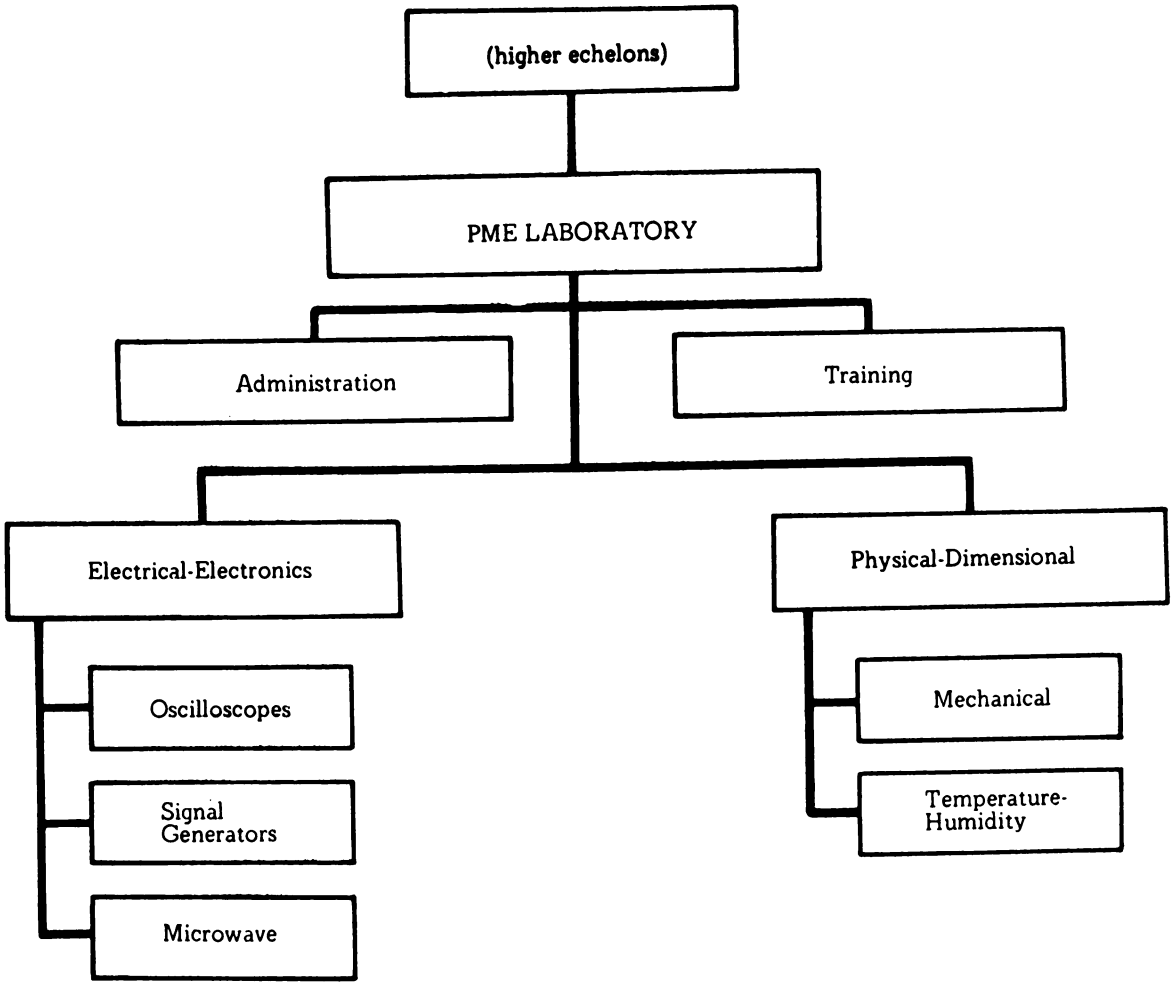


Figure 1–3. PME laboratory organizational chart.

Functional charts. A functional chart is much like an organizational chart, except the duties and responsibilities of each position will be listed on the chart. It may also list job descriptions and AF publications required for the tasks. The functional chart serves as a quick reference of the responsibilities required of a specific position.

Exercises (018):

1. List areas of responsibility in which the supervisor may delegate authority to subordinates.

2. What levels of supervision are normally shown on organizational charts?

3. What the information does the functions chart list?

019. Cite ways to resolve technical problems encountered by subordinates.

Resolving Technical Problems. You, as a supervisor, will be called upon many times to solve technical problems. "Ask the boss" is the standard answer when anyone encounters a problem. When you are that "boss" you must come up with the answer. The answers you will give go a long way in establishing your reputation as a supervisor. You must come up with a good answer. Perhaps your past experience will be of use to you in the form of so-called tricks of the trade. Perhaps you will have to research TOs or manuals to come up with the answer. Maybe just telling the worker with the problem where to go to find the answer will suffice. It may be that you will have to ask for outside help if the problem is beyond your knowledge or ability to solve. Never leave a problem unsolved if it is possible for you to solve it. If you refer one of your people to someone else for a solution to problem, check back with the individual to see if the problem was solved. By doing this, your people will get the feeling that their problems are your problems (which they are), and this situation will increase their confidence in you as a supervisor.

Exercises (019):

1. Whom would one of your airmen consult for assistance in solving a problem?

2. What would you do next if one of your people gives you a problem that you cannot answer?

3. When you refer your people to someone outside the organization, why should you check to see whether or not the problem was solved?

020. State how workers in your shop can initiate policy change.

Recommendations by Supervisors and Subordinates. During your time as a supervisor, you will need to recommend policy changes concerning the personnel you supervise and the equipment they use. Where do these recommendations originate? One source of these recommendations is from your own personnel. As a supervisor, you are not always fully aware of what is happening around you due to time contraints and other additional duties. Who else knows better than your own technicians what equipment needs replacing or what area of the lab needs its manpower adjusted to meet the workload. A good supervisor needs to actively solicit recommendations from personnel on equipment changes and other office related matters. After all, the people who work for you can make you or break you.

One of the main factors in soliciting recommendations or suggestions, whether it be up or down the chain of command, is to maintain lines of communication. Allowing these lines to remain open means being receptive to recommendations from all levels. And too be receptive, you should listen, be sincere, and possibly add any comments which might bolster or substantiate the recommendation.

You also must consider and weigh all factors when dealing with suggestions. If you do not, this will destroy lines of communication. For example, if one of your workers approaches you with a suggestion concerning improving a preventive maintenance performance task of scheduling which the worker thinks would save your section 100 man-hours per week, hear that person out. If you make a comment such as *That's ridiculous,* there is no way this worker will ever approach you with another suggestion. If you listen you might just save that 100 man-hours as well as promote higher morale among all your employees. Encourage your workers to bring their suggestions to you. Think about their concern—listen and be more patient—and the result will be a smoothly run lab which suggests changes and brings forth new ideas willingly.

When your supervisor makes a recommendation or advises you on a particular matter, how do you handle it? If you believe that the suggestion is valid and will improve your operation, you incorporate it into your operation without any problem. On the other hand, if you believe that the suggestion will prevent smooth operation in your section, how do you handle this? The best way is to be receptive, consider and weigh the suggestion, and then decide on your course of action. If you do not intend to implement the suggestion, be prepared to justify your case. This might entail documentation of your case so that your supervisor will not make the suggestion an order.

In the event that your supervisor does make the suggestion an order, what course of action do you have left? You must decide how this order will affect your total operation. If it will reach the individual technician, the best way to convey the change in operation of a plan is to call a conference of the individuals concerned. Lay out the new plan to them. Present all of the facts. Listen to their side of the situation and counter their resistance to the change the best way that you can. These conditions arise, and you must be ready to handle them. Do the best that you can to operate under the new situation and, as time goes along, keep documentation on how this new plan or operation is running. You might just discover that it was not such a bad idea after all; or, your documentation could prove that the new plan or operation was not a good idea. Then you can approach your supervisor and show what effect the change in policy has had on your operation.

Exercises (020):

1. As a supervisor, what is one main source of recommendations for policy changes that you should constantly use?

2. After listening to recommendations, what should you do?

3. What factor must be maintained to encourage recommendations?

021. List procedures for counseling personnel and resolving individual problems.

Resolving Individual Problems. Much has been written about how to get along better with other people. Considerable emphasis has been placed in base-level management training programs on the why and how of working with people in a team spirit to reach a common goal. Let us review some of the ways to resolve individual problems, such as employee relations, and examine procedures for handling problems.

Employee relations. Instead of discussing employee relations, we will list the normal foundations necessary for good employee relations and then outline effective procedures for handling their problems. The following items will aid you with many employee relations problems. They are not all-inclusive, but will give you a start in the right direction. As you observe other supervisors at work and gain experience, you can add to the list.

- Let workers know how they are getting along. Tell them what you expect, and point out ways to improve their work. Praise in public, criticize in private, and always give credit where credit is due.
- Look for extra or "beyond the call of duty" type of performance. Tell it while it is "hot" and tell people in advance about changes that will affect them. Tell them why, if you know, and sell them on the idea of accepting the change.
- Make the best use of each person's ability. Look for that extra ability that may not be in use. Never stand in a person's way.

Handling a problem. One responsibility with which you may have trouble at times in handling a problem. You may be confronted with difficult situations that appear to have no solution. There are fortunately, tried and true ways to help solve most problems. Use the following procedure in a difficult situation.

- Get the facts. Review the record, find out what rules and regulations apply, and talk with the individual concerned. Get opinions and feelings, but be sure you have the complete story.
- Weigh and decide. Fit all the facts together, consider their bearing on each other, and answer this question: What possible courses of action are there? Check practices and policies of your organization at your level. Consider objectively the effect on the individual, group, and work. Do not jump to conclusions.
- Take action. Will you handle this yourself? Will you require help? Should you refer it to your supervisor? Make your decision and time your actions to fit the decisions. Do not pass the buck.
- Check results. How soon will you follow up? How often? Observe changes in output, relationships, and attitudes. Has your action increased or decreased the work output of the individual or group?

Exercises (021):

1. What are some of the points to remember when telling workers how they are progressing?

2. In problem solving, what four general procedures apply?

1-4. Materiel Deficiency Reporting System

Today we are all familiar with the civilian recall of automobiles to correct deficiencies. The Air Force is no different. From time to time, items of equipment are found to have contributed to an accident or incident, or to have created a safety hazard. Some of these items are caught through analysis of the maintenance data collection system, but the Air Force also depends on each individual to report materiel deficiencies. You will always have plenty of help when you make a materiel deficiency report, because there are normally many people involved. Quality Control is responsible for clearance and control of materiel deficiency reports. If you ever have to make out one of those reports, check TO 00–35D–54, *USAF Materiel Deficiency Reporting and Investigating System,* to make sure that you have the latest information. Also be sure to check with your quality control section for up-to-date advice on material deficiency reporting. Now let us see what type of reports are available and how they are defined.

022. Select the correct type of materiel deficiency report for given cases.

Reports. There are two classes of reports that may be submitted—category I and category II. The category I report is used to report emergency conditions of a safety nature on all types of equipment. This report is submitted to the office having the prime responsibility, called an action office, by priority communications. The category II report is used to report quality deficiencies presently revealing no safety hazards but potentially hazardous through prolonged usage. The category II report is submitted as a routine communication. Both reports are used to report deficiencies caused by component failure, improper design, nonconformance with specifications, etc. They are not used to report nonperformance-related deficiencies such as might be caused by damage in shipment. This type of damage is reported through other documentation such as DD Form 6, Packaging Improvement Report.

Category I report. This report relates to deficiencies that could damage persons or equipment, either airborne or on the ground. Deficiencies that primarily relate to PME are of the type that may expose personnel to lethal voltages, excessive radiation, or some mechanical hazard. Accordingly, the deficiency that could place 120 volts AC on the chassis of a voltmeter would be reported as a category I deficiency report.

Category II report. This report details nonsafety deficiencies such as nonconformance to specifications, poor workmanship, or missing components in new equipment. Other deficiencies that are presently not a problem but potentially a future hazard, or which may shorten the useful life of the equipment, also are submitted as a category II report. An example of this type deficiency would be a resistor that shows signs of overheating under normal operating conditions is a number of like items of equipment. One or two such reports may not constitute a valid deficiency; however, a large number of reports could reveal a design deficiency.

Also included in the Category II report is the reporting of software deficiencies. A software deficiency is an error in the statements or instructions that comprise a computer program used by an embedded computer system. An embedded computer system is a digital programmable piece of equipment or system physically incorporated into a larger system, whose primary function is not data processing. As you can see, this means that as more state-of-the-art and automatic test equipment is incorporated into our labs, the more probable your chances are of becoming involved in the materiel deficiency reporting system.

Documentation. Both categories of reports contain essentially the same information, with the difference being the method of preparation and submission. The category I report is prepared directly on a DD Form 173, Joint Message form, while the category II report is first prepared on the SF 368. Quality Deficiency Report, an then transferred to the DD Form 173. The SF 368, after submission through normal channels, provides for follow-on actions to document investigative and corrective results. Basically, the data documented includes:

- Submission data (From, To, Date).
- Item identification (Manufacturer, Stock Number, Nomenclature).
- Manufacturer's identification (Part Number, Lot Number)
- Deficiency (Symptoms, When Failure Occured).

Exhibits. The deficient equipment is normally kept as evidence of the deficiency. At times, there may be no exhibit because the equipment may have been destroyed through the event that made the deficiency apparent. In either case, exhibit availability is documented in the deficiency report. Exhibits are held in a secure area to insure that they are not altered or lost. The action office, after processing the deficiency report, sends instructions for disposition of the exhibit. These instructions may require shipment of the exhibit to the action office, disassembly and analysis by a local activity, or some other action such as disposal without disassembly and analysis.

