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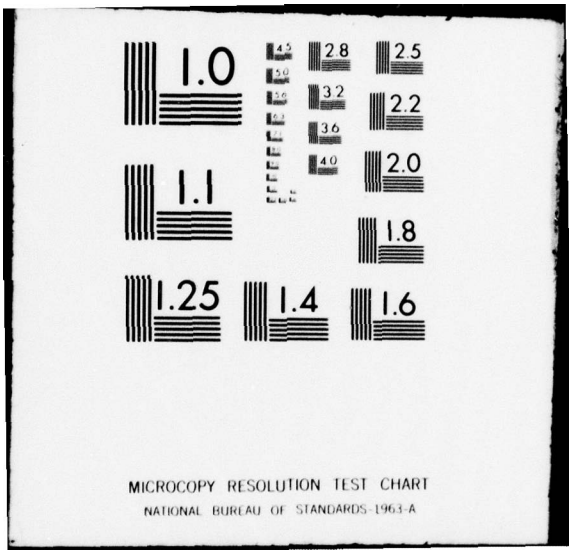
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MAINTENANCE RESOURCE ASSESSMENT

Volume I

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Analysis conducted to determine the maintenance cadre, equipment, shop facilities, materials and spare parts necessary to support the operations of a prototype chemical agent and munition demilitarization project.

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1.0 INTRODUCTION

This report is prepared and submitted pursuant to CDRL Sequence Item A003 of Contract DAAG-49-75-C-0135. This report presents the results of an analysis conducted to establish the maintenance resources necessary to support the Chemical Agent/Munitions Disposal System (CAMDS) located at the Tooele Army Depot (TEAD), Tooele, Utah. The CAMDS is being developed to dispose of lethal chemical agents and munitions in a manner which provides total confinement of all hazardous materials with impeccable safety to operating personnel and civilian population while meeting stringent environmental control standards. The system is being developed by, and will be operated by the U.S. Army.

This maintenance resource analysis (MRA) was conducted to determine the CAMDS maintenance cadre, equipment, shop facilities, materials and spare parts necessary to support the CAMDS operations. The analysis draws heavily from the results of the CAMDS Task 2 Maintainability and Reliability Assessment, Reference 1., conducted under this same contract.

The analysis results are summarized in Section 2 which also includes the study recommendations. The study scope, groundrules and constraints which governed the effort are delineated in Section 3. Sections 4 and 5 present the summary MRA's at the building block and munition demil line levels respectively. Section 6 addresses the maintenance approach adopted and the necessary maintenance resources. Section 7 lists references cited in this report.

2.0 SUMMARY

Maintenance will play a major and vital role in CAMDS operations. The low mean time between failures (MTBF) and high mean time to repair (MTTR) predicted by the CAMDS Maintainability and Reliability Assessment, Reference 1, and the Rocky Mountain Arsenal M34 experience dictate such.

A comprehensive maintenance resource assessment is therefore important if CAMDS operating goals are to be met. The current maintenance assessment, the results of which are reported herein, is fundamentally based on the 3 October 1975 CAMDS baseline cited in Section 3.0. This baseline, because of the incomplete design status of most of the equipment at that time, is full of gaps. The results of these assessments, therefore, represent a "best effort" reflecting the information contained in the aforementioned baseline. Since changes to the CAMDS equipment designs are occurring, the findings and recommendations presented herein, particularly relative to spares provisioning, should be reevaluated when design changes are completed.

2.1 MAINTENANCE RESOURCE ASSESSMENT FINDINGS

The following lists the more significant findings of this maintenance resource assessment.

1. Three general but distinct maintenance approaches were evaluated for application to the CAMDS. Briefly these were:

   - Breakdown maintenance approach wherein the equipment is allowed to operate until failure before it is replaced or repaired.
   - Preventive maintenance approach wherein the equipment is periodically shutdown for testing, overhaul and component replacement or repair to prevent breakdowns.
   - Engineered maintenance approach which utilizes predictive testing and actual operating experience to forecast equipment overhaul, replacement or repair to prevent breakdowns.

Of these approaches evaluated, the breakdown maintenance approach is best suited to the needs and character of CAMDS (See Section 6.0 for further discussion).

2. To support the breakdown maintenance approach, maintenance resources, particularly personnel, provisions (repair parts) and facilities, must be postured to cope rapidly with breakdowns to minimize equipment down time.

3. Three basic line maintenance skill types were identified.

   - Electro-Mechanical technicians with a basic foundation in electro-mechanical systems and special training in process monitors, controls and instruments to support the heavily process oriented ADS, DFS, and MPF.
   - Electro-Mechanical mechanics with a good foundation of electro-mechanical mechanisms and machines to maintain the munition demilitarization machines and their supporting subsystems.
   - Electronic technicians specially trained to maintain the SCS, COM, and CTV.

4. Thorough personnel familiarization with equipment and repair procedures is necessary to minimize equipment downtimes; dedication of personnel to discrete maintenance roles is warranted to assure proficiency.

5. To promote safety and maintenance efficiency, a training program is warranted for indoctrination of safety rules and procedures, and for the development of skilled, competent CAMDS equipment maintenance personnel.

6. Certain elements of the CAMDS equipment, not directly associated with the dismantling of munitions or the distruction of agent, can be, and should be maintained with depot support. These include the UTL boilers and air compressors, the UTL and ELE diesel generators and switch gear, and all material handling equipment not part of any CAMDS building block.

7. No significant special tool requirements were identified. However, because special tool requirements best manifest themselves only after operating experience is assimilated, it is anticipated that operating experience will dictate the acquisition of additional special tools beyond those already defined (see Section 6.4).

8. There is a noted lack of parts standardization. For example, 86 different hydraulic cylinders supplied by 14 different manufacturers were noted. This lack of standardization results in a large burden on the CAMDS spares provisioning and ties up significant maintenance resources.

9. Identical items are currently identified by different inventory control numbers; without a fully comprehensive cross referencing system, sparing of duplicate items under different inventory control numbers could result.

10. To minimize down times, in situ repair of faulty components should be avoided. To the extent practical, repairs should be effected via component removal and replacement actions. This requires a well provisioned spare parts inventory.

11. Routine preventive maintenance actions as projected by this assessment for all munition lines are readily effected by a 6 man crew working one weekend shift.

2.2 RECOMMENDATIONS

The aforementioned findings serve as the basis for the following recommendations.

1. To ensure the timely availability of a qualified and trained maintenance staff, acquisition and training of personnel should be initiated immediately.

2. All maintenance procedures should be proofed (validated) to the extent possible prior to operations with "live" (explosive and agent) munitions. Particular emphasis should be placed on the removal and replacements of critical items such as cutting tools and punches; process sensors, monitors, controls; process pumps; hydraulic actuators, control valves and power units.

3. Maintenance Staff Personnel (see Section 6.2 for discussions). An administrative staff consisting of a Director of Maintenance assisted by 2 technical assistants, 2 or 3 provisions specialists, and clerical and secretarial help is recommended.

3. (Cont'd.)
A line maintenance crew consisting of a shift supervisor, 6 qualified maintenance men (consisting of electro-mechanical mechanics and technicians, and electronics technicians), and two helpers is recommended for each operational shift. For a 2 shift per day schedule, a minimum of 18 line maintenance staff members are required; for a 3 shift per day schedule, a minimum of 27 is required.

4. Preventive Maintenance
Initially, paid overtime of the maintainance staff is recommended for routine preventive maintenance actions during weekend shutdowns. Preventive maintenance actions projected necessary by this assessment do not warrant a separate preventive maintenance staff. If however, operating experience indicates that deferred corrective maintenance represents a major portion of the weekend work requirements, an additional work shift is recommended to work both days over the weekend and three days during the week days. This shift, in addition to satisfying weekend work requirements and assisting with the normal week day maintenance activities, could serve as a manpower pool to mitigate personnel absentism and turnover problems, as well as serving as a buffer against major breakdowns of the equipment.

5. To promote proficiency, it is recommended that personnel be identified with, and dedicated to certain building blocks or subsystems. The ADS, MPF and DFS in particular merit a group of maintenance men, who through repeated exposure to maintenance episodes of these building blocks, become thoroughly familiar with the equipment and repair procedures.

6. Depot maintenance support should be utilized to perform corrective maintenance on the UTL boilers and air compressors, the UTL and ELE diesel generators and switch gear, and all material handling equipment not part of the CAMDS building blocks. In addition, depot support should be employed for preventive maintenance of the material handling equipment not part of the CAMDS building blocks.

7. As part of equipment acceptance testing and validation of maintenance procedure, it is recommended that efforts be made to identify areas where special tools or equipment can be utilized to facilitate maintainance. Particular emphasis should be placed on repetitive maintenance actions, and actions where equipment access is limited. Special tools recommendations as determined by this assessment are listed in Table 6-3.

8. To minimize sparing of identical items under different inventory control numbers, a cross referencing system, noting identical items and their respective inventory control numbers, should be generated.

9. Maintenance facilities, as gauged by floor space requirements as noted below are recommended for CAMDS. All facilities should either be on the CAMDS site or adjacent to it. (See Section 6.3 for specifics).

   - 500 square feet for office space
   - 13,000 square feet for spare parts and provisions storage (binned and palletized)
   - 500 square feet for a mechanical repair shop
   - 300 square feet for a electrical repair shop
   - 1000 square feet for a decontamination area
   - 1000 square feet for storage of contaminated items and machines/fixtures not currently in use.

10. Recommended spare parts are listed in Table 6-5.
    It is to be noted that this list reflects the 3 October 1975 baseline and that the ADS, DFS, and MPF spare parts are not included. This spare list should be updated to incorporate design changes made to the 3 October 1975 baseline and to include the ADS, DFS, and MPF spares.

3.0 ASSESSMENT SCOPE, GROUNDRULES AND CONSTRAINTS

3.1 SCOPE

To facilitate technical and financial management, the CAMDS has been subdivided into 37 building blocks. Many of these building blocks do not require maintenance support and are therefore exempt from the intent and purview of this assessment. These exempt building blocks are:

MOD - B/B 28 Scale Model
TDP - B/B 34 Technical Data Package
TNG - B/B 36 Training
RAM - B/B 37 Repair and Maintenance
SMP - B/B 38 System Management and Planning
OES - B/B 39 Operating Engineering Support
SIT - B/B 40 Initial Test and Site Development
SYS - B/B 41 System Integration

Additionally, by mutual agreement between the Army and TRW, three building blocks, viz., CML (32) - Chemical Lab, PER (29) - Perimeter Detectors, and DET (33) - Detectors, were not included in the assessment. It was felt that the maintenance resources of these highly unique and specialized systems are best established by TEAD, EA and CAMDS personnel who possess the required special knowledge and experience.

Two building blocks, CON(10) -Control Module and PDF(20)-Projectile Disassembly Facility, were identified by the 3 October 1975 CAMDS baseline as a set of trailers used to house the SCS(35)-Site Control Systems, and a building sheltering the PPD(18)-Projectile Pull and Drain Machine, the CDS(19) Central Decon System, and the BIF(21)-Bulk Item Facility. Additionally, details available on the PSC(12)-Personnel Support Complex, were not definitive enough to ascertain maintenance requirements. However, since these building blocks (CON, PDF and PSC) fundamentally do not require maintenance support as would be provided by the CAMDS maintenance staff (only janitorial and building upkeeping support is envisioned) these building blocks were also not included within the scope of this assessment.

The assessment therefore covered the remaining 23 building blocks which were analyzed to isolate and identify maintenance support requirements. The primary goal of this assessment was the determination of the maintenance resources necessary to support the CAMDS operations in the form of maintenance cadre, equipment, shop facilities, materials, supplies and spare parts.

3.2 GROUNDRULES AND CONSTRAINTS

The following groundrules and constraints governed the conduct of this evaluation:

- The fundamental design baseline of the CAMDS system evaluated is that determined by the set of drawings and related data available at TRW on 3 October 1975, hereinafter referred to as the "3 October 1975" baseline. This baseline is identified in reference 1.
- Where the 3 October 1975 baseline is not adequate for a comprehensive maintenance resource assessment, best estimates are to be made based on data available.
- Depot maintenance support is to be utilized where possible and advantageous to CAMDS. For further discussion, see Section 6.0
- Whereas maintenance equipment are to be identified, special emphasis is placed on isolating and defining special or unique tools, equipments and facilities. It is assumed that the standard complement of common tools, such as would be available in any well equipped maintenance shop, would be available.
- Tools necessary to perform normal preventive and corrective maintenance are cached in each toxic area to preclude the need for decon and special handling of contaminated tools. All tools cached are to be uniquely identified to their respective toxic area to facilitate accountability. Tools and equipment as required to support major maintenance actions will be provided from a central source which will require strict accountability.
- Equipment operators are allowed to perform minor maintenance. Operators at their operating stations will be utilized to facilitiate fault isolation.

- Union work rules are not anticipated to be a problem; strict job description adherence will not be enforced such that performance of maintenance normally beyond one's purview can routinely be accomplished to expedite maintenance.
- Major fault isolation is to be performed by maintenance personnel with coordinated assistance from equipment operators.
- A buddy system is enforced throughout the CAMDS site; no one is allowed on site without a partner.
- Two suited (Level A) men must work in toxic areas at all times and another man partially suited (half masted) must be on standby.
- Per entry, only two hours in Level A suit is permitted. Suit re-entry is permitted following an equal (two hour) time out of suits.
- Items requiring specialized support (e.g. CTV Camera) can be optionally accomplished with outside (contract support) personnel.
- The CAMDS design is adequate. Maintenance resources to support repair and equipment modifications, as well as resources required to support system proofing and debugging will not be considered.
- Reliability and availability analysis indicate that the CAMDS equipment availability will be poor. As such, a full complement of maintenance cadre should be on site during all operational shifts.
- Only random single failures are to be considered. Multiple failures are not considered in this effort.
- Only one munition type is to be processed at any time; multiple munition line operation will not be effected.

4.0 BUILDING BLOCK ASSESSMENTS

Actions performed on the CAMDS equipment are considered to fall into two principle and distinct operations; preventive maintenance actions (PMA) and corrective maintenance actions (CMA). For purposes of the following discussions, PMA is defined as actions performed to retain the operation capabilities of the CAMDS equipment through routine scheduled checks and services (cleaning and lubrication), while CMA encompasses all actions performed to return the CAMDS equipment to operational status following unscheduled production line stoppages due to equipment failures or malfunctions.

Because of the absence of data in the form of detailed maintenance procedures, the principle basis for this assessment was the set of equipment design drawings provided to TRW. These drawings, to the extent available at TRW on 3 October 1975 served as the baseline CAMDS evaluated, and is herein referred to as the 3 October 1975 CAMDS Baseline. These drawings, supplemented by reports as listed in Section 7, were used to the extent possible to isolate maintenance requirements. Component manufacturer's data, as available, or as could be obtained, were also used to assess maintenance requirements.

To serve as the basis for the overall CAMDS maintenance resource assessment, the requirements of the building blocks were identified as follows. Detailed studies of the building blocks design drawings were made to identify the general mechanization schemes adopted to meet the objectives and requirements of the munitions processing equipment and support subsystems. Subsequent evaluation of the drawings was made to isolate the major functional elements and their criticality in the total mechanization approach. The types of components employed was then determined to establish PMA maintenance points and actions. Maintenance as recommended by equipment manufacturers served as guidelines; where such data was not available, engineering judgement was employed.

To scope CMA requirements, the drawings were studied to evaluate maintenance access, actions necessary to effect component removal and replacement, or repair, and whether safety or hazard related considerations exist.

Wearable items, such as cutting tools, punches, nonmetallic parts (e.g. seals, boots, etc.) and consumables were noted as well as items prone to abuse or breakage. Specialized tools, equipment, skills and facilities as could be identified were also noted.

To gauge the building block CMA requirements, "typical" CMAs were generally established for each building block as follows. The CAMDS Maintainability and Reliability Assessment, Reference 1., was reviewed to isolate high incidence failures and the types of components involved. Also noted were the estimated mean time to repair (MTTR) and the mean time between failures (MTBF). These items were used to structure a representative CMA for the building block which was then used to determine the "typical" maintenance skill type and number.

Summary results of the building block analyses are presented in the following.

4.1 UNPACK AREA (UPA), BB#01

4.1.1 Purpose

The Unpack Area houses the material and personnel required to receive all munitions (except bulk items) and unpackage and prepare them for conveyor loading to the ECC or PPD. The UPA also houses the airlock for entry into the ECC.

4.1.2 Description

The UPA consists of an unpack area and an airlock area.

The Unpack Area comprises a floor mounted jib crane, material handling equipment, scrap hoppers, work table and an emergency decon shower. A motorized overhead door admits a forklift loaded with a full pallet of ammunition. A filter system provides six air changes per hour.

The airlock area includes a shower, foot bath, decon area, fresh water and a tool storage area. Openings in the airlock provide for placement of the unpackaged munition upon conveyors going to ECC or PDF. A separate filter system provides 25 air changes per hour and keeps a negative pressure within the air lock..

4.1.3 Special and Safety Requirements

Normal maintenance actions will take place with personnel wearing level E protective clothing.

4.1.4 Typical Preventive Maintenance Actions (PMA)

Typical PMA's will include lubrication of hoists, conveyor, overhead door bearings and tilt machine bearings.

PMA for the forklift is assumed handled by Depot Maintenance as stated in section 6.2.3.

One man can handle the necessary PMA which is estimated at 0.2 man hours per week.

4.1.5 Typical Corrective Maintenance Actions (CMA)

Typical CMA's will include removal and replacement of electro-mechanical components, such as cylinders and bearings within the tilt machine and electric motor (access door).

CMA for the forklift and jib crane hoist will be handled by the Maintenance Depot as stated in Section 6.2.3.

CMA can be handled by one electro-mechanical maintenance man.

4.1.6 Materials

A special chemical (TBD) is required for the airlock area's foot bath.

4.1.7 Special Tools

1) A beryllium wrench or pliers is required for removal of the striker nut for the 4.2" mortars.
2) An approved tool is required for removing the mine arming plug and spring.

4.1.8 Facilities

No UPA unique maintenance facility requirement was identified.

4.2 EXPLOSIVE CONTAINMENT CUBICAL (ECC), BB#02

4.2.1 Purpose

The Explosive Containment Cubicle houses the machinery (RDM, PDM, MOR and MIN) which handles the explosive demil processing. It is designed to retain explosive munition fragments and nerve agent in the event of an accidental explosion occasioned by mechanical dissassembly/distruction of a munition containing agent. The chemical agents will be drained from rockets and mines within the ECC.

4.2.2 Description

The ECC is cylindrical in shape with end panels containing hinged doors for passage of personnel, conveyors, munitions and ventilation air. The sealed doors are remotely controlled using hydraulic actuators and locking pins.

Types and quantities of components determining the nature of maintenance required by the ECC are listed below:

Item	Qty
Cylinders, hydraulic	18
Switch, position	12
Hinge, door	9
Bearings (door closures)	4
Seals, static (door closures)	6
Absorber, shock, hydraulic (door)	1
Valve, check	8
Valve, sequence control, solenoid	8

4.2.3 Special and Safety Requirements

Level A protective clothing must be worn by maintenance personnel. All munition demil machines should be disabled prior to personnel entry into the ECC.

4.2.4 Typical Preventive Maintenance Action (PMA)

Typical PMA's will include scheduled lubrication of door hinges, linkage and bearings; checking for and elimination of hydraulic leaks; adjusting limit switches; servicing control valves (if required).

PMA's can be handled by one man requiring approximately 0.4 man-hours per week.

4.2.5 Typical Corrective Maintenance Action (CMA)

Typical CMA's involve removal and replacement of components such as hydraulic cylinders, check valves, control valves and position switches.

CMA's can be handled by one electro-mechanical maintenance man.

4.2.6 Materials and Special Tools

No special materials or tools were identified.

4.2.7 Facilities

No special ECC unique facility requirements were identified.

4.3 DEACTIVATION FURNACE SYSTEM (DFS), BB #04

4.3.1 Purpose

The DFS thermally deactivates propellants and explosive munition parts or components which result from the CAMDS demil operations. In addition, it accomplishes thermal detoxification of drained GB or VX M55 rocket metal parts and drained VX M23 mines.

4.3.2 Description

The primary elements of the system include:

- An oil fired rotary retort with a double tipping valve at the charging end for the containment of blast effects which may occur within the retort. This is the heart of the system where deactivation/detoxification of feed material occurs.
- A electrically heated ($\sim 1000^{o}F$) discharge conveyor where any residual agent on the retort discharge is detoxified.
- A cyclone separator for the collection of dry particulate matter in the retort gas effluents.
- A slagging afterburner for the complete destruction of agent traces in the retort exhaust gas.
- A quench tower, a venturi scrubber, a packed bed scrubber, a caustic tank. and brine tanks for scrubbing of the retort exhaust gas.

The mechanization of the DFS encompasses a wide spectrum of component types ranging from boiler plate items such as the retort and scrubber tower to sensitive process monitors and alarms. Per the Task 2 CAMDS Reliability and Maintainability Study, the following component types, utilized extensively in the DFS, are identified as being the significant maintenance requirement determinants.

- Process sensors, monitors, controllers and alarms
- Process pumps and control valves
- Retort drive system and oil forming system
- Discharge conveyor drive and heating system

4.3.3 Safety and Special Considerations

Unless precluded by a system malfunction, all (preventive and corrective) maintenance must be performed following an orderly system shutdown per the Standing Operating Procedures. Level A protection is required for all DFS maintenance outside of the non toxic control area. Penetration into the retorts cyclone collector, quench tower and other hot components is permitted only after cooldown and/or authorization by safety personnel.

4.3.4 Typical Preventive Maintenance

Typical preventive maintenance for the DFS consists of lubrication, servicing and calibration of process monitors and controllers, and flushing of the scrubber tower. The frequency of these preventive maintenance actions will probably be extremely varied, ranging from possibly weekly flushing of the scrubber tower to annual calibration of select process monitors. Unfortunately, the absence of prior operating experience, or operating experience of similar systems preclude estimates of the required frequencies. As such, it is assumed for purposes of this assessment that weekly flushing of the scrubber tower is required as well as general servicing of the rest of the scrubber loop. It is further assumed that this preventive maintenance activity is the most significant item influencing the maintenance resources required and entails a crew of two men for four manhours per week.

4.3.5 Typical Corrective Maintenance

Typical corrective maintenance for the DFS appears to be the servicing or removal and replacement of items identified in paragraph 4.3.2 which can be readily performed, for the most part, by a two man crew. If necessary, assistance is assumed available from the operating crew which numbers 8 men (per recommendation of the system design contractor), one of which normally services the furnace and works in a protective suit. Because of the multiplicity of process monitors, alarms and controllers, the maintenance crew should have instrument servicing training.

4.3.6 Materials

To support corrective maintenance of the retort, spares for the "dry" bearings (carbon type) used by the retort drive and idler rollers are required. No other special DFS unique materials requirement were identified.

4.3.7 Special Tools

No special tools requirement was identified.

4.3.8 Facilities

No DFS unique maintenance facility requirement was identified.

4.4 METAL PARTS FURNACE (MPF), BB #05

4.4.1 Purpose

The Metal Parts Furnace thermally destroys residual GB and VX on explosiveless metal munitions parts and thermally destorys mustard within ton containers and munitions without explosives.

4.4.2 Description

The MPF includes a direct fired 3-chamber roller hearth furnace, a primary fume burner, an auxillary fume burner, a quench tower, scrubbers, burster well basket conveyor, a multi-position loader, bulk item loading station, scrap handling and cooling station.

The MPF incorporates in excess of 1600 electro-mechanical assemblies. The significant types and approximate quantities contributing to preventive or corrective maintenance actions are listed in Table 4-1.

4.4.3 Special and Safety Requirements

Unless precluded by a system malfunction, all (preventive and corrective) maintenance must be performed following an orderly system shutdown and cool down per Standing Operating Procedure. Level A protection is required for all MPF maintenance outside of the non toxic control area. Penetration into the furnaces, fume burners, quench towers and other hot components are permitted only after cooldown and/or authorization by safety personnel.

4.4.4 Typical Preventive Maintenance Actions (PMA)

The typical PMA will occur on weekends or shifts in which the MPF is shut down. This will maximize safety and access to the equipment to be serviced. Typical PMA's over the course of one year is envisioned as follows:

Weekly

- Inspect (and replace as required) dynamic soft goods for signs of excessive wear or impending failure, i.e., rubber drive belts, hydraulic hose and air lock seals.
- Inspect hydraulic system connections for leakage.

TABLE 4-1

MAJOR MPF COMPONENTS

ITEM	QUANTITY
Control valves	22
Controller, recorder	11
Tanks, liquid	5
Accumulator	1
Controller, recorder	5
Regulators	2
Pumps (centrifugal, rotary, turbine)	30
Clutches	5
Motors (½ to 150 HP)	95
Gear box reducers	10
Power unit	1
Scrubber assembly, venturi	1
Positioner	2
Blower/fans	22
Controller, temperature	26
Filters	25
Heaters	50
Brake, electric	1
Air conditioners	2
Cylinders, hydraulic	4
Chains, roller	43
Elevator	1
Punch assemblies	2
Thermocouples	11
Flowmeters	5
Burner assemblies	16
Limit switches	58
Bearings, roller (loaders, conveyors)	130

*Quantities are approximate, based upon drawings available to TRW as of October 3, 1975.

Weekly (Cont'd.)

- Inspect punch assembly bellows for cracks.
- Inspect drain traps for proper drainage.

Monthly

- Lube/oil bearings (conveyor rollers, motors).
- Grease punch chamber elevator guides and slide blocks.
- Oil drive chains.
- Inspect burner assembly flame guard sensor for smudging.

Quarterly

- Drain scrubber sump; remove sludge.
- Inspect scrubber nozzles and volatilization/burnout chamber for the nozzles for proper flow pattern.
- Check or calibrate transducers and gauges.

Semi-Annually

- Lube overhead crane wheel bearings.
- Tighten and/or replace stuffing box seals on the punch assembly.

Annually

- Inspect and clean burner oil strainers.
- Inspect and clean steam boiler tubes.
- Clean and paint scrubber housing chimney stack, blower housings, etc. Note: painting tasks can be stretched out over several weekends or during MPF non-production down time.
- Drain, clean and inspect caustic tank - repair as required.

Two men, working an estimated 4 manhours total per week are required for PMA.

4.4.5 Typical Corrective Maintenance Actions (CMA)

A typical CMA can occur during a demil run, requiring MPF shutdown, or can be deferred to weekend non-production periods. Typical CMA's are envisioned as follows:

Singly remove and replace the following typical equipments:

- Cylinders (hydraulic)
- Pumps (hydraulic, water, liquor) (R&R complete pump assembly, i.e., motor, pump & drive)
- Valves
- Chains/belts
- Limit switches
- Heaters/burners
- Transducers (temperature, pressure, level sensors)

Prior to removal, the repair area will require flushing (agent/spent decon systems) or cool down (thermally hot zones) or isolation (fluid plumbing). Following equipment replacement, the item must be functionally checked out.

The typical CMA (removal and replacement only) can be accomplished by two (2) men.

4.4.6 Materials

No specific MPF unique materials were identified.

4.4.7 Special Tools

No special tools were identified.

4.4.8 Facilities

No MPF unique facility requirements were identified.

4.5 ROCKET DEMIL MACHINE (RDM), BB #06

4.5.1 Purpose

The Rocket Demil Machine, installed within the Explosive Containment Cubicle (ECC), is used to drain the agent from the rocket warhead and to cut the rocket in small pieces for thermal detoxification in the Deactivation Furnace System (DFS).

4.5.2 Description

The RDM consists of a punch/drain station and a saw station. Input and discharge conveyors (part of the MHE, BB #22) support the RDM during its demil operation.

The RDM incorporates in excess of 200 assemblies; the major types and quantities contributing to maintenance actions are listed below:

Item	Quantity
Cylinder, hydraulic	34
Hose, hydraulic & agent drain (flexible)	33
Regulator, pressure	1
Controller, flow (with check valve)	6
Valves, solenoid	6
Valves, hydraulic check	3
Switches, limit	26
Switch, pressure	3
Switch, float	4
Bushings	4
Rollers (with bearings)	6
Motor	7
Saw blades	6
Pumps, diaphragm	1

4.5.3 Special and Safety Requirements

Level A protective clothing must be worn by maintenance personnel. All munitions must be removed from the RDM and ECC prior to maintenance actions. Local control of the RDM is vital from a safety standpoint during maintenance to preclude inadvertant operation of saws, punches, jaws, etc.

Following RDM removal from the ECC after having been exposed to nerve agent during rocket demil, it is necessary that the RDM be isolated during its standby storage. Isolation must be secure from personnel contact when not in proper protective clothing. Before placing in storage, the RDM must be detoxified (as much as practical) and preserved from atmospheric elements. See section 6.3 for additional details.

4.5.4 Typical Preventive Maintenance Actions (PMA)

Typical PMA's will consist of lubrication of bearings, bushings, rollers and pumps; changing saw blades and punches; adjusting position switches; tightening fasteners; inspecting hydraulic hoses for signs of leaks or impending failure; housekeeping.

PMA's can be handled by one man of moderate maintenance skills, using 2.0 manhours per week.

4.5.5 Typical Corrective Maintenance Actions (CMA)

Typical CMA's are envisioned primarily as removal and replacement of component assemblies, such as:

- cylinders
- hoses, flexible
- valves (solenoid, check)
- switches (limit, pressure)
- motors
- saw blades (unscheduled broken or dulled blades)
- pump

Typical CMA can be handled by one man, an electro-mechanical type.

4.5.6 Material and Tools

No special materials or tools were identifed. A standard set of mechanics tools will handle both PMA's and CMA's.

4.5.7 Facilities

Special storage (see para. 4.5.3 above) for the RDM must be provided between usage.

4.6 DUNNAGE INCINERATOR, (DUN), BB#07

4.6.1 Purpose

The Dunnage Incinerator (DUN) is housed within a metal shelter and is utilized to burn only non-contaminated dunnage (such as pallets and wooden boxes) removed from munitions.

4.6.2 Description

The DUN is a multiple chamber oil fired incinerator with an induced draft fan and a wet scrubber module.

Principle components requiring maintenance actions are:

- 3 - oil burners
- 1 - induced draft fan and motor
- 3 - belt drive for draft fan
- 1 - scrubber separator tank
- 1 - recirculation tank
- 1- recirculating centrifugal pump/motor
- numerous valves, solenoids, gages
- bearings (fan and recirculation pump)

4.6.3 Special and Safety Requirements

Level E clothing may be worn by maintenance personnel.

