*TC 8-13

Tactical Hospital Infrastructure

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*This publication supersedes TC 8-13, dated 7 December 1990.

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Tactical Hospital Infrastructure

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Preface

Army Medical Department analyses of future Role 3 medical and surgical capabilities contrasted with current Role 3 capabilities culminated in the development and Army approval of a new modular hospital organization to replace the combat support hospital. The hospital center's modular design and ability to task-organize requisite medical and surgical capabilities rectifies major deficiencies in the current combat support hospital. Required revisions in organizational design, medical and surgical capabilities, and ability to perform split or geographically dispersed operations were critical factors in the decision to replace the combat support hospital with the hospital center.

This publication updates the previous version of TC 8-13 and addresses the changes in complexing the new hospital center and its medical augmentation detachments. The modularity that was the cornerstone of the hospital's development makes it adaptable to a myriad of situations and missions, from short-term contingency missions to large-scale combat operations.

This manual impacts all facets of the Army Health System through the utilization of tactical hospitalization capabilities. The scope of this manual is to provide the basic infrastructure recommendations for the complexing of a tactical hospital in order to provide Role 3 support. The mission requirements will determine the necessary configurations. This training circular's content ranges from planning, module complexing and deployment to the setup and operation of medical materiel sets (MMSs), dental equipment sets (DESs), and nonmedical equipment. A Role 3 hospital facility will be responsible for operational medical capabilities that provide definitive patient care while retaining responsiveness to combat units. This manual is designed to serve as a supplement to the equipment-specific publications that are issued with each equipment system.

The proponent of this publication is the United States Army Medical Center of Excellence, (**ATTN: ATMC-DTC-M, 2377 Greeley Road, Suite B, Joint Base San Antonio Fort Sam Houston, Texas 78234-7731**) Send comments and recommendations on DA Form 2028 (*Recommended Changes to Publications and Blank Forms*) directly to: usarmy.jbsa.medical-coe.mbx.ameddcs-medical-doctrine@mail.mil.

Publication TC 8-13 applies to the Active Army, Army National Guard/Army National Guard of the United States and the United States Army Reserve unless otherwise stated. Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men.

Refer to the Medical Center of Excellence Lessons Learned at: https://secure-ll.amedd.army.mil/lessonslearned/Default.aspx to research hospital centers that have trained in field exercises and submitted after action reports with the systems.

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Chapter 1
Introduction

Since the Vietnam War, hospitalization has evolved and changed to better support tactical operations. Various modular hospitals were developed to meet requirements identified in national policies and numerous updates have been made to organizations, equipment, shelter systems, and medical capabilities within deployable hospitals. The most recent of these updates converts combat support hospitals to hospital centers, which include five modular components that allow commanders and planners to employ specific capabilities to meet mission requirements.

EVOLUTION OF DEPLOYABLE MEDICAL SYSTEMS

1-1. A deficiency identified in the Battlefield Development Plan was the theater Health Service Support's (HSS) inability to provide the deployability and flexibility required to support projected patient workloads. It also noted theater HSS systems could not adapt to changing mission requirements dictated by the threat and patient distribution and densities.

1-2. The solution to this deficiency was the development of a standard, mission-adaptable, modular medical support system. Standardized health care modules would include:

- Result in a standardized logistics and training system.
- Facilitate the modernization of equipment as new technologies develop.
- Improve medical unit reconstitution.
- Increase medical unit self-contained, transportable flexibility.

1-3. From 1963 to 1979, the Army utilized the Medical Unit, Self-Contained, Transportable (MUST) Program. The primary objectives of the program include:

- Improve the level of medical treatment.
- Increase productivity of treatment facility members.
- Increase mobility.
- Increase flexibility.
- Reduce resupply.
- Promote all-weather capability.
- Ensure a high degree of equipment reliability.

1-4. The materiel selected for the MUST program consisted mainly include:

- Standard items available in the Department of Defense (DOD) supply system.
- A limited number of commercial products were modified to meet military-unique requirements.
- Approximately 20 items developed completely by the Army. These items were available from commercial sources and included:
- Rigid-wall expandable shelters:
  - Soft-wall, inflatable shelters.
  - Mobilizers.
  - Utility power units.

1-5. The first Army hospital equipped with MUST materiel was deployed to Vietnam in 1966. Subsequently, four additional field hospitals and two Marine Corps medical treatment facilities (MTFs) successfully used MUST materiel during the Vietnam conflict.

1-6. Congressional investigations into the utility power unit's fuel consumption and poor quality of the inflatable shelters resulted in a denial of funds during Fiscal Year (FY) 79 –82 for these items and assets on hand were to be used until no longer economically repairable more suitable replacements became available. Various studies conducted within the DOD confirmed a severe shortage of deployable medical assets essential to HSS which could not be provided during wartime.

LEGISLATION INVOLVEMENT

1-7. The Military Field Medical Systems Standardization Steering Group was established in May 1981. This group consisted of general officers from the Army, Navy, Air Force, and Marine Corps. They provided a guide to development a standard tactical hospital center system for use by all military services with prescribed policy and assigned responsibilities governing the standardization and acquisition of tactical hospital center system. The tactical hospital center system would employ functional modules, on a "building block" basis, to establish hospital centers from the most forward to the rearward edge of an area of operations (AO) and across the military services. To accomplish one of the most challenging aspects of standardizing tactical hospital center system, 23 panels were convened to select components of medical materiel sets (MMSs) and dental equipment sets (DESs). Each panel consisted of expert clinicians supported by experienced combat operations and logistics officers. The panels verified the therapeutic regimen described for 309 combat-related diagnoses developed from historical wartime statistics. They selected the specific equipment and supplies required for each procedure. Many of the MUST items were selected as MMS/DES components. These included the Army-developed:

- Operating table.
- Hospital bed.
- Anesthesia apparatus.
- Surgical instrument table.

1-8. To ensure a uniform and adequate, yet austere standard had been met, a clinical review committee evaluated the MMS/DES components selected by the panels. This committee consisted of a senior physician from each of the military services. The committee reviewed all aspects of integrated health care in an AO and a computer data base for a quad-service systems approach. Based on this, they consolidated, eliminated, and substituted items. The results of this process identified MMSs and DESs for the basic tactical hospital center system modules listed below. Specialized items to meet the specific needs of selected hospitals were identified as MMSs components of augmentation are the following:

- Operating room (OR) unit assemblage.
- Sterile Processing Department (SPD).
- Laboratory, general.
- Laboratory, blood bank.
- X-ray.
- Pharmacy.
- Triage/EMT/preoperative (Pre-Op).
- Postoperative (Post-Op)/Intensive care unit (ICU).
- Intermediate care ward (ICW).
- Minimal care ward (MCW).
- Physical therapy (PT)/Occupational therapy (OT).
- Medical services clinic.
- Orthopedic cast clinic (OCC).
- Eye clinic.

- Hospital dentistry.
- Medical supply (military service and hospital unique).
- Specialized care functions.

RESPONSIBILITY

1-9. The Defense Logistics Agency (DLA) accepted responsibility for the acquisition, assembly, and management of tactical hospital center system MMSs and DESs. Quad-service standardized modules permitted DLA to assemble applicable sets on a production basis to meet the needs of all military services. The DLA employed new methods of contracting for medical components to improve their ability to provide repair parts as well as to enhance reliability, maintainability, and interoperability include:

a. Defined the tactical hospital center system as a facility capable of being located in a desired or required area of operation (AO) during a contingency, war, or national emergency.
b. Established DOD policy to standardize the tactical hospital center system.
c. Assigned responsibility to the Defense Medical Standardization Board (DMSB) to direct the development of tactical hospital center systems consistent with the distinct missions of the military services.
d. Mandated the services acquire only those tactical hospital center systems submitted by the DMSB and approved by the Assistant Secretary of Defense (ASD) Health Affairs (HA). Joint Services Operational Requirement for DOD Deployable Medical Systems was approved on 25 October 1984. The DMSB and the ASD HA approved the MMSs, DESs, and nonmedical support equipment reflected in this manual. They also established procedures for a continuous review and modernization for all tactical hospital center system components.

1-10. The Army Surgeon General places a very high priority on improving capabilities to promote a healthy, vigorous, and fit fighting force. The current tactical hospital center system fielding plan may have an impact on certain installations in the way of medical support. System fielding is scheduled to continue through FY 2020.

UNIT ACTIVITIES WITH TACTICAL HOSPITAL CENTER SYSTEM

1-11. Afghanistan: Operation Enduring Freedom/ Iraq: Operation Iraqi Freedom. Following the September 11, 2001, terrorist attacks on the World Trade Center and the Pentagon, the United States responded by deploying military personnel in Southwest Asia. By January 2002, more than 30,000 active duty personnel were involved and additional reserve personnel continued to be called to duty. The Combat Support Hospitals (CSH) which deployed into theater included:

- 10th CSH
- 14th CSH
- 28th CSH
- 31st CSH
- 47th CSH
- 86th CSH
- 212th CSH

LESSONS LEARNED

1-12. Lessons learned from Afghanistan and Iraq as well as internal analysis of the MEDCoE transformational goals supported a decision to redesign the CSH or develop a new Role 3 hospital structure. The CSH was systematically and critically reviewed to evaluate the organizational structure, mobility, split operational capabilities, internal medical capabilities, surgical capabilities, personnel specialties, dependencies, and other factors affecting the hospital's capabilities and functions during deployments.

HOSPITAL CENTER

1-13. The redesign effort culminated in the development of the hospital center, a new and innovative Role 3 hospital structure comprised of five modular units with inherent capabilities providing mission-specific medical and surgical HSS. The advanced modular design has integral capabilities for an enhanced task-organized hospital with the ability to provide a maximum of 240 beds to the AO. The characteristics of the hospital modules and their combined competencies provide the ability to accommodate split operations with both surgical and medical support. Commanders can task-organize the medical forces to support unified land operations, matching the anticipated mix of required capabilities and medical specialties to the population supported and the clinical challenges they present. The hospital center performs in combination with varying augmentation detachments, provides the medical and staffing capabilities to perform the appropriate HSS suitable to support a full range of military operations.

1-14. The hospital center's enhanced organizational design and collective medical and surgical capabilities are products of numerous capability development process reviews. The deployment of a Role 3 Army hospital center to an AO rectifies major deficiencies in the current CSH with revisions in organizational design, medical and surgical capabilities, and ability to perform split or geographically dispersed operations. The hospital center is designed to enhance flexibility and at the same time provide the requisite medical capabilities to support the Army's goal in developing a versatile and agile force. The organizational structures and positions are established in tables of organization and equipment (TOEs). The organization of these units is subject to change in order to comply with manpower requirements criteria outlined in Army Regulation (AR) 71-32 Force Development and Documentation. These organizations are also subject to change at the unit level in order to meet wartime requirements and these changes are reflected in the units' modified table of organization and equipment.

HOSPITAL ORGANIZATION AND FUNCTIONS

1-15. The hospital center provides essential care within the theater evacuation policy to either return the patient to duty or stabilize the patient for evacuation to a Role 4 MTF outside the AO. The hospital center's assigned medical personnel, facilities, equipment, and materials provide the requisite capabilities to render significant preventive and curative health care. These highly robust services encompass primary inpatient and outpatient care; emergency care; and enhanced medical, surgical, and ancillary capabilities. The modular design of the hospital provides the capability to tailor and deploy capabilities as supplemental modules provide incrementally increased medical services.

Chapter 2

Setup/Operation of Medical Materiel Sets and Dental Materiel Sets

There are numerous medical materiel sets that combine to create the full complement of Role 3 medical capabilities within the hospital. The medical materiel sets are standardized sets used across Army tactical hospitals and provide the equipment required to perform surgical, laboratory, primary care, pharmacy, emergency medical, physical therapy, medical maintenance, ancillary, intensive care, and intermediate care services. There are numerous ways to establish the lay-out of hospitals, but this chapter describes examples of a way to set up each of the various medical materiel sets.

GENERAL

2-1. This chapter describes the functions and setup of the tactical hospital center system MMSs and DESs. Each paragraph provides the unit of allowance (UA) and line item number (LIN) information for the set. Layouts may have to be altered to accommodate a unit's operations. There are 68 units of assemblages in various configurations. There are some layouts illustrated for the MMSs and DESs. Terrain may require certain components be positioned differently than shown. The SPD International Organization for Standardization (ISO) may have to be connected to the end of the OR ISO, rather than the side, as shown. Changes, however, must be functional to provide required patient support.

CAUTION

Never place equipment in front of the personnel or cargo doors. Emergency evacuation procedures may be compromised if the doors are blocked.

MEDICAL MATERIEL SET OPERATING ROOM (UA: Q301; LIN: M72936)

2-2. The OR is established in a 3:1 ISO. It is packed and transported in the OR ISO, with overflow in the OR/SPD (military-owned demountable container) MILVAN. The OR prep area is established in a 64 feet (ft.) x 20 ft. Tent, Extendable, Modular, Personnel (TEMPER). The surgical staff uses this area as its scrub and dressing area. Some units also use this area as the patient prep area. Bulk supplies for the OR and SPD are stored in the TEMPER or supporting MILVAN. Specialty augmentation MMSs are authorized under separate LINs/National Stock Numbers (NSN) or in a common table of allowances. The number of OR MMS is dictated by the type of hospital employed.

2-3. Examples of the equipment found in the OR MMS includes:

- Anesthesia apparatus.
- Generator, oxygen medical system portable.
- Defibrillator/monitor.
- Electrosurgical apparatus.
- Fluid warming system.

- Light surgical ceiling.
- Monitor Anesthetic Agent.
- Monitor patient vital.
- Oxygen Generator: Field Portable (OGFP).
- Pump IV infusion.
- Shelter tactical two-sided.
- Table operating field.
- Thermo-regulator, patient.
- Sink surgical scrub.

2-4. Examples of basic layouts for surgery are the operating room MMS in figure 2-1 below and the operating room prep area in figure 2-2, also below.

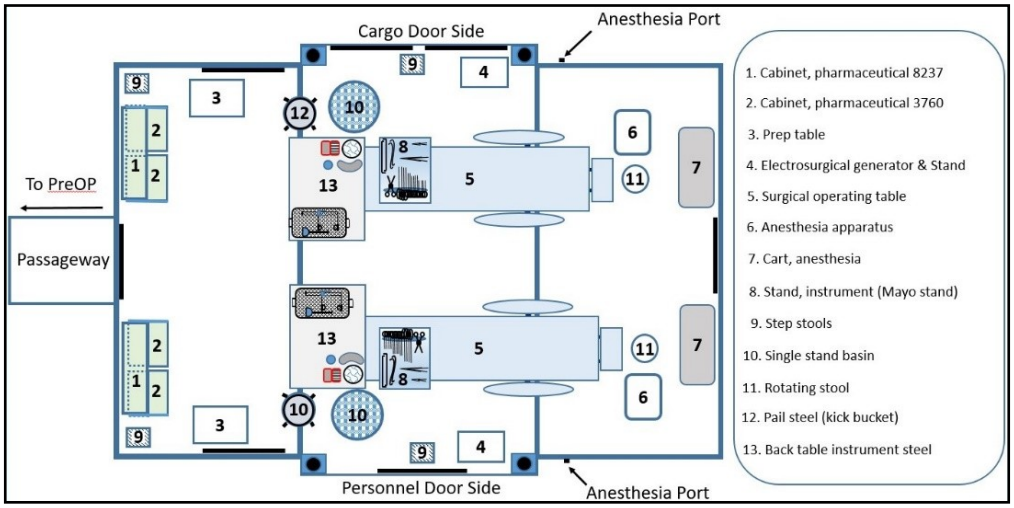

Figure 2-1. Operating room MMS

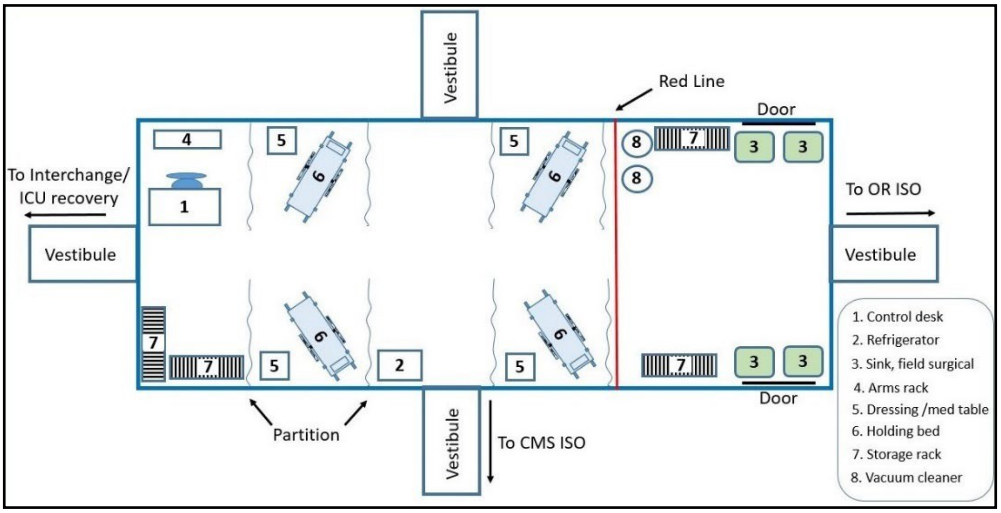

Figure 2-2. Operating room prep area MMS

2-5. Setup of the OR MMS consists of unpacking the components and positioning the equipment in an operational layout. Set up the equipment as instructed by the supervisor or as trained in

professional/advanced individual training (AIT). Set up the field surgical operating table according to the applicable technical manual (TM) or manufactures literature which includes:

- Cardiac monitor. See the manufacturers/TM for the operating instructions for the specific cardiac monitor issued to your unit.
- Other equipment issued to your the OR. Refer to the technical/manufacturer's manual for specific operating instructions.

MEDICAL MATERIEL SET STERILE PROCESSING DEPARTMENT (UA: Q302; LIN: M08417)

2-6. This set provides decontamination, high level disinfection, sterilization and storage capability of the basic operative requirements, supporting items of equipment and sufficient durable and consumable supplies to sustain operations for 72 hours. The Medical Materiel Set SPDs provides processing and issue of all surgical instruments for the OR. The set provides support to other areas of the hospital to include the wards, triage, emergency medical treatment (EMT)/Pre-Op and other supported units. This set also provides materiel to perform wide range of frequently performed surgical procedures including abdominal, thoracic, urologic, gynecological, and orthopedic. The SPD receives, cleans, assembles, sterilizes, stores, and issues sterile trays, packs, supplies, and specialized items and equipment. These services are provided for the OR as well as the wards and clinics. The SPD MMS is contained in a 2:1 ISO shelter. A two-section TEMPER is issued with each SPD MMS to serve as an additional work area. One SPD MMS is issued with each OR. See the SPD figure 2-3 below and the SPD work area in figure 2-4 on page 2-4, depict suggested layouts. Equipment in an SPD MMS includes:

- Cleaner ultrasonic.
- Cabinet solution warming.
- Refrigerator blood.
- Shelter, tactical expandable one side.
- Sterilizer surgical.
- Sink unit surgical scrub.

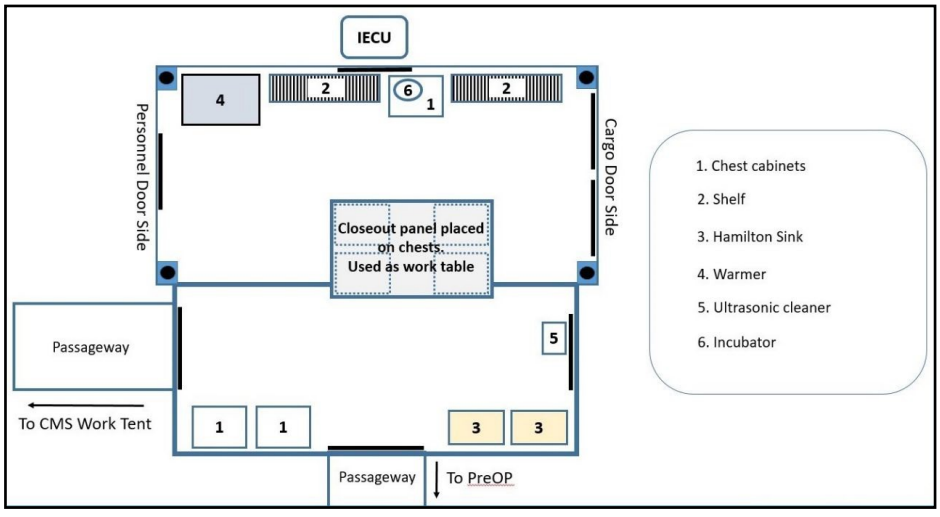

Figure 2-3. Sterile processing department

The Training Circular 8-38, *Sterile Processing Department*, provides a ready reference for personnel assigned to SPD in Army table of distribution and allowances and table of organization and equipment hospitals and forward surgical teams. This TC also provides information for any medical unit performing sterilization or disinfection activities. The guidelines provide standardization of procedures and techniques. The associated form is DA Form 3750 (*Centralized Materiel Service Item Request and Issue).*

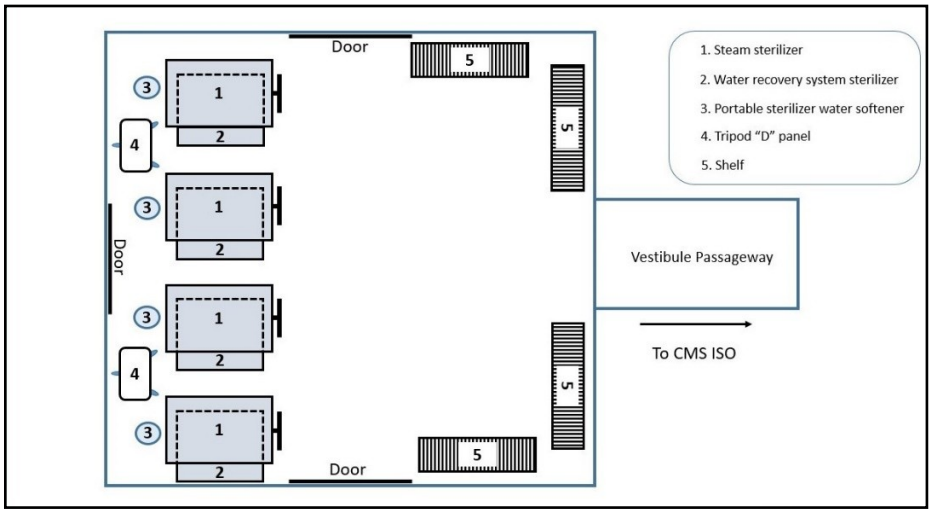

Figure 2-4. Sterile processing department work area

MEDICAL MATERIEL SET LABORATORY, GENERAL, LARGE (UA: P703; LIN: M13275)

2-7. The General Laboratory MMS contains the necessary supplies and equipment to provide clinical laboratory capabilities in chemistry, hematology, microbiology, serology, and bacteriology.

2-8. This set contains the necessary supplies and equipment to provide clinical laboratory testing to support diagnosis and care of battlefield and disease non-battle injury.

2-9. The laboratory MMS operates in a 3:1 ISO shelter. A 16 ft. x 20 ft. TEMPER, medical, is used in conjunction with the ISO to provide additional work/storage space. The MMS is stored and transported in the ISO.

2-10. Examples of the equipment in the general laboratory MMS are:

- Hematology analyzer small footprint.
- Analyzer clinical chem.
- Analyzer blood.
- Coagulation timer unit.
- Sink unit scrub field hospital.
- Shelter tactical.
- Refrigerator blood.

2-11. An example for a basic layout of the General Laboratory MMS is shown below in figure 2-5 on page 2-5.

2-12. This is the sequence for setting up/operating the equipment in the laboratory for the following are:

- Sink unit, scrub, field, hospital.
- Other laboratory equipment/supplies. Set up other equipment as instructed by the responsible individual or as described in the specific equipment manual. Set up supplies to support the procedures performed in the laboratory.

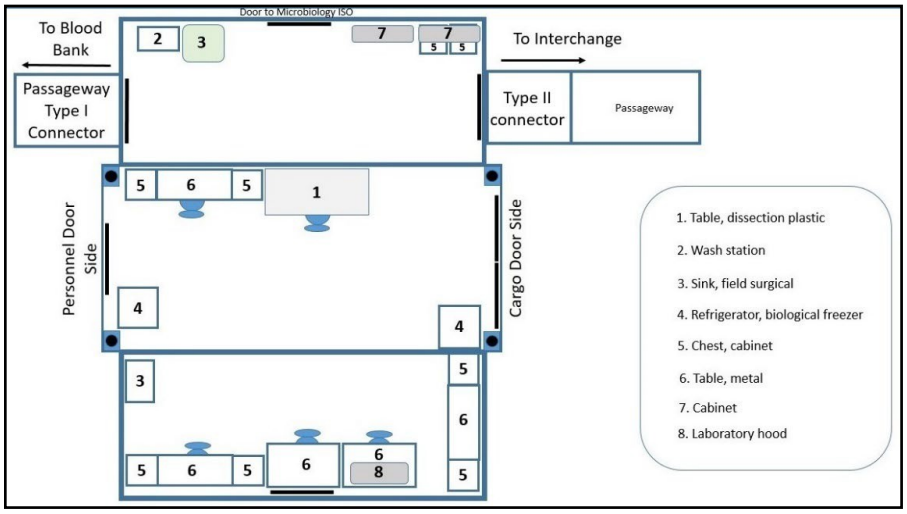

Figure 2-5. Laboratory, general MMS

MEDICAL MATERIEL SET LABORATORY (BLOOD BANK, LIQUID), LARGE (UA: N704 P704; LIN: M08849)

2-13. The Blood Bank MMS is capable of collecting (150 units per day), processing, storing, and distributing blood. It may operate in conjunction with the general laboratory MMS to provide a full range of laboratory support. The MMS is operated, stored, and transported in a 3:1 ISO.

2-14. Examples of the equipment in this MMS are:

- Centrifuge: laboratory general purpose.
- Centrifuge, apheresis.
- Refrigerator mechanical blood bank.
- Refrigerator solid state biological.
- Sealing machine.
- Shelter tactical.
- Sink unit surgical scrub.
- Thawing system, plasma.
- Ice making machine cube: manual dispensing 200 lb.
- Freezer mechanical blood plasma, gray 5.4 cubic feet cap under counter.
- Case transport hardened platelet system.
- Agitator blood storage platelet.
- Cabinet pharmaceutical base section steel.
- Container transport thermal maintain temp f/48+hrs3color woodland.
- Chair lounge blood donor versatile multiple donor positions.
- Case medical instrument and supply set med chest 6’ 30" x 18"x 20" olive drab polyurethane material.
- Viewer agglutination test tube for blood typing 25 watt bulb.
- Incubator blood platelet 10.500" x 17.750" x 13.250" flash memory.
- Microscope optical binocular led lighting tilting head packaged in hard shipping case.
- Scale donor automatic.
- Desk field nurses desk, portable w/chair.

2-15. An example for the Laboratory Blood Bank, Liquid MMS seen below, in figure 2-6.

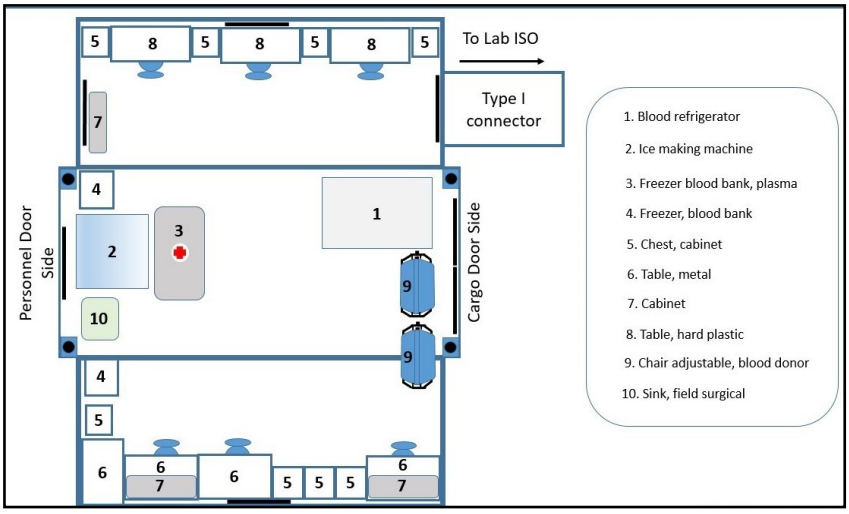

Figure 2-6. Laboratory (blood bank, liquid) MMS

2-16. The sequence for setting up/operating the equipment in the laboratory blood bank is as follows:

- Sink unit, scrub, field, hospital.
- Other laboratory blood bank equipment/supplies. Set up other equipment as instructed by the responsible individual or as described in the specific equipment manual. Set up supplies to support the procedures performed in the laboratory blood bank.

MEDICAL MATERIEL SET, MEDICAL SERVICES (UA: P713; LIN: M72355)

2-17. It is established in a 64 ft. x 20 ft. medical TEMPER and includes the Obstetrics/Gynecology (OB/GYN) Clinic (UA: P316; LIN: M31824), the PT/ OT Clinic (UA: Q312; LIN: M72050), and the OCC (UA: Q314; LIN: M72868 (This MMS is stored and transported in a MILVAN (LIN: C13825). Setup of this MMS consists of unpacking the components and positioning the equipment in the appropriate clinics in an operational layout. An example of a basic layout of the medical services MMS is shown in figure 2-7 on page 2-7. The OCC is set up in a tent, general purpose (GP), small.

