Field Manual
NO. 43-20

*FM 43-20
HEADQUARTERS
DEPARTMENT OF THE ARMY,
Washington, DC, 10 November 1989

GENERAL SUPPORT MAINTENANCE OPERATIONS

Preface

This manual is the Army's doctrinal guide for maintenance at the general support level on the Air Land battlefield. The purpose of this manual is to establish General Support (GS) maintenance management doctrine for the Active Army, Army Reserve , and Army National Guard. It is primarily intended to provide information amd guidance on the responsibilities, functions, and operation procedures of the conventional general support maintenance battalion organization and the various types of units organized and operating under Army of Excellence (AOE) tables of organization and equipment (TOE).

AR 700-9 defines logistics doctrine as "A collection of the best thinking the Army has to offer on how to perform a particular combat service support in wartime". Consequently, the intent of this publication is to provide information about GS maintenance which will be useful in planning for and providing support in time of war. This manual identifies current reference documents and provides guidance for commanders and staffs who provide GS maintenance for Army Forces during wartime and is compatible with the principles, concepts, and objectives of maintenance as described in AR 750-1.

The proponent of this publication is Headquarters, Training and Doctrine Command, Ft. Monroe, Virginia 66027. Submit changes for improving this publication on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward to:

Use of specific gender in this publication is for ease of reading. Whenever the masculine or feminine gender is used, either gender is intended.

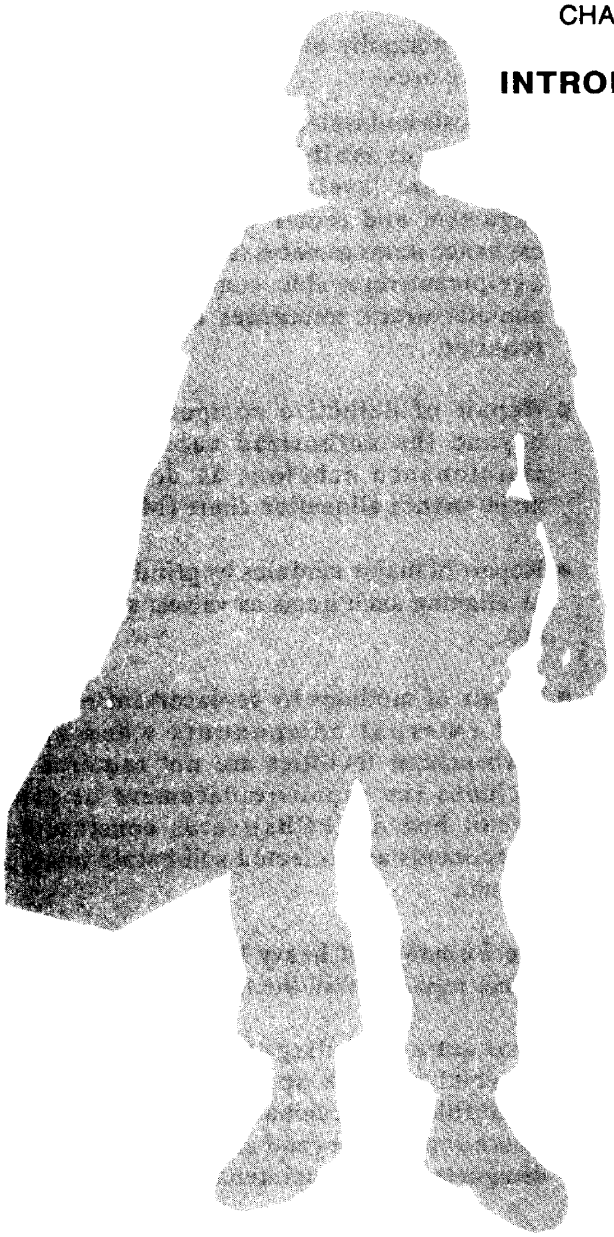
Commander
US Army Ordnance Center and School
ATTN: ATSL-DTD-DLD
Aberdeen Proving Ground, Maryland 21005-5201

***This publication supersedes FM 29-24, 15 April 1974.**

Table of Contents

CHAPTER 1

INTRODUCTION



GENERAL

The battlefield of the future will be highly volatile in nature. Employing weapons systems of increased complexity and mobility, in which they will be operating in a fully integrated environment (see Appendix A). Thus, the maintenance doctrine and concepts associated with the three categories of maintenance were found to be inadequate and inconsistent in providing responsive support to the AirLand battle. Therefore, the Army has returned to the four levels of maintenance in order to provide responsive support to the AirLand battlefield.

The Army's maintenance support requires change to accommodate new battlefield environments, new equipment, and new methods of employment. The Department of the Army (DA) has decided to change to a maintenance structure that will satisfy these requirements. The change to J- and L-series TOEs will occur as units and systems are selected for conversion. During this transition period, some units will continue to operate under the old structure.

LEVELS OF MAINTENANCE

The current maintenance structure consists of unit, direct support (DS), general support (GS), and depot maintenance.

Unit level maintenance is performed by the operator, crew, and the company maintenance team (CMT) and/or unit/battalion maintenance personnel. Equipment operators, crew, and the CMT use preventive maintenance checks and services (PMCS) to detect equipment deficiencies. Maximum use is

made of built-in test equipment (BITE) and test measurement and diagnostic equipment (TMDE) to perform maintenance. These tasks are performed at the deployed location of the equipment, the unit motor pool, or the unit maintenance collection point (UMCP).

Direct support units (DSUs)/Activities are found in divisional and nondivisional organizations. DSUs repair and return equipment to the user and provide repair parts supply. DS tasks may be performed at DS and/or in the supported unit level maintenance area.

GS maintenance provides equipment repair and returns repaired equipment to the theater supply system. GS maintenance units are located in echelons above corps (EAC) and are characterized by commodity-oriented platoons or commercial activities repairing components and end items. GS maintenance includes shop/bay or production line operations conducted in fixed or semifixed facilities. GS units are manned with 10 percent more soldiers than their primary mission requires in order to perform backup DS maintenance for divisional and corps units. This will be especially critical during reconstitution operations.

Depot maintenance supports both the combat forces and the Department of Defense (DOD) supply system by overhaul and rebuild operations. Depot maintenance is performed by selected industrial-type activities operated by the Army, other military services, contracted commercial firms, or specialized repair activities.

For discussion of current maintenance policies, see AR 750-1.

GENERAL SUPPORT MAINTENANCE RESPONSIBILITIES

This manual is compatible with the principles, concepts, and objectives of maintenance as described in AR 750-1. As a matter of general policy, maintenance will be allocated where it can be accomplished most efficiently while maintaining or improving readiness on a cost effective basis,

GS level will concentrate on the repair of items specified by the Theater Army Materiel Management Center. Due to the nature of the work done at the GS level, there will be more component repair than at lower echelons.

GS maintenance activities are responsible for providing overflow or backup maintenance support to maintenance units and installation/Army or local area theater supply operations by--

- Repair of unserviceable modules in support of reparable exchange (RX) service to lower level maintenance activities.
- Repair/modification of end items/reparable components for return to installation/ command/local area supply stocks.
- Providing on an exception basis DS maintenance support. The theater, or area commander can designate area maintenance support, technical assistance, on-site maintenance, and contact team support.

Operations normally allocated to the GS level of maintenance are--

- Diagnosis and isolation of equipment/reparable component malfunctions to the internal component level; adjustment, calibration, alignment and repair of equipment/reparable exchange items as necessary. Restoration of the equipment/reparable components to original manufacturer's tolerances or standards is not required.
- Repair of defective components which are beyond the authorized capability of lower maintenance echelons as depicted by the maintenance allocation chart (MAC).
- Repair of major modules by grinding, adjusting, or aligning such items as valves, seats, tappets, etc.
- Repair of modules by replacement of internal and external components when special environment facilities are not required. This includes the repair/replacement of printed circuit boards (PCBs)/cards constructed of components and selected solid-state integrated circuits.
- Performance of heavy body, hull, turret, and frame repair within the limits of the MAC.
- Evacuation of disposable, unserviceable materiel through appropriate channels and reparable, unserviceable end items/modules whose repair is beyond authorized capability to designated depot maintenance facilities.

Maintenance tasks include repair of components, items, printed circuit boards (PCBs), and repair of selected items in the theater general support maintenance (GSM) program. Missions may include specialized repair activities to repair complex PCBs, cards, and other selected items when authorized by HQDA. The maintenance mission is normally performed using shop stock repair parts or programmed repair parts tailored to specified mission requirements. The maintenance activity may also screen unserviceable line replaceable units (LRUs) and Shop Replacement Unit (SRUs), including complex PCBs, before evacuating the unserviceable to depot or contractor for repair.

GSM activities should maintain a liaison with supported activities. This coordination will assure activities are familiar with and have the skill to complete their materiel maintenance responsibilities. Upon request of a supported activity, maintenance support teams are formed and dispatched by the GSM unit. These teams perform required materiel support maintenance tasks on site. MSTS may also assist in training personnel of the supported activity as part of the maintenance operations technical assistance effort.

Tables of organization and equipment (TOE) GSM units within the continental United States (CONUS) will be assigned operational support missions as part of the CONUS training base. GS TOE units will provide this support under the operational or technical control of the installation maintenance activity. However, such units will not be absorbed into the operations of installation TDA materiel maintenance activities. GSM activities will function as separate units. In assigning missions to TOE maintenance units, installation commanders will consider, as a primary factor, the wartime mission training requirements to ensure operational ability of units.

Some GSM personnel may work. in installation facilities to maintain their skills and update MOS training as required. The productive capability of the installation materiel maintenance activity must be sustained at a level that can readily be expanded to support mobilization work loads required when GSM units are--

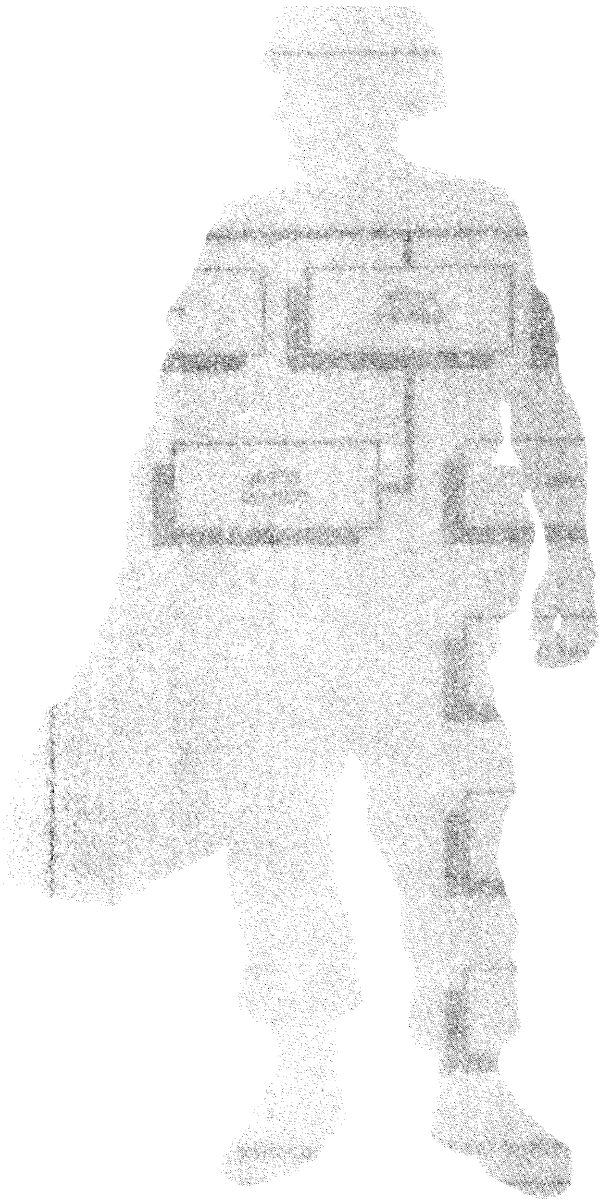
- Deployed.
- Transferred.
- Inactivated.
- Reorganized.
- Engaged in extended field exercises.

Centralized installation maintenance production planning and control (PP&C) activities will be established under the control of the installation maintenance officer (IMO). This will assure the effective use of available maintenance resources. Divisions, separate regiments, brigades, corps as well as echelons above corps, that are tenants to the installation will manage their own PP&C systems. However, they will furnish work load data to the central installation PP&C Office so the installation commander will be able to give required assistance.

Test, measurement, and diagnostic equipment (TMDE) maintenance support will be provided as outlined in AR 750-25, TB 750-25, and TB 43-180. When resource constraints can be expected, maintenance operations will be combined into the minimum number of facilities at each installation. This will assure acceptable materiel readiness levels, satisfaction of operational commitments, and contingency deployment.

CHAPTER 2

ORGANIZATION



GENERAL

One of the functions of the theater Army (TA) organization is to provide maintenance to units in and passing through the communications zone (COMMZ), backup DS and GS maintenance support to one or more corps, and the repair and return of equipment and materiels to the supply system. Conditions imposed by the integrated battlefield will discourage formation of large, consolidated maintenance facilties which are vulnerable to attack. Maintenance activities in the COMMZ should be dispersed to reduce vulnerability. Clustering of some facilities may be necessary to counter threats from rear area ground attacks. TA organization principles for maintenance support are--

- Conserve resources within the scope of mission accomplishment.
- Train to survive and accomplish the mission under both conventional and nuclear, biological, and chemical (NBC) combat conditions.
- Reduce the maintenance burden on forward elements.
- Concentrate on rapid return of equipment to the supply system.
- Allocate critical maintenance skills to support requirements that contribute the most to operational availability.
- Ensure that total system support requirements are considered when allocating resources.

Combat vehicles are of little use to the tactical commander if they cannot be fueled or armed because support vehicle availability has been sacrificed for combat vehicle availability.

- Provide for channels to obtain support as needed from allied maintenance organizations.

AREA SUPPORT GROUP

The area support group (ASG) is normally assigned on the basis of one or more per Theater Army Area Command (TAACOM), depending on geographic area and number of subordinate units. ASGs have the mission of providing DS and GS maintenance, supply, and service support to tenant units (Figure 2-1) and units passing through its assigned area.

ASGs are located within the TA along lines of communication in order to take advantage of the transportation networks behind the corps rear boundary, and under the command of the TAACOM. The ASG provides:

- DS maintenance to supported units on an area basis.
- GS maintenance to the theater supply system.
- GS supply to the corps' units and units passing through or stationed in its geographical area of responsibility; also assists in receiving, equipping, and preparing US units arriving in the theater.