4.6.4 Typical Preventive Maintenance Actions (PMA)

Typical PMA's will consist of lubricating bearings, motors and seals; inspection of and cleaning of scrubber, separator and recirculation tanks. One man expending an estimated 0.5 manhours per week can handle PMA's.

4.6.5 Typical Corrective Maintenance Actions (CMA)

Typical CMA's will consist of removal and replacement of fan belts, recirculating pump seals, fan drive bearings, burner components (motor, transformer, electrodes), valves, filters and switches.

CMA's can be handled, generally by one electro-mechanical maintenance man.

4.6.6 Materials and Tools

No special materials or tools were identified.

4.6.7 Facilities

No DUN unique maintenance facilities are required.

4.7 UTILITIES HOUSING (UTL), BB #08

4.7.1 Purpose

The purpose of the Utilities Housing is to provide an enclosed area for the boiler plant, compressed air supply system, hydraulic system and the 480 volt emergency electrical generator system. It should be noted that this latter system is considered part of the ELE and is so covered. The hydraulic system is limited to supplying requirements of the PPD during demil operations.

4.7.2 Description

The boiler system consists of two redundant oil fired boilers and independent boiler controls for supplying steam to the CAMDS systems. The compressed air supply system consists of two redundant air compressors capable of delivering air requirements of the CAMDS equipment. The hydraulic system consists of a single hydraulic pump and associated accumulator, filters, pressure reduction and control valves.

Because of the redundancy in the steam and air systems, maintenance may be performed at any time on the standby unit.

4.7.3 Special and Safety Requirements

This area is considered non toxic; no UTL unique agent related safety requirements exist.

4.7.4 Typical Preventive Maintenance Actions (PMA)

Typical PMA's encompass inspections and services as follows:

Hydraulic Unit

- Replenish hydraulic fluid supply as required
- Clean hydraulic filters (pump intake, reservoir return)
- Change oil at 1000 hour intervals
- Inspect for hydraulic fluid leaks; repair as required

Boiler System

- Service water softners (recharge)
- Service chemical feed units
- Lube water pumps
- Service burners (flame guard control cleaning)
- Clean fuel oil filters

Diesel Engine

- Add or change crank case oil
- Replace filters (air,oil)
- Inspect radiator fan belt, replace as required
- Lube engine (water pump, control linkage, etc.)
- Add or replace radiator anti-freeze fluid.

Compressors

- Add or change crank case oil
- Inspect drive belts (replace and/or adjust tightness as required)
- Replace air filters

One man can handle these PMA's working one hour per week.

4.7.5 Typical Corrective Maintenance Actions (CMA)

CMA is assumed under the cognizance of the Tooele Maintenance Depot as discussed in Section 6.2.3.

4.7.6 Materials and Tools

No special materials or tools were identified.

4.7.7 Facilities

No UTL unique maintenance facility requirements were identified.

4.8 ECC HYDRAULIC MODULE (EHM), BB #09

4.8.1 Purpose

The EHM supplies the hydraulic requirements for the ECC, the ECC input and output conveyors, and all epuipment within the ECC (RDM, PDM, MIN, MOR).

4.8.2 Description

The EHM consists of a 20 GPM electric motor-driven hydraulic pump mounted on a reservoir. It includes an accumulator (nitrogen charged), check valves and sensors (temperature, pressure and level) for remote computer monitoring of the system.

The EHM comprises some 50 component assemblies; those contributing significantly to maintenance actions listed below:

Item	Quantity
Pumps, hydraulic piston type	1
Accumulator, hydraulic, nitrogen charged	1
Filters	2
Switch, float	2
Motor	1
Temperature Sensor	1
Valve, check	1
Valves, control	40

4.8.3 Special and Safety Requirements

Level B clothing will be worn by personnel performing maintenance actions. Oil, drained from the EHM system, will be burned in the Metal Parts Furnace.

4.8.4 Typical Preventive Maintenance Actions (PMA)

Typical PMA's will include servicing filters and inspecting plumbing for leaks and making scheduled repair as required. Hydraulic oil should be changed at approximate 1000 hours of operation.

PMA's can be handled by one man and require approximately 0.5 manhours per week.

4.8.5 Typical Corrective Maintenance Actions (CMA)

Typical CMA's will consist of removal and replacement of control valves, pump and motor.

Most CMA's envisioned can be accomplished by one electro-mechanical maintenance man.

4.8.6 Materials and Tools

No special materials, aside from hydraulic oil (type TBD) or tools were identified. A standard set of mechanics tools will handle both PMA's and CMA's.

4.8.7 Facilities

No EHM unique maintenance facilities requirement were identified.

4.9 AGENT DISTRUCTION SYSTEM (ADS), BB #13

4.9.1 Purpose

The Agent Distruction System detoxifies and neutralizes liquid agents GB and VX. The ADS also supplies neutralization solution (18% sodium hydroxide) to the MPF, DFS and CDS. The ADS also processes spent decon from all CAMDS sources. All brines and the resulting salts are packaged in 55-gal steel drums.

4.9.2 Description

Agent processing is conducted in toxic, negative pressure enclosures. The remainder of the ADS housing contains the brine bulk drying and utility units. A railroad unloading station and air compressor permits unloading of chlorine and hydrochloric acid.

The ADS incorporates in excess of 700 electro-mechanical assemblies. The significant types and approximate quantities contributing to preventive or corrective maintenance actions are listed below:

Item	Quantity
Vessels	4
Scrubbers	1
Agitators	13
Pumps	34
Heat Exchangers	12
Fans	5
Water treatment system	1
Tanks	27
Air Compressors	1
Control valves	80
Motors	76
Instrumentation	
Pressure recorders	12
Pressure indicators	8
Pressure transducers	20
Temperature recorders	18
Temperature Indicators	21
Temperature transducers	39

Item	Quantity
Instrumentation (con't)	
Flow recorders	10
Flow Indicators	10
Flow transducers	20
Level recorders	27
Level probes	27
pH recorders	8
pH probes	8
Speed recorders	15
Speed counters	15
Load cells & recorders	5
TV cameras	3

4.9.3 Special And Safety Requirements

Maintenance personnel will wear level A protective clothing during maintenance in the toxic cubicle. They will wear safety shoes and cotton gloves during palletizing of drums. Eye protection will be worn when handling caustic or acid. Eye washes and safety showers are available in the ADS area.

4.9.4 Typical Preventive Maintenance Actions (PMA)

The typical PMA will occur on weekends during which the ADS is shut down and is envisioned as follows:

- Inspect dynamic soft goods for signs of excessive wear or impending failure - Replace soft goods as required.
- Inspect agent/decon storage and detox reactor tanks and associated plumbing for leaks and schedule appropriate repair.
- Replace HVAC filters
- Remove clean, replace fluid strainer elements
- Lube pumps and motors
- Replenish hydraulic fluid, as necessary
- Inspect compressed air and fuel oil supply plumbing for leaks and schedule appropriate repair
- Calibrate process monitors (temperature, flow, level, pH, load cells) on a periodic schedule as required

Two men working approximately 3 hours total per week can handle preventive maintenance actions.

4.9.5 Typical Corrective Maintenance Actions (CMA)

A typical CMA can occur during a Demil run, requiring ADS shutdown or by isolating a subsystem and scheduling a work around situation. Or, the PMA can be carried out during demil shift downtimes or weekends. Typical CMA's are envisioned as removal and replacement of the following equipment(s):

- pump assemblies (includes motor, pump and drive)
- control valve assemblies
- agitator/mixer assemblies
- measurement transmitters (thermocouples, pH, pressure, flow)
- heaters/steam exchangers
- pipe sections
- pressure regulators

Two men can handle all CMA's.

4.9.6 Materials and Tools

Because only P&I diagrams were available for review, specific materials and tools could not be identified.

4.9.7 Facilities

No ADS unique maintenance facilities requirement were identified.

4.10 EXPLOSIVE TREATMENT SYSTEM (ETS), BB#14

4.10.1 Purpose

The ETS processes the sludge generated by the RDM and PDM through particulate and carbon filters to remove the explosive components prior to sludge disposition in the ADS. The ETS also prepares and supplies sodium carbonate decon solution for GB operations and stores sodium hypochlorite decon solution prepared in the CDS for supply on demand to the ECC during VX and mustard operations.

4.10.2 Description

Major components of the ETS include:

- a decon supply tank
- a vacuum conveyor for transfer of carbonate powder to the supply tank
- a vacuum conveyor for transfer of spent (wet) carbon
- a sludge surge tank
- a sludge holding tank
- 2 parallel particulate filters
- 3 activated carbon adsorption columns
- a control panel and monitoring equipment
- 3 tank agitators
- 6 pneumatically operated plug valves
- 2 manual sleeve valves
- 32 manual plug valves
- 3 centrifugal pumps

The system is situated in a separate ventilated housing which is nominally a non toxic area. However, inadvertent contamination is possible and safety precautions as delineated below are to be observed.

4.10.3 Special and Safety Considerations

All maintenance actions which result in the potential release and exposure to the explosive sludge or the chemical decon is to be performed with Level B protection. Routine preventive maintenance and maintenance actions which do not require the dismantling of the system may be performed in Level D protection provided the above limitation is observed.

4.10.4 Typical Preventive Maintenance Action (PMA)

Preventive maintenance consists of periodic equipment inspections and lubrication, and cleaning (flushing) of decon monitoring (pH, temperature, level) probes. All preventive maintenance actions are straight forward and readily accomplished with no special skill requirements.

For this analysis, it is assumed that filter bag and activated carbon changeouts are under the purview of, and will be accomplished by, the equipment operators. One man working for one hour per week can handle all PMA's.

4.10.5 Typical Corrective Maintenance Actions (CMA)

Typical corrective maintenance of the ETS encompasses removal and replacement of defective components or assemblies. Since the ETS is basically a simple system with no complex elements, fault isolation, correction and checkout is readily accomplished with no special skill requirements. Maintenance access to the ETS equipment is generally superior than nominal standards. A two men maintenance team is more than adequate to cover the identified maintenance actions necessary to support the ETS operation.

4.10.6 Materials

No special material requirements were identified beyond the normal inventory of spare parts and lubricants necessary to support the operation of the ETS. It is to be noted that filter bags, charcoal and decon chemical provisioning necessary to support the operation of the ETS is assumed, for this analysis the responsibility of the CAMDS Operations Office and not considered as maintenance resources.

4.10.7 Special Tools

None identified.

4.10.8 Facilities

No ETS unique maintenance facilities requirements were identified.

4.11 PROJECTILE DEMIL MACHINE (PDM), BB #15

4.11.1 Purpose

The PDM removes the explosive components from a projectile and cuts these components into sizes suitable for incineration in the Deactivation Furnace (DFS).

4.11.2 Description

The PDM is installed within the Explosive Containment Cubicle (ECC). The PDM consists of a projectile saw station, *supplementary charge removal station, a burster removal station and a burster saw station. Input and discharge conveyors (part of the MHE, BB #22) support the PDM during its demil operation.

The PDM comprises some 200 electro-mechanical assemblies; those types and quantities contributing to maintenance actions are listed below:

Item	Quantity
Motors	4
Gear boxes (reduction drives)	2
Pumps	4
Cylinder, hydraulic	22
Bearing, sleeve	8
Gage	4
Valves, control, hydraulic and pneumatic	16
Hose, pressure	6
Blades, saw	2
Conveyors, roller	4
Switches, position limit	14
Regulator, hydraulic pressure	1

*Not used at TEAD

4.11.3 Special and Safety Requirements

Level A clothing must be worn by maintenance personnel when working on the PDM within the ECC. Local control of the PDM is vital from a safety standpoint during maintenance to prevent inadvertent operation of saws, cylinder actuator jaws, etc.

Following PDM removal from the ECC after having been exposed to nerve agent during projectile demil, it will be necessary that it be isolated during standby storage. Isolation must be secure from possibility of personnel contact when not in proper protective clothing. Before placing in storage, the PDM must be detoxified (as much as practical) and preserved from atmospheric elements. See section 6.3.2 for additional details.

4.11.4 Typical Preventive Maintenance Actions (PMA)

Typical PMA's will consist of lubrication of bearings, gear boxes, pumps, conveyors, motors (if required), changing saw blades, calibrating gages; adjusting position switches, tightening fasteners, inspecting hydraulic and pneumatic hoses for signs of wear or leakage, and housekeeping.

PMA's can be handled by one man expending an estimated 2.0 manhours per week.

4.11.5 Typical Corrective Maintenance Actions (CMA)

Typical CMA's are envisioned as removal and replacement of components assemblies, which include:

cylinders
motors and gear boxes
pumps
gages
valves/switches
hoses
saw blades (unscheduled replacement of broken or dulled blades)

CMA can be handled by a crew of two electro-mechanical maintenance men.

4.11.6 Materials and Tools

No special materials or tools were identified.

4.11.7 Maintenance Facilities

A special standby storage facility will have to be provided for the PDM when removed from the ECC (see section 4.11.3 above).

4.12 PROJECTILE PULL AND DRAIN MACHINE (PPD), BB #18

4.12.1 Purpose

The Projectile Pull and Drain Machine removes the nose closure from non-bursted projectiles, thence the burster well and finally removes the VX and GB agent from within the projectile.

4.12.2 Description

The PPD is located within a toxic containment enclosure located within the Projectile Disassembly Facility (PDF).

The PPD consists of six separate processing stations; load, nose closure removal, burster well weld cutting, burster well pull, drain and unload stations.

The PPD machine comprises in excess of 200 electro-mechanical assemblies; the major types and numbers which will require maintenance are listed below:

Item	Quantity
Cylinders, hydraulic	19
Cylinders, pneumatic	2
Bearings (ball, cylinder, bushing)	76
Clutch, cam	1
Chain, roller	2
Brake, air operated	1
Switch, position	15
Motors	2
Head, milling	1
Belt, drive	1
Pump, diaphragm	1
Probes (redox, pH)	6
Valves, control	11
Valves, check	3

4.12.3 Special and Safety Requirements

Maintenance personnel must wear Level A clothing for maintenance of the PPD. Care is to be exercised to assure local control of the machine when performing maintenance tasks to ensure against inadvertent operation of cylinders, motors, etc.

4.12.4 Typical Preventive Maintenance Actions (PMA)

Typical PMA's will consist of lubrication of bearings, chains, pumps, and cams; servicing filters; adjusting position switches, belts, chains; servicing chemical probes, inspection and correcting minor hydraulic leaks.

Two men can handle all PMA's expending an estimated 1.5 manhours per week.

4.12.5 Typical Corrective Maintenance Actions (CMA)

Typical CMA's envisioned as removal and replacement of components, will involve:

Cylinders (hydraulic and air)
Chain, rollers (replacing link sections)
Belt, drive
Motors (fraction HP)
Pump, diaphragm
Valves, control
Switches

An electro-mechanical maintenance crew of two men is required to perform CMA.

4.12.6 Materials and Tools

No special materials or tools were identified. A standard set of mechanics tools will handle PMA and CMA's.

4.12.7 Facilities

No PPD unique maintenance facility requirements were identified.

4.13 CENTRAL DECON SYSTEM (CDS), BB #19

4.13.1 Purpose

The CDS prepares and supplies calcium hypochorite decon solution for CAMDS VX and mustard operations. It also stores sodium hydroxide decon solution prepared in the Agent Destruct System for supply on demand to the Projectile Pull and Drain Machine and the Bulk Item Facility for GB operations.

4.13.2 Description

The system essentially consists of pumps, decon mixing/storage tanks, pneumatically and manually operated valves and other ancilliary items. Major components of the system include:

- 2 centrifugal pumps
- 2 pneumatically actuated plug valves
- 17 manual plug valves
- 3 tank agitators
- a control panel and monitoring equipment
- a vacuum conveyor for transfer of hyprochlorite powder to the supply tank
- supply tank (HTH mixing and NaOH storage)
- 2 HTH holding tanks

The system is located in the Projectile Disassembly Facility in a non-toxic area.

4.13.3 Special and Safety Considerations

During maintenance operations, personnel will wear eye protection, rubber gloves and aprons (Level D protection) for protection against chemical spills.

4.13.4 Typical Preventive Maintenance Actions (PMA)

Preventive maintenance consists of periodic equipment inspections and lubrications, and cleaning (flushing) of the decon temperature, pH, and level probes. All PMA's are simple and readily accomplished with no special skill requirements. One man working roughly one manhour/week can handle all PMA's.

4.13.5 Typical Corrective Maintenance Actions (CMA)

Typical corrective maintenance primarily consists of removal and replacement of defective components. Since the CDS is basically a simple system , fault

isolation and correction, and functional checkout is generally accomplished with no special skill requirements; an instrument technician may be however, occasionally required to maintain certain elements of the CDS control panel.

Maintenance access is good for the CDS equipment; a two man maintenance team is more than adequate for all identified corrective maintenance actions.

4.13.6 Materials

Beyond the normal inventory of spare parts and lubricants, no special materials or consumables are required to support maintenance of the CDS.

4.13.7 Special Tools

None identified

4.13.8 Facilities

No CDS unique maintenance facilities requirement was identified.

4.14 BULK ITEM FACILITY (BIF), BB #21

4.14.1 Purpose

The Bulk Item Facility is situated within an enclosure located in the Projectile Dissassembly Facility. The purpose of the BIF is to drain large agent filled munitions and bulk storage containers.

4.14.2 Description

The Bulk Items Facility consists of a toxic munitions drain area wherein the munition drain fixtures and ancilliary piping system (pumps, tanks, valves, etc.) are situated, and a control room (non-toxic) where monitoring and control of agent draining and transfer, and decon flushing of agent filled munitions and bulk storage containers are effected. Also part of this facility are a buffer zone/air lock, a holding area, and a personnel decon room. The holding area serves as a storage, preparation and transfer area for items processed in the BIF. The buffer zone/ air lock isolates the toxic drain bay from the holding area and the personnel decon room provides Level A suit decon facilities for personnel conducting operations in the toxic munitions drain bay.

During demil operations, GB/VX (mustard ton containers are not processed through the BIF) filled munitions or bulk containers are transported into the toxic drain bay by means of an overhead hoist and placed on the drainage fixture. The fixtures are mechanized to support, position, and weigh the bulk items. To drain and flush ton containers, plumbing connections are made to the valved end through glove ports situated in the wall separating the drain bay and control room. For the bombs and spray tank, a pneumatically powered drill provides a hole through which a vacuum and fill tube is inserted to drain and flush the bombs/spray tank. Four drain fixutres are required to demil Bulk Items, each tailored to a specific Bulk Item type (i.e., Ton Container, MC-1 Bomb, Mk-94 Bomb and Spray Tank). Only one drain fixture can be used in the BIF at any one time.

The plumbing system to support agent drain and transfer, and bulk item flushing includes 2 diaphragm pumps, a decon supply tank, a sump tank, pneumatically actuated valves, manual valves and decon monitors (pH, temperature and level) and agitator.

The bulk item drain fixtures are typically similar and consists of hydraulic cylinders, motors, control valves, and gear boxes, jacks, load cells, air drills, agent and decon plumbing, position sensors (limit switches), frame assemblies and bulk item cradles.

4.14.3 Special and Safety Considerations

Maintenance in the BIF munitions drain bay is to be performed in Level A protection. Prior to any maintenance action, the bulk item drain fixture and supporting subsystems are to be disabled (safed) as necessary to prevent physical injury to personnel and equipment. Close coordination between the maintenance crew in the toxic area and the BIF control room is to be maintained to facilitate fault isolation, repair and checkout.

4.14.4 Typical Preventive Maintenance Action (PMA)

Preventive maintenance consists of inspections, lubrication and cleaning. When bombs or the spray tanks are being processed , preventive maintenance also includes periodic drill bit replacement. Manpower levels beyond two men for any preventive maintenance actions have not been identified. No special skills are required for preventive maintenance. Two men working an estimated two (2) manhours can handle weekly PMA's.

4.14.5 Typical Corrective Maintenance Actions (CMA)

Projected typical corrective maintenance actions consist of removal and replacement of defective components. Maintenance access is generally good; a two man crew in the toxic area is adequate for all CMA anticipated. Except for an instrument technician required to service certain elements of the BIF control panels, no special skill requirements were indicated.

4.14.6 Materials

No special materials or consumables are required to support the BIF.

4.14.7 Special Tools

To remove and replace the pneumatic air drill, used on the MC-1 and Mk-94 bomb fixtures, a strap wrench is required.

4.14.8 Maintenance Facilities

A storage facility for previously used (i.e. contaminated) BIF munition drain fixtures is recommended. This facility should be a special area, suitably isolated and ventilated with limited and controlled access, which could also serve as storage for contaminated spare parts (previously used , repaired or overhauled components which cannot be certified non-toxic). The alternative to this storage facility is the complete tear-down of the fixtures, disassembly of components, disposal of all "soft" items and thermal detoxidification of the metal parts.

4.15 MATERIAL HANDLING EQUIPMENT (MHE), BB #22

4.15.1 Purpose

The MHE transports munitions and munition parts between CAMDS building blocks during demil operations.

4.15.2 Description

Per the 3 October 1975 CAMDS/baseline, the MHE consists of the following conveyors:

- Rocket ECC Input Conveyor
- RDM Input Conveyor
- Rocket ECC Discharge and Segregating Conveyor
- DFS Input Conveyors
- ECC Bypass Conveyor
- PDF Input Conveyor
- Projectile Input Conveyor
- PSM Input Conveyor
- Projectile Burster Output Conveyor
- ECC Projectile Discharge Conveyor
- HE Discharge and Segregating Conveyor
- PDR 90^{o} Turn Station
- PDF Output Conveyor

The MHE transports munitions and munition parts between the CAMDS building blocks, and as implied by the conveyor nomenclatures, different conveyor combinations are used with different munition types. The majority of the conveyors are typically continuous belt or chain conveyors which are relatively simple to maintain.

Intermittent conveyors are also employed, typified by the Rocket Input Conveyor. However, like the continuous conveyors, these intermittent material handling devices are also relatively simple and easily maintained.

Principle functional components of the conveyors consists of

- Gear motors
- Hydraulic motors
- Hydraulic or pneumatic cylinders
- Conveyor belts or chains
- Bearings
- Position/Motion sensors

4.15.3 Special and Safety Considerations

Without exception, all maintenance of the conveyors is to be performed in level A protection. All tools and other support equipment used during maintenance are to be handled as contaminated items. Prior to any maintenance action, the conveyors are to be disabled (safed) and under the sole operational cognizance of the maintenance personnel.

4.15.4 Typical Preventive Maintenance Action (PMA)

Preventive maintenance consists of periodic inspection, lubrication, and cleaning. Periodic detailed inspection of belts and chains are to be performed to isolate and eliminate impending wearout failures. Manpower levels beyond two men for any preventive maintenance action, including belt/chain repair or replacement, cannot be identified. No special skills are required. An estimated one man hour weekly is required for PMA.

4.15.5 Typical Corrective Maintenance Actions (CMA)

Projected typical corrective maintenance action consists of removal and replacement of gear motors and cylinders which require approximately 16 and 8 hours respectively. Occasional adjustment, and removal and replacement, of other miscellaneous items (rollers, bearings, position sensors) are anticipated, however, these actions do not significantly influence maintenance resources. As in the case of preventive maintenance, a two man crew is adequate for performing corrective maintenance on the conveyors. No special skills requirement were identified.

4.15.6 Materials

Beyond the necessary inventory of spare parts and lubricants, no special materials or consumables are required to support the MHE.

4.15.7 Special Tools

No special tool requirements were identified.

4.15.8 Maintenance Facilities

No MHE unique maintenance facilities are required. Belts and chains will be repaired in-situ while other repairable components can be processed via the available decon/repair facilities.

4.16 FILTER SYSTEM (FIL), BB #23

4.16.1 Purpose

The Filter System is designed, along with ventilation systems of the various CAMDS enclosures, to ensure the containment of all airborne contamination within toxic enclosures, and to filter contamination from the exhaust air.

4.16.2 Description

Eleven air filter units serve the CAMDS toxic enclosures ranging in capacity from 333 CFM to 15,000 CFM.

Each filter contains a filter train consisting of prefilters, high efficiency particulate air (HEPA) filters, two banks of activated charcoal filters, and finally a second bank of HEPA filters. Filters are mounted in a skid-mounted housing along with blowers, air control vanes, pressure drop gages and sampling ports.

Significant equipment contributing to maintenance actions are:

Item	Quantity	
	Per Filter Unit	Total
Prefilter Bank	1	11
HEPA Filter Banks	2	22
Charcoal filter Banks	2	22
Fans	1	11
Motors	1	11
Dampers (volume control)	1	11
Gages	8	88

4.16.3 Special and Safety Requirements

For the smaller filters units (333 to 2000 CFM), filter changes are made using a "bag-in/bag-out" concept. Here Level B clothing is to be worn.

For the larger filter units (3000 to 15,000 CFM), maintenance personnel will be required to enter the unit for accomplishing filter changes. Here Level A clothing is required.

4.16.4 Typical Preventive Maintenance Actions (PMA)

Typical PMA will consist of:

- Filter/tray replacement
- Lubricate fan and motor bearings
- Calibrate gages/instruments
- Conduct in-place HEPA filter integrity leak tests
- Check fan belt tension/condition - adjust or replace
- Inspect unit for corrosion
- Conduct in-situ charcoal filter integrity tests.

Two men will be required to perform these PMA's, especially to accomplish bagging and handling of the filters and charcoal trays. PMA can be handled by scheduling one shift of weekend effort whenever filter change is indicated.

4.16.5 Typical Corrective Maintenance Actions (CMA)

Typical CMA's will consist of:

- Remove/replace fan and blower unit
- Remove/replace filter peripheral seals
- Remove/replace corroded metal parts, fasteners, etc.

Two men will be required to perform these tasks.

4.16.6 Special Tools

No special tools were identified.

4.16.7 Materials

- Bag-out bags: Vendor - CTI Nuclear, Inc. P/N - 119-1001 (11 MIL, 92" long x 132" circumference).

4.16.8 Special Instruments

The following special instruments are required to check integrity of the filter systems. These units are being supplied to Cryogenic Technology, Inc. (CTI).

Nomenclature	Model/Part No.
Particulate Detection Apparatus	TDA-2D
DOP Generator	TDA-5A
Freon Detector	TDA-55
Halon Metering Device	*

4.16.9 Special Equipment Requirements

There is a need for special equipment and/or procedures to preclude contaminated air diffusion to atmosphere when manned entry is made into the filter systems for maintenance actions. Also step-stools must be provided for use in the larger filters to enable access to the charcoal trays. These stools are to remain inside the filter housing.

4.16.10 Maintenance Facilities

No unique FIL maintenance facilities are required.

*There is a need for a metering device for use in the injection of the challenging agent (Halon 12) upstream of the carbon filter bed. Such a device was not identified by CTI.

4.17 MORTAR DEMIL MACHINE (MOR), BB #24

4.17.1 Purpose

The purpose of the Mortar Demil Machine is to unscrew the M8 fuse with the M14 burster attached from the 4.2 inch mortar shell, then unscrew the fuze from the burster.

4.17.2 Description

At the present time, the MOR machine has not been completely designed and is not included in the 3 October 1975 CAMDS baseline. Preliminary sketches, provided to TRW to support the Task 2 efforts, grossly identify the mechanization approach but lack detail to permit comprehensive maintenance resource assessment. As such, the maintenance resource analysis of this building block represents best estimates based on the data available. When the MOR design is finalized, the CAMDS maintenance resources should be reviewed to ascertain that the needs of this demil machine can be accommodated by the resources identified.

4.17.3 Special and Safety Considerations

This machine normally does not affect the integrity of the mortar agent contaminant vessel. However, because this machine is situated in a nominally toxic area (the ECC) and because inadvertent agent release during demil operations can not be totally assured, level A protection is mandatory for all maintenance. Prior to maintenance actions, the MOR machine and ECC should be disabled to prevent personnel injury or equipment damage and control of the equipment should be vested solely with the personnel maintaining the MOR for as long as maintenance actions are in process.

4.17.4 Typical Preventive Maintenance Actions (PMA)

Specific preventive maintenance actions cannot be identified with data (preliminary sketches) available. However, no unusual or extensive preventive maintenance requirements are implied by the sketches. It is estimated that two men working one manhour (at most) per week can accomplish PMA's.

4.17.5 Typical Corrective Maintenance Actions (CMA)

The major functional components of the MOR machine appear to be hydraulic cylinders, motors and control valves, and position sensors. Corrective maintenance will therefore consist primarily of removing and replacing these components.

Maintenance access appears adequate; a two man crew will probably suffice for most maintenance. No special skill requirements can be identified.

4.17.6 Materials

No special materials were identified.

4.17.7 Special Tools

No special tools requirement were identified.

4.17.8 Maintenance Facilities

A special storage facility for the MOR machine is required after it has been utilized and contaminated.

4.18 MINE DEMIL MACHINE (MIN), BB #25

4.18.1 Purpose

The MIN machine drains the agent (VX) and removes the explosive components from the M-23 land mines.

4.18.2 Description

The MIN machine consists of the following major elements, most of which are embodied at one station (exceptions are the conveyors and the agent drain subsystem):

- Mine input conveyor
- Mine inside conveyor
- Mine discharge conveyor
- Agent drain subsystem
- Hydraulic clamps
- Hydraulic punches
- Booster retainer ring remover
- Booster removal device
- Adaptor plate removal head

Per the 3 October 1975 baseline, most of these elements are fairly well defined, except for the agent drain subsystem, for which no drawings were available. Unfortunately, the agent drain subsystem is one of the major, more complex and involved elements of the system. This analysis, is therefore not to be considered complete, until the agent drain subsystem is analyzed following drawing completion.

The mechanization of the MIN machine is generally straight forward and relatively simple. While numerous items are involved, all of which must function properly in a prescribed sequence, the individual elements are simple and do not require any specialized or extensive maintenance.

4.18.3 Special and Safety Considerations

Without exception, all maintenance of the MIN machine is to be performed with level A protection. Prior to any maintenance actions, the ECC shall be voided of all explosives and the MIN machine and ECC disabled (safed) to prevent personnel injury or equipment damage. Control of the MIN machine and ECC is to be vested solely with the personnel performing maintenance on the MIN machine for as long as maintenance actions are in process.

4.18.4 Typical Preventive Maintenance Actions (PMA)

Preventive maintenance for the MIN machine, with the exception of the agent drain subsystems, is straight forward and simple consisting principally of inspection, lubrication and adjustments of conveyor belts and limit switches. Periodic replacement of the punches are required as well as replacement of punch seals and the clamping jaws butyl rubber facings (which seals against the mine body).

Lack of data on the agent drain subsystem precludes identification of specific preventive maintenance requirements. However, per the description of the MIN machine in the draft Demil Plan, reference 2, no unusual or extensive preventive maintenance actions are implied, and none are assumed in this assessment.