Exercises (022):

1. A new signal generator in a broken carton is received from Supply. After removing the signal generator from the carton, a hole is discovered in a side panel of the generator. Would this be reason for submitting a material deficiency report?

2. Which type of deficiency report should be submitted when personal safety is of concern?

3. For which type of report is the SF 368 used?

The maintenance management concepts presented in this chapter have been of a general nature. Due to the various concepts that are available—avionics, missile, communications-electronics-meteorological, field, organizational, technical training center—it is impossible to cover all concepts in this CDC. In order to understand the concept at the laboratory to which you are assigned, study AFR 66–1 as it applies to your base.

1-5. USAF Calibration Program

You are one of the hundreds of precision measuring equipment technicians who are responsible for the operation of the USAF Calibration Program. Since you are a part of this program, learn all you can about it.

023. State the goals of the calibration program and identify the regulation that governs it.

Program Goals and Regulations. The fulfillment of the goals established for the USAF Calibration Program is due in part to AFR 74–2, *Air Force Metrology and Calibration Program*. This regulation outlines policy and assigns responsibility for the management of the program. It applies to all Air Force activities that are responsible for the design, development, control, maintenance, and use of precision measurement equipment (PME).

Program goals. The primary goals of the USAF Calibration Program (USAF Single Integrated Calibration System) are to:

- Establish a base-capability for the calibration and repair of all types of test equipment.
- Establish a system to maintain, calibrate, and distribute standards.

Each group of words has special meaning to all precision measuring equipment technicians. In the first goal, *base-level capability* means that a base is equipped with necessary facilities, standards, and trained personnel. *Calibration and repair* call attention to the assessment of dual responsibility: calibration and repair. *All types of test equipment* means just what it says-any item of test equipment. the first goal says that each base should be equipped with the necessary facilities, base standards, and trained PME technicians to calibrate and repair all types of test equipment. Now let's look at the second goal.

a. System—An organized procedure is established.

b. Maintain—The responsibility to store, to guard from damage, and to keep at its assigned operating efficiency.

c. Calibrate—The process involving the comparison of one item with a standard. The technical definition for this word also includes the process adjustment.

d. Distribute—Calibration standards are assigned to base laboratories. The word also includes the process of shipping or delivery.

e. Standards—Items of precision measuring equipment whose calibration accuracies are many times greater than the accuracies of the equipment being calibrated.

As you examined the two goals, you probably thought of additional definitions or interpretations. As long as there is no conflict in basic concepts, this is good. When you compare the goals, you should realize that one goal is concerned with the base-level capability to do the jobs

assigned to you, and the other goal is concerned with supplying your laboratory with the standards you need for calibration purposes.

Implementation regulation. AFR 74–2 establishes official guidelines for you and all other personnel engaged in organizational, field, Air Material Area (AMA), and Air Force level maintenance of precision measuring equipment. Some of the paragraph titles are:

- Explanation of terms—terms such as Air Force Metrology and Calibration Program, metrology, precision measurement equipment (PME), precision measurement equipment laboratory (PMEL), calibration, and certification.
- Need for a system to control measurement accuracies.
- Types of standards used in measurement and testing.
- Relationship with other related programs.
- How the Air Force Calibration and Metrology Program is organized.
- HQ USAF office of primary responsibility (OPR).
- Responsibilities of all major commands.

We list the titles so that you will know where to find certain information when you need it. You don't need to learn the regulation word for word, but you should know why it was written and what it contains. The last paragraph title listed is one of our primary concerns. That paragraph charges the major commands with the responsibility of assuring that competent personnel are used in the repair, calibration, and certification of precision measurement equipment. You are one of these competent persons to whom the regulation refers.

Exercises (023):

1. What are the goals of the USAF Calibration Program?

2. Which of these two goals are you more directly associated with as a PME technician?

3. What regulation implements the USAF Calibration Program?

024. Specify organizational and operational details of the USAF Calibration Program.

Organizational and Operational Details. Let's look now at the governing organizational and operational details prescribed in TO 00–20–14, *Air Force Metrology and Calibration Program.* In addition to implementing AFR 74–2, this technical order establishes the policies and rules that govern the organization and operation of the USAF Single Integrated Calibration System. To understand the organization and operation of the USAF Calibration Program, you must consider the methods used to provide AF units with appropriate calibration service and associated reference standards that are used in calibrating PME. Figure reference standards that are used in calibrating PME. Figure 1-4 shows the organization of the USAF Calibration Program and the relationships among the participating organizations. As you study the rest of this chapter, refer to this organizational chart. Note that the National Bureau of Standards (NBS) occupies the top position in the calibration system because the NBS establishes and maintains the highest echelon of calibration reference standards of measurement in the United States.

Calibration and certification of standards. Periodic calibration and certification of standards are essential to the calibration program. Because of the different characteristics of various types of standards, each type is calibrated and is certified by specific procedures. Except for Precise Time and Time Interval Standards certified by the U.S. Naval Observatory, Air Force reference standards are certified at regularly prescribed intervals by the NBS. Measurement reports and correction data provided by the certifying agency remain with the standard as long as it is used as an AF reference standard. As indicated in figure 1-4, the Directorate of Metrology is the Air Force focal point of contact with the NBS and with the U.S. Naval Observatory to assure technical compatability of the USAF calibration services.

Air Force base reference standards are certified at regularly prescribed intervals by the NBS, the Naval Observatory, or the USAF Measurement Standards Laboratory as determined by the Directorate of Metrology. These standards are hand-carried or shipped to the PMEL in exchange for like items that are due for certification, or are certified by transferring measurement data at the PMEL where standards are located. The calibration, repair, and return (CR/R) concept applies to the exchange process. The CR/R concept allows the bypassing of the base supply process.

Other items of equipment identical or equivalent to certified AF base reference standards are considered working standards and are the responsibility of the PMEL to certify. These standards will not be returned to NAFS for calibration. Working standards are calibrated by the PMEL, using reference standards are calibrated by the PMEL, using reference standards. AFTO Form 108, Certification Label, is affixed and certified by laboratory personnel. Working standards are used by the PMEL to support work performed there by traveling teams, in support of base activities which have no calibration capability, and by off-base AF activities.

Calibration and certification of PME. Calibration and certification of PME are done as prescribed in TO 33K- or 33L-series calibration procedures. When no TO 33K- or 33L-series calibration procedures are available, calibrations are done first, in accordance with the applicable maintenance handbook, or second, in accordance with commercial data. The maximum calibration intervals are as prescribed in applicable TOs. If no calibration interval is prescribed in the TO, the maximum calibration interval is 12 months.

There is no minimum time interval between calibration periods of PME. A calibration interval between calibration periods of PME. A calibration interval may be shorted by

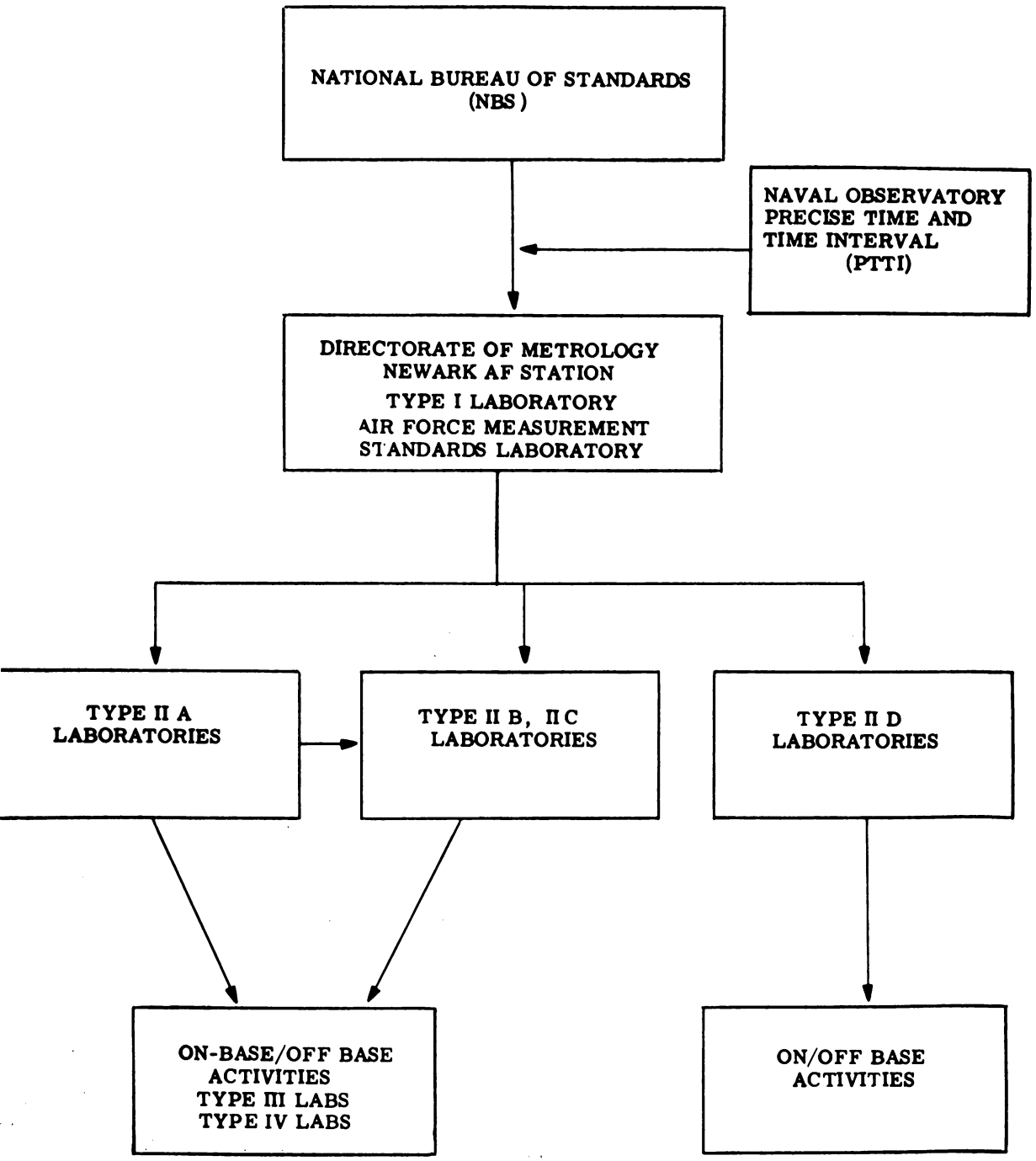


Figure 1–4. USAF Calibration Program.

either the owning organization or by the PMEL. PME exposed to rough handling or to overloading is recalibrated, regardless of the calibration interval due date. PME that has exceeded the prescribed calibration interval or that has not been calibrated must not be used.

Many items of PME are designed to operate over a wide range but are used only for a portion of, or at certain points within, a wide range. In this case, you need to calibrate the item at the points where it is used. This limited calibration must be clearly indicated on the item. The using organization will specify desired calibration points or ranges.

Because of lack of equipment and technical data, situations arise in which the PMEL is unable to calibrate certain items of PME completely. When this happens, contact the PME user to determine whether or not partial calibration will suffice. If not, the calibrating workcenter that lacks the capability to calibrate assigned PME must take the following steps (these instructions apply equally to item of PME that cannot be calibrated at all by the local PMEL):

a. The request for assistance is forwarded through channels to the major command for certification (command certification that the requirement is mission essential and beyond practical limitations of command resources).

b. The using command makes the certification and forwards the request to the geographic Air Logistics Center (ALC). If the ALC has the capability, it provides the required services. If it does not have the capability, it notifies the PMEL.

c. Calibration support requirements beyond ALC capability are submitted to the Directorate of Metrology, Aerospace Guidance and Metrology Center (AGMC).

d. The Directorate of Metrology is responsible for calibrating the equipment, giving technical assistance, obtaining support from NBS of the U.S. Naval Observatory, or recommending that arrangements be made for interservice or contractual calibration support.

e. The activity requesting calibration services is advised how calibration support will be given and is provided with instructions for delivery of the equipment. The equipment must be in operable condition before it is submitted for calibration.

f. Requests for unscheduled calibration support on equipment designated as AGMC or ALC responsibility in TO 33K–1–100 are directly coordinated between the PME scheduler or other performing work center and the ALC or AGMC scheduling personnel.

Materiel Control Support for PMEL. Scheduling of PME for calibration is the responsibility of the PME scheduler. Schedulers are assigned sufficient storage and work space, ideally within the PMEL work area. Specific materiel control responsibilities may be decentralized by assignment of materiel control personnel to the PMEL. As a minimum, the PME scheduler must:

a. Set certain hours during the duty day for turn-in or pick-up of PME. This period should cover approximately one-half of the duty day to allow adequate time for administrative actions. Emergency and mission essential equipment must be accepted at any time.

b. Accept PME and update the scheduling report in accordance with AFM 66–267, *Maintenance Data Collection (MDC) System: DSD G001B/BD, Users Manual.* Unscheduled PME is only accepted when accompanied by a completed AFTO Form 350 and one handscribed general purpose card. Part II, AFTO Form 350 and one handscribed general purpose card. Part II, AFTO Form 350, is used as a receipt for the property. Inspect each item of incoming PME to determine the exterior condition, such as paint, hardware completeness, handles, latches, and general appearance. Dirty and incomplete items are brought to the attention of the owning workcenter and may be returned if the situation warrants.

c. Coordinate all scheduling with the performing workcenter (PWC) to insure proper scheduling of equipment for a balanced workload. In addition, consult the PWC on all actions which will cause a sharp increase in their workload or a decided deviation from the programmed schedule.

d. Insure that all PME items shipped through transportation to an off-base support PMEL for CR/R are processed according to AFR 66–1. The PME owner or user must comply with AFR 66–1, AFM 66–267, TO 00–20–14 and other applicable TO–00–20-series TOs.

e. Prepare a letter for the DCM to the appropriate unit commander identifying workcenters or activities that did not deliver scheduled PME within 3 workdays after the calibration due date for on-base activities and 10 days for off-base activities.

f. Keep a file of all open delinquency notifications.

g. Keep an accurate PME inventory. Updated copies of MDC master ID listing by performing workcenters, together with request for initial calibration of new items furnished by owning workcenters, suffice for documenting the PME inventory.

h. Brief owning workcenter (OWC) personnel on the PME program and their responsibilities.

i. Inform OWC of changes in item status within three workdays of the change; for example, AWP and NRTS. Telephone notification is sufficient.

j. Schedule PME TCTOs.

k. Advise the supervisor weekly of the estimated backlog for PME calibration requirements.

l. Keep a PME scheduling file to control PME being processed through the laboratory for scheduled calibration and unscheduled maintenance. The file consists of prepunched general purpose scheduling cards for scheduled calibration and handscribed general purpose cards for unscheduled maintenance. The PME scheduling file for laboratory work has six sections:

(1) Awaiting scheduled laboratory input. This section has a copy of the scheduling cards for each item awaiting calibration. On the date the item is received, a copy is moved to the INW or AWN section of the scheduling file.