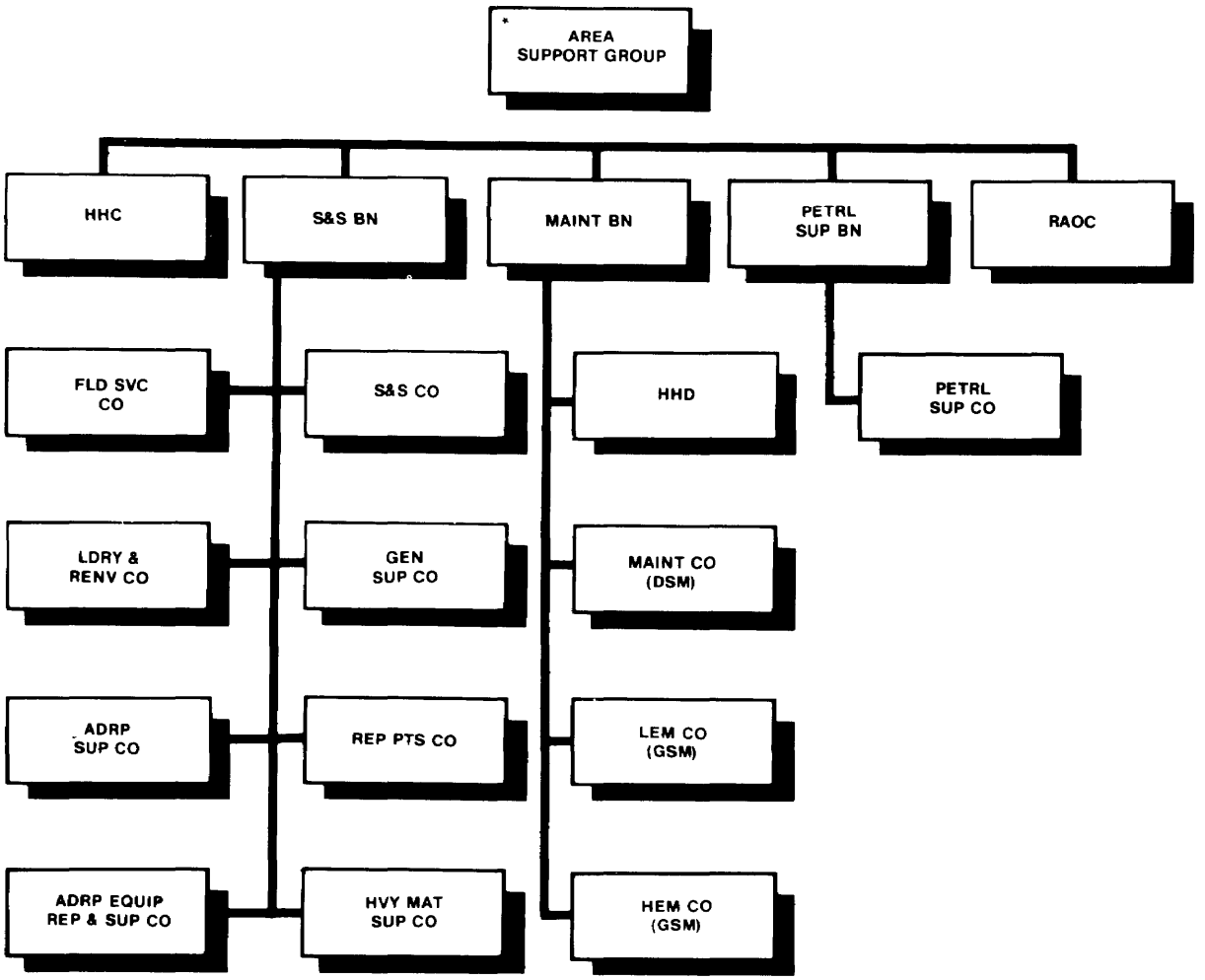


Figure 2-1. Typical AGS GS organization.

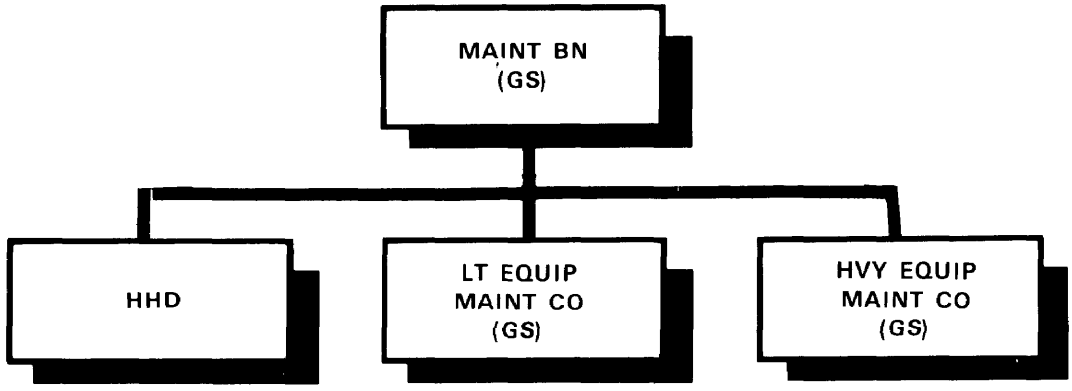
The ASG also maintains and issues TA war reserves and sustaining stocks. It is within these ASGs that the GSM units are found. (NOTE: Within an ASG, there maybe both DSM and GSM units. These units may be in separate battalions or in the same battalion, depending upon the size of the force being supported.)GSM companies, along with DSM companies, are normally assigned/attached to a Maintenance Battalion (TOE 43-436L000). These battalions are diverse organizations with large and varied missions.

Many skills are required in the battalion, representing command, supervisory, and staff functions; maintenance and supply management; production and quality control; personnel administration; communication; and packaging and preservation of a wide range of commodities. GSM units are most efficient when allowed to occupy fixed or semi-fixed facilities employing industrial methods of production. Figure 2-2 shows the organization of a typical GSM battalion.

Operations assigned to GS level include the following:

- Diagnose, isolate, and repair of faults within modules/components.
- Repair of selected LRUs and PCBs.
- Performance of heavy body, hull, turret, and frame repair.
- Area maintenance support, to include technical assistance and on-site maintenance as requested.
- Evacuation of unserviceable end items and components, through the appropriate supply support channels.
- Fabrication or manufacture of repair parts, assemblies, components, jigs, and fixtures when approved by the major Army command (MACOM).
- Provide for backup support as required.

Types of G-S Maintenance Units in a Maintenance Battalion) (Figure 2-2).



NOTE: Numbers and types of units in each inertmediate (GS) maintenance battalion depends on mission requirements. All battalions will not contain all the types of units indicated. Also, depending on special mission requirements, several maintenance units of one specific type may be included in a battalion organization.

Figure 2-2. GSM battalion, TACCOM support group.

Headquarters and Headquarters Detachment, Maintenance Battalion (TOE 43-436LO), as shown in Figure 2-3.

- Provides command, tactical, administrative, training, and technical operational supervision for attached maintenance units. For a list of personnel duties for specific positions see Appendix C.
- Commands and directs the operations of three to five maintenance units. These units may be either DS or GS or some combination of both.
- Members of headquarters and headquarters detachment can assist in defense of the unit's area.

Light Equipment Maintenance Company (LEMCO), General Support (GS), Theater Army Area Command (TAACOM) (TOE 43-637L2).

Mission. To provide GS maintenance for conventional light equipment end items and components for return to the customer and/or supply system.

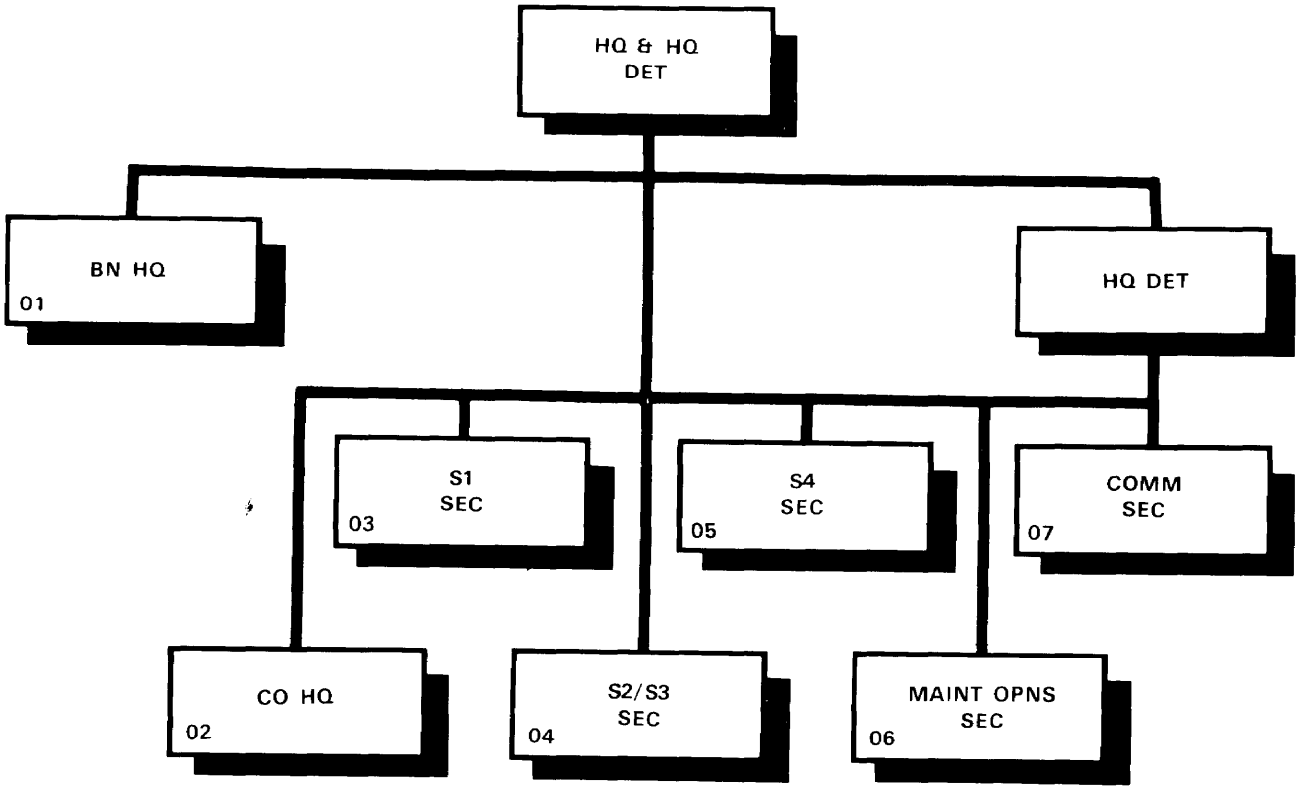


Figure 2-3. Headquarters and Headquarters Detachment.

Assignment. To a TAACOM and normally attached to a Headquarters and Headquarters Detachment, Maintenance Battalion (TOE 43-436L0). See Appendix C, for a listing of the types of personnel that are assigned to the Quality and Production Control of this unit and what their specific duties are.

Capabilities.

- This unit repairs and returns to the supply system communications equipment, special electronic devices, utilities equipment, power generation equipment, and quartermaster and chemical equipment. In addition, the unit performs metalworking, machining, and refrigeration equipment repair.

UNIT REPAIRS AND RETURNS TO SUPPLY SYSTEM COMMUNICATIONS EQUIPMENT, SPECIAL ELECTRONIC DEVICES, UTILITIES EQUIPMENT, POWER GENERATION EQUIPMENT, AND CHEMICAL EQUIPMENT.

- This unit does not repair aircraft, missiles, ammunition, and medical, marine, and rail equipment.

- Provides internal Class IX supply only.

- Provides area maintenance support, to include technical assistance, on-site maintenance, and back up support as required.

Perform unit maintenance on theater reserve stocks (TRS) when augmented by unit maintenance teams, on an as-required basis.

Perform GS maintenance support of automated data processing (ADP), PCBs, TMDE, radar, controlled cryptographic items, office machines, and audiovisual and electronic warfare/intercept equipment when augmented by modular teams. (See Appendix B.)

Annual man-hours of productive GS maintenance.

Communications Equipment Repair	142,600
Special Electronics Devices Repair	15,500
Utilities Equipment Repair	34,100
Power Generation Equipment Repair	167,400
Quartermaster/Chemical Equipment Repair	49,600
Metalworking	18,600

NOTE: Availability criteria based on Category III unit, allowing 3,100 annual productive man-hours per repairman.

Members of the light equipment maintenance company can assist in defense of the unit's area and perform unit-level maintenance on organic equipment. Limitations of this company and annual available maintenance man-hours for the base company and augmentation teams are listed in the TOE. A typical

organization of the light equipment maintenance company is shown in Figure 2-4.

Heavy Equipment Maintenance Company (HEMCO), General Support (GS), Theater Army Area Command (TAACOM) (TOE 43-638L1OO).

Mission. To provide GSM for conventional heavy equipment end items and components for return to the supply system.

Assignment. To a TAACOM and normally attached to a Headquarters and Headquarters Detachment, Maintenance Battalion (TOE 43-436LO). See Appendix C for a list of the types of personnel that are assigned to the Quality Assurance and Production Control Office.

Capabilities:

THIS UNIT REPAIRS AND RETURNS TO SUPPLY SYSTEM AUTO EQUIPMENT, CONSTRUCTION EQUIPMENT, SMALL ARMS, AND TANK TURRET.

- • This unit repairs and returns to the supply system automotive equipment, construction equipment, small arms, and tank turrets . In addition, the unit performs canvas repair and metalworking.

- This unit does not perform repairs on aircraft, missiles, ammunition-peculiar items, and medical, cryptographic, marine, and rail equipment.

- Provides internal Class IX supply only.

- Performs unit maintenance on TRS when augmented by TOE 29-600H4, unit maintenance teams (see Appendix B)on an as-required basis.

- Provides GSM support of fire control instruments, fire control systems, and artillery equipment when augmented by modular teams (see Appendix B).

Annual man-hours of productive GS maintenance.

AutomotiveEquipment Repair	331,700
Canvas Repair	12,400
Construction Equipment Repair	55,8OO
Metalworking	34,100
Small Arms Repair	12,400
Tank Turret Repair	15,500

NOTE: Available criteria based on Category III unit. Allowing 3,100 annual productive man-hours per repairman.