All preventive maintenance (estimated at 1 hour weekly) identified can be performed adequately by the two men crew which is mandatory in level A toxic areas. No special skills are required.

4.18.5 Typical Corrective Maintenance Action (CMA)

Projected typical corrective maintenance action consists of removal and replacement of hydraulic cylinders and gear motors. Occasional adjustments, or removal and replacement of other miscellaneous items (conveyor belts, take-up rollers, position sensors, pressure switches) are anticipated, however these actions do not significantly impact maintenance resource determinations. A two man crew is more than adequate for most of the corrective maintenance actions identified. No special skill requirements have been identified for this building block.

4.18.6 Materials

No special material needs have been identified to support the MIN machine beyond the MIN unique spare parts.

4.18.7 Special Tools

No special tool requirements were identified.

4.18.8 Maintenance Facilities

A special storage facility is required to store the contaminated MIN machine after use.

4.19 PIPING (PIP), BB #26

4.19.1 Purpose

The piping system transfers all fluids throughout the CAMDS site; air, water, steam, drained agent (GB/VX), fresh and spent decon, hydraulic fluid, scrubber brine and fuel oil.

4.19.2 Description

Main water and fuel oil are piped underground. All other piping is installed above ground via pipe racks. Electric heating tape is utilized on exposed agent and water lines to prevent freezing. The decon solution lines, fabricated using polypropylene lined steel pipe, are traced with steam lines to prevent freezing. The agent lines are double walled; agent within the inner pipe, with negative air pressure and agent monitors between the inner and outer pipes.

The pipes themselves will require negligible maintenance. The component assemblies listed below will require maintenance activity.

Item	Quantity
• Valves, gate	90
• Valves, plug	4
• Valves, ball	6
• Valves, diapragm, flow control	3
• Valves, punch, flow control	15
• Valves, globe	3
• Switches, limit	3
• Regulators	3
• Gauges, pressure	3

4.19.3 Special and Safety Requirements

Maintenance on the agent or spent decon lines requires level A protective clothing. Lines are to be flushed with a neutralizing solution and isolated before entry is made for repair action.

4.19.4 Typical Preventive Maintenance Actions (PMA)

Typical PMA's will be limited to periodic inspection of lines for leakage, refurbishment of weather protection and calibration of gauges, sensors, etc.

No special skills are required; approximately 0.5 man hours per week should be allocated for PMA.

4.19.5 Typical Corrective Maintenance Actions (CMA)

CMA's will consist of removal and replacement of valves, regulators, limit switches, gauges and sensors. Occasional piping replacement/additions may be required.

An electro-mechanical maintenance type is required.

4.19.6 Materials and Tools

No special materials or tools were identified.

4.19.7 Maintenance Facilities

No unique piping maintenance facilities are required.

4.20 ELECTRICAL DISTRIBUTION SYSTEM (ELE), BB #27

4.20.1 Purpose

The electrical distribution system supplies and distributes commercial and emergency standby power throughout the CAMDS site.

4.20.2 Description

Electrical power is supplied at the 12,470 volt level by Utah Power & Light Co. At the CAMDS site, this power is reduced to 208V and 480V and is connected to six motor control centers. All power cables are supported in cable trays throughout the CAMDS complex.

Three diesel engine driven emergency standby generators provide power in case of commercial power failure to ensure safe shutdown of the demil operations.

Details of the emergency standby generator sets were not available for review. The secondary power contains in excess of 1000 electromechanical switching and overload units. The significant types and approximate quantities contributing to preventive or corrective maintenance are listed below:

Item	Quantity
• Breakers, circuit	482
• Relays	4
• Starters, motor	49
• Contactors	5
• Transformers, control	63
• Heaters, overload	115
• Fuse, buss	62

4.20.3 Special and Safety Requirements

No special requirements during CMA or PMA were identified.

4.20.4 Typical Preventive Maintenance Actions (PMA)

The typical PMA will consist of visual observation/inspection to determine physical condition of wiring insulation, arcing conditions indicating loose connections, or other conditions where impending component failure is evident. The exposed power cables running between CAMDS housings in cable trays should be inspected periodically for indications of insulation damage from vermin

infestation. The emergency diesel engine will require servicing in the form of lubrication, filter changes, fan belt tightening/replacement and fuel injector cleaning.

One man can handle PMA's, expending an estimated one manhour per week.

4.20.5 Typical Corrective Maintenance Action (CAM)

Typical CMA's will consist of removal and replacement of switching components, i.e., circuit breakers, motor starters, control transformers, and fuses. CMA on the emergency diesel engine is to be accomplished at the Depot level as discussed in Section 6.2.3.

One man can handle typical CMA's.

4.20.6 Materials and Tools

No special materials or tools are required - a standard set of electricians tools will handle typical CMA's.

4.20.7 Maintenance Facilities

No ELE unique maintenance facilities requirement was identified.

4.21 CLOSED CIRCUIT TELEVISTION SYSTEM (CTV), BB #30

4.21.1 Purpose

The Closed Circuit Television System (CTV) remotely monitors critical operation in hazardous and/or unmanned areas.

4.21.2 Description

The CTV consists of television cameras and monitors. Controlled zoom and pan/tilt mounts are used in the majority of locations. Cameras are located in the UPA, ECC, DFS, PDF, ADS and MPF.

Failure of individual CTV components will not automatically cause a production line shutdown.

4.21.3 Special and Safety Requirements

Entry into contaminated buildings for camera removal/replacement will require wearing of level A protective clothing.

4.21.4 Typical Preventive Maintenance Actions (PMA)

The typical PMA will consist of visual observation/inspection of component mounting integrity and periodic camera lens cleaning. Cable trays carrying TV cables between buildings will also require infrequent examination to assess cable condition.

One man can handle all PMA's, requiring approximately 0.5 manhours/week.

4.21.5 Typical Corrective Maintenance Actions (CMA)

Typical CMA's will consist of removal and replacement of cameras, pan and tilt mounts/controls, and signal cables.

4.21.6 Materials and Tools

No special materials or tools were identified from the data available for review.

4.21.7 Maintenance Facilities

No unique CTV maintenance facilities requirement was identified.

4.22 COMMUNICATION SYSTEM (COM), BB #31

4.22.1 Purpose

The Communication System provides communication throughout the CAMDS site.

4.22.2 Description

The COM consists of a central exchange, phone extension and amplified public address speakers. Personnel working in level A clothing are provided with direct communication to supervisory personnel.

Failure of individual communication components will not automatically cause a production line shutdown.

4.22.3 Special and Safety Requirements

Entry into contaminated buildings for removal/replacement of communication equipment requires wearing of level A protective clothing.

4.22.4 Typical Preventive Maintenance Actions (PMA)

The typical PMA will consist of:

- Adjusting amplifiers for proper speaker audio level and clarity.
- Checking cable terminals at speakers for connection solidarity.
- Inspecting cable trays to assess cable condition.

One man can handle all PMA's, requiring approximately 0.5 manhours per week.

4.22.5 Typical Corrective Maintenance Actions (CMA)

The typical CMA will consist of removal and replacement of telephone units, speakers (including head sets) and cable sections. Amplifiers will also require infrequent replacement.

4.22.6 Materials and Tools

No special materials or tools were identified from the data available for review.

4.22.7 Maintenance Facilities

No COM unique maintenance facilities requirement was identified.

4.23 SITE CONTROL SYSTEM (SCS), BB #35

4.23.1 Purpose

The Site Control System (SCS) provides a means of automatically controlling and/or monitoring the operations of the CAMDS systems.

4.23.2 Description

Basic demil machines and attendant conveyors are under direct control of this computer based system which permits logic and operational sequences to be stored in a memory bank. The system has capability of processing digital inputs/outputs for controlling machine control devices such as solenoid valves and motor starters.

The computer also has analog input/output capabilities to monitor/control quantitative signals.

A semi-automatic, multi-programmer control overide exist, which will allow manual machine operation for fault diagnostic purposes or functional check-outs of the SCS.

4.23.3 Special and Safety Requirements

Level F clothing is to be worn during PMA or CMA.

4.23.4 Typical Preventive Maintenance Actions (PMA)

PMA will be limited to periodic diagnostic program checks of the computer and its peripheral equipment.

4.23.5 Typical Corrective Maintenance Action (CMA)

CMA will consist of fault isolation to the basic replacable module level and replacement of defective modules.

One man can conduct CMA's.

4.23.6 Materials and Tools

No special materials or tools are required beyond that normally provided by the computer manufacturer.

4.23.7 Maintenance Facilities

No SCS unique maintenance facilities are required.

5.0 MUNITION LINE ASSESSMENTS

As in the building block assessment, Section 4.0, the 3 October 1975 CAMDS baseline served as the basis for the munition line assessments. Eight distinct CAMDS munition line configurations are required to demilitarize the various munitions specified. These munition line configurations, as well as the different munitions and agent containers are described in the August 1975 draft of the CAMDS Demil Plan, Reference 2. The different munition lines evaluated include,

M55 Rocket, GB or VX
Projectiles/Cartridges with Bursters, GB or VX,
Projectiles/Cartridges without Bursters, GB or VX
Projectiles with Bursters, Mustard,
4.2 Inch Mortar, Mustard,
M23 Mine, VX,
Bulk Items, GB or VX
Ton Containers, Mustard

Utilizing the results of the building block assessments, Section 4.0, and the results of the munition line study of the CAMDS Maintenance and Reliability Assessment, Reference 1., representative munition line maintenance requirements were defined. The CMA requirements of constituent building blocks were consolidated to create munition line level requirements. The projected munition line MTTR's and MTBF's of Reference 1 were used to gauge the personnel (skills and number) requirements necessary to effect correction of single point failures in the munitions line; only manpower levels necessary to effect the actual maintenance actions were identified. Identification of personnel requirements to support maintenance actions as dictated by CAMDS safety considerations were deferred to the overall CAMDS level assessment where it can be better addressed to ensure effective personnel deployment and maximum efficiency.

Building block PMAs were also consolidated, as well as any special tools, equipment or facilities, to a munition line level requirement.

Summary results of the munition line assessments are presented in the following.

5.1 M55 ROCKET DEMIL LINE

5.1.1 Munition Line Description

In this process, shown in Figure 5-1, the rockets are transported on pallets from the storage igloo to the Munition Holding Area (MHA). At both these locations, the rockets are subjected to inspection for possible agent leakage. The rockets are transported by a forklift from the MHA to the Unpack Area (UPA). Here the rockets are removed from their pallets and fed, one-at-a-time onto a conveyor which takes them to the Explosive Containment Cubicle (ECC). The empty pallets and other burnable dunnage are fed to the Dunnage (DUN) incinerator for burning and the resultant ash is sent to disposal.

In the ECC, the rockets are processed in the Rocket Demil Machine. First holes are punched through the war head to drain the agent which is sent to the Agent Distruct System (ADS). The rockets are then cut into seven pieces; the rocket segments are sent to the Deactivation Furnace System (DFS), and the explosive sludge generated by the sawing operation is sent to the Explosive Treatment System (ETS), for processing. In the DFS, the rocket propellant and explosives are burned and any residual agent on inert parts is incinerated. Thermally decontaminated metal parts and fiberglass are sent to the disposal area via the Material Handling Equipment (MHE). Brine, continuously removed from the DFS scrubber, is transferred to brine retention tanks. Full brine tanks are sampled by the chem lab for certification as non toxic, the brine is then pumped to the ADS for drying.

The ADS also neutralizes and dries the agent drained from the rocket. The salts produced during the drying process are drummed and after chem lab certification, are sent to disposal.

The decon solution for GB is sodium carbonate, which is prepared in the ETS, and is pumped to the ECC for use in the RDM. Calcium hypochlorite, used during VX filled rocket demil operations, is prepared in the Central Decon System (CDS) and pumped, on demand, for use in the ECC. The decon sludge, generated by the rocket sawing operation is sent from the ECC to the ETS, where the explosive material is filtered out and removed from solution by further processing through charcoal absorber colums. The resulting explosive-free filtrate is sent to the ADS for detoxification and drying. After chem lab certification, the drummed salts are sent to storage. Metal and fiberglass particules are sent from the ETS to the DFS to be burned.

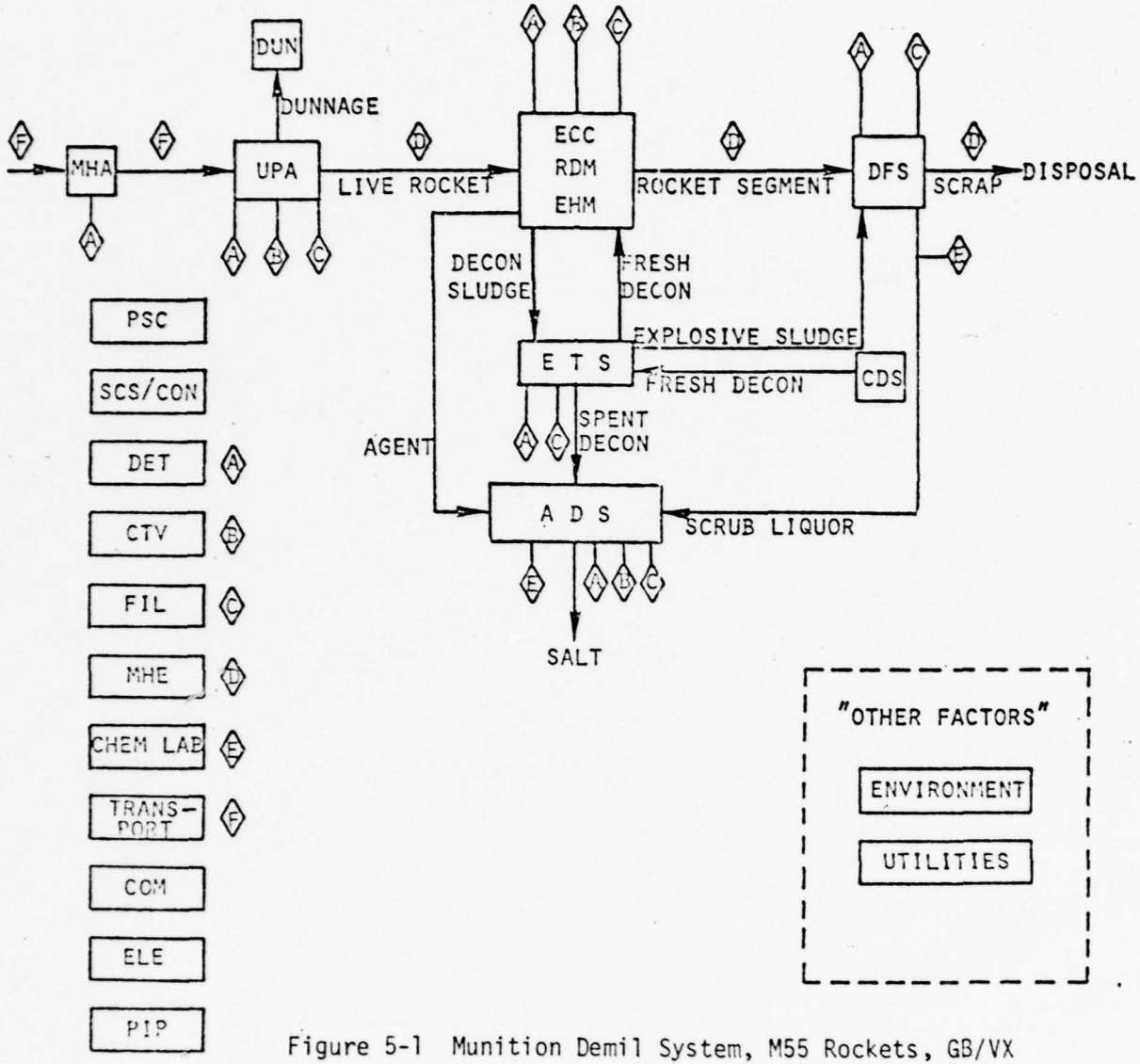

Figure 5-1 Munition Demil System, M55 Rockets, GB/VX

5.1.2 Corrective Maintenance Action (CMA) Manning

Table 5-1 summarizes the MTTR, MTBF, availability and the maintenance manpower requirements of the munition line and its constituent building blocks as determined by the building block assessments summarized in Section 4.0 and the CAMDS Maintainability and Reliability Assessment, Reference 1.

Considering only single failures in compliance with the study constraints, (no multiple building block failures), it is evident from Table 5-1 that at most, a two man level of effort is required to perform the actual corrective action necessary. It is to be noted, however, that because MTTR is in excess of two hours, multiple work crews must be used in relays of two hour stints for corrective actions in contamination (level A) areas.

In addition, Table 5-1 indicates (excluding the UTL, DET, and Transportation which are considered by others) that the RDM, EHM, ADS, MHE, DFS, and SCS are the munition line elements which dictate most significantly, the following line maintenance crew requirements.

1. A minimum of two electro-mechanical repairmen specially trained in process equipment, monitors, controls and instruments, to support the ADS and DFS.
2. A minimum of two repairmen with a good basic foundation of maintenance of hydro and electro-mechanical machines, to support the MHE, RDM and EHM.
3. At least one electronics technician specially trained to diagnose and correct faults in the SCS system.
4. A capability of supporting continuously, a two man level of effort in level A suits within the CAMDS safety constraints and work rules.
5. A general capability of supporting maintenance in all other non level A contaminated areas.

Except as noted above, no other unique skills or personnel requirements were isolated for this munition line.

TABLE 5-1 M55 ROCKET DEMIL LINE MAINTENANCE AND RELIABILITY SUMMARY
(VX LINE SHOWN BELOW AS TYPICAL)

BUILDING BLOCKS		CORRECTIVE MAINTENANCE				PREVENTIVE MAINTENANCE	
		MTBF	MTTR	AVAILABILITY	MEN REQ'D FOR CMA	EST PMA MAN HRS WEEKLY	MEN REQ'D FOR PMA
UPA	Unpack Area	N/A	N/A	≈1.0	1	0.2	1
ECC	Explosive Contain Cubical	1960	12.0	0.994	1	0.4	1
RDM	Rocket Demil Machine	377	12.3	0.968	1	2.0	1
UTL	Utilities	N/A	N/A	≈1.0	**	1.0	1
EHM	ECC Hydraulics	545	10.1	0.982	1	0.5	1
ADS	Agent Destruction System	210	7.6	0.965	2	3.0	2
ETS	Explosive Treatment System	2539	5.7	0.998	2	1.0	1
CDS	Central Decon System	3896	4.6	0.999	2	1.0	1
MHE	Material Handling Equipment	217	11.6	0.949	2	1.0	2
DFS	Deactivation Furnace System	397	6.9	0.983	2	6.0	2
FIL	Filter System	1571	7.1	0.996	2	***	2
PIP	Piping	20K	2.9	≈1.0	1	0.5	1
ELE	Electrical	1961	2.0	0.998	1	1.0	1
CTV	Closed Circuit Television	8760	2.0	≈1.0	1	0.5	1
COM	Communications	2738	3.0	0.999	1	0.5	1
SCS	Site Control System	359	2.1	0.994	1	0.5	1
DET	Detectors	700	1.0	0.999	*	*	*
	Transportation	350	1.0	0.997	**	**	**
Total Munition Line		38.0	7.03	0.844	2 Max	19.1	2 Max

Men Req'd: Reflects actual manning required to effect CMA or PMA. Requirements of buddy system not included (to be considered later)

* Not considered, see Section 3.0

** CMA will be accomplished at depot level section.

*** Deferred maintenance (filter change-out), must be scheduled as needed

5.1.3 Preventive Maintenance Action (PMA) Manning

Table 5-1 summarizes the estimated PMA required during weekend shut down of the CAMDS equipment. It does not include deferred corrective maintenance, the requirements for which is not forecastable, nor readily quantified.

Total weekly average PMA is estimated at approximately 19 man hours, 14 of which are performed in level A suits. To conform with safety work rules relative to the level A suit work period limitation and the buddy system, a PMA crew of about 6 is required, working two shifts. No special PMA related skill requirement was identified.

5.2 PROJECTILE/CARTRIDGES WITH BURSTER DEMIL LINE

5.2.1 Munition Line Description

NOTE

The only burstered munition in this class located at Tooele, is the GB filled 105 mm M360 cartridge. The rounds are packaged two to a box, 12 boxes to a pallet.

In this process shown in figure 5-2, the pallets are transported from their storage igloos to the Material Handling Area (MHA), where they are temporarily held until required for processing. In the meantime, the boxes are inspected for agent leakage at both the igloo and MHA.

A fork lift is used to take the pallet from the MHA to the Unpack Area (UPA), where the rounds are removed from the packing container, placed on a conveyor which feeds the round to the Explosive Containment Cubicle (ECC). The propelling charge and cartridge case remain in their original packing container and are sent to storage.

In the ECC, the round is fed into the Projectile Demil Machine (PDM). The round first enters the saw station where the fuse or nose closure plug is sawed off the projectile. A cut is made through the fuse burster to expose the burster pellet, so that it will burn instead of detonating in the Deactivation Furnace System (DFS). The explosive sludge generated in the PDM sawing operation is pumped to the Explosive Treatment System (ETS) where the saw cuttings and explosive components are filtered out, and sent to the DFS for incineration; the filtrate is pumped to the Agent Destruction System (ADS) for detoxification, drying and disposal. The projectile is moved to the next PDM station where the burster is removed from the burster well. The burster is cut up into two sections. The fuse or nose closure, and cut up burster are fed to the DFS, where they are incinerated or thermally deactivated and sent to disposal.

The round is then conveyed from the ECC to the Projectile Disassembly Facility (PDF) to be processed in Projectile Pull and Drain Machine (PPD). In the PPD, the projectiles burster well is removed, the agent vacuum drained and transferred to the Agent Destruction System (ADS). The burster well is passed through a decon bath; decon being supplied by Central Decon System (CDS). The spent decon from the PPD is sent to the ADS. The empty round and burster well are then conveyed to the Metal Parts Furnace (MPF) for thermal decontamination. After being certified, the metal parts from the MPF are sent to scrap disposal.

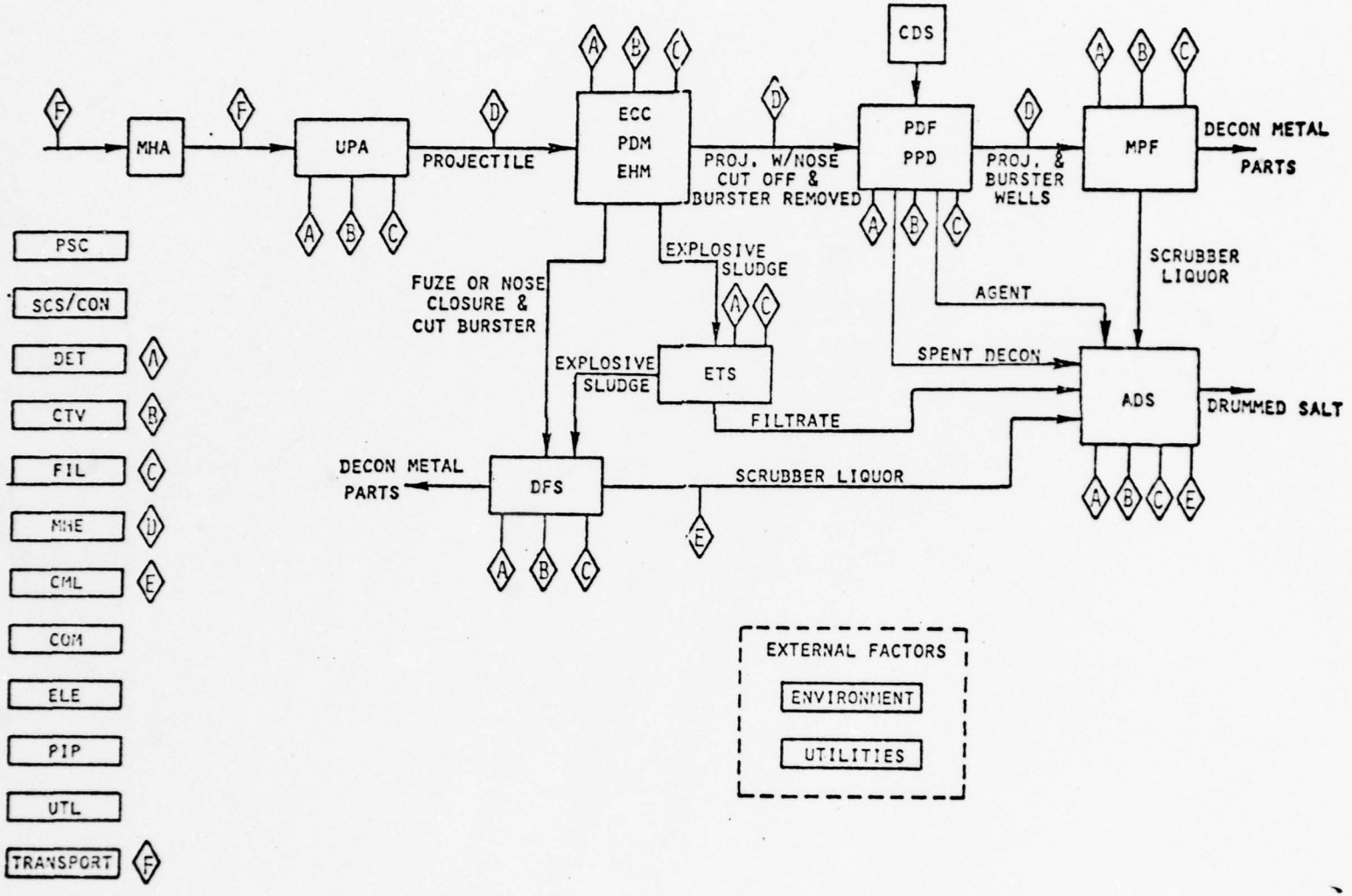

Figure 5-2 Munition Demil System - GB/VX With Bursters, Projectiles/Cartridges

The ADS neutralizes the agent and spent decon from the PDF/PPD. Liquor containing agent residuals from the MPF/DFS scrubbers are also detoxified and dried; salts produced are chemically analyzed, and upon certification, are drummed and sent to storage.

5.2.2 Corrective Maintenance Action (CMA) Manning

Table 5-2 summarizes the MTTR, MTBF, availability and the maintenance manpower requirements of the munition line and its constituent building blocks as determined by the building block assessments summarized in Section 4.0 and the CAMDS Maintainability and Reliability Assessment, Reference 1.

Considering only single failures in compliance with the study constraints, (no multiple building block failures), it is evident from Table 5-2 that at most, a two man level of effort is required to perform the actual corrective action necessary. It is to be noted, however, that because MTTR is in excess of two hours, multiple work crew teams must be used in relays of two hour stints for corrective actions in contaminated (level A) areas.

In addition, Table 5-2 indicates (excluding the UTL, DET and Transportation which are considered by others) that the ADS, DFS, MPF, EHM, PDM, PPD, MHE, and SCS are the munition line elements which dictate most significantly, the following line maintenance crew requirements.

1. A minimum of two electro-mechanical repairmen specially trained in process equipment, monitors, controls and instruments, to support the ADS, MPF and DFS.
2. A minimum of two repairmen with a good basic foundation of maintenance of hydro and electro-mechanical machines, to support the EHM, PPD, MHE, and PDM.
3. At least one electronics technician specially trained to diagnose and correct faults in the SCS system.
4. A capability of supporting continuously, a two men level of effort in level A suits within the CAMDS safety constraints and work rules.
5. A general capability of supporting maintenance in all other non level A contaminated areas.

Except as noted above, no other unique skills or personnel requirements were isolated for this munition line.

TABLE 5-2 PROJECTILE/CARTRIDGES WITH BURSTER DEMIL LINE

MAINTENANCE AND RELIABILITY SUMMARY

BUILDING BLOCKS		CORRECTIVE MAINTENANCE				PREVENTIVE MAINTENANCE	
		MTBF	MTTR	AVAILABILITY	MEN REQ'D FOR CMA	EST PMA MAN HRS WEEKLY	MEN REQ'D FOR PMA
UPA	Unpack Area	N/A	N/A	1.0	1	0.2	1
ECC	Explosive Contain Cubicle	879	11.7	0.987	1	0.4	1
DFS	Deactivation Furnace System	397	6.9	0.983	2	6.0	2
MPF	Metal Parts Furnace	228	8.8	0.963	2	4.0	2
UTL	Utilities	231	10.0	0.959	**	1.0	1
EHM	ECC Hydraulics	231	10.0	0.959	1	0.5	1
ADS	Agent Distruction System	294	7.0	0.977	2	3.0	2
ETS	Explosive Treatment System	2539	5.70	0.988	2	1.0	1
PDM	Projectile Demil Machine	224	12.7	0.947	2	2.0	1
PPD	Projectile Pull & Drain Machine	195	10.4	0.950	2	1.5	2
CDS	Central Decon System	3896	4.6	0.999	2	1.0	1
MHE	Material Handling Equipment	184	8.1	0.958	2	1.0	2
FIL	Filter System	1031	7.1	0.993	2	***	2
PIP	Piping	20K	2.9	1.0	1	0.5	1
ELE	Electrical	1961	2.0	0.998	1	1.0	1
CTV	Closed Circuit Television	8760	2.0	1.0	1	0.5	1
COM	Communications	2738	3.0	0.999	1	0.5	1
DET	Detectors	700	1.0	0.999	*	*	*
SCS	Site Control System	359	2.1	0.994	1	0.5	1
	Transportation	350	1.0	0.997	**	**	**
Total	Munition Line	24.6	8.7	0.739	2 Max	24.6	2Max

Men Req'd: Reflects actual manning level required to effect CMA or PMA. Requirements of buddy system not included (to be considered later)

* Not considered, see Section 3.0

** Maintenance accomplished at depot level

*** Deferred maintenance (filter change-out) must be scheduled as need arrises.

5.2.3 Preventive Maintenance Action (PMA) Manning

Table 5-2 summarizes the estimated PMA required during weekend shut down of the CAMDS equipment. It does not include deferred corrective maintenance, the requirements for which is not forecastable, nor readily quantified.

Total weekly average PMA is estimated at approximately 25 man hours, 19 of which are performed in level A suits. To conform with safety work rules relative to the level A suit work period limitation and the buddy system, a PMA crew of about 6 is required, working two shifts. No special PMA related skill requirement was identified.

5.3 PROJECTILE/CARTRIDGES WITHOUT BURSTER DEMIL LINE

5.3.1 Munition Line Description

NOTE

The following non-burstered projectiles are stocked at Tooele Army Depot.