2-18. Obstetrics/Gynecology Clinic.

a. The clinic provides OB/GYN examinations, diagnoses, and treatment.

b. This clinic contains the following major components:

- Refrigerator, freezer.
- Suction apparatus surgical.
- Defibrillator, monitor-recorder.
- Sink unit, surgical scrub.
- Electrocardiograph.
- Scale, digital baby portable.
- Thermometer kit clinic.
- Table, examining & treatment.
- Light floor gen exam.
- Case medical instruments & supply.
- Desk, field.

c. The procedures for setting up/operating the equipment in the OB/GYN clinic are as follows:

- Chest, surgical instrument and dressing, six-drawer. Remove the lid and arrange the contents in a functional layout.
- Table, operating, field. Follow the instructions of the responsible individual or as described in the specific equipment manual.
- Other OB/GYN clinic equipment/supplies. Set up other equipment as instructed by the responsible individual or as described in the specific equipment manual. Set up supplies to support the procedures performed in the clinic.

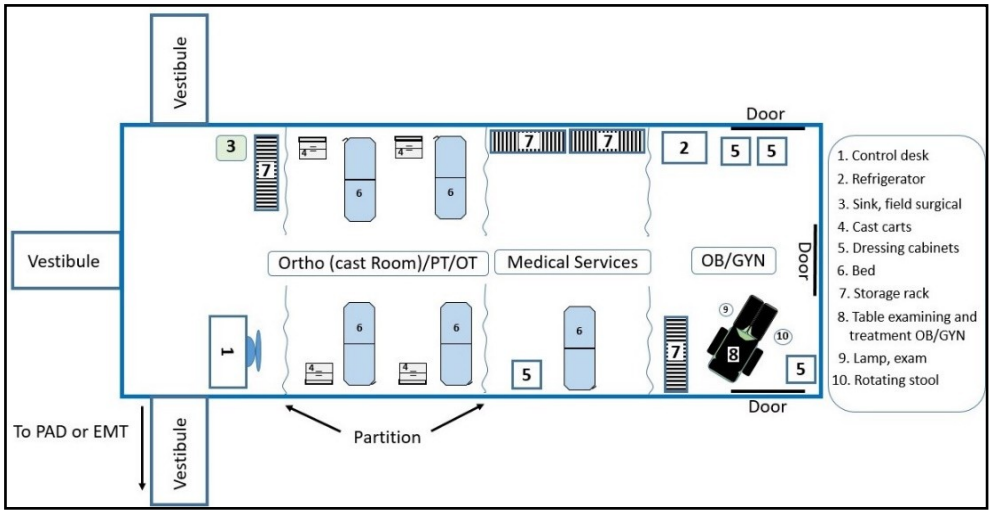

Figure 2-7. Medical services MMS

2-19. Medical Services Clinic.

a. This clinic provides outpatient care for the hospital staff. Other clinical services provided depend on the type of hospital.

b. The following major equipment components are in the medical services clinic. Other equipment provided depends on the additional clinical services provided by the medical services clinic includes:

- Stand, surgical instrument, adjustable.
- Desk, flat top, nurse's.
- Table, examining.
- Table, surgical instrument and dressing.
- Tray, instrument.
- Orthopedic Cast Cutter-Vacuum System, Portable.
- Cart, resuscitation.
- Sink unit, surgical, scrub.
- Litters/litter stands.

2-20. The procedures for setting up/operating the equipment in the medical services clinic are as follows:

a. Table, examining. Follow the instructions of the responsible individual or as described in the specific equipment manual.

b. Sink unit, surgical, scrub.

c. Other medical services clinic equipment/supplies. Set up other equipment as instructed by the responsible individual or as described in the specific equipment manual. Set up supplies to support the procedures performed in the clinic.

MEDICAL MATERIEL SET X-RAY RADIOGRAPHIC (UA: P305; LIN: M86675)

2-21. This MMS contains a sufficient type and quantity of medical materiel to function as a deployable, 2:1 ISO shelter X-ray module. It contains a solid-state, high-capacity X-ray apparatus. Additional work/storage space is provided by a 16 ft. x 20 ft. TEMPER. The basic layout of the X-ray Radiographic MMS is shown below in figure 2-8.

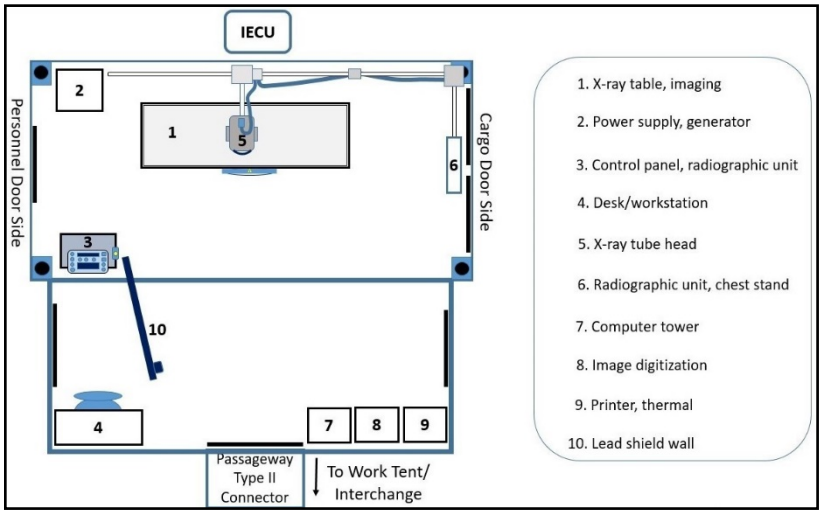

Figure 2-8. X-ray radiographic MMS

2-22. Examples of the equipment in the x-ray MMS includes:

- Sink Unit Scrub field hospital CRS.
- X-ray Apparatus Radiographic Med Bucky.
- Shelter Tactical Expandable One-Side.
- Reader System Computed Radiography Laser.
- Container Cargo: reusable w/o mechanical restraint system.

2-23. Follow the instructions of the responsible individual, or the specific equipment/manufacturer's manual for the other equipment. Set up supplies to support the procedures in the X-ray Clinic.

2-24. See an example of a basic layout for the X-ray Work Tent in figure 2-9 below.

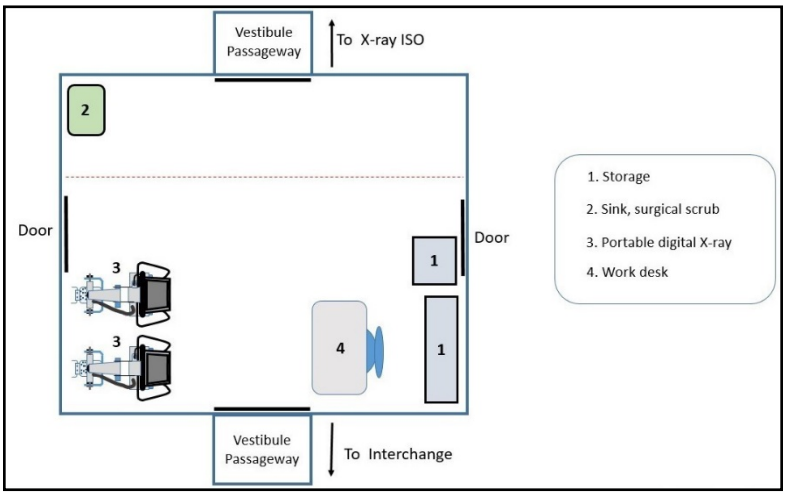

Figure 2-9. X-ray work tent

MEDICAL MATERIEL SET, PHARMACY LARGE (UA: P706; LIN: M73186)

2-25. The pharmacy is used to receive process, store, provide quality assurance for, and dispense pharmaceuticals and related items. It contains a 3-day level of consumable supplies. This MMS operates, is stored, and is transported in a 2:1 ISO. It also has a 23 ft. x 21 ft. TEMPER Air Supported (TAS). The pharmacy shares a MILVAN with the laboratory and X-ray. The pharmacy basic layouts of the pharmacy MMS in figure 2-10 on page 2-10, pharmacy tent figure 2-11 also on page 2-10.

2-26. Examples of the equipment found in the pharmacy MMS are as follows:

- Refrigerator, freezer.
- Shelter.
- Counter, table automatic.
- Table, surgical instrument.
- Hood, laminar flow, laboratory.
- Typewriter, manual.
- Sink Unit Scrub Field.
- Container Cargo Reusable.

2-27. The obvious need for a sink is filled by the sink unit, scrub, field, hospital. To set up/operate the other equipment in the pharmacy MMS, follow the instructions of the responsible individual or the description in the specific equipment/manufacturer's manual. Set up supplies to support the procedures in the pharmacy.

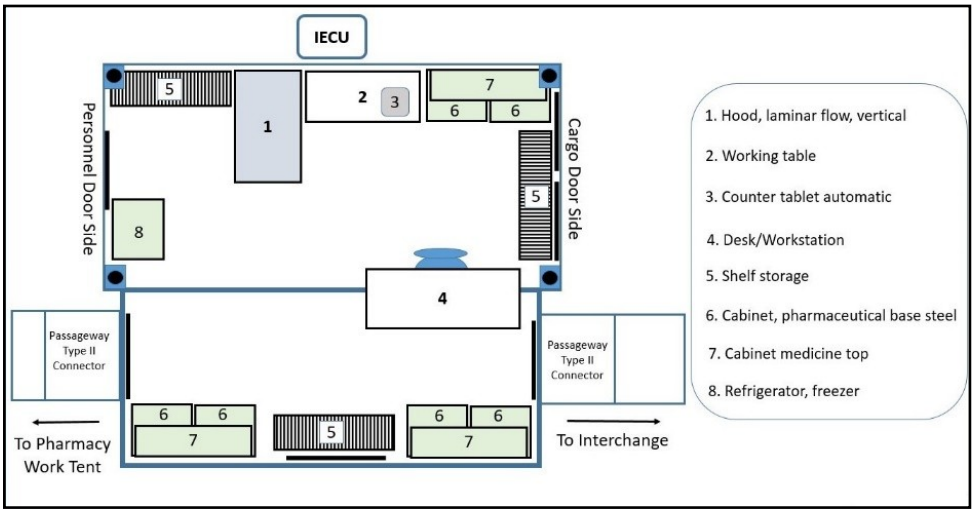

Figure 2-10. Pharmacy MMS

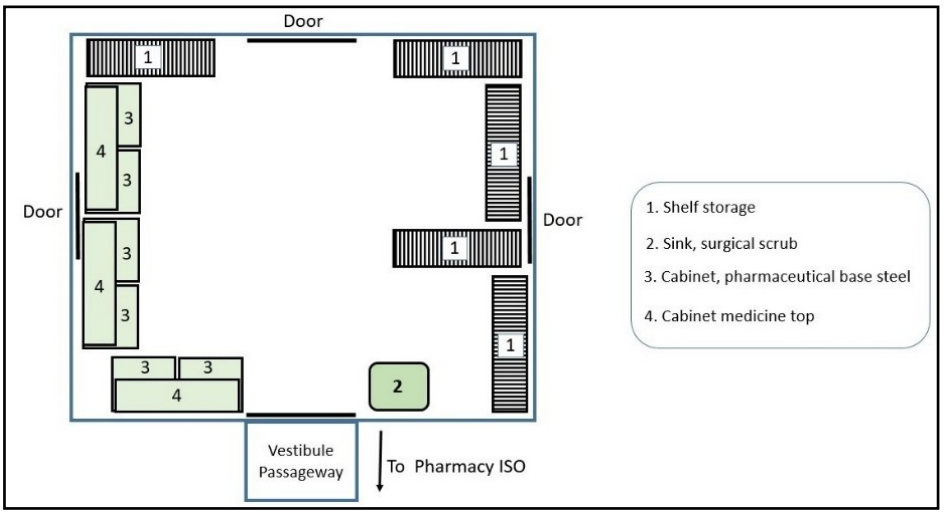

Figure 2-11. Pharmacy tent

MEDICAL MATERIEL SET POSTOPERATIVE/INTENSIVE CARE UNIT (UA: Q309; LIN: M09576)

2-28. The post-op/ICU MMS provides a full range of nursing care for the support of a 12-bed surgical/medical intensive care ward operating in a 64 ft. x 20 ft. TEMPER. The MMS is packed and shipped in a MILVAN.

2-29. Some examples of the equipment found in the post-op/ICU MMS includes:

- Defibrillator/monitor.
- Electrocardiograph.
- Fluid warming system.
- Monitor Patient Vital Signs.
- Monitor Patient Vital Signs, (MVS).
- Medical oxygen generator (MOG).
- OGFP.

- Patient Oxygen Distribution System (PODS).
- Pump Intravenous Infusion (PIV).
- Thermoregulator, Patient Auto & Manual.
- Suction Apparatus Surgical.
- Sink surgical scrub.
- Ventilator volume portable.

2-30. The following are examples of Postoperative/Intensive Care (see figure 2-12, below) and Intensive Care MMS (see figure 2-13, below) layouts.

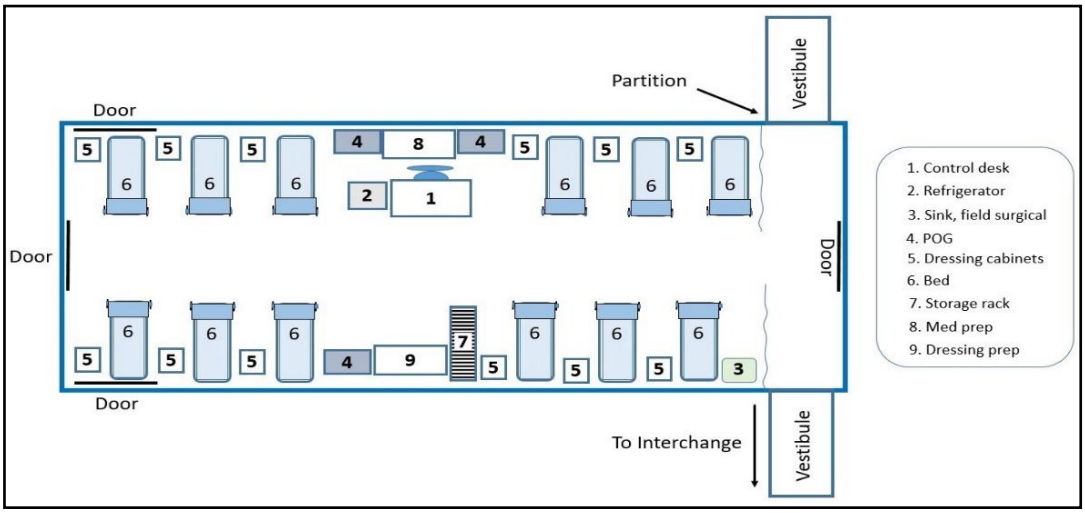

Figure 2-12. Postoperative/Intensive Care MMS

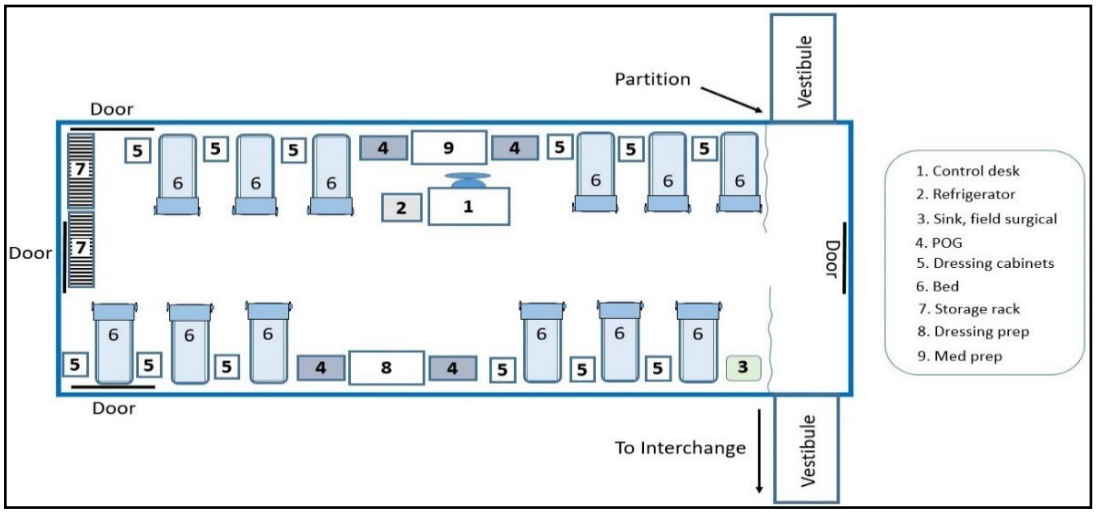

Figure 2-13. Intensive Care MMS

2-31. Setup of the post-op/ICU MMS consists of unpacking the components and positioning the equipment in an operational layout. The procedures for setting up the equipment are as instructed by supervisor, as trained in professional training/AIT.

a. Chest, medical instrument, two-shelf. Position the medical chest where needed. Remove the front cover and arrange instruments/supplies to provide needed ease of access.

b. Chest, medical instrument with 22-drawer insert. Position the chest where needed. Remove the front cover and arrange instruments/supplies to provide needed ease of access.

c. Other equipment and supplies. Set up as shown above in figure 2-13, as instructed by supervisor, as trained in professional training/AIT, or per TM/manufacturer's instructions.

2-32. Operate post-op/ICU equipment as trained per technical/manufacturer manual.

MEDICAL MATERIEL SET TRIAGE/EMT/PRE-OP (UA: Q308; LIN: M73050)

2-33. The triage/EMT/preoperative MMS (figure 2-14, below) is normally the first treatment area in the hospital to see the patient. In this module, the patient is examined to determine the extent and type of treatment required. Initial EMT procedures are performed. When surgery is required, the patient is prepared for admission to the OR. This MMS is set up and operated in a 64 ft. x 20 ft. TEMPER. It has 12 EMT work stations consisting of a litter and litter supports. A wheeled litter carrier and additional litters are provided for each work station to assist in transporting patients. It is packed and shipped in a MILVAN which also provides auxiliary storage and/or work space.

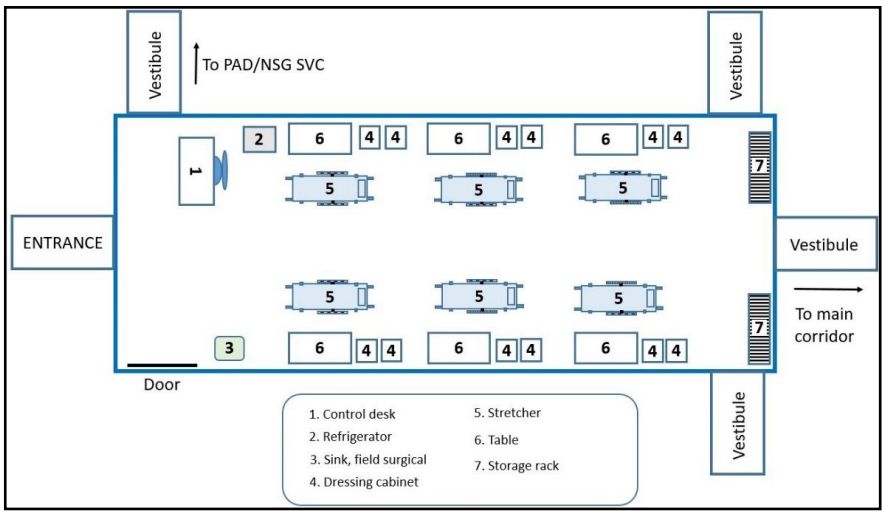

Figure 2-14. Triage/EMT/Preoperative MMS

2-34. Examples of the equipment in this MMS include:

- Generator oxygen medical system.
- Defibrillator/monitor.
- Electrocardiograph.
- Fluid warming system.
- Monitor patient vital signs.
- MVS.
- Pump Intravenous Infusion PIV.
- Thermo-regulator patient.
- Sink surgical scrub.
- Suction Apparatus, Surgical.
- Ultra sound diagnostic system.
- Ventilator volume portable.

2-35. Setup of the triage/EMT/pre-op MMS consists of unpacking the components and positioning the equipment in an operational layout. Set up each component as instructed by the supervisor, as trained in professional training/AIT, according to the technical as follows:

a. Chest, medical instrument, six-drawer. Position the chest on the base end. Remove the front cover and straighten the contents.
b. Chest, medical instrument with 22 drawer insert. Position the chest in designated location. Remove the cover and straighten the contents.

Note. The removed cover may be snapped into slots on the chest top and used as a work area or desk.

c. Cart, resuscitation. This cart is used for setting up the defibrillator/monitor as well as emergency equipment. Excess space can be used by all elements in the unit.
d. Sink unit, surgical, scrub.
e. Other equipment/supplies. Set up other triage/EMT/pre-op equipment and supplies as trained, as instructed by responsible individual, or as described in manufacturer's or technical manuals.

2-36. Operate triage/EMT/pre-op equipment as trained or as directed by the surgeon or other responsible individual.

MEDICAL MATERIEL SET INTERMEDIATE CARE WARD (UA: Q310; LIN: M08599)

2-37. The ICW MMS provides nursing care support for a 20-bed medical or surgical ICW. It is housed in a 64 ft. x 20 ft. medical TEMPER and contains a 3-day level of consumable supplies. This MMS is stored and transported in a MILVAN. The basic layout of the ICW MMS is shown below in figure 2-15.

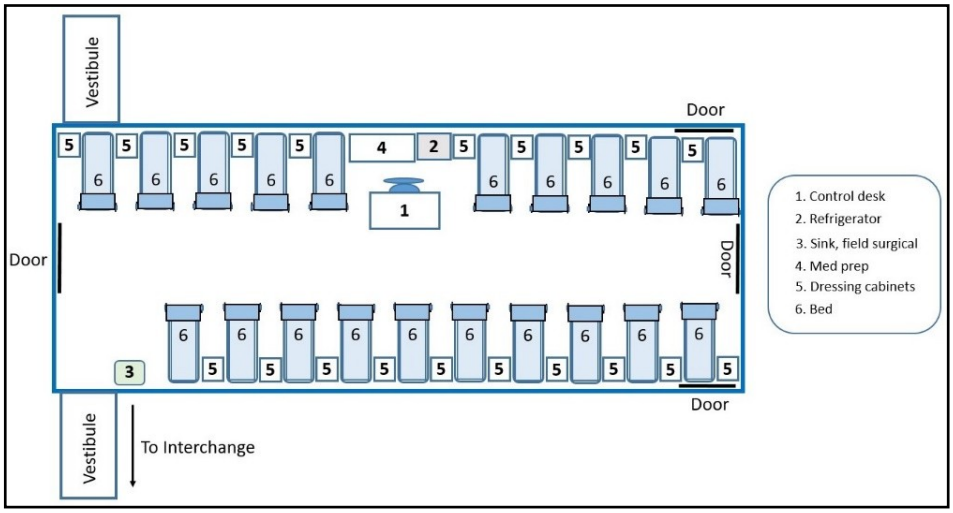

Figure 2-15. Intermediate Care Ward MMS

2-38. Some examples of the equipment in the ICW MMS include:

- Medical oxygen concentrator.
- OGFP.
- Pump Intravenous Infusion PIV.
- Suction Apparatus Surgical.
- Sink surgical scrub.

2-39. The procedures for setting up/operating the equipment in the ICW are as follows:

a. Chest, surgical instrument and dressing, field #3. Remove the lid and arrange the contents in a functional layout.

b. Chest, surgical instrument and dressing, two-shelf. Remove the lid and arrange the contents in a functional layout.
c. Sink unit, surgical, scrub.
d. Bed, adjustable, hospital, folding.
e. Other ICW equipment/supplies. Set up other equipment as instructed by the responsible individual or as described in the specific equipment manual. Set up supplies to support the procedures performed on the ward.

PHYSICAL THERAPY/OCCUPATIONAL THERAPY MEDICAL MATERIEL SET (UA: Q312; LIN: M72050)

2-40. The PT/OT MMS contains the types and quantities of supplies and equipment needed to conduct an expedient PT/OT operation. The service is further augmented by wound management, burn, and splint packages. The PT/OT service should be located as close as possible to the intermediate and minimal care wards. This MMS operates in a 64 ft. x 20 ft. TEMPER and is stored and transported in a MILVAN. The PT/OT service provides the following:

- Neuro-musculoskeletal evaluation and treatment.
- Fabrication and application of orthotic devices.
- Exercise regimes to improve strength and range of motion.
- Debridement and wound management.
- Activity programs designed to improve fitness, reduce stress, and develop work tolerance.

2-41. The equipment in the PT/OT MMS a sink unit, surgical, scrub.

2-42. An example of a layout for the PT/OT service is as depicted below in figure 2-16.

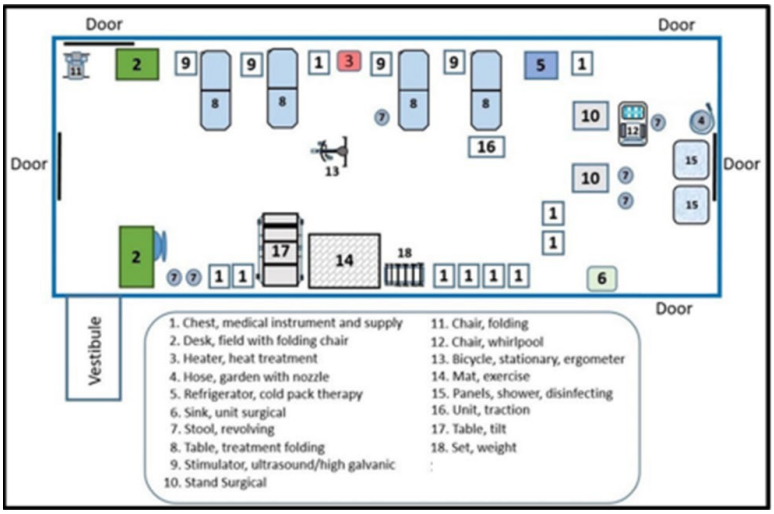

Figure 2-16. Physical Therapy/Occupational Therapy MMS

2-43. Setup of the PT/OT service equipment and supplies as instructed, trained, or directed in technical/manufacturer's manual.

2-44. Operate equipment as trained, as instructed by supervisor, or according to the technical/manufacturer manual.

DENTAL SERVICES

2-45. The dental services consist of four DESs: Comprehensive Dentistry, Field (UA 174 B, LIN D43802) Dental Hygienist, Field (UA 179 B, LIN D39228) Dental X-Ray, Field (UA 270 B, LIN D39478) Dental Support (UA 274 B, LIN D95343). It also includes one Dental Supply Set Emergency Denture Repair (UA 279 B, LIN F95778), one Dental Instrument and Supply Set Emergency Treatment, Field (UA 079 B, LIN F95504).The hospital center is also issued a 64 ft. x 20 ft. TEMPER. The other hospitals are issued one 16 ft. x 64 ft. TEMPER. The sets share a single MILVAN for storage and shipping. These are examples of the equipment found in the hospital dentistry DES includes:

- Dental Field Treatment Operating System.
- Dental Portable Operating System.
- Light Dental, Operating Field.
- Sink, Unit Surgical & Utensil Hospital Field.

2-46. The Dental X-ray DES list includes:

- X-Ray Apparatus, Dental.
- Dental Filmless Imaging System (DFIS).

AUGMENTATION MEDICAL MATERIEL SETS

2-47. Medical Material Set Neurosurgery Augmentation (UA: P318; LIN: M48305).

a. The neurosurgery augmentation MMS provides the essential equipment and supplies for performing specialized surgical procedures. This MMS is authorized in the hospital center. The MMS is stored and transported in the OR/SPD MILVAN. The neurosurgery augmentation MMS is used in the OR.

b. The neurosurgery augmentation MMS consists of the following major components:

- Coagulation system irrigating.
- Monitor, intracranial pressure system.
- Craniotome Set.
- Module, cranial.
- Driver, perforator, surgical.
- Drill surgical electrical.
- Case med instrument & supply.

c. Lay the neurosurgery augmentation MMS out as directed by the surgeon. Setup and operation of the MMS is as trained, as instructed by the surgeon, or according to the technical/manufacturer manual.

2-48. Medical Material Set Orthopedic Surgery Augmentation (UA: Q417; LIN: M32074).

a. The orthopedic surgery augmentation MMS provides the specialized medical equipment and supplies to perform orthopedic surgery procedures. This MMS is also stored and transported in the OR/SPD MILVAN. The orthopedic surgery MMS is used in the OR.

b. The major components for orthopedic surgery augmentation MMS consists of the following:

- Drill System Electric Surgical.
- Drill Saw Hand Bone.
- Surgical kit, orthopedic, battery-powered, multipurpose drill.
- Cart, plaster cast material, mobile.
- Cast cutter, orthopedic, 10-inch.
- Table, operating, orthopedic hand, adjustable legs with pan.

2-49. Medical Materiel Set Eye Exam Clinic (UA: Q315; LIN M08667).

a. The exam clinic augmentation MMS supports the work area for an ophthalmologist to perform ambulatory diagnostic and minor therapeutic eye procedures. The set contains no drugs other than anesthetics or diagnostics. Therapeutics which are required must be obtained from the

MMS Pharmacy or MMS Ophthalmology Surgery Special Augmentation. The hospital to which unit is attached will provide transportation.

b. The major components for the eye exam clinic MMS consists of the following:
   - Lens measuring instrument: LED LM-101 115 Volt 60 Hz.
   - Light slit ophthalmological: base mount adjustable table tonometer and deployable case.
   - Portable ophthalmic slit lam hand-held compact, lightweight; cordless rechargeable power supply.
   - Visual acuity test system.

2-50. Medical Materiel Set Ophthalmological Surgical Special Augmentation (UA: Q419; LIN M86425).

a. The ophthalmological surgical special augmentation MMS allows an ophthalmologist to perform ambulatory diagnostic and minor therapeutic eye procedures to expedite return to duty (RTD) and to stabilize for evacuation. The set requires collocation with basic OR and SPD for operative, sterilization, and anesthesia support. Requires retina vitreous trained ophthalmologists for full range of globe repair.

b. The Ophthalmological surgical special augmentation components consists of the following:
   - Cryosurgical system.
   - Cutter-aspirator vitrectomy (Vitreoretinal Surgical System).
   - Diathermy apparatus ophthalmic portable
   - Diode laser system.
   - Scanner ultrasonic ocular.
   - Microscope surgical portable.