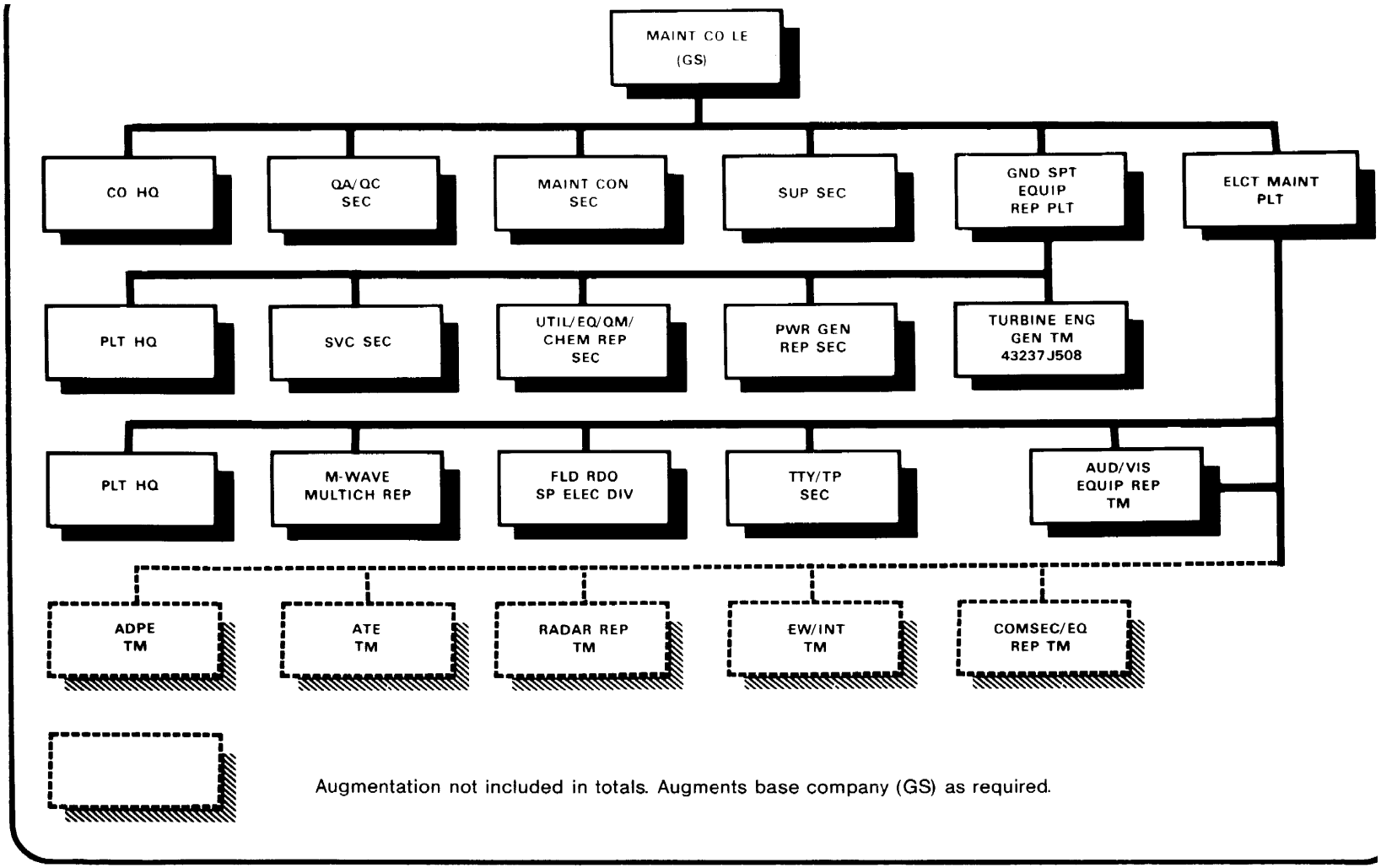


Figure 2-4. Light Equipment Maintenance Company organization.

MODULAR TEAMS INCREASE THE CAPABILITIES OF THE UNIT

Modular augmentation teams. Modular teams increase the capabilities of the unit. Normal use is one **GS** repair team per every five heavy equipment maintenance companies.

Members of the HEMCO can assist in defense of the Unit's area and perform unit-level maintenance on organic equipment. Limitations of this company and annual available maintenance man-hours for the base company and augmentation teams are listed in the TOE. A typical organization of the HEMCO is shown in Figure 2-5.

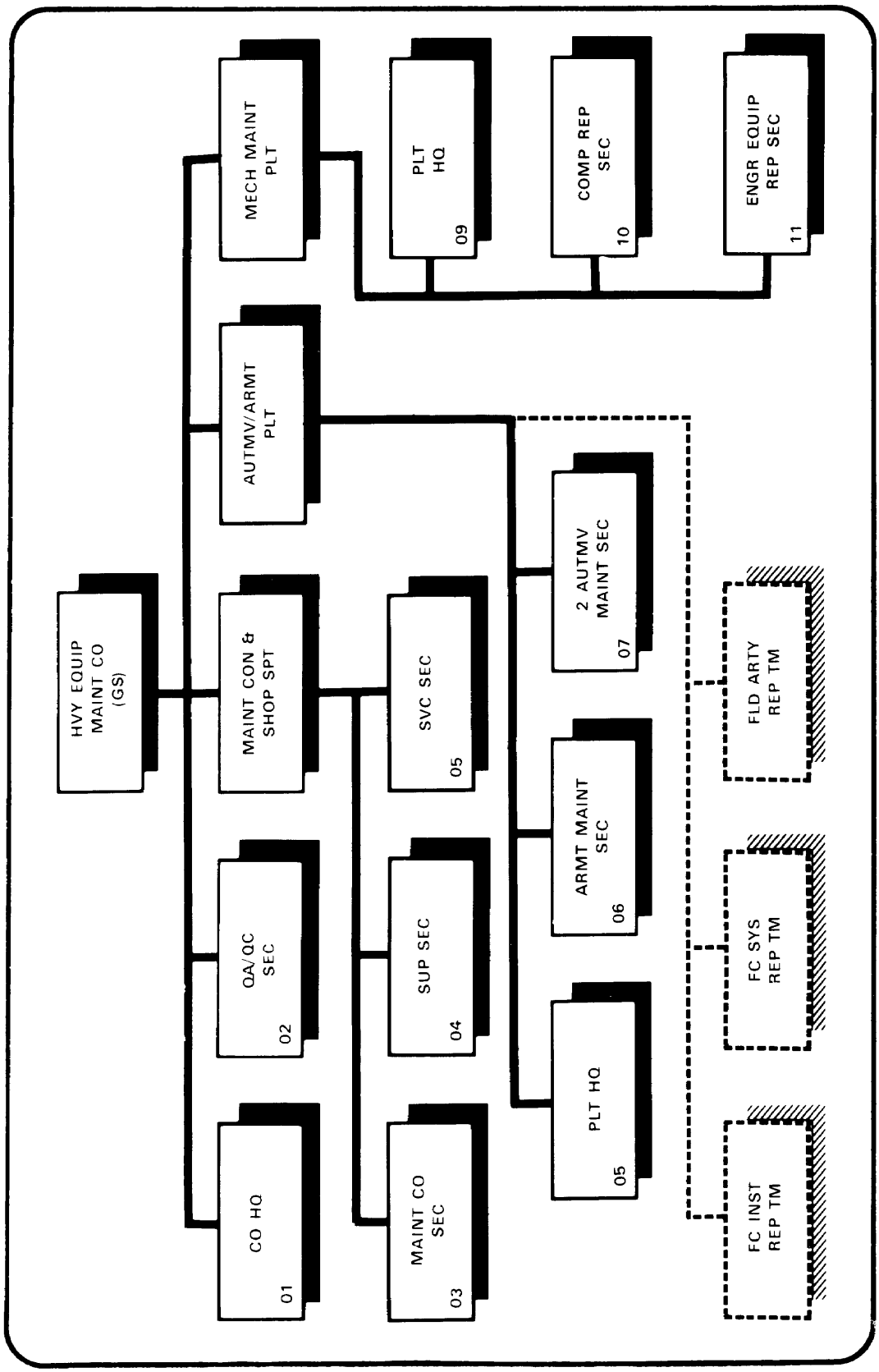


Figure 2-5. Heavy Equipment Maintenance Company organization.

CHAPTER 3

GS MAINTENANCE MANAGEMENT

GENERAL

Maintenance management includes the forecasting, distribution, scheduling, and production control of maintenance work load. The objective of GSM management is efficient use of GS assets to accomplish GS work load requirements. This objective is achieved by supervising, training, motivating, and developing, as well as implementing, managerial techniques to improve efficiency and production.

A ready source of accurate and timely information must be developed on maintenance requirements and status upon which plans and decisions may be based.

GSM management involves the application and control of all available resources in a manner best suited to mission accomplishment. It involves the use of rapid and reliable communication facilities for the transmission of information, instructions, and decisions.

Automation is used to expedite the flow and processing of reports and data required by the maintenance manager. GSM management also involves development and modification of operating procedures, use of timely and complete information to continually assess status, assignment of work loads, and supervision of operations.

GSM management operations requires continuous. coordination between the MMCs of the Theatre Army (TA) and TAACOM; the ASG materiel directorate; the materiel officer (MATO) of the maintenance unit, heavy materiel supply company, repair parts company, GS maintenance battalion, and the GS maintenance company.

MANAGEMENT BY THE MMC

The TA Materiel Management Center (TAMMC) assigns the GS work load through the Theater Army Area Materiel Management Center (TAAMMC) based on the determing of the materiel needs within the theater. Typically, the TAMMC is the only agency having theater-wide visibility of supply assets and requirements. It will apportion the GSM work load among the TAACOMs. It assigns the GSM work load in one of the following ways:

- The GSM work load requirement is given to the TAACLOM MMC. The TRACOM MMC the assigns the work to the appropriate ASG/GSM unit.
- The GSM work load requirement is given directly to the ASG/GSM unit. An information copy of the work loading document if transmitted to the TAACOM MMC. For either method the TAACOM MMC monitors the performance of the ASG/G SM unit.

Host nation support (HNS) is an important logistics multiplier in any theater where the Army has deployed forces. HNS to Army forces can include practicably every aspect of support to sustain military operations. It may be performed by civilian or military personnel. Further, HNS requirements and capabilities vary based on the phase of the war, the presence of U.S. forces in the area prior to the war, and the capabilities of the Host Nation (HN).

HN personnel or units can perform many functions as well as U.S. personnel because of their familiarity with local customs, terrain, transportation networks, facilities, and equipment. The theater commander, in coordination with HQDA, must determine functional levels of HNS that can be accepted without risking overall mission accomplishment.

The HNS is limited only by the availability of HN resources and the ability to reach agreements concerning their use. In a major conflict, GS maintenance will also be performed by HN units. A Cellular Logistics Team (CLT) will coordinate the GS maintenance mission and work load, track items of equipment, monitor priorities, verify conformance to quality standards, and provide technical expertise to HN maintenance units. These CLTs currently support the German Wartime HN Maintenance Battalions. For further discussion of HNS, see FM 100-16, Chapter 6.

MANAGEMENT BY THE ASG MATERIEL DIRECTORATE AND THE GS MAINTENANCE BATTALION MATO

The materiel directorate of the ASG and the MATO of the maintenance battalion have similar functions. The materiel directorate of the ASG is more involved in planning. The battalion MATO will be more involved with the management of the day-to-day operations. The ASG materiel directorate acts more as an interface with the TAMMC and a monitor of the GS maintenance battalion.

The materiel directorate's functions are to evaluate the GS work load directed by the MMCs, forecast repair parts requirements, and notify the MMCs of problems regarding the GS maintenance programs.

Evaluation of the GS maintenance work load begins by determining the number of items in the program. The GS maintenance production quota or program goal (output) is established by the TAMMC. Given the output quota, the repair time per item will be determined based on historical data or by the MAC. Determining the repair time per item is crucial in aligning personnel requirements.

Man-hours required to execute the program must be matched to man hours available. Once personnel requirements are determined and deemed available, the directorate will establish whether or not there are sufficient unserviceable items available (input) and repair parts available to complete the program.

Consumption data from previous programs and technical manuals are used to forecast repair parts requirements. In lieu of these two alternatives, results from teardown inspections or sampling inspections will be used.

MANAGEMENT BY THE GS MAINTENANCE UNIT

The primary management responsibility of the GS maintenance unit is the actual execution of the GS maintenance program. GS maintenance units will employ industrial production methods. The bay shop, job shop, and production-line methods are all used, depending on the type of equipment to be repaired and the facilities available to the unit. The type of production method used by a GS maintenance unit is determined by the type and quantity of materiel to be repaired, direction by higher headquarters, security requirements, and facilities and time available.

The bay shop method is used for the repair of large items such as wheeled and tracked vehicles. The job shop method is used for the repair of small quantities of components and small end items, assemblies, and subassemblies. The production-line method is normally used to repair a large number of similar items.

Effective management at the GS maintenance unit involves more than just ensuring that the proper industrial method is used. It also encompasses and requires:

- **Leadership.** Supervisors must exercise effective leadership. Each supervisor must know what is to be done, resources available, limitations and other factors influencing job performance, and how to motivate personnel to improve performance productivity.

- **Production control.** Production control involves production planning and scheduling, proper routing and rerouting of work, and attaining maximum production by keeping all shop elements working at or near capacity. Work load analysis, a prime responsibility of the shop office involves a continuing review much work load with unrealistic priorities and deadlines.