105 MM M360 (GB)	155 MM M122 (GB)
155 MM M121 (GB)	8" M426 (GB)
155 MM M121A1 (GB)	155 MM M121A1 (VX)

In this process, shown in Figure 5-3, the munitions are taken on pallets from their storage igloo to the Material Handling Area (MHA), where they are temporarily held until required for processing. In the meantime, the munitions are inspected for agent leakage at both the igloo and MHA.

A fork lift is used to take the pallet from the MHA to the Unpack Area (UPA), where rounds are removed from the pallet and placed on the Explosive Containment Cubicle (ECC) by-pass conveyor which carries them to the Projectile Disassembly Facility (PDF) to be processed in the Projectile Pull and Drain Machine (PPD). The pallets are sent to the Dunnage Incinerator (DUN) for burning and the resulting ash sent to disposal.

In the PPD, the projectiles nose closure is removed, then the bruster well is extracted. Agent is vacuum drained and pumped to the Agent Destruction System (ADS). The burster well is passed through a decon bath; decon being supplied by the Central Decon System (CDS). The spent decon from the PPD is also pumped to the ADS.

The empty round, burster well and nose closure are then conveyed via the Material Handling Equipment (MHE) to the Metal Parts Furnace (MPF) for thermal decontamination. After being certified, the metal parts from the MPF are sent to scrap disposal.

The ADS neutralizes the agent and spent decon from the PDF/PPD, liquor containing agent residuals from the MPF is detoxified and dried; salts produced are chemically analyzed, and upon certification, are drummed and sent to storage.

5.3.2 Corrective Maintenance Action (CMA) Manning

Table 5-3 presents an assessment of maintenance man level requirements and maintainability/reliability parameters (MTBF, MTTR, availability) for the building blocks comprising this demil line.

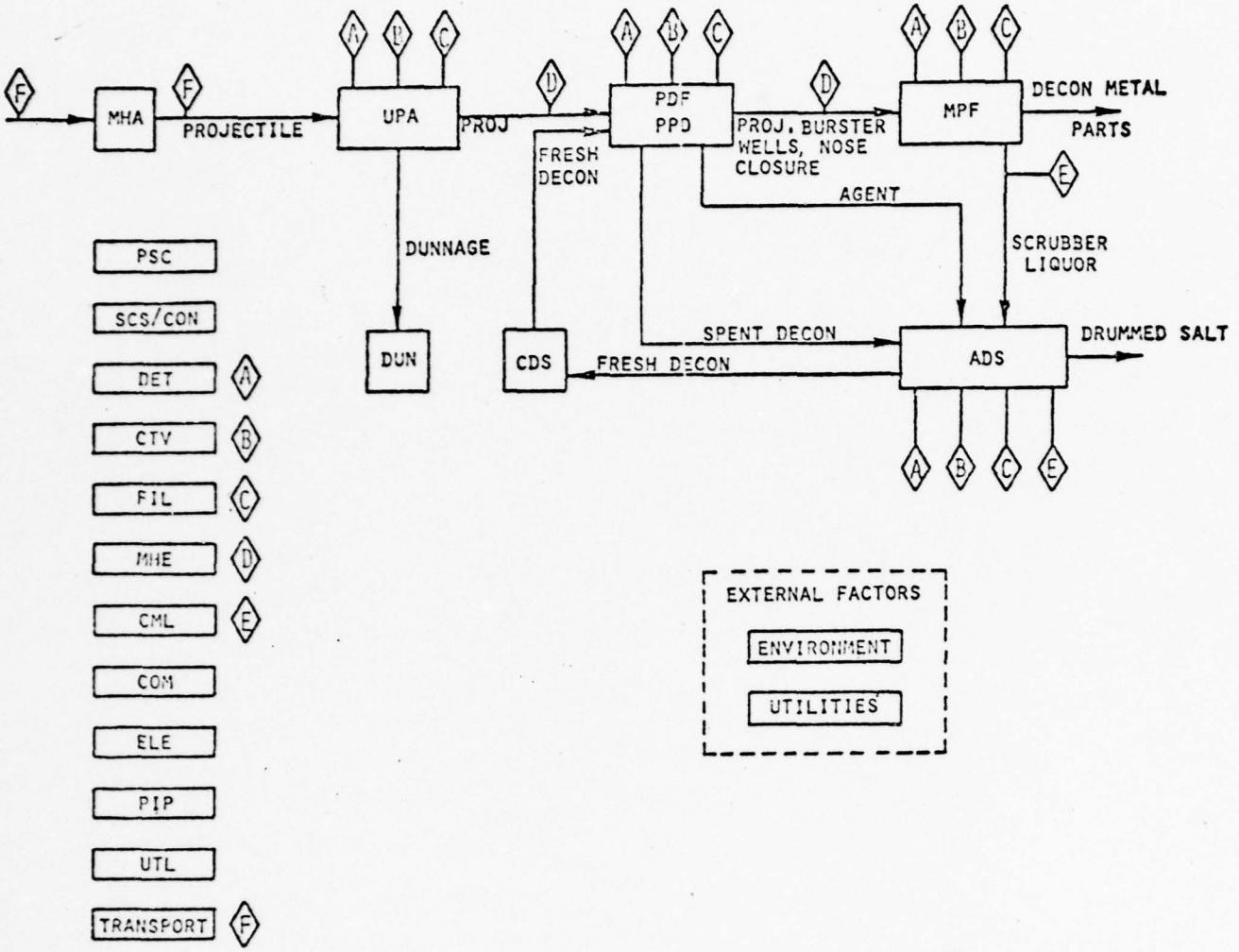

Figure 5-3 Munition Demil System - GB/VX Without Bursters, Cartridges/Projectiles

TABLE 5-3. PROJECTILE/CARTRIDGE WITHOUT BURSTER, GB/VX

BUILDING BLOCKS	CORRECTIVE MAINTENANCE				PREVENTIVE MAINTENANCE	
	MTBF	MTTR	AVAILABILITY	MEN REQ'D FOR CMA	EST PMA MAN HRS WEEKLY	MEN REQ'D FOR PMA
UPA Unpack Area	4149	2.43	0.999	1	0.2	1
MPF Metal Parts Furnace	228	3.77	0.963	2	6.0	2
UTL Utilities	348	10.2	0.972	**	1.0	1
ADS Agent Destruct System	294	7.0	0.965	2	3.0	2
PPD Project Pull and Drain Machine	283	10.3	0.965	2	1.5	2
CDS Central Decon System	3896	4.55	0.999	2	1.0	1
MHE Material Handling Equipment	721	8.6	0.988	2	1.0	2
FIL Filter System	1571	7.1	0.996	2	***	2
PIP Piping	19696	2.94	0.999	1	0.5	1
ELE Electrical	1961	2.02	0.998	1	1.0	1
CTV Closed Circuit TV	8760	2.0	0.999	1	0.5	1
COM Communications	2738	3.0	0.999	1	0.5	1
DET Detectors	700	1.0	0.999	1	*	*
SCS Site Control System	359	2.14	0.994	1	0.5	1
- Transportation	350	1.00	0.997	**	**	**
TOTAL MUNITION LINE	40.3	6.4	0.863	2 Max	16.2	2 Max

Men Req'd: Reflects actual manning required to effect CMA or PMA. Requirements of buddy system not included (to be considered later)

* Not considered, see Section 3.0

** Maintenance accomplished at depot level

*** Defered maintenance (filter change-out), must be scheduled as needed

Per Table 5-3, excluding the DET and Transportation whose maintenance resources are determined by others, the MPF, ADS, PPD, MHE and SCS most significantly dictate the maintenance requirements of this demil line. Discounting multiple building block failures, Table 5-3 also indicates that a two man crew is required to perform the maintenance actions required and since MTTR's exceed 2 hours, most repairs in contaminated areas will require relaying of suited repair teams. This dictates the following maintenance crew composition:

1. A minimum of two electro-mechanical repairmen specially trained in process equipment, monitors, controls and instruments, to support the ADS and MPF.
2. A minimum of two repairmen with a good basic foundation of maintenance of hydro and electro-mechanical machines, to support the PPD and MHE.
3. At least one electronics technician specially trained to diagnose and correct faults in the SCS system.
4. A capability of supporting continuously, a two man level of effort in level A suits within the CAMDS safety constraints and work rules.
5. A general capability of supporting maintenance in all other non level A contaminated areas.

Except as noted above, no other unique skills or personnel requirements were isolated for this munition line.

5.3.3 Preventive Maintenance Action (PMA) Manning

Table 5-3 summarizes the estimated PMA required during weekend shut down of the CAMDS equipment. It does not include deferred corrective maintenance, the requirements for which is not forecastable, nor readily quantified.

Total weekly average PMA is estimated at approximately 16 man hours, 12 of which are performed in level A suits. To conform with safety work rules relative to the level A suit work period limitation and the buddy system, a PMA crew of about 6 is required, working two shifts. No special PMA related skill requirement was identified.

5.4 PROJECTILES WITH BURSTERS, MUSTARD, MUNITION DEMIL LINE

5.4.1 Munition Line Description

Figure 5-4 illustrates schematically, the demil line for mustard filled projectiles with bursters. All building blocks shown must function to sustain production of the munition line. The process begins in the UPA where projectiles are placed on a conveyor which feeds them one at a time to the PDM situated in the ECC. The PDM cuts the nose closure off the projectiles and extracts the burster. The burster is cut up and sent to the DFS with the nose closure. From the PDM, the projectiles are sent to the PPD where the burster well is extracted. The projectiles (still filled with mustard) and burster wells are then conveyed to the MPF where the mustard is incinerated. Explosive sludge generated by the sawing operations in the PDM are sent to ETS, then to the ADS for removal of explosive components, and detoxification and disposal, respectively.

5.4.2 Corrective Maintenance Action (CMA) Manning

Table 5-4 summarizes the MTTR, MTBF, availability and the maintenance manpower requirements of the munition line and its constituent building blocks as determined by the building block assessments summarized in Section 4.0 and the CAMDS Maintainability and Reliability Assessment, Reference 1.

Considering only single failures in compliance with the study constraints, (no multiple building block failures), it is evident from Table 5-4 that at most, a two man level of effort is required to perform the actual corrective action necessary. It is to be noted, however, that because MTTR is in excess of two hours, multiple work crew teams must be used in relays of two hour stints for corrective actions in contaminated (level A) areas.

In addition, Table 5-4 indicates (excluding the UTL, DET and Transportation which are considered by others) that the ADS, DFS, MPF, EHM, PDM, PPD, MHE and SCS are the munition line elements which dictate most significantly, the following line maintenance crew requirements.

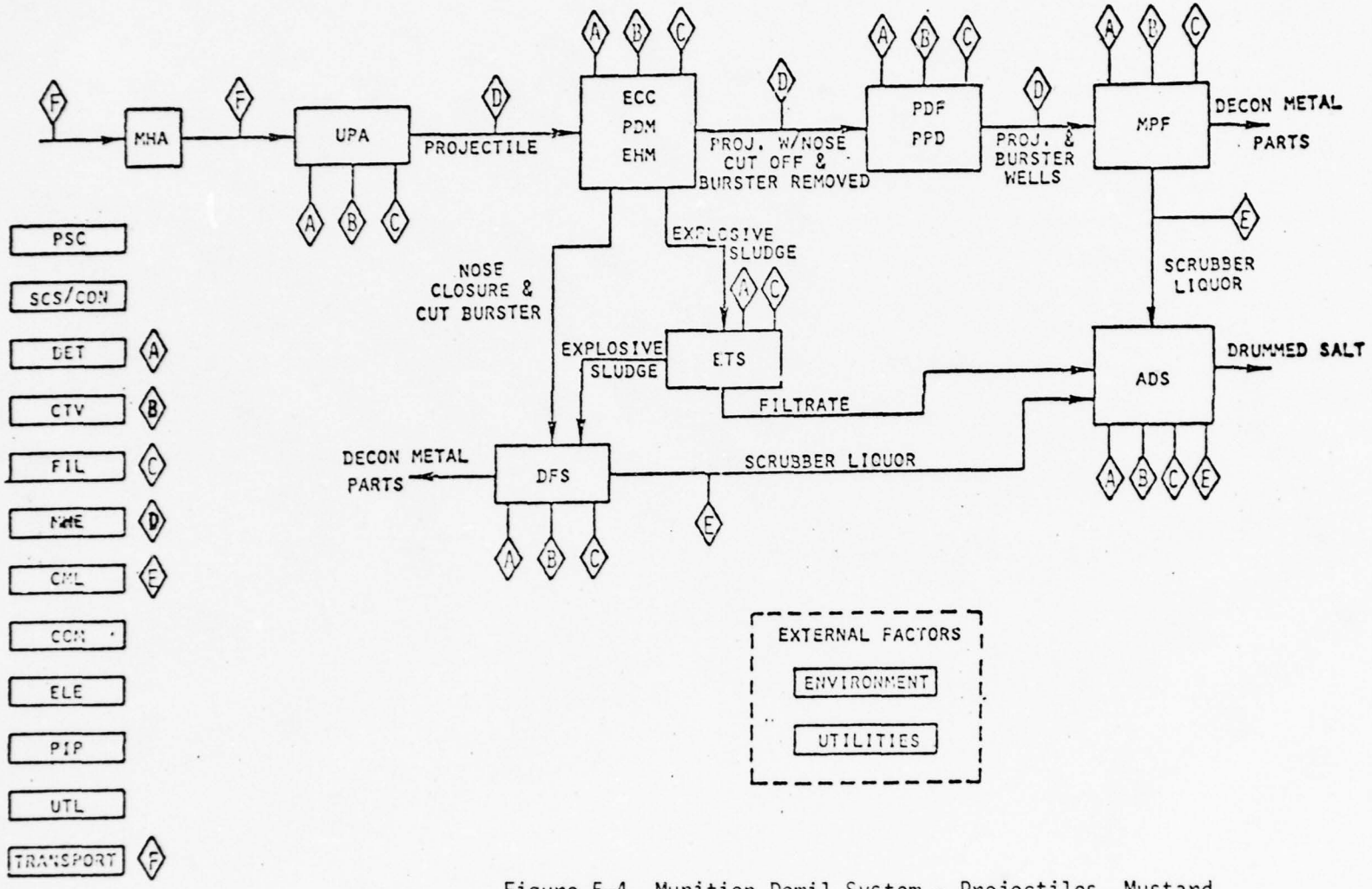

Figure 5-4 Munition Demil System - Projectiles, Mustard

TABLE 5-4. PROJECTILES WITH BURSTERS, MUSTARD, DEMIL LINE
MAINTENANCE AND RELIABILITY SUMMARY

BUILDING BLOCKS		CORRECTIVE MAINTENANCE				PREVENTIVE MAINTENANCE	
		MTBF	MTTR	AVAILABILITY	MEN REQ'D FOR CMA	EST PMA MAN HRS WEEKLY	MEN REQ'D FOR PMA
UPA	Unpack Area	4149	2.43	0.9994	1	0.2	1
ECC	Explosion Cont. Cubicle	1255	11.72	0.9907	1	0.4	1
DFS	Deact Furnace System	397	6.91	0.9829	2	6.0	2
MPF	Metal Parts Furnace	228	8.77	0.9630	2	4.0	2
UTL	Utilities	348	10.02	0.9720	**	1.0	1
EHM	ECC Hydraulics	348	10.02	0.9720	1	0.5	1
ADS	Agent Destruction System	445	6.44	0.9857	2	1.0	2
ETS	Explosive Treatment System	2539	5.70	0.9978	2	1.0	1
PDM	Proj. Demil Machine	389	12.64	0.9641	2	2.0	1
PPD	Proj. Pull & Drain	331	10.47	0.9693	2	1.5	2
MHE	Material Handling Equip.	271	8.28	0.9704	2	1.0	2
FIL	Filter System	1031	7.09	0.9932	2	***	2
PIP	Piping	41827	2.69	0.9999	1	0.5	1
ELE	Electrical	1961	2.02	0.9979	1	1.0	1
CTV	Closed Circuit TV	8760	2.0	0.9997	1	0.5	1
COM	Communications	2738	3.0	0.9989	1	0.5	1
DET	Dectors	700	1.0	0.9986	*	*	*
SCS	Site Control System	359	2.14	0.9941	1	0.5	1
-	Transportation	350	1.0	0.9972	**	**	**
	TOTAL MUNITION LINE	28.5	7.4	0.7942	2 Max	21.6	2 Max

Men Req'd: Reflects actual manning required to effect CMA or PMA. Requirements of buddy system not included (to be considered later)

* Not considered, see discussion Section 3.0

** Maintenance accomplished at depot level

*** Deferred maintenance (filter change-out), must be scheduled as needed.

1. A minimum of two electro-mechanical repairmen specially trained in process equipment, monitors, controls and instruments, to support the ADS, MPF and DFS.

2. A minimum of two repairmen with a good basic foundation of maintenance of hydro and electro-mechanical machines, to support the EHM, PPD, MHE, and PDM.

3. At least one electronics technician specially trained to diagnose and correct faults in the SCS system.

4. A capability of supporting continuously, a two man level of effort in level A suits within the CAMDS safety constraints and work rules.

5. A general capability of supporting maintenance in all other non level A contaminated areas.

Except as noted above, no other unique skills or personnel requirements were isolated for this munition line.

5.4.3 Preventive Maintenance Action (PMA) Manning

Table 5-4 summarizes the estimated PMA required to be performed during weekend shut down of the CAMDS equipment. It does not include deferred corrective maintenance, the requirements for which is not forecastable, nor readily quantified.

Total weekly average PMA is estimated at approximately 22 man hours, half of which is performed in level A suits. To conform with safety work rules relative to the level A suit work period limitation and the buddy system, a PMA crew of about 6 is required, working two shifts. No special PMA related skill requirement was identified.

5.5 4.2 INCH MORTAR, MUSTARD MUNITION DEMIL LINE

5.5.1 Munition Line Description

The system for the demil of mustard filled 4.2 inch mortar cartridges is shown in Figure 5-5. Sustained processing of 4.2 inch mortars require the functioning of all building blocks shown. Processing of 4.2 inch mortars involve the following steps. In the UPA, removal of the propelling charge, obturator, and base plate is effected by UPA personnel. From the UPA, the mortar is sent to the ECC via conveyor. In the ECC, the fuse burster assembly is removed and the burster and the fuse are sent to the DFS. From the ECC, the mortar is sent to the PPD where the burster well is extracted. Both burster well and mustard filled mortar are then finally sent to the MPF for agent incineration and metal parts decontamination.

5.5.2 Corrective Maintenance Action (CMA) Manning

Table 5-5 summarizes the MTTR, MTBF, availability and the maintenance manpower requirements of the munition line and its constituent building blocks as determined by the build block assessments summarized in Section 4.0 and the CAMDS Maintainability and Reliability Assessment, reference 1.

Considering only single failures in compliance with the study constraints (no multiple building block failures), it is evident from Table 5-5 that at most, a two man level of effort is required to perform the actual corrective actions necessary. It is to be noted, however, that because MTTRs are in excess of 2 hours, multiple work crew teams must be used in relays of 2 hour stints for corrective actions in contaminated (level A) areas.

In addition, Table 5-5 indicates (excluding the UTL, DET and Transportation which are considered by others) that the ADS, DFS, MPF, MHE, EHM, MOR, PPD, and SCS are the munition line elements which dictate collectively, the following line maintenance crew requirements.

1. A minimum of two electro-mechanical repairmen specially trained in process equipment, monitors, controls and instruments, to support the ADS, MPF and DFS.
2. A minimum of two repairmen with a good basic foundation of maintenance of hydro and electro-mechanical machines, to support the EHM, PPD, MHE and MOR.

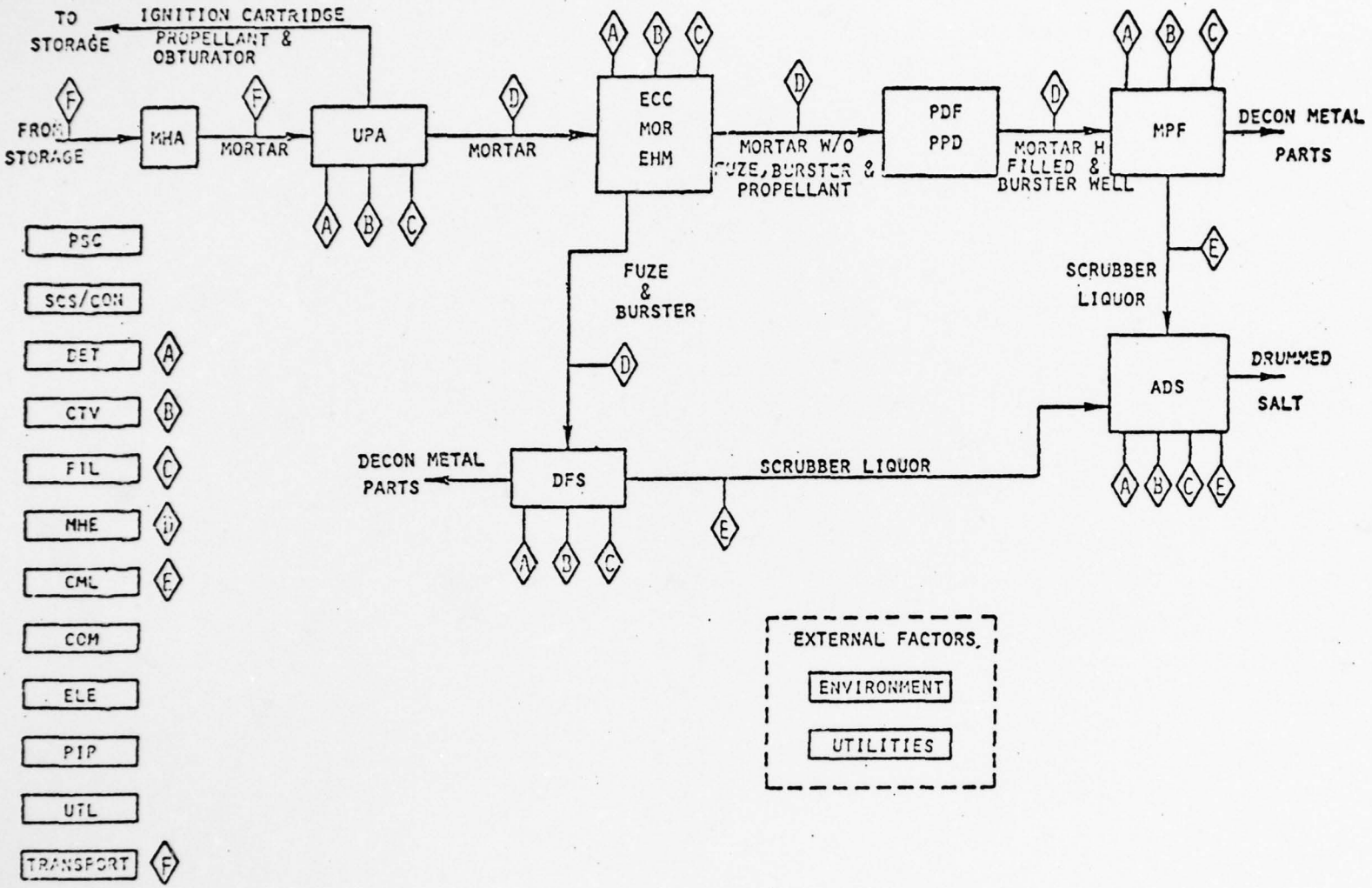

Figure 5-5 Munition Demil System - 4.2" Mortar, Mustard

TABLE 5-5. 4.2 INCH MORTAR DEMIL LINE MAINTENANCE AND RELIABILITY SUMMARY

BUILDING BLOCKS	CORRECTIVE MAINTENANCE				PREVENTIVE MAINTENANCE	
	MTBF	MTTR	AVAILABILITY	MEN REQ'D FOR CMA	EST PMA MAN HRS WEEKLY	MEN REQ'D FOR PMA
UPA Unpack Area	-	-	~1.0	1	0.2	1
ECC Explosion Cont. Cubicle	931	11.50	0.9878	1	0.4	1
DFS Deact Furnace System	397	6.91	0.9829	2	6.0	2
MPF Metal Parts Furnace	228	8.77	0.9630	2	4.0	2
UTL Utilities	231	9.98	0.9586	**	1.0	1
EHM ECC Hydraulics	231	9.98	0.9586	1	0.5	1
ADS Agent Destruction System	445	6.44	0.9857	2	3.0	2
PPD Proj. Pull * Draw	230	10.49	0.9564	2	1.5	2
MHE Mat'l Handling Equipment	303	10.02	0.9680	2	1.0	2
FIL Filter System	1127	7.09	0.9937	2	***	2
MOR Mortor Demil Machine	1034	14.12	0.9871	2	1.0	2
PIP Piping	41827	2.69	0.9999	1	0.5	1
ELE Electrical	1961	2.02	0.9979	1	1.0	1
CTV Closed Circuit TV	8760	2.00	0.9997	1	0.5	1
COM Communications	2738	3.00	0.9989	1	0.5	1
DET Detector	700	1.0	0.9986	*	*	*
SCS Site Control System	359	2.14	0.9941	1	0.5	1
- Transportation	350	1.0	0.9972	**	**	**
TOTAL MUNITION LINE	27.4	.7.7	0.7814	2 Max	21.6	2 Max

Men Req'd: Reflects actual manning required to effect CMA or PMA. Requirements of buddy system not included (to be considered later)

* Not considered, see discussion Section 3.0

** Maintenance accomplished at depot level

*** Deferred maintenance (filter change-out), must be scheduled as needed.

3. At least one electronics technician specially trained to diagnose and correct faults in the SCS system.
4. A capability of supporting continuously, a two man level of effort in level A suits within the CAMDS safety constraints and work rules.
5. A general capability of supporting maintenance in all other non-level A contaminated areas.

Except as noted above, no other 4.2 inch mortar munition demil line, unique skill or personnel requirements were isolated.

5.5.3 Preventive Maintenance Action (PMA) Manning

Table 5-5 summarizes the estimated PMA required during weekend shut down of the CAMDS equipment. It does not include deferred corrective maintenance, the requirement for which is not forecastable, nor readily quantified.

Total weekly average PMA is estimated at approximately 22 man hours, half of which is performed in level A suits. To conform with safety work rules relative to the level A suit work period limitation and the buddy system, a PMA crew of about 6 is required, working two shifts. No special PMA related skill requirement was identified.

5.6 M23 MINE, VX, MUNITION DEMIL LINE

5.6.1 Munition Line Description

The system for the demil of M23 mines is shown in Figure 5-6. Sustained operation of the demil line requires the functioning of all building blocks shown. Actual demil of the mines starts in the UPA where mines are fed one at a time, to the ECC via conveyor. In the ECC, the mine is positioned in the MIN machine where it is punched and drained. The agent is sent to the ADS for detoxification and disposal, and the mine body, burster and booster are sent to the DFS where the residual agent and explosive materials are incinerated.

5.6.2 Corrective Maintenance Action (CMA) Manning

Table 5-6 summarizes the MTTR, MTBF, availability and man power required to effect maintenance on the M23 mine munition line and its composite building blocks as determined by the building block assessments summarized in Section 4.0 and CAMDS Maintainability and Reliability Assessment, Reference 1.

Per Table 5-6, excluding the DET and Transportation whose maintenance resources are determined by others, the ADS, DFS, MIN, EHM, and SCS are the building blocks which most significantly dictate the maintenance requirements of this demil line. In addition, discounting multiple building block failures, Table 5-6 indicates that at most, a two man crew is required to perform the maintenance actions required and since MTTR's exceed 2 hours, most repairs in contaminated (level A) areas will require relaying of suited repair teams.

The above considerations therefore dictate a maintenance crew which features:

1. A minimum of two electro-mechanical repairmen specially trained in process equipment, monitors, controls and instruments, for the maintenance of the ADS and DFS.
2. A minimum of two repairmen with a good foundation in the maintenance of hydro and electro-mechanical machines to support the MIN and EHM.