(2) Awaiting maintenance. This section has a copy of the scheduling cards for each scheduled item or handscribed general purpose card for each item requiring unscheduled maintenance. It may have subsections that correspond to the reason PME is awaiting input, technical, support equipment, environment, standards, etc. An AWM

:ondition may occur at any stage of the processing cycle; herefore, performing workcenters advise the scheduler of :tatus changes in order that the scheduling file can be ›roperly maintained.

(3) In-work. This section has a copy of the scheduling :ards for each scheduled calibration item or a handscribed general purpose card for each item requiring unscheduled maintenance when the item is actually in-work in the performing workcenter.

(4) Awaiting parts. This section is kept for AWP items the sanie way the AWNM section is kept.

(5) Depot. This section has a copy of the scheduling cards for each item sent to another activity for calibration or repair.

(6) Work completed. This section has a copy of the scheduling cards for each scheduled calibration item or a handscribed general purpose card for each item requiring unscheduled maintenance when the work has been completed. Normally, these cards can be destroyed after the completed AFTO Form 349 has been processed through data automation and appropriate data have shown up in the production reports and the next inventory report.

m. Forward prepunched scheduling cards and monthly runs for peculiar PME to the appropriate production control scheduler for the performing workcenter for accomplishment.

n. Verify with supply PME UND "A" and "B" conditions. Perform daily follow-up with MSL or supply on reportable PME condition codes W and R.

o. Monitor dueout release points.

p. Recommend cannibalization per TO 00–20–2.

Laboratory Certification. Each PMEL is evaluated and certified periodically by the Directorate of Metrology to determine technical competence to perform calibrations and the adequacy of the facilities in which the calibrations are made as specified in the Air Force directives. Each PMEL is evaluated by a visiting team from the Directorate of Metrology at least once every two years. The Directorate of Metrology will base the certification status upon the evaluation team's report. When analysis of the evaluation data indicates the laboratory has the required capability, the Directorate of Metrology will issue a certificate through the major command indicating the PMEL can accurately calibrate all PME within its assigned areas of responsibility. When analysis of the evaluation data indicates the laboratory does not have the required capability, the Directorate of Metrology will:

(1) Determine specifically what is needed to bring the laboratory to the full capability.

(2) Initiate corrective action within the doctorate's capability.

(3) Notify the major command of the reasons for considering the PMEL incapable; any limitations imposed, the action required by the command, base, for obtaining calibration support pending completion of corrective action. Conduct technical assistance visits to aid in resolving problems when requested by the major command.

(4) Withdraw the present certification through the major command until completion of corrective action or a "no notice" evaluation indicates the laboratory has the required capability.

(5) Conduct no-notice evaluation visits to those PMELS that were not certified during the last evaluation.

A certificate is not issued when analysis of the evaluation data indicates a laboratory does not have the required capability to perform accurate calibrations. A certificate will be issued identifying measurement limitations imposed for environment if this is the only deficient area. A certificate issued by the Directorate of Metrology will remain in effect until it is withdrawn or a new certificate is issued. Deficiencies reported in the evaluation report are corrected by the base organization with functional responsibility for the area affected.

Exercises (024):

1. Which TO covers the USAF Calibration Program?

2. Who establish and maintains the highest echelon of calibration reference standards of measurement in the United States?

3. Why is the Naval Observatory tied into the Air Force calibration program?

4. If no calibration interval is given in the TO on an item of PME, what are the maximum and minimum intervals?

5. Who is responsible for scheduling PME for calibration?

6. Must all PME be calibrated on all ranges?

7. How often is a PMEL evaluated and certified by the Directorate of Metrology?

025. State the purpose of reports prepared in the PME laboratory.

As a supervisor, you must complete and evaluate reports within the PME laboratory.

Precision Measurement Equipment Laboratory Evaluation Document (AFTO Form 465). This form is used by an evaluation team and by PMEL management at the operational and command level.

Precision Measurement Equipment Laboratory Report (AFTO Form 80). This report provides information to the Directorate of Metrology to aid in managing the Air Force Metrology and Calibration Program and to the major commands for the management of their respective PMEL programs. The report is completed as of 30 June and 31 December each year at Air Force activities operating PMELs. It is submitted to the Directorate of Metrology Center, Newark AFS, Ohio 43055, to arrive by the 31st day of July and January. The report is made on AFTO Form 80, (figs. 1-5 and 1-6). Since local reproduction is authorized, you can copy the form for your own self-evaluation between visits by Metrology Center personnel. The report must not contain classified information. When it necessary to submit classified information, send it by separate correspondence and cross reference it to the applicable section of the AFTO Form 80. Prepare AFTO Form 80 per TO-00-20-14.

NOTE: Any supervisor should be thoroughly familiar with all sections of TO -00-20-14. This technical order covers the Air Force Metrology and Calibration Program. *Make sure your TO is current and follow it.*

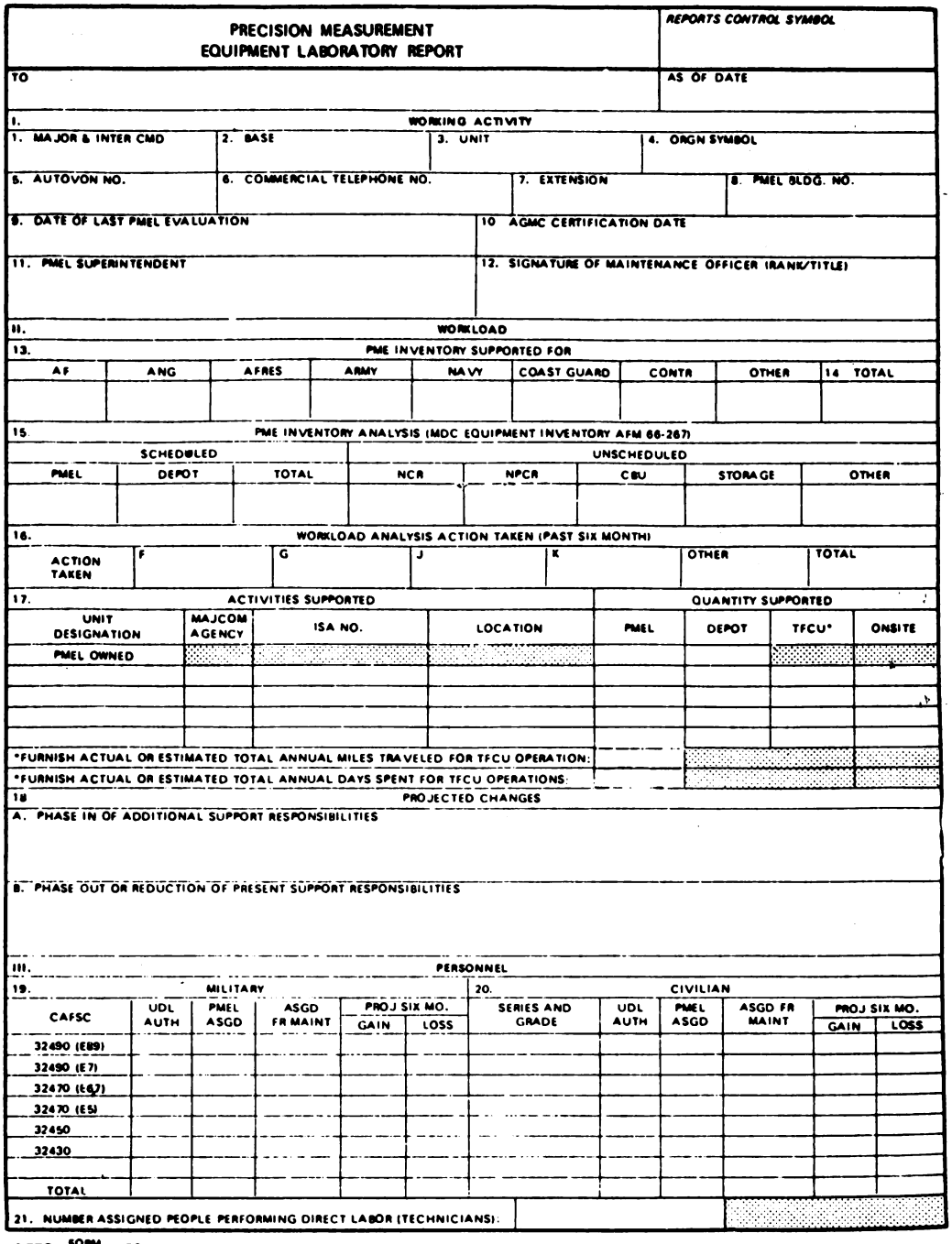
Exercises (025):

1. What is the purpose of AFTO Form 80?

2. How often is it prepared?

3. What is your Guidance for preparing AFTO Form 80?

4. What is the purpose of AFTO Form 465?



PRECISION MEASUREMENT EQUIPMENT LABORATORY REPORT

REPORTS CONTROL SYMBOL

TO

AS OF DATE

I. WORKING ACTIVITY

1. MAJOR & INTER CMD	2. BASE	3. UNIT	4. ORGN SYMBOL

5. AUTOVON NO.	6. COMMERCIAL TELEPHONE NO.	7. EXTENSION	8. PMEL BLDG. NO.

9. DATE OF LAST PMEL EVALUATION	10 AGMC CERTIFICATION DATE

11. PMEL SUPERINTENDENT	12. SIGNATURE OF MAINTENANCE OFFICER (RANK/TITLE)

II. WORKLOAD

13. PME INVENTORY SUPPORTED FOR

AF	ANG	AFRES	ARMY	NAVY	COAST GUARD	CONTR	OTHER	14 TOTAL

15. PME INVENTORY ANALYSIS (MDC EQUIPMENT INVENTORY AFM 66-267)

SCHEDULED			UNSCHEDULED				
PMEL	DEPOT	TOTAL	NCR	NPCR	CBU	STORAGE	OTHER

16. WORKLOAD ANALYSIS ACTION TAKEN (PAST SIX MONTH)

ACTION TAKEN	F	G	J	K	OTHER	TOTAL

17. ACTIVITIES SUPPORTED / QUANTITY SUPPORTED

UNIT DESIGNATION	MAJCOM AGENCY	ISA NO.	LOCATION	PMEL	DEPOT	TFCU*	ONSITE
PMEL OWNED							

*FURNISH ACTUAL OR ESTIMATED TOTAL ANNUAL MILES TRAVELED FOR TFCU OPERATION:

*FURNISH ACTUAL OR ESTIMATED TOTAL ANNUAL DAYS SPENT FOR TFCU OPERATIONS:

18 PROJECTED CHANGES

A. PHASE IN OF ADDITIONAL SUPPORT RESPONSIBILITIES

B. PHASE OUT OR REDUCTION OF PRESENT SUPPORT RESPONSIBILITIES

III. PERSONNEL

19. MILITARY

CAFSC	UDL AUTH	PMEL ASGD	ASGD FR MAINT	PROJ SIX MO. GAIN	PROJ SIX MO. LOSS
32490 (E89)					
32490 (E7)					
32470 (E6,7)					
32470 (E5)					
32450					
32430					
TOTAL					

20. CIVILIAN

SERIES AND GRADE	UDL AUTH	PMEL ASGD	ASGD FR MAINT	PROJ SIX MO. GAIN	PROJ SIX MO. LOSS

21. NUMBER ASSIGNED PEOPLE PERFORMING DIRECT LABOR (TECHNICIANS):

AFTO FORM JUL 78 80 PREVIOUS EDITION IS OBSOLETE

Figure 1–5. AFTO Form 80 (front).

IV. FACILITIES

22. AVAILABLE SPACE OF _____ SQ FT ☐ IS ☐ IS NOT ADEQUATE FOR WORKLOAD

23. UNIQUE FACILITIES ☐ ARE ☐ ARE NOT REQUIRED AND ☐ ARE ☐ ARE NOT AVAILABLE (Explain in Section VII).

24. SPACE AVAILABLE (SQ FT)	25. ENVIRONMENT
TOTAL PMEL (Gross Space)	A. TEMPERATURE MAINTAINED AT °F.
CALIBRATION/REPAIR AREA	TEMPERATURE EXCEEDED LIMITS DAYS.
OFFICE AREA	B. HUMIDITY MAINTAINED AT %. RH.
RECEIVING/ISSUE/STORAGE AREA	HUMIDITY EXCEEDED LIMITS DAYS.
TRAINING/TECH LIB/BREAK AREA	26. FACILITY IMPROVEMENTS
CLEANING ROOM	MCP / O & M / WORK ORDER
OTHER	PROJECTED BY
	APPROVED
	FUNDED
	IN WORK
	(EXPLAIN IN SECTION VIII)

V. EQUIPMENT

27. MOBILE CALIBRATION EQUIPMENT (TFCU, VANS, ETC)

NSN	NOUN	QTY	NSN	NOUN	QTY

28. TA 734AAA ITEMS ON HAND AND NOT REQUIRED		29. TA 734AAA ITEMS REQUIRED BUT NOT ON HAND		
ITEM	PART NO.	ITEM	PART NO.	RQN NO.