2-51. Medical Materiel Set Maxo-Facial Head Neck Surgical Augmentation (UA: P320; LIN M09098).

a. The maxo-facial head neck surgical augmentation set treats penetrating neck injuries evaluated radiographically (e.g., Computed Tomography Angiography and/or surgically to rule out esophageal and vascular injury. This set requires collocation with and support by basic OR and SPD for full operative and anesthesia capability. The hospital to which unit is attached will provide transportation.

b. The Maxo-facial head neck augmentation and surgical augmentation components consists of the following:
   - Drill system small bone: drill small power system core system kit.
   - Battery driver set: 12 volt attachments for couplings/keys.
   - Suction apparatus: surgical.

2-52. Medical Materiel Set Minimal Care Ward Detachment (UA: Q311; LIN M48055).

- The minimal care ward provides care to medical or surgical patients who are ambulatory, partially self-sufficient and able to maintain their own hygiene and ambulate to mess hall for meals. Some patients may require assistance with dressing changes and/or administration of oral medications. This assemblage and all organization equipment is dependent upon organic vehicles or a designated transportation element for movement.
- The Minimal Care Ward Detachment consists only of a sink, unit surgical scrub hospital field.

MEDICAL MATERIEL SET, MEDICAL MAINTENANCE LARGE (UA: P725; LIN: M72152)

2-53. The medical maintenance/medical maintenance material augmentation MMSs include specific tools and equipment for providing unit level maintenance on medical equipment. The MMSs are stored, transported, and operated in a 3:1 ISO.

2-54. These are some of the examples of the equipment in these MMSs are as follows:

- Sink Unit Surgical Scrub.
- Shelter Tactical.

- Refrigerator-freezer.
- Simulator, sensor.
- Service kit.
- Test kit X-ray c-arm.
- Calibration kit oxygen.
- Chest med 2-shelves.
- Case med instrument & supply.
- Phantom, multipurpose.
- Desk, field.
- Cabinet storage flammable.
- Table, work.
- Cleaner, vacuum, electrical.

2-55. The medical maintenance MMS equipment setup is depicted in figure 2-17 below.

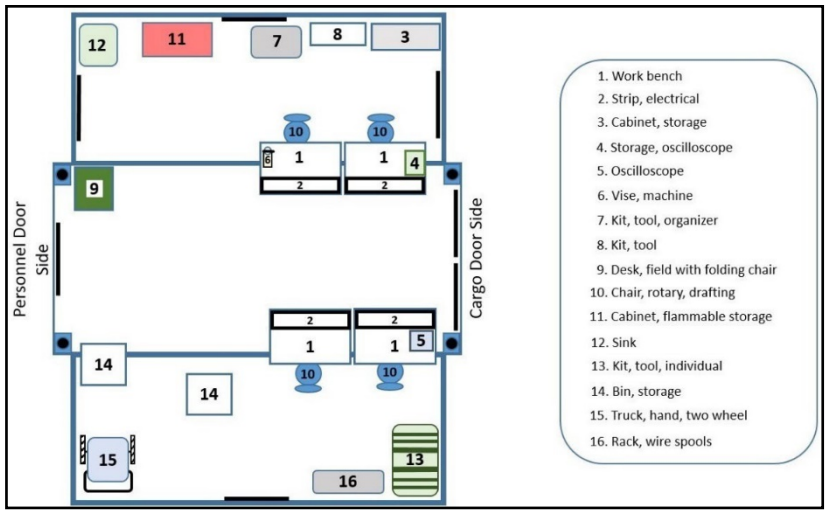

Figure 2-17. Medical maintenance MMS

2-56. Operation of the equipment is as trained or according to the technical/manufacturer's manuals.

MMS/DES AUTHORIZATIONS

2-57. The number of MMSs and DESs authorized, by type, in each type hospital is shown in table 2-1 on pages 2-18 and 2-19.

Table 2-1. MMS and DES authorization matrix

	Hospital Center				
	HOSP CTR	32 Bed	Surg Det	Med Det	ICW Det
DES Comprehensive Dentistry, Fld				1	
DES, Dental Hygienist, Fld				1	
DES, Dental Support				1	
DES, Dental X-ray				1	
DES, Inst & Supply, Emer Treatment, Fld			1	1	
DES, Maxillofacial Surgery				1	
Joint Bio Agt Ident & Diag Sys (JBAIDS)		1		1	
MES, Chemical Agent Patient Treatment		5			
MES, Chemical Agents Patient Decon		3			
MES, JBAIDS Aug		1		1	
MMS, Cent Mat Svc Spec Aug		1	1		
MMS, Sterile Processing Department		1	1		
MMS, Intermediate Care		1		1	3
MMS, Minimal Care Ward		1			
MMS, Laboratory Microbiology Aug			1	1	
MMS, Laboratory, Gen, Large		1			
MMS, Laboratory, Gen, Small				1	
MMS, Laboratory, Liq Bld Bnk, Large		1			
MMS, Laboratory, Liq Bld Bnk, Small				1	
MMS, Med Maintenance, Large		1			
MMS, Med Services, Large CSH			1	1	
MMS, Medical Supply, Large CSH		1			
MMS, Medical Supply, Small CSH				1	
MMS, OB/GYN Clinic			1	1	
MMS, OR		1	1		
MMS, Ortho Cast Clinic			1	1	
Neurosurgery Augmentation			1		
MMS, Orthopedic Surgery Aug		1			
MMS, Pharmacy, Large		1			
MMS, Pharmacy, Small				1	
MMS, Phy Therapy/Occ Therapy			1	1	
MMS, Post-op/ICU		1	2	1	
MMS, Radiology Comp Tomography		1			
MMS, Triage/EMT/Pre-op		1			
MMS, X-ray, Low Cap, Prtb		1			
MMS, X-ray, Radiographic/Fluoroscopic		1			
MMS, Waste Water, Management, Field Hospital		1			
Wastewater Management System, MRI	1				
Water Distribution Connect Set	1	1			
Water Distribution Set, Large	1				

Table 2-1. MMS and DES authorization matrix (continued)

	Hospital Center				
	HOSP CTR	32 Bed	Surg Det	Med Det	ICW Det
Water Distribution Set, Hosp, MRI Small		1			
WDWWMS Maint Set Hosp MRI Small		1			
WDWWMS Maintenance Set	1				

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Chapter 3

Nonmedical Equipment

The shelter systems used to create the physical structure of hospitals may be as important as the medical equipment sets used to perform medical care. There are several components required to erect a hospital that include various types of tents, hardened expandable units, transportation containers, power generation, and environmental control systems. The configuration of these components vary with terrain and mission requirements, however there are standardized and widely accepted requirements or best practices regarding the manpower needed to set up the components.

SECTION I – SHELTER SYSTEMS

3-1. This section describes the setup and operation of specific nonmedical equipment used to support tactical hospital center system-equipped hospitals. This support ranges from transporting and storing equipment and supplies to providing equipment needed for establishment and operation.

a. The AMEDD TAS Medical Shelter. The shelter houses the ICU, ICW and several other hospital elements. It also provides additional workspace for areas such as the OR, EMT and dental services. The TAS shelter features a vinyl-covered fabric, or tent canvas. It uses a patented high-pressure AirBeam technology that resists bending. The TAS shelters are available in three sizes: 21 ft. x 32 ft. (large), 23 ft. x 21 ft. (medium) and 21 ft. x 18 ft. (small). All have identical 10-inch diameter x 21 ft. clear span AirBeam supports and offer an abrasive- resistant, water repellent and ultraviolet resistant cover assembly with integral floor, an integrated inflation system, external bracing and stakes. Standard features of the TAS shelter include environmental control unit (ECU) duct openings, a removable lightweight thermal liner with an air distribution plenum and integrated hanging straps for lighting and other accessories. They are available in limited configurations, including end panel, side panel, and an ISO container. The TAS boot kits and litter airlock interfaces, with the addition of an optional “complexing kit” (see figures 4-14 on page 4-18 and 4-15 on page 4-19). The TAS can be complexed together end-to-end, side-to-side or side-to-end. Among the key advantages of the TAS are its strength and durability, rapid deployment and minimal work force requirements. A small logistics chain and parts count also contribute to a low lifecycle cost for each shelter. The durability of these shelters has been demonstrated in over 150 consecutive erection-strike cycles without incident. Regardless of size, a TAS is erected by laying out the shelter and staking it to the ground at the four anchor points. It is then inflated simultaneously using a commercial air compressor. Four to eight people can deploy and strike a shelter in less than fifteen minutes, using prepositioned inflation hoses. To construct/erect a 65 ft. ICU or ICW requires connecting two 32 ft. shelters together with a 12-inch boot gap connection area in the center. The mid-size TAS shelter provides for additional work and/or storage space. This shelter is used in supporting areas such as pharmacy, X-ray and SPD. The small TAS shelter is used in the microbiology section.

b. The AMEDD Medical Shelter, Alaska 2065 (Alaska Shelter). This shelter has been replaced by the preceding described TAS tents, and is in the process of being phased out of the AMEDD deployment system. The AK-AMS-2065 is a 20 ft. wide x 65 ft. long x 10 ft. high free span medical shelter. Each AK-AMS-2065 can be packed in a vinyl carrying bags. Each shelter is made with a lightweight, structural aluminum frame system that tensions into a high strength, aluminum base. Each shelter is modular, supported by the aluminum frame and covered with

military specification vinyl fabric. All Alaska Shelters are 10 ft. high at the peak. Each shelter is constructed of a heavy-duty mil-spec vinyl fabric that is tensioned over a lightweight and powder-coated aluminum frame to provide an unmatched level of protection. Collective protection versions of the Alaska Shelter are available, allowing U.S. Army forces to rapidly concentrate, attack, reinforce and block enemy forces in chemical, biological, radiological, nuclear (CBRN) environments. The Alaska Shelter is a medical shelter system engineered to provide maximum flexibility against all-weather types – snow, rain, hail, and wind. Additionally, the Alaska Shelter can be deployed in extremely diverse environments ranging from rough mountainous terrains, tundra and glacial areas, jungle areas, to desert environments. Exposure to the extreme temperatures of these environments are life threatening. The smallest Alaska Shelter, which provides additional work/storage, space for areas such as pharmacy, X-ray and SPD the measures 20 ft. x 19.5 ft. The Alaska Shelter is available in three sizes, each offering rapid deployment capabilities.

c. Tent, Extendable, Modular, Personnel. This shelter has been replaced by the preceding described TAS tents, and is in the process of being phased out of the deployment system. The TEMPER, houses the ICU, ICW, and several other hospital elements. It also provides additional workspace for areas such as the OR, SPD, and dental services. The TEMPER features a magnesium/alloy frame with a vinyl-covered fabric, which we will refer to as canvas. It is constructed in 8-foot sections and comes in two designs, a door section and a window section. Each 8-foot section is 20 feet wide. It measures 10 feet at the ridge and 6 feet, 9 inches at the eave.

d. The following measurements are for the TEMPER system section include:

- A two-section tent, 16 ft. wide x 20 ft. long, SPD, 6, Personnel, 2 per arch.
- A two-section medical tent, 16 ft. wide x 20 ft. long, Personnel, 2 per arch.
- An eight-section medical tent, 64 ft. wide x 20 ft. long. This version has one door section and seven window sections, 18 Personnel, 2 per arch.
- An eight-section surgical tent, 64 ft. wide x 20 ft. long. This version has three door sections and five window sections. The configuration of the surgical version will vary with operational needs and site preparation, 18 Personnel, 2 per arch.

3-2. The depiction of manpower requirements (seen in table 3-1 below). It will also include with or without lift support information.

Table 3-1. Manpower requirements per system with or without lift support

Shelter System	Technical Manual	Size	Weight	Recommended Personnel w/Forklift	Recommended Personnel w/o Forklift
Air Supported Shelter	AirBeam Shelters (00-0120-721 Rev. B)	**Large** 4 beams (x2)	1,200 lbs.	**8 Personnel** (additional time required to connect two 32ft. tents for a 65 ft. set up)	Manufacture recommends against moving w/o forklift
	AirBeam Shelters	**Medium** 4 beams	525 lbs.	**4 Personnel** (6 recommended)	Manufacture recommends against moving w/o forklift
	AirBeam Shelters	**Small** 3 beams	525 lbs.	**4 Personnel** (6 recommended)	Manufacture recommends against moving w/o forklift **(1 soldier per 40 lbs.)**
Alaska Shelter	Alaska Structures/ Alaska 2065 AMEDD Medical Shelter	**Large** 65 ft.	1,750 lbs.	18-21 personnel	1 Soldier per 40 lbs.
	Alaska Structures/ Alaska 2019.5 AMEDD Medical Shelter	**Small** 19.5 ft.	450 lbs.	6-8 personnel	1 Soldier per 40 lbs.
TEMPER Shelter	TM 10-8340-244-13&P	Two-section tent 16 ft. x 20 ft.		6 personnel	Soldier/forklift carry
	TM 10-8340-244-13&P	Two-section medical tent		6 personnel	Soldier/forklift carry
		Eight-section medical tent		18 personnel	Soldier/forklift carry
LEGEND: TM – Technical Manual					

3-3. The components for the AMEDD Shelter System, Air Support, Medical include:

- Shelter, Air Supported Medical, 21 ft. x 65 ft., large.
- Shelter, Air Supported Medical, 21 ft. x 23 ft., medium.
- Shelter, Air Supported Medical, 18 ft. 21 ft., small.

3-4. The components for the Alaska Shelter System include:

- Shelter, Alaska 20 ft. x 65 ft.
- Shelter, Alaska 20 ft. x 19 ft. 6 in.

3-5. Erecting of shelter systems.

a. The following information explains the important elements and conditions required for erecting the shelters systems.

b. Site selection. Choose a site location, at least 35 ft. x 75 ft. Ensure the area is free of any debris and make as smooth and level as possible.

c. Deploying and striking the 20 Series air-supported shelter includes:

- Personnel. The proper number of personnel should always be used when deploying and striking the 20 Series Air-Supported Shelter.
- Anchoring. Shelters must always be properly anchored because weather conditions can change quickly and without warning. Shelters should be anchored during any deployment regardless of duration.
- Air Beam Pressures. Maintain air beam pressure between 55 – 60 pounds per square inch (psi). Shelter regulator is set for 60 PSI, do not exceed 60 PSI.
- Personal Protective Devices. Always wear protective headgear when working around partially deployed shelters. Also, always wear protective ear and eye gear when deflating any Air-Supported shelter.

WARNING

Caution and care must be taken when deploying and striking the 20-series Air-supported Shelter. Failure to follow proper procedures may result in damage to the shelter and/or injury to personnel.

CAUTION

When deploying the shelter, pay close attention to surrounding hazards, such as overhead power lines, buried power lines, tree limbs, and water sources and draining systems.

WARNING

Injury or death to personnel may occur, if warnings are not observed. Wear safety glasses whenever hammering on stakes and anchors. Wear gloves when handling structural components or pulling ropes. Beware of spring tension on frame members. Do not start combustible hearing devices inside shelter, unless properly vented. Ensure shelter is anchored to fully resist all wind loads in the area. Use adequate number of personnel when handling components (floors, covers).

CAUTION

Damage to equipment may occur if cautions are not observed. Do not allow snow or ice to build up on the room shelters. Do not drag fabric components on the ground or over sharp objects. When driving stakes through the base frame, do not pound on the base frame or drive stakes so as to dent the base frame. Ensure that all base hooks are on the outside of the base assembly frame.

3-6. Complexing Procedures. Complexing is the process in which two tents are connected together end to end to create one large open area. To properly complex two (2) 20-Series TAS, follow the procedures in this manual.

Note. Complexing is the laying out and joining of tent to tent, tent to ISO, tent to passageway or any combination thereof. Place two (2) 20-Series TAS on the ground and fully unroll so each shelter is spread flat on the ground.

a. Position the shelters end to end so the hardware connecting the TAS to external bracing and to the end of each shelter is approximately four (4) inches apart.

Note. The end walls of the shelter are the walls that contain the external bracing, personnel doors, and run parallel to the air beams inside the shelter.

b. Refer to table 3-2 on page 3-5 for the TAS staking sequence for the Air Supported Shelter.

Table 3-2. TAS staking sequence for the air supported shelter

Step 1	
Stake 1	Release guy line ratchets and extend guy lines to full length. Pull floor tensioning line out tight and mark the ring position on ground. Make new mark 12 inch closer to the shelter and drive stake through all 3 rings at location of new mark. Peak strap ring should be on top.
Step 2	
Stake 2	Release guy line ratchets and extend guy lines to full length. Pull floor tensioning line out tight and mark ring position on the ground. Make a new mark 12 inches closer to the shelter and drive the stake through all 3 rings at location of the new mark. Peak strap ring should be on top.
Step 3	
Stake 3	Measure 20 ft. 8 in. across the end of the shelter from stake 1. Drive stake 3 through all 3 external bracing lines at this location. Peak strap ring should be on top.
Step 4	
Stake 4	Repeat steps from stake 2. Drive stake 4 through all 3 external bracing lines. Peak strap ring should be on top.

c. Inflation process. To properly inflate each shelter, refer to the inflation procedures in the 20-Series TAS user's instruction manual includes:

Note. Do not leave the shelters unattended during the inflation process. Maximum operating pressure for the air beams is 60 PSI. Do NOT exceed 60 PSI!

- Once each shelter has reached a working pressure of 55 to 60 PSI, discontinue the inflation process by deactivating the compressor and isolating each air beam by closing the valve in each "Air Beam Access Pocket".
- Tension all external bracing. Each stake in the four (4) corners of the complexed shelters should be securing three (3) lines, each of which contain a ratchet. Ratchet all external bracings hand tight, do not over tension.
- Secure all wind lines for both shelters to the ground. To do so properly, see deployment procedures in the 20-Series TAS user's instruction manual.

Note: Step inside the shelter to complete the next four steps (d through g).

d. Remove the walls between the two (2) shelters. If both shelters are equipped with a liner, remove the liner end wall, and then the end wall of the shelter. Repeat this process for the second shelter.

Note. The two (2) shelters should now be one (1) large open space.

e. Move the shelter open-end lace boot into position between the two shelters. This is the panel that will transform the two (2) individual shelters into one (1) large shelter.
f. The open-end lace boot is held in place with a Loop-N-Becket lace line connecting the panel to both shelters. Loops at each end of each shelter run through grommets on the open-end lace boot. A step stool or short ladder is needed to lace the boot in place, starting with the outside panel.
g. If both shelters are equipped with a liner, install an open-end lace boot to connect the liners of both shelters. To properly install the liner fill open-end lace boot, start from the center of one shelter (at the peak) and work outward in both directions. Lace and/or hook and loop the liner open-end lace boot into position.

3-7. Deploying and erecting the Alaska shelter system. This an introduction for the Alaska Shelter system, 20 ft. x 65 ft. shelter characteristics, description and capabilities. The base frame assembled, with purlins and arches of a completely erected Alaska shelter frame. Then there is the Alaska Shelter End Panel canvas

being connected to Alaska Shelter end section frame. The final step has the cover being drawn over the completed Alaska Shelter frame.

a. Purposes and functions. The Alaska 20 ft. x 65 ft. shelter is designed as a medical shelter which can be utilized for a number of medical facilities, including ORs, hospital, pre-op, triage and supply. The shelter is designed to provide protection for medical personnel, equipment and supplies in all types of climate, including extreme cold and heat.
b. Capabilities. The shelter is engineered for durability, portability and simplicity during erection and tear down. It is capable of transportability in all mode for organic transport.
c. Performance characteristics. The shelter is available in tan or green for use in environments where the terrain is predominately those colors. The shelter can be used in all types of weather, such as snow, rain, hail, wind and on all types of terrain, such as desert sand or in artic conditions. It is designed to be set up by a crew of a minimum of 12 trained Soldiers.
d. Shelter description. Each shelter can be packed in a vinyl carrying bags or in a wooden crate. The shelter is made with a lightweight structural aluminum frame system that tensions into a high strength aluminum base. Each shelter is modular, supported by the aluminum frame and covered with specification vinyl fabric.
e. System items required and not furnished include:
   - A small sledgehammer and two 8-foot ladders are required for shelter assembly and plenum installation.
   - A hammer drill with a 5/8 in. masonry bit for drilling into, asphalt, concrete or frozen ground.
   - A 100 ft. tape measure or a precut assist rope is needed to square the base frame. The throw ropes supplied may be used to square the base frame.

3-8. The TEMPER system houses the ICU, ICW, and several other hospital elements. It also provides additional work space for areas such as the OR, SPD, and dental services. The TEMPER features a magnesium/alloy frame with a vinyl-covered fabric, which we will refer to as canvas. It is constructed in 8-foot sections and comes in two designs, a door section and a window section. Each 8-foot section is 20 feet wide. It measures 10 feet at the ridge and 6 feet, 9 inches at the eave. Tactical hospital center system uses four configurations, including:

- A two-section SPD or a two-section medical.
- An eight-section medical. This version has one door section and seven window sections.
- An eight-section surgical. This version has three door sections and five window sections. The configuration of the surgical version will vary with operational needs and site preparation. For more information see TM 10-8340-224-13 TEMPER system.

3-9. Shelter, Tactical, Expandable. The shelter, tactical, expandable, also known as ISO, is the hard-walled shelter used in the tactical hospital center system. The ISO shelters employed in the system are one-side expandable (2:1) and two-sided expandable (3:1). The shelters are transported in the closed position. See the first diagram of the shelter (see figure 3-1 on page 3-7). For shelter deployment and installation reference TM 10-5411-200-14, Tactical Shelter Expandable 2:1 or 3:1. They are identified as ISO tactical shelter expandable. The equipment used to transport the ISO are either organic equipment such as the M1022 or M1022A1 Dolly Sets (paragraph 3-14[a]) and a prime mover or with assistance fromtransportation units.

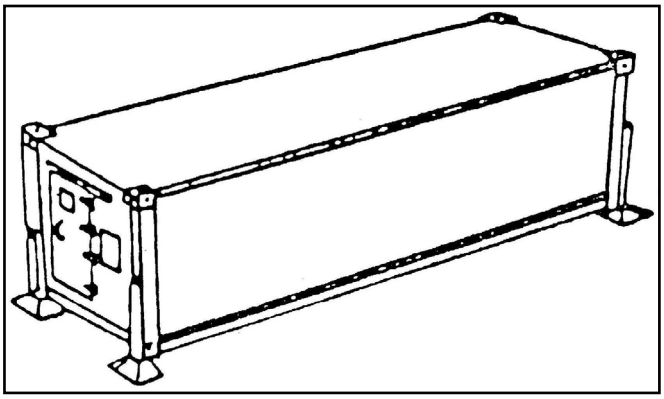

Figure 3-1. ISO in closed position

a. The 2:1 ISO services is used for the following:
- X-ray.
- Pharmacy.
- SPD.

b. The 3:1 ISO services is also used as follows:
- OR.
- Laboratory (general).
- Laboratory (blood bank).
- Medical maintenance.

c. The outer components of the ISO are as follows:
- Cargo door end.
- Cargo doors (vents, door handles, latches, door stops, door hooks).
- Jacks/door mounts.
- Personnel door end.
- Personnel door (door handle, latches, door stop, door hook).
- Shelter frame jack assembly fittings.
- Level indicators.
- Steps.
- Power entry panel.
- Exterior light fitting.
- Data plates.
- Cam lock latches.
- Toolbox (placed inside cargo or personnel door) and contents.

Note. Six Soldiers are needed to perform the following procedures.

CAUTION

Failure to follow expansion steps will damage the lifting jacks and/or ISO.

3-10. Expanding the ISO.

Note. An ISO can be expanded without removing equipment.

a. Open personnel/cargo doors to the locked position.
b. Remove tie-down equipment and place on top of ISO contents to free door openings.

Note. Identify quick release pins, stop plates (horseshoe), and solar bars at this time.

c. Remove quick release pins from stop plates (horseshoes) on both load balancers.
d. Raise (flip-up) the "U" shaped stop plates to allow the metal balls clamped to the cables to travel freely.

DANGER

Do not stand in front of hinged sections (floor/wall) as it weighs 700 pounds.

e. Flip up and rotate the two cam lock handles (floor locks) on each corner post, bottom one first.
f. Grasp the top cam lock handle on each corner post. In unison, rotate handles to full open position—sliding floor/wall section out.

Note. If section does not slide open freely, do not try to force. Ensure the danger area is clear and reseat cam locks.

g. Recheck the level and relevel ISO if needed; then repeat steps (e) and (f), the last 2 steps above.

Note. If floor/wall section will not release (freezing weather) or if it only releases a portion at the top, after above procedures, use the solar bar handles to assist in sliding the section out.

h. Grasp section at each end and pull down, lowering to full extension of support cables, see figure 3-2 below.

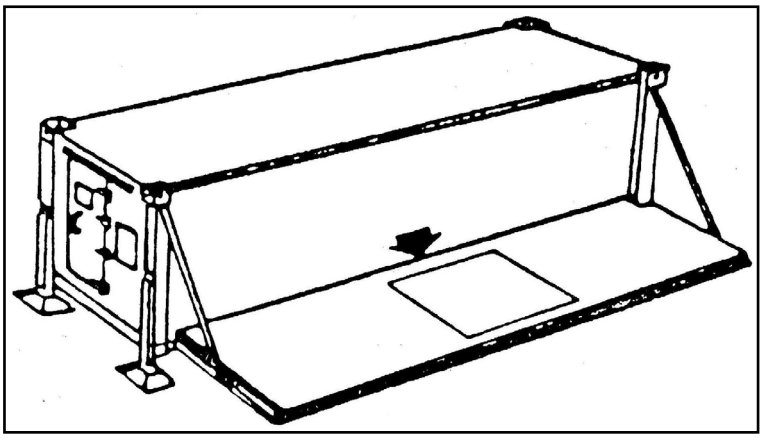

Figure 3-2. Lowering the floor

i. Remove quick release pins and flip stop plates (horseshoes) down. Replace quick release pins in lower holes.

Note. Ensure the ball on the support equipment is outside the stop plate.

j. Obtain two support braces from toolbox.

k. Obtain two support jacks from left cargo door. Position them in vicinity of the corners, clear of the work area.
l. Place personnel on each side. Raise hinged sidewall, and hold in position, (see figure 3-3 below).

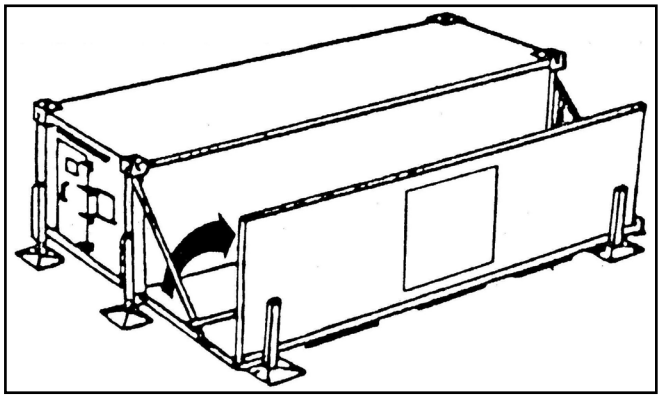

Figure 3-3. Raising the sidewall

m. Install both support braces, one on each end, inside cables and in the brace cups on floor and sidewall, while supporting wall.

Note. For steps (n) and (o), remember to keep upward lift on jack. Once safety pin is in place, release jack; it will stay in place.

---

n. Obtain jacks and engage jack attachments into jack support brackets on hinged wall. Insert jack lift pins into floor sockets.
o. Insert safety pins.
p. Raise jacks until the least resistance is felt, then stop.
q. Move to the end of wall. Step back a few paces and sight down the wall to ensure it is leaning outward enough to clear roof when raised.

Note. Maintain wall support in case of high winds. Winds may or may not be pushing sidewall in. Remember to hold straps on wall only and keep fingers clear of ends because roof will be raised next.

---

r. Move inside ISO to solar bars. Push the two handles simultaneously, to their full extent, to slide hinged roof outward.
s. Remove quick release pins from strut stowage brackets and swing down struts.
t. Extend struts and lock inner and outer tubes with quick release pins when holes align.
u. Position two persons inside the ISO back to back at the struts. Position two persons at each end of the roof, on the outside, to assist in raising it.
v. With all six personnel in place, raise the roof to the full height of the support struts, (see figure 3-4 on page 3-10), raising the roof. One person should give the command to raise the roof.

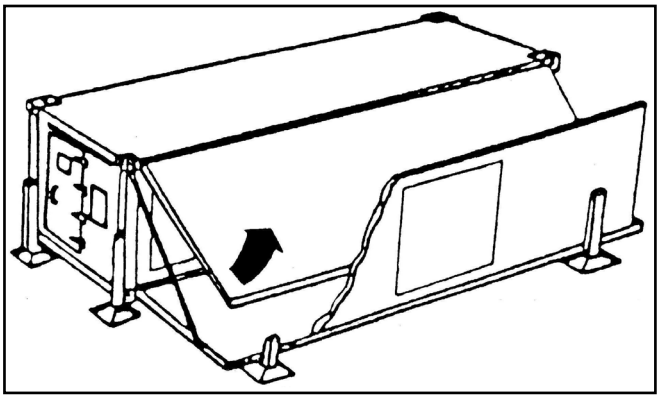

Figure 3-4. Raising the roof

w. Swing hinged endwalls out into position and hold in place, (see figure 3-5 below).

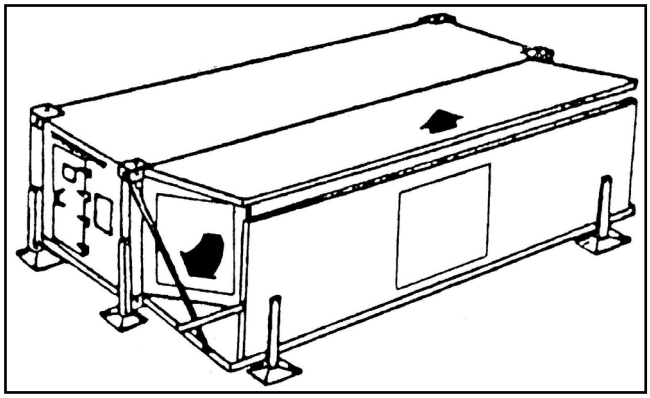

Figure 3-5. Moving the endwall into position

x. Raise jacks until the stenciled leveling marks on endwall and sidewall align.