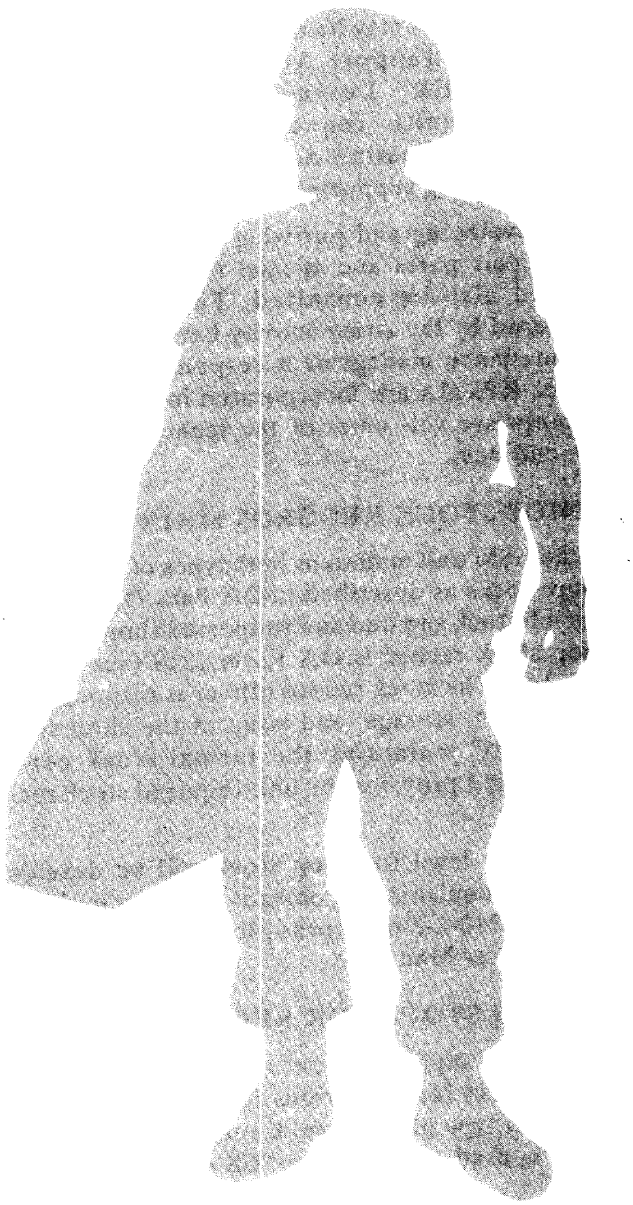
- **Standard Army Maintenance Systems** (SAMS). Manpower, materiel, and facilities, once organized, must be directed and controlled in an efficient manner. The SAMS described in DA Pam 738-750 provides the means by which the resources can be directed and controlled. The procedures outlined in this manual enhance and improve managerial control of maintenance resources during peacetime and wartime in addition to enhancing the quality and reducing the quantity of reports to higher headquarters.

Work simplification and work measurement. These are related to production control and are part of the production control process. Work measurement and simplification techniques must be applied to every GS unit as defined in AR 750-1, Appendix F. Work measurement standards must be developed and applied to measure and compare work of repairers and maintenance elements/companies engaged in similar types of operations. The resource analysis system (RAS) procedures contained in Automated Information Systems Manual (AISM),18-L21AHN-BUR-UM provides an effective tool to analyze work measurement.

- **Quality assurance/control.At** the GS level, this facet of operation is critical to maintenance management, Technical publications applicable to particular commodities and items of equipment are the basic tools for quality control and quality assurance. When detailed inspection of individual items is impractical, selective sampling and statistical quality control techniques must be applied to measure the quality of performance and repaired items and to identify problem areas Continuous use of initial inspections, in process inspections and final inspections will ensure quality assurance in the workplace.

CHAPTER 4

SHOP SUPPLY



INTRODUCTION

Shop supply is defined as the element of a maintenance unit that provides the repair parts, assemblies, components, and maintenance materials needed by the unit shops to accomplish the maintenance mission.

At the GSM level, shop supply is one of the most important, and most critical, elements of the company mission. Normally, GS maintenance units have no supply responsibilities to using units. Generally, they repair items for return to the supply system. Exceptions to this rule are GSM units that have an assigned limited DS mission because of peculiar operational requirements.

Examples are marine and rail GSM units performing DS maintenance and supply roles in addition to their basic GS support missions, and certain missile maintenance units. The entire maintenance mission of a GSM unit hinges on how well it performs its shop supply functions; therefore, this aspect of unit operations requires command emphasis as well as precise management.

Each of the units discussed in this manual has an organic element to perform shop supply functions. In the light equipment and heavy equipment GS maintenance companies, this element is identified as a supply section. Since GS maintenance units normally do not supply repair parts to outside customers, their supply sections exist only to provide repair parts and maintenance supplies to their shops and to support the internal RX requirements.

SHOP SUPPLY FUNCTIONS

Shop supply at the GS level performs the following functions:

- Develops and maintains the unit's shop stock list of repair parts and maintenance supplies.

- Requisitions, stores, and issues the parts needed by the shop to accomplish the mission.
- Provides necessary support for the unit's RX requirements.
- Assists in the development of parts requirements to support planned maintenance operations (when this is not done at the MMC or other higher headquarters); orders, receives, and stores these parts; and issues them to the repair sections when needed.

Though the basic functions are the same, shop supply functions vary a great deal among units. This wide variance is caused by the difference in missions. Some GSM units may specialize in the overhaul of specific items, while others may have a overflow direct support maintenance (DSM) mission. Each of these differences will affect the size of the unit's repair parts stockage and may impact on the unit's bench stock requirements. In addition, the number of individual parts requested will vary significantly, depending on the type of work the unit does: production-line operations, job or bay shop operations.

When the density of supported units does not justify assignment of a DSM unit, the theater or area support command may assign the DS mission on an exception basis to a GS unit. These GS units would maintain a larger stockage of repair parts and supplies because they provide repair parts support to customer units. In this case, Class IX supply at the GS level functions much like the supply support activities at DS level.

ESTABLISHING MAINTENANCE SHOP STOCKS

The GS unit repair parts stockage is maintained IAW AR 710-2 and DA Pam 710-2-2, as well as the Automated System User Manuals.

As in other categories, repair parts authorizations at the GS level are based on usage data. Initial stockage is based on essential needs, as supported by historical consumption (demand data) of similar units maintaining the same equipment (NSN), modified by local mission requirements and/or other information furnished by the commodity commands and the units MMC.

When a unit is setting up its initial stockage list, it should first ask for help from the MMC. The MMC may have records which show what types and quantities of parts are stocked in similar units. This listing can then be adjusted to fit the particular unit. For example, if the sample stockage list is based on the production-line repair of a large quantity of tank engines and the new unit will not have this mission, parts peculiar to this job should be deleted from the listing.

If the MMC is not able to give assistance, the GS unit can still try to locate a similar unit and get a copy of its stock age list. If there is one, the list must again be adjusted by experienced supply and maintenance personnel as soon as sufficient demand information is accumulated to provide for a more realistic stockage objective.

When valid consumption data is not available from the above sources for the preparation of stockage lists, such a list may be requested from the Materiel Readiness Support Activity (MRSA) ATTN: AMXMD-ER, Lexington, KY 40511-5101. However, units requesting such listings must provide information on the type and density of materiel being supported.

In developing and purifying stockage lists, essential repair parts and special tools lists (RPSTLs) should also be consulted. These RPSTLs are prepared by the Army activity having national level maintenance management responsibilities for end items. RPSTLs are incorporated in or published as appropriate volumes of the technical manual for the end item.

SHOP STOCK RECORDS MAINTENANCE

The GSM unit maintains both types of maintenance shop stocks as described in DA Pam 710-2-2. These are job stock and demand supported shop stock. The shop stock record is DA Form 3318 (see DA Pam 710-2-2). The stock record officer is responsible for the receipt, storage, and issue of the shop supply. The MMC maintains the formal stock control records and provides the unit required stock record support.

Stockage level for shop stock will be developed from the requisitioning objective table as outlined in DA Pam 710-2-2 or as prescribed in the Automated System User Manuals.

BENCH STOCK FOR REPAIR ELEMENTS

The shop supply element of the GS unit provides bench stocks for the various repair elements. Bench stock is a type of shop stock authorized by AR 710-7 and is used extensively by GS maintenance units.

Bench stock is low-cost, bulk-type supplies which are used at unpredictable rates. Examples of items include: common hardware, rope, wire, glass, welding rods, gasket materiel, and minor electrical components such as resistors and capacitors. Bench stocks are further explained in AR 710-2-2.

PARTS REQUIREMENTS FOR MAINTENANCE REQUESTS ON INDIVIDUAL ITEMS

GS maintenance units receive many work requests for individual items. Most of these come from DS units for work beyond their capacity or capability. The supply system also submits individual job orders for the repair and issue of excess turn-ins.

These job orders for individual items usually require repair parts. When the equipment enters the shop, it will be inspected and the appropriate forms annotated by the inspectors. Shop supply will order all parts requested.

Parts bins should be set up for separating the parts received for each work request. These bins are marked to show the work control number for which the parts have been ordered. When the repair parts are received, they are stored in these bins until all the items needed for the particular job are on hand. Large items that cannot be stored in bins are normally placed in a central location. They should also be marked in some manner to show the job for which they were requisitioned.

Each time a part is received for a work request, shop supply notes the receipt in the document register and on the maintenance request for a job. The shop supply section immediately notifies the maintenance control section so that it can schedule the equipment into the shop. Shop supply continues to store the parts.

Due-out reconciliation and follow-ups on outstanding supply requests are made as described in DA Pam 710-2-2 or as presented in the Automated System User Manuals.

PARTS REQUIREMENTS FOR PRODUCTION-LINE MAINTENANCE (PROGRAM STOCK)

GSM units may have to obtain and store large quantities of repair parts in preparation for production-line operations. This type of stock is often called “program stock. ”

The MMC will normally assist in forecasting such parts requirements and take action to assure provision of the items before production-line operations begin.

The company (with assistance from the battalion materiel office) may have to forecast requirements. If the MMC is unable to provide such repair parts, requirement forecasts, or historical data, guidance can be obtained in AR 710-2.

SUPPLY OPERATIONS

Supply service in the shop is planned to satisfy the peculiar requirements of each type operation when the shop layout is originally created. Adjustments are made as experience indicates and when the shop plan is altered. Distances which mechanics must move to pick up reparable assemblies, dispose of repaired assemblies, and obtain parts must be reduced to the minimum. The following general rules are applied in the type operation described.

Specifically designated supply personnel deliver reparable items to bins or pallets placed beside the various stations on the line. Other supply personnel pick up repaired items from the adjacent bins or pallets reserved for completed items. Careful tallies are kept of deliveries of assemblies to the line for repair and of deliveries of repaired assemblies to storage or shipping locations. This information is turned in to the supply section for posting of records.

Parts stocks in bins placed beside the line are replenished as required by supply handlers assigned to that duty. The work load of each individual is adjusted so that bins may be checked frequently enough to prevent out-of-stock conditions. Each delivery of parts to a bin is recorded on the tag attached to the bin. At the time each replenishment is made, the stock remaining in the bin is counted

The total of remaining quantity and the quantity placed in the bin are entered on the bin card. If the facility is operated at night, it is preferable to restock bins at this time, with stockage based on the next day’s predicted requirements (plus a l0-percent safety factor).

To keep the line inactive for the shortest possible time between completion of one run and the start of another, sufficient storage space is provided beside the line to permit “stocking up” for the next run while stocks for the current run are being phased out. This is particularly important when the duration of the average job accomplished in the shop is limited to a few days.

REPAIR PARTS SUPPORT FOR UNIT EQUIPMENT

Like any unit possessing organic equipment requiring unit and support maintenance, GSM units must have a source of repair parts required for this repair. Many of the items required for this maintenance are the same as those required for the DSM. Further, the GSM unit obtains replenishment of its mission stocks of repair parts supply units as DSM. Thus, when such commonality exists, requirements for maintenance on unit vehicles are combined with parts requirements for the GSM mission and are obtained from the GS supply source.

The above procedure does not apply in all cases. For example, the marine and rail maintenance units will still have to obtain support for such items as vehicles, armament, and communications equipment from the DS units charged with providing DSM of such items.

Procedures for establishing and maintaining a prescribed load list (PLL) of repair parts to support unit maintenance requirements are described in AR 710-2.

PUBLICATIONS AND REGULATIONS

Shop supply must have the publications required to operate efficiently. Catalogs of national stock numbers (NSNs) are a necessity, as are ARs 710-2,735-5, and DA Pam 710-2-2, contained in Unit Supply Update 11. Shop supply also has in its library those technical publications for the items it supports and operates.

Publications that describe operating procedures, including local SOP, command directives, and regulations are also needed. DA Pam 25-30 lists regulations for general supply operations and maintenance policies and procedures. Technical manuals for determining parts authorizations and maintenance levels are listed in DA Pam 25-30.

CONTROL OF SPECIAL TOOLS

Depending on the desires of the commander, the shop supply element may be required to operate a tool room for the activity it supports. If the tool room is operated within the maintenance shop proper, the same general procedures apply.

Tool rooms are used to ensure the availability and security of tools which are not issued to mechanics on an individual basis. An inspection system that will ensure tools are being maintained should be developed for each tool room operation. Special tools such as drill motors, sanders, valve grinders, and special wrenches are stored on racks or boards in the tool room.

- Tool rooms must be centrally located since they support many mechanics working in widely scattered areas. Therefore, a tool room that supports substantial and widespread operations frequently requires an accountability system for each tool checked out. See DA Pam,710-2-l for further reference on this subject.

- Tool chits are perhaps the most widely used means of controlling tools issued to mechanics on a temporary basis. A tool chit is a small metal or hard paper disk with a hole punched so that it can be conveniently hung on a hook or nail. Each chit is numbered and assigned to the personnel who will use the tool. The mechanic must turn in a chit for each tool he receives from the toolroom. The toolroorn keeper then places the chit wherever the tool was stored. The toolroom keeper then knows exactly who has each tool.

- Special tools, test, and other support equipment designed and developed to perform a specific maintenance operation on specific assemblies or subassemblies will be found on the RPSTL.

TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT

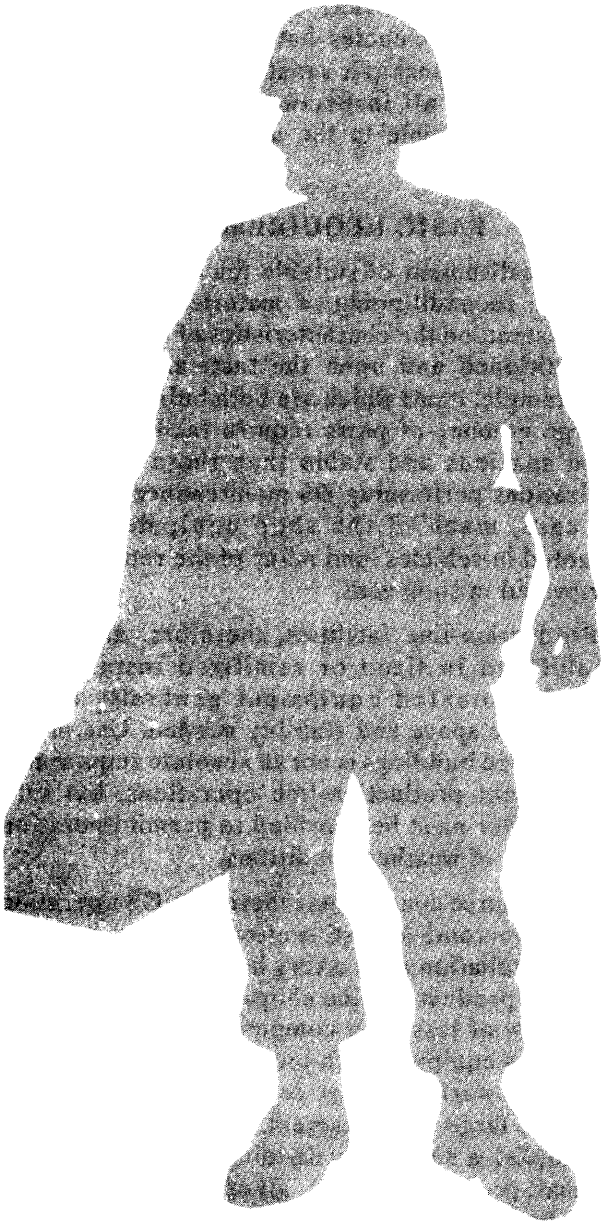
TMDE calibration and repair support program will be established in each unit. The Program objective is to ensure maximum availability of accurate and serviceable TMDE for use in test, measurement, and diagnostic operations. Each unit will have a TMDE coordinator who will be the central point of contact for TMDE matters.

Each unit is required to maintain an instrument master record file. DA Label 80 (U.S Army Calibrated Instrument), DA Label 163 (U.S. Army Limited or Special Calibration), and DA Form 2417 (U.S. Army Unserviceable or Limited Use Tag) will be used by each unit.

All instruments that require calibration and are available for use must show evidence that they have been calibrated and were within the specified tolerances at the time of calibration. Instruments will be calibrated at the specified intervals IAW TB 43-180.

CHAPTER 5

PRODUCTION-LINE OPERATIONS



GENERAL

Complex repair jobs can usually be performed more efficiently when they are broken down into a number of simple tasks. It has been found that the production- line method is normally the best method to use when repairing large numbers of similar items. Each task is assigned to a workman or team especially equipped and trained to perform the operation. This division of labor and work is practical only when it is possible to work continuously on the same type item for considerable periods of time.

Workmen develop speed and dexterity through repetition of the same operations, attaining high work output per man. In addition, personnel training problems are simplified, since workmen with little mechanical expertise can learn to perform simple tasks in a minimum of time. Skilled technicians are used on the more intricate tasks and for supervision as well as inspection.

It is usually more convenient to move the item to be repaired pasta series of workstations. This technique is usually referred to as the “production-line” method. However, many of the advantages of the production-line method can be realized without the use of a moving line. If the materiel is too heavy or bulky, it can be placed in a fixed location and the workmen perform their assigned tasks in the most logical order.

Production-line techniques are ideally suited to depot maintenance activities; however, they can be profitably employed in many GSM operations engaged in the repair or reconditioning of like items of materiel. For definitions of repair and reconditioning, see AR 310-25 and AR 750-1.

Efficiency in production line methods of operation requires careful planning of shop operations, personnel assignments, and supply actions.

LIMITATIONS

Fixed facilities are usually required for a maintenance operation organized on a production-line basis. If the threat of enemy action requires units and activities in the theater to maintain mobility for defensive purposes, production-line operations may not be practicable.

In addition, the sections of a production-line installation cannot be dispersed to any appreciable degree without serious loss of productivity or security. Frequent movement of the installation will involve so much time for dismantling and reconstruction that savings effected through operating efficiencies will be canceled.

REPAIR STANDARDS

The ability to perform maintenance and to comply with standards is affected by resources. The standard established for each situation must be based on such factors as the requirement for materiel, availability of personnel skills, supplies, and the ability of the enemy to interfere with maintenance operations.

Materiel may be disassembled for detection and repair of all deficiencies. All parts, assemblies, and components which do not meet minimum serviceability standards are replaced, providing the operations involved can be performed without cutting or grinding the basic parts based on the appropriate technical manual MACs.

Repair operations may include resizing of basic parts, such as the reboring of engine cylinders to specified oversize dimensions. TOE tool and equipment sets do not include all of the equipment for this type of operation, and the special tools must be obtained through the supply system or by local purchase.

Materiel may be rebuilt (when rebuild is authorized, IAW AR 750-1) to standards approximately equal to new conditions. It is unlikely that the extensive facilities required for such operations could be installed or defended in a theater where modern weapons such as missiles and tactical nuclear devices are extensively employed.

Maintenance standards for support maintenance are included in equipment technical manuals. These may be updated or supplemented as appropriate by technical bulletins, modification work orders, and other equipment publications.

QUALITY CONTROL

Adherence to repair standards prescribed for each production-line shop depends largely on adequate inspection before, during, and after processing. Members of the inspection section examine materiel prior to repair to determine its condition and the work that must be performed on it. Qualified inspectors are stationed throughout the shops to determine the serviceability of questionable parts and assemblies and to ensure that repairs in process neither exceed nor fall below prescribed standards.

Repair in excess of specified limits tends to cut production rates below necessary levels, Substandard repairs reduce the life expectancy of reconditioned materiel. Final inspections determine whether all deficiencies have been corrected and whether workmanship is satisfactory. A chief inspector supervises all inspection activities and he is directly responsible to the maintenance unit commander.

BASIC REQUIREMENTS

The establishment of suitable facilities for production-line reconditioning of materiel depends, to a great extent, on the characteristics of the items to be reconditioned and upon the tactical environment. For example, items which are both bulky and contain a large number of parts require facilities that are more spacious and stable than those used by organizations performing DS maintenance, In the latter case, much of the shop equipment can be mounted in vehicles, and many of the repairs can be performed in shop vans.

Production-line facilities, therefore, are usually established in fixed or semi fixed installations. Vehicle-mounted equipment generally cannot provide the space and stability needed. Use of permanent type buildings is not an absolute requirement for efficient production-line operations, but sufficient shelter must be provided to permit operations regardless of weather conditions.

The resource constraints inherent in GS operations can be overcome almost as effectively in a relatively small installation as in a very large one. Many highly efficient production-line shops have been operated by a crew of less than company size in improvised structures equipped with locally fabricated fixtures. In modern warfare, where conditions prohibit operation of a large establishment, it may be possible to accomplish a mission by dividing it among a number of small production shops, all of which are similarly equipped.

Enough protected storage and work space should be provided to permit layout of all operations in efficient patterns and in proper relationship to each other. The various sections of a shop need not be housed under the same roof so long as convenient distances are maintained and traffic flow between sections is unimpeded.

Shelters must be adequate to protect personnel and materiel under prevailing climatic conditions. They are no more elaborate than necessary to serve this purpose, since they are subject to loss through destruction or abandonment if a position becomes untenable.

Fixtures such as workbenches, engine cradles, and conveyor lines must be designed to prevent unnecessary handling and to facilitate movement of items from one work section to another. Rough fixtures, simply constructed, are preferable to elaborate fixtures, as long as they serve the purpose. All design and construction refinements which do not substantially increase efficiency should be avoided. Whenever possible, buildings and fixtures should be designed so that they may be dismantled in transportable sections and erected elsewhere if a location must be abandoned.

SHELTERS

Production-line maintenance operations are sheltered to the extent necessary for materiel protection and crew efficiency. Certain items, such as disassembled major components, require protection from dirt and weather. If existing shelters are not available, adequate facilities are constructed.

In a favorable situation, standard engineer buildings may be erected. However, under conditions of modern warfare, many maintenance activities may have to operate in temporary shelters. Building activities are not undertaken until it has been determined that no suitable tentage is available. If adequate tentage cannot be obtained, temporary shelters may be built from materials normally available in the theater.

Unless wind or snow loads are excessive, frames of light timber or poles, roofed and sided with tarpaulins, will suffice. Roofs should be reinforced with canvas, plywood, or other sturdy screening material. Side tarpaulins should be applied so they can be rolled up in good weather for light and ventilation. Planking, packed gravel, or other suitable material will serve as flooring.

Electricity for light and power is provided by power generation equipment if no commercial source is available. In cold weather, the heating of facilities may present a serious problem. Flimsy structures dissipate heat rapidly. Stoves, possibly built from drums, may be the only heat source available. Such heaters are hazardous and are used only if there is no alternative. Standard, high-output devices should be used, if available. Whatever the method used, temperatures will probably be no more than tolerable, unless a steam plant can be obtained or constructed, or suitable standard heating equipment can be obtained through the supply system. The latter is the most satisfactory and least dangerous of all methods in such applications.

FIXTURES

Shop-made fixtures required for the various repair operations must be carefully designed and built. They will probably be made of wood, since this is usually the most readily available material. These fixtures must be sturdy to stand up under the hard and continuous use to which they are subjected. They must also be portable so they can be transported if the installation must be dismantled and reerected elsewhere. Too much valuable time and material are invested to permit abandoning them unnecessarily. Nails, bolts, or screws are used as fasteners whenever possible. Most of the fixtures mentioned below require 2-inch lumber:

- Workbenches must be solid, well braced, and no larger than necessary. Few benches need be wider than two feet; 18 inches is sufficient for most.

- Pallets are designed for each specific job. Size is held to a minimum. Since they must hold the heaviest items, such as power train components, 2-inch lumber is required. Bolted construction is desirable.

- Parts bins are designed so that partitions can readily be inserted and removed. One-inch lumber is sufficient for storage of most parts. Since these items are bulky, unnecessary strength and weight are undesirable.

- Trestles for conveyor lines are designed in sections so that they can be dismantled for movement. Individual sections are heavily braced and should be as small as practicable to facilitate movement.

CLEANING

Manual cleaning of bulky, heavily soiled components is a very time-consuming operation which can create a serious bottleneck in production-line operations unless unskilled local labor, employable only for rough work, is available in quantity. Cleaning equipment capable of quickly removing grease, heavy soil, and corrosion is most desirable. A steam cleaner is suggested as the best kind of equipment for this type of operation.

PACKAGING AND PRESERVATION

As most materiel repaired in a GS maintenance installation is released to supply stocks, it must be properly preserved and packaged after repair. Items are preserved to the extent necessary to protect them from damage and deterioration in the circumstances under which they will be handled and stored. Certain components have openings which must be sealed tightly to protect machined surfaces from dirt and moisture.

EXPOSED SHAFTS AND OTHER PROTRUDING ELEMENTS MUST BE PROTECTED AGAINST BENDING OR BURRING.

Exposed shafts and other protruding elements must be protected against bending or burring. Many items require crating or packaging. Reusable boxes and shipping containers should be used if available. If available quantities are not sufficient, additional crates must be obtained from outside facilities or manufactured in the maintenance installation. If large-scale crate production is necessary, power equipment must be obtained.

GENERAL SHOP LAYOUT

A production-line shop can be operated in improvised shelters using simple, locally fabricated fixtures. The principles of the production-line method, described in the following paragraphs, may be applied in the reconditioning of most materiel items which are complex enough and used in sufficient quantities to warrant production-line processing. The sample layouts are designed to provide general guidance in the application of those principles and may be varied to suit specific situations.

Information available in technical manuals pertinent to the various items of materiel is used to supplement the general guidelines. The production lines described in the following paragraphs, in common with most operations of this type, can be more effectively manned and equipped by using TDAs than by employing troop units using TOE equipment.

ENGINE RECONDITIONING

Figure 5-1 illustrates an engine disassembly line suitable for the complete dismantling of the item. However, before dismantling takes place, it is recommended that the engine be tested on a dynamometer or similar device and tested after assembly to ensure acceptable serviceability.

On arrival at the line, each unserviceable engine is drained of oil and placed on a holding fixture or pallet. When engines are received at the line with transmissions attached, the transmissions are removed at the first station and sent to transmission disassembly. All parts and accessories are placed in cleaning baskets immediately on their removal to minimize handling.

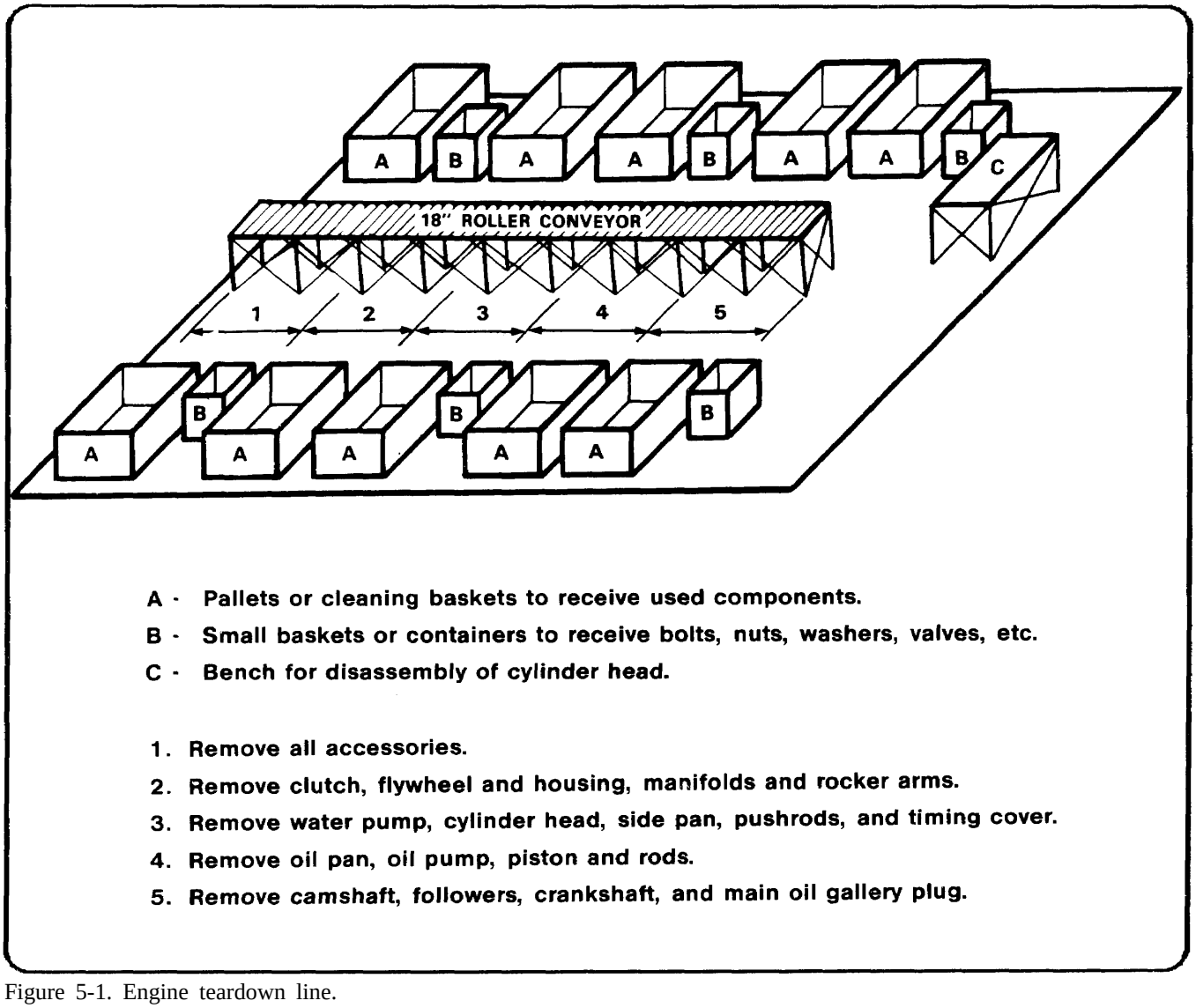


Figure 5-1. Engine teardown line.