VI. SELF SUFFICIENCY

ATTACH A LIST OF ITEMS SENT TO SOME OTHER AGENCY FOR CALIBRATION

VII. SUPPLEMENTAL DATA

30. PME SUPPORTED BY PWC OTHER THAN PMEL

A. NUMBER OF PWC

B. NUMBER OF PME SUPPORTED AT OTHER THAN PMEL

31. UNUSUAL REQUIREMENTS

32. TECHNICAL PROBLEMS

33. OTHER

Figure 1–6. AFTO Form 80 (reverse).

Career Field Hazards

IN THIS CHAPTER, we review safety hazards and basic safety requirements pertaining to the PME laboratory. Learn to apply safety principles and to recognize hazards. The safety requirements and hazards. The safety requirements and hazards identified are by no means all-inclusive. Any careless moment may result in the breach of additional principles or the creation of additional hazards. Our primary concern in this chapter is the application of safety principles, avoidance of hazards, and exercise of good judgment in trying to prevent accidents.

2-1. Basic Safety Requirements

When you operate Air Force equipment, your attention must be focused on two important aspects of the operation: first, how to operate equipment properly; and second, how to operate equipment safely. When we use the term "properly," we refer to the usage of equipment according to established procedures to achieve the desired results. Nine of the basic safety requirements in the PMEL are:

(1) Preoperational training.
(2) Discipline.
(3) Alertness.
(4) Safe practices.
(5) Mental and physical fitness.
(6) Avoidance of physical hazards.
(7) Safe operating condition of machines and equipment.
(8) Safe working environment.
(9) Preoperational planning.

026. State the primary objective of preoperational training.

Preoperational Training. Your preoperational training started when you were a student in the PME course. You may recall your instructors' telling you how to use equipment or how to turn on electronic system that you may have had to test or calibrate. Furthermore, you learned procedures for a job by reading technical orders and maintenance document. In every case, either from an instructor or from a document, safety precautions were included in the procedures. One of the primary functions of preoperational training is to encourage you to learn and understand equipment operating procedures before you start a job, so that you can operate the equipment properly and safely. If you aren't sure you know a procedure, study it until you known it well enough to apply it accurately (without procedural error) and safely to the job assigned. Don't take chances.

In the 32 career fields, we are faced with a continual equipment modification program. Many times, units or portions of whole systems are modified to varying degrees. Be sure that you read instructions and understand the modified equipment or systems you repair or calibrate. Too modified equipment or systems you repair or calibrate. Too often you hear, "I've always done it this way and haven't had any trouble before. Pretty flimsy excuse, if you injure yourself or your buddy, or if you damage the equipment.

Exercises (026):

1. What is the primary function of preoperational training?

2. If you apply power to a piece of modified electronic equipment without first reading the operating procedure, which basic safety requirement are you violating?

027. Identify the type of discipline required of PMEL personnel.

Discipline. During your military training and your PME classroom training, you learned the importance of two different types of discipline. In this chapter, we stress the discipline you must exercise in the base PMEL. Two of the primary base for discipline are law observance and law enforcement. Law observance is the exercise of self-discipline which compels us to abide by established rules, procedures, and safety precautions. Law enforcement refers to those restrictions imposed on us (external discipline). When you reduce the speed of your car because you see a traffic patrolman, the discipline is imposed and external. Although measures are taken in the PMEL to assure compliance with all safety precautions and standards, the laboratory supervisor expects you to apply the self-discipline necessary to meet the safety requirements of your job. For this reason, all references to discipline in a PMEL must be considered as self-discipline.

What does self-discipline have to do with safety on the job? Perhaps we can best illustrate the relationship by an example. Suppose that you are aligning a unit of the radar system. One step of the procedure tells you never to remove

the cover from the unit unless you have the high voltage turned off. However, you've done the job so many times that you know you can remove the cover. You may get by with this once—maybe several times—but you may be betting your life when you discard the restraints of self-discipline. You known you shouldn't take unnecessary chances to save a few minutes, but since the supervisor isn't there to enforce the established safety precautions, you removed the equipment without disconnection the high voltage. Sooner or later your failure to exercise self-discipline will become a factor in other violations of safety practices, an accident, and possibly an injury.

Exercises (027):

1. Air Force policy requires that calibration personnel follow tech order procedures when calibrating test items. You find you can complete a particular job quicker by using your own method. What principle of discipline do you violate when you use your own procedure?

2. What kind of discipline is exhibited when PME personnel follow prescribed calibration procedures and associated safety precautions in the absence of direct supervision?

028. Identify factors that may violate the safety requirement of alertness.

Alertness. The third basic safety requirement is alertness. Fundamentally, alertness means paying attention to what you are doing at all times. Unless you are alert, you undoubtedly end up doing something wrong, thereby creating a situation in which an accident can happen. The enemies of alertness are external and internal distractions—things occurring outside you and things occurring inside you, either mentally or physically. We can't talk about all of the external and internal distractions, but let's look at a few of each.

External distractions. A distraction caused by another person is an external distraction. For example, when you are concentrating on the alignment of an item of PME, you may be startled and distracted by a loud cough. If this happens, you must brace yourself and regain your composure and self-control as quickly as possible. Perhaps most important of all is not to look around to see who caused the disturbance. This is easier said than done, but it may keep you from placing your hand on a high-voltage circuit. As a rule, you cannot control this type of disturbance. The only thing you can do is to train yourself to respond to it properly. The uncontrollable disturbance is bad enough and can cause an accident. It is inexcusable for you or your buddy to create an unnecessary disturbance which could cause an accident. External distraction usually involves conversation or horseplay.

Conversation is a very common distraction. Does this mean you should ignore a fellow worker who says, "Good morning"? The answer is "yes", if you're at a critical point of your work. Get past this critical point, then return the greeting. When you are the greeter, withhold your greeting safely. Remember, conversation with fellow workers may be serious distracter. It is usually all right if you keep your eyes on your work, but hazardous if you turn your head to talk. Horseplay is undoubtedly the most risky and the most inexcusable type of distraction. Horseplay has no place in the PME laboratory!

Internal distractions. A mental distraction is perhaps most often caused by thinking about personal problems, rather than concentrating on what you are doing. This internal distraction causes you to violate the principle of alertness. This mental distraction is especially hazardous, because it is impossible for most people to concentrate on more than one thing at a time. If your personal problems are so great that they interfere with your work, let your supervisor know. The supervisor may be able to help you to solve them, or at least keep them from causing accidents that might damage equipment of injure PME personnel.

Another common mental distraction is daydreaming. This is a particularly dangerous type, since your mind can become completely absorbed in the pleasant thoughts of a daydream. Thereby, alertness is almost destroyed. There are very few of us who haven't, at one time or another, been caught napping in a daydream that creates an emergency that otherwise might not have occurred. Even during a routine job operation, a daydream may sufficiently destroy alertness to cause an accident.

Another distraction that is closely related to daydreaming is boredom. Boredom leads to indifference, inattentiveness, and a decrease in alertness. You must guard against working too hastily to complete the dull task to get to the more interesting one. If you work too fast, you may have an accident; obviously, you cannot concentrate on each phase of your tasks as much when you're working fast as when you're working at a normal speed. Remember the old proverb, "haste makes waste." The solution to the hazards of daydreaming, thinking about personal problems, or working at a boring task is willpower. There are no simple solutions.

Fatigue, severe pain, and illness are examples of internal physical distractions common to all of us. Most of us take care of severe pain and illness, or at least we should. The problem of fatigue cannot always be eliminated. You should recognize it and immediately inform your supervisor.

Exercises (028):

1. Assume that you are making a "power on" adjustment, and a buddy of yours jokingly mentions an incident that happened the night before. As a results of the comment, you hand slips and you get a high-voltage shock. What basic principle of safety did you violate?

2. Which type of external distraction on the job is perhaps the most dangerous and definitely the most inexcusable?

3. List six kinds of internal distraction and identify each as being either mental or physical.

029. Identify the most common job-related injury, and tell how to prevent this injury.

Safe Practices. The requirement of safe practices is essential. Therefore, let's consider three areas where safe practices are extremely important—operating equipment, using tools, and handling materials. Preoperational training provides the best source of information on equipment operation and the use of handtools associated with your specific job. Safety precautions on specific alignment and maintenance procedures are usually found in the technical orders containing the maintenance instructions. Don't minimize the importance of these procedures. An unsafe practice in equipment operation or in the use of handtools is inexcusable.

The real danger of unsafe practice come from doing tasks you do not perform daily. Handling material is a good example. You may not have been taught the body control necessary to insure the safe handling of equipment. You may have forgotten some of the key points of safety involved. According to the National Safety Council, the major sources of injuries on the job are from handling materials. MOst are back injuries due to lifting heavy objects improperly. With this in mind, study figures 2-1 and 2-2.

The straighter the bones in your spinal column are, the stronger your spinal column will be. Therefore, the main point to remember in lifting is to keep your back as straight as possible. Lift with your legs, not your backs. The correct method is illustrated in figure 2-1. Squat down, get a good grip under the load, and then lift slowly with your legs. By lifting with your legs, you avoid bending your back and placing a severe strain on your spinal column.

The wrong way to lift is illustrated in figure 2-2. If too much strain is placed on a weak spot, a bad back injury may occur. It is best to lift straight up with the legs to avoid placing such strain on the weak spot. As stated before, haste in completion of a job may be the cause of an accident. Perform all duties at a moderate, consistent pace.

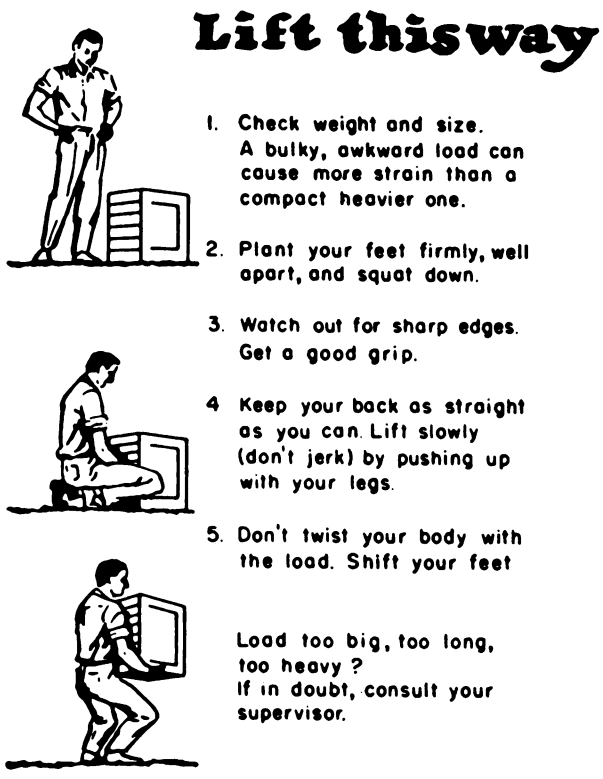


Figure 2-1. How to lift a heavy load safely.

Exercises (029):

1. What is the most common job-related injury?

2. When lifting a heavy object, how can you avoid putting a severe strain on your spinal column?

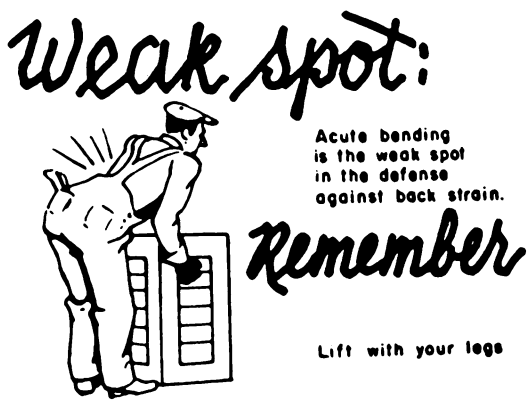


Figure 2-2. Every vertebra a potential weak spot.

030. State how you can maintain mental and physical fitness.

Mental and Physical Fitness. The fifth basic safety requirement is mental and physical fitness. To maintain mental and physical fitness, you need balanced meals, moderate exercise, and sufficient sleep. The nature of your work as a PME specialist/technician sometimes eliminates lack of exercise as a problem in keeping fit. I'm sure you agree that, oftentimes, the exercise is even more than moderate! This makes getting enough sleep even more important. The lack of a good night's sleep has been a contributing factor to many serious accidents.

I'm sure you are aware of the importance of your eyes and ears in your job as well as their importance to your well-being and enjoyment. Eyes are a one-time issue; if you want them to last the rest of your life, take care of them!

If you need glasses, by all means get them. Surprisingly enough, a great many need glasses, but don't know it. They are accustomed to seeing things slighted blurred. Do you fall into this category? If you do, you are exposing yourself and others to many dangerous situations without knowing it. To be safe and sure, have your eyes examined by a specialist. If you must wear glasses, remember that electronics workers must not wear metal rim glasses when working on electrical equipment.

As you know, the PME job performance sometimes requires that you work around high-pitch noises. Use the proper precautions against ear damage when you find yourself in this situation. AFR 161–35, *Hazardous Noise Exposure*, requires specified control procedures and monitoring for personal safety in situations such as these. If you are supposed to wear earplugs to prevent damage to your ears—wear them!