WARNING

Do not allow endwall out past metal plates on floor when jacking floor up. To do so well will result in damage to bottom of endwall.

y. Lower roof using two personnel on struts.
z. Remove quick release pins from struts. Compress and re-secure struts to stowage brackets with pins.
aa. Move outside. Ensure all rubber seals are compressed.
bb. Elevate, if required. Only one leveling jack is used to align the stenciled marks on roof and sidewall.

Note. If sidewall mark is to the right side of roof mark, as you face them raise the jack on the right end of floor. If mark on sidewall is on left side of roof mark, raise the left floor jack.

cc. Move inside ISO. Engage panel latches to further compress all rubber seals. Start at the bottom of each corner. Work up and toward center of sidewall.
dd. Obtain four removable latches from toolbox. Install two on the inside of the sidewall and the other two on the inside of the endwalls. Thumb tighten at marked positions.
ee. Seat locking devices and turn butterfly wing; turn and flip it down.

ff. Remove both support braces and store in toolbox.

Note. Above procedures were for a 2:1 ISO. For a 3:1 ISO, repeat steps 3-10(c) through 3-10(ff) for other side. Figure 3-6 below depicts a fully expanded shelter.

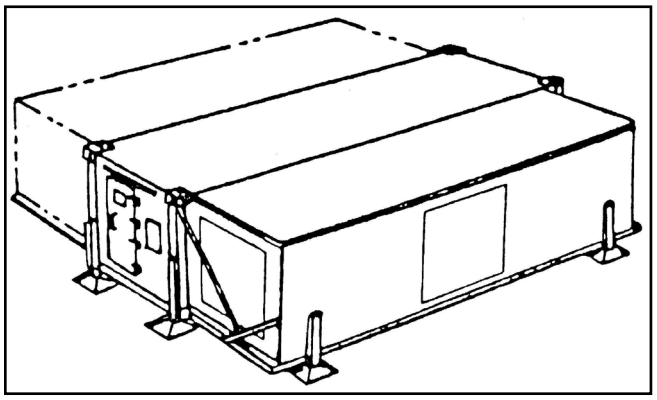

Figure 3-6. Expanded ISO

3-11. Installing the accessories.

a. Remove electrical outlets from their stored locations. Place them on expanded sidewall in designated locations. Secure cables with hook and pile straps at top of walls.

b. Remove fluorescent light sets that have cord/plug attached by pushing ceiling plunger lock in with one hand. Grasp center of metal partition with other hand and slide light set off retaining tracks (four each).

CAUTION

Do not grasp fluorescent lights when removing or moving them.

Note. Once light set retaining track moves over ceiling plunger lock, release the lock. Keep your hand on the light set to prevent dropping it.

c. Move to expanded side. Locate electrical wall socket and ceiling retaining tracks. Turn light set with cord/plug toward socket.

d. Insert light set on retaining tracks. Slide light set until you hear or see the ceiling plunger lock "SNAP" out and into place.

Note. Do not let go of the light set until you are sure it is secured.

e. Plug power cord into socket and twist it, locking it in place.

f. Remove the two solid panels from air conditioner/heater inlet/outlets (2:1) on wall.

Note. A 3:1 ISO may have air conditioner/heater inlet/outlet panels on wall yet to be expanded.

g. Remove the two air conditioner/heater inlet/outlet panels from their stowed locations.

h. The air conditioner/heater inlet/outlet panels are marked. Place them into wall openings (adjustable vent at top, metal screen vent at bottom for summer operation, reverse for winter operation).

Note. When ISO bump-through-doors are used the air conditioner/heater provides adequate heat to -10ºF.

i. Secure the two solid panels in panels' stowage locations.

Note. Panels should be tightened snug with screwdriver to prevent water from entering the ISO.

j. Remove outside light from stowage. Attach it to the outside brackets and connect power cord.

Note. Stowage of accessories/closing ISO: reverse steps 3-11(a) through 3-11(j).

3-12. Shelter grounding.

Note. Shelter is grounded through externally connected power supply which is installed by using the grounding rod identified in TM 10-5411-200-14 supplied in the ISO tool box.

a. Drive ground rod into the ground. Assistance from the power team will be needed to provide slide hammer. Pick a site that enables ground cable, attached to rod, to reach ground stud on power entry panel.
b. Remove nut, star washer, and flat waster from stud on power entry panel.
c. Connect ground cable connector to stud and secure with washer, star washer, and nut.
d. Check all connections for security.

SECTION II – SHELTER SYSTEM TRANSPORT AND SUPPORT EQUIPMENT

3-13. This section discusses some of the transport and support equipment which is essential to deploy for the tactical hospital. It includes Dolly sets, medium tactical vehicle and the load handling system.

CONTAINER CARGO: REUSEABLE WITHOUT MECHANICAL RESTRAINT SYSTEM

3-14. The cargo container, better known as a MILVAN, is a metal container measuring 8 feet by 8 feet by 20 feet. The MILVAN is used to store and transport tents, MMS sets, and other tactical hospital center system equipment and supplies. It may also be used by other hospital elements such as the headquarters and motor pool.

3-15. Like the ISO, the MILVAN is transported by organic equipment or when available, other types of transport equipment may be used.

Note: The Container, Cargo has a shipping capacity (inside) of 1,070 cubic feet of cargo. Weight capacity of cargo is 50,000 lbs.

a. The M1022 and M22A1 Dolly Sets. The M1022 Dolly Sets are used to transport an ISO or MILVAN. The dolly set consists of two assemblies or halves. The dolly is towed by a truck of whatever series has a rated pintel and sufficient air capacity for the brakes. The truck is capable of moving the dolly set and ISO or MILVAN weighing up to 15,000 pounds, over prepared roads and rough terrain. Use of the Dolly systems for ISO movement and spotting is recommended for the following:

CAUTION

Extra space required while maneuvering into position and dolly sets not designed to travel in reverse for long distances.

- The M1022 Dolly System, see figure 3-7 below, is the first version of the Dolly system to be used by tactical hospital center system and is manually operated. This set can only move 8 ft. high MILVANS. Refer to TM 9-2330-379-14&P (M1022).
- The M1022A1 Dolly System, see figure 3-8 below, has hydraulics operated with diesel engines and can mover either 8 ft. MILVANS, or the taller commercial containers. Refer to TM 9-2320-390-14&P (M1022A1) for operating instructions and further information.

Figure 3-7. M1022 Dolly System

Figure 3-8. M1022A1 Dolly System

SUPPORT EQUIPMENT

3-16. The M1083A1P2, Medium Tactical Vehicle (MTV) provides mobility for the hospital center. It is the primary mover for the dolly system.

3-17. The FMTV 5 Ton Load Handling System M1148A1P2.

a. The Family of Medium Tactical Vehicles (FMTV) 5 Ton Load Handling System M1148A1P2 is also part of the unit's inventory. Load plans need to be carefully designed due to the extreme angle of the container when being picked up. Extreme caution must be used when picking up and dropping ISOs. Refer to TM 9-2320-337-10-1 for operating instructions includes:

- When moving an FMTV 9.0 Ton Load Handling System (LHS) M1148A1P2, the total lift capacity is 17,640 lbs., making the weight capacity of 4,710 lbs. for the container, cargo and 12,930 lbs. of cargo.
- The FMTV 5-ton cargo truck load handling system with winch included is described below in table 3-3 on page 3-14.
- The FMTV trailer can transport up to a gross vehicle weight of 21,000 lbs.

Table 3-3. FMTV 5 Ton Load Handling System with winch

FMTV 5 Ton Load Handling System with Winch
• Has a payload of 10,000 lbs. • Is capable of winch operation from the driver's position except for the free-spooling operation. Winch can be operated from the front or rear of the vehicle: has a line pull of 15,500 lbs., with a line speed of 15 feet per minute • The FMTV/LHS can load, drop or transfer supplies in a 20 foot ISO container or a flat rack. The hook arm alone is used for loading a standard flat rack. With flat racks, it has a payload capability of 6.1 tons. The lift frame and hook arm combination is used for loading standard sized 8 ft. x 8 ft. x 20 ft. ISO containers. • Is capable of operating worldwide on primary and secondary roads, trails and cross-country terrain in all climatic conditions.

b. The MTV LHS trailer (see figure 3-9 below), is compatible with the MTV LHS. It is a trailer with a flat load carrying platform without sides or end gate; the platform is of solid, one level construction suspended above the wheels and does not include a gooseneck or wheel recesses extend through the bed. Associated with the T54516, Truck Materials Handling-Container Hoisting: M1148A1P2 providing mobility (TOE Cargo/Personnel) for the Hospital Center (240 bed), including the Field Hospital (32 bed).

Figure 3-9. Medium Tactical Vehicle load handling system trailer

c. The Light Capability Rough Terrain Forklift is C-130 and CH-47 sling load transportable with a 5,000 pound capacity, variable reach rough terrain forklift with fork line oscillation and side-shift cab controls.

d. Rough Terrain Container Handler (RTCH), Kalmar Rt240. The RTCH is not organic to the hospital center. It is found with the Quartermaster Supply unit, Transportation Cargo Company and Transportation Seaport Operations Company. When the RTCH is put into operation the total lift capacity is 53,000 lbs., making the weight capacity of 4,710 lbs. for the container, cargo and 48,290 lbs. of cargo for a total of 53,000 lbs.

SECTION III – POWER GENERATION EQUIPMENT AND CLIMATE CONTROL SYSTEMS

3-18. The 100-kilowatt (kW) Tactically Quiet Generator (TQG), (see figure 3-10 on page 3-15), is a trailer-mounted generator and is the principal means of powering a hospital. This Generator is used in conjunction with an M400 power distribution panel. Refer to TM 9-6115-729-10 for operating instructions.

Figure 3-10. 100 kW Tactical Quiet Generator

3-19. Large Tactical Power (LTP) FY 18 – FY 22. Modernization Program to replace Military-Standard (MIL-STD) and TQG sets and M400 Power Distribution Panel with next generation of Standard DoD Mobile Electric Power Generating Sources. Replace present 100 kW Generator with 200 kW and replace M400/M100s with new Power Distribution Illumination Systems Electrical (PDISE).

DISTRIBUTION ILLUMINATION SYSTEM ELECTRICAL (DISE) AND M400 POWER DISTRIBUTION SYSTEM

DANGER

Field units may find it necessary to connect to and operate from local commercial power. This is not an advocated procedure, however if required, the connections must be made by utility service representatives.

WARNING

DEPMEDS units may find it necessary to connect to and operate from local commercial power. This is not an advocated procedure, however if required, the connections must be made by utility service representatives.

- The DISE distributes electricity from the 100 kW generator or other source to tactical hospital center system components and provides illumination. The DISE is designed to operate in temperature ranges of -25°F to 120°F, under combat conditions. Standard military Class-L connectors are used and the system is protected by circuit breakers. Refer to TM 9-6150-226-13 for more details. Line distance from generator to load is limited to 300 feet. Line distances greater than 300 feet cause an unacceptable voltage loss. See TM 3-34.46 for specific loss levels and operation in the field. The DISE does not replace existing lighting sets. The cable wires are color coded as follows:

- L1 (phase A)—black.
- L2 (phase B)—red.
- L3 (phase C)—blue.
- LO (neutral)—white.
- G (ground)—green or bare wire.

3-20. The DISE major components consists of the following:

- Electrical feeder system, M100, (see figure 3-11 below).
- Electrical feeder system, M40, (see figure 3-12 on page 3-17).
- Electrical feeder system M60 (used for single-phase small generator operations) (see figure 3-13 on page 3-18).
- Electrical utility assembly M46, (see figure 3-14 on page 3-19).

3-21. The M100 and M40 electrical feeder systems require a 3-phase electrical power source rated at 208v AC, 50/60Hz for input power. These systems provide 3-phase, 208v AC or single-phase, 120v AC for the following:

- M100 electrical feeder system is a 3-phase, 120/208v, 100 amp per phase power distribution system.
- Power input is through an 8-pin, 100-amp cable connector.

3-22. Power output is through one 100-amp, 3-phase, 36-kilowatt connector; two 60-amp, 3-phase connectors; two 40-amp, 3-phase connectors; and two 20-amp, single-phase connectors. A general use for this panel is to provide additional outputs for the M400 if needed, or supply power for smaller or remote operations. This panel equates to a 30 kW Generator, and can be wired directly into a generator through the use of the pigtail.

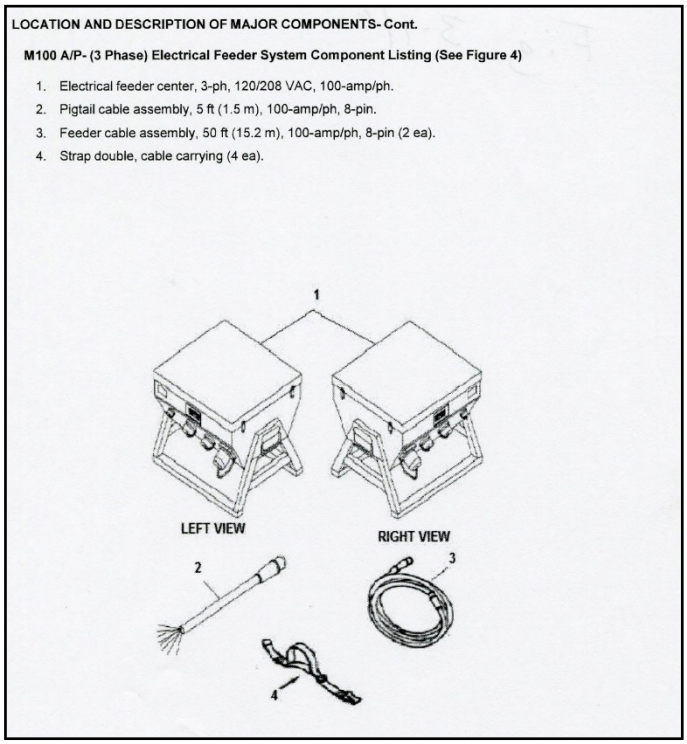

Figure 3-11. M100 Electrical feeder system

3-23. M40 electrical feeder system is a 3-phase, 120/208v, 40-amp per phase power distribution system. Power input is through a 5-pin, 60-amp cable connector. This panel is used for smaller operations or for life support tents needing multiple 20 amp circuits. This unit can be pigtailed directly into a generator.

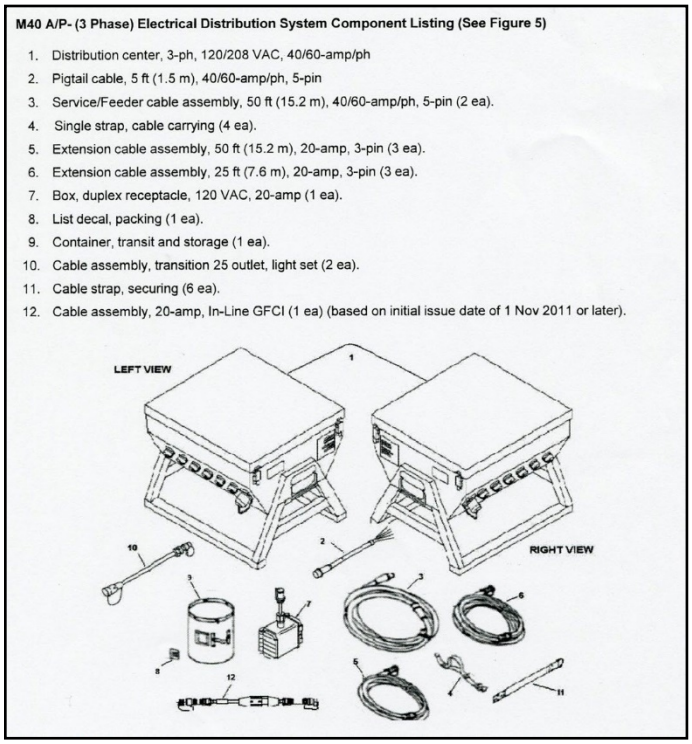

Figure 3-12. M40 Electrical feeder system

3-24. The M60 A/P system requires a single-phase electrical power source rated at 120VAC, 50/60 Hz, for input power. This system will provide only single-phase (120 VAC, 50/60 Hz) electrical power at the output receptacle. Placement of the Convenience Power Outlets will be along each side of the inside walls of the tent on the floor facing upward. They will be connected to the power distribution (A-Panel) box.

Note. The M60 is typically used for single phase small generator operations.

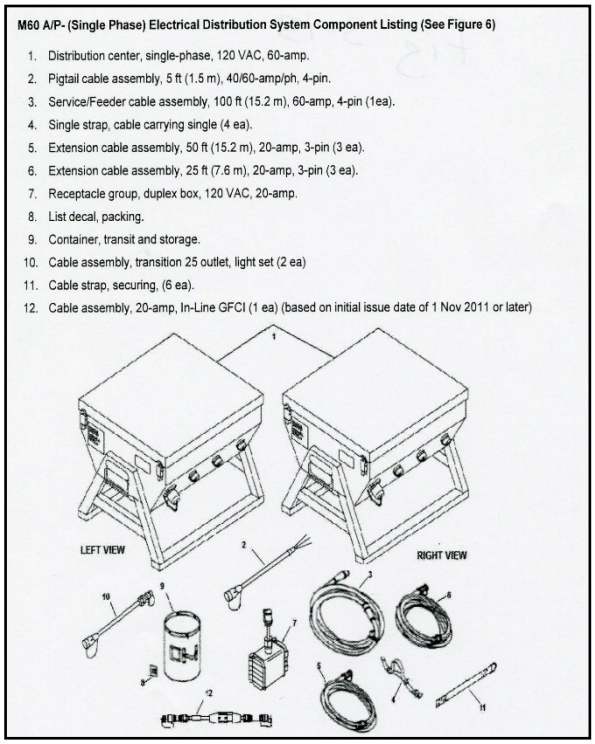

Figure 3-13. M60 Electrical distribution system

3-25. The M46 system connects to the M60 A/P system outputs or to the single-phase outputs of the 3-phase systems (M40 A/P, M100 A/P, and M200 A/P). The M46 System consists of various electrical cables, lights for illumination, and standard household type duplex receptacles for plugging in electrical loads, not to exceed the rating of the circuit breaker.

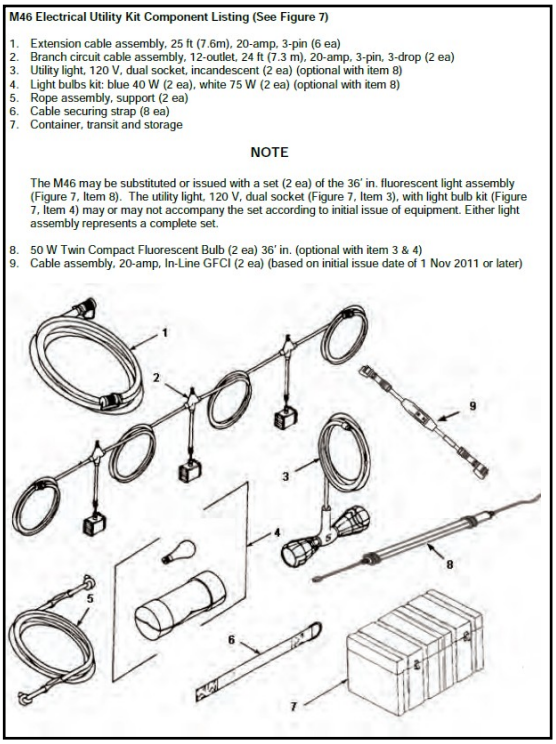

Figure 3-14. M46 Electrical utility assembly

Note. The M46 set is commonly used to provide lighting and power to the life support tents, as well as other structures not connected to the hospital.

3-26. Placement of the Power Distribution box. The Power Distribution box, also called an A Panel, (see figure 3-15 below,) is placed to the left of the entry door at each end of the tent.

Figure 3-15. A Panel

3-27. The M400 Power Distribution Center (PDC) (see figure 3-16 on page 3-20) is a 3-phase, 120/208v unit with 400 amps per phase. Input is hard-wired from the 100 kW generator or a switch gear box using 350 amp cables. The M400 requires three 350 amp input cables, one 350 amp neutral cable, plus a 4-0 grounding

cable. The power cables and neutral cables are connected to the M400 at the input/neutral ground connectors. The earth ground wire is attached to the unit at a screw compression point. Output is provided by four 100-amp, 3-phase and ten 60-amp, 3-phase output connectors. The M400 provides for maximum use of the 100 kW generator. Several M100 and M40 feeder systems can be serviced by one generator. Only trained power personnel should be installing this equipment.

WARNING

Allow only personnel trained and certified to operate the DISE equipment and generators.

Figure 3-16. M400 Power Distribution Center

DANGER

Ensure that incoming power is shut off and that there is no voltage at the PDC before connecting power cables. Do not take anyone's word for it; check it yourself. There could be dangerously high and possible lethal voltage present. Take extreme care when connecting power lines; do not cross the l0 with any of the other phases (l1, l2, or l3).

3-28. When establishing the consolidated power network you need to know the location of all structures being supported, and what they contain requiring power. Begin analysis with determining what the power requirements are for each structure or end user. This is done by adding up the total wattage of each area. Next the wattages of all users are added together to determine the total power requirements which will, in turn, dictate the number of generators and PDISE equipment will be needed. An attempt should be made to maximize the use of the generators. Optimum would be 80% actual load.

Note. The largest overall power users in the hospital are the air conditioner/heater units. In moderate temperatures it is difficult to get a good load on the generators because the Heating, Ventilation and Air Conditioning (HVAC) units are not working hard. Therefore a theoretical load of 100% is used for planning, but not typically seen. The standard for planning power distribution is to split the power on all medical tents have two power service panels so in the event a generator fails the tent will not lose complete power.

3-29. These are figures used for training events, in an attempt to get at least a 50% actual load on a generator. These figures are based on a 100% load test and data collected from multiple exercises and make a good starting point for determining a unit's actual needs. Plan for a theoretical load of 100% on the generators. Power usage is weather-dependent. When the weather is moderate and the HVAC is not working hard then the power usage will be lowered for the following:

- Resistive loads change electrical energy into light or heat by way of an element or filament of high resistance material (light bulbs). Add up watts (light bulbs) and divide by volts (120) = amps. Example: 40 light bulbs x 60 watts = 2400 watts / 120 volts = 20 amps.
- Inductive loads change electrical energy into mechanical motion through induced magnetism in coils or windings (fans and motors). Change horsepower to kW, or watts, and divide by volts. EXAMPLE: 1 horsepower = 1 kW or 1000 watts; 1000 watts divided by 120 volts = 8.33 amps.
- Combined loads are resistive and inductive loads working together in one device.

3-30. Balance Connector Load—feeder cable loads must not exceed the kilowatt or amperage rating of the supporting circuit breaker. Table 3-4 below lists the maximum loads for each system. Any combination of output connectors can be used as long as total output does not exceed the system's capacity.

Table 3-4. Feeder/Distribution Center output connector loads

Connector Type (Max Connector Load)	Balanced Connector kW Load	Numbers of Connectors	Total kW Load
a. M100 Feeder Center(36 kW total output capacity			
100-amp, 8-pin, 3-phase (36 kW)	36	1	36*
60-amp, 5-pin, 3-phase (21.6 kW)	18	2	36*
40-amp, 5-pin, 3-phase (14.4 kW)	14.4	2	28.8
20-amp, 3-pin, single-phase (2.4 kW)	2.4	2	4.8
b. M40 Distribution Center(14.4 kW total output capacity)			
40-amp, 5-pin, 3-phase (7.2 kW)	14.4	1	14.4*
20-amp, 3-pin, single-phase (2.4 kW)	1.2	12	14.4*
c. M60 Distribution Center(7.2 kW total output capacity)			
60-amp, 4-pin, 3-phase (7.2 kW	7.2	1	7.2*
20-amp, 3-pin, single-phase (2.4 kW)	1.2	6	7.2*
*Requires feeder/distribution center's total output capacity.			

WARNING

Distribute load evenly across available connectors. Ensure total load does not exceed circuit breaker rating.

3-31. A typical PDISE and PDC-specific layout for the Field Hospital (32 bed) may require changes due your current mission requirements.

3-32. Install electrical power system. Based on analysis of terrain and tactical constraints, connect equipment to provide electrical power from the least number of generators includes:

- Based on the individual's choice of electrical distribution cables on the distance between generator set, distribution center, and user (ISO or tent).

Note. Remember the longer the cable, the greater the voltage loss at the user's end (300 foot maximum from generator). If equipment is sensitive to voltage loss, you may have to use shorter cables.

- Route cables to avoid roadways and troop walkways. If you must cross a roadway, bury cable to protect it from damage. DO NOT lay cable connectors where water can collect.
- Connect power cables from generator to PDC.
- Connect power cables from PDC to M100 and M40 feeder systems.
- Connect power cables from feeder systems to user's power input connectors (ISO, tent, air conditioner/heater, H-81 heater).

WARNING

1. Ensure that power switches are in "OFF" position and the generator is not operating when making power connections.

2. User's power equipment should be set up when MMS and equipment are set up.

3-33. The startup power system includes:

- Set all PDC and feeder system circuit breakers in "OFF" position.
- Start the generator.
- Set the PDC circuit breaker to "ON".
- Set branch feeder system's circuit breaker to "ON".

WARNING

Notify all users that the power system is being turned on. Failure to do so may result in severe injury or death of users.

3-34. Check current output at the generator for each phase (amp/voltage). If the current draw for any one phase is 10 percent greater than any other phase, set all circuit breakers to "OFF" position and shut down the generator. Reconnect user's load to various branch circuit output connectors until all three phases are evenly balanced (commonly called balancing the generator). This is done at the single phase outputs on the distribution panels, typically the A Panel. It is usually only an issue during winter operations when single phase heating units replace the 3 phase ECUs or under Chemical Protective operations.

3-35. Operate DISE and PDC according to the power requirements, TM, or manufacturer's manual.

HEATING AND ENVIRONMENTAL CONTROL

3-36. The following heating units, Improved Army Space Heater (IASH), Electric Powered, Multi-Fuel, 140,000 British Thermal Unit (BTU), Model H-140 (see figure 3-17 on page 3-22), refer to TM 9-4520-271-14 for operation and maintenance, Heater Duct Type Portable 350k (see figure 3-18 on page 3-22), refer to TM 5-4520-256-14 for operation and maintenance, are designed for heating and ventilating the ISOs for the

Air Supported and Alaska Shelters. The heater can be operated as a recirculating (closed system) or fresh air (ventilating) heater.

3-37. These heat units are connected to the ISO/tent through the same intake and return panels used with the air conditioner. There is one heater authorized for each tent and each ISO. The heaters replace one of the air conditioner/heaters on the tent for cold weather operations. It also replaces the air conditioner/heater of the ISO.

Note. When the bump-through-doors are used on the ISOs, the air conditioner/heater provides adequate temperature control down to -10ºF.

Figure 3-17. Improved Army Space Heater, electric powered

Figure 3-18. Heater Duct Type Portable 350k

FIELD DEPLOYABLE ENVIRONMENTAL CONTROL UNIT (FDECU)

3-38. The FDECU (see figures 3-19 and 3-20 below) is a horizontally configured electric motor driven heat pump. The unit uses integral supplemental resistance heaters during system defrost and low ambient temperature conditions.

3-39. The unit will circulate and filter the air and provide fresh make-up air as desired.

3-40. The unit is designed for use while directly exposed to the environment and will operate with the filter blower overpressure systems developed for use in CBRN environments.

3-41. There are differences between the models. The FDECU-2 uses two compressor crankcase heaters wrapped around the compressor and a compressor warm up indicator light on each of the control panels to indicate heater operation. Units after the FDECU-2 do not have compressor crankcase heaters or compressor warm up indicator lights. The FDECU-4 and thereafter are lighter weight due to manufacturing process changes and the use of a lighter compressor. The new compressor is placed on resilient mounts and stabilized with the cushion clamp to reduce vibration and sound levels.

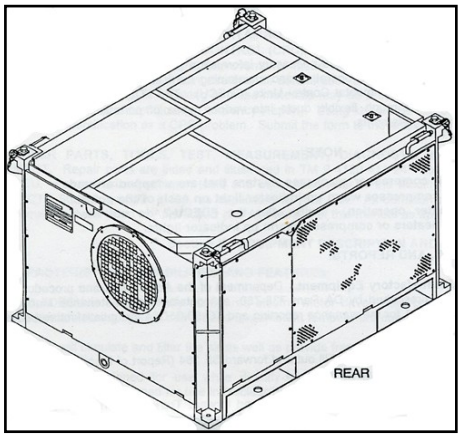

Figure 3-19. Field Deployable Environmental Control Unit (FDECU) front

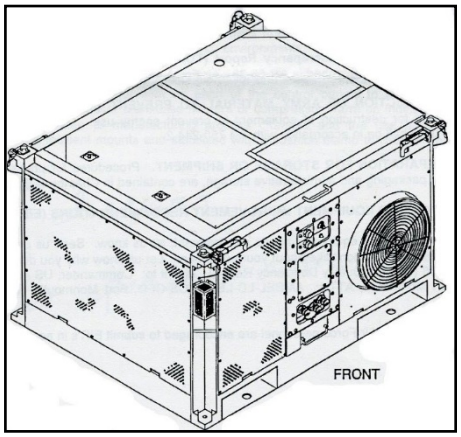

Figure 3-20. Field Deployable Environmental Control Unit (FDECU) rear

3-42. Operation Instructions.

a. Table 3-5 below explains the FDECU power setup sequence.