PARTS ARE CLEANED AND DELIVERED TO APPROPRIATE RECONDITIONING FACILITIES IN BASKETS IN WHICH THEY WERE ORIGINALLY PLACED

Parts are cleaned and delivered to the appropriate reconditioning facilities in the baskets in which originally placed. Unless cylinders are to be prebored and bearing surfaces reconditioned, all internal parts removed from the engine block are tagged, since they must be reassembled into the same engine. Cleaning may be accomplished at the central cleaning facility or may be done by hand in the solvent vats.

If the shop is operated on a repair-as-required basis, complete disassembly may be reserved for those engines having a large number of defects. Others may bypass certain stations in the line. This determination is made by the inspector. If defects are few and obvious, an engine may be removed from the line for repair in a job shop. Such a shop is shown in Figure 5-2.

Parts and accessories are delivered to the reconditioning line (Figure 5-2). Engine blocks are placed on pallets on conveyor lines as shown at the bottom of the diagram. Two lines are provided in order that blocks having many defects may be sidetracked while those requiring little repair proceed through the other line.

Due to the difficulty of turning engine blocks on the conveyors without jarring the entire line, blocks are removed manually to workbenches beside the line for inspection and repair. They are then returned to the conveyors.

Other parts and accessories are delivered to racks adjacent to the workbenches shown in the center of the diagram. These racks are divided into two main sections. One section is reserved for items awaiting inspection and repair; the other contains sufficient bins to hold required repair parts and space to receive items after repair. Repair parts stocks include such items as extra pistons and rods to replace those found to be irreparable.

Items which are combined into sets for installation in the engine are released from the repair bench in complete sets. Workbenches are equipped with vises and other suitable holding fixtures. Inspection and repair procedures for all items handled in this shop are covered in appropriate technical manuals.

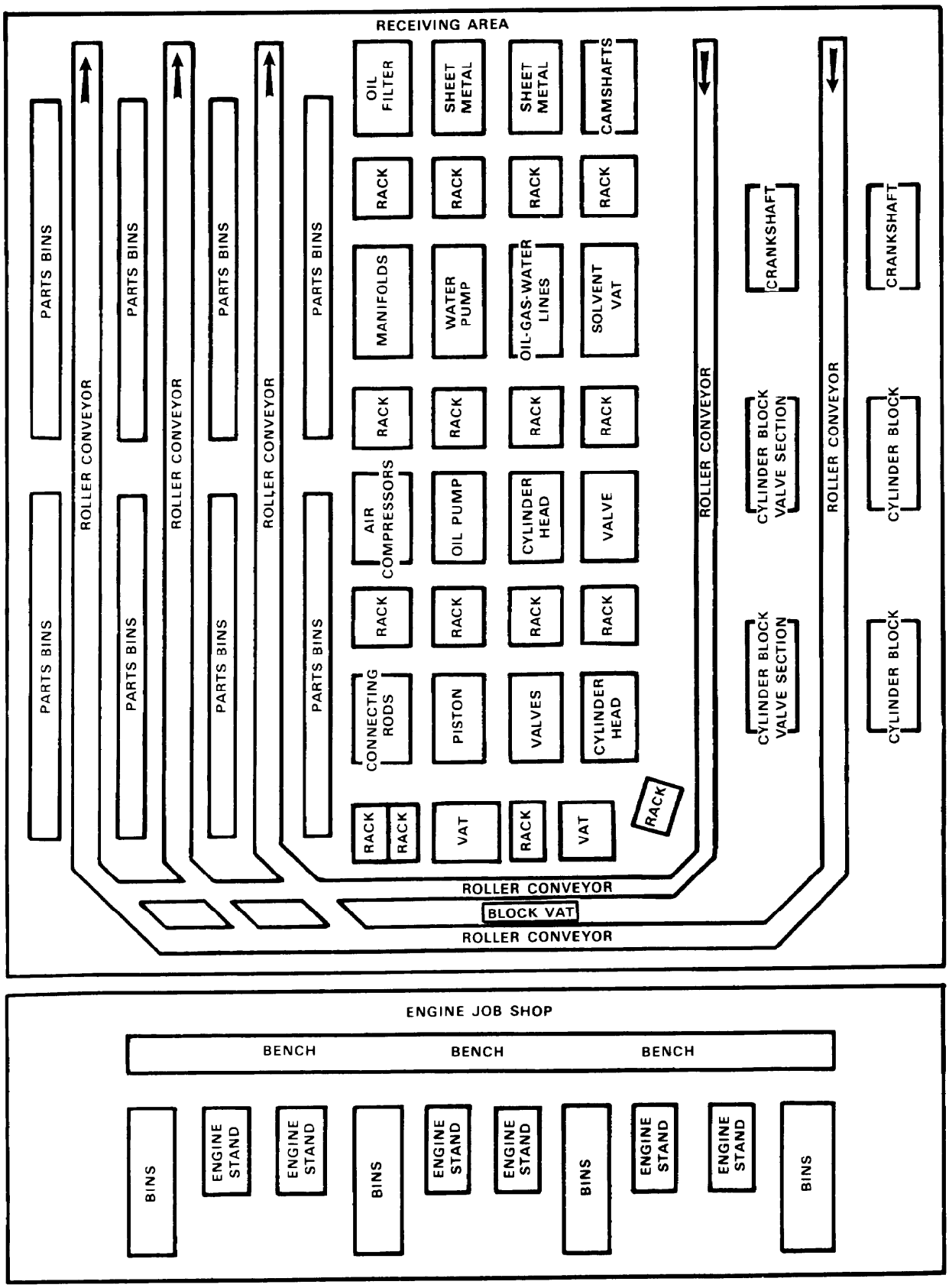


Figure 5-2. Engine job shop and production line.

Engine assembly lines appear at the top of Figure 5-2 and a blowup of a single line is shown in Figure 5-3. At least two lines should be provided so that blocks arriving at the line before their internal parts are ready may be sidetracked, while blocks for which mated parts are available proceed on the other line. Racks should be placed beside the lines to receive internal parts which will be tagged for specific blocks. Bins placed along other portions of the lines receive the interchangeable components and assemblies from the repair lines. These bins also contain the additional quantities required to replace those found to be irreparable and the small parts required for engine assembly.

Shop supply personnel are responsible for stocking all parts bins in the engine shop with predetermined quantities of repair parts and assemblies. They should transfer repaired items from the repair stations to assembly lines or to stock, whichever is applicable. Finished engines are transferred to the supply system, or to an end item assembly line if the Class VII end item is reconditioned on the installation. The supply section must keep accurate records of parts expenditures and losses of components through washouts. This data is vital to compute future supply requirements.

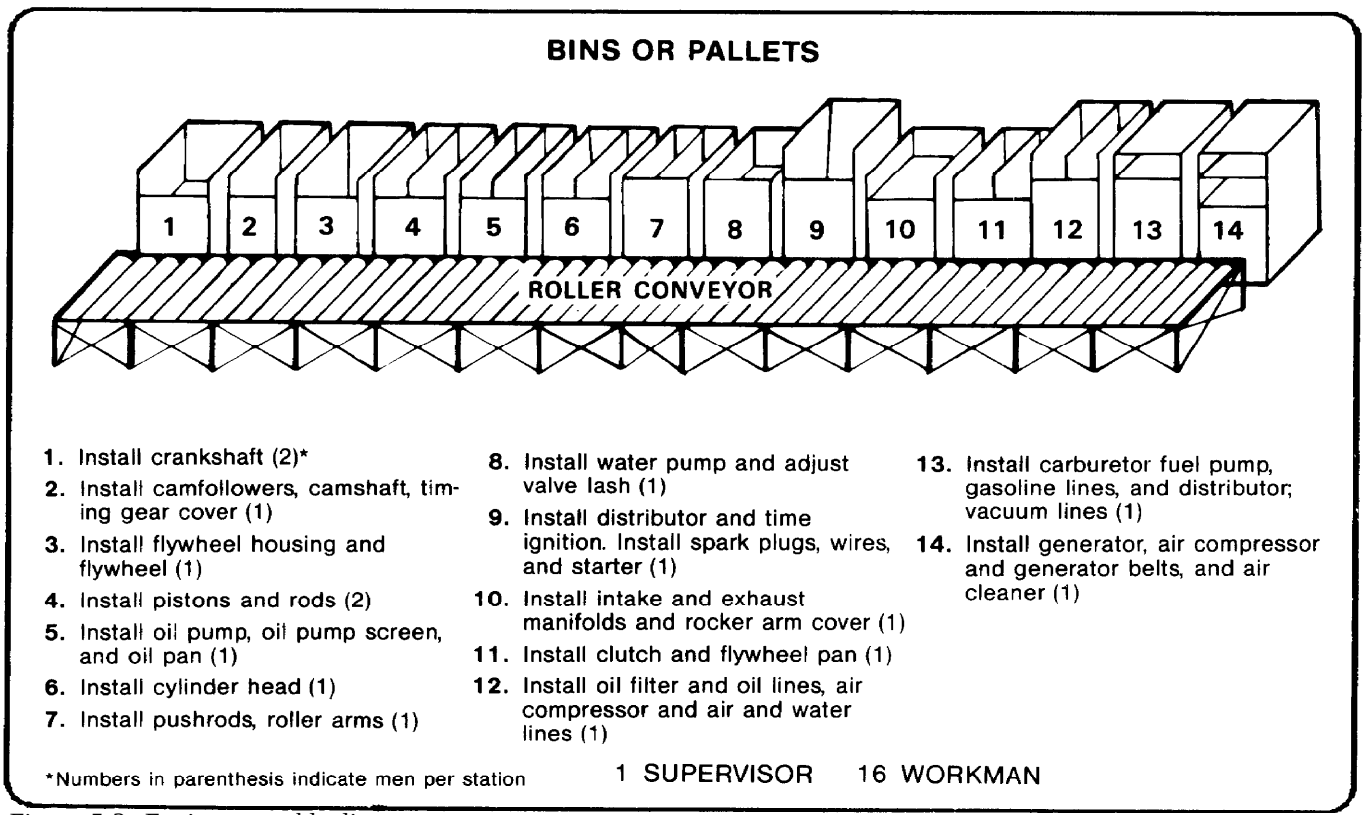


Figure 5-3. Engine assembly line

END ITEM RECONDITIONING

Addition of a shop facility of the type shown in Figure 5-4 is all that is required to give the above described installation an end item reconditioning capacity. Sheds may be built over the storage pallets on either side of the central shed if desired.

No component disassembly is performed in this facility. Unserviceable components are replaced with units reconditioned on the installation's assembly lines. Unserviceable components replaced are turned in to shop supply for reconditioning.

LINE STOPPERS

The orderly production of completed items from the end of a production line depends on the uninterrupted, timely flow of parts and supplies to all stations on the line. An empty bin (line stopper) has the same effect as a vacant station the line halts. When work on an item in a repair-as-received shop must stop for lack of parts, the crew on that job is assigned to another job for which parts are available. Thus, overall productivity of the shop is not seriously affected.

A line stopper due to a supply failure inactivates a sizeable portion of the shop's production capacity until supplies are obtained or the line is set up for a new job. Therefore, every possible precaution is taken to avoid supply deficiencies.

Certain refinements are added to the basic supply procedures prescribed in regulations and in Chapter 4 to satisfy the special requirements of a production-line activity.