Another aspect of fitness involves the use of alcohol. Although the use of alcohol is popular, it creates many problems. People often start out drinking socially, become addicted, and eventually allow drinking to affect their Air Force duties. It would be better to abstain from alcohol completely than to let it adversely affect you or your work. Keep in mind that alcohol is a narcotic depressant. This means that it numbs and slows down the operation of the nervous system. If a dangerous situation presents itself while you are in this condition, you cannot react quickly or accurately. Furthermore, when you are depressed you may be in a bad mood and most certainly are not up to par. Remember that this depressing effect lasts longer than just the time you are under the influence of alcohol. The depressing mood is quite often felt the day after too. AFR 16–36, *Alcoholism Rehabilitation*, prescribes professional policies, procedures, and practices for treatment, management, and rehabilitation of personnel with drinking problems.

In all other aspects of physical fitness, keep your general health as good as possible. Get plenty of rest the night before each day's work, eat balanced meals, and otherwise observe the Air Force physical fitness program.

Exercises (030):

1. What can you do to keep yourself mentally and physically fit to perform your job?

2. How do you protect your ears when you work around high-pitched noises?

031. Identify the prime causes of accidents and state a prerequisite for eliminating hazards.

Avoidance of Physical Hazards. Every job situation has its own peculiar physical hazards. Some of these can be eliminated by taking precautionary measures. Let's look at a few hazards that apply to anyone who does maintenance work. You'll note that all of the hazards listed are those you can do something about. The human element of carelessness is present in every case.

- Not using safety devices.
- Operating unsafe equipment.
- Working at unsafe speeds.
- Careless housekeeping.
- Indulging in horseplay.
- Assuming an unsafe body position while working.
- Failing to want individuals of possible dangers in equipment condition.
- Fatigue.

If you're wondering why the list isn't called common causes of accidents instead of hazards, you have a good point. Every item on the list has at one time or another caused a serious accident. The biggest hazards on the job are usually ourselves and our work habits rather than the equipment. Equipment is not designed to hurt us. It can, but only when we allow or cause it to. So, if you just recognize each situation presented as being a hazard, you shouldn't have accidents.

Exercises (031):

1. What are the two prime causes of accidents that you must consider is eliminating or minimizing and avoiding hazards?

2. What must you do before you can eliminate hazards?

032. State the possible effects of operating defective equipment, and state precautions to take before using any equipment.

Safe Operating Condition of Machines and Equipment. The next basic safety requirement is concerned with the operating condition of equipment. If equipment is not in good operating condition, you may have a loss of job efficiency and a safety hazard. For example, a multimeter may not have moving parts that can become worn or defective, thus causing a safety hazard—but what about those multimeter leads with the broken insulation or the probe tip broken off? These conditions can be just as dangerous as a machine with defective parts. On all electrical and electronic equipment, be sure to check the cables for undue wear or breaks in the insulation. Such conditions, as you know, pose an electrical shock hazard and the possibility of fire.

In any situation involving machines and equipment, the prime responsibility for operational safety lies with you, the operator. Before operating any equipment, become thoroughly familiar with its various parts and become especially familiar with the safety hazards that may develop due to defective or worn parts. Know what hazards to look for and look for them frequently. As noted earlier under "Preoperational Training," a very dangerous condition can develop when you receive a new model of similar equipment or a modified revision of current equipment. In either case, never assume that just because you knew the proper operating procedures and safety involved with the old equipment, you know all about the new equipment. Be sure to find out how the new or modified equipment differs from the old equipment. Carefully read the technical order or accompanying instruction manual. Remember, new models of similar equipment may have different parts, different controls, and different safety hazards.

Exercises (032):

1. Name the undesirable results that are likely if you operate equipment that is in poor condition.

2. What should you do before operating any equipment?

033. Define the working environment and explain how good housekeeping contributes to a safe working environment.

Safe Working Environment. Another basic safety requirement is the one prescribing proper working environment. Your immediate surroundings (environment) can help or hinder you from a safety standpoint. When we talk about environment, we speak of many things; for example, climate, light, heat, noise, equipment, people, etc. For our purposes, working environment is the surrounding conditions under which we work. Many of these conditions we can control, while others we cannot control. Climate or weather conditions create working environments over which we have little control. We can control other environmental conditions such as heat, light, space, proper equipment, etc. Let's take a brief look at both the uncontrollable conditions and the controllable conditions.

If you've ever worked outside when the temperature was below zero, the snow was deep, and the wind was blowing, you have a pretty good idea of an uncontrollable environmental condition that can be a safety hazard. The same is true when the temperature is 100°F or higher—so hot that you can't touch equipment with your bare hands. Anyone who has had these experiences knows how important environment can be. Since we have to live with these weather conditions, we must be aware of the additional safety hazards they pose. You know what they are. In the extreme cold, it is either cold hands or bulky gloves, icy conditions under foot, etc. In extremely hot weather, it is probably hands wet with sweat, equipment you cannot touch without gloves, blinding heat waves off the ramp, and seemingly unbearable heat conditions. About the only thing you can do is to slow down your work pace, use extra precautions, and think before doing that otherwise normal task.

Now let's talk about a few controllable environmental conditions. One major principle to observe in maintaining a work environment conducive to safety is good housekeeping. One of the elements of good housekeeping is disposal of waste and scrap. If floors or workbenches are cluttered by such materials, the likelihood of an accident is definitely increased. Similarly, it is important to keep floors and workbenches clean, especially from such things as oil, grease, paints, chemicals, radioactive materials, or any other matter that may pose a safety hazard.

You should keep handtools and test equipment clean. If they are greasy, they may slip and cause an accident. Your hand may slip off the tool and hit some other object, or the tool may slip and fall into some unit, damaging it or causing an electrical short. Closely related to keeping tools clean is the need for good housekeeping, which means keeping tools and materials properly stored and in good order. Remember a working environment cluttered with tools creates a safety hazard.

Exercises (033):

1. Define "working environment" and list factors that affect it.

2. Explain how good housekeeping contributes to a safe working environment.

034. State how good preoperational planning aids safety.

Preoperational Planning. The more thoroughly you plan your work, the more likely you will perform it properly

and safely. When you perform a task without first planning for it, you usually make many unnecessary operations and many mistakes and also use many unsafe actions. Since efficiency and safety are two of your most important considerations as a PME technician, it is essential that you plan your work thoroughly before you perform it. During this preoperational planning you should organize all operations necessary to complete the work properly, efficiently, and safely.

The most important thing to bear in mind when you are planning to begin a job is to check any pertinent safety instructions, such as equipment ground. Be sure to study safety instructions carefully, especially if it's a job you're doing for the first time. As you begin work each day, even on comparatively simple tasks you are familiar with, plan ahead to be sure all pertinent safety principles are observed. If any protective devices are required, have them available for each job you are assigned—make use of the nine basic safety requirements. Help make your unit safety-conscious. In everything you do, be careful!

Exercises (034):

1. How are personnel and equipment safety affected by inadequate or poor preoperational planning?

2. Why should you check pertinent safety instructions before planning to begin a job?

2-2. Personnel Hazards

Most of the hazards confronting you in the repair and calibration of electronic equipment are associated with careless maintenance practices. The list below details safety principles related to specific jobs. Because of the many and varied maintenance jobs you perform, the list cannot be considered complete. However, if you observe the safety precautions presented (feel free to add to the list from your experiences), you and those who work with you will benefit. Everyone must be safety-conscious.

035. From hypothetical situations, determine which maintenance safety precautions were violated or observed.

General Precautions. The following safety precautions are commonsense types to be observed in the repair and calibration of electrical equipment.

a. Do not wear metal identification bracelets, wristwatches, or rings while working with electrical equipment.

b. Pull fuses, open circuit breakers, or disconnect the circuits from their power source to protect yourself, the test equipment, or the equipment under test. Never trust a switch.

c. Do not troubleshoot a circuit with the primary power applied unless absolutely necessary.

d. Do not use your bare hands to remove hot tubes from their sockets—use asbestos gloves or a tube puller.

e. Use the correct tool (screwdriver, alignment tool, etc.) for doing the job.

f. Keep handtools and test equipment clean. if they are greasy, your hand may slip off the tool and hit some other object, or the tool may slip and fall into some unit, damaging it and subjecting you to possibility of an injury (as stated earlier).

g. If you must work on equipment with power applied, keep one hand free so that you do not complete a circuit path through your body by placing one hand on a voltage source and the other hand on a ground point.

h. Beware of charged capacitor when checking circuits.

i. Be certain that there is no power applied to a circuit when you make a continuity or resistance check.

j. Turn off the power before connecting alligator clips to circuit components.

k. Inspect the insulation on test leads carefully.

Exercises (035):

1. From the following hypothetical situations, list the maintenance safety precautions that each PME specialist/technician either violated or properly observed.
   a. When you ask Bill if he can finish calibrating the test equipment he is working on by a certain time, he checks the watch he is wearing before answering.

   b. When checking voltage at a point difficult to reach, Carole holds one arm behind her back as she attaches the alligator clip of the test lead to the live circuit component.

036. State the basic principle of the buddy system of the maintenance and its primary advantage.

The Buddy System. Some commands have been using this system for a long time; maybe yours is one. You may call your system by a different name or use very similar terminology. The buddy system of safety adopts the policy. "Do not work alone around electronic equipment if you can possibly avoid it." If you are working on high-voltage equipment, use the two-person concept, or buddy system. In fact, AFOSH 127–66, *General Industrial Operations,* directs that there be a safety observer present whenever you work on high-voltage equipment.

The buddy system in electronic maintenance is one of those super-safety precautions to avoid a tragedy. If you should accidentally touch a live wire or circuit and suffer shock, your buddy can help in preventing an accident from becoming a fatality by administering first aid. The buddy system has a practical side in addition to the safety it provides. In laboratory maintenance, there may be occasions when it saves time if someone is available to

operates switches and controls located at some distance from the unit on which you are working. In this type of cooperative maintenance, make sure that you have your signals straight as to when switches are to be activated.

Exercises (036):

1. What is the buddy system of maintenance?

2. What is one of its primary advantages?

037. Cite safety precautions for soldering.

Safety With Soldering Tools. The soldering iron or gun has probably caused more injuries than any other electrical tool used. In most cases, the injuries are not too severe (slight burn, etc.). However, any burn can be a source of infection, so do not take it lightly. Poor soldering also can cause some real maintenance problems, but we are concerned primarily with the personal safety aspect of soldering.

Soldering is a relatively safe process if the dangers associated with it are recognized and the correct precautions are observed. The risk of painful and dangerous burns is always present during soldering and desoldering. Burns can be received from soldering irons or from soldered connections (or parts) that have not cooled. Always observe these following precautions:

a. Protect eyes and skin with proper clothing and other protective devices because soldering fluxes frequently spatter when they are heated.

b. Always assume that a soldering iron is hot.

c. Make sure the cord and plug on the iron or gun are in good condition.

d. Do not rest a hot soldering iron on a wood bench or chair. Use an appropriate soldering iron holder.

e. Do not flip excess solder from the tip of the soldering iron, from the wick, or from a wire lead. Bits of hot solder can cause serious skin and eye burns; and if flipped on a flammable object such as paper, the hot solder may cause a fire. Use a clean, damp sponge or cloth for cleaning off excess hot solder.

f. Do not hold the sponge or cloth in your hand when cleaning a soldering iron or gun of excess solder; place the sponge or rag on a safe surface where the hot iron may be wiped across it.

g. Do not wear rings or watches while soldering. A small solder spatter caught under a ring or wristband can cause severe burn.

h. Always disconnect electronic systems equipment from the power supply source before you solder. Serious burns or death can result from contact with energized, high-voltage, and high-current circuits.

i. Hold small soldering iron before it has cooled.

j. Do not store a soldering iron before it has cooled.

k. Provide adequate ventilation. Fumes from fluxes and cleaning solvents may contain toxic gases.

l. If you allow fluxes or cleaning solvents to remain on the skin unnecessarily, materials in these products may cause skin irritations. Wash with water.

m. After soldering, wash your hands thoroughly before eating or smoking. Most fluxes contain materials that are health hazards when ingested.

n. In addition to these precautions, follow all other general and special shop safety precautions.

Exercises (037):

1. What precaution should you take before soldering electronic equipment?

2. How should you clean excess solder off a soldering iron?

3. Why should the soldering area be well ventilated?

038. Identify the dangers involved and the safety precautions that must be applied when working with high voltage.

Safety Precautions Around High Voltage. High voltage means different things to different people. To some, it is the 115 volts in the normal home electrical circuit. To others, 300 volts is not considered high. or our purpose, high voltage means any voltage capable of producing a lethal current.

Surface (skin) resistance to electrical current varies with each individual and ranges between 100,000 and 600,00 ohms, depending upon how wet or dry the skin is. Internal resistance from ear to ear is about 100 ohms and from hand to foot somewhere between 400 and 600 ohms. From the values quoted, you should realize the internal resistance of the body is fairly low. Further, the skin offers a fairly high resistance unless it is wet. Even then, it is considerably higher than the internal resistance of the body. As an example, suppose that you came into contact with 115 volts, your skin was wet from perspiring, and you were standing on a surface that was not insulated from ground. We can assume that a total body resistance of 1500 ohms (skin, body, and ground contacts) would limit the current through the body to approximately .077 ampere. Although this volume of current may not be fatal, it is sufficient to inflict pain the possibility of muscular contractions and breathing difficulties.

There is a common misconception that it takes a high voltage to kill you—somewhere from 300 volts up. It is not the voltage that kills; it is the current. Even a low voltage kills if there is enough current. A high voltage may be

harmless if the amount of current is small. It takes only one-tenth of an ampere to kill an average person. Remember, many circuits carry more than the one-tenth ampere required to kill. Remember these voltage and current measurement hazards and always observe the safety precautions in the following list.

a. Don't rely on safety devices without checking them.

b. Don't rely on insulation for complete protection against electrical shock.

c. Keep your feet clear of objects on the floor—stumbling into high voltage is common problem.

d. Use a shorting rod to discharge all high-voltage capacitors before working on a circuit.

e. Use rubber gloves when called for in the maintenance procedure. Make sure that the gloves are in good condition and test for holes and insulation breakdown.

f. Do not change electron tubes inside equipment when the high-voltage supply is turned on.

g. Make certain that the equipment is properly grounded. Ground all test equipment to the equipment under test.