Table 3-5. FDECU Power setup sequence

FDECU Power Setup Sequence	
1.	Position the FDECU on a level surface, at least four feet from any obstructions. Ensure the ducts can be attached between the FDECU and the shelter without kinks or shop bends. Reference TM 9-4120-411-14 for operation and maintenance instructions.
2.	Open top cover by removing pins, and secure in open position with the rod provided. Insert safety pin through the rod.
3.	Remove insulated ducts and drain hose.
4.	Unwind power cables and guide cable through opening on the side panel.
5.	If remote control box is used, unwind remote cable and guide remote control box and cable inside shelter through appropriate hole in shelter and install at eye level, away from drafts or supply air opening.
6.	Close top cover and secure with pins provided. Make sure cable cannot interfere with fan.
7.	Remove return air duct by rotating the adaptor counter-clockwise to unlock. Flip the adapter so the perforated ring projects beyond the FDECU, and lock the adapter and by rotating clockwise. Connect the 7 foot duct to the adapter and to the shelter opening. Note the airflow direction arrow on duct. The arrow must point toward the FDECU.
8.	Remove the panel covering the supply duct. Uncoil condensate drain hose then pass it through hole in frame located in front of drain fitting and route to appropriate drainage area. Remove the retaining pins that secure the heater assembly, and slide the assembly forward. Replace the panel and connect 9 foot duct to the heater assembly and to the shelter opening. Note airflow direction arrow. The arrow must point toward the shelter.
9.	Connect power cable to the three-phase, 2-8 volt alternating current (VAC), 60 amp power supply.

b. Table 3-6 below explains the FDECU operating modes.

Table 3-6. FDECU operating modes

FDECU Operating Modes	
1.	Push the “VENT MODE ON/OFF” button for the vent mode, and/or the “CLIMATE CONTROL ON/OFF” button for automatic climate control. The corresponding “ON” indicator light will illuminate.
2.	Check the proper phasing of power supply. Fan must spin in direction of arrow.
3.	Set the adjustable “TEMPERATURE” knob to the position desired. HOT or COLD. Turning the knob clockwise increases the temperature (WARMER), and counter-clockwise decreases the temperature (COOLER).

c. Shutdown. To turn off, push the VENT MODE ON/OFF and/or the CLIMATE CONTROL ON/OFF buttons.

IMPROVED ENVIRONMENTAL CONTROL UNIT

3-43. The 60K BTU/HOUR (HR) Improved Environmental Control Unit (IECU), (see figure 3-21 on page 3-26), is used on ISO shelters and tents to provide 60,000 BTU’s of cooling or 22,780 BTU’s of heat per hour.

3-44. It is designed to automatically maintain the air in the room, or enclosure, at the desired temperature selected on the remote box. Refer to TM 9-4120-431-14 for operating instructions.

Note: Due to the length of the supply ducts it is advantageous to place the IECU on pallets when supplying air to an ISO.

Figure 3-21. The 60K BTU/HR Improved Environmental Control

Chapter 4

Module Complexing

Role 3 hospitals have numerous requirements when choosing a site to establish operations. Selecting a location to set up a hospital accounts for environmental and enemy threats, topography, size, and medical evacuation routes. Much like a tactical operations overlay, the hospital's staking plan provides a blueprint for personnel priorities of work and how the facility will fit into the terrain's landscape. It requires key leader involvement, training, practice, and rehearsals to plan, stake, and erect a hospital that maximizes all of its capabilities in the most efficient way.

SECTION I – COMPLEX PLANNING

4-1. Regardless of the type hospital, it is imperative a plan be developed prior to moving. This plan is normally developed at the direction of the hospital commander. The personnel involved should include, but not be limited to the following:

- Commander.
- Executive Officer.
- Command Sergeant Major.
- First Sergeant.
- Warrant Officer, Construction Engineer Technician.
- Chief of Nutrition Care.
- Chief Nurse.
- Chief Wardmaster.
- Operations Officer.
- Operations NCO.
- Logistics Officer.
- Logistics NCO.
- Detachment Commander.
- Detachment Sergeant.
- Communications Chief.
- Communications NCO.
- Generator operator.

4-2. Site Selection. The selection of a hospital site requires thorough coordination at appropriate command levels. Under normal circumstances, the hospital will receive guidance from its higher headquarters. This guidance will probably come in the form of a briefing and/or an operations order. Also included will be the grid coordinates of the general area for the site. The commander will then send out an advance party to select a specific site. Section I discusses some things must be considered when selecting a tactical hospital system site.

a. Vulnerability to Enemy Actions. If at all possible, do not locate adjacent to potential tactical targets. These include areas such as airfields, munition and supply dumps, railroads, crossroads, bridges, and communication sites. The hospital may come under both direct and indirect fire in the enemy's attempts to hit rear area targets. If the general area is within an existing or

planned perimeter, select a site in the center. This will help protect it from potential enemy ground action.

b. Accessibility. The site must be accessible to various modes of transportation (air and ground) for patients and supplies. There must also be maneuvering area for vehicles used in transporting or hoisting shelters.

c. Topography. The hospital should be located on ground that is as level as possible. The slope of the terrain should not exceed 18 in. over the projected area of an expanded ISO, or 3 1/2 in. per 8-foot. Top soil consisting of sand and gravel is the most desirable, with subsoil that allows for rapid drainage. Marshy sites and soil with large amounts of clay and/or organic matter are the least desirable. Marshy sites will not support a tactical system hospital. Clay sites will not allow for proper drainage, thereby creating severe problems.

4-3. Space Requirements. Tactical system hospitals require extensive operating space. Based on available space, portions of the complex may have to be removed from the hospital core. The following are the space requirements for the various hospitals. Both tables 4-1 and 4-2 below are requirements which are only estimates. They do not include the space required for external roads, billets, helicopter landing pad, and motor pool.

Table 4-1. Combat Support Hospital operational space requirements

Hospital Unit	Required acreage
Early Entry Element (44 bed)	3.6 acres
Hospital Element (40 bed)	2.01 acres
Company A (Small)	5.7 acres
Company B (Large)	5.7 acres
CSH (248 bed)	9.3 acres

Table 4-2. Estimated Hospital Center operational space requirements

Hospital Unit	Required acreage
Headquarters and Headquarters Detachment	1.12 acres
Field Hospital (32 bed)	6.78 acres
Hospital Augmentation Detachment (Surgical 24 bed)	1.09 acres
Hospital Augmentation Detachment (Medical 32 bed)	.23 acres
Hospital Augmentation Detachment (Intermediate Care War 60 bed)	.32 acres
Hospital Center (240 bed)	18.45 acre

4-4. Site Preparation. Coordination with supporting engineers for site clearance and preparation is essential. This paragraph discusses some problems you may encounter in preparing the site, along with suggested remedies.

a. Forested Site. Complete site clearing is not essential. If engineer support is not available, you may have to fracture your hospital. The hospital core may be complexed around a stand of trees. However, tree stumps, bushes, and other growth must be removed from projected shelter areas. Otherwise, the equipment may be damaged. In addition, remove tree branches and bushes that may interfere with power distribution panels, distribution illumination systems, air conditioners/heaters, and other electrical systems.

b. Rocky Site. Large boulders need not be removed if hospital components can be successfully complexed around them. However, stones and sharp objects must be removed from pathways and projected tent areas. Failure to remove these objects may result in damage to the tent flooring.

c. Sandy Site. As mentioned earlier, soil with a high sand content is desirable. However, it may require some additional preparation. Ensure tent stakes and other securing/supporting devices can be adequately secured/stabilized. If the area is soft or muddy, place supports under the ISO leveling jacks to prevent excessive settling.

4-5. Guidance for Effective Patient Flow.

a. Typical flow should take the patient from EMT to the laboratory/X-ray, to the OR, to ICU, to an ICW, and later a Minimum Care Ward (MCW). Designate a point of entry for your patients. Not only will this assist in patient flow, it will also assist in controlling visitors. This, of course, is only a suggestion. Leadership must plan patient flow based on the unit's mission and capabilities; leadership should then plan the hospital complexing based on patient flow and cross contamination.

b. The environment should be closed for patients if possible by connecting all ISOs and tents (Alaska Shelter or Air supported) tents. This may not always be possible, but should be the goal.

c. Patient flow should be continuous, no backtracking.

d. Do not allow surgical and medical paths to conflict or join, except as necessary.

e. Direct the personnel working in clinical support areas (laboratory, pharmacy) to go to the patient. Maximize the use of portable X-rays. Locate these services adjacent, or as close as possible, to the areas they support.

4-6. Establishment Priorities.

a. In most instances, the unit will not be able to move the entire hospital in one move and only has so many vehicles and dollies. Support may be available from corps/theater Army transportation assets. Hospitals, however, may have to make the move entirely with organic vehicles. This means the relocation of the hospital will have three or more phases of movement. Therefore, a decision must be made as to when each of the components will be moved. Initial establishment of the hospital starts at EMT working towards the OR. Then build off that baseline until complete. Staging is a significant factor in mission success as well as the sequence of events. Staking and layout should be done prior to the arrival of equipment. The ISO containers can be placed along with tent bundles. Both the tents and the ISO can be set up at the same time. Power distribution can be placed by generators and connected to M400 along with placement of ECUs. Water and wastewater can begin laying down hoses, while complexing tent-to-tent and tent-to-ISO or ISO to ISO is taking place.

b. Lastly, power generation can run cables and connect to users to complete set up. This works with diesel compressors. If electric compressors are used then the sequence changes to staking and layout, ISO and tent placement. Power distribution would then run cables to compressors in order to inflate tents. This is followed by water and waste water and last, power distribution to users.

4-7. The following are some considerations that should be kept in mind when making this decision. Based on the unit's mission, determine which modules will be required for initial treatment and hospital establishment. Refer to table 4-3 below to consider the following questions to assist in the determination of priorities.

Table 4-3. Establishment considerations

Establishment Considerations
Is an operating room necessary?
If so, is there a need for a SPD to support that operating room?
Should the first move include an x-ray MMS?

- If there is a portable x-ray, it may suffice until the x-ray MMS can be moved. Consider each module using the same reasoning.
- Move the ISOs, MILVANs, and other support equipment according to the priorities established above and unit standard operating procedure (SOP).
- Position each ISO and MILVAN at its predetermined location upon arriving at the site. Thirteen feet are needed to disconnect a dolly from an ISO or MILVAN to move it away. Plan the layout in advance to allow placement of the modules where they are needed in order to avoid the need to move another module, reposition a shelter or to navigate a vehicle out of a tight spot.
- Position MILVANs as close to their ward or service area as possible. Keep in mind these areas must be ready to accept patients shortly after the facility is established.

- Position power generation and distribution equipment so the cables run from the power source to the user. Do not exceed a distance of 300 ft.
- Erect the facility from the center outward. Avoid blocking equipment that will be positioned later.
- Provide adequate roads for petroleum, oil, and lubricants (POL), food service, and other vehicles.

SECTION II – STAKING PLAN AND LAYOUT

4-8. This section illustrates how to stake and layout a hospital into multiple variants, using the three equipment tent systems. Including site selection considerations for the systems. It also shows how each system can be connected using complexing kits and vestibules.

PLANNING LAYOUT

4-9. A tactical hospital system can be complexed into many variations. As previously stated, the commander has the final approval as to how the hospital will be laid out. This section provides specific dimensional criteria and instructions to ensure the proper alignment of tents and ISOs. For information concerning the erection of tents and ISOs, refer to paragraphs 3-4 and 3-5.

4-10. There are several sets of dimensions critical for complexing a tactical hospital system. These dimensions provide for connecting the various shelters, passageways, and vestibules include:

- Alaska Shelter or Air Supported Shelter door panel to an ISO side closeout panel.
- ISO side closeout panel to an ISO end closeout panel.
- ISO end closeout panel to an Alaska Shelter or Air Supported Shelter endwall door.
- Alaska Shelter or Air Supported Shelter side door panel to an Alaska Shelter or Air Supported Shelter side door panel.
- Alaska Shelter or Air Supported Shelter endwall door to an ISO side closeout panel.
- Alaska Shelter or Air Supported Shelter endwall door to an Alaska Shelter or Air Supported Shelter endwall door.

4-11. Starting Point. Starting with a diagram, approved by the commander, this is a drawing of the hospital layout. The next steps are to decide where to start and how to start? For example, figure 4-1 on page 4-5, explains the setup of the complex using the TEMPER system. Figure 4-2, on page 4-6, depicts the Alaska Shelter System and figure 4-3 on page 4-7, depicts the TEMPER Air Supported Shelter System.

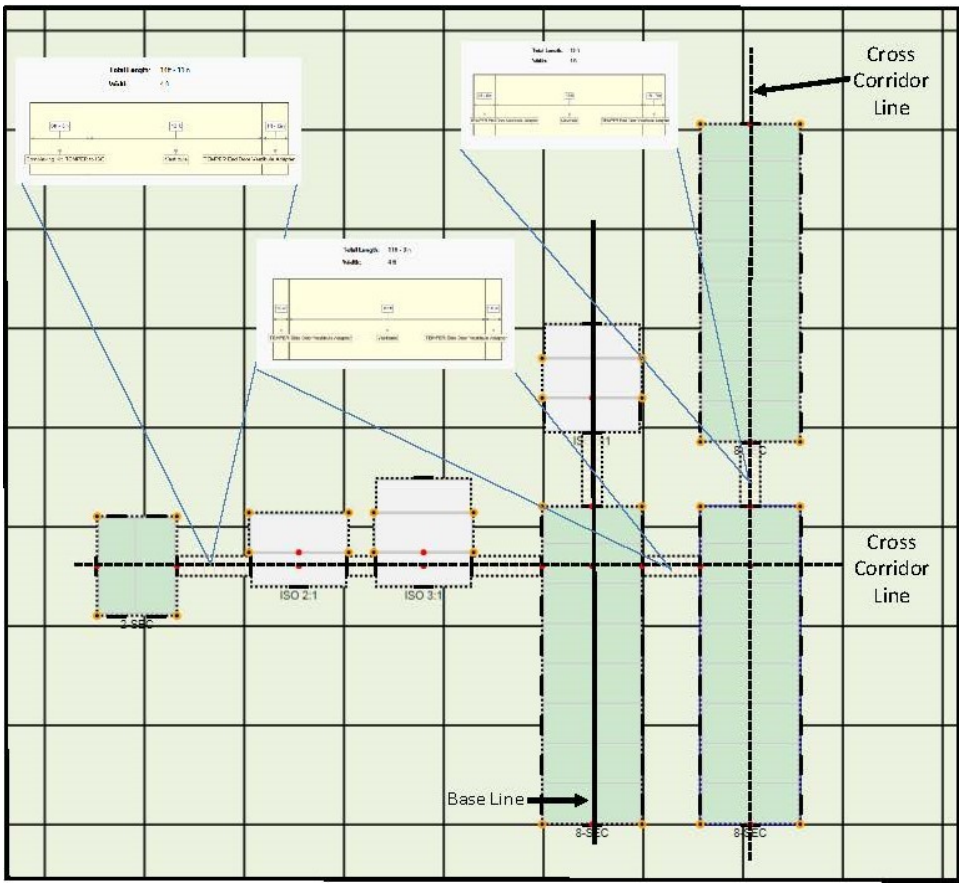

Figure 4-1. Hospital layout (TEMPER)

4-12. The tent marked number 1 in figure 4-2 on page 4-6 will be the starting point, which is the control point. The only criteria for the starting point is that it is placed in the center of the endwall door. For illustration purposes, the shelter in figure 4-2 on page 4-6, could be the Triage/EMT MMS. Stake the shelters in the order as shown in figure 4-2 on page 4-6.

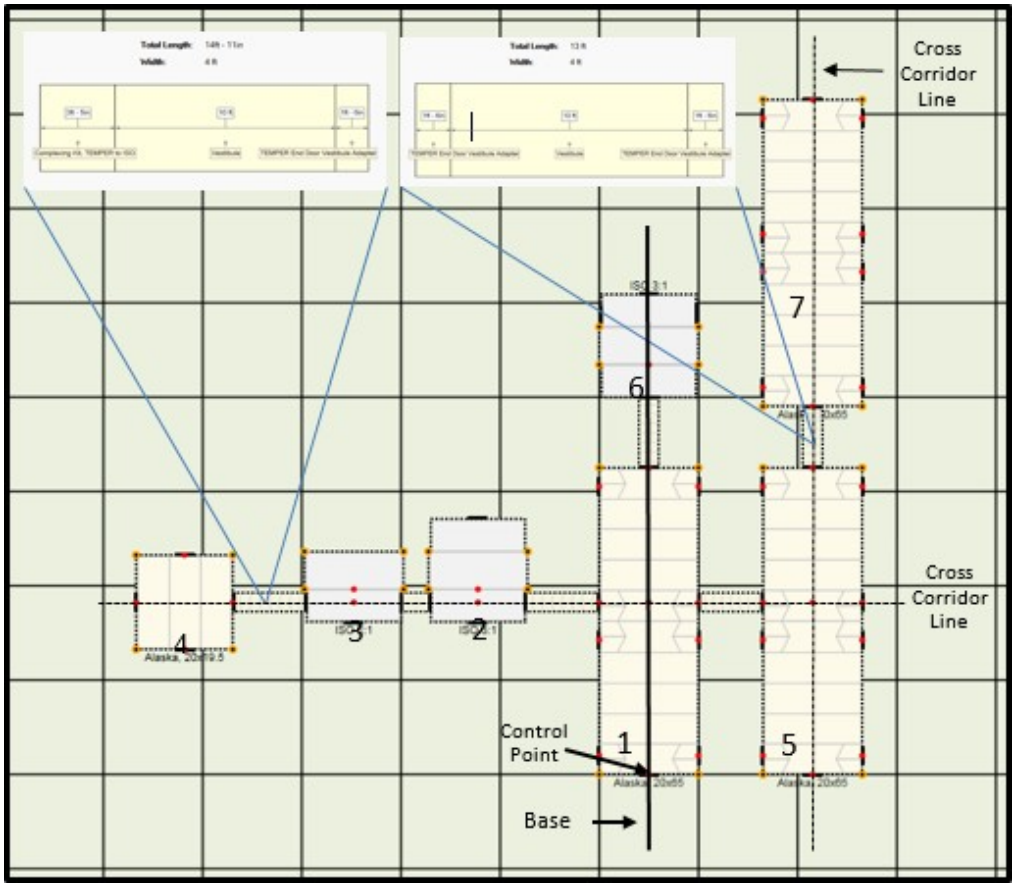

Figure 4-2. Hospital layout (Alaska Shelter)

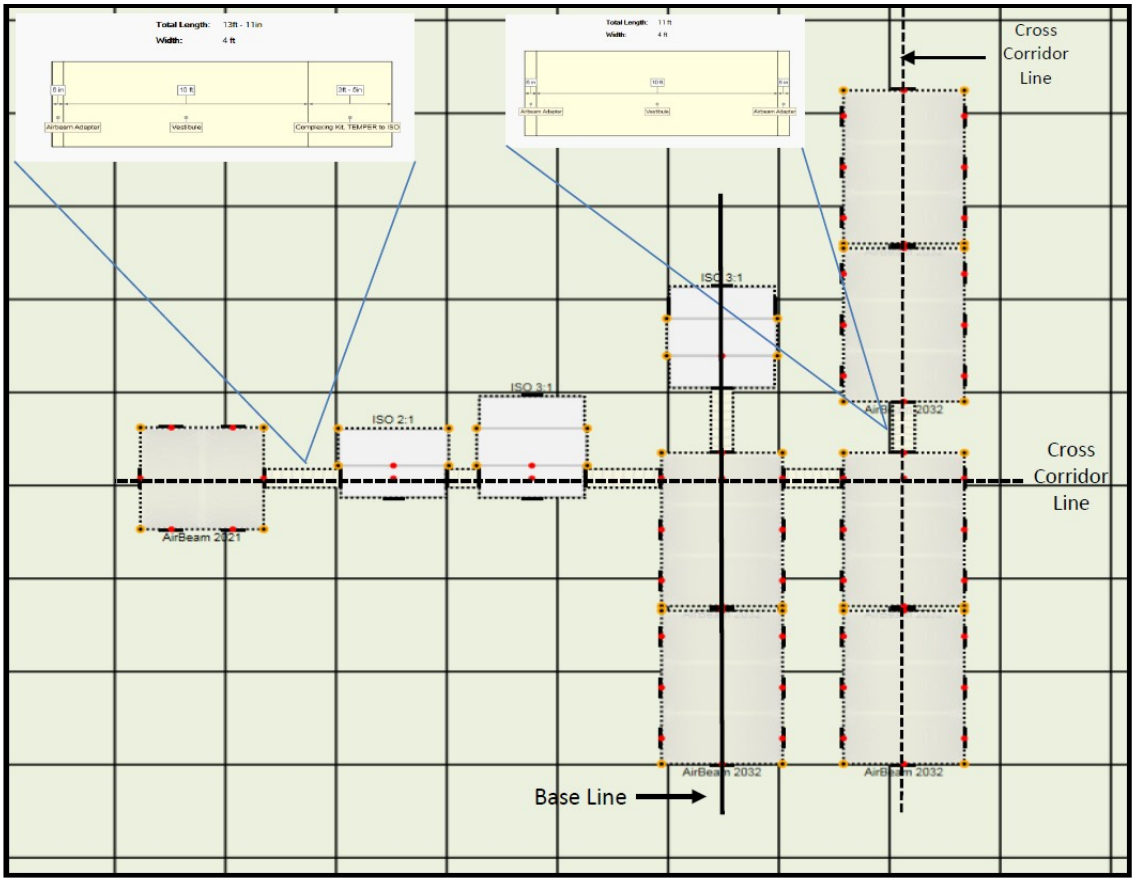

Figure 4-3. Hospital layout (TEMPER Air Supported)

4-13. Baseline. Establish a baseline by physically placing a strip of engineer tape on the ground, see figure 4-4 on page 4-8. This strip of tape should run the entire length of your planned complex. Notice the baseline in figure 4-2 on page 4-6, runs through the center of an Alaska Shelter 65 ft. x 20 ft. and a 3:1 ISO. The procedure is the same for the Air Supported Shelter system.

4-14. Control Point. To establish a (Stake A) control point then it has to bed marked on the baseline staking plan (see figure 4-4 [Air Supported Shelter]) on page 4-8. Use a stake, can lid, or other material to mark this and any other point. Our only suggestion is the marker be something that can readily be identified. All of the measurements on the baseline will be made from this control point.

4-15. Cross-Corridor Point. When the staking is completed there will be a complexed diagram with ISOs and tents joined with cross-corridors. The corridors are marked as cross-corridor points in the staking plans for the Air-supported (see figure 4-4 on page 4-8), Alaska Shelter (see figure 4-5 on page 4-9) and TEMPER shelters (see figure 4-6 on page 4-10). Referring to the figures, notice the cross-corridor point and baseline intersection will be at a different location depending on shelter system (TAS, Alaska or TEMPER) during the staking layout.

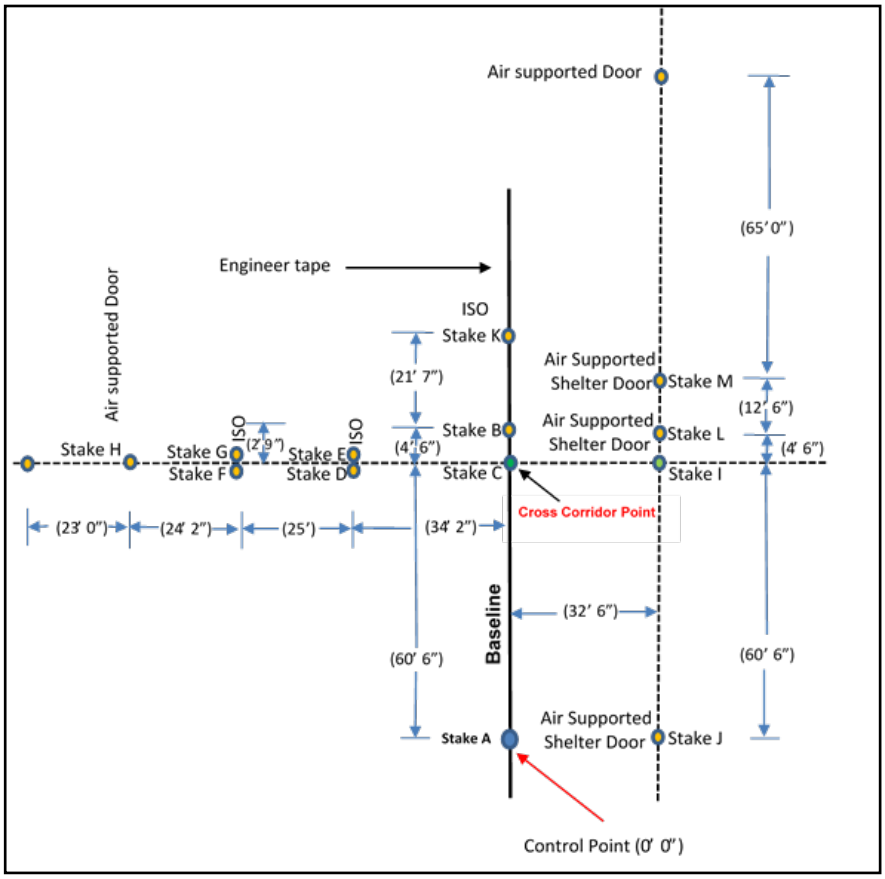

Figure 4-4. Staking plan (Temper Air Supported)

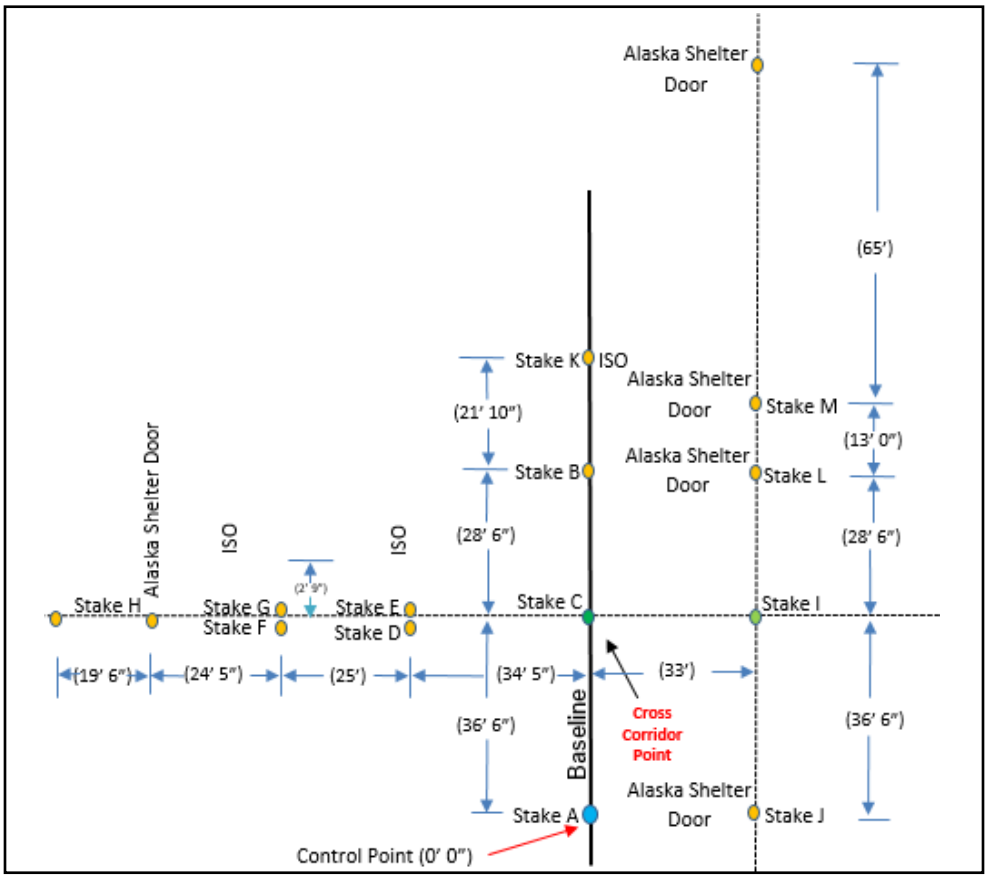

Figure 4-5. Staking plan (Alaska Shelter)

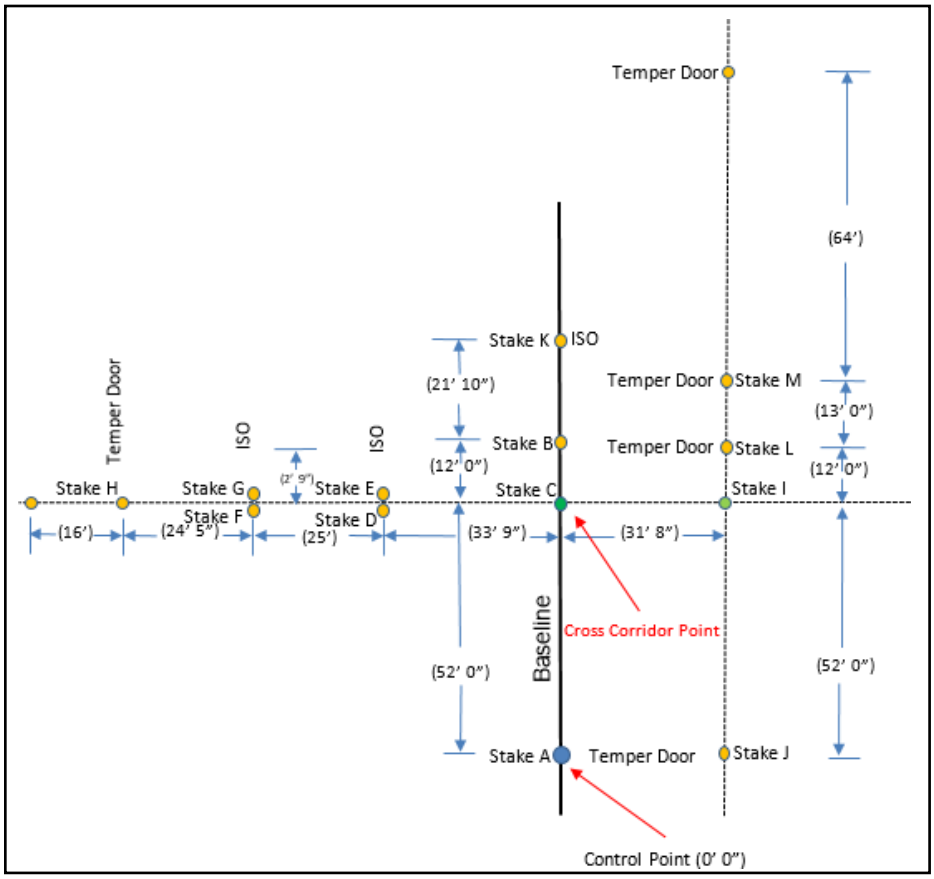

Figure 4-6. Staking plan (TEMPER)

4-16. Cross-Corridor Line.

a. The line at the cross-corridor point is at a right angle to the baseline. There are several ways to establish a right angle in the field. The easiest method requires a 100-foot tape measure and three Soldiers, which is called plotting a right angle (see figure 4-7 on page 4-11) include:

- Measuring and marking (on the baseline) a point 20 ft. to the left of the cross-corridor point.
- Measuring and marking another point 20 ft. to the right of the cross-corridor point.
- Position a Soldier at each point. Have one Soldier hold the "0 ft." mark on the tape measure. Instruct the other Soldier to hold the "100 ft." mark.
- Instruct the third Soldier to grasp the tape measure at the 50 ft. mark. Extend the tape measure out in the direction of the desired line. The tape should be stretched to its full length.
- Mark the point on the ground where the 50 ft. mark is located on the measuring tape. Ensure both ends of the measuring tape form a perfect triangle.
- Have the third Soldier move to the other side of the baseline and repeat the above steps.
- Stretch a length of engineer tape between the two points just marked.

b. The line formed by this length of engineer tape is at a 90-degree angle to the baseline. Extend this cross-corridor line the entire width of the compound. A cross-corridor line may be established at any point on any line using these procedures.