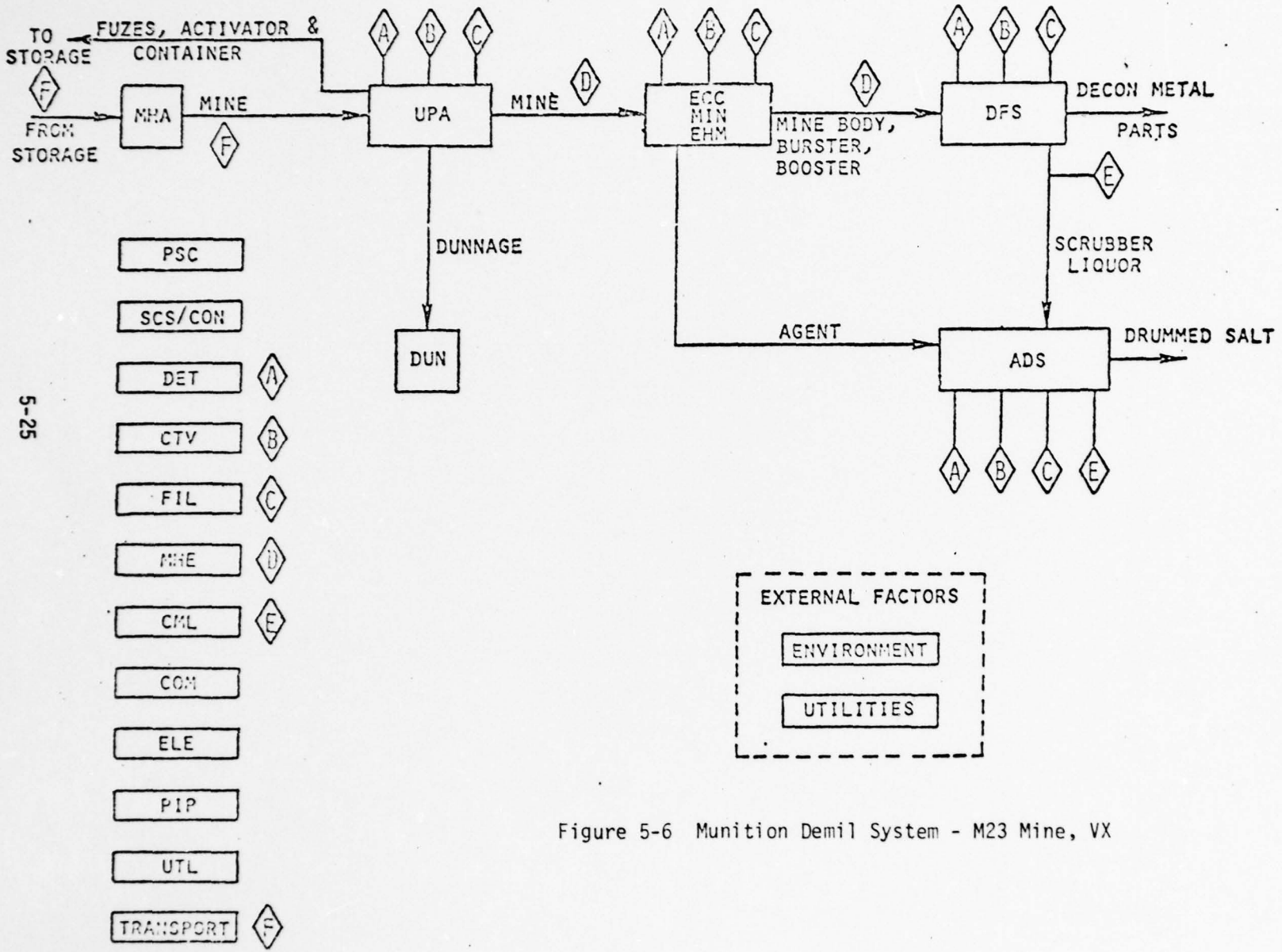

Figure 5-6 Munition Demil System - M23 Mine, VX

TABLE 5-6. M23 MINE DEMIL LINE MAINTENANCE AND RELIABILITY SUMMARY

BUILDING BLOCKS	CORRECTIVE MAINTENANCE				PREVENTIVE MAINTENANCE	
	MTBF	MTTR	AVAILABILITY	MEN REQ'D FOR CMA	EST PMA MAN HRS WEEKLY	MEN REQ'D FOR PMA
UPA Unpack Area	-	-	~1	1	0.2	1
ECC Explosion Cont. Cubicle	1246	11.91	0.9905	1	0.4	1
DFS Deact Furnace System	397	6.91	0.9829	2	6.0	2
EHM ECC Hydraulics	286	10.00	0.9662	1	0.5	1
MHE Mat'l Handling Equipment	16783	6.06	0.9996	2	1.0	2
FIL Filter System	1808	7.10	0.9961	2	***	2
MIN Mine Demil Machine	360	13.96	0.9627	2	1.0	2
PIP Piping	19695	2.94	0.9998	1	0.5	1
ELE Electrical	1961	2.02	0.9979	1	1.0	1
CTV Closed Circuit TV	8760	2.0	0.9997	1	0.5	1
COM Communications	2738	3.0	0.0089	1	0.5	1
DET Detectors	700	1.0	0.9986	*	*	*
SCS Site Control Sys	359	2.14	0.9941	1	0.5	1
ADS Agent Destruction System	210	7.55	0.9653	2	3.0	2
- Transportation	350	1.0	0.9972	**	**	**
TOTAL MUNITION LINE	43.3	5.6	0.8846	2 Max	15.1	2 Max

Men Req'd: Reflects actual manning required to effect CMA or PMA. Requirements of buddy system not included (to be considered later)

* Not considered, see discussion Section 3.0

** Maintenance accomplished at depot level

*** Deferred maintenance (filter change-out), must be scheduled as needed.

3. At least one electronics technician specially trained to diagnose and correct faults in the SCS computer.

4. A capability of supporting continuously, a two man level of effort in level A suits within the CAMDS safety constraints and work rules.

5. A capability of supporting any maintenance action in any other non-level A protection areas.

Except as noted above, no other M23 mine munition line unique skills or personnel requirements were identified.

5.6.3 Preventive Maintenance Action (PMA) Manning

Table 5-6 summarizes the estimated PMA required during weekend shut downs of the CAMDS equipment. It does not include deferred maintenance, the requirement for which is not forecastable, nor readily quantified. The total weekly average PMA is estimated at roughly 15 man hours, approximately half of which requires level A protection. To conform with CAMDS safety work rules (2 hour limitation on level A suit work period, buddy system, etc.), a PMA crew of 6 or 7 men is required working one weekend shift. No special PMA related skill requirement was identified.

5.7 BULK ITEMS (GB/VS), MUNITION DEMIL LINE

5.7.1 Munition Line Description

The system for the demil of GB/VX filled bulk items (spray tanks, MC-1 bombs, MK-94 bombs and ton containers) is shown in Figure 5-7. Sustained demil of bulk items require the functioning of all building blocks shown. Four different fixtures, each tailored to the requirements of a different bulk item, are used in the BIF to drain the bulk item of agent. Only one fixture can be placed and used in the BIF, thus limiting demil operations to a single bulk item type at any given time.

During demil operations, bulk items are taken directly from storage to the BIF where they are placed on the drain fixture. For the bombs and the spray tank, a drain/vent hole is drilled through the wall of the agent containment vessel, and the agent is pumped out and sent to the ADS for detoxification and disposal. The bombs or spray tank is then rinsed with decon solution. The resulting spent decon solution is sent to the ADS for detoxification and disposal. The drained bombs or spray tank is finally sent to the MPF where any residual agent is incinerated; the decontaminated metal parts are disposed of as scrap.

For ton containers, agent draining and decon rinsing is effected using valves on the container in lieu of a hole drilled through the container wall. All other operations are similar to that of the bombs and spray tank.

5.7.2 Corrective Maintenance Action (CMA) Manning

Table 5-7 summarizes the MTTR, MTBF, availability and the maintenance manpower requirements of the bulk item demil line and its composite building blocks as determined by the building block assessments summarized in Section 4.0 and the CAMDS Maintainability and Reliability Assessment, reference 1.

Per Table 5-7, discounting the DET and Transportation whose maintenance resources are determined by others, it is clear that the building blocks which most significantly influence maintenance requirements are the ADS and MPF. Furthermore, excluding multiple building block failures, Table 5-7 clearly shows that at most, a two man crew is required to perform the actual

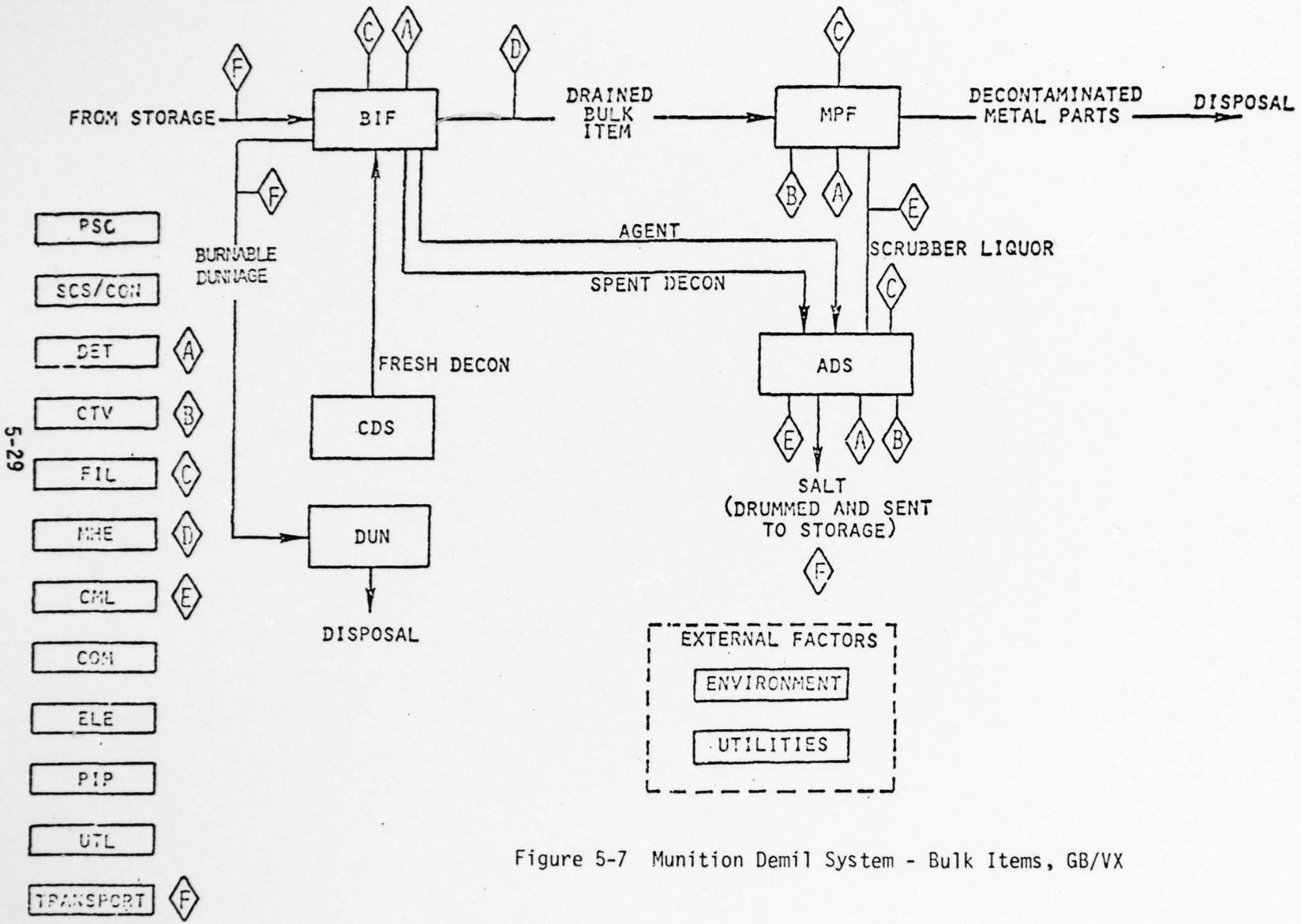

Figure 5-7 Munition Demil System - Bulk Items, GB/VX

4.20 ELECTRICAL DISTRIBUTION SYSTEM (ELE), BB #27

4.20.1 Purpose

The electrical distribution system supplies and distributes commercial and emergency standby power throughout the CAMDS site.

4.20.2 Description

Electrical power is supplied at the 12,470 volt level by Utah Power & Light Co. At the CAMDS site, this power is reduced to 208V and 480V and is connected to six motor control centers. All power cables are supported in cable trays throughout the CAMDS complex.

Three diesel engine driven emergency standby generators provide power in case of commercial power failure to ensure safe shutdown of the demil operations.

Details of the emergency standby generator sets were not available for review. The secondary power contains in excess of 1000 electromechanical switching and overload units. The significant types and approximate quantities contributing to preventive or corrective maintenance are listed below:

Item	Quantity
• Breakers, circuit	482
• Relays	4
• Starters, motor	49
• Contactors	5
• Transformers, control	63
• Heaters, overload	115
• Fuse, buss	62

4.20.3 Special and Safety Requirements

No special requirements during CMA or PMA were identified.

4.20.4 Typical Preventive Maintenance Actions (PMA)

The typical PMA will consist of visual observation/inspection to determine physical condition of wiring insulation, arcing conditions indicating loose connections, or other conditions where impending component failure is evident. The exposed power cables running between CAMDS housings in cable trays should be inspected periodically for indications of insulation damage from vermin

TABLE 5-7. BULK ITEMS (GB/VX) DEMIL LINE MAINTENANCE AND RELIABILITY SUMMARY

BUILDING BLOCKS	CORRECTIVE MAINTENANCE				PREVENTIVE MAINTENANCE	
	MTBF	MTTR	AVAILABILITY	MEN REQ'D FOR CMA	EST PMA MAN HRS WEEKLY	MEN REQ'D FOR PMA
MPF Metal Part Furnace	228	8.77	0.9630	2	4.0	2
UTL Utilities	-	-	1.0	**	1.0	1
ADS Agent Destruction System	294	7.0	0.9768	2	3.0	2
CDS Center Decon System	3896	4.55	0.9988	2	1.0	1
BIF Bulk Item Facility	2160	8.60	0.9960	2	1.0	2
FIL Filter System	1808	7.10	0.9961	2	***	2
PIP Piping	37187	8.26	0.9999	1	0.5	1
ELE Electrical	1961	2.02	0.9979	1	1.0	1
CTV Closed Circuit TV	8760	2.0	0.9997	1	0.5	1
COM Communications	2738	3.0	0.9989	1	0.5	1
DET Detectors	700	1.0	0.9986	*	*	*
Transportation	350	1.0	0.9972	**	**	**
TOTAL MUNITION LINE	69.7	5.4	0.9277	2 Max	12.5	2 Max

Men Req'd: Reflects actual manning required to effect CMA or PMA. Requirements of buddy system not included (to be considered later)

* Not considered, see discussion Section 3.0

** Maintenance accomplished at depot level

*** Deferred maintenance (filter change-out), must be scheduled as needed

corrective actions required, and since MTTR's exceed 2 hours, most repairs in contaminated areas (level A) will require relaying of suited repair teams.

The munition demil line therefore dictates a maintenance crew which primarily features:

1. A minimum of two electro-mechanical repairmen specially trained in process equipment, monitors, controls and instruments to maintain the ADS and MPF.
2. A capability of supporting continuously a two man level of effort in level A suits within the CAMDS safety constraints and work rules.
3. A capability of supporting any maintenance action in any other non level A protection area.

Except as noted above, no other special skill types or personnel requirements necessary to support this demil line were identified.

5.7.3 Preventive Maintenance Action (PMA) Manning

Per Table 5-7, approximately 12-1/2 manhours of PMA is projected during weekend shut downs of the CAMDS equipment, approximately 6 manhours of which require level A suits. This estimate does not include deferred maintenance which is not forecastable, or readily quantified. A PMA crew of 6 men working one weekend shift is projected necessary. No special skill requirements were identified.

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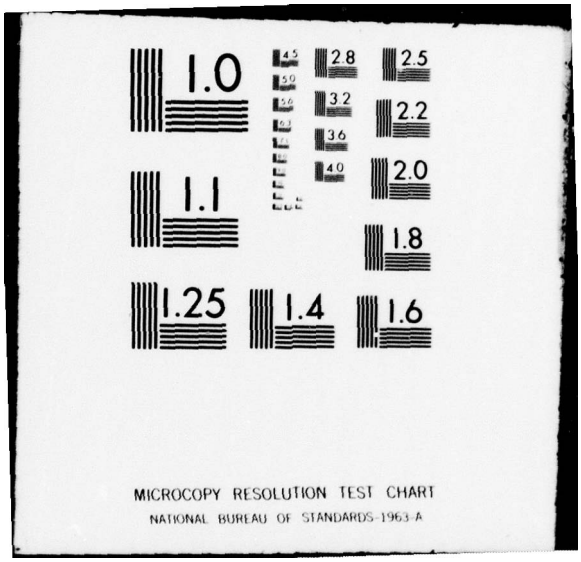
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5.8 MUSTARD FILLED TON CONTAINER DEMIL LINE

5.8.1 Demil Line Description

Figure 5-8 illustrates schematically, the processing of mustard filled ton containers and the building blocks necessary to support the demil operations. This is the simplest demil line which directly involves only 2 building blocks. Mustard ton containers are taken directly from storage to the MPF where holes are punched in the ton container and volatilization and incineration of the agent occurs. Scrubber liquor from the MPF's air pollution equipment is sent to the ADS for disposal. The decontaminated ton containers are sent to disposal.

5.8.2 Corrective Maintenance Action (CMA) Manning

Table 5-8 summarizes the MTTR, MTBF, availability and man power required to effect maintenance on the mustard ton container demil line and its composite building blocks as determined by the assessments summarized in Section 4.0 and the CAMDS Maintainability and Reliability Assessment, reference 1.

Excluding the DET and Transportation building blocks, whose maintenance requirements are determined by others, the maintenance requirements of this demil line are dominated by the needs of the MPF and ADS. Therefore, like the GB/VX Bulk Items demil line, this demil line dictates a maintenance crew which primarily features:

1. A minimum of two electro-mechanical repairmen specially trained in process equipment, monitors, controls and instruments, to maintain the ADS and MPF.
2. A capability of supporting continuously a two man level of effort in level A suits within the CAMDS safety constraints and work rules.
3. A capability of supporting any maintenance action in any other non level A protection areas.

Except as noted above, no other special skill types or personnel requirements necessary to support this demil line were identified.

5.8.3 Preventive Maintenance Action (PMA) Manning

Per Table 5-8, approximately 10 to 11 man hours weekly are required to perform PMA on this demil line. Of these, approximately 5 to 6 man hours must be expended in level A contaminated areas. A maintenance crew of 5

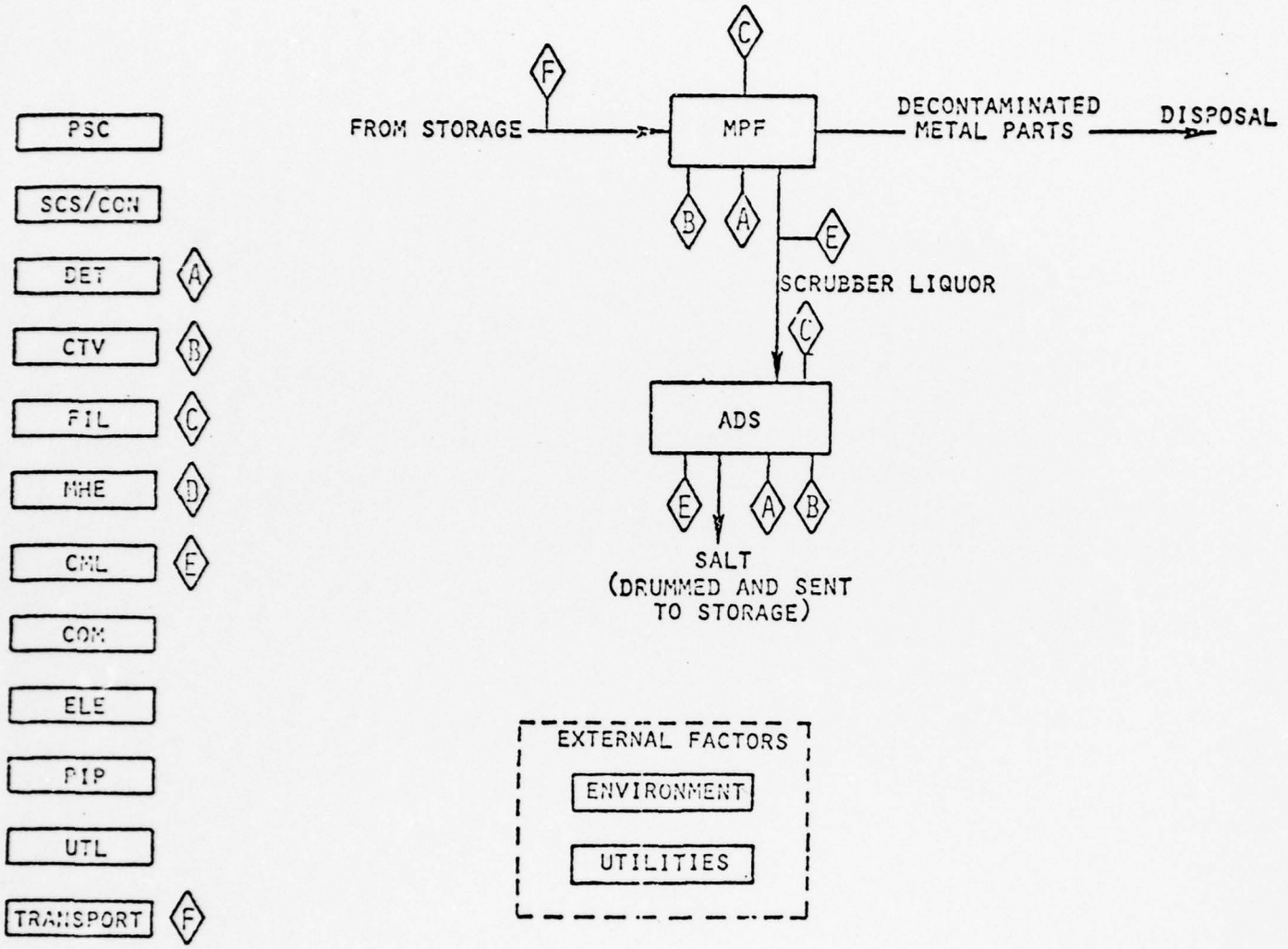


Figure 5-8 Munition Demil System - Ton Containers, Mustard

TABLE 5-8. MUSTARD FILLED TON CONTAINER DEMIL LINE
MAINTENANCE AND RELIABILITY SUMMARY

BUILDING BLOCKS	CORRECTIVE MAINTENANCE.				PREVENTIVE MAINTENANCE	
	MTBF	MTTR	AVAILABILITY	MEN REQ'D FOR CMA	EST PMA MAN HRS WEEKLY	MEN REQ'D FOR PMA
MPF Metal Parts Funace	228	8.77	0.9630	2	4.0	2
UTL Utilities	-	-	~1.0	**	1.0	1
ADS Agent Destruction System	445	6.44	0.9857	2	3.0	2
FIL Filter System	2177	7.10	0.9967	2	***	2
PIP Piping	104412	2.83	~1.0	1	0.5	1
ELE Electrical	1961	2.02	0.9979	1	1.0	1
CTV Closed Circuit TV	8760	2.0	0.9997	1	0.5	1
COM Communications	2738	3.0	0.9989	1	0.5	1
DET Detection	700	1.0	0.9986	*	*	*
- Transportation	350	1.0	0.9972	**	**	**
TOTAL MUNITION LINES	80.8	5.1	0.9409	2 Max	10.5	2 Max

Men Req'd: Reflects actual manning required to effect CMA or PMA. Requirements of buddy system not included (to be considered later)

* Not considered, see discussion Section 3.0

** Maintenance accomplished at depot level

*** Deferred maintenance (filter change-out), must be scheduled as needed

men minimum is necessary to perform PMA during one weekend work shift.

Note that deferred maintenance is not considered in these estimates. Additional man power to perform deferred maintenance must be scheduled as necessary on a week to week basis, or the PMA staff must be "oversized" to accommodate deferred maintenance which inherently is not forcastable.

6.0 CAMDS MAINTENANCE RESOURCE ASSESSMENT

6.1 CAMDS MAINTENANCE APPROACH

Three general but distinct maintenance approaches can be applied to support CAMDS, viz., breakdown, preventive and engineered maintenance. Briefly these are defined as follows.

Breakdown maintenance permits equipment to operate until failure before it is replaced or repaired. It entails little planning but downtimes may be excessive if maintenance resources are not postured to cope with these failures with the proper maintenance personnel, skills, facilities and replacement or repair parts.

The preventive maintenance approach utilizes scheduled inspections and periodic equipment overhauls or replacements to prevent breakdowns. This approach embraces significantly more actions than what's normally performed during preventive maintenance actions (routine services) in the form of test, equipment replacement and overhaul which is to be routinely performed. This approach can be effective, but is generally expensive and is not a guarantee against breakdowns stemming from random failures.

Engineered maintenance utilizes predictive testing and/or actual operating experience (or experience of similar systems in similar applications) to forecast equipment overhaul, replacement or repair to prevent breakdowns. It combines the advantages of the other approaches, but can only be effectively employed if the necessary predictive data base is available.

While any of the approaches can be used, breakdown maintenance appears most compatible with the CAMDS. The engineered maintenance approach is clearly not practical for CAMDS because of the lack of the maintenance forecasting data base. As is generally true for all "first" systems, operational experience is not available. In addition, predictive testing has not been accomplished and is probably not practical for CAMDS because of the complexity of the system and multiplicity of critical elements, making isolation of a comprehensive set of predictive tests difficult, if not impossible, and certainly expensive.

The preventive maintenance approach is also not practical for CAMDS because of the following. The CAMDS Maintainability and Reliability Assessment, Reference 1., predicts mean time between failures (MTBF) for the different munition lines varying from 24.6 to 123.7 hours, with 60 hours being representative. These MTBF's suggest that effective preventive maintainance would require scheduled shutdowns of the munition lines on the average of every 6th or 7th work shift for equipment inspections, tests, overhaul, replacement or repair. This operation encompasses more downtime and resources than correction of a single point breakdown. The preventive maintainance approach would therefore not only cost more than breakdown maintenance, but would decrease the system's availability and therefore its productivity. It is also evident that preventive maintenance is attractive generally only when avoidance of unscheduled shutdowns is of paramount importance.

The breakdown maintenance approach is therefore recommended for CAMDS. While this approach requires posturing of the maintenance resources which are not insignificant, for rapid repair of breakdowns, it is still considered the cost effective approach for CAMDS. It is to be noted that this approach will be particularly attractive during the initial operations of the different CAMDS equipment and munition lines where numerous equipment malfunctions, breakdowns and other "teething problems" are anticipated.

6.2 CAMDS MAINTENANCE CADRE

To meet the requirements of breakdown maintenance, the CAMDS maintenance personnel must be highly motivated, innovative, multiskilled craftsmen, with a good solid basic understanding of the relatively complex electro-mechanical systems and chemical processes involved. In addition, the CAMDS maintenance personnel must possess certain mental attributes, most important being a capability of functioning effectively, in isolation (with a partner) in confining, mobility and dexterity limiting protective gear in a toxic and lethal environment. The first set of requirements can be readily assured by proper screening, selection and training of personnel. The second set is somewhat harder to achieve, for regardless of indoctrination, training or even experience, most individuals cannot approach jobs requiring routine confrontations with a potentially lethal environment without some degree of nervousness to the detriment of productivity.

The primary purpose of the maintainance crew is to maintain the operational capabilities of the demil equipment and minimize system downtime with impeccable safety. To meet this objective, an intelligent and thoroughly trained staff which thinks and performs as a homogeneous unit must be assembled.

6.2.1 Maintenance Personnel Types

The maintenance staff should consist of a line maintenance staff and an administrative staff. As envisioned for CAMDS, the administrative staff should consist of a chief administrator (Chief of Maintenance), technical assistants, provisioning specialists and clerical and secretarial help. The chief administrator is responsible for all maintenance of the CAMDS equipment, and all maintenance personnel and resources. He is assisted by technical assistants with associate or bachelor's degrees to help in the administration of maintenance resources and to maintain and/or develop the technical paperwork such as procedures, standards, failure analyses and disposition reporting/recording, etc. The provisions specialists establishes, maintains and dispenses maintenance provisions, including tools, repair/replacement parts and materials.

To accommodate the breakdown maintenance approach, each operating work shift must be accompanied by a line maintenance crew capable of coping with any and all maintenance actions required. The nucleus of the line maintenance staff consists of foremen, technicians and mechanics. The line maintenance staff is

divided into as many line maintenance crews as there are daily operating shifts, each with equal capabilities. Each shift maintenance crew is headed by a shift supervisor (foreman) who coordinates and directs all maintenance actions during his shift. He also coordinates with his predecessor and relief to ensure continuity of maintenance activities from shift to shift.

The backbone of the line maintenance staff is the mechanics and technicians who perform the actual maintenance of the CAMDS equipment. These are the skilled repairmen specially trained to effect repairs within certain building block types, but fully capable of assisting with, or even performing maintenance beyond his normal sphere of responsibilities. Because explosive and toxic agent confinement considerations severely restrict maintenance access, the crew which can effectively work on the equipment at any one time in response to a single point failure, is very limited. Maximum repairmen flexibility and utilization is therefore vital to efficient maintenance and minimum downtime. It is therefore exigent that maintenance personnel not be classified in union contracts by trade and not be limited to specific crafts.

To assist the maintenance mechanics and technicians, mechanics' helpers are provided. These helpers perform as directed by the mechanics and technicians in direct line maintenance or supportive functions.

6.2.2 Personnel Skills and Deployment

The basic maintenance personnel requirements (skills and numbers) were determined through an evaluation of the maintenance requirements of the building blocks and the munition lines. As described earlier, each building block was initially evaluated separately to identify its maintenance needs; the munition lines were then analyzed to isolate any additional munition line oriented maintenance requirements.

The consolidated results of these evaluations indicate a shift line maintenance crew consisting of the following personnel types and numbers.

- A shift supervisor
- 2 Electro-mechanical technicians with a basic training of electro-mechanical systems and special training in process components, controls, monitors and instruments.
- 2 Electro-mechanical mechanics (the term "mechanic" is used here to distinguish these types from the "technicians" described above), with a basic foundation of hydro- and electro-mechanical mechanisms and machines.
- An electronics technician specially trained to maintain the SCS, COM, and CTV.
- 2 Mechanics' helpers

The composition of this shift line maintenance crew is dictated by the following considerations.

- Electro-Mechanical Technicians: The ADS, DFS and MPF are vital elements in all the munition lines. Without exception at least two of these building blocks representing the subsystems which ultimately destroy agent via incineration or neutralization, are employed in all munition demilitarization operations. These building blocks also have in common, the extensive use of process monitors, controls, pumps, and instruments which are projected, as a group, to be one of the most failure prone elements. These building blocks merit, therefore a separate crew specially trained to maintain these subsystems. Further, to assure efficiency and proficiency, this crew should be fundamentally dedicated to these building blocks but may assist in maintenance in other areas as the need occurs. Because projected MTTR's for these

building blocks exceed the two hour work period limitation (per suit entry) by wide margins (average MTTR is 7½ hours), a minimum of two fully trained technicians per operational work shift, working in relays with mechanics helpers, are necessary.

- Electronics Technicians: The CTV, COM and SCS are vital support elements in all munition lines and are utilized during all demilitarization operations. These building blocks have in common the extensive use of electronic components requiring highly specialized knowledge and training. Because these building blocks are vital to the demil operations, rapid fault diagnosis and repair is dictated which precludes reliance of outside contract support. Therefore, to support these building blocks in a fashion that assures maximum availability, a minimum of one electronic technician per shift, capable of fault isolation to the lowest replaceable module level is indicated.

- Electro-Mechanical Mechanics: Generally, with the exception of the building blocks cited above, the rest of the CAMDS building blocks evaluated in this assessment are basically hydro- and electro-mechanical systems. Evaluations of these building blocks and their associated munition lines indicate that maintenance can be readily accomplished with a two man crew who physically effect the actual repair with appropriate assistance and coordination from operators at control stations. For the most part, maintenance consists of isolation and replacement of faulty components. In non toxic areas, this presents no special problem. In toxic areas however, the projected MTTR's exceed the two hour level A suit work limitation (per suit entry) requiring relaying of repair teams, thereby increasing personnel requirements. A minimum of two repair teams is necessary, each comprised of a fully trained mechanic and a mechanics helper.

- Mechanics Helpers: These helpers assist the technicians and the mechanics perform maintenance. They in general, provide support as directed by the shift supervisor or the mechanic or technician assisted. They also function as the backup man (½ masted) to the crew working in level A suit in toxic areas. Mechanic and technician trainees are included in this personnel category until they become fully qualified maintenance repairmen. A minimum of two helpers are required.

The number of the maintenance personnel types were determined by deployment considerations as follows. Figure 6-1 illustrates the scheduling and assignments of the shift maintenance crew for a failure in a toxic area of the MPF, DFS or ADS. Pertinent assumptions significant to Figure 6-1 are as follows.