Exercises (038):

1. Under what conditions must a relatively low-voltage circuit be given the same respect as a high-voltage circuit?

2. What is one common misconception about the danger of electrical shock?

3. How much current is required to kill the average person?

4. What should you do before working on a circuit that involves high-voltage capacitors?

5. What precaution is necessary when checking equipment with test instruments?

039. Cite safety measures for handling compressed gases.

Safety Precautions for handling Compressed Gases. Air Force operations require the use of flammable and nonflammable gases. Compressed gages are used in welding operations, in life-support systems, in pressure test, as cooling agents, to pressurize system components, as propellants, etc. Because of the compressibility of gas, large quantities can be stored in high-quality steel cylinders. These cylinder are similar for all common gases. Each cylinder has a valve with a safety cap containing fusible safety plugs to released the compressed gas when extreme pressures build up or when temperatures reach the danger point. The following information from TO 42B5-1-2, *Use, Handling and Maintenance Instructions for Storage-Type Gas Cylinders,* provides the general rules and precautions for safe handling of cylinders containing compressed gases.

Refer to gases by their proper names, rather than as *air* or *gas*. All Air Force compressed-gas cylinders have the name of the gas stenciled parallel to the longitudinal axis on diametrically opposite sides. Don't tamper with the safety devices in the cylinder valves. Don't use regulators, pressure gages, hoses, and other fittings interchangeably. Be particularly sure that the threads on regulators or unions are the same as those on the valve being used. Don't use compressed gas from the cylinder without reducing the pressure through the regulator intended for this purpose. Before connecting the coupling or pressure regulator to the cylinder valve, open the valve approximately one-fourth turn and close it immediately. This clears the valve of dust, dirt, or moisture elements that could enter the regulator. Don't do this near any possible source of ignition. After attaching the pressure regulator the cylinder valve, check to be sure that the adjusting screw on the regulator is released before you open the cylinder valve. If you have difficulty opening a valve, point the valve opening away from your body and use greater force. If you use a wrench or key, keep it ready for instant use while gas is issuing from the cylinder.

NOTE: Wrenches or hammers must not be used to open or close valve equipped with handwheels. Such tools can damage the valve seat, resulting in the escape of the gas.

Before you remove a pressure regulator from the cylinder, be sure to close the cylinder valve and release all gas from the regulator. Open the cylinder valve fully but slowly each time gas is used from the cylinder to prevent sudden discharge of gas into the regulator (CAUTION: Acetylene valves are an exception to this rule. Acetylene valves should never be opened more than 1½ turns. If a valve leaks when it is open, immediately close the valve. If the leak does not stop, move the cylinder out of doors and expel the gas. Never attempt to stop a leak between cylinder and regulator. Always close the cylinder valve when the gas is not in use. Always assume that compressed gas cylinders are full, and handle them with corresponding care. Helium and nitrogen gases are odorless, tasteless, colorless, and chemically inert. They are neither corrosive, explosive, nor flammable. The do not support combustion, are not toxic nor irritating, and do not combine with other materials to form nitrides. However, they can dilute atmospheric oxygen to unsafe levels and create an asphyxiation danger. Helium and nitrogen under high pressure, like other compressed gases, present a serious hazard to personnel because of the very large amounts of energy stored in these compressed gases.

In addition to the instructions and precautions contained in the appropriate equipment technical orders, the following information from AFOSH 127-66 provides guidance and safety instructions for handling gaseous helium and nitrogen. Always wear adequate eye protection (glasses or face shields). Never enter an area where there is a high

concentration of gaseous helium or nitrogen without using an auxiliary source of air for breathing. At least two people should be present when a pressure system is being operated. Store cylinders where they are protected from weather and where they can be adequately restrained to prevent unwanted movement. Storage facilities should have adequate ventilation because these gases are odorless and colorless and can asphyxiate without prior warning.

Exercises (039):

1. When you attach a coupling or regulator to a valve on a cylinder of compressed gas, how do you clear the valve of dust, dirt, or moisture?

2. If you close the valve on a cylinder of compressed gas and the gas continues to leak from the valve, what should you do?

3. What protective measures should you take when pressuring a system with helium and nitrogen gases?

040. State the safety practices for handling and working with cleaning agents, chemicals and solutions.

Cleaning Agents and Chemicals. Cleaning agents for electrical equipment should be carefully chosen. An acceptable solvent is tricholorethane. Don't use highly toxic or highly flammable cleaning solvents (such as carbon tetrachloride, tricholorethylene, or benzene) which require special ventilation storage, and control procedures. The most common dermatitis—producing substances used in the PME field are liquids, including the many solvents. Through direct action on the skin, these substances and compounds may cause acute or chronic skin injury. Potentially hazardous chemicals that may react with each other must be stored separately to prevent mixing in case of spill or leaking containers. Provide adequate ventilation to prevent excessive heat generation that could result in spontaneous ignition or the creation of explosive gases in the atmosphere. Inspect all storage areas periodically to make certain the chemical containers are not decomposing or other hazardous reactions are not taking place.

Ventilation. Ventilation is the process of passing clean air through any space or area to dilute or remove undesirable air and its contaminants. The health, efficiency, motivation, and comfort of personnel will be greatly influenced by the quality and quantity of ventilation in their work area. Many ventilation methods are used to keep shop air-contaminant levels within healthful or safe limits. The particular method selected will depend on the physical properties and quantity of hazardous materials present, methods of operation, and other factors. The determination of adequate ventilation requirements is a complex problem and will be solved with the help of base environmental health, civil engineers, and fire protection personnel.

Exercises (040):

1. What type of cleaning solvent is acceptable for cleaning electrical equipment?

2. When more than one type of chemical is used within a shop, how must they be stored?

3. Who will help you determine the ventilation requirements when a complex problem exists?

4. What determines the type and amount of ventilation required for a particular environment?

041. Cite hazards associated with radioactive contaminated materials and equipment, and state the precautionary measures to be taken against them.

Radioactive Materials and Contaminated Equipment. We are all familiar with the term "radiation." A loudspeaker radiates sound waves which are electomagnetic in nature. Electromagnetic radiation includes frequencies between the lower radio frequencies (100,00 hertz) and the cosmic rays (10 quadrillion megahertz). The cosmic rays include electron and heavy particle showers from space. There are several types of electromagnetic radiation that cause serious injury if you are exposed to them for any length of time. The ones you most often encounter are:

- Microwaves—3000 megahertz to about 3 million megahertz.
- X-rays—50 billion megahertz to about 100 trillion megahertz.
- Alpha particles—positive charged particles released by splitting the atom.
- Beta particles—negative charged particles released by splitting the atom.

The types are all high-energy radiation which can have a very adverse effect on living cells and tissues of the human body. The exact amount of damage depends upon the form of radiation and the degree of exposure. Unless they are present in a very large quantities, alpha and beta radiations present primarily an internal hazard. These particles may be inhaled, ingested or absorbed into the body by handling contaminated equipment. Whenever these particles enter the body, they cause damage to various organs. This damage can ultimately result in disease and possible death. Alpha particles cannot penetrate unbroken skin; beta particles can penetrate, but usually to not more than one-third of an inch of tissue.

To be adequately protected from radioactive material, you must guard against the contamination of your clothing and surrounding equipment and material. Safeguards against radiation contamination are similar to those used against toxic gas and dust. You must wear adequate protective clothing, hoods, respirators, gloves, boots, and any other required equipment to insure that you do not inhale or absorb the alpha or beta particles into your body. The object of the protective clothing is not to reduce the radiation generated outside your body, but to keep the radioactive debris or dust from being deposited upon your personal clothing where it can spread to clean areas and subsequently find its way into your body. For positive radiation identification and safety in an area of contamination, you should wear a film badge. Wear this badge on the outside of your clothing; e.g., clipped to the collar, breast pocket, shirt opening, or belt. The type of badge, or dosimeter, is determined by the nature and intensity of the radiation.

As we previously mentioned, certain Air Force publications spell out the controls and procedures to follow whenever you are working in an area that is subject to contamination by radioactive substances. Your organization has implemented the necessary controls and procedures. Be sure you're familiar with these directives. The following precautionary procedures give you a good basis for what to do and what not to do around radioactive equipment:

Have a thorough medical examination before exposure and as often as necessary thereafter. Have base hospital service give proper safety instructions before maintenance personnel begin operations on contaminated equipment. Wear protective clothing and a badge or dosimeter at all times during exposure periods. While working in a contaminated area, do not smoke, eat, chew gum, or drink. Wash hands and face after working on contaminated electronic equipment and before eating or smoking. Do not wear items such as watches and rings in a contaminated area. If you have been exposed to radiation, do not handle telephones, reports, or other articles while wearing protective gloves. Monitor the equipment to determine the extent of contamination and mark it with a applicable AFTO form showing the standard hazard warning emblem.

The base medical service decides whether it is necessary to set up a change house in which personnel who process radioactive contaminated material may wash, bathe, and change clothes. The change station may consist of existing restroom facilities, but it should be designed and posted to indicate a clean locker area, a washup or shower facility, and a contaminated area for removing contaminated clothing. It is mandatory to adhere to good personal hygiene practices (washing hands and face before eating or smoking).

Exercises (041):

1. What are the hazards associated with alpha and beta radiations?
2. To what extent can alpha and beta particles penetrate the skin?
3. What are the principal safeguards against radiation contaminated materials and equipment?
4. Assuming you are wearing the proper protective clothing and equipment, what two precautions must you observe to prevent the entry of alpha and beta particles into the body by means of ingestion or absorption?

042. Cite the hazards associated with microwave and X-ray radiations.

Microwave and X-ray Radiation. The biological effect of microwave radiation has recently become a matter of concern to personnel who come in contact with modern electronic equipment. The power sources for many radar devices can produce radiation powerful enough to damage human tissue. Microwave and X-ray are the two types of radiation produced by electronic equipment. Electromagnetic radiation emitted by radar antennas can be absorbed or reflected by an object in the direct path of its beam. The total amount of radiation absorbed or reflected depends upon the types of materials encountered by the beam and the frequency and power intensity of the beam.

Microwaves produced localized heating when absorbed by matter. This heating effect can cause biological damage to the human body if excessive amounts of radiation are absorbed. The amount of temperature rise in the body is related to the intensity of power and the frequency of radiation. Most parts of the body send a warning to the brain in the form of pain before enough heat is absorbed to cause biological damage. However, the eye is less sensitive than other parts of the body and is capable of absorbing more heat before pain s felt. Thus, it is possible to damage the eye without knowing it at the time.

The depth to which radiation can penetrate the human body depends upon the frequency of the microwaves and the body depends upon the frequency of the microwaves and the absorptive properties of the human tissue. When radiation is absorbed in any of the layers, heat is produced. The skin layer contains most body's sensory elements (nerve endings). If this layer absorbs the energy, there is little danger of overexposure because you are warned by the heating effect. However, if the frequency of the microwave is such that penetration is deeper than the skin layer, the heating is below the sensory elements and possible damage to tissue can result without your being able to feel it. Exposing the body to microwave radiation in the frequency range above 3000 megahertz is somewhat similar to an exposure to sunlight or infrared light.

There are certain precautionary measures that you should exercise whenever working in an area where microwave radiation is generated. One of the most important things to remember when working near transmitting radar equipment is that the energy level (power density) is highest at the source of emission and diminishes as the distance from the power source increases. Do not make a close visual inspection of any microwave radiator reflector, waveguide opening, or waveguide horn during periods of transmission. Do not make a close visual inspection of an operating klystron except through a leaded glass window or by remote viewing. Absorbent screening material, such as dummy loads or water loads, should be provided to contain the primary beam of a microwave radiator whenever possible. In radar component test areas, use the minimum number of personnel required to accomplish the test. Some ECM antennas can transmit frequencies above 1000 megahertz. Be aware of such antennas, because the sensory elements of your skin cannot warn you of their radiation. At the present time, there is no immediate first aid for excessive microwave radiation exposure. If you feel heat generated on your skin, move away from the antenna or radiation device. Your best protection is to recognize exposure and avoid it.

X-rays are elctromagnetic ionizing radiation that constitutes a hazard to the health of personnel who work with X-ray equipment and radioactive materials. The extent to which even small doses of X-ray radiation adversely affect the human body is not fully known. The symptoms of X-ray injury generally are no different than those that occur in a variety of illnesses. Radiation produces its effects by altering the functions of the cells of the body, and the response of the body of cell damage is the same regardless of the cause. The serious aspect of radiation damage, however, is that radiation can penetrate to any of the cells of the body. Radiation is known to affect the chromosomes in the nuclei of cells. Chromosomes contain the genes, or hereditary factors.

The process of cell division is affected by exposure to X-ray radiation so that the rate of normal cell replacement is altered. If the cell has been altered so that the daughter cell are genetically different from the parent cell, the daughter cells may die before they, in turn, reproduce themselves, or they may continue to grow without dividing, or they may divide at a higher or lower rate than the parent cell. Keep in mind that each cell of the body is a distinct living unit. Tissues and organs are basically collections of cells; thus the interactions among cells are injured or destroyed in this manner in a short period of time, the individual becomes sick and the medical diagnosis is "radiation sickness."

Exercises (042):

1. What dangerous effect does microwave radiation have on the body?
2. Why are the higher frequencies of microwave radiation more dangerous to humans than the lower frequencies?
3. How does ionizing radiation affect the body tissues and organs?
4. What is your best protection against microwave radiation exposure?