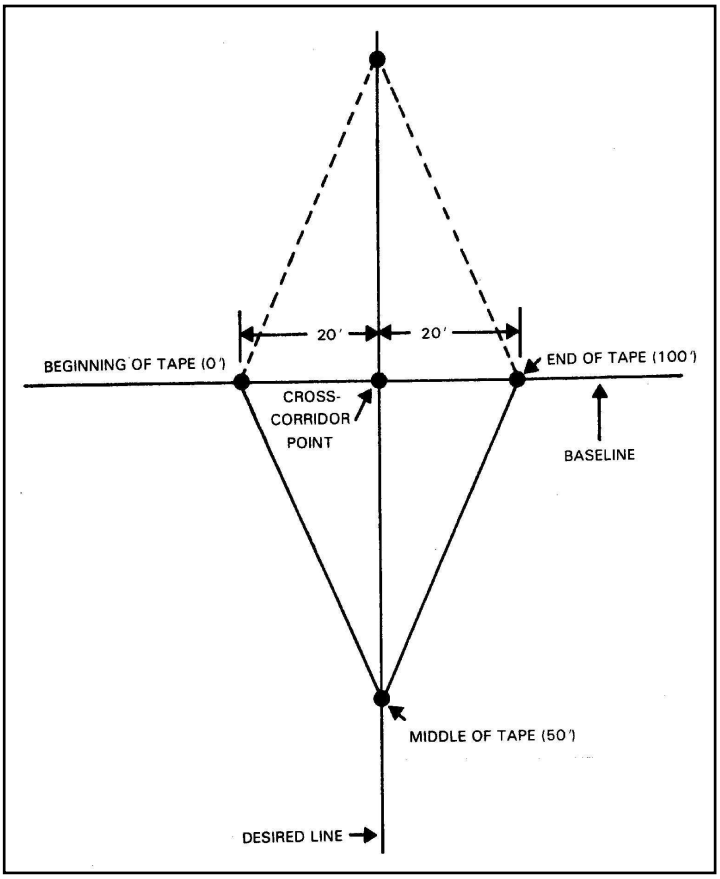

Figure 4-7. Plotting a Right Angle

4-17. The Right Angle Method. This method will require the use of the Pythagorean Theorem (see figure 4-8 on page 4-12). The Pythagorean Theorem deals with the lengths of the sides of a right triangle. The theorem states: the sum of the squares of the lengths of the legs of the right triangle ('a2' and 'b2' in the triangle shown below) is equal to the square of the length of the hypotenuse ('c2').

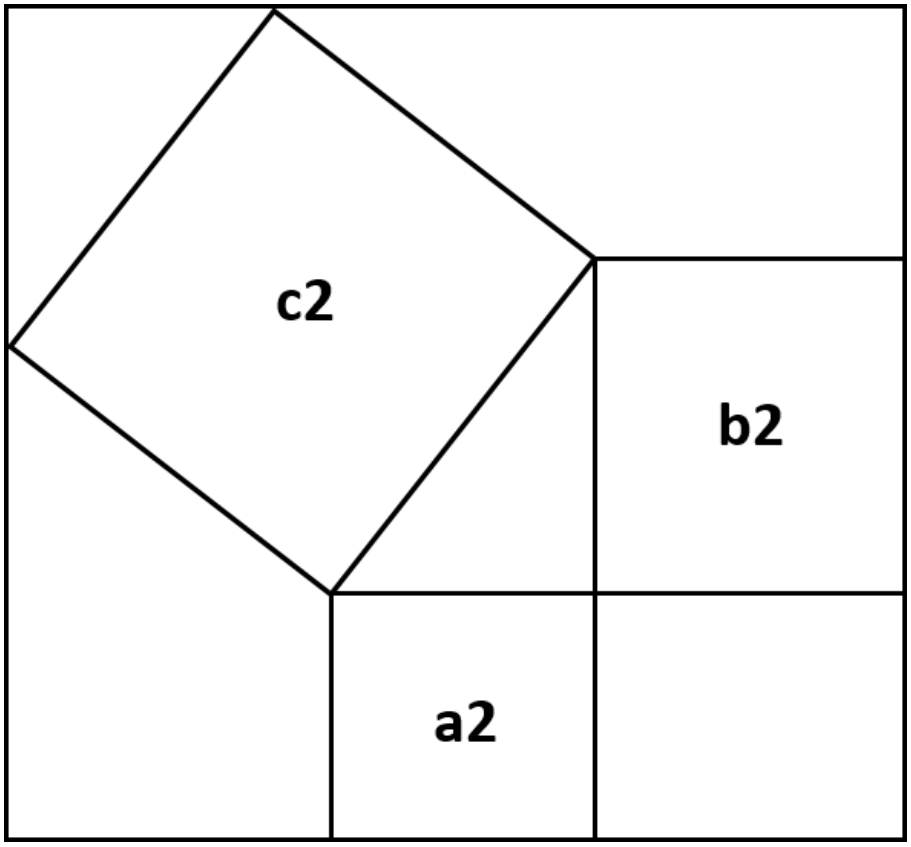

Figure 4-8. Pythagorean Theorem

4-18. Now to mark the right angle. Use the following sequence for establishing a right angle. By using a triangle with sides measuring 3 ft., 4 ft., and 5 ft., which provides a right angle. For example, 3 ft. x 3 ft. = 9 ft. and 4 ft. x 4 ft. = 16 ft. and 5 ft. x 5 ft. = 25 ft., which will give a triangle measuring 9 ft., 16 ft., and 25 ft. See figure 4-9 on page 4-13.

4-19. The baseline will extend through the center of the tent (see figure 4-9 on page 4-13).

Note: Do not attempt to center the tent over the line. Instead, measure and mark the four corners of the tent.

a. Remember, the control point marks the center of the door on the tent end wall. Measure 10 ft. on both sides of the control point (Stake A) and mark those spots. Use the procedures in paragraph 4-12 to ensure the spots are at right angles to the baseline. Refer to the correct dimensions 10 ft., 6 in. per side for Air Supported Shelter staking, figure 4-10 on page 4-14 and the correct dimensions is 10 ft. per side for the Alaska shelter staking, (see figure 4-11 on page 4-15).
b. To mark the corners of all the tents are part of the baseline utilize the Pythagorean Theorem. It is also sometimes referred to as the method 3 - 4 - 5 Right Triangle. Using longer consistent measurements when finding a right angle will leave less room for errors. Here is an example using Right Angle Measuring 9 ft., 16 ft., 25 ft. (see figure 4-9 on page 4-13).

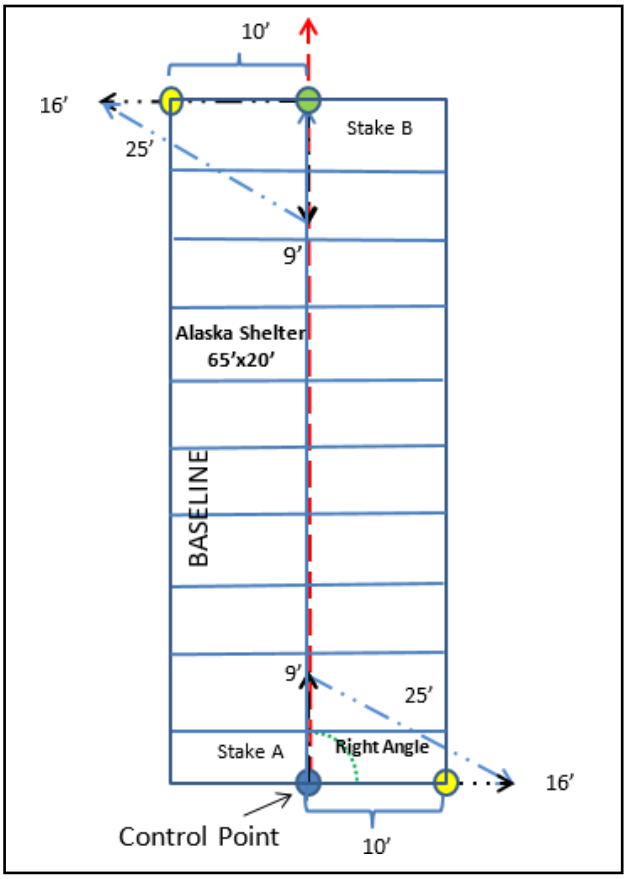

Figure 4-9. Right Angle measuring 9 Ft., 16 Ft., 25 Ft.

4-20. Establishing a Right Angle. Refer to table 4-4 below for the sequence in establishing a right angle for a control point.

Table 4-4. Establishing a Right Angle sequence

Establishing a Right Angle Sequence	
1.	This right angle method requires three measurement tapes and five Soldiers see figure 4-9 above. Position the first Soldier kneeling at the control point. This soldier will hold the "0" mark of two measurement tapes (Tapes #1 and #2).
2.	Instruct the second Soldier with the measurement tape #1 to extend measurement tape along the base line to reach a 9-foot mark.
3.	Instruct the third Soldier with the measurement tape #2 to extend measurement tape out to the 12-foot mark to the right or left of the Soldier kneeling at the control point.
4.	Instruct the fourth Soldier with measurement tape #3 to go to the 9-foot mark. This Soldier with the measurement tape #3 will extend the tape out to a 15-foot mark. The measurement tapes at 15 ft. and 12 ft. need to intersect.
5.	A fifth Soldier will place a lid at the 10-foot mark on the "0" to 12-foot measurement tapeline.

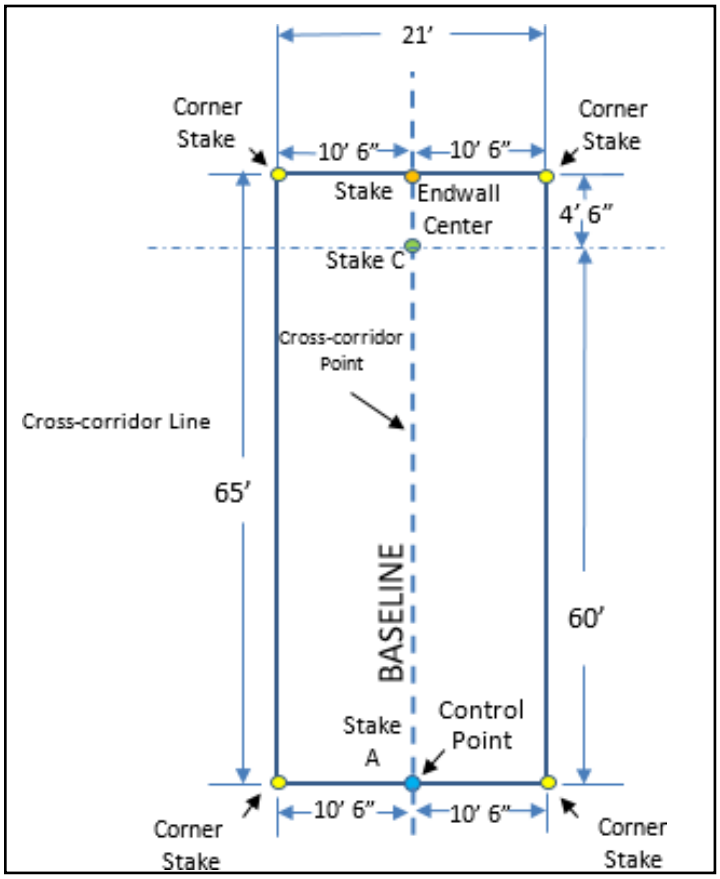

Figure 4-10. Air Supported Shelter staking

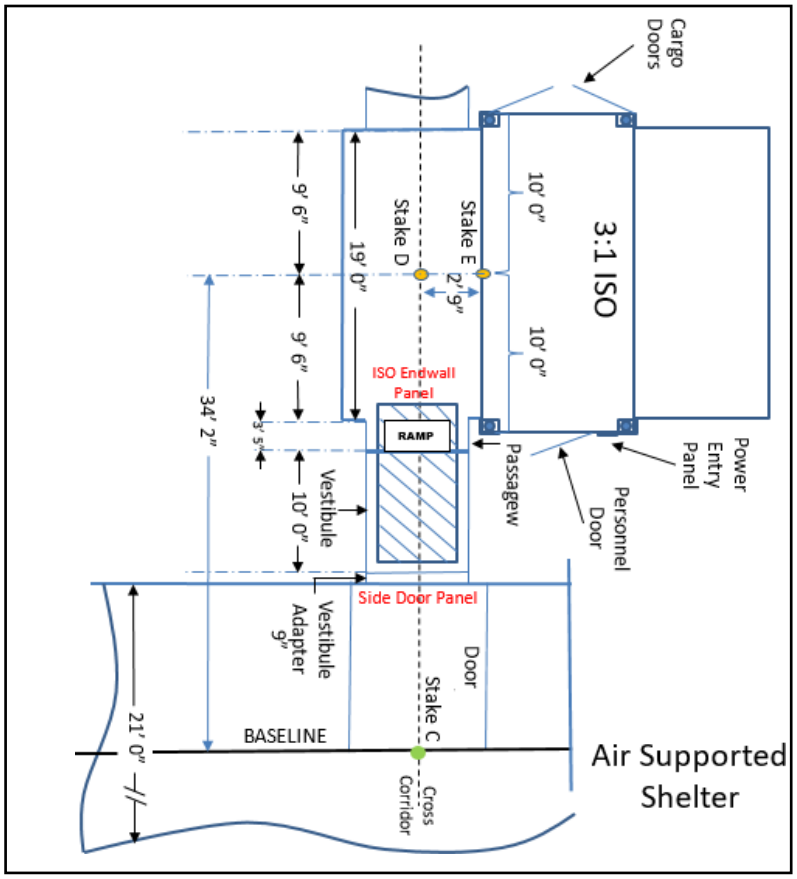

Figure 4-11. Alaska Shelter staking

4-21. Air Supported Shelter and Alaska Shelter End Door Panels to ISO Endwall Closeout Panels. There is an important consideration when placing the ISO shelter once it is moved to the staked site. The ISO will be unexpanded when moved into position. Therefore, ensure the ISO is orientated according to the staked diagram, in order to have the ISO endwall closeout panel on the correct side. On the 3:1 ISO the endwalls are located only on one side. If a soldier faces the container from outside the personnel door, the endwall closeout panel is on the left of the power entry panel. The 3:1 ISO personnel door is oriented towards the base line (see figures 4-12 on page 4-15 and 4-13 on page 4-16) includes:

- The Air Supported Shelter side door panel to ISO 3:1 (pronounced three for one) endwall closeout panel can be seen in figure 4-12 on page 4-16.
- The Alaska Shelter side door panel to ISO 3:1 endwall closeout panel is in figure 4-13 on page 4-17.

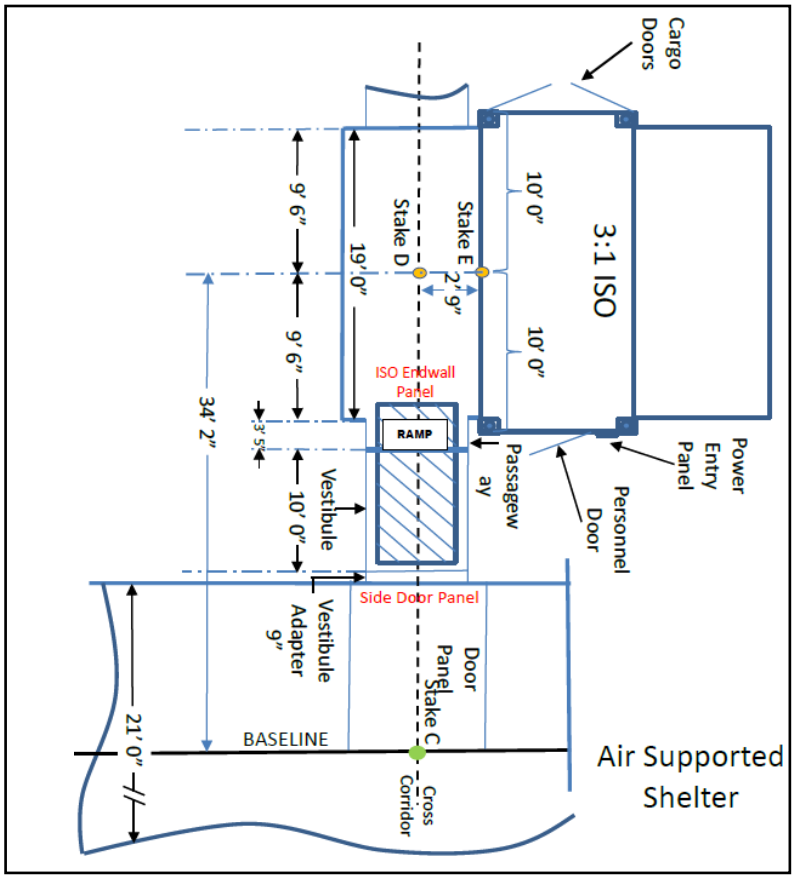

Figure 4-12. Air Supported Shelter side door panel to ISO Endwall closeout panel

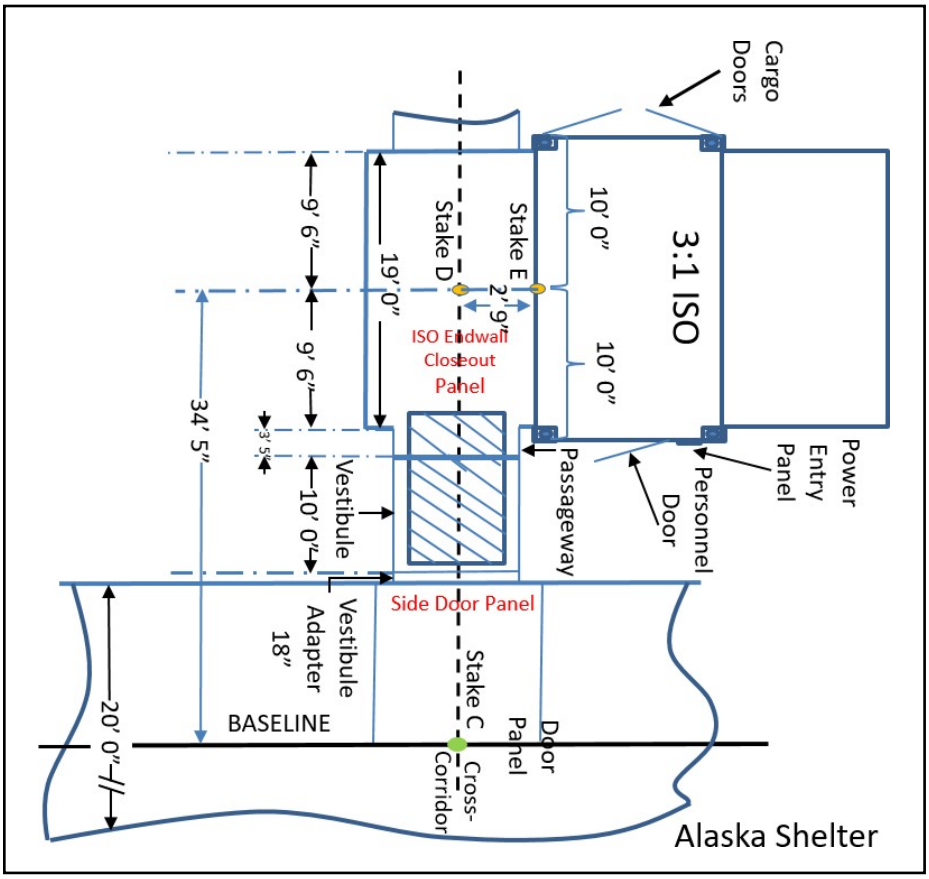

Figure 4-13. Alaska Shelter side door panel to ISO Endwall closeout panel

4-22. Complexing Kits. During the expansion of the ISO, there are steps that must take place while installing the Type I or Type II complexing kit(s). The Complexing Kit Passageway is provided in two models - one model connects an ISO Shelter and a tent, the other model connects two ISO shelters. The purpose of these passageways is to provide an environmentally sealed walkway for personnel and equipment to move from one shelter to another includes:

- Complexing Kit Passageway Type I measurements are 3 ft., 5 in. long, see figure 4-14 on page 4-18.
- It is used to connect ISO to ISO. The ISO to ISO passageway is 6 ft. long.
- It has a ramp that is 8 ft., 2 in. long (see figures 4-12 on page 4-15 and 4-13 above). Reference TM 10-5411-203-13 for installation and maintenance.

4-23. Preparing Complexing Kit Passageway Type I for use (see table 4-5 below).

Table 4-5. Preparing Complexing Kit Passageway Type I

Preparing Complexing Kit Passageway Type I	
1.	Place ramp in ISO in preparation for removal of the closeout panel.*
2.	Remove closeout panel and attach to brackets on outside of the ISO shelter. This step may be done inside or outside of the ISO.
3.	Align frame assembly with weather barriers on outside of shelter.
4.	Angle bottom of frame over lip of ISO shelter opening. This step is done on the inside of the ISO. Hold bottom of frame while another individual raises frame to top of the opening.
5.	Lock frame in place using fasteners.**
6.	Secure weather barriers to ISO shelters.***
Note.* During the first step, check frame and canvas for defects of the complexing kits prior to use. Stop use immediately if any defect is noted that would impair or endanger equipment or personnel. ***Note.*** Above procedures may be done on one ISO or both ISO's simultaneously depending on the number of personnel available. ***Note.**** Point out safety measures prior to securing weather barriers.	

WARNING

During the alignment of the assembly of the weather barriers, keep hands and fingers away from hinged joints.

Figure 4-14. Complexing Kit Passageway Type I

4-24. Preparing Complexing Kit Passageway Type II for Use (see table 4-6 below).

Table 4-6. Preparing Complexing Kit Passageway Type II

Preparing Complexing Kit Passageway Type II	
1.	The Complexing Kit Passageway Type II, dimensions are 6 ft. long, see figure 4-15 on page 4-19. This is utilized to connect ISO to tent. Figure 4-12 on page 4-16 depicts a 3:1 ISO vestibule passageway to tent. The sequence of the installation will be from 3:1 ISO to a passageway complexing kit type II to a tent. Then the next step is to connect the vestibule to the tent. This passageway measures 3 ft., 5 in. It has a metal ramp that measures 11 ft., 2 in., (see figures 4-12 on page 4-15 and 4-13 on page 4-16). Reference TM 10-5411-203-13 for installation and maintenance.
2.	Place ramp inside tent.
3.	Remove closeout panel and attach to brackets on outside of shelter.*
4.	Align frame assembly with ISO opening with weather barrier on top.**
5.	Angle bottom of frame over lip of ISO opening.
6.	One individual holds the bottom of the frame, while another raises frame to top of opening.
7.	Lock the frame in place using fasteners.
8.	Locate and assemble exterior frame assembly for passageway and lay to side out of the way.
9.	Figure 4-15 on page 4-19, depicts a 3:1 ISO vestibule passageway. The sequence of the installation will be from 3:1 ISO to a passageway complexing kit type I to the vestibule. Then the next step is to connect the vestibule to the tent. This passageway measures 3 ft., 5 in. It has a metal ramp that measures 11 ft., 2 in., (see figures 4-14 on page 4-17 on page 4-18).
10.	The ISO to ISO passageway is 6 ft. long. It has a ramp that is 8 ft., 2 in. long, (see figures 4-14 on page 4-17 and 4-15 on page 4-18).
Note.* Step 3 may be done inside or outside of ISO. ***Note.*** Step 4 is done inside the shelter. ***Note.**** Steps 9 and 10 are for the connection of the tent flap to the passageway only. If a vestibule is to be used, it should have been attached prior to the tent flap and frame assembly.	

Figure 4-15. Complexing Kit Type II

4-25. Vestibules. Vestibules are issued with each tent, reference TM 10-8340-244-13&P for installation and maintenance. The same vestibules are issued for the Air Supported Shelter and Alaska Shelter tents. The vestibule is 10 ft. long and is designed to connect two tents. The by utilizing the vestibule it provides a passageway or hallway between the tents (see figure 4-16 on page 4-20). Due to the length of the ramp, it is strongly recommend to use a vestibule with the passageway, when connecting an ISO to the tent. If not, the ramp will extend 6 ft., 11 in. into the tent itself. This could present some safety hazards, especially if an ISO is connected to the other side of the tent. It also reduces the amount of floor space utilized.

Figure 4-16. Vestibule

4-26. Erecting Vestibule. The Air-Supported shelter is provided with a standard tent vestibule. These vestibule erection steps detail installation of the vestibule frames, floor section, vestibule door and guy lines. The vestibule erection requires four of the sixteen tent pins provided in the vestibule kit. The remaining tent pins are used later in this work package. For best results, connect each vestibule frame together outside of the vestibule, then move them inside vestibule to place them properly in the vestibule.

WARNING

Sharp edges or burrs may be present on vestibule frame components. Exercise care when handling vestibule frame components. Failure to do so may result in injury to personnel or damage to equipment.

4-27. The following are the steps to erect a vestibule (see table 4-7 below).

Table 4-7. Erecting a vestibule

Erecting a Vestibule
1. Locate assembled vestibule frame or assemble one vestibule frame.
2. Locate exterior frame and place the header bar over the passageway top.
3. Fasten all straps to header bar; adjust accordingly.
4. Tilt frame legs TOWARD the tent.
5. Locate the vestibule frame and insert the spindles through both the tent flap and passageway grommets and pins.*
6. Tilt the vestibule frame legs toward the tent.**
7. Commence the becket lacing from the top center of passageway using the same procedure as the vestibule.
8. Raise and stand the vestibule poles upright.
9. Becket lace/hook and loop fasteners both sides.
10. Install both exterior frame legs to ISO.
11. Secure weather barrier to the ISO.
Note.* . There are three flaps on the passageway to choose from in order to assure a tight fit. ***Note.*** If vestibule is attached, instead of using tent flap, the procedure is the same.

4-28. Vestibule Adapters Each tent door has a flap around it called a Vestibule Adapter. Vestibule Adapters are short a section of material that is located on the tent End and tent Sides. The vestibule is the connector tentage of the tents. It is made of the same material as the tent and is connected using the method of becket

lacing to connect and secure. The vestibule adapter is attached to the sidewall or endwall of the tents. The only difference between the endwall door adapter and the sidewall adapter are the lengths are as follows:

- Air Supported Shelter vestibule endwall adapter is 1 ft. 6 in. or 18 in.
- The Air Supported Shelter sidewall vestibule adapter measures at 9 in.
- Alaska Shelter vestibule adapter endwall and sidewall adapter is 1 ft. 6 in. or 18 in.

4-29. Becket Lacing Locations (see table 4-8 below).

Table 4-8. Becket Lacing locations

Becket Lacing Locations
1. Becket lacing locations, (figure 4-17 below), is used to connect tent canvas to a vestibule or vestibule to complexing kit passageway Type I or Type II.
2. Becket Lacing Method sequence is the following: **a.** From the outside, lace the vestibule end panel into the end of the vestibule from the peak to the bottom of each side, using the becket lacing method (see figure 4-18 below) as follows: **b.** Identify the first becket lace #1 and becket grommet #2 near the ridge. **c.** Insert first becket lace #1 through the first becket grommet #2 and the second becket #3 through the second becket grommet #4. **d.** Insert second becket lace #4 through the loop of the first becket lace #3. **e.** Pull second becket lace away from the ridge. **f.** Insert third becket lace through grommet and through the loop of the second lace. **g.** Pull third becket lace tight away from ridge.
3. Repeat Steps a. through g. to becket lace the opposite side of the vestibule end section.