1. For convenience, the failure is assumed to occur at the end of the previous work shift. Failures are likely, in fact, to occur any time during a work shift; this however, does not alter the manning requirement. Its principle impact is that two or more work shifts may be involved in maintenance actions.

2. The shaded areas shown represent the time required to get into and out of Level A suits. While shown as a single ½ hour block at the beginning of a suited period, it is shown as such only for convenience. This period in reality, encompasses two separate actions occurring at both ends of the 2 hour suited period.

3. After each work period in level A suits, a ½ hour observation and rest period is requird, to ascertain that inadvertent exposure to agent has not occurred. These periods are designated by "OBSV."

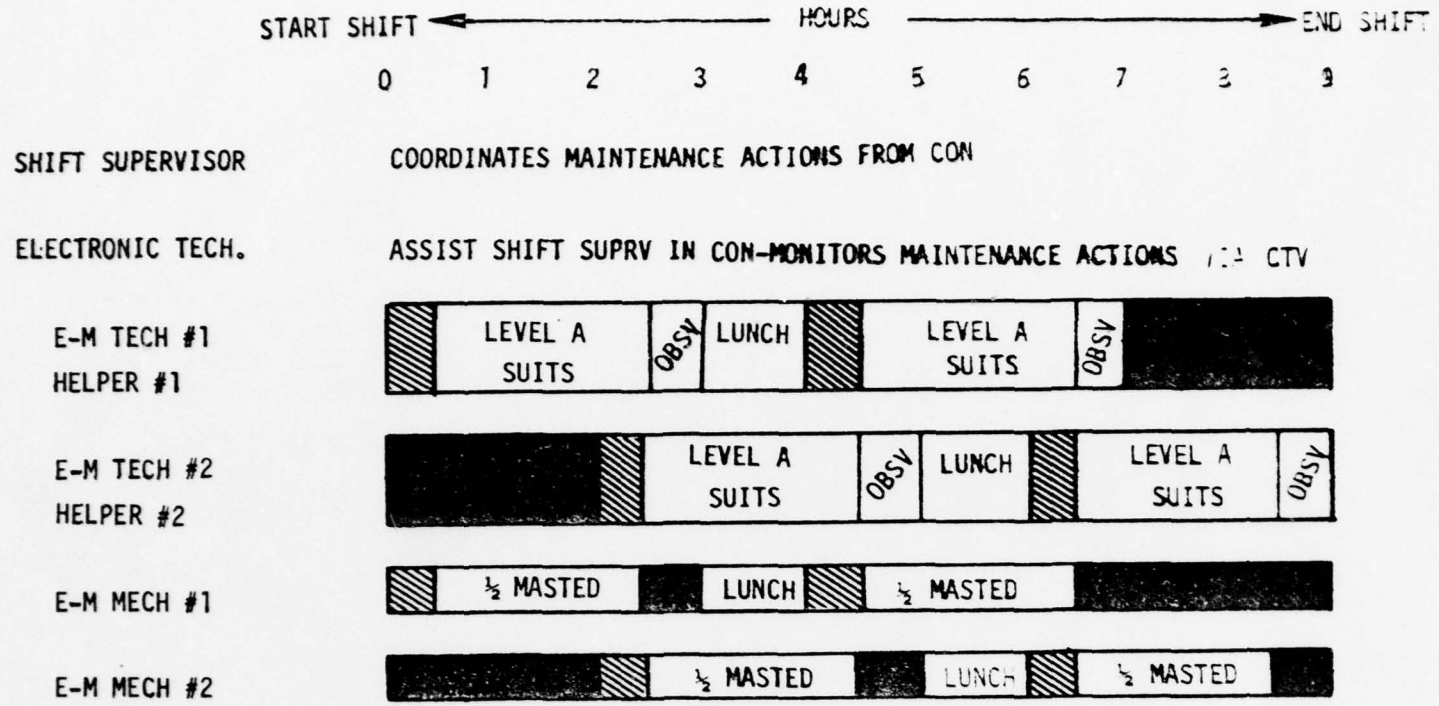
4. A work shift includes a one hour break and lunch period. Personnel are at the CAMDS site a minimum of 9 elapsed clock hours as shown.

5. The shift supervisor directs and monitors the overall maintenance action from the CON. The electronics technician, who is not involved directly in this fault episode, assists the shift supervisor in monitoring and coordinating maintenance actions.

6. Repair teams consisting of an electro-mechanical (E-M) technician and a mechanics' helper, work in relays to perform the actual fault correction. MTTR's are such that a single crew working a two hour shift cannot complete fault isolation and elimination.

7. The E-M mechanics are partially suited and function as backup men to the suited work teams as shown. They are also available when not required as backup men to provide assistance as directed by the shift supervisor.

8. Personnel as required to satisfy the buddy system enforced on site and other safety oriented work rules are drawn as required from



LEVEL A SUITS: PERFORMS MAINTENANCE ACTIONS IN LEVEL A SUITS

OBSV: REST AND OBSERVATION TO ASCERTAIN NO INADVERTENT AGENT EXPOSURES

LUNCH: LUNCH BREAK

½ MASTED: BACKUP MAN TO PERSONNEL IN LEVEL A SUITS

: TIME (TOTAL) ALLOTED FOR WEARING AND REMOVING LEVEL A SUITS

: SUPPORT AS DIRECTED BY SHIFT SUPERVISORS

FIGURE 6-1. LINE MAINTENANCE CREW DEPLOYMENT FOR FAULT CORRECTION IN LEVEL A CONTAMINATED AREA

the idle CAMDS operating cadre.

9. The personnel and facilities which normally support the operating CAMDS cadre, i.e., the PSC personnel are also available to support the maintenance crew.

10. E-M mechanics and technicians assist the electronics technician in any repair action required in toxic areas of building blocks normally under their respective responsibilities. Further, such repair action is universally removal and replacement of assemblies or components with no in-situ repair.

11. Breakdown maintenance of the UTL systems and the ELE diesel generator is to be effected by depot maintenance.

It is obvious that Figure 6-1 can be made applicable to faults in the building blocks normally serviced by the E-M mechanics rather than the E-M technicians by interchanging the E-M mechanics positions for E-M technicians. It is further obvious that for fault correction in the non toxic areas, the manning level dictated by Figure 6-1 exceeds the manpower actually required primarily because the two hour level A suit work stint limitation does not apply.

Figure 6-1 therefore represents the minimum line maintenance crew per work shift necessary to cope with any unscheduled shutdown of the production line as is required by the breakdown maintenance approach adopted in this assessment. Comparison of this line maintenance crew against the munition line requirements determined earlier (Section 5.0) indicates compatibility and generally a good fit, except for the mustard ton container demil line where minor over staffing results.

While Figure 6-1 identifies the bases for determining the minimum line maintenance staff, it does not include provisions for personnel illness, vacation and other absences. Assuming 35 days vacation and sick leave per man per year, approximately 1 man year's time per shift is lost to absences. As such the maintenance crew should be increased by one man per shift who should either be a E-M technician, a E-M mechanic, or an electronic technician. With careful scheduling of vacations, this additional man can easily maintain the proficiency of the shift maintenance crew at acceptable standards. To accommodate illnesses and other unpredictable absences, temporary use of manpower from the CAMDS operating cadre should be considered.

For a two shift per day, 5 day work week, the maintenance staff recommended for CAMDS is as shown on Table 6-1. For a three shift per day, 5 day work week, the recommended staff is shown on Table 6-2. These are to be considered the minimum requirements based on premises as delineated above. Between production line failures, the maintenance staff is to be utilized to perform routine preventive maintenance (to the extent possible with the system operating) and miscellaneous overhaul and repair of equipment.

Table 6-1 Maintenance Staff Deployment For Two Shifts Per Day Operations

	Total	1st Shift	2nd Shift
Administrative Staff			
Chief of Maintenance	1	1	-
Technical Assistants	2	1	1
Provisions Specialists	2	1	1
Secretary	1	1	-
	6	4	2
Line Maint. Staff			
Shift Supervisor	2	1	1
E-M Technician	4	2	2
E-M Mechanic	5	3	2
Electronics Technicians	3	1	2
Helpers	4	2	2
	18	9	9

Table 6-2 Maintenance Staff Deployment for Three Shift Per Day Operations

	Total	1st Shift	2nd Shift	3rd Shift
Administrative Staff				
Chief of Maintenance	1	1	-	-
Technical Assistants	3	1	1	1
Provisions Specialist	3	1	1	1
Secretary	1	1	-	-
	8	4	2	2
Line Maint. Staff				
Shift Supervisor	3	1	1	1
E-M Technicians	7	3	2	2
E-M Mechanics	7	2	3	2
Electronic Technicians	4	1	1	2
Helpers	6	2	2	2
	27	9	9	9

For routine PMA which can not be accomplished whenever the demil lines are functioning, weekend preventive maintenance must be scheduled. Per analyses at the building block and munition line levels, the manpower requirements for weekend preventive maintenance does not exceed twenty-four man hours. To perform preventive maintenance a weekend work shift of no more than 6 men is adequate. In lieu of assembling a separate preventive maintenance crew or overstaffing the shift line maintenance crews to provide the manpower pool to accommodate the additional preventive maintenance requirements, it is recommended that preventive maintenance be accomplished via scheduled overtime of the shift line maintenance staff. This approach is considered most cost effective in the long run as staffing, training, overhead and payroll expenses are minimized.

It is to be noted however, that despite the cost effectiveness of paid overtime for weekend PMA, deferred maintenance requirements may dictate a crew larger than necessary to accomplish preventive maintenance only. Deferred maintenance (i.e., maintenance stemming from failures or malfunctions which do not compromise safety and which can be deferred to weekend shutdowns before repairs are effected), may occupy most of the preventive maintenance personsel such that required PMA are not accomplished. Deferred maintenance are not forecastable since they basically stem from random events. Quantification of deferred maintenance requirements is also difficult, particularly without extensive operating experience. As such, it is recommended that initially paided overtime be employed for PMA. As experience is assimilated, if deferred maintenance becomes a large portion of the weekend maintenance activities, consideration should be given to a 3rd (for a 2 shift work day) or 4th (for a 3 shift work day) full shift working 3 days during the week and both days during the weekend for PMA and deferred maintenance.

6.2.3 Use Of Depot Maintenance Resources

During the course of this assessment, numerous instances wherein depot maintenance can advantageously be employed for maintenance of the CAMDS equipment were noted. In general, these involved maintenance of elements or subsystems in non toxic areas, which are not directly associated with the dismantling of munitions or draining and disposal of agents, and which are similar to equipment already maintained at the depot level where trained personnel and facilities already exist.

Therefore, to ease the demands on the CAMDS maintenance resources, it was assumed in this assessment that depot maintenance will be utilized to maintain the CAMDS equipment where merited. The CAMDS resources identified by this assessment therefore reflects the use of depot maintenance for the following items:

1. Materials Handling Equipment: Corrective and preventive maintenance on trucks, forklifts, cranes, hand carts, etc., not part of the CAMDS building blocks.
2. UTL boilers and air compressors: Corrective maintenance only, preventive maintenance by CAMDS.
3. UTL diesel generator and switch gear: Corrective maintenance only, preventive maintenance by CAMDS.
4. ELE diesel generator and switch gear: Corrective maintenance only, preventive maintenance by CAMDS.
5. CAMDS buildings: Preventive and corrective maintenance.

6.2.4 Personnel Training

Extensive training of CAMDS maintenance personnel is necessary, not only to ensure system performance and availability, but to ensure impeccable safety to CAMDS personnel and the surrounding civilian community. Ideally, it is best to have experienced, competent mechanics and technicians steeped in the basic fundamentals and train them for the unique CAMDS equipment and safety and operating procedure. However, it is not always possible to find adequate numbers of such personnel, particularly considering the hazards inherent in CAMDS. A training program is therefore recommended to acquire the necessary maintenance cadre.

This training program should be instituted as soon as possible to ensure availability of qualified repairmen prior to the initial operations of CAMDS. To the extent possible, on the job training should be employed utilizing dummy munitions to familiarize personnel with "actual" working conditions and procedures. The training program should incorporate the basic fundamentals as necessary to produce a qualified mechanic/technician. Such fundamentals as the basic maintenance techniques, mechanical maintenance and electrical maintenance should be included to teach new students and to serve as refreshers for old timers. In addition, indoctrination and repeated drilling of safety procedures and contingency actions, the recognition of symptoms following exposure to agent, and the proper aid procedures should be included. The hard core of the training program should be, however, familiarization with and maintenance of the CAMDS equipment.

6.3 CAMDS MAINTENANCE FACILITIES

To ensure rapid and full response to CAMDS equipment breakdowns, as necessary to minimize down times, a well equipped maintenance facility is essential. This maintenance facility should at minimum, encompass fully outfitted repair shops, a decontamination area, office space and space for repair parts and supplies. In addition, it is important that this facility be on site to maximize access to maintenance resources and to eliminate the problems of handling and accountability of contaminated items off-site. The following lists the general requirements of the maintenance facilities considered necessary to support CAMDS.

6.3.1 Building Requirements

- Office Space: Approximately 500 square feet for Administrate staff; 100 square feet for chief of maintenance, 400 square feet for staff.
- Spare Parts and Provisions Space: Approximately 13,000 square feet for 10,000 line items, both binned and palletized, based on RMA M34 experience.
- Mechanical Repair Shop: Approximately 500 square feet for three work benches, storage bins, tools, and lockers. This repair shop is to be used for refurbishing components typically represented by hydraulic cylinders, draphram pumps, and air tools.
- Electrical Repair Shop: Approximately 300 square feet for two work benches, one desk, storage bins and test equipment. This repair shop is to be used to repair components typically represented by TV monitors, cable assemblies, and control panels.
- Decontamination Area: Approximately 1000 square feet area, ventilated through a charcoal filter with sodium hydroxide, calcium hypochloride, and clear water dip tanks, a vacuum oven, a toxic floor sump and fork lift access.
- Storage for Contaminated Items: Approximately 1000 square foot area ventilated through a charcoal filter for the storage of items which have been contaminated and cannot be detoxified

without damage, eg., the FIL filter leak tester and sensitive electronic instruments. This area is also for the storage of contaminated demil machines/ fixtures not currently in use.

6.3.2 Shop Equipment

1. A complete set of basic hand tools and tool lockers.
2. Oxy-Acetylene welding unit.
3. Arc-welder.
4. Drill press, bench type.
5. Work benches.
6. Storage bins.
7. Bench or pedestal grinder.
8. Small metal lathe.
9. Safety solvent cleaning tank.
10. Hand drills with extension cords.
11. Portable hand drill.
12. Hydraulic jacks.
13. Soldering equipment.
14. Combination vices.
15. Pipe threader/cutter.
16. Tap and die sets.
17. Pipe taps
18. Tube cutters, bending and flaring tools (portable)
19. Wood working tools (saws, combination square, etc.)
20. Spirit level.

6.4 CAMDS SPECIAL EQUIPMENT

Special tools as identified by this analysis are tabulated in Table 6-3. These were isolated by review of the design drawings in the 3 October 1975 CAMDS baseline, a process which even under the best of circumstances, is extremely limited for purposes of special equipment identification and definition.

Recognizing that good engineering practice fosters the minimizing of special maintenance gear it must also be recognized that while not mandatory, special tools can ease maintenance and reduce down times. Situations where special tools could be extremely beneficial are typically represented by actions wherein maintenance access is extremely limited and where repetitive high frequency maintenance actions, such as cutting tool servicing, are involved. Totally dedicated tools, jigs or even fixtures are readily justified for CAMDS particularily for use in contaminated areas.

Unfortunately, special tool requirements and options generally best manifest themselves after hardware is fabricated and installed and often only after operation experience is assimilated. It is therefore recommended that as part of acceptance testing and validation of maintenance procedures, concerted efforts be made to identify special maintenance gear. Areas which should be investigated for special tools consideration are tabulated in Table 6-4.

Table 6-3 Special Tools Requirements

Building Block	Tool Description	Purpose
UPA	Beryllium Wrench	Removal of striker nut on 4.2" mortars
	Special Tools	Removal of mine arming plug and spring
ECC	ECC Tool Set	Set dedicated to maintenance of the ECC and machines and support system installed in the ECC
DFS	DFS Tool Set	Set dedicated to maintenance of the DFS contaminated components.
MPF	MPF Tool Set	Set dedicated to maintenance of the MPF contaminated subsystems.
ADS	ADS Tool Set	Set dedicated to maintenance of the ADS contaminated subsystems.
PPD	PPD Tool Set	Set dedicated to maintenance of the PPD and associated conveyors in the PDF
BIF	BIF Tool Set	Set dedicated to maintenance of BIF subsystems in the agent drain bay.
	Strap Wrench	Removal of air drills
	Wrench	Removal of 2 inch nut.
MHE	MHE Tool Set	Set dedicated to maintenance of the conveyors. This tool set is to be decontaminated after use and stored in the maintenance facility in a special ventilated area.
FIL	Step Stool	To facilitate removal and installation of filter elements in the 6000, 8000, and 15,000 cfm filters.
	Filter Challenging Agent Dispenser	To meter Halon 12 challenging agent upstream of charcoal filters.
CTV, COM and SCS	Test Equipment and Tools	For diagnosis and maintenance of electrical equipment.

maintenance repairmen. A minimum of two helpers are required.

Table 6-4 Recommended Areas for Special Tool Consideration

Building Block	Purpose
RDM	Saw blade removal and replacement. Punch removal and replacement.
MIN	Punch removal and replacement.
PDM	Nose closure saw removal and replacement. Burster saw removal and replacement.
FIL	Permit penetration of filter enclosure without agent release to atmosphere during inspections and filter replacement.

6.5 CAMDS SPECIAL MATERIALS

6.5.1 Lubricants and Hydraulic Oils

While lubricants, solvents and hydraulic oils are not normally considered special materials, for CAMDS these items must be carefully selected and controlled. All lubricants, and hydraulic fluids must be screened to ensure that they are compatible with the agent protective gear worn by CAMDS personnel and do not degrade the agent exclusion capabilities of the protective gear. Furthermore, safeguards should be implemented to ensure that only approved lubricants, solvents and hydraulic fluids are utilized on-site and that all non-approved types are barred, not only from use, but from being admitted to the CAMDS site.

Currently, investigations assessing campatibility of protective gear and lubricants, solvents and hydraulic oils are in process by the Army. As such, the specification of lubricants or solvents is not possible; the following however, lists a summary of the lubricant type required for the CAMDS as determined by the current assessment.

- A "spray-lube" rust, corrosion, anti-seize protection for the conveyors belts, chains, links, etc.
- A general prupose grease, medium grade for packing, bearings, cam followers, clevis bearings, etc.
- A high temperature grease, non melt type for use in hot dynamic components of the furnaces.
- An all purpose gear fluid lubricant, non corrosive, extreme pressure for gear boxes, gear motors and transmissions.
- An air tool lubricant for pneumatic motors, drills, cylinders, actuators, etc.
- Hydraulic fluids for the hydraulic power systems.
- Air compressor oil, with additives to keep compressor clean, and with high fire and flash points.
- Solvent; non drying, lubricating and cleansing type.
- An extreme pressure grease, for gear boxes, jactuators, bearing, etc.

6.5.2 Contaminated Item Bags and Transporters

Transportation of contaminated items through clean areas require the items to be sealed in an agent tight container. Polyethylene and other impervious plastic bags are convenient for the smaller and lighter items and have found wide use for this purpose. However, the larger and heavier items, particularly irregular shaped hardware with sharp edges and corners, present special handling problems because of the tendency of plastic to tear if the item is not properly supported. Special bags, selected for their strength characteristics (particularly load bearing, and penetration and tear resistance) are therefore recommended for use as follows. The contaminated item is first put into the special strength bag, then placed and sealed in the plastic bag. The plastic bag should be loosely fitted to permit firm gripping and holds on the inner bag without stressing or tearing of the outer plastic bag. These special bags as well as the outer plastic bags should be expendable and burned in the MPF. Bag materials should therefore be selected such that air pollutants are not added to the MPF effluents.

For handling of large and/or heavy items which occur routinely, e.g., the filter elements in the FIL, special support gear warrants consideration. Special hand carts equipped with sealable containers, either expendable or reusable, designed to butt up and seal against the FIL access doors could greatly simplify not only disposal of used filters, but the change out operation itself.

It is therefore recommended that special bags constructed of high strength material (e.g., canvas, thick burlap, nylon, etc.) be procured and utilized to support CAMDS as noted above. In addition, consideration is recommended for special carts/containers for handling of contaminated items on a routine basis.

6.6 SPARE PARTS

The success of the breakdown maintenance approach hinges, to a large extent, on the rapid availability of replacement or repair parts necessary to fix breakdowns. A well stocked spare parts inventory is therefore vital to to CAMDS if downtimes are to be minimized.

In view of the above, considerable efforts were expended to develop a spare parts inventory which will assure, with high probabilities, the availability of the "right" spare and repair parts without sparing a complete second system (ie., sparing everything which, while prudent, is very expensive and cumbersome). This spares inventory was generated in the following fashion. Design drawings, as available, were studied in detail to isolate the mechanization methods employed by the CAMDS equipment (to meet design objectives) to identify functional and dynamic components, critical components, and components subject to wear. These components were then categorized relative to:

- criticality of function furnished
- projected failure rates
- wearing characteristics
- procurement lead times
- vulnurability to abuse or damage from minor off-normal operations
- servicability

These categorizations then served as the basis for selecting items and their numbers to be spared. Generally, all critical items vital to the operations of the equipment were spared, and any item with high failure rates, poor wear characteristics, long lead times, poor servicability, or is subject to abuse and damage, was spared. Items with high mortality rates were spared in quantities to provide more than a first replacement.

In keeping with the basic maintenance philosophy of deemphasizing in situ repair to minimize downtime, assemblies were generally spared in favor of repair parts (eg., saw assemblies were spared rather than saw repair parts). However, in selected instances, particularly where cost considerations favor component repair, repair parts were also spared.

Additionally maintenance guidelines, specifically the following, were utilized to facilitate the spares definition process:

- To minimize downtimes, component removal and replacement to be employed for fault correction to the maximum extent practical, i.e., avoid in-situ repair. (Note that this infers a virtual "second system" of all critical components.)
- Items are deemed expendable if the cost of decontamination, repair parts and labor approached the replacement cost.
- Sparing of repair parts necessary to fix or refurbish a component or assembly is not critical if the basic component or assembly itself is spared. Ordering of spare parts in such situations can be done after disassembly of the item removed to determine the nature of the failure and the parts necessary to make repairs.

Table 6-5 presents the CAMDS spare part list as structured by the above process. The format utilized is identical to that used by TEAD for their CAMDS spares inventory listings.

During construction of Table 6-5, a number of difficulties and deficiencies in the CAMDS design and spare parts inventory control system surfaced. These are as follows:

1. The inventory control number (ICN) system employed resulted in a great number of identical items being spared under different inventory control numbers. Typically, for example, the Wilden Pump and Engineering Company diaphram pump model M-8-S is listed separately under three different ICNs, viz., 21-650-0315, 18-651-0301 and 18-651-0401. Unless a cross referencing system is established to note that these pumps are identical, 3 pumps at approximately $1,500 each will be spared under different ICNs. It. is, therefore, advantageous to set up a cross referencing system to eliminate duplicity of hardware spared under different ICNs, or to revise the design drawings to ensure that all identical hardware are listed under common ICNs.

2. The 3 October 1975 baseline drawings used to construct the spares listed is not a complete set. Numerous components as well as subsystems, known to exist, could not be identified on the drawings. The spare parts list is therefore incomplete and must be updated. In Table 6-5, such items listed without ICNs represent items known to be part of the system which could not be identified on drawings.

3. The 3 October 1975 baseline did not identify most of the MPF, DFS and ADS process monitors, controls and instruments by vendors and part numbers. Therefore a complete list of spare parts could not be generated for these building blocks. Since the contractors designing these systems are currently obligated to furnish recommended spare parts lists, TRW was directed to not include these building blocks in their spares listing. This spare parts list therefore does not include the requirements of the ADS, DFS and MPF, which should be incorporated as they become available.

4. Lack of Parts Standardization - Numerous examples of parts standardization could be made to significantly ease maintenance logistics. Three examples follow:

   Hydraulic Cylinders: The 3 October 1975 baseline identifies 86 different hydraulic cylinders. Since hydraulic cylinders are generally considered critical items, approximately the same number of different cylinders will be spared. Moreover 14 different manufacturers are specified. It is probable that this extreme diversity of cylinders and manufacturers could have been pared significantly had diligent standardization efforts been instituted in the early design process, since many of the cylinders are similar with minor differences (e.g., 1/2 inch stroke difference and cushioned ends vs. non-cushioned ends). The advantage of reducing the number of different cylinders is obvious. The reduction of different manufacturers eases logistics, could even lead to standardization of cylinder repair parts, and would reduce the need to familiarize the maintenance staff with the different manufacturer's design approaches, styles and features.

Limit Switches: 36 different limit switches are identifiable under 48 different ICNs. Additional limit switches are known to exist but are not identifiable by ICNs. There is a noted lack of standardization in limit switches. Plug-in types are used in some systems while in others, non plug-in types are employed. Additionally, variation in the cam followers were noted; differences creating different part numbers which could have been avoided, for the most part, by minor design considerations.

Hydraulic Motors: Currently 3 hydraulic motors manufactured by Char-Lynn are specified, all under different ICNs. Two motors are Geroler model AA while the third is a Geroter model AAs. While very minor differences in torque characteristics exist, both models have the same mounting and hydraulic connection interfaces and a rated displacement of 3 cu in/rev. Standardizations of these motors could result in sparing of one motor in lieu of 2 or 3.

5. The drawings do not consistantly specify vendor part numbers to completely identify the part. In some cases where different vendor part numbers are specified, the accompanying narrative description suggests identical items. For example, 4 gear motors, all manufactured by Boston Gear Company with identical service requirements, viz., 58.3 rpm, 385 in-lb output torque, 230/460/60/3 A.C. power are specified as follows:

ICN	VENDOR PART NUMBER
22-400-0102	None Specified
22-401-0101	F321B-FUX
22-418-0102	F321B-30-FUX
22-419-0601	F321B-30-J3-FUX

It is suspected that these items are in fact the same component. If they are not, the differences are probably minor variations in motor enclosure types, which should have been standardized.