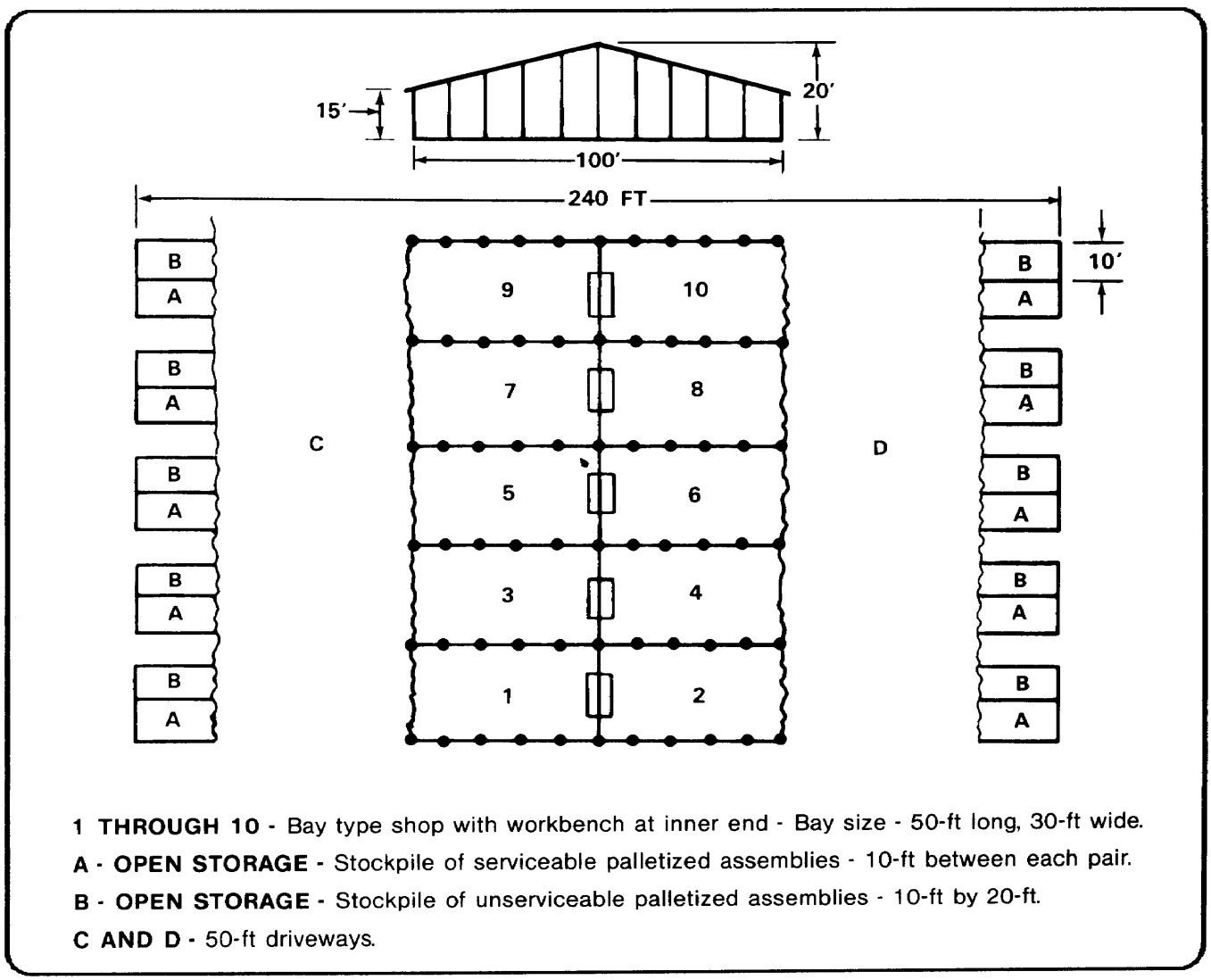


Figure 5-4. End item shop.

Production runs must be planned far enough in advance to allow for computing, requisitioning, and receiving the necessary supplies. A line is not ordinarily set up for a run until all the supplies needed to complete it have been received, checked, and stored by shop supply and are ready for movement to the line. Methods used to compute supply requirements depend, primarily, on the repair standards under which the shop operates.

Two general classes and the supply computation techniques appropriate to each are discussed in the paragraphs below. Regardless of the methods used, the margin allowable for error is small. Minor shortages will result in an incomplete run. A major oversight, such as failure to procure a single part which is required for a high percentage of the items in the run, will halt the entire job.

In a shop where items being repaired are completely dismantled for replacement of all parts subject to wear or deterioration, supply determination presents no problem. Requirements are computed by multiplying the quantity of each part requiring replacement in each assembly to be repaired by the total number of assemblies in the run. Error in computation is the chief hazard here.

When the need for parts replacement is determined by inspection on the line, the supply problem becomes more complex. If a fairly large number of like items are to be repaired, parts requirements may be estimated by inspecting a percentage of the total quantity. When this method is used, care must be exercised to assure that the sampling is representative of the whole. Any valid random sampling technique may be employed to select the items to be inspected. The probability of error decreases as the total number of items in the run and the percentage inspected increases. If the same type of item has been previously repaired in the shop, experience gained in the earlier runs can be used to determine requirements.

In a shop that processes a considerable variety of items in relatively short runs, it may be impractical to order parts for each job. This situation is most likely to occur when a number of small shops operate under a central control agency, and job scheduling is determined by the urgency of need for specific types of items rather than reparable quantities accumulated. Under these circumstances, heavy reliance is placed on the unit's maintenance shop stocks. If recurrence of runs on various types is not consistent enough, the additional expedients described in the following paragraphs, should be considered.

Certain auxiliary records are desirable in a production-line shop. Supply expenditure experience gained in each production run should be preserved for future use. A card of the type illustrated in Figure 5-5 offers a convenient means of recording such data. It may also be desirable to devise an extra insert to the standard stock record card to indicate the items in which the part is used and the average expenditure per quantity repaired (12 per 100, etc.). Many such expedients are possible. Their effectiveness depends on the ingenuity of the supervisor.

ASSEMBLY

PART	RUN NO.. (..ASSYS) QTY	AVERAGE PER..	RUN NO.. (..ASSYS) QTY	AVERAGE PER..	RUN NO.. (..ASSYS) QTY	AVERAGE PER..

NOTE: Average should be computed on completion of each run.

Figure 5-5. Supply expenditure data sheet.

CHAPTER 6

BAY AND JOB SHOP OPERATIONS

GENERAL

There are two other types of production methods that can be used by a GS Maintenance Company in addition to the production-line method described in Chapter 5. As described in Chapter 5, production-line methods are primarily used for processing a large volume of like components. The job shop operation method is primarily used for small amounts of reparable components, whenever the quantities of such items do not justify the establishment of a production line.

The bay shop is used for the repair of large end items such as self-propelled guns and tanks, but the low quantities do not justify the setting up of a production line. All three methods of production can be employed by the same GS maintenance unit at the same time (e.g., tanks, trucks, and various self-propelled guns being repaired in a bay shop, while tank engines are being produced in a production line method by another portion of the company and truck fuel injectors are being repaired using a job shop method by a component repair section of the same company).

The type of production method to be used by a general support maintenance company, regardless of commodities it supports, is determined by the type and quantity of materiel to be repaired, direction from higher headquarters, security requirements such as dispersion, cover, and concealment as well as the enemy's deep strike capabilities. Equally important factors affecting production are personnel, facilities, and time available.

Requirements as stated in Chapter 5, pages 5-2 through 5-6 apply to bay and shop operations.

Requirements as stated in Chapter 5, page 5-2, Repair Standards, apply to bay and job shop operations. The requirements, as stated in Chapter 5, page 5-2, Quality Control, apply to bay and job shop operations as well.

BAY SHOP

The bay shop method is used when a variety of jobs is performed in the same shop or bay. It is also used when the item being repaired is difficult to move. The equipment remains in one shop location until the work has been completed.

In a modified bay operation, personnel or equipment performing the same or similar jobs are grouped together in sections. Then the equipment to be repaired moves from one section to another at irregular intervals until the work is completed. Portions of the end items, such as radios, fire control equipment, fuel injectors, etc., can be sent to other shops for repair using the job shop or production-line method.

In most cases, bays are nothing more than physically separated sections of the maintenance area, where work is performed in the open or under a shelter of some type (fixed, semifixed, or temporary). If adequate space is available, the maintenance facility may be divided into bays (or stalls).

JOB SHOP

Job shops are used for the repair of items small enough to be conveniently moved by hand. These reparable items often require a high degree of technical skill, or where maintenance must be performed in a clean, environmentally controlled area. Often the only place such an environment can be found in a GS maintenance unit is inside a van or shop truck.

Work performed at stands or benches under maintenance shelters or within shop vehicles is considered job shop repair. This method is used to repair small arms, fire control instruments, fuel and electrical system components, PCBs communications equipment, or like items that must be repaired under controlled conditions and similar items that can be moved without difficulty.

APPENDIX A

REAR AREA THREAT INFORMATION

GENERAL

Maintenance assets are inherently susceptible to attack from the forward line of troops (FLOT) through CONUS due to their composition and diverse missions. The small size, limited combat power, and geographic dispersion of maintenance assets combine to present a highly vulnerable target. These factors, coupled with the future centralization of selected maintenance functions, make maintenance activities vulnerable and lucrative.

The following are the most probable threats by type and area which will impact on the general support company's mission. For more information on rear area operations, see FM 90-14.

Agents, terrorists, and Warsaw Pact (WP) sympathizers, although not a significant combat threat, can disrupt operations and inflict severe damage on Ordnance activities. The threat will use information collected by these elements in their overall effort to identify and target key activities. Additionally, these groups will conduct random acts of sabotage against soft targets. Units in the division rear area and beyond are the most likely to encounter these threats due to the lower intensity of combat and the higher density of soft targets.

Special purpose forces (SPFs) pose a threat similar to that of agents, terrorists, and WP sympathizers. However, SPF teams are highly trained, well-equipped experts organized to accomplish specific missions. As with Level I threats, probability of contact with SPF teams increases the further away a unit is from the FLOT.

Air mobile and airborne forces, because of their flexibility, overwhelming combat power, and operational depth of employment pose a serious threat to ordnance operations. Because of their employment range limitations, the threat will probably employ air mobile forces from the FLOT to the corps/TA boundary, with Airborne forces reserved for deeper, high-value targets like theater port and maintenance complexes.

Radio electronic combat (REC) poses the single greatest threat to the LOG C2 system. The disruption or destruction of the logistics control system would effectively halt maintenance and logistic support until the system was either repaired or replaced.

Soviet air operations will impact on every ordnance activity throughout the entire width and depth of the mission area. Rotary wing assets pose the greatest threat to units operating within the division area. Threat helicopters will affect maintenance operations through normal combat and by engagement as targets of opportunity within their area of operation. Fixed-wing assets present a greater threat to deep (corps and above) ordnance operations because of their numerous combat capabilities,

Artillery and missiles will also impact on operations throughout the mission area. Units deployed forward in the brigade and division areas are highly susceptible to attack by tube artillery while units in corps and theater areas would be more susceptible to missiles.

NBC operations by the threat will significantly degrade mission accomplishment. Every echelon should expect attack. Not only will maintenance units have to defend against attack, they might have to operate in a contaminated environment. The use of nuclear weapons, because of electromagnetic pulse (EMP), would compound this problem.

Tank battle attacks into the rear area would devastate maintenance operations. Due to the small size and limited combat power of most maintenance units, they are incapable of defending against an attack by a major armored force (tank company or larger). It is doubtful most ordnance activities would be the primary objective of an operational maneuver group (OMG). The primary threat from OMGs is to disrupt or destroy key maintenance and logistic facilities deep in the rear area and from incidental combat with raiding parties. If an activity is between an OMG and its objective, it will be engaged.

Support unit. When a general support maintenance unit is in a tactical environment, care should be taken to set up in a small geographically definable area that is well-drained, possessing good hard stands and an all weather road network running through the area. Permanent or semipermanent buildings can be located in the area to be used for shop space. Whenever possible, the position should be situated and configured to take advantage of natural and man-made terrain features for concealment and base defense.

APPENDIX B

MODULAR AUGMENTATION TEAMS

ORDNANCE MAINTENANCE COMPANY, LIGHT EQUIPMENT GS, TOE 43237J5

Modular teams increase the capabilities of the unit to the extent provided by the augmentation personnel and equipment. Basis of allocation for each augmentation team listed below is stated in applicable subparagraphs. Optimum utilization is based upon one (GS) repair team per every five ordnance (maintenance) companies, light equipment.

No more than two teams should be assigned to one company in order to maintain an effective level of unit administration and equipment maintenance.

TOE 432375 J502, AUTOMATIC DATA PROCESSING EQUIPMENT TEAM

MISSION. Provides (GS) maintenance for ADP equipment, to include field artillery computers (Less COMSEC) in support of the theater army supply system.

CAPABILITIES. Provides the following annual man-hours of productive maintenance when operating as a category III team:

TACFIRE repair l8,600

ADP repair 21,700

MOBILITY.

[1] This team is capable of transporting 12,000 pounds (800 cubic feet)of TOE equipment with organic vehicles.

[2] This team has 8,100 pounds (400 cubic feet) of TOE equipment requiring transportation

TOE 43237 J502, AUTOMATIC TEST EQUIPMENT TEAM

MISSION. Provides (GS) maintenance for communications electronics LRUs, subassemblies, modules, and PCBs in support of the theater Army supply system.

CAPABILITIES. Provides the following annual man-hours of productive maintenance when operating as a category III team.

Automatic test equipment 37,2OO

MOBILITY.

[1] This team is capable of transporting 2,500 pounds (650 cubic feet) of TOE equipment with organic vehicles.

[2] This team has 3,600 pounds (200 cubic feet) of TOE equipment requiring transportation.

TOE 43237 J503, RADAR/METEOROLOGICAL REPAIR TEAM

MISSION. Provides (GS) maintenance for radar and meteorological equipment in support of the theater Army supply system.

CAPABILITIES. Provides the following annual man-hours of productive maintenance when operating as a category III team.

Radar equipment repair 9,300

Meteorological equipment repair 6,2OO

MOBILITY.

[1] This team incapable of transporting 12,500 pounds (1,500 cubic feet) of TOE equipment with organic vehicles.

[2] This team has 15,300 pounds (1,700 cubic feet) of TOE equipment requiring transportation.

TOE 43237J504,
ELECTRONIC WARFARE/INTERCEPT
EQUIPMENT REPAIR TEAM

MISSION. Provides (GS) maintenance for electronic warfare/intercept equipment in support of the theater Army supply system.

CAPABILITIES. Provides the following annual man-hours of productive maintenance when operating as a category III team.

EW/SIGINT repair 18,600

MOBILITY.

[1] This team is capable of transporting 29,000 pounds (3,000 cubic feet) of TOE equipment with organic vehicles,

[2] This team has 13,100 pounds(1,400 cubic feet) of TOE equipment requiring transportation.

TOE 43237J505,
COMSEC EQUIPMENT
REPAIR TEAM

MISSION. Provides (GS) maintenance for communications security equipment in support of the theater Army supply system.

CAPABILITIES. Provides the following annual man-hours of productive maintenance when operating as a category III team.

COMSEC repair. 49,600

MOBILITY.

[1] This team is capable of transporting 48,500 pounds (3,900 cubic feet) of TOE equipment with organic vehicles.

[2] This team has 13,700 pounds (1,600 cubic feet) of TOE equipment requiring transportation.

TOE 43237J507,
AUDIOVISUAL MAINTENANCE TEAM
EQUIPMENT REPAIR TEAM.

MISSION. Provides (GS) maintenance for audio visual equipment in support of the theater Army supply system.

CAPABILITIES. Provides the following annual man-hours of productive maintenance when operating as a category III team.

Audiovisual equipment repair 77.500

MOBILITY.

[1] This team is capable of transporting 62,500 pounds (4,650 cubic feet) of TOE equipment with organic vehicles.

[2] This team has 7,900 pounds (450 cubic feet) of TOE equipment requiring transportation.

TOE 43237J506,
TURBINE ENGINE-DRIVEN
POWER GENERATION

MISSION. Provides (GS) maintenance for turbine engine driven power generator equipment in support of the theater Army supply system.