Figure 4-17. Becket Lacing locations

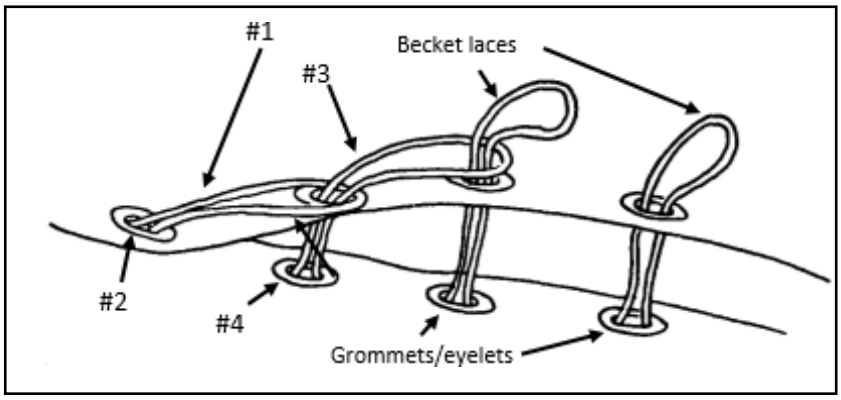

Figure 4-18. Becket Lacing method

4-30. Becket Lacing tie off procedure (see table 4-9 below).

Table 4-9. Becket Lacing tie off procedure

Becket Lacing Tie Off Procedure	
1.	Upon reaching the last becket lace at the eave, insert-next-to-last becket through the loop of the last becket lace.
2.	Pull the next-to-last becket lace back towards the ridge and tie off with half-hitch knot.
3.	Continue this procedure until the lacing reaches the end of the side vestibule adapter section. As the lacing progresses, close the hook and loop fasteners on the vestibule panel over the becket lacing.
4.	Upon reaching the last becket lace on the end panel at the bottom of the vestibule, thread the last becket lace, (see figure 4-19 below), through the last vestibule grommet tying around the second to last becket lace.

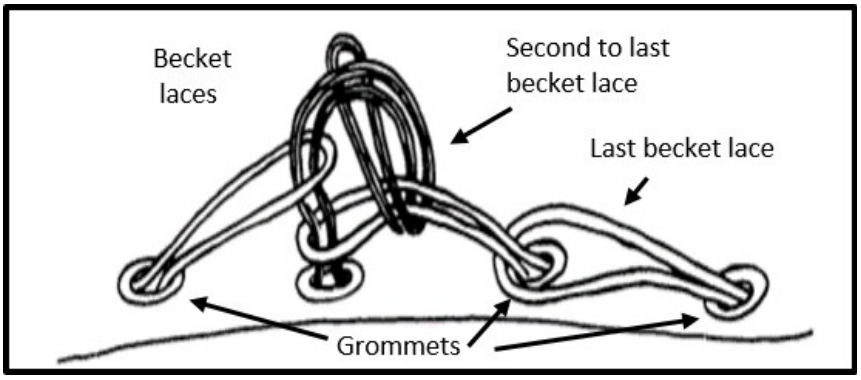

Figure 4-19. Becket Lacing tie off procedure

4-31. Offsetting the ISO Container, 2 ft., 9 in. requires the following:

- The definition of offset is to properly stage the ISO container using a dolly, load handling system or RTCH to place the ISO container on the ground. The ISO container will be placed at 2 ft., 9 in. away from the cross-corridor line towards the area where the ISO container will be placed. This is done to allow the center of the expanded side door to be centered on the cross-corridor staked line. See the example of offsetting ISO container, 2 ft., 9 in. (see figure 4-20 on page 4- 23).
- Prior to expanding the ISO container, it is important to ensure the measurement of the ISO expansion side is offset (2 ft., 9 in.).

Note. Incorrect placement of ISO container will affect set-up time, immensely, by several hours. As the Dolly, Load Handing System or RTCH are now disconnected and moved away from the set up area.

- The expanded side of an ISO container measures 6 ft., 11 in. The ISO container may look incorrectly placed at the offset, which is 2 ft., 9 in. from the cross corridor staked line, however, it is correctly placed. It is critical in the expansion of the ISO container to have the passageway and vestibule aligned on the cross corridor/baseline correctly.
- If this is not done, the endwall closeout panels on the ISO will not line up correctly. Then measure 10 ft. to the left and right to mark the ISO corners. If the marks are straight, both should measure 2 ft., 9 in. from the cross-corridor line. Then ensure right angles are established at 2 ft. 9 in. to place the container to the line.
- Measure the 2 ft., 9 in. on the cross-corridor line and mark the spot (stake E) is perpendicular from (stake D). From there, mark the corners of the ISO. Measure 10 ft. to the left and right as you face the cross corridor, and mark both spots. If the corners are straight, they should each measure 2 ft., 9 in. from the cross corridor. If not, adjust the corner marks as needed. The center

of the ISO (stake E) should be perpendicular 34 ft. 5 in. from the cross corridor, the same distance as (stake D) from the cross corridor. See the example of offsetting ISO container, 2 ft., 9 in. in figure 4-20 below.

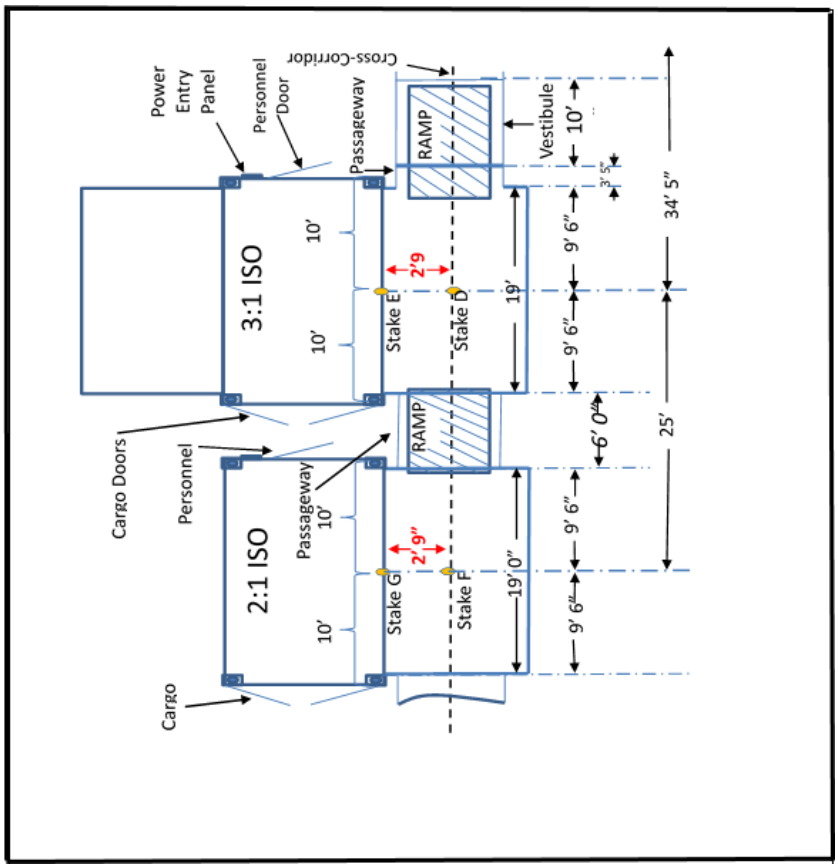

Figure 4-20. Offsetting ISO container, 2 ft., 9 in

4-32. ISO 3:1 Endwall Closeout Panel to ISO 2:1 Endwall Closeout Panel. Figure 4-21, on page 4-24 depicts an ISO 3:1 Endwall Closeout Panel to ISO 2:1 Endwall Closeout Panel.

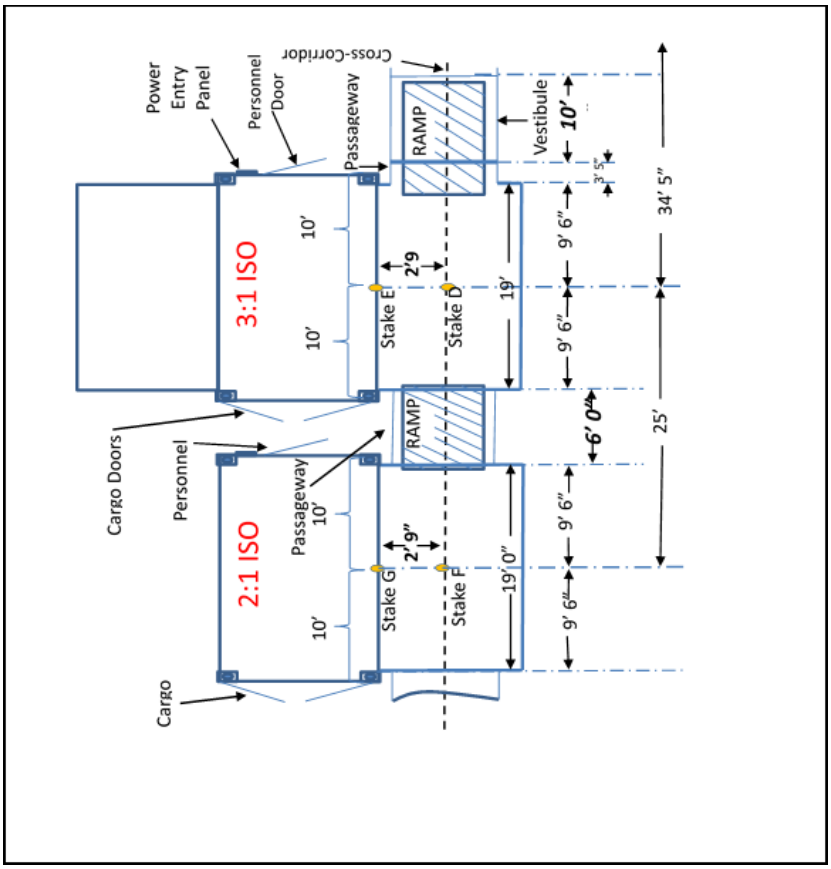

Figure 4-21. ISO 3:1 Endwall closeout panel to ISO 2-1 closeout panel

4-33. ISO 2-1 End Closeout Panel to Air Supported Shelter 21 by 23 Ft. Endwall Door. The next figure 4-22, on page 4-25, depicts an illustration of an ISO 2-1 End closeout panel to the Air Supported Shelter 21 ft. by 23 ft. endwall door.

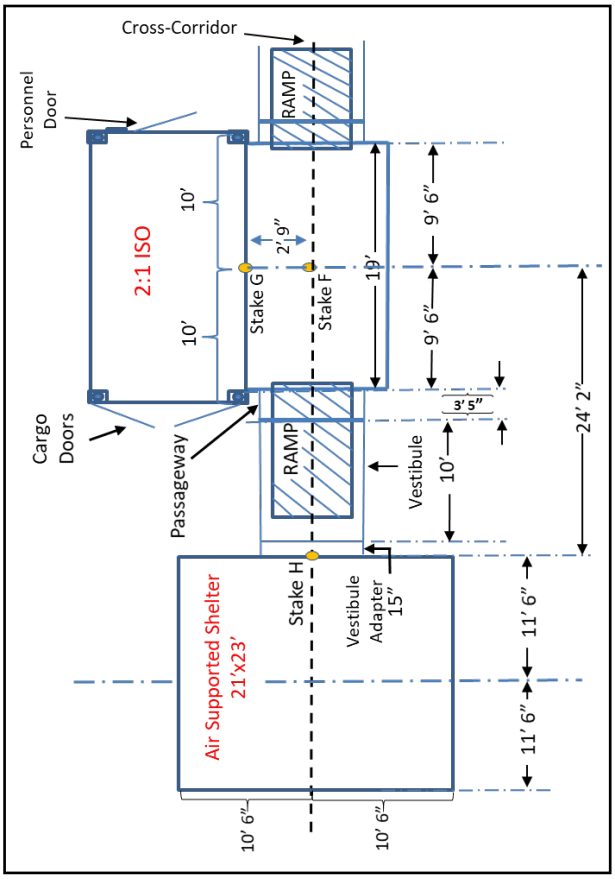

Figure 4-22. ISO 2-1 End closeout panel to Air Supported Shelter 21 ft. by 23 ft. endwall door

4-34. ISO Side Closeout Panel to Alaska Shelter Endwall Door. The next figure 4-23, on page 4-26, depicts an ISO 3-1 side panel to an Air Supported Shelter 65 ft. by 21 ft. endwall door.

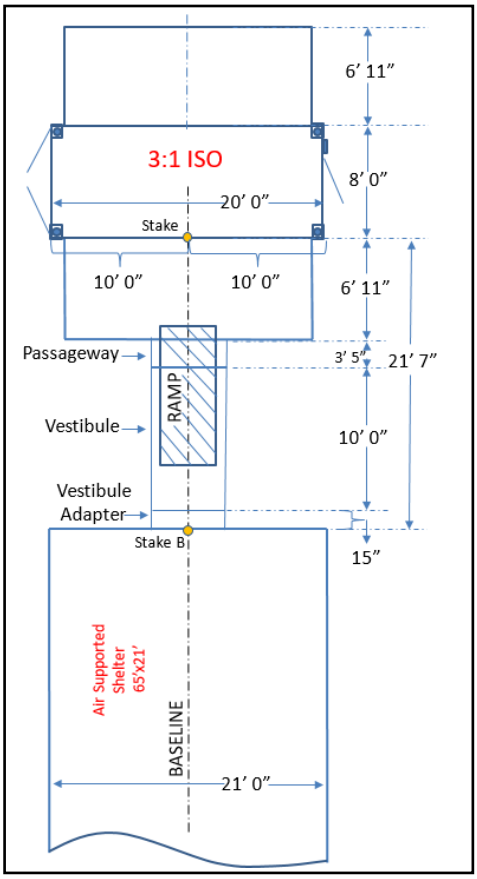

Figure 4-23. ISO 3:1 Side Panel to an Air Supported Shelter 65 ft. by 21 ft. endwall door

4-35. ISO 2:1 End Door Closeout Panel to Alaska Shelter 20 Ft. by 20 Ft., 5 in. Endwall Door. The next figure 4-24 on page 4-27 depicts an example of an ISO 2-1 end door closeout panel to an Alaska Shelter 20 ft. by 20ft., 5 in. Endwall Door.

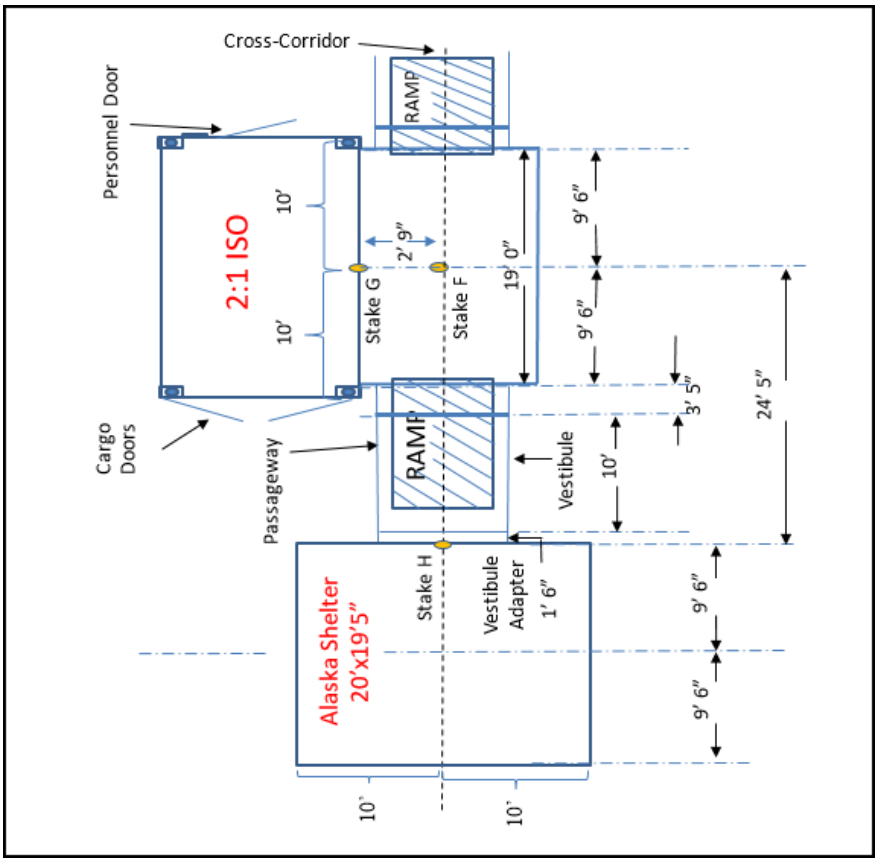

Figure 4-24. ISO 2:1 End Door closeout panel to Alaska Shelter 20 ft. by 20 ft., 5 In. endwall door

4-36. ISO 3:1 Side Closeout Panel to Alaska Shelter 65 Ft. by 20 ft. Endwall Door. The next figure 4-25 on page 4-28 depicts an example of an ISO 3:1 Side Closeout Panel to Alaska Shelter 65 ft. by 20 ft. Endwall Door.

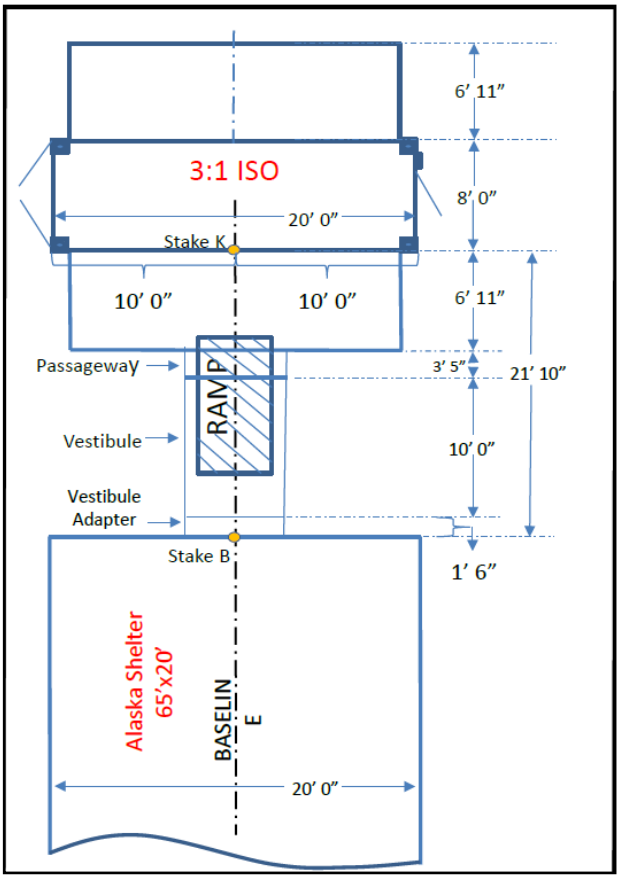

Figure 4-25. ISO 3:1 Side closeout panel to Alaska Shelter 65 Ft. by 20 ft. endwall door

4-37. Air Supported Shelter 65 Ft. by 21 Ft. Side Door Panel to Air Supported Shelter 65 Ft. by 21 Ft. Side Door Panel. The next figure 4-26 on page 4-29 depicts an example for an Air Supported Shelter 65 ft. by 21 ft. side door panel to Air Supported Shelter 65 ft. by 21 ft. side door panel.

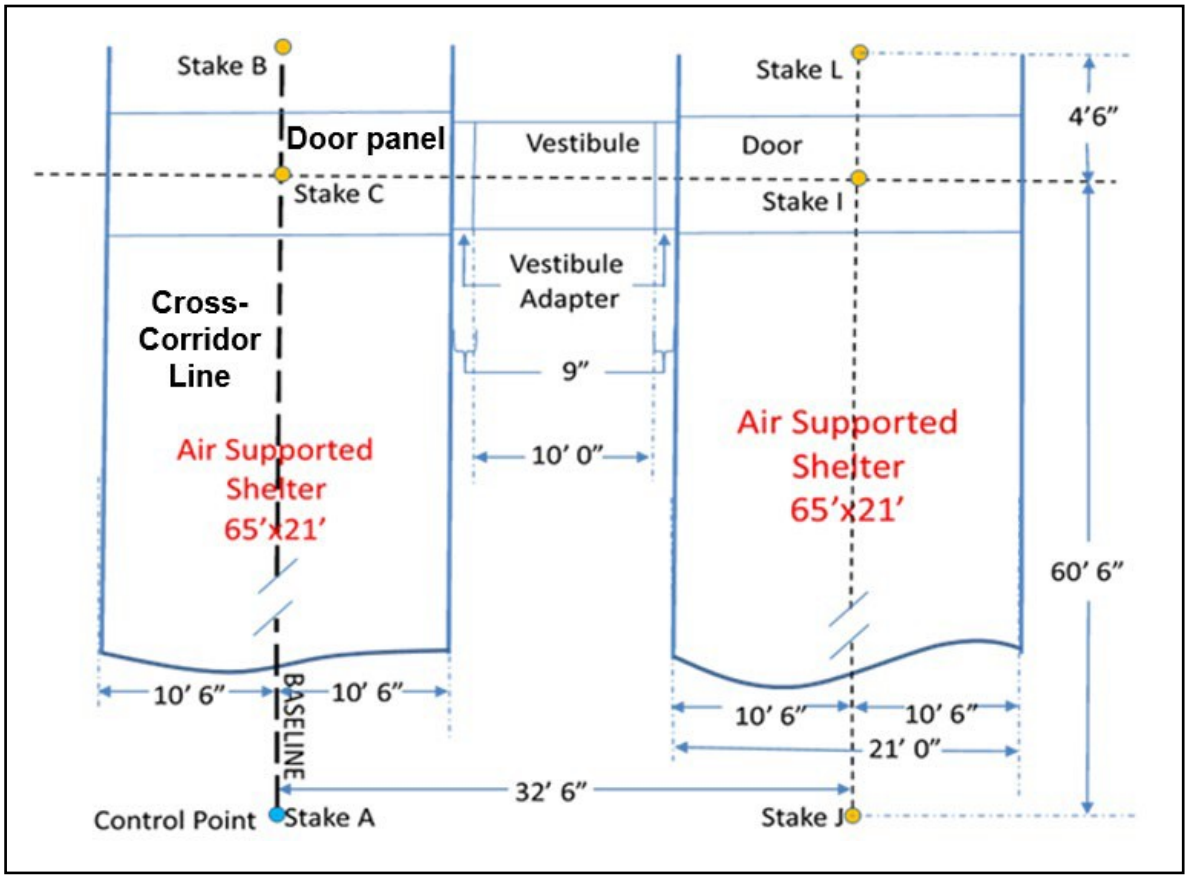

Figure 4-26. Air Supported Shelter 65 Ft. by 21 ft. Side door panel to Air Supported Shelter 65 ft. by 21 ft. side door panel

4-38. Alaska Shelter 65 Ft. by 20 Ft. Side Door Panel to Alaska Shelter 65 Ft. by 20 Ft. Side Door Panel. The next figure 4-27 on page 4-30 depicts an ISO 3:1 Side Closeout Panel to Alaska Shelter 65 ft. by 20ft. Endwall Door.

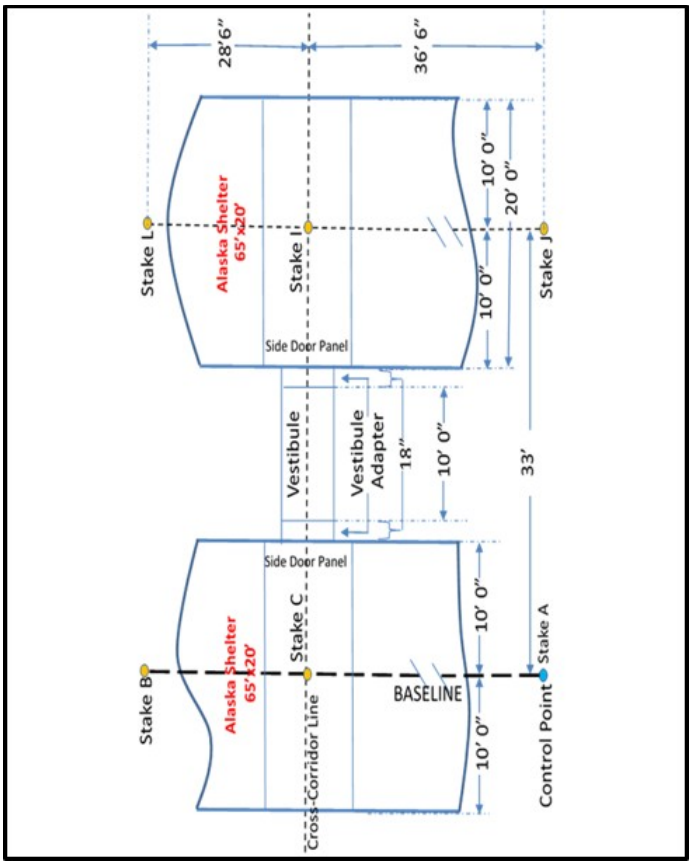

Figure 4-27. Alaska Shelter 65 ft. by 20 ft. side door panel to Alaska Shelter 65 Ft. by 20 ft. side door panel

4-39. Air Supported Shelter 65 Ft. by 21 Ft. Endwall Door to Air Supported Shelter 65 Ft. by 21 Ft. Endwall Door. The next figure 4-28 on page 4-31 illustrates the Air Supported Shelter Endwall Door 65 ft. by 21 ft.to an Air Supported Shelter 65 ft. by 21 ft. Endwall Door.

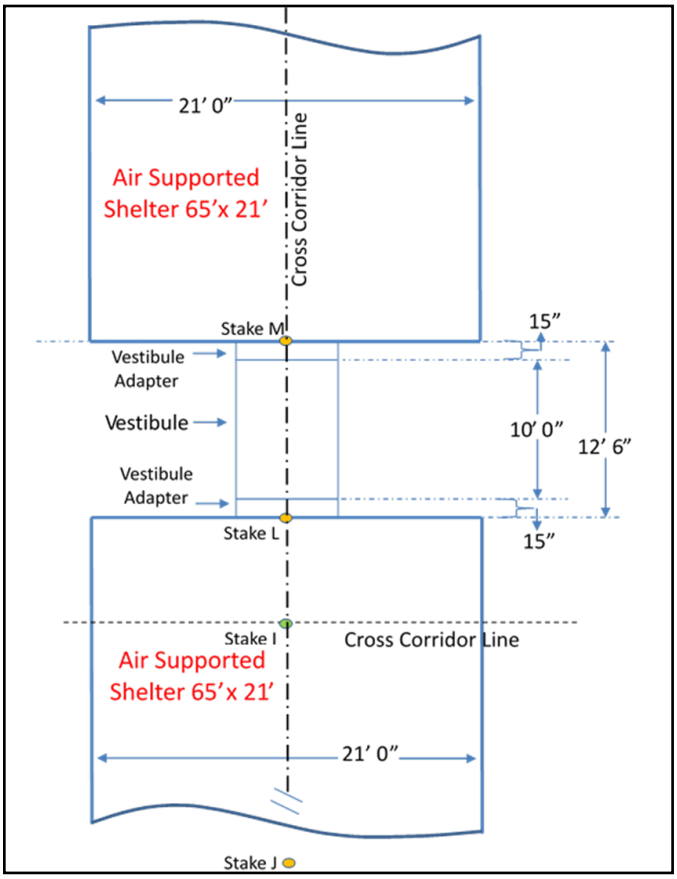

Figure 4-28. Air Supported Shelter endwall door 65 ft. by 21 ft. to an Air Supported Shelter 65 ft. by 21 ft. endwall door

4-40. Alaska Shelter 65 Ft. by 20 Ft. Endwall Door to Alaska Shelter 65 Ft. by 20 Ft. Endwall Door. The next figure 4-29 on page 4-32 shows the Alaska Shelter 65 ft. by 20 ft. Endwall Door to Alaska Shelter 65 ft. by 20 ft. Endwall Door.

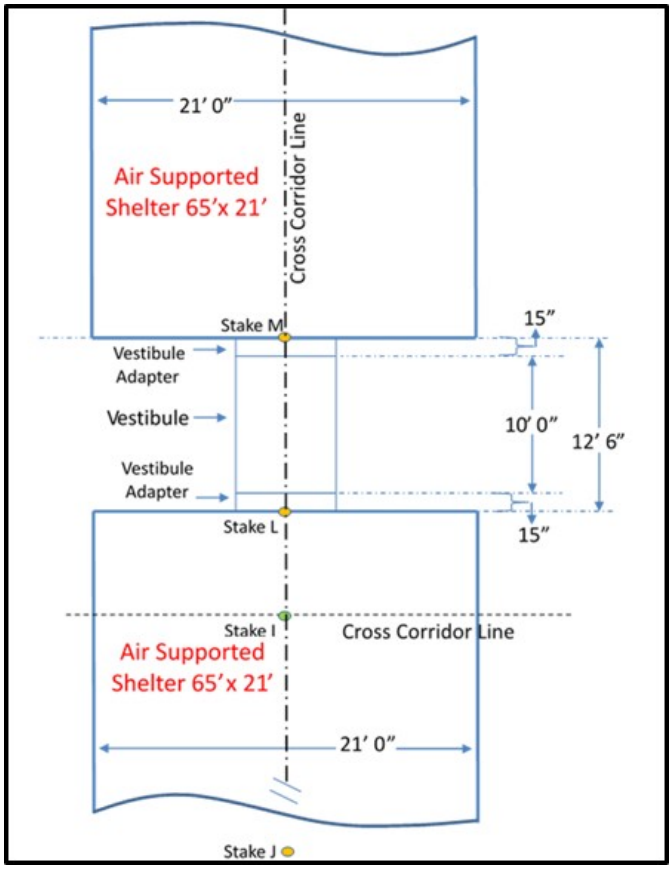

Figure 4-29. Alaska Shelter 65 ft. by 20 ft. endwall door to Alaska Shelter 65 ft. by 20 ft. endwall door

4-41. AutoDISE Software System Capabilities. As part of the preparation for set up of the hospital, the S-3and/or chief ward master need access and training on AutoDISE system:

- AutoDISE is a computer model that can be developed to simulate the use of DISE or PDISE. It also has the capability to develop a water & waste water and power distribution equipment layouts. The program is able to show CSH/hospital layouts to scale.
- The staking layout and complexing of the hospital, (see figure 4-30 on page 33) is seen with correct distances on a diagram along with providing an aerial topographical/photographic representation of the site to reduce the amount of guesswork involved when setting up the hospital. In addition, AutoDISE provides a layer of functionality for assisting in design of information technology capabilities using Non-classified Internet Router Network, Secure Internet Protocol Router Network and other hospital communications.
- AutoDISE has capabilities for equipment inventories, phase balancing, automatic connection of power distribution and power consuming items. Additional, AutoDISE can depict shelter layouts, system analysis, as well as user defined power distribution systems and loads.
  - AutoDISE also provides a unique tool for facilities layout designers called the HVAC Requirements Calculator.
  - It is designed to simplify the process of determining the heating or cooling requirements for a shelter by providing an easy-to-use module for calculating various needs involved in the process.
- This program is recommended when preparing for exercises and deployments of the CSH/hospital. End user training is available and detailed tutorials are included after download code is authorized. AutoDISE uses updates to keep system software current. Layouts can be

saved and sent as joint photographic experts groups or graphic interchange format without worry of reconfiguring design. This program should be utilized as a virtual sand table and keeps us ahead of the digital age in the future. Pictures used in this TC come from AutoDISE and although other diagrams have been used in the past, none can represent the hospital layout to scale to include placing it on a map like AutoDISE.