043. Specify hazards created when one or more radioactive tubes are broken and state precautionary measures to be taken against them.

Radioactive Tubes. Several types of electron tubes used by the Air Force contain radioactive materials. These tubes are used in equipment of various types and include the spark-gap, glow-lamp, cold-cathode, transmit-receive (TR), and the anti-transmit-receive (ATR) tubes. The amount of radioactive material in the tubes presents no significant external radiation hazard when the tubes are handled one at a time or in small numbers. However, extremely large quantities of radioactive tubes may present an external hazard. Breakage of one or more of these tubes could definitely present an internal hazard to personnel working in and around the area. Additional information or assistance relative the potential hazards should be obtained from the base medical service.

Handling procedures and warning notices. As previously indicated, the external hazard from the normal handling and use of radioactive tubes is insignificant. If the tubes are broken, the radioactive tubes, is significant. If the tubes are broken, the radioactive materials may escape and contaminate the surrounding area and the air around it. This presents an internal hazard to the personnel involved. The radioactive tubes is insignificant. If the tubes are broken, the radioactive materials may enter the body through the nose, the mouth, or an open wound. The precautionary measures concerned with radioactive tubes and spark gaps deal primarily with careful storage and handling. Here are a few of the most important:

a. Handle the tubes as little as possible.

b. Handle tubes carefully and make every effort to keep breakage to an absolute minimum.

c. Should breakage occur, exercise the proper cleanup procedures in the contaminated area.

d. Never stores tubes that are not individually boxed.

e. Never carry radioactive items in pockets (except such items as a watch or compass).

f. Use placards, labels, and tags to identify tubes and storage areas. These items are described in TO 00–11N–3 and have AFTO form numbers in the 9 series. They are used for warning or identification purposes. A magenta standard radiation hazard warning emblem on a yellow background

is used to designate hazardous areas. All lettering is block type and black in color.

Decontamination. In case of broken or damaged containers of radioactive materials, clear the area of all personnel not required to evaluate the condition or decontaminate the area or material. Secure the area. In cases of contamination by ingestible radioactive material suspended in the air, close doors and windows and turn off ventilation equipment. Notify the radiological protection officer (RPO), the assigned radiological monitor, immediate supervisors, and other directly concerned personnel immediately. Survey the area to determine the extent of the radiological hazard. Monitor personnel who have been or may have been exposed to determine the extent of medical action required. The RPO will direct the decontamination or recovery operation as necessary. Package broken or damaged items safely and dispose of them per TO 00-11N-2, *Radioactive Waste Disposal.*

Exercises (043):

1. What is the danger when a single radioactive tube is broken?

2. What precautionary measure is taken to limit the number or radioactive tubes broken at one time?

3. What TO describes radioactive warning labels, placards, and tags?

4. Whom should you notify in cases of contamination by ingestible radioactive material suspended in the air?

2-3. Equipment Hazards

The reliability and operational effectiveness of Air Force systems are the concern of all Air Force personnel, uniformed members and the civilian work force. Damage to electrical and electronic parts from electrostatic discharge (ESD) has long been known. The current trends in technology are toward greater complexity, increased density, and hence thinner dielectrics between active elements, resulting in electronic devices becoming even more sensitive to ESD. Various electronic parts are more electrostatic discharge sensitive (ESDS) than others. These can be damaged by ESD levels commonly generated by personnel testing, handling, repairing, and assembling electronic components without their being aware that a discharge of static electricity has even occurred. Many ESDS electronic devices such as semiconductors, thick and thin film resistors, chips and hybrid devices, and piezoelectric crystals can be damaged or destroyed by ESD levels of a few hundred volts, far below our threshold of awareness (around 4000 volts). We cannot see, feel or hear discharges below that level. This section discusses the precautions you must take when handling electronic parts that are electrostatic discharge sensitive.

044. Cite precautions to be used when using Electrostatic Discharge Sensitive Devices.

Static Generating Materials. They are everywhere around us. Our clothing of man-made fibers, vinyl floor tile, common plastics such as polyethylene, polyurethane and numerous other commonly used materials, are prime generators of electrostatic charges. Voltages in excess of 30,000 volts are common.

We can take certain measures to protect ESDS items by instituting low cost ESD controls. The lack of these controls has resulted in high repair costs, excess equipment downtime, and has reduced operational effectiveness, because susceptible parts are bing damaged during processing, assembly, inspection, handling, packaging, shipping, storage, installation, and maintenance. This occurs throughout the equipment life cycle from manufacture, on through the hands of the using agency.

Sources of Static Electricity. Static electricity is an electrical charge at rest. The electrical charge is due to the transfer of electrons within a body or from one body to another. The magnitude of the charge is dependent on the size, shape, composition and electrical properties of the substances which make up the bodies. When two substances are rubbed together, are separated, or flow relative to one another, one substance gains electrons and the other loses electrons. These electron charges are equal, and in the case of nonconductors, tend to remain in the localized area of contact for relatively long periods of time. Charges on conductors are rapidly distributed over their surfaces.

Typical prime charge sources or generators commonly encountered are work surfaces; floors; clothes; chairs; and packaging, handling, assembling, cleaning, testing, and repair areas. These prime generators are nonconductors (essentially insulators) and are typically synthetic materials. Electrostatic voltage levels generated with these insulators can be very high since they are not readily distributed over the entire surface of the substance. The conductivity of some insulative materials is increased by the absorption of moisture under high humidity conditions, which tends to dissipate static charges.

Numerous parts are susceptible to damage when an ESD occurs across their terminals or leads, or when these parts are exposed to electrostatic fields. ESDS parts installed in assemblies such as a printed circuit board can be damaged by an ESD. Some of the susceptible items are listed below.

(1) Microelectronic devices such as MOSFETS, PROMS, ROMS, RAMS, and CMOS.
(2) Discrete semiconductors.
(3) Film resistors.

(4) Resistor chips.
(5) Other thick and thin film devices.
(6) Piezoelectric crystals.

When handling an ESDS item outside of its ESD protective packaging, be sure you are in a protected area. A protected area generally consists of a grounded workbench, a personnel wrist strap, a grounded floor mat, and grounded tools and equipment all connected to a common ground. The elimination of static generators is also a requirement for an ESD protected area.

All workbenches in a shop need not be grounded, but those where ESDS items are handled must be grounded. An effective method is to cover the work surface with a conductive antistatic sheet such as Velostat. Of the several types available, the preferred is a conductive mat that provides a constant drain of static charges to ground. The mat should have a grounding cable with a resistance in series of at least 250,000 ohms and a definite electrical connection to the common ground in the facility.

Personnel handling ESDS items must wear a skin-contact wrist strap. The wrist strap must be connected to the table mat at the grounding cable connector or other grounding means and be long enough to permit freedom of movement. It should have a quick release mechanism for emergency. It is important that the wrist strap have a resistance of at least 250,000 ohms between it and the junction to protect the wearer by limiting the current to less than 5 milliamperes. (fig. 2-3.) The resistor in the wrist strap should be located near the point of contact to the person's skin to reduce the chances of the strap shorting to ground such as by fraying and shunting the strap's resistance.

Each work station should have a grounded floor mat. As with the table mat, the floor mat provides a drain of static charge to ground. Make sure the floor mat is equipped with a grounding cable to meet at a common point with the table mat and wrist strap for a connection to the facility ground. The floor mat should also have a resistance of at least 250,000 ohms in series to ground for personnel protection.

Make sure each work station is also provided with grounded tools and equipment. Soldering irons, solder pots, or flow soldering equipment should be hard grounded and transformer or direct current isolated from the powerline. Be sure to ground other electrical power equipment that comes in contact with ESDS items. Use ESD protective solder suckers. Check insulated handles of hand tools for static generation and periodically treat them with an antistatic if required or if grips have been removed.

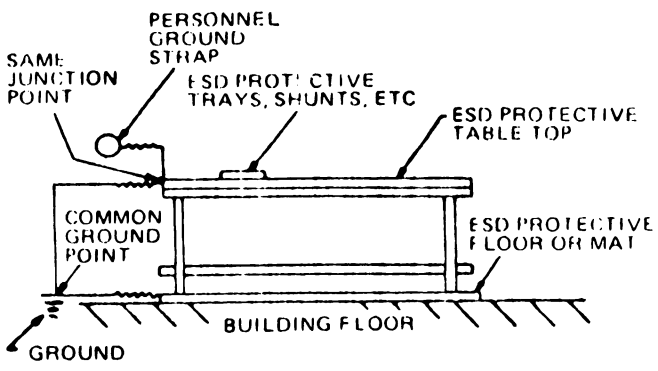


Figure 2-3. Typical ESD grounded work bench.

Other protective equipment in an ESD area include conductive parts' trays, tote boxes, and carriers to store or carry ESDS parts. Use shorting bars, clips, or special shunts to short ESDS part leads and higher assembly connectors. You can use conductive foam for shorting part leads and as a cushioning for packaging and use conductive bags of the Faraday cage type for item storage. Refer to DOD-HDBK-263 for use of these items.

Preventing Electrostatic Charge Buildup. Humid air helps to dissipate electrostatic charges and it lessens their generation. Relative humidity between 40 and 60 percent in ESD protective areas is desirable as long as it does not accelerate the formation of rust or result in other detrimental effects in electronic assemblies.

Where the formation of static charges become critical at an already protected work area, ionized air blowers may be necessary. The stream of ionized air blowing over the work dissipates static charges as they are being formed.

In some critical work it may be necessary for personnel to wear ESD protective smocks, gauntlets, finger cots, or aprons.

Use ionized air blowers, conductive solvents, or ionized nozzles as applicable to prevent electrostatic charge buildup in the work area when spraying, cleaning, or painting equipment containing ESDS items.

Keep the ESD protected area clear of common static generators. Styrofoam cups, plastic candy wrappers, common plastic bags, common plastic equipment covers, plastic document covers, and nonconductive tote boxes are all notorious static generators. Smocks, gloves, finger cots, or aprons of common plastic, rubber, nylon, or untreated cotton should never be used in an ESD protected area.

Each designated ESD protected area must have a warning sign similar to the following:

"ESD PROTECTED AREA—
USE PRECAUTIONS WHEN HANDLING
ESDS ITEMS OUTSIDE
THEIR PROTECTIVE WRAPS."

Periodic monitoring of ESD protected areas shall be performed with ohmmeters and meggers to assure the resistances are low enough to limit residual ESD voltages and high enough to protect personnel from nearby line voltages.

Operating Procedures. Observe the following general guidelines for ESDS materiel handling and storage requirements:

a. Persons handling ESDS items shall be trained in ESD precautionary procedures.

b. ESDS items must be protected from electrostatic fields and ESD with shunts such as bars, clips, conductive foams, or inside of conductive coverings, during storage, shipping, and while transporting from parts storage to grounded workbench. The ESD protective cover and shunts

should be removed only at a grounded work station immediately before being installed into the assembly for which it is intended.

c. Persons repairing electronic equipment shall ensure they are grounded prior to removing ESDS items from their protective packaging.

CAUTION

When ESDS items are handled outside their protective packaging, they should be handled by the shunting device, without touching the ESDS parts or electrical runs.

d. The leads or connector terminals of ESDS items should not be probed when using multimeters without having first touched the probe to ground.

e. Tools and test equipment used in ESD protected areas shall be properly grounded. Hand tools should not have insulated handles. Those with insulated handles should be treated with topical antistat. Hand tools should be neutralized before and during use by contacting with a grounded surface.

f. Power should not be applied to equipment or assemblies while ESDS items are being removed or installed.

g. Work instructions, test procedures, technical orders, drawings, or similar documents used in ESD protected areas should not be enclosed in common plastic covers.

h. Conductive tote boxes and other containers should be contacted together or grounded to a common ground before transferring ESDS parts from one to another.

i. Work instructions, technical orders, drawings and other documents should identify ESDS items and contain cautions and labels to require that such items be removed from their protective packaging only in ESD protected areas.

j. Neutralize charges on all ESD packaged items by placing the packages on an ESD grounded work surface prior to opening them.

k. Watch for caution markings and symbols on the packaging or parts, on assembly drawings, technical orders, printed circuit boards, and on the equipment cover or cabinet.

Exercises (044):

1. What is the minimum resistance that a wrist strap should contain?

2. Prior to removing a part from its protective packaging, what should you ensure?

3. A protected area generally consists of what?

4. What material can be used for shorting parts leads and as cushioning for packaging?

5. What can you do to dissipate electrostatic charges?

Bibliography

Department of the Air Force Publications

AFR 0–10, *Management Control and Authorization Program of Allowance Source Codes for USAF Activities.*

AFR 39–1, *Airman Classification Regulation.*

AFR 74–2, *Air Force Metrology and Calibration Program.*

AFOSH 127–66, *General Industrial Operations.*

AFR 161–35, *Hazardous Noise Exposure.*

TO 00–110A–1, *Guidelines for Identification and Handling of Aircraft and Material Contaminated with Radioactive Debris.*

TO 00–110N–2, *Radioactive Waste Disposal.*

TO 00–110N–3, *Requisition, Handling, Storage, and Identification of Radioactive Materiel.*

TO 00–110N–7, *Handling and Disposition of Radioactive Electron Tubes and Spark Gap.*

TO 00–20–14, *Air Force Metrology and Calibration Program.*

TO 00–35D–54, *USAF Materiel Deficiency Reporting and Investigating System.*

TO 33K–1–100, *PME Interval, Labor Estimate, Calibration and Repair Technical Order Reference Guide and Work Unit Code Manual.*

TO 42B5–1–2, *Use, Handling, and Maintenance Instructions for Storage-Type Gas Cylinders.*

TO 00–25–234, *General Shop, Practice Requirements for the Repair, Maintenance, and Test of Electronic Equipment.*

Department of Defense Publications

DOD Handbook H–106, *Multilevel Sampling Procedures and Tables for Inspection by Attributes.*

Glossary

ATE—Automatic test equipment.
BASO—Base supply office.
EMO—Equipment management office.
ESD—Electrostatic discharge.
ESS—Electrical standards set.
ETSC—Engine test stand calibrator.
MDC—Maintenance data collection..
MDR—Material deficiency report.
MSEP—Maintenance standardization and evaluation program.
PATEC—Portable automatic test equipment calibrator.
QVI—Quality verification inspection.
TFCU—Transportable field calibration unit.
TMDE—Test, measurement and diagnostic equipment.
UDL—Unit detail listing.