CAPABILITIES. Provides the following annual man-hours of productive maintenance when operating as a category III team.

Turbine engine generator repair 15,500

MOBILITY.

[1] This team is capable of transporting 9,500 pounds (800 cubic feet) of TOE equipment with organic vehicles.

[2] This team has 2,100 pounds (450 cubic feet) of TOE equipment requiring transportation

ORDNANCE MAINTENANCE COMPANY,
HEAVY EQUIPMENT GS, TOE 43238J5.

Modular teams increase the capabilities of the unit to the extent provided by the personnel and equipment. Basis of allocation for each modular team listed below is stated in applicable subparagraphs. Optimal utilization is based upon one (GS) repair team per every five ordnance (maintenance) companies, heavy equipment. No more than three teams should be assigned to one company in order to maintain effective level or unit administration and equipment maintenance.

TOE 43238 J501,
FIRE CONTROL INSTRUMUENT
REPAIR TEAM

MISSION. Provides (GS) maintenance for fire control instruments in support of the theater Army supply system.

CAPABILITIES. Provides the following annual man-hours of productive maintenance when operating as a category III team.

Fire control instrument repair 15,500

MOBILITY.

[1] This team is capable of transporting 10,500 pounds (1,050 cubic feet) of TOE equipment with organic vehicles.

[2] This team has 18,850 pounds (2,650 cubic feet) of TOE equipment requiring transportation.

TOE 43238J502,
ARTILLERY REPAIR TEAM.

MISSION. Provides (GS) maintenance for artillery equipment in support of the theater Army supply system.

CAPABILITIES. Provides the following annual man-hours of productive maintenance when operating as a category III team.

Field artillery repair 34,100

MOBILITY.

[1] This team is capable of transporting 5,000 pounds (550 cubic feet) of TOE equipment with organic vehicles.

[2] This team has 2,400 pounds (150 cubic feet) of TOE equipment requiring transportation

TOE 43238503,
FIRE CONTROL SYSTEMS
REPAIR TEAM

MISSION. Provides (GS) maintenance for fire control systems equipment in support of the theater Army supply system.

CAPABILITIES. Provides the following annual man-hours of productive maintenance when operating as a category III team.

Fire control systems repair 6,200

MOBILITY

[1] This team is capable of transporting 5,000 pounds (450 cubic feet) of TOE equipment with organic vehicles.

[2] This team has 5,000 pounds (750 cubic feet) of TOE equipment requiring transportation.

APPENDIX C

FUNCTIONS AND DUTIES OF PERSONNEL

The following is a list of personnel duties for specific positions found within the three GS maintenance units discussed in this manual. All TOE positions are not included. Only those positions with duties that are unique to a maintenance organization are covered here. Those positions are of a more or less universal nature within the Army (Battalion Commander and Company Commander) and are not included in this appendix. Further information on the duties inherent with those jobs can be found in AR 611-201.

Each position is listed by TOE, paragraph and line number, grade, and MOS. A brief description of the duties of these personnel is provided.

(l.) Headquarters and Headquarters Detachment

MATO MAINTENANCE OPERATIONS SECTION

PARA	LINE	DESCRIPTION	GRADE	MOS	DUTIES
c	01	Battalion Commander	05	91A	Commands the battalion. Establishes policies. Provides recommendations to higher headquarters. Plans, supervises, and inspects operations.
c	01	Company Commander	03	91B	Responsible for the Commander effective and efficient accomplishment of all functions required to properly feed, clothe, equip, house, assign, and train personnel. He is also responsible for the welfare and the maintaining of morale and health of all personnel under his command. NOTE: This duty description applies to the position of company commander for all units listed in this appendix.
c	03	Maintenance Officer	04	91A	Exercises staff supervision over the battalion's technical support mission and resources. Establishes reports and controls to assure mission accomplishment. Advises the commander and staff on technical aspects of the battalion mission. Conducts staff visits to higher, attached, and supported units. Maintains close coordination with the MMC. Reviews reports, summaries, and digests to keep track of accomplishments and to identify problems.

PARA	LINE	DESCRIPTION	GRADE	MOS	DUTIES
C	01	Materiel Management Officer	03	91B	Provides advice and assistance to the maintenance officer and to subordinate units on maintenance problems, procedures, and requirements relative to their commodity specialties.They also make recommendations to eliminate or alleviate problems in the areas of technical inspections, excessive backlog, low production ratio, repair parts shortages, personnel shortages, or any other problems related to the maintenance mission.
C	02	Electronics Officer	03	91B	See "Materiel ManagementOfficer."
C	04	Supply Management Officer	03	92B	See "Materiel Management Officer."
C	05	PT/ST Maintenance Technician Officer	W4	915E	See "Materiel Management Officer."
C	06	Communications Equipment Maintenance Chief	E8	29X	See "Materiel Management Officer".
C	07	Maintenance Operations NCO	E8	63Z	Assigns duties to enlisted members of the section. Assists in planning, scheduling, and maintenance management functions.
C	08	Armament Maintenance Sergeant	E7	45Z	Provides advice and assistance to the Maintenance Operations officer and other officers of battalion headquarters and attached units, with respect to planning, scheduling, and managing or maintenance operations. Assists in the development of plans, policies, and recommendations. Collects and maintains data relative to maintenance performance and problems, and makes recommendations. Assists in conducting of inspections of the maintenance activities of attached units. Assists in the establishment of maintenance standards and controls.

PARA	LINE	DESCRIPTION	GRADE	MOS	DUTIES
C	09	Construction Equipment Maintenance Sergeant	E7	62B	See" Armament Maintenance Sergeant."
C	10	Materiel Management Supervisor	E7	76P	See" Armament Maintenance Sergeant."

(2.) **Ordnance Maintenance Company, Light Equipment, GS TOE 43-237J5.**

QUALITY ASSURANCE (QA)/QUALITY CONTROL (QC) SECTION

02	01	CE Equipment Repair Technician	WO	256A	Performs initial and QC inspections of CE equipment assemblies and components.
02	02	Radio Repair Inspector	E6	29E30	Performs initial and QC inspections for radio receivers, transmitters, and associated equipment.
02	03	TAC\SAT Microwave Supervisor	E6	29M30	Performs initial and QC inspections on tactical satellite, microwave, multichannel radio, multiplexer and associated equipment.
02	04	Technical Inspector	E6	52D30	Performs initial and QC inspections on power generation equipment up through 200 KW (expect for turbine engine driven generators).
02	05	Technical Inspector	E6	52D30	Performs initial and QC inspections of refrigeration equipment, air conditioning units, forced air heaters, bottle cleaning and charging station, gasoline engines, and electrical motors peculiar to equipment supported.

MAINTENANCE CONTROL SECTION

03	01	Maintenance Officer	LT	91B	Responsible to the company commander for the efficient accomplishment of the technical mission of the unit and maintenance of shop records. Assumes command in absence of the commander.

03	02	Maintenance Control Chief	E7	29W4K	As senior technical NCO of the unit, advises the control officer concerning technical operations of each of the elements subordinate to the control section. Serves as NCO in charge of the inspectors assigned to the section. Supervises preparation and flow of records and reports.

PARA	LINE	DESCRIPTION	GRADE	MOS	DUTIES

(3.) Ordnance Maintenance Company, Heavy Equipment (GS) TOE 43238J5.

QA/QC SECTION

02	01	SPT/STAF Maintenance Technician	WO	915E	Performs initial and QC inspections of major disassembly, assembly, and repair of automotive equipment.
02	02	Armament Maintenance Inspector	E6	45K30	Performs initial and final inspection of turret mechanisms and weapons of tanks and cupolas, towed artillery, self-propelled artillery, and small arms.
02	03	Technical Inspector	E6	63H30	Performs initial and final inspection of track/wheel vehicles, materials handling equipment (MHE), chemical and quartermaster equipment (less office machines), and fuel and electrical systems.
02	04	Technical Inspector	E6	62B30	Performs initial and final inspection of construction equipment.
03	01	Maintenance Control Officer	LT	91B	Responsible to the company commander for the efficient accomplishment of the technical mission of the company, maintenance of required records, QC production control, establishment of shop policy, and effective use of available personnel. Assumes command in the absence of the commander.
03	02	Maintenance Control Sergeant	E7	63H4K	Assists the control officer in the performance of his duties. Directs and coordinates jobs within the shop and supervises maintenance of shop records.

GLOSSARY

ADP ... *automatic data processing*
ASG ... *area support group*
BITE ... *built-in test equipment*
CE ... *communications-electronics*
CMT ... *company maintenance team*
COMMZ ... *communication zone*
COMSEC ... *communications* security
CONUS ... *continental United States*
CLT ... *cellular logistics team*
DA ... *Department of the Army*
DOD ... *Department of Defense*
DS ... *direct support*
DSM ... *direct support maintenance*
DSU ... *direct support unit*
EAC ... *echelons above corps*
EMP ... *electromagnetic pulse*
FLOT ... *forward line of own troops*
GS ... *general support*
GSM ... *general support maintenance*
HEMCO ... *heavy equipment maintenance company*
HN ... *host nation support*
IAW ... *in accordance with*
IMO ... *installation maintenance officer*
LEMCO ... *light equipment maintenance company*
LRU ... *line replaceable unit*
MAC ... *maintenance allocation chart*
MACOM ... *major Army command*
MATO ... *materiel officer*
MHE ... *materials handling equipment*
MMC ... *Materiel Management Center*
MOS ... *military occupational specialty*
MRSA ... *materiel readiness support activity*
NBC ... *nuclear, biological, and chemical*
NSN ... *national stock number*
OMG ... *operational maneuver group*
PCX ... *printed circuit board*
PLL ... *pescribed load list*
PMCS ... *preventive maintenance checks and services*
PP&C ... *production planning and control*
QA ... *quality assurance*
QC ... *quality control*
RAS ... *resource analysis system*
REC ... *radio electronic combat*
RPSIZ ... *repair parts and special tools list*
RX ... *reparable exchange*
SAMS ... *Standard Army Maintenance System*
SIGINT ... *signals intelligence*
SPF ... *special-purpose forces*
TA ... *theater Army*
TAACOM ... *Theater Army Area Command*
TAAMMC ... *Theater Army Area Materiel Management Center*
TACFIRE ... *tactical fire direction system*
TAMMC ... *Theater Army Materiel Management Center*
TMDE ... *test, measurement, and diagnostic equipment*
TOE ... *tools of organization and equipment*
TRS ... *theater reserve stocks*
UMCP ... *unit maintenance collection point*
WP ... *Warsaw Pact*
TAC/SAT ... *tactical satellite*

References

ARMY REGULATIONS (ARs)

5-3	*Installation Management and Organization*
310-25	*Dictionary of US Army Terms*
611-201	*Military Occupational Classification and Structure Update*
700-18	*Provisioning of US Army Equipment*
700-82	*Joint Regulation Governing Use and Application of Uniform Source Maintenance and Recoverability Codes*
710-2	*Supply Policy Below the Wholesale Level (Unit Supply Update)*
735-5	*Policies and Procedures for Property Accountability (Unit Supply Update)*
750-25	*Army Test Measurement and Diagnostic Equipment (TMDE) Calibration and Repair Support Program*
750-1	*Army Materiel Maintenance Policies*

DEPARTMENT OF THE ARMY FORMS (DA FORM)

2417	*US Army Calibration System Rejected Instrument*
3318	*Records of Demands - Title Insert*

DEPARTMENT OF THE ARMY LABELS (DA LABEL)

80	*US* Army *Calibrated Instrument*
63	*US Army Limited or Special Calibration*

DEPARTMENT OF THE ARMY PAMPHLETS (DA Pares)

25-30	*Consolidated Index of Army Publications and Blank Forms*
710-2-1	*Using Unit Supply System (Manual Procedures)*
710-2-2	*Supply Support Activity Supply System: Manual Procedures (Unit Supply Update)*
738-750	*The Army Maintenance Management Systems (TAMMS)*

FIELD MANUALS (FMs)

43-12	*Division Maintenance Operations*
54-40	*Area Support Group*
63-4	*Combat Service Support Operations TheaterArmy Area Command*
90-14	*Rear Battle*
100-10	*Combat Service Support*
100-16	*Support Operations (Echelons Above Corps)*

STANDARDIZED AGREEMENTS (STANAGS)

1135	*Interchangeability of Fuels, Lubricants and Associated Products used by the Armed Forces of the North Atlantic TreatyNations*
2002	*Warning Signs for the Marking of Contaminated or Dangerous Land Areas, Complete Equipment, Supplies and Stores*

2010	*Military Load Classification Markings*
2014	*Operation Orders, Annexes to Operation Orders, Administrative and Logistic Orders*
2019	*Military Symbols for Land Based Systems*
2023	*Marking of Military Cargo for International Movement by all International Means of Transportation*
2025	*Basic Military Road Traffic Regulations*
2034	*Land Forces Procedures for Allied Supp!y Transactions*
2041	*Operation Orders, Tables and Graphs for Road Movement*
2047	*Emergency Alarms of Hazard or Attack (NBC and Air Attack On!y)*
2079	*Rear Area Security and Rear Area Damage Control*
2103	*Reporting Nuclear Detonations, Biological and Chemical Attacks, and Predicting and Warning of Associated Hazards and Hazard Areas*
2135	*Procedures for Emergency Logistics Assistance*
2154	*Regulations for Military Motor Vehicle Movement by Rodad*
2174	*Military* Routes *and* Route/Road *Networks*
2827	*Materials Handling in the Field*
2828	*Military Pallets, Packages and Containers*
2829	*Materials Handling Equipment*
2832	*Restrictions for the Transport of Military Equipment by Rail on European Railways*
2889	*Marking Hazardous Areas and Routes Through Them*

TECHNICAL BULLETINS (TB)

43-180	*Calibration and Repair Requirements for the Maintenance of Army Materiel*
750-25	*Maintenance of Supplies and Equipment: Army Test, Measurement, and Diagnostic Equipment (TMDE) Calibration and Support Program*

INDEX

FM 43-20
10 NOVEMBER 1989

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

WILLIAM J. MEEHAN II
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:

Active Army, USAR, and ARNG: To be distributed in accordance with DA Form 12-11 E, Requirements for FM 29-24, General Support Maintenance Operations (Qty rqr block no. 1097) and FM 100-10, Combat Service Support (Qty rqr block no. 406).

☆ U.S.G.P.O.: 1989-627-027/00100