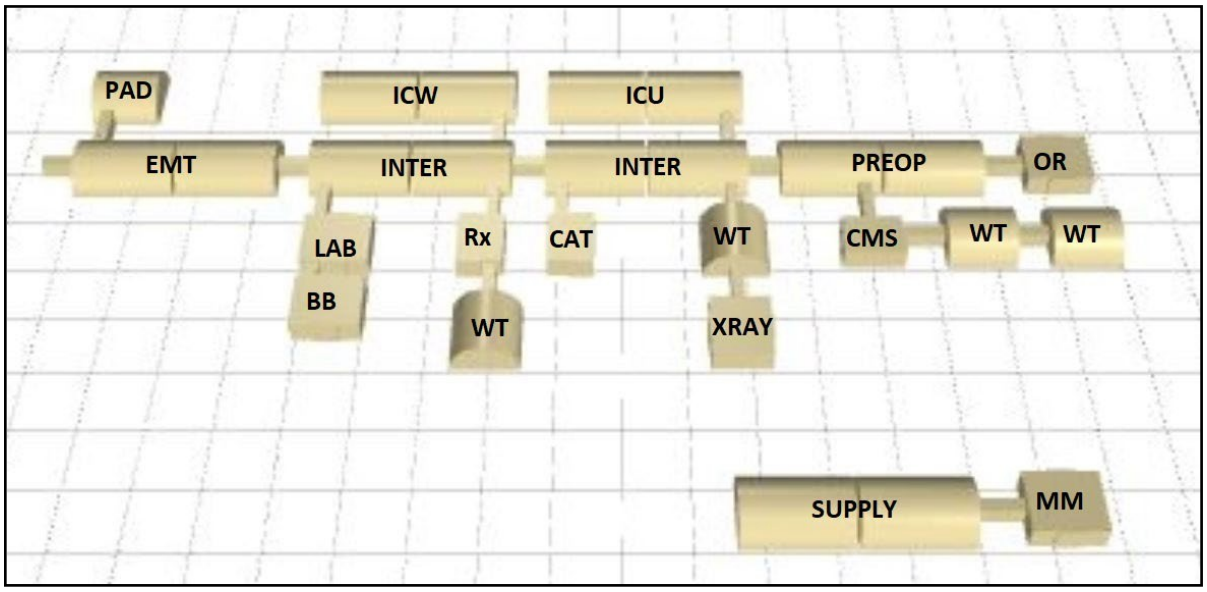

Figure 4-30. Field Hospital (32 bed) AutoDISE layout

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Chapter 5

Water Distribution and Wastewater Management System

5-1. Water is essential to the medical care, feeding, and laundry services provided in the hospital. Several factors dictate water consumption requirements and are mostly predictable, including water requirements for waste management. Water distribution and wastewater removal are additional parts of the planning and staking of the hospital modules and effectively laying out the pumps and hoses requires training and practice. Finally, medical and field waste are significant considerations for hospital operations.

SECTION I – FIELD DISTRIBUTION AND CONSUMPTION

5-2. Sufficient potable water is essential for effective health care operations and quality patient care. Subsequently, the efficient removal and disposal of liquid and solid waste reduces the potential for disease transmission.

CURRENT DOCTRINE

5-3. Current doctrine calls for bulk delivery of potable water by quartermaster units. Users are responsible for storage and distribution. The inventory of water storage containers provides an adequate storage capacity. However, the fielding revealed short falls in internal water distribution. The Belvoir Research, Development, and Engineering Center has developed a pressurized water distribution system using standard quartermaster equipment. The new deployable medical systems Water Distribution System is discussed in Section II.

5-4. Field expedient procedures for wastewater and solid waste disposal are described in Training Circular 4-02.3, Field Hygiene and Sanitation. Large waste generators, such as hospitals, may require engineer support to construct waste disposal facilities. Waste collection and disposal, however, remain a unit responsibility.

POLICIES AND PROCEDURES

5-5. Doctrine, technology, and procedures for water distribution and waste disposal are under continual review. Hospitals rely on current doctrine and procedures as described in this chapter. Changes to this manual will be published as new concepts and systems are developed.

FIELD WATER DISTRIBUTION SYSTEMS

5-6. Field water distribution systems are less sophisticated than municipal or garrison systems. Since they are not closed systems, purified water is subject to recontamination by careless handling or unclean equipment. Garrison and municipal systems satisfy all community needs. A field water distribution system provides potable water for drinking, cooking, and personal hygiene as well as hospital functions. A field water distribution system may consist of any combination of the following:

a. Water points. A water point is a site at which potable water is produced and made available for unit pickup. The development of a water point is the responsibility of the Corps of Engineers. Water production, purification, and distribution are quartermaster responsibilities.
b. Dry points. Dry points are established for distributing treated water. They allow the installation of treatment equipment at the best water source even though it may be some distance from consumers. The water is trucked from the treatment point to dry points, where distribution facilities are more conveniently located. A single water point can serve several dry points, especially when the bulk of the water goes to a few large consumers, such as hospitals.
c. Pipelines and pumps. Field pipelines may be used to carry water over terrain that is inaccessible to trucks. However, pipelines are not generally used in the field because of cost, construction

time, equipment availability, and adaptability to terrain. The Tactical Water Distribution System, a field pipeline, is available but will normally be used only in arid environments where water sources are limited.

d. Tank Trucks and Trailers. Most TOE hospitals are equipped with 400-gallon water trailers towed by 2 1/2-ton cargo trucks. Some hospitals will be equipped with 5-ton trucks and the Forward Area Water Point Supply System.

e. Storage Containers. The storage containers are authorized in the field are the following:

- Storage tanks. Units are currently authorized collapsible fabric water storage tanks ("stave" tanks) with capacities of 500, 1,500, and 3,000 gallons. The number of tanks depends on the size of the unit and its storage requirements. The new 3,000-gallon collapsible fabric "onion" tank will replace the "stave" tank. The onion tank is discussed in paragraph 5-23b. See Appendix A for planning considerations.

5-7. Table 5-1 below has the estimated daily water requirements for hospital units.

Table 5-1. Estimated daily water requirements

Estimated Daily Water Requirements
i. Daily laundry water requirements for patient care items and direct patient care staff are listed separately. These do not include routine laundry requirements common to all Soldiers. Quartermaster laundry units in support of hospitals are normally collocated with a water supply point or source. Therefore, programming organic storage for laundry water requirements is neither practical nor necessary.
ii. The recently developed 160-gallon lightweight collapsible pillow tank (LCPT) (LIN: Z77981) provides additional internal storage and distribution flexibility. Availability and distribution of the LCPT is being evaluated.
iii. The 1,000-gallon tank truck (LIN: 58367) is being replaced by the FAWPSS. This will enable the hospital to pick up and deliver at least part of its requirements if quartermaster delivery is interrupted. The FAWPSS includes six 500-gallon collapsible drums and the Basis of Issue Plan calls for an additional 5-ton drop-side truck. This added capability more than replaces the tank trucks.
iv. Refinement of water usage and storage requirements will continue as hospitals are fielded and tested. The pressurized distribution system may also impact on total storage requirements.

- Lyster Bags. Each unit is equipped with 36-gallon lyster bags. These bags are issued on the basis of one per 100 personnel. They provide a means of purifying and storing water in the unit area. They are used primarily for filling individual canteens.
- Water Cans. All Army units are issued 5-gallon water cans. These are used by individual sections to carry and store water used in accomplishing their missions.
- Canteens. The 1-quart canteen is a basic item of issue to all Army personnel.

5-8. Water Consumption Planning Factors. Potable water usage and storage requirements for hospitals have been reevaluated. This is in light of replacement storage tanks and revised quartermaster water planning factors. This paragraph provides the consumption planning factors used to estimate daily water requirements for various hospitals. Hospital water consumption is related to the number and types of casualties treated.

5-9. Refer to table 5-2 below for Climate/Environmental Regions.

Table 5-2. Climate/Environmental regions

	Climate/Environmental Regions
i.	Hot (tropical and arid) Areas of the world with a mean daily temperature higher than 80°F (27°C).
ii.	Water requirements in the hot, arid regions and hot, tropical regions are essentially the same; both will be referred to as hot.
iii.	Non-potable water is plentiful in most tropical areas. It can be used untreated for some purposes or with limited treatment for others. Limited local water sources can be anticipated in the hot, arid regions. This requires extensive water supply and transportation systems.
iv.	Temperate. Areas of the world with a mean daily temperature ranging from 32°F (0°C) to 80°F (27°C).
v.	Cold (arctic). Areas of the world with a mean daily temperature of less than 32°F (0°C). These regions generally correspond to seasonally frozen lands which do not support forest vegetation.
	Types of Water
i.	Potable water. Water which is sufficiently pure in mineral content and free of microbiological contamination to be suitable for drinking or other consumption without producing adverse health effects.
ii.	Treated water. Non potable water which has been disinfected or otherwise processed to remove undesirable contaminants to make it safe for showers or other non-consumptive uses.

5-10. Refer to table 5-3 below for common water requirements.

Table 5-3. Estimated common daily requirements

	Drinking Water
i.	This function includes all of the water and water-based fluids consumed to satisfy the body's needs. This water must be potable. The amount of water required by the human body is related to climate, intensity of work, and type of battlefield. Since the body's water reserve is small, individual effectiveness requires water replacement keep pace with water losses.
ii.	The quality standards for potable water are stipulated by Technical Bulletin Medical (TB MED) 577, Sanitary Control and Surveillance of Field Water Supplies. These standards are generally set as the maximum allowable concentrations of chemical elements and compounds, chemical agents, and radiation, and the relative absence of pathogenic microbiological organisms.
iii.	The consumption factors, in gallons, per person, per day are as follows:

	Climate/Environment		
Battlefield	**Hot**	**Temperate**	**Cold**
Conventional	3.0	1.5	2.0
Integrated	4.5	2.0	2.0

5-11. Personal Hygiene. This function includes the water used for shaving, brushing teeth, handwashing, and sponge baths. This water must also be potable. The consumption factor for personal hygiene is 1.7 gallons per person, per day.

5-12. Centralized Hygiene. This function includes the water for showers which are taken in conjunction with clothing exchange. Potability is not mandatory; however, in some areas, the quality of the water will be such that the medical authorities may determine the need for limited water treatment. From a health maintenance perspective, The Surgeon General recommends at least one shower a week regardless of location, season, or levels of combat activity. Nonmedical factors such as troop morale, appearance, and acceptability by fellow Soldiers may also justify showers at least once a week. Patient care personnel may require daily showers. As such, this requirement is included in paragraph 5-16. The consumption factor for centralized hygiene is 1.8 gallons per person, per day based on weekly showers.

5-13. Food Preparation. Potable water is required for food preparation, sanitation of kitchen facilities and utensils, and cleaning of individual mess equipment. Potable water requirements are significantly reduced by the use of disposable eating utensils with B or T Ration meals or the use of the Individual Field Ration (IFR). The water consumption planning factors for food preparation are listed in table 5-4 below.

Table 5-4. Food preparation water consumption factors

	Type of Meals		
Gallons Of Water Per Person Per Day	IFR	T or B Rations W/Mess Kit	T or B Rations W/Disposables
0.75	3	—	—
1.00	2	—	1
1.25	1	—	2
1.50	—	—	3
1.75	2	1	—
2.75	1	2	—
3.75	—	3	—

5-14. Laundry.

a. This function is conducted weekly, corresponding with clothing exchange and showers. As discussed here, laundry includes only the field uniform.
b. Potable water is not required for laundry; however, it may require some treatment for the removal of foreign matter and/or microorganisms. Medical authorities may require disinfection in some areas.
c. The consumption factor for laundry is 2.1 gallons per person, per day.

5-15. Hospital laundry (smocks, sheet, etc.).

a. Bed patients—(ICU and ICW beds occupied) x 22.0 gal./day = x gal./day.
b. Ambulatory patients—(MCW beds occupied) x 10.0 gal/day = x gal/day.
c. Staff—(unit strength) x 9.4 gal/day = x gal/day.

5-16. Hospital Water Requirements. This paragraph includes water requirements which are specific to hospitals. Recommend only potable water be used due to the increased susceptibility of patients to infection. This will also avoid the confusion of a dual water system. Hospital water requirements included that are used for the following:

- Patient drinking.
- Bed baths or showers.
- Personal hygiene.
- Food preparation.
- Surgery scrub-up.
- Washing instruments.
- Operating room cleanup.
- Emergency room cleanup.
- Washing bedpans.
- Hospital linen laundry.
- Extra staff showers.
- Sterilizers.
- Laboratory.
- X-ray development.
- Ambulance/litter washing.
- Handwashing.

- Heat casualty treatment.

5-17. The intensity of each of these functions varies with the type of hospital. Likewise, they produce different impacts on total consumption by each type of hospital.

a. Hospital water requirements do not vary significantly with the type of climate. The only difference is the amount of water required for drinking. All other functions are essentially fixed.
b. Some water savings may be realized by delaying a few hospital functions. The resultant savings are minimal, though, when compared with the consumption associated with other non-deployable critical functions. Any delayed or reduced use of water should be a decision of the hospital commander based on the situation at the time. Do not attempt to reduce hospital water planning factors based on assumed, deployable functions.
c. The water consumption factors for a hospital are listed in table 5-5 on page 5-6.

5-18. Miscellaneous Water Requirements.

a. For decontamination are the following:
   - This function includes the water used in removing chemical contaminants from personnel and equipment. The planning factors are 7 gallons per decontamination of each individual and 380 gallons per major end item.
   - The water used to decontaminate personnel should meet the same standards as water used for routine showers. The water used to decontaminate vehicles and equipment should be free of contaminants, but may, otherwise, be of a lesser quality.
b. Vehicle Maintenance. This water is for vehicle coolant replacement. A factor of 1/2 gallon in temperate climates to 1 gallon in hot environments per vehicle, per day, can be used.
c. Graves Registration. While this is not a medical function, graves registration units may be located in the hospital vicinity. Six gallons per fatality is the planning factor.
d. Loss and Waste. A loss factor must be considered to cover evaporation, spillage, and waste. Ten percent of the total requirements is a reasonable estimate. This estimate is based upon observed losses and waste in several exercises.

5-19. Personnel Strength. Actual patient census and staff strength figures can be used to calculate daily water requirements. With experience, actual usage factors can be used to develop more accurate requirements. For initial planning purposes though, use projected patient loads or total bed capacity to develop preliminary estimates. An example of preliminary hospital requirements are as follows:

- Patient care—total beds x 17.25 =
- Surgery—number of surgical cases x 13.0 =
- Staff requirements—unit strength x 10.25 =

Table 5-5. Hospital water consumption factors

Patient Care		
Drinking	(1)	1.5 gal/bed/day
Food Preparation	(2)	3.75 gal/bed/day
Bed Bath	(3)	5.0 gal/bed/day
Hygiene	(4)	1.7 gal/bed/day
Bedpan Wash	(5)	1.5 gal/bed/day
Laboratory	(6)	0.2 gal/bed/day
Sterilizer	(7)	0.2 gal/bed/day
X-ray	(8)	0.2 gal/bed/day
Handwashing	(9)	2.0 gal/bed/day
Cleanup	(10)	1.0 gal/bed/day
Heat Treatment	(11)	0.2 gal/bed/day
Total		17.25 gal/bed/day
Surgical		
Scrub	(12)	8.0 gal/bed/day
Instrument Wash	(13)	2.0 gal/bed/day
OR Cleanup	(14)	3.0 gal/bed/day
Total		13.0 gal/bed/day
Hospital Laundry		
Bed Patients	(15)	22.0 gal/bed/day
Ambulatory Patients	(16)	10.0 gal/bed/day
Staff Smocks	(17)	9.4 gal/bed/day
Total		41.4 gal/bed/day
Staff		
Drinking	(18)	1.5 gal/bed/day
Hygiene	(19)	1.7 gal/bed/day
Food Preparation	(20)	1.75 gal/bed/day
Extra Showers	(21)	5.3 gal/bed/day
Total		10.25 gal/bed/day

LEGEND:

(1) Includes beverages with and between meals. May increase by 0.5 gal/day in hot climates.
(2) Based on three T or B Ration meals for patients. May be reduced if disposable utensils are used.
(3) Includes daily showers for ambulatory patients.
(4) Same as common personal hygiene requirements for all other personnel.
(5) Washing and sanitizing of bedpans.
(6) Laboratory cleanup, water for laboratory procedures, blood bank, and so forth.
(7) Instrument washing and sterilization.
(8) Water for X-ray development.
(9) Staff handwashing between patients.
(10) Includes cleanup of ward areas, admissions area, ambulances, and litters.
(11) Based on estimate of 30 gallons per heat casualty. May be increased in hot climates.
(12) Based on average size surgical team.
(13) Cleanup of surgical instruments.
(14) Cleanup of OR between cases.
(15) Based on 11 pounds of laundry/patient/day with standard 60 pound, 125 gallons per load quartermaster laundry equipment.
(16) Based on reduced linen requirements for minimum care/ambulatory patients.
(17) Based on laundry of hospital smocks for direct patient care staff.
(18) Common drinking requirements may be increased in hot climates to 3.0 gal/person/day.
(19) Common personal hygiene factor.
(20) Based on one T or B Ration meals and two IFR per day. May be reduced if disposable utensils used.
(21) Based on daily shower for direct patient care staff.

SECTION II – WATER DISTRIBUTION SYSTEM

5-20. This section describes the assembly, operation, and disassembly of the deployable medical systems water distribution system. The combination of hoses, fittings, and valves provides maximum flexibility in setting up the system. This flexibility will enable Soldiers to set up the system in almost any configuration to support the hospital's mission.

5-21. One of the main reasons for having a water distribution system like this is to control infection and communicable diseases in the hospital. It is essential the water be of the highest possible quality. Coordinate early for preventive medicine personnel to inspect, and take samples from, the water distribution system. Advise hospital personnel the water from the system cannot be considered potable until certified by preventive medicine personnel.

5-22. Further information regarding the water distribution system can be found at the following link: https://partners.usammda.army.mil/index.cfm/whpe/wdwwms.

5-23. Components

a. Cam-Lock Connections. With one exception, every connection in the water distribution system is cam-lock. That one exception is the field sink adapter discussed in paragraph 5-27 j. A cam-lock is a quick connection system that requires no special training or tools. There are no threads. You simply insert the male end of the fitting into the female end of another fitting and pull the locking levers back to lock the two parts together. There are, however, precise steps in making and breaking this connection. These assembly steps begin with the final bullet on page 5-22. The component disassembly steps are in table 5-11 on page 5-26. Figure 5-1 below shows hose ends with male and female cam-lock fittings.

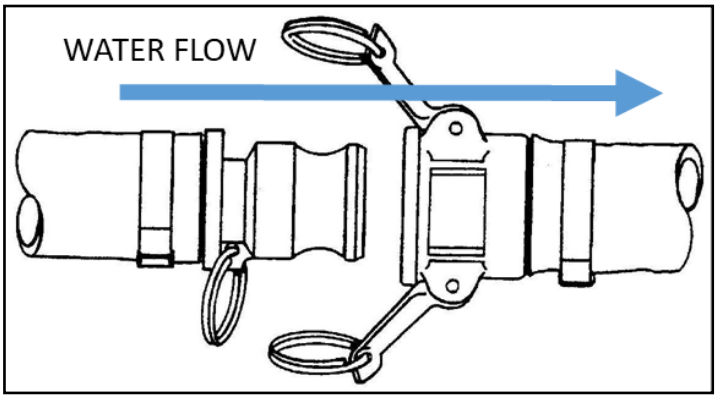


Figure 5-1. Cam-lock hose connections

b. Water Storage Tanks. Units will be authorized collapsible, fabric, 3,000 gallon water storage ("onion") tanks. The water distribution system will allow for interconnecting up to four of these water storage tanks. Figure 5-2 on page 5-8 shows a 3,000 gallon onion tank.

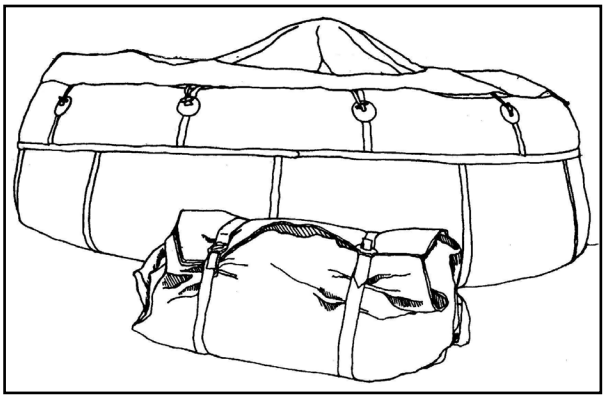


Figure 5-2. The 3,000-gallon onion tank

5-24. Water Pump. The water pump in the system has a 220-volt, 3-phase, totally enclosed, fan-cooled, 9 electric motor. Each pump has a Class "L"connector compatible with the electrical distribution system. Each pump has a male and female 1 1/2- inch cam-lock fitting. There are four pumps in the Field Hospital water distribution system. All pumps should be installed in the primary loop, preferably evenly spaced around the loop to provide a more even water pressure. There are two additional pumps provided with the Hospital Center for use with the secondary loops. Recommend installation of 1 pump minimum per secondary loop. Only the first pump downstream of the tanks must be operated. Additional pumps can be left off if flow rate demand is low. Extensions cords are not to be used so power planning is essential.

CAUTION

Two persons are required to lift or carry a water pump.

5-25. Hoses. Hoses in water distribution system may be tan with a blue strip or all BLUE indicating use for potable water. Each hose has a blue stripe running its length indicating use for potable water. When sections of hose are connected, they are bulky and heavy. To avoid injury, limit the amount of hose carried to 60 feet. Carry smaller amounts of hose. DO NOT DRAG THE HOSE; you will damage it and the connections. There are two types of hoses in the system: suction hose and discharge hose. The suction hose has a diameter of 1 1/2 inch and is 10 feet long. There are two sizes of the discharge hose, 1-inch and 1 1/2 inch.

a. Suction Hose. This rigid, wire reinforced hose is placed between the pump and water storage tank. It is the only hose in the system that can withstand the suction pressure of the water pump. The suction hose must be installed immediately upstream of every pump in the primary and secondary loop.
b. Discharge Hose, 1 1/2 Inch. This flexible hose is the main loop of the water distribution system. Water users (field sinks and ISOs) are not connected directly to the 1 1/2-inch hose. One-inch discharge hose (discussed below) is the link between the 1 1/2-inch hose and the water users. The 1 1/2-inch discharge hose comes in lengths of 5, 10, 20 and 50 feet.
c. Discharge Hose, 1 Inch. This flexible hose is the link between the primary (1 1/2 inch) loop and individual water users, such as field sinks, ISOs, and nozzles. The 1-inch hose also serves as the secondary loop(s). This hose comes in lengths of 5, 10, 20, and 50 feet.

5-26. Fittings and Valves. There are numerous fittings and valves in the water distribution system. With one exception, every fitting in the system has cam-lock connections.

a. Gate Valve, 2-Inch Female, 1 1/2-Inch Male. This valve is attached to the male cam-lock fitting on the onion tank. This valve is always open when the pump is operating. The valve is shown in figure 5-3 on page 5-9.
b. Gate Valve, 1 1/2-Inch Female, 2-Inch Male. This valve is attached to the female cam-lock on the onion tank. It is used to control the rate of flow in the primary loop with one tank or multiple

tanks in series. It is placed after the flowmeter and pressure gauge. This valve is shown in figure 5-4 below.

c. Gate Valve, 1 1/2 Inch, Female-Male. This valve is attached to the 1 1/2-inch loop, immediately after the beginning of a 1-inch loop. This is discussed in more detail on page 5-19. It is also used when multiple water tanks are arranged in parallel (see figure 5-8 on page 5-12). In this application this valve controls the rate of flow in the system. This valve is shown in figure 5-5 on page 5-10.

d. Gate Valve, 1 Inch, Female-Male. When used with individual water users, such as field sinks and nozzles, this valve controls the rate of flow. It is also used at the beginning of secondary loops and long one-way water lines. Used this way, repairs or changes in the secondary loops can be made without interrupting water supply to the rest of the hospital. Use of this valve is demonstrated in figures 5-19 on page 5-19, figures 5-20 on page 20 and 5-21 on page 5-20. Except for its size, this valve is identical to the one shown in figure 5-5 on page 5-10.

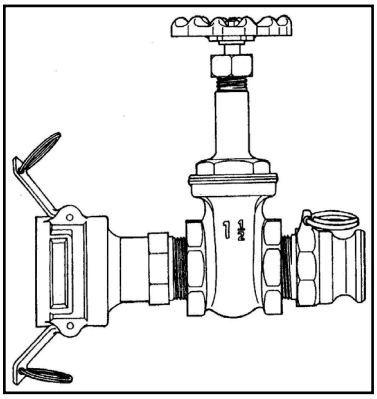


Figure 5-3. Gate valve, 2-in. female, 1 1/2-in. male

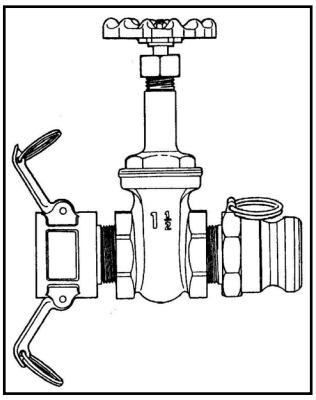


Figure 5-4. Gate valve, 1 1/2-in. female, 2-in. male

e. Tee Assembly, Reducing, 1 1/2 Inch, Female-Male-Male. This fitting is used at each place where the one-way feeder lines branch off to the individual users, such as SPD, pharmacy, and X-ray. It is also used at the beginning and end of the secondary loop. Use of this fitting is demonstrated in figure 5-17 on page 5-17, figure 5-18 on page 5-18 and figures 5-21 on page 5-20. This fitting is shown in figure 5-6 on page 5-10.

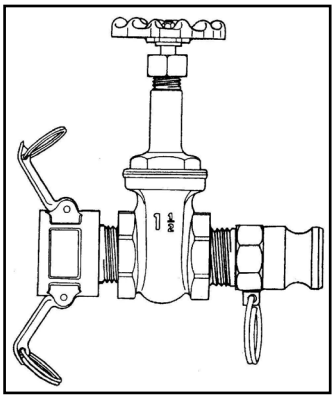


Figure 5-5. Gate valve, 1 1/2 in female-male

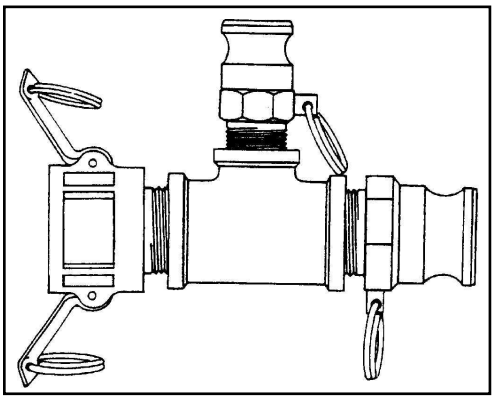


Figure 5-6. Tee assembly, reducing, 1 1/2 in., female-male-male

f. Tee Assembly, 1 Inch, Female-Male-Male. This fitting allows connection of additional users along secondary loops or long one-way lines. Use of this fitting is shown in figures 5-17 on page 5-17. A side view of this fitting is shown in figure 5-7 on page 5-11.

g. Tee Assembly, 1 1/2 Inch, Female-Male-Male. This fitting is used when the water storage tanks are configured as shown in figure 5-8 on page 5-12. It is used on the return side of the primary loop. This fitting looks like the fitting in figure 5-7 on page 5-11.

h. Tee Assembly, 1 1/2 Inch, Female-Female-Male. This fitting is located between the water storage tanks and the pump when the water storage tanks are employed in parallel. It is shown as item c in figure 5-8 on page 5-12. This fitting is shown in figure 5-9 on page 5-12.

i. Adapter, 1 Inch, Female-Female. This adapter is shown in figure 5-10 on page 5-13. It has two applications:

- Its most common purpose is to connect an ISO to the water distribution system. It has female connections on both ends because the discharge end of the hose and the receptacle on the ISO are both male fittings.
- Its other application is at the end of the secondary loop, where it returns to the primary loop. Like the ISO connection, this adapter is used to connect two male fittings: the male discharge end of the hose and the male end of the reducing tee.

j. Field Sink Adapter. This fitting has a 1-inch female cam-lock and a standard garden hose connection. It is designed to connect a field sink to the water distribution system. The field sink adapter can be permanently connected to a field sink. The field sink adapter is shown in figure 5-11 on page 5-13.

k. Dust Caps and Plugs. A dust cap or dust plug is attached by chain to every cam-lock fitting in the water distribution system. The caps and plugs prevent dirt and other contaminants from entering the pump, hoses, valves, and fittings when they are disconnected. Caps and plugs must

always be installed on the fitting when the fitting is