Answers for Exercises

CHAPTER 1

Reference:

001 – 1. Functional grouping permits related positions to be grouped on the basis of similarity of knowledge, education, training, experience, and other related abilities.

001 – 2. (1) The minimum aptitude score for entry into the 32 career field; (2) background, training, experience, and security classification; (3) expressed preference; and (4) Air Force manpower requirements.

002 – 1. The first two digits.

002 – 2. The skill level.

002 – 3. A minimum of five digits; however, certain specialists may require the use of a suffix and a prefix.

002 – 4. A letter suffix is used with an AFSC to identify qualifications related to specific system or aircraft. A letter prefix is used to identify a special duty qualification that is common to more than one AFS.

003 – 1. The duty you are most qualified to perform.

003 – 2. The PAFSC is the AFSC in which you are most qualified for duty, and the secondary AFSC represents your second best qualifications.

003 – 3. The DAFSC designates the specialty to which you are actually assigned. The CAFSC identifies your highest usable skill. (You may or may not be serving in your CAFSC.)

004 – 1. (1) Satisfactorily perform the duties of AFSC 32470 for a minimum of 12 months, (2) successfully complete CDC 32470, (3) be recommended by your supervisor, and (4) meet the mandatory requirements in the specialty description.

004 – 2. The degree of job-related knowledge you have acquired. For upgrading purposes, a satisfactory score is one of the criteria.

005 – 1. Test measurement and diagnostic equipment; it is inspected for compliance with preventive maintenance, cleanliness and safety requirements.

005 – 2. Automatic test equipment.

005 – 3. By helping the specialist analyze and isolate malfunctions in complex equipment.

005 – 4. When planning and organizing laboratory activities.

006 – 1. The DCM is the executive manager of the maintenance organization and is responsible for training, planning, and scheduling of all maintenance activities.

006 – 2. Through staff agencies that are responsible for the various functions.

007 – 1. Administration is responsible for reports, correspondence, local maintenance, directives, and keypunch service.

007 – 2. Production analysis is responsible for improving the overall maintenance operation by analyzing maintenance data and statistical inputs.

007 – 3. Qualification training, management training, and upgrade training.

007 – 4. Programs and Mobility.

007 – 5. a. Designate qualified personnel for mobility commitments.
b. Require that personnel designated for mobility keep their immunization and personal affairs documents current.
c. Identify equipment and materials prescribed by the mobility plan.
d. Establish procedures to insure that prescribed marking, packaging, and marshalling requirements are accomplished.

007 – 6. a. Prepare and submit the maintenance financial requirements.
b. Distribute budget allocation.
c. Monitor the status of expenditures by cost center.
d. Advise the DCM on the financial status of the maintenance complex.

007 – 7. Job Control; Materiel Control; and Plans, Scheduling, and Documentation.

007 – 8. To direct and control maintenance of aircraft, related support equipment, and services.

007 – 9. To provide coordination between maintenance and supply managers, manage supply transactions, and manage production of assets in the repair cycle.

007 – 10. To plan and schedule section plans, and to schedule the use and maintenance of aircraft and related equipment to meet mission commitments.

007 – 11. To determine the quality of the maintenance performed.

007 – 12. To the maintenance supervisor, Quality Control, DCM.

008 – 1. Item description, manufacturer's name, and part number.

008 – 2. The table of allowance (TA) for that activity.

008 – 3. The equipment management office (EMO).

008 – 4. Base supply office (BASO).

008 – 5. Date of request and unit designation, until supply request number, name and telephone number of the unit supply custodian, equipment stock number or part number, name or description of item, justification for the request (including the applicable allowance document and a brief statement of circumstances), quantity required, and certification by the commander or commander's representative to validate the requirement.

009 – 1. Cash Collection Voucher (DD Form 1131) and Statement of Charges (DD Form 362).

009 – 2. The top price is the full price, while the bottom price is the price the Air Force is to collect from the individual. This reduction for depreciation is allowed but may not exceed 25 percent.

009 – 3. An acknowledgement, an authorization, a waiver or right, an affirmation, and an agreement.

010 – 1. It explains and records circumstances involving lost, damaged, or destroyed Air Force property.

010 – 2. Whoever has custodial responsibility at the time of loss.

010 – 3. No later than 30 days.

011 – 1. Job Control.

011 – 2. The supervisor must work with many agencies to insure that the work and training schedules are kept and on time.

012 – 1. Planning and scheduling work assignments in accordance with priorities.

012 – 2. Manpower and equipment.

012 – 3. You may need to borrow equipment or work around other personnel.

012 – 4. To satisfy mission requirements as soon as possible.

013 – 1. No. A 3-level specialist may have special qualifications or experience in a particular area.
013 – 2. Job knowledge is learned by working on specific type of equipment assigned, while the skill level is awarded by the Air Force to indicate the knowledge level.
013 – 3. The priority of the assigned tasks.

014 – 1. Make frequent checks.
014 – 2. The supervisor.
014 – 3. (1) To assure that the equipment operates properly and safely and (2) inspection of the completed work can serve as a training situation.
014 – 4. Comment on how well the job was completed, but also point out the holddown mount bolts. By taking time to explain how to safety-wire these bolts, the supervisor will probably keep the worker from making the same mistake again.
014 – 5. Jobs may have to be redone completely if an error is made at the beginning of the task. Making several inspections while the task is being done many save time and increase work output.

015 – 1. To analyze maintenance activities and determine work patterns of the personnel.
015 – 2. To analyze the ones that take too much time.
015 – 3. At least three graphs.

016 – 1. A performance standard. Standards enable a supervisor to evaluate the quality of the work people are doing. If standards are not met, workers are not fulfilling their responsibilities, which could result in mission failure.
016 – 2. To keep substandard conditions from becoming viewed as acceptable.

017 – 1. Modification of equipment, excessive overtime, TDY commitments, additional duties, additional flying hours, and transit aircraft traffic.
017 – 2. Reassign tasks to other sections; request emergency manning.
017 – 3. To insure that all the facts are known before going to higher commands for assistance.

018 – 1. On-the-job trainers, shop training monitor, test equipment monitor, shift supervisors, safety supervisor, team chiefs, mobility supervisor, dispatchers, etc.
018 – 2. One level above and two levels below the charted position.
018 – 3. The responsibilities of each position and the publications that function normally uses.

019 – 1. The immediate supervisor.
019 – 2. Research the problem or rely on past experience.
019 – 3. By checking back, you make the workers feel that their problems are your problems; this increases their confidence in you as a supervisor.

020 – 1. Your laboratory technicians.
020 – 2. Consider, weigh, and decide.
020 – 3. Open lines of communications.

021 – 1. Let them know what you expect, point out ways to improve, praise them in public, and criticize them in private.
021 – 2. Always get the facts, weigh and decide, take actions, and then check the results.

022 – 1. No. This damage was apparently caused in shipping and reporting would be done by other means.
022 – 2. As stated, any deficiency that affects equipment or personal safety is reported as a category I deficiency.
022 – 3. Category II deficiency report.

023 – 1. To establish a base-level capability for the repair and calibration of all types of test equipment, and to establish a system to maintain, calibrate, and distribute standards.
023 – 2. Since you are most likely assigned to a base BPMEL, your job is more directly associated with the base-level capability to repair and calibrate all types of test equipment.
023 – 3. AFR 74–2.

024 – 1. TO 00–2–14.
024 – 2. The National Bureau of Standards.
024 – 3. It calibrates PTTI Standards.
024 – 4. Maximum 12 months. The minimum is set by the using activity and the PMEL.
024 – 5. The PME scheduler.
024 – 6. No. This equipment should be calibrated only on the ranges or points at which it is used.
024 – 7. At least once every 2 years.

025 – 1. It provides the Directives of Metrology information from the PME laboratory.
025 – 2. Semiannually.
025 – 3. 00–20–14.
025 – 4. It is a PMEL evaluation document.

CHAPTER 2

026 – 1. To help individuals learn and understand equipment operating procedures before they start a job so that they can operate the equipment properly and safely.
026 – 2. The requirement of preoperational training. You must read the operating procedure for the modified equipment to be sure that you incorporate any changes necessary.

027 – 1. The principle of law observance (self-discipline).
027 – 2. Self-discipline, or law observance.

028 – 1. The principle of alertness.
028 – 2. Horseplay.
028 – 3. Mental distractions that violate the principle of alertness are thinking of personal problems, daydreaming, and boredom. Examples of physical distractions are fatigue, severe pain, and illness.

029 – 1. A back injury.
029 – 2. By lifting with your legs.

030 – 1. Eat balance meals, exercise moderately, get enough sleep, have ears and eyes checked periodically, and follow the Air Force physical fitness program.
030 – 2. Wear ear plugs.

031 – 1. We and our work habits are the greatest causes of accidents.
031 – 2. First recognize the hazards, then take corrective action to eliminate them.

032 – 1. The results may be loss of efficiency or a potential safety hazard.
032 – 2. Become thoroughly familiar with the various parts of the equipment and become especially familiar with the safety hazard that may be develop due to defective or worn parts.

033 – 1. "Working environment" means the surrounding conditions under which we work. This includes climate, light, heat, noise, equipment, people, etc.
033 – 2. Good housekeeping reduces the likelihood of accidents because:
   a. Scraps and waste will not be left on the floor to be tripped over.
   b. Spilled oil, grease, paints, and chemicals will not be left on the floor to cause someone to slip.
   c. Tools will not be allowed to become dirty or greasy, making it possible for your hand to slip off the tool and hit some other object, or the tool to slip and fall into a piece of equipment.
   d. Tools and materials will not be left lying around to cause a safety hazard.

034 – 1. Many unnecessary operations are used in performing tasks. This practice creates many mistakes that result in unsafe actions.
034 – 2. The safety instructions indicate special rules required for the safe operation of equipment.

035 – 1. a. Violation—wearing a watch while working on electrical equipment.
   b. Observation—precaution against being grounded.
   Violation—failure to remove power while attaching clip to circuit.

036 – 1. The buddy system is a two-person concept for working on high-voltage equipment. This system allows two persons to work as a team.

036 – 2. There is immediate first aid available in case of severe electrical shock.

037 – 1. Always disconnect electronic equipment from the power supply source before you solder.
037 – 2. Place a cleaning rag on a suitable surface and wipe the hot tip across it.
037 – 3. Fumes from fluxes and cleaning solvents may contain toxic gases.

038 – 1. Excessive humidity, wet areas, lack of protective matting, or other protective equipment, etc.
038 – 2. Many people think high voltage is necessary to produce a fatality.
038 – 3. One-tenth of an ampere can kill the average person.
038 – 4. Discharge the capacitors with a shorting rod.
038 – 5. Make certain the equipment is properly grounded and that all test equipment is grounded to it.

039 – 1. Open the valve approximately one-fourth turn and then close it immediately.
039 – 2. Move the cylinder out doors, expel the gas into the atmosphere, and keep all unnecessary personnel and sources of ignition away until the cylinder is empty.
039 – 3. In addition to the safety precautions in the appropriate technical order, always wear adequate eye protection and use the buddy system.

040 – 1. Trichloroethane.
040 – 2. They must be stored separately to prevent mixing.
040 – 3. Base environmental health, civil engineers, and fire protection personnel.
040 – 4. The physical properties and quantity of hazardous materials present and the methods of operation.

041 – 1. In moderate or low quantities, they are primarily an internal hazard. These particles may be inhaled, ingested, or absorbed when contact is made with contaminated equipment.
041 – 2. Normally, alpha particles do not penetrate the skin Beta particles may penetrate about 1/3 inch.
041 – 3. Protective clothing, hoods, respirators, gloves, boots, and other devices designed to prevent alpha and beta particles from being inhaled or absorbed into the body.
041 – 4. While working in an area where contaminated equipment is present, do not smoke, eat, drink, or chew gum. Wash your face and hands after handling contaminated equipment and before you smoke or eat.

042 – 1. Localized heating, which may cause tissue damage.
042 – 2. They penetrate deeper and cause heating below the sensory elements of the skin, making it possible for damage to occur without warning.
042 – 3. If it injures or destroys enough cells, the body tissues and organs are also injured or destroyed.
042 – 4. To recognize exposure and avoid it.

043 – 1. An internal hazard from possible ingestion, inhalation, or penetration into open wounds.
043 – 2. For storage, tubes are packaged in individual boxes.
043 – 3. TO 00–11N–3.
043 – 4. The radiological protection officer, the assigned radiological monitor, immediate supervisor, and other directly concerned personnel.

044 – 1. 250,000 ohms.
044 – 2. That you are in a protected area.
044 – 3. Personnel wrist strap and grounded workbenches, floor mats, tools, and equipment all connected to a common ground.
044 – 4. Conductive foam.
044 – 5. Maintain relative humidity between 40 and 60 percent, use ionized air blowers, and keep protected area clear of common static generators.

AUGAFS, AL (860181) 700

☆ U.S. GOVERNMENT PRINTING OFFICE: 1985--631-028/20610 Region #4

universal®
www.myuniversalop.com
phone: 1-866-756-4676
UNV12113
MADE IN USA