Table 6-5

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
				LEVEL							
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS	ACTION
01-000-0001	77190	26500	AIR HOIST								
01-000-0002	37655	26500	CHAINBASKT								
01-000-0003	7703	26500	TROLLEY								
01-000-0007	01-000-0007		JIB CRANE								
01-000-0008A	01-000-0008A		CONVEYOR								
01-000-0012	01-000-0012		ANEMOMETER								
01-000-0015	4001-Z	98963	AIR DRYERS								
01-000-0016	1.5-CZOF-18.5-CC	05283	CYLINDER								
01-000-0019	7702	26500	TROLLEY								
01-422-0101	01-422-0101	05283	CYLINDER		1		1				
01-422-0404	PPB16	71041	PILLOW BLK		2		2				
01-422-0405	SRP16	71041	PILLOW BLK		2		2				
01-422-0406	NF1616-9	71041	BEARING		2		2				
02-000-0008	B-1216-6	71041	BEARING								
02-000-0009	B-1216-12	71041	BEARING								
02-000-0010	M-6472-32	71041	BEARING								
02-000-0015	3040-X88-6557		CYLINDER								
02-000-0016	75474103		CYLINDER								
02-311-	SAH51.125X4-R	29265	SHOCK ABS		1		1				
02-311-	LSYPC1A-3C	91929	LIMIT SW		1		1				
02-311-	LSYPC1A-1A	91929	LIMIT SW		1		1				
02-311-	LSYPC1A-2C	91929	LIMIT SW		2		3				
02-311-	LSYPC1A-1C	91929	LIMIT SW		2		4				
02-311-1401	J868		CYLINDER		1		2				
02-311-1501	02-311-1501	15515	CYLINDER								
02-311-1902	5-MH-SL-5-CC	05283	CYLINDER		2		4				
02-311-3101	NJ2-11-E-G	04137	SENSOR		1		3				
02-311-3106	LM42-LR	15515	CYLINDER		3		7				
02-311-3201	3.25-MH-FB-6-CC-K	05283	CYLINDER		2		4				
06-306-0603	P56-8	99105	DRILL BUSH		1		2				
06-306-0812	06-306-0812		SPRING		1		2				
06-306-0814	S-88-48	99105	DRILL BUSH		1		2				

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57 LEVEL MAX	58-61 ON-HAND	62-65 REORDER	66-69 QTY REQD	70-74 BIN LOC	75-76 REPL CODE	77-78 UNIT ISS	80 ACTION
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE								
06-306-0815	06-306-0615	85002	HOSE ASSY		1		1				
06-306-2807	7250	73680	JOINT XPAN		1		1				
06-306-2809	1.5AZF30S2236MT	01029	VALVE		1		1				
06-306-3201	2.5-MH-SL-06-CC-K	05283	CYLINDER		1		2				
06-306-3202	5-MH-RF-04-CC	05283	CYLINDER		1		1				
06-306-3203	5420R	53477	REGULATOR		1		1				
06-306-3204	8210C93	04845	VALVE		1		1				
06-306-3205	3003-06-546-506-20	85757	HOSE ASSY		1		1				
06-306-3211	3003-08-548-548-24	85757	HOSE ASSY		1		2				
06-306-3212	3003-08-548-548-50	85757	HOSE ASSY		9		26				
06-306-3213	1.125-MH-FF-3	05283	CYLINDER		1		1				
06-306-3214	2.5-MH-FF-1.25	05283	CYLINDER		1		2				
06-306-3215	3003-08-548-548-36	85757	HOSE ASSY		1		2				
06-306-3321	3.25-MH-FF-11-00-0	05283	CYLINDER		1		2				
06-306-3323	P-307	20977	FLOW DIVID		1		1				
06-306-3324	2.5-MH-FF-7-00-0	05283	CYLINDER		2		6				
06-306-3326	PCCM-800-S	09990	VALVE		2		6				
06-306-3401	3.25-MH-F-3-00-K	05283	CYLINDER		1		2				
06-306-3402	3.25-MH-FF-1-00-0	05283	CYLINDER		4		12				
06-306-3501	1.5-MH-FF-2-00-0	05283	CYLINDER		2		4				
06-306-3502	1.5-MH-RF-2.5-CC-0	05283	CYLINDER		1		1				
06-306-3503	MODEL 20	06428	PUMP		1		1				
06-306-3508	U124	30327	HOSE,16 FT		1		1				
06-306-3511	1728	37239	VALVE		1		1				
06-306-3513	8211A30	04845	VALVE		1		1				
06-306-4905	06-306-4905	01029	VALVE		1		1				
06-306-4908	7250,6 INCH LG	73680	JOINT XPAN		1		1				
06-526- 29	51ML7	91929	LIMIT SW		4		12				
06-526- 30	51ML1	91929	LIMIT SW		1		1				
06-526- 31	102ML1	91929	LIMIT SW		1		1				
06-526- 32	1PD1	91929	SWITCH		1		1				
06-526- 34	8211826	04845	VALVE SOL		1		1				

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57 LEVEL MAX	58-61 ON-HAND	62-65 REORDER	66-69 QTY REQD	70-74 BIN LOC	75-76 REPL CODE	77-78 UNIT ISS	80 ACTION
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE								
06-526- 54	EX-AR30	91929	LIMIT SW		3		8				
06-526- 55	BRG1L		LIMIT SW		1		2				
06-526- 56	51ML-1-E1-0.5	91929	LIMIT SW		1		1				
06-526- 57	102ML-1-E1-0.5	91929	LIMIT SW		1		1				
07-	NU-WAY 7012-A2		BURNER ASY		1		3				
07-			NOZZLE		3		3				
07-			NOZZLE		3		3				
07-	A1490		ELECTRODE		6		6				
07-	A312P		PUMP,FUEL		1		3				
07-	A137PA(V4046A)		VALVE		1		3				
07-	151A32		MOTOR		1		3				
07-			TRANSFORMR		1		3				
07-	A576-P		GASKET		3		3				
07-	A393P		INSULATOR		2		6				
07-	C7027A1031		MINI-PEEPR		1		3				
07-	S-SILICON	65149	THERMOCOUP		1		1				
07-	AR600V-120VAC,4-POLE		RELAY		3		11				
07-	T654A1666(50-800)	17479	TEMP CONTR		1		1				
07-	MP4-A6-09-MP5-48		TIMER		1		1				
07-	1900-5		SWITCH		1		1				
07-			CARTRIDGE		3		3				
07-	52601		THERMOSTAT		1		1				
07-	23998	04034	SWITCH		1		2				
07-	ST20173	04034	RELAY		1		2				
07-	AP-41-153,RANGE-39	39709	SWITCH		1		1				
07-	AP-41-153,RANGE-37	39709	SWITCH		1		1				
07-	3V600(B-60)	71956	V-BELT		3		3				
07-	861		BASKET		1		1				
07-	351		BASKET		1		1				
07-	EL-8	01029	ACTUATOR		1		1				
07-	T-316-0.25B10		NOZZLE		2		6				
07-	T-316-GGA10		NOZZLE		1		3				

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	LEVEL MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS	ACTION
07-	2C831	16327	MOTOR		1		3				
07-	R-1351-0.5-5-10	77844	VALVE		1		1				
07-	1328-A,0.75NPT		VALVE		1		2				
07-	WP81109,0.75ND 120V	04845	VALVE		1		1				
07-	750,0.5NPT	01029	KIT,VALVE		1						
07-	M-502-S6-T-S6,0.25SS	28740	KIT,VALVE		2						
07-	M-502-S6-T-S6,2SS	28740	KIT,VALVE		1						
07-	M-502-S6-T-S6,1SS	28740	KIT,VALVE		1						
07-	M-502-S6-T-S6,0.75SS	28740	KIT,VALVE		1						
07-	M-502-S6-T-S6,0.5SS	28740	KIT,VALVE		1						
07-	F-602-BR-B,0.75BRONZ	28740	KIT,VALVE		1						
07-	F-602-BR-B,0.25BRONZ	28740	KIT,VALVE		1						
08-000-0001	08-000-0001		ANALYSER D								
08-000-0007	5730-X88-7965		VALVE SOL		2		6				
08-000-0008	ACGH150010	62983	HOSE VACUM		1		2				
08-000-0011	GM1500	62983	GAUGE PRES		2		4				
08-000-0013	6105-X88-8297		MOTOR								
08-000-0014	200026	98963	REGULATOR		1		2				
08-000-0017	1137-2FMG	98963	FILTER AIR		1		2				
08-000-0018	200146	98963	REGULATOR		1		2				
08-000-0019	1137-4FMG	98963	FILTER AIR		1		2				
08-000-0020	20013G	98963	REGULATOR		1		3				
08-000-0021	LSKIA-88	91929	LIMIT SW		7		20				
08-000-0022	CTK-50		TEST KIT		1		1				
08-308-0201	PBDG-5S4L-062-C-51	62983	VALVE		1		2				
08-308-0202	RT-06-A2-22	62983	VALVE		1		2				
08-308-0203	XT-06-B-20	62983	VALVE		1		2				
08-308-0204	PBDG4S2L-012A-50	62983	VALVE		1		2				
08-308-0205	C2-820	62983	VALVE CK		1		1				
08-308-0206	PBDG4S4L-012A-50	62983	VALVE		5		32				
08-308-0207	DCTC-1-21	62983	SENSOR		1		1				
08-308-0208	LVSW67	39305	SENSOR		1		1				

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57 LEVEL MAX	58-61 ON-HAND	62-65 REORDER	66-69 QTY REQD	70-74 BIN LOC	75-76 REPL CODE	77-78 UNIT ISS	80 ACTION
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE								
08-308-0209	CTS-060A-B-50	62983	VALVE RELF		1		1				
08-308-0210	50FC-2F-10	62983	FILTER		1		1				
08-308-0211	DFM-300-10	62983	FILTER		1		1				
08-308-0211K01	228468 CAT-1-3953-S	62983	FILTER EL		1						
08-308-0212	PVB20-FLSFW-20CMC-11	62983	PUMP		1		1				
08-308-0213	08-308-0213	62983	MOTOR		1		1				
08-308-0214	T-100	62983	RESERVOIR		1		1				
08-308-0215	AI2050-20	62983	ACCUMULATR		1		1				
08-308-0216	LS-800	04039	SWITCH		1		2				
14-650-	25231-001	03990	FILTER-REG		1		1				
14-650- K01	M-20	05490	MUFFLER		1						
14-650- K02	HG-N	05490	HOUSING		1						
14-650- K03	CG-55-S	05490	COVER,GASK		1						
14-650- K04	FG-55N	05490	GASKET FIL		1						
14-650- K05	DF-SS	05490	FILTER BAG		5						
14-650- K06	VO-A	05490	ORIFICE		1						
14-650-0224	14-650-0224	92316	GUARD		1		3				
14-650-0225	14-650-0225	61349	GAUGE		1		3				
14-650-0310	RB-1	80717	FILTER		0		2				
14-650-0311	P100P1S	80717	FILTER BAG		20						
14-650-0311K01	FOR RB-1	80717	O-RING SET		2						
14-650-0311K02	FOR RB-1	80717	BASKET		2						
14-650-0312	14-650-0312	61349	GAUGE		1		3				
14-650-0313	14-650-0313	92316	GUARD		1		3				
14-650-0407	14-650-0407	96717	PUMP ASSY		1		1				
14-650-0407K01	14-650-0407	96717	PUMP		1						
14-650-0407K02	5K145BL2670-JHF		MOTOR		1						
14-650-0407K03	35916-1A	85265	INSERT		2						
14-650-0407K04	35916-2A	85265	SEAL RING		2						
14-650-0407K05	35916-3A	85265	PACKING		2						
14-650-0407K06	35916-6A	85265	SPRING								
14-650-0407K07	35916-7A	85265	O-RING		2						

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-36	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78 80
				LEVEL						
COS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS ACTION
14-650-0407K08	35916-4A	85265	RING,COMPR		2					
14-650-0514	FRH-2C	80293	AGITATOR		1		1			
14-650-0617	3611-11M2M1A	91556	ROTAMETER				1			
14-650-0618	5510A10EGA0A	91556	INDICATOR				1			
14-650-0619	FPG-2C	80293	AGITATOR		1		1			
14-650-0620	14-650-0620	96717	PUMP ASSY		1		1			
14-650-0620K01	14-650-0620	96717	PUMP		1					
14-650-0620K02	5K145BL2670-JHF		MOTOR		1					
14-650-0620K03	35916-1A	85265	INSERT		2					
14-650-0620K04	35916-2A	85265	SEAL RING		2					
14-650-0620K05	35916-3A	85265	PACKING		2					
14-650-0620K06	35916-6A	85265	SPRING		4					
14-650-0620K07	35916-7A	85265	O-RING		2					
14-650-0620K08	35916-4A	85265	RING,COMPR		2					
14-650-0726	FRG-2C	80293	AGITATOR		1		1			
14-650-0727	14-650-0727	96717	PUMP ASSY		1		1			
14-650-0727K01	14-650-0727	96717	PUMP		1					
14-650-0727K02	5K145BL2670-JHF		MOTOR		1					
14-650-0727K03	35916-1A	85265	INSERT		2					
14-650-0727K04	35916-2A	85265	SEAL RING		2					
14-650-0727K05	35916-3A	85265	PACKING		2					
14-650-0727K06	35916-6A	85265	SPRING		4					
14-650-0727K07	35916-7A	85265	O-RING		2					
14-650-0727K08	35916-4A	85265	RING,COMPR		2					
14-650-0898	14-650-0898		HEATER		1		1			
14-650-0899	14-650-0899		HEATER		1		3			
14-650-1002	14-650-1002		GASKET		1		3			
14-650-1004	14-650-1004		GASKET		1		3			
14-650-1104	14-650-1104	92316	GUARD		3		6			
14-650-1105	14-650-1105	38056	GAUGE		3		6			
14-650-1299	14-650-1299		PROBE OVER		1		6			
14-650-1302	8784-J-3-5-90-1-2-1	31922	PROBE TEMP		1		2			

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	LEVEL MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS	ACTION
14-650-1303	87R4-J-3-5-90-1-2-1	31922	PROBE TEMP		1		1				
14-650-1399	8784-J-3-5-66-1-2-1	31922	PROBE TEMP		0		1				
14-650-1402	14-650-1402	31922	J-BOX		1						
14-650-1498	7773-2-2-02-1	31922	PROBE PH		1		1				
14-650-1498K01	14-650-1498K01	31922	KIT MAINT		1						
14-650-1499	14-650-1499	31922	PROBE PH				1				
14-650-1499K01	324442	31922	KIT MAINT.		1						
14-650-1499K02	352107	31922	J-BOX		1		1				
14-650-1597	14-650-1597	50807	PROBE LEVL		1		1				
14-650-1598	14-650-1598	50807	PROBE LEVL		1		3				
14-650-1599	14-650-1599	50807	PROBE LEVL		1		1				
14-650-1601	060-220-1	96717	VALVE PLUG		3		9				
14-650-1601K01	14-650-1601	96717	PACKING		1						
14-650-1603	CB-320-SR	16583	ACTUATOR		3		9				
14-650-1603K01	911236	16583	KIT ACTUAT		5						
14-650-1604	RX21	16583	SWITCH		3		9				
14-650-1605	8321A6	04845	VALVE SOL		3		9				
14-650-1699	14-650-1699	96717	VALVE ASSY		3		7				
14-650-1901	060-220-1	96717	VALVE PLUG		4		11				
14-650-1902	060-176-5	96717	VALVE PLUG		7		21				
14-650-1903	055-496-4	96717	JOINT XPAN		1		3				
14-650-1904	055-498-0	96717	JOINT XPAN		2		6				
14-650-1918	056-009-4	96717	TUBE		2		6				
14-650-1933	L-7211	08660	VALVE		1		2				
14-650-1937	2-SV-100	08660	VALVE		1		2				
15-302-0101	379	25651	SAW		1		1				
15-302-0102	1P801	16327	PUMP		1		1				
15-302-0103	R2K	98153	CYLINDER		1		1				
15-302-0201	15-302-0201	84561	CYLINDER		1		1				
15-302-0218	C-3L-1-4	84561	CYLINDER		1		1				
15-302-0405	P-1620-8	71041	BEARING		2		2				
15-302-1101	PR-600-S-1	09990	VALVE		1		1				

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	LEVEL MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS	ACTION
15-302-1102	11S	38506	GAUGE		1		1				
15-302-1116	421-8	84561	HOSE 12FT		1		1				
15-302-1209	1.125-HH-BX-04-CC	05283	CYLINDER		1		1				
15-302-1210	1.125-HH-TF-2.125-CC	05283	CYLINDER		1		1				
15-302-1212	P-1014-8	71041	BEARING		2		4				
15-302-1213	P-1216-6	71041	BEARING		2		2				
15-302-1214	FP-1014-E	71041	BEARING		2		2				
15-302-1303	CE 0.75	19187	MAGNET ELE		3		8				
15-302-1806	421-6	84561	HOSE 12FT		1		1				
15-302-1901	15-302-1901	54940	BLADE		10		1				
15-302-1902	15-302-1902	25651	BLADE		10		1				
15-303-0105	15-303-0105	38911	ROLLER		2		4				
15-303-0106	2-MH-FF-2.5-CC	05283	CYLINDER		1		1				
15-303-0109	2-MH-FF-2-CC	05283	CYLINDER		1		2				
15-303-0601	11S	38506	GAUGE		1		1				
15-303-0602	PR-600-5-1	09990	VALVE		1		1				
15-303-0604	421-6	84561	HOSE 3.5FT		1		1				
15-303-0605	421-6	84561	HOSE 14FT		1		1				
16-304-0120	D-2X2.75-H6	23952	CYLINDER		1		2				
16-304-0121	D-1.5X2.75-H6	23952	CYLINDER		1		2				
16-304-0122	D-2X9-H6	23952	CYLINDER		1		2				
16-304-0123	A-1.5X14-H6	23952	CYLINDER		1		2				
16-304-0124	A324864	96881	BALL BUSH		4		12				
16-304-0125	S-2000	96881	SEAL		4		12				
16-304-0129	1P801	16327	PUMP		1		1				
16-304-0131	130-AA,5 LB CAN	73219	LUBRIPLATE		1						
16-304-1007	378	25651	SAW COLD		1		1				
16-304-1008	15-304-1008	23952	CYLINDER		1		1				
16-304-1101	1.125-HH-RF-10.25	05283	CYLINDER		1		1				
16-304-1102	1.125-HH-FF-26.5	05283	CYLINDER		1		2				
16-304-1105	A1X2-5-1-4M-0-DE	05448	CYLINDER		1		1				
16-304-1109	2-116	02697	O-RING		1		1				

Table 6-5 (continued)

CAMDS REPAIR PARTS INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78 80
				LEVEL						
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS ACTION
16-304-1111	2-345	02697	O-RING		1		2			
16-304-1207	P-1014-8	71041	BEARING		2		4			
16-304-1505	16-304-1505	05448	CYLINDER							
16-304-2319	421-6	84561	HOSE 20FT		1		1			
16-304-2401	PR-600-S-1	09990	VALVE		1		2			
16-304-2402	115	38058	GAUGE		1		2			
16-304-2405	421-8	84561	HOSE 75FT		1		1			
16-304-2518	RCT-03-D2	62983	VALVE		1		2			
16-304-2521	1608-3		VALVE		1		1			
16-304-2522	PCM-600-S	09990	VALVE		1		3			
16-304-3001	16-304-3001	54940	BLADE		10		1			
16-304-3002	16-304-3002	25651	BLADE		10		1			
18-307-0105	TAS3-U224H-9	92420	BEARING		2		2			
18-307-0107	J618		CYLINDER		1		1			
18-307-0201	1-J-3L-1-9-1	84561	CYLINDER		1		3			
18-307-0207	18-307-0207	43334	BEARING		1		1			
18-307-0208	HT-30	76474	CLUTCH		1		1			
18-307-0212	18-307-0212	92420	BEARING		2		2			
18-307-0219K01	18-307-0219	92420	CHAIN LINK		4					
18-307-0223	1-K-J-3L-1-9	84561	CYLINDER		1		1			
18-307-0303	NF1-PH	82722	CYLINDER		1		1			
18-307-0703	B-812-6	71041	BEARING		2		6			
18-307-1003	B-2226-20	71041	BEARING		1		1			
18-307-1301	18-307-1301		SPRING		4		24			
18-307-1304	18-307-1304	71041	BEARING		16		48			
18-307-1305	18-307-1305		SPRING		4		12			
18-307-1602	1-F-3L-L-S-1-4-2.5	84561	CYLINDER		1		2			
18-307-1803	1.5-MH-RFX-51.5-CK-K	05283	CYLINDER		1		2			
18-307-1807	7-K-J-2H-L-S-1-3-7	84561	CYLINDER		1		1			
18-307-1811	3.25-J-3L-1-9-2	84561	CYLINDER		1		1			
18-307-1814	A-487296	96881	BALL BUSH		2		4			
18-307-2401	LC6-H16-GT1000	76137	MILL HEAD		1		1			

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
				LEVEL							
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS	ACTION
18-307-2402	MODEL 6	76137	RT ANGL HD		1		1				
18-307-2403	3.25-MH-SL-10.5-CC	05283	CYLINDER		1		1				
18-307-2703	B-2428-16	71041	BEARING		2		4				
18-307-3001	1.5-MH-FF-42-CR-K	05283	CYLINDER		1		1				
18-307-3008	A-324864	96881	BALL BUSH		2		2				
18-307-3301	1.125-MH-C-2-CC-K	05283	CYLINDER		1		1				
18-307-3302	FB-1620-E	71041	BEARING		2		2				
18-651-01	MC11274		SWITCH		2		4				
18-651-0121	18-651-0121		VALVE BALL		1		2				
18-651-0123	054-817-2	69717	GASKET		1		1				
18-651-0123	054-817-2	96717	GASKET		3		7				
18-651-0125	TU-4	14007	VALVE BALL		1		1				
18-651-0129	117392	31922	ELECTRODE		1		2				
18-651-0130	117390	31922	ELECTRODE		1		2				
18-651-0131	117418	31922	ELECTRODE		1		2				
18-651-0301	M-8-S	52837	PUMP		1		1				
18-651-0301K01	M-8-S ITEM 40	52837	SEAT		1		1				
18-651-0301K02	M-8-S ITEM 24	52837	DIAPHRAM		1						
18-651-0301K03	M-8-S ITEM 21D	52837	O-RING		1						
18-651-0301K04	M-8-S ITEM 20A	52837	PISTON ASY		1						
18-651-0301K05	M-8-S ITEM 20B	52837	GASKET		1						
18-651-0301K06	M-8-S ITEM 20U	52837	O-RING		1						
18-651-0312K01	25241-0	03990	FILTER EL		1						
18-651-0317	SWG-12C-1	18034	VALVE CK		1		3				
18-651-0321	060-201-1	96717	VALVE PLUG		1		2				
18-651-0323	054-817-2	96717	GASKET		1		2				
18-651-0340	1SE1	82633	SWITCH		2		2				
18-651-0401	M-8-S	52837	PUMP		1		1				
18-651-0401K01	M-8-S ITEM 40	52837	SEAT		1		1				
18-651-0401K02	M-8-S ITEM 24	52837	DIAPHRAM		1						
18-651-0401K03	M-8-S ITEM 21D	52837	O-RING		1						
18-651-0401K04	M-8-S ITEM 20A	52837	PISTON ASY		1						

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	LEVEL MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS	ACTION
18-651-0401K05	M-6-S ITEM 208	52837	GASKET		1						
18-651-0401K06	M-8-S ITEM 200	52837	O-RING		1						
18-651-0410K01	25241-0	03990	FILTER EL		1						
18-651-0415	SWG SS-12C-1	18034	VALVE CK		1		1				
18-651-0417	8211C87	04845	VALVE SOL		2		2				
18-651-0420	18-651-0420	14007	VALVE ASSY		1		2				
18-651-0502	SVHC8-8M	16444	DISCONNECT		1		1				
18-651-0505	054-817-2	96717	GASKET		1		3				
18-651-0507	18-651-0507		VALVE BALL		1		1				
18-651-1007	TU-4	14007	VALVE BALL		1		2				
19-650-	25231-001	03990	FILTER-REG		1		1				
19-650-0217	FRG-2C	80293	AGITATOR		1		1				
19-650-0218	19-650-0218	96717	PUMP CENTR		1		2				
19-650-0218K01	CN35916	85265	INSERT		2		4				
19-650-0218K02	CN35916	85265	RING SEAL		4						
19-650-0218K03	CN35916	85265	PACKING		4						
19-650-0218K04	CN35916	85265	SPRING		4						
19-650-0218K05	CN35916	85265	O-RING		4						
19-650-0218K06	CN35916	85265	RING COMPR		4						
19-650-0316	FRG-2C	80293	AGITATOR		1		1				
19-650-0427	FRG-	80293	AGITATOR		1		1				
19-650-0709	060-220-1	96717	VALVE PLUG		4		16				
19-650-1202K01	MF-DFS-0.25	05490	FILTER BAG		1						
19-650-1202K02	JAV-3	05490	V-VALVE		1						
19-650-1202K03	M-20	05490	MUFFLER		1						
19-650-1202K04	FS-A	05490	MOTOR AIR		1						
19-650-1203	VHN-1.5X15	05490	HOSE VACUM		1		1				
19-650-1207	HPRG-0.5	05490	REGULATOR		1		1				
19-650-1208	FDS-3X8X12L	05490	DUST SLEEV		1		1				
19-650-1705	055-496-4	96717	JOINT XPAN		1		2				
21-	S02	51040	RESERVOIR		1		1				
21-	21-	91040	MOTOR		1		1				

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-36	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	LEVEL MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS	ACTION
21-	AL100 1-3/8X7/8	51040	COUPLING		1		1				
21-	MM	51040	HOUSING		1		1				
21-	450C08L1A1B1AC	51040	PUMP		1		1				
21-	20S20CM3FF1	51040	FILTER SUC		1		1				
21-	DPG-1000	51040	GAUGE PRES		1		1				
21-	4FV6AN-6	51040	VALVE		1		1				
21-350-0122	AE1002920H0280	00624	HOSE ASSY		2		4				
21-350-0123	AE1002920H0250	00624	HOSE ASSY		1		1				
21-350-0124	AE1002920H0124	00624	HOSE ASSY		1		1				
21-350-0140	BZV6-2RQ81	91929	LIMIT SW		1		1				
21-350-0142	BZV6-2RN	91929	LIMIT SW		1		1				
21-350-0157	LSF7L	91929	LIMIT SW		1		1				
21-350-0205	MODEL AA	96151	MOTOR		1		1				
21-350-0213	SYH-100X	52676	PILLOW BLK		0		2				
21-350-0214	SY-8	52676	PILLOW BLK		0		2				
21-350-0216	SK-2656-B(RH)	18740	GEAR BOX		1		1				
21-350-0217	SK-2656-B(LH)	18740	GEAR BOX		1		1				
21-350-0302	FY-100	56676	BEARING		4		8				
21-350-0310	MODEL AA	96151	MOTOR		1		1				
21-350-0409	21-350-0409	18740	JACTUATOR		2		4				
21-350-0416	21-350-0416	91940	CYLINDER		1		1				
21-350-0419	BLFR-12-045	81376	BEARING		1		1				
21-350-1105	21-350-1105		BOOT		1		1				
21-350-1202	21-350-1202		VALVE RELF		1		3				
21-350-1203	YP-01-01A1	24765	VALVE		1		3				
21-350-1204	CPF-01-TT-1003	24765	VALVE		1		3				
21-351-0111	LSM-1-2X4(CC)	60285	CYLINDER		1		1				
21-351-0120	LSM-4-2X31(CC)	60285	CYLINDER		1		1				
21-351-0124	AE1002924G0240	00624	HOSE ASSY		1		1				
21-351-0132	LSA3K	91929	LIMIT SW		1		2				
21-351-0139	LSB3K	91929	LIMIT SW		3		4				
21-351-0148	LSM7N	91929	LIMIT SW		1		1				

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57 LEVEL MAX	58-61 ON-HAND	62-65 REORDER	66-69 QTY REQD	70-74 BIN LOC	75-76 REPL CODE	77-78 UNIT ISS	80 ACTION
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE								
21-351-0153	LSN3K	91929	LIMIT Sw		1		1				
21-351-0155	AE1002920G0360	00624	HOSE ASSY		1		1				
21-351-0162	LSM-1-1.5X16(CC)	60285	CYLINDER		1		1				
21-351-0171	AE1987E0120240	00624	HOSE ASSY		1		1				
21-351-0179	AE1002920F0180	00624	HOSE ASSY		1		1				
21-351-0203	06918-5H-1.00 DIA	71041	PILLOW BLK		4		8				
21-351-0204	PBO-24-OPN	96881	BALL BUSH		2		6				
21-351-0206	EB-375	63810	E.M. BRAKE		1		1				
21-351-0303	21-351-0303	03089	LOAD CELL		2		4				
21-351-0403	S-375-SS	96881	SEAL		2		2				
21-351-0404	A-61014-SS	96881	BALL BUSH		2		2				
21-351-0418	V52D81125	81978	VALVE SOL		2		2				
21-351-0420	V500K	24047	VALVE-4WAY		2		2				
21-351-0607	LSM-8-1.5X1.5(NC)	60285	CYLINDER		2		2				
21-351-0608	21-351-0608	60285	CYLINDER		1		1				
21-351-0609	92D10-2.5	24047	DRILL		1		1				
21-351-0610	A-24506,0.750	24047	DRILL B.T.		1		1				
21-351-0901	21-351-0901		GASKET		3		1				
21-351-1201	21-351-1201		O-RING		3		1				
21-351-1202	21-351-1202		O-RING		3		1				
21-351-1202	041-DX	19541	CYLINDER		1		1				
21-351-1203	21-351-1203		DRILL BIT		5		1				
21-351-1205	21-351-1205		GASKET		1		1				
21-351-27	MCP-200-S-1/8	09990	VALVE		1		2				
21-351-2706	4MD-20-A-8	09990	VALVE 4WAY		1		1				
21-351-2707	4MD-01-A-C	09990	VALVE 4WAY		1		3				
21-351-2708	MF200-S-10	09990	VALVE		2		5				
21-351-2722	4MD-06-A-C	09990	VALVE 4WAY		1		2				
21-352-			VALVE 4WAY		1		1				
21-352-			VALVE RELF		1		3				
21-352-0113	21-352-0113	60285	CYLINDER		1		1				
21-352-0113K01	200-1-01	60285	LIMIT SW		2		2				

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	LEVEL MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS	ACTION
21-352-0114	LSM-3-2X1.8(CC)	60285	CYLINDER		1		1				
21-352-0114K01	200-1-01	60285	LIMIT SW		2		2				
21-352-0124	AE1002924J0360	00624	HOSE ASSY		1		1				
21-352-0125	AE1002926E0260	00624	HOSE ASSY		2		2				
21-352-0126	AE1002920E0300	00624	HOSE ASSY		1		1				
21-352-0127	AE1002920G0400	00624	HOSE ASSY		2		2				
21-352-0128	AE1002920G0180	00624	HOSE ASSY		1		1				
21-352-0129	AE1002920G03C0	00624	HOSE ASSY		1		1				
21-352-0130	AE1002920G0480	00624	HOSE ASSY		1		1				
21-352-0131	AE1002920G0540	00624	HOSE ASSY		1		1				
21-352-0132	MODEL AA	96151	MOTOR		1		1				
21-352-0139	SK-2717-B(RH)	18740	GEARBOX		1		1				
21-352-0141	SK-2658-B(RH)	18740	GEARBOX		1		1				
21-352-0151	21-352-0151	18740	JACTUATOR		2		4				
21-352-0155	BZV6-2RQ61	91929	LIMIT SW		2		2				
21-352-0164	AE1002920H0300	00624	HOSE ASSY		1		1				
21-352-0168	AE1002924E0300	00624	HOSE ASSY		2		2				
21-352-0186	V53D82150	81978	VALVE,SOL		2		2				
21-352-0276	AE1002920J0420	00624	HOSE ASSY		1		1				
21-352-0279	AE1002926E0150	00624	HOSE ASSY		1		1				
21-352-0280	LSB3K-4M	91924	LIMIT SW		1		1				
21-352-0281	LSA3K-4M	91924	LIMIT SW		1		1				
21-352-0287	LSA3K-2C	91924	LIMIT SW		2		2				
21-352-0288	LSM-8-1.5X1.5(NC)	60285	CYLINDER		2		2				
21-352-0288	21-352-0288	60285	CYLINDER		1		1				
21-352-0288K01	200-1-01	60285	LIMIT SW		1		1				
21-352-0306	LSM-2-.75X23(NC)	60285	CYLINDER		1		1				
21-352-0325	21-352-0325	03990	DRILL		1		1				
21-352-0332	40591-4	03990	VALVE ASSY		1		1				
21-352-0333	9600	03990	VALVE		2		2				
21-352-0505	21-352-0505		O-RING		3		1				
21-352-1401	21-352-1401		GASKET		3		1				

Table 6-5 (continued)

CAMDS REPAIR PARTS
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AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78 80
				LEVEL						
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS ACTION
21-352-1801	4MD-20-A-B	09990	VALVE 4WAY		1		1			
21-352-1803	4MD-01-A-C	09990	VALVE 4WAY		1		4			
21-352-1805	MF-200-S-10	09990	VALVE		1		4			
21-352-1819	101-08-C-1-A-Y-C	09990	VALVE 4WAY		1		1			
21-352-1821	MF-600-S-10	09990	VALVE		1		1			
21-353-01107	M666000F0320	00624	HOSE ASSY		1		1			
21-353-0123	LSM-4-2X31(CC)	60285	CYLINDER		1		1			
21-353-0124	LSM-1-2X6(CC)	60285	CYLINDER		1		1			
21-353-0137	LSB3K	91929	LIMIT SW		1		1			
21-353-0138	LSN3K	91929	LIMIT SW		1		1			
21-353-0139	LSA3K	91929	LIMIT SW		4		4			
21-353-0140	LSMTN	91929	LIMIT SW		1		1			
21-353-0142	M666000G0240	00624	HOSE ASSY		2		2			
21-353-0149	LSM-1-1.5X10.375(CC)	60285	CYLINDER		1		1			
21-353-0157	M666000G0330	00624	HOSE ASSY		1		1			
21-353-0198	M666000E012G	00624	HOSE ASSY		1		1			
21-353-0203	06918-5H-1.00 DIA	71041	PILLOW BLK		4		8			
21-353-0204	SPB-32-OPN	96881	BALL BUSH		2		4			
21-353-0206	EB-375	63810	E.M. BRAKE		1		1			
21-353-0303	21-353-0303	03089	LOAD CELL		1		4			
21-353-0403	S-375-SS	96881	SEAL		2		2			
21-353-0404	A-61014	96881	BALL BUSH		2		2			
21-353-0418	V52DB1125	81978	VALVE SOL		2		2			
21-353-0420	V500K	24047	VALVE 4WAY		1		1			
21-353-0501	92D10-3-S-2.5	24047	DRILL		1		1			
21-353-0511	A-61014-SS	96881	BALL BUSH		2		2			
21-353-0532	041-DX,3/4X1	19541	CYLINDER		1		1			
21-353-0538	LSB3K	91929	LIMIT SW		1		1			
21-353-0542	LSM-8-1.5X1.5(NC)	60285	CYLINDER		2		2			
21-353-0543	21-353-0543	60285	CYLINDER		1		1			
21-353-0543K01	200-1-01	60285	LIMIT SW		1		1			
21-353-0544	A-24506,0.750	24047	DRILL B.T.		5		1			

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
				LEVEL							
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS	ACTION
21-353-0901	21-353-0901		GASKET		1		1				
21-353-1201	21-353-1201		O-RING		1		1				
21-353-1202	21-353-1202		O-RING		1		1				
21-353-1203	21-353-1203		DRILL BIT		10		1				
21-353-2701	4MD-20-A-B	09990	VALVE 4WAY		1		1				
21-353-2702	4MD-01-A-C	09990	VALVE 4WAY		1		3				
21-353-2703	MF200-S-10	09990	VALVE		2		5				
21-353-2717	MCP-200-S-1/8	09990	VALVE		1		2				
21-353-2718	4MD-06-A-C	09990	VALVE 4WAY		1		2				
21-650-0114	SS-QC4-D-4PM-VT	02570	DISCONNECT		2		2				
21-650-0115	SS-QC4-B-4PM-VT	02570	DISCONNECT		2		2				
21-650-0118	AE10029206O240	00624	HOSE ASSY		1		1				
21-650-0122	21-650-0122	14007	VALVE		1		2				
21-650-0123	21-650-0123	14007	VALVE		6		16				
21-650-0208	7773-3-2-00-0-000	31922	PROBE PH		1		1				
21-650-0209	117392	31922	ELECTRODE		1		1				
21-650-0210	117390	31922	ELECTRODE		1		1				
21-650-0210K01	324442	31922	KIT MAINT		1						
21-650-0211	117418	31922	ELECTRODE		1		1				
21-650-0218	FRH-3	80293	AGITATOR		1		1				
21-650-0310	7773-3-2-00-0-000	31922	PROBE PH		1		1				
21-650-0311	117392	31922	ELECTRODE		1		1				
21-650-0312	117390	31922	ELECTRODE		1		1				
21-650-0313	117418	31922	ELECTRODE		1		1				
21-650-0317	21-650-0317		PROBE		1		1				
21-650-0701	21-650-0701		GASKET		4		7				
21-650-0702	21-650-0702		GASKET		2		3				
21-650-0703	21-650-0703		GASKET		2		6				
21-650-0705	21-650-0705		GASKET		2		3				
21-650-1315	M-8-S	52837	PUMP		2		2				
21-650-1315K01	M-8-S ITEM 40	52837	SEAT		2						
21-650-1315K02	M-8-S ITEM 24	52837	DIAPHRAM		2						

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57 LEVEL MAX	58-61 ON-HAND	62-65 REORDER	66-69 QTY REQD	70-74 BIN LOC	75-76 REPL CODE	77-78 UNIT ISS	80 ACTION
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE								
21-650-1315K03	M-8-S ITEM 21D	52837	O-RING		2						
21-650-1315K04	M-8-S ITEM 20A	52837	PISTON ASY		2						
21-650-1315K05	M-8-S ITEM 20B	52837	GASKET		2						
21-650-1315K06	M-8-S ITEM 20U	52837	O-RING		2						
21-650-1318	8211C87,1/2NPT	04845	VALVE SOL		2		2				
21-650-1318K01	158-927	04845	KIT MAINT		2						
21-650-1318K02	64-9a2-1 120VAC 60HZ	04845	COIL		2						
21-650-1322	SS-12C-1	18034	VALVE CK		2		2				
21-650-1335	21-650-1335		PROBE		1		1				
21-650-1337	21-650-1337	14007	VALVE		1		1				
21-650-1341	25241-000	03990	FILTER		0		1				
21-650-1341K01	25241-0	03990	FILTER EL		1						
21-650-1347	25241-000	03990	FILTER		0		1				
21-650-1347K01	25241-0	03990	FILTER EL		1						
21-650-1401	21-650-1401		VALVE ASSY		2		3				
21-650-1501	21-650-1501		VALVE ASSY		2		2				
21-851-0302	PTSHA212F	91929	SELECT SW		1		3				
21-851-0303	CR103C5402	02295	LIGHT IND		1		1				
21-851-0304	CR103C2402	02295	LIGHT IND		2		2				
21-851-0305	CR103C3402	02295	LIGHT IND		2		2				
21-851-0402	PTSHA212F	91929	SELECT SW		1		4				
21-851-0404	PTP32F	91929	PUSH BT SW		1		3				
21-851-0405	CR103C5402	02295	LIGHT IND		1		1				
21-851-0406	CR103C3402	02295	LIGHT IND		6		6				
21-851-0407	CR103C2402	02295	LIGHT IND		5		5				
21-851-05	PTSHA212F	91929	SELECT SW		1		5				
21-851-05	PTP32F	91929	PUSH BT SW		1		3				
21-851-05	CR103C2402	02295	LIGHT IND		5		5				
21-851-05	CR103C3402	02295	LIGHT IND		6		6				
21-851-05	CR103C5402	02295	LIGHT IND		2		2				
21-851-05			PWR SUP		1		1				
22-400-			LIMIT SW								

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78 80
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	LEVEL MAX	ON-HAND	REORDER	QTY RFQD	BIN LOC	REPL CODE	UNIT ISS ACTION
22-400-0101	22-400-0101	26455	CYLINDER		1		1			
22-400-0102	22-400-0102	71041	GEARMOTOR		1		1			
22-400-0104	RC-40,10FT/80X	92420	CHAIN		18X		38X			
22-400-0106	CF-1	92563	BEARING		10		30			
22-400-0201	D-600-10	09990	VALVE		2		2			
22-400-060501	HB-68	15310	BALL TRANS		10		20			
22-400-1001R1	LSZ1C	91929	LIMIT SW							
22-401-			LIMIT SW							
22-401			LIMIT SW							
22-401			LIMIT SW							
22-401-0101	F3218-FUX	71041	GEARMOTOR		1		1			
22-401-0103	22-401-0103	19388	CHAIN		1		2			
22-401-0108	CLH-D-2	05283	CYLINDER		2		2			
22-401-0114	TB-1228	71041	BEARING		2		6			
22-401-0115	L-TW-64-8	99862	BUSHING		2		2			
22-401-0117	22-401-0117	04373	CYLINDER		1		1			
22-401-0408	B-1216-12	71041	BEARING		2		2			
22-401-0409	B-710-4	71041	BEARING		2		2			
22-401-0914	313-3-08-548-548-27		HOSE ASSY		2		2			
22-402-			LIMIT SW							
22-402-0101	22-402-0101	26445	CYLINDER		1		1			
22-402-0110	22-402-0110	05283	CYLINDER		1		1			
22-402-0114	CF-1.5-S	92563	BEARING		10		28			
22-402-0119	22-402-0119	05283	CYLINDER		1		1			
22-402-0122	FB-812-4	71041	BEARING		2		2			
22-402-0502	FB-812-4	71041	BEARING		2		2			
22-402-0504	B-610-6	71041	BEARING		1		1			
22-402-0704	FB-810-4	71041	BEARING		2		2			
22-402-0906	22-402-0906	92563	BEARING		2		6			
22-403-0202	051CTA	92563	BEARING		10		28			
22-403-0204	DF-600-10	09990	VALVE DECL		2		2			
22-403-0209	LSF1A	91929	LIMIT SW		1		1			

Table 6-5 (continued)

CAMOS REPAIR PARTS
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AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78 80
				LEVEL						
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS ACTION
22-403-0210	LSK1A-8A	91929	LIMIT SW		7		7			
22-403-0211	LSD1A	91929	LIMIT SW		1		1			
22-403-0304	TB-1016	71041	BEARING		10		28			
22-403-0305	TB-410	71041	BEARING		10		30			
22-403-0313	0515-10003-33-10	26500	CYLINDER		3		7			
22-403-0947	22-403-0947		BELT,CONV		1		1			
22-403-2114	22-403-2114	26455	CYLINDER		1		1			
22-403-2201	1ADF1	82800	GEARMOTOR		1		1			
22-403-2202K01	RC50,10FT/BCX	82800	CHAIN		18X					
22-404-0201	22-404-0201	26455	CYLINDER		1		1			
22-404-0202	SY-012	52676	PILLOW BLK		2		6			
22-404-0203	1.125-A-TF-CC-0	05283	CYLINDER		3		3			
22-404-0204	DF-600-10	09990	VALVE DECL		2		2			
22-404-0205	CF-1,1DIA,7116SH,1LG	92563	CAM FOLLOW		5		20			
22-404-0701K01	UC-2467-7,40 PITCHES	19382	CHAIN		1					
22-404-0702	UC-2469-12	19382	SPROCKET		2		6			
22-404-0703	FWC 326C-100-M1	71041	GEARMOTOR		1		1			
22-404-0704	22-404-0704	71176	TORQ LIMIT		1		1			
22-404-0705	22-404-0705		CHAIN		1		1			
22-404-0706	FB22420-H,1.25IN SH	19382	BEARING		4		10			
22-404-0711	T-B22420-H	19382	TAKE-UP U		1		2			
22-404-0712	22-404-0712		WEAR STRIP		60F		60F			
22-410-			BELT,CONV							
22-410-0101	22-410-0101	15310	E.ROLL ASY		1		1			
22-410-0110	22-410-0110	15310	ROLLER		31		104			
22-410-0111	C-736-8.484 BRG	15310	RET ROLLER		2		6			
22-410-0502	CF-711-8-1/2-35	15310	CONV DRIVE		1		1			
22-410-0508	M100		ROTACH		1		1			
22-411-			GEARMOTOR							
22-411-			TORQ LIMIT							
22-411-			CHAIN							
22-411-			SENSOR							

Table 6-5 (continued)

CAMDS REPAIR PARTS
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4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	LEVEL MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS	ACTION
22-411-0108	22-411-0108	05319	BELT ASSY		1		2				
22-411-0109	22-411-0109	71956	BEARING		2		2				
22-412-			BELT,CONV								
22-412-0101	22-412-0101	15310	E.ROLL ASY		1		1				
22-412-0108	22-412-0108	15310	ROLLER		30		90				
22-412-0109	C-736-8.484 BRG	15310	RET ROLLER		2		4				
22-412-0110	CF-711-8-1/2-35	15310	CONV DRIVE		1		1				
22-412-0807	M100		ROTACH		1		1				
22-414-			LIMIT SW								
22-414-0101	MODEL AAS	96151	MOTOR		1		1				
22-414-0105	06984-31,5/8DIA	71041	PILLOW BLK		2		4				
22-414-0106	PB-20-A.1.250IA	32105	BALL BUSH		2		4				
22-414-0109	22-414-0109	71041	CHAIN		1		2				
22-414-0701	22-414-0701	01509	TURNTABLE		1		1				
22-414-0706	F313B-50-CU	71041	GEARMOTOR		1		1				
22-414-0707	EC-375	63810	CLUTCH		1		1				
22-414-0710	NO.40-1/2PITCHX18LG	71041	CHAIN		1		1				
22-414-0711	NO.40-1/2PITCHX23LG	71041	CHAIN		1		1				
22-414-0712	22-414-0712	05283	CYLINDER		1		1				
22-415-0702	22-415-0702		PROJ PIKUP		5		25				
22-418			LIMIT SW								
22-418-0101	22-418-0101	26455	CYLINDER		1		1				
22-418-0102	F321B-30-FUX	71041	GEARMOTOR		1		1				
22-418-0104	PC-40,10FT/BOX	92420	CHAIN		1BX		5BX				
22-418-0106	CF-1	92563	BEARING		10		30				
22-418-0816	22-418-0816	09990	VALVE DECL		2		2				
22-419-			LIMIT SW								
22-419-			LIMIT SW								
22-419-			LIMIT SW								
22-419-			PHOTO CELL								
22-419-0402-4	B-1216-14	71041	BEARING		2		2				
22-419-0403-4	B-1216-14	71041	BEARING		2		2				

Table 6-5 (continued)

CAMDS REPAIR PARTS
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AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78 80
				LEVEL						
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS ACTION
22-419-0601	F3218-30-J3-FUx	71041	GEARMOTOR		1		1			
22-419-0603	22-419-0603	19388	CHAIN		1		3			
22-419-0614	22-419-0614	99197	CYLINDER		3		3			
22-419-0616	22-419-0616	05283	CYLINDER		1		1			
22-419-0617	22-419-0617	05283	CYLINDER		1		1			
22-419-0619	NT1217	71041	BEARING		2		4			
22-420-			LIMIT SW							
22-420-0108	3138-30-61	71041	GEARMOTOR		1		1			
22-420-0110	22-420-0110	71041	CHAIN		1		1			
22-420-0304	22-420-0304		BELT,CONV		1		1			
22-420-0308	FP-1216-6	71041	BEARING		2		4			
22-420-0309	P-1216-6	71041	BEARING		2		4			
22-421-0101	22-421-0101	76780	BELT,CONV		1		1			
22-421-0102	22-421-0102	91193	BELT,CLEAT		7		14			
22-421-0105	FP-1216-8	71041	BEARING		2		4			
22-421-0106	P-1216-8	71041	BEARING		2		4			
22-421-0304	F313-30-DUx	71041	GEARMOTOR		1		1			
22-421-0312	22-421-0312	71041	CHAIN							
23-357-0102	BC81-NL	11524	PRE-FILTER		530					
23-357-0103	7081-NL	11524	HEPA-FILTR		420					
23-357-0104	D28699		TRAY ABSOR		460					
23-357-0113	2003	85274	GAUGE							
23-357-0118	3003	85274	GAUGE							
23-357-0120	B9367	00646	FAN							
23-357-0124	FMS-F	05322	FLOW MEAS							
25-000-0002	RP-800-S-1	09990	VALVE		1		1			
25-000-0003	C800S10	09990	VALVE		1		1			
25-000-0006	DLC105LB	84830	SPRING		4		10			
25-000-0007	DG4S4L012C50		VALVE		4		10			
25-000-0010	PB12A	96881	BALL BUSH		2		6			
25-000-0011	4820-x89-0107		VALVE		2		3			
25-000-0012	3040-x89-0106		VALVE		2		3			

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78 80
				LEVEL						
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	RFPL CODE	UNIT ISS ACTION
25-000-0013	517-D	96861	BEARING		2		4			
25-000-0014	A101814	96681	BUSHING		2		2			
25-000-0015	R2J	98153	CYLINDER		1		2			
25-000-0016	3040-X89-1271		CYLINDER		1		1			
25-000-0017	PB12A	96881	BUSHING		2		2			
25-000-0018	3040-X89-1272		CYLINDER		1		2			
25-000-0019	CFL-0.5-SB	92863	CAM FOLLOW		1		2			
25-309-32124	LSYPC1A5-5C	91929	LIMIT SW		1		1			
25-309-32155	1.5-MH-FF-2-NC-D	05283	CYLINDER		1		1			
25-309-32156	1.125-MH-FF-8-CF	05283	CYLINDER		1		1			
25-309-32157	1.5-MH-C-4-NC	05283	CYLINDER		1		1			
25-309-32159	1.125-MH-FF-6-CF-D	05283	CYLINDER		1		1			
25-309-32163	LSYPC1A3L8	91929	LIMIT SW		1		1			
25-309-32164	LSY C1A	91929	LIMIT SW		1		1			
25-309-3311	LC-0550-6-	84830	SPRING		1		1			
25-309-3315	LC-66TH-1-ES	84830	SPRING		1		1			
25-309-3354	LC-D6TJ-1-85	84830	SPRING		1		1			
25-309-3398	D5C	96151	MOTOR		1		1			
25-309-3399	1.125-MH-FF-5-CF	05283	CYLINDER		1		2			
25-309-34155	1.5-MH-FF-2-NC-D	05283	CYLINDER		1		1			
25-405-			CYLINDER							
25-405-0892	B3137-16	71041	BUSHING		1		1			
25-405-0893	25-405-0893	03469	BEARING		1		1			
25-405-11144	DF-600-10-5	09990	VALVE		2		2			
25-405-11146	AE32	03743	REELITE		1		1			
25-405-11148	LSYHC1A3-4N	91929	LIMIT SW		1		1			
25-405-11150	LSYPC1A5-5C	91929	LIMIT SW		1		1			
25-405-1701	1.125-MH-RF-8-CC-K	05283	CYLINDER		1		1			
25-405-1702	LSYVC1A	91929	LIMIT SW		1		1			
25-405-1703	LSYVC1A	91929	LIMIT SW		1		1			
25-406-0104	C-737-15	01509	ROLLER ASY		1		2			
25-406-0105	C-770-15	01509	ROLLER ASY		1		2			

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78 80
				LEVEL						
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS ACTION
25-406-0106	25-406-0106		MOTOR		1		1			
25-406-0107	C-701-15-0.5-72	01509	CONV DRIVE		1		1			
25-406-0202	PB-12-ADJ	96881	PILLOW BLK		2		4			
25-406-0204	101	01509	BALL TRANS		2		4			
25-406-0206	1.125-MH-RP-6-CC-K	05283	CYLINDER		1		1			
25-406-0802	LSYHC1A	91929	LIMIT SW		1		1			
25-406-0803	LSZ51A	91929	LIMIT SW		1		1			
25-407-0302	C770	01509	ROLLER ASY		1		1			
25-407-0303	C710	01509	CONV DRIVE		1		1			
25-407-0304	C737	01509	IDLER ASY		1		1			
25-407-0308	25-407-0308	76157	BELT,CONV		1		1			
25-407-0406	G56-8-7	71041	BUSHING		1		1			
25-407-0510	E5-43-201-38	94222	SEAL		120		357			
25-407-2501	25-407-2501	38911	ROLLER ASY		1		1			
25-407-2502	25-407-2502	26455	CYLINDER		1		1			
25-407-2503	LSYAC1A-2C	91929	LIMIT SW		1		1			
25-407-2504	DS-15-1	23347	ACTUATOR		1		1			
26-606-0107	26-606-0107		GASKET		2		4			
26-606-0108	26-606-0108	98991	VALVE BALL		1		3			
26-606-0110	26-606-0110		LIMIT SW		1		3			
26-606-03	26-606-03		PACKING		3		9			
26-606-03	26-606-03		GASKET		3		9			
26-607-0115	8748	73680	GASKET		1		2			
26-607-0116	8748	73680	GASKET		2		6			
26-607-0118	26-607-0118		VALVE BALL		1		1			
26-607-0119	26-607-0119		VALVE BALL		1		2			
26-607-0124	8748	73680	GASKET		2		4			
26-607-0214	8748	73680	GASKET		1		2			
26-607-0215	8748	73680	GASKET		2		6			
26-607-0216	26-607-0216		VALVE DIA.		1		2			
26-607-0217	26-607-0217		VALVE DIA.		2		6			
26-608-0115	26-608-0115	96717	VALVE PLUG		2		4			

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	LEVEL MAX	ON-HAND	REORDER	QTY RECD	BIN LOC	REPL CODE	UNIT ISS	ACTION
26-608-0118	26-608-0118	96717	GASKET		1		1				
26-609-0113	26-609-0113		VALVE PINC		3		5				
26-609-0114	26-609-0114		VALVE PINC		2		4				
26-609-0117	26-609-0117	96717	GASKET		1		1				
26-610-0140	26-610-0140	92764	GASKET		1		2				
26-610-0141	26-610-0141	92764	GASKET		1		2				
26-610-0142	26-610-0142	92764	GASKET		1		1				
26-610-0143	26-610-0143		VALVE GATE		1		3				
26-610-0144	26-610-0144		VALVE GATE		2		5				
26-611-0162	26-611-0162		GASKET		1		3				
26-611-0163	26-611-0163		GASKET		1		2				
26-611-0164	26-611-0164		GASKET		1		1				
26-611-0165	26-611-0165		GASKET		1		2				
26-611-0166	26-611-0166		GASKET		2		6				
26-611-0167	26-611-0167		GASKET		2		5				
26-611-0168	26-611-0168		GASKET		1		1				
26-611-0169	26-611-0169		VALVE GATE		1		3				
26-611-0170	26-611-0170		VALVE GATE		1		3				
26-611-0171	26-611-0171		VALVE GATE		1		2				
26-611-0172	26-611-0172		VALVE GATE		1		2				
26-611-0173	26-611-0173		VALVE GATE		1		3				
26-611-0174	26-611-0174		VALVE GATE		1		2				
26-611-0175	26-611-0175		VALVE GLOB		3		7				
26-611-0230	26-611-0230	92764	GASKET		2		6				
26-611-0231	26-611-0231	92764	GASKET		1		1				
26-611-0232	26-611-0232	92764	GASKET		1		2				
26-611-0233	26-611-0233		VALVE GATE		3		8				
26-611-0234	26-611-0234		VALVE GATE		1		3				
26-614-	26-614-		SOLVENT		1		1				
26-614-0101	26-614-0101	53345	TAPE 38OFT		1		1				
26-614-0102	N3E-4-4070	53345	THERMOSTAT		2		4				
26-614-0103	348L	34984	LIGHT SIGN		2		4				

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-36	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	LEVEL MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS	ACTION
26-614-0217	26-614-0217		VALVE GATE		11		32				
26-614-0218	26-614-0218		VALVE GATE		2		4				
26-614-0219	26-614-0219		VALVE GATE		5		13				
26-614-0220	95L 1E3927-29142		REGULATOR		1		3				
26-614-0221	1279		GAUGE PRES		1		3				
26-614-0223	26-614-0223		VALVE GLOB		1		3				
26-614-0224	26-614-0224		VALVE SAFE		1		3				
27-501-01	FJ3-B400	30086	BREAKER		1		3				
27-501-01	KM3-B600	30086	BREAKER		1		2				
27-501-01	LM3-B800	30086	BREAKER		1		1				
27-501-07	TEB132050		BREAKER		1		2				
27-501-11	27-501-11		BREAKER		1		1				
27-501-2005	323003	75915	FUSE 15A		3		5				
27-501-2007	CAB30	71400	FUSE 30A		1		2				
27-501-2008	CAC60	71400	FUSE 60A		1		2				
27-501-2009	CAC40	71400	FUSE 40A		2		6				
27-501-2010	27-501-2010	02580	LIGHT HG		14		41				
27-501-2411	KM3-B600	30086	BREAKER		1		3				
27-501-2412	KM3-B500	30086	BREAKER		1		1				
27-501-2416	FJ3-B125	30086	BREAKER		1		2				
27-501-2417	EH3-B100	30086	BREAKER		1		3				
27-501-2418	EH3-B050	30086	BREAKER		1		1				
30-503-0301	MODEL 2006-001	05159	CAMERA TV		3		8				
30-503-0302	MODEL PT-550-MX	12644	P-T ASSY		4		12				
30-503-0303	AC17E	05159	CABLE								
30-503-0305	CA-310GE-16S-1S-A105	71468	PLUG FMALE		4		10				
30-503-0306	CA-310GE-16S-1P-A105	71468	PLUG MALE		4		10				
30-503-0307	AC28E - 1000FT.	05159	CABLE		1						
30-503-0309	PC06A-18-30S(SR)	05159	PLUG FMALE		3		8				
30-503-0310	CA-310GE-28-21P-A105	71468	PLUG MALE		3		8				
30-503-0313	CA-310GE-28-21P-A105	71468	PLUG MALE		3		8				
30-503-0314	30-503-0314	05159	CAMERA CTR		3		9				

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78 80
				LEVEL						
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS ACTION
30-503-0314K01	8395221-001	05159	VIDEO BD							
30-503-0314K02	8395101-001	05159	PWR SUP BD							
30-503-0314K03	842211-001	05159	GENERATOR							
30-503-0314K04	8395451-201	05159	DEFLEC BRD							
30-503-0315	2481-010	05159	LENS CONTR		5		14			
30-503-0316	2481-001	05159	P-T CONTRL		5		14			
30-503-0317	RG-59B/U - 100FT.	05159	CABLE		1					
30-503-0318	2-329083-1		CONNECTOR		6		30			
30-503-0319	9800-162		AMPLIFIER		1		1			
30-503-0320	2740-400		GENERATOR		1		2			
30-503-0321	SNA912A	72737	MONIT 6IN		2		18			
30-503-0322	C2006-356-000	32791	SWITCH		1		2			
30-503-0323	SNA23/Y	72737	MONIT 23IN		1		2			
30-503-0325	AC27E - 50FT.	05159	CABLE		2		8			
30-503-0901	MODEL 2006-012	05159	CAMERA TV		1		2			
30-503-0902	MODEL 2006-005	05159	CAMERA TV		3		8			
30-503-0903	MODEL 2006-012	05159	CAMERA TV		1		1			
30-503-0905	30-503-0305	12644	P-T ASSY		1		2			
30-503-0906	MODEL 3961-911	05159	CAMERA CTR		2		4			
30-503-0908	ER-7722A	05159	CONT SELEC		1		1			
30-503-0909	ER-7722B	05159	CONT SELEC		1		1			
30-503-0910	IVC-700	29641	RECORDER		1		2			
30-503-0911	VS-12L-A	11650	SWITCH		1		2			
30-503-0912	TBFH-200-165-1PS	31746	CONNECTION		2		5			
30-503-0913	TBFH-200-28-21PS	31746	CONNECTION		2		7			
30-503-0914	TBFH-200-18-10PS	31746	CONNECTION		1		2			
31-502-0101	AKD860	21789	EXCHANGE		1		1			
31-502-0102	K-3554	34767	TELEPHONE		2		40			
31-502-0103	LT-200	22874	AMPLIFIER		2		4			
31-502-0104	F1D-T	05614	SPEAKER		4		10			
31-502-0105	C1B-T	87771	SPEAKER		5		15			
31-502-0106	RL-8	87771	SPEAKER		8		22			

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78 80
				LEVEL						
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	REPL CODE	UNIT ISS ACTION
31-502-0107	116840	82872	HEADSET		4		10			
31-502-0108K01	MS50	22447	MICROPHONE		5					
31-502-0108K02	T55-2	22447	RECIEVER		5					
31-502-0115	BMN2425	21789	POWER SUPP		1		1			
31-502-0119	M-177-03,AKD741	82681	TONE ADAPT		1		1			
31-502-0504	LS1-1105	98438	TRANSEIVER							
31-502-0505	31-502-0505	82872	HEADSET							
31-502-07	31-502-07		SWITCH							
35-504-0102	11TW19-1-A002	91929	SWITCH		16		48			
35-504-0103	PTK-E-A2-35-1-C	91929	SWITCH		1		1			
35-504-0104	801-48A-115VAC	14195	RELAY		1		1			
35-504-0107	B1A-NE-51-MBB	72619	LIGHT		1		3			
35-504-0110	STCL-7A-F40	26031	LIGHT		16		48			
35-504-0111	CBS-A01	26031	SWITCH		1		1			
35-504-0113	50A28	34538	POWER SUPP		1		1			
35-504-0114	801-48A-115VAC	14195	RELAY		2		4			
35-504-0702	KRP-5A	77342	RELAY		5		20			
35-504-0902	PTSB02128	91929	SWITCH		6		18			
35-504-1402	G021-KZ1C	75282	SWITCH		1		1			
35-504-1403	G028-2A3F22D	75282	SWITCH		1		1			
35-504-1404	G028-3C3G30D	75282	SWITCH		1		1			
35-504-1405	G021-RZ2B	75282	SWITCH		1		1			
35-504-1406	G023-R23U	75282	INDICATOR		1		1			
35-504-1702	PTSBC212C-BDD	83783	SWITCH		1		1			
35-504-1703	PTH2216B	83783	SWITCH		1		1			
35-504-1704	PTH2214-B29-PTCB	83783	SWITCH		1		1			
35-504-1705	PTM238-B04	83783	SWITCH		1		1			
35-504-1706	PTL-2213-B04	83783	LIGHT		1		1			
35-504-1708	SSR7281-G2	07137	READOUT		1		1			
35-504-1710	PTN-2213	83783	LIGHT		1		1			
35-504-1713	50A-5	34538	POWER SUPP		1		1			
35-504-1716	3AG10D	75915	FUSE		1		1			

Table 6-5 (continued)

CAMDS REPAIR PARTS
INVENTORY CONTROL SYSTEM

AS OF 04/06/76

4-18	19-38	39-43	44-53	54-57	58-61	62-65	66-69	70-74	75-76	77-78	80
				LEVEL							
CDS NUMBER	MFG PART NUMBER/FSN	MFG CODE	NOMENCLATURE	MAX	ON-HAND	REORDER	QTY REQD	BIN LOC	RFPL CODE	UNIT ISS	ACTION
35-504-1802	CMC911-A-G-B-01-1-BB	83783	SWITCH		6		17				
35-504-1803	CMC910-B-D-A-01-1	83783	SWITCH		1		1				
35-504-1907	PTL-2216	83783	LIGHT		1		1				
35-504-2402	PTL-2133	91929	LIGHT		1		1				
35-504-2403	PTL-2134	91929	LIGHT		1		1				
35-504-2404	PTL-2136	91929	LIGHT		1		1				
35-504-2405	PTL-2137	91929	LIGHT		1		1				
35-504-2407	50A-12	34538	POWER SUPP		1		1				
35-504-2410	901-24GA-12-45	14195	RELAY		1		1				
35-504-3005	3813-7	82121	SWITCH		1		1				
35-504-3007	PTM33B-C04	91929	SWITCH		1		1				
35-504-3008	PTH22148-C00	91929	SWITCH		1		1				
35-504-3009	PTH22168-C00	91929	SWITCH		1		1				
35-504-3010	PTL-2113-C00	91929	LIGHT		1		1				
35-504-3011	PTL-2114-C00	91929	LIGHT		1		1				
35-504-3012	PTSBC212B-C00	91929	SWITCH		1		1				
35-504-3014	SSR72B1-G2	07137	READOUT		1		2				
35-504-3016	PW-8216	91929	LIGHT		3		7				
35-504-3105	30-S	34538	POWER SUPP		1		1				
35-504-3108	3AG,312015	75915	FUSE		1		1				

7.0 REFERENCES

1.0 Reliability and Maintainability Allocation, Assessment Analysis Report For CAMDS:

Phase 1, Systems Level Analysis

Phase 2, Building Block Level Analysis

2.0 Operation of the Chemical Agent Munitions Disposal System (CAMDS) at Tooele Army Depot, Utah.

Draft Demilitarization Plan, August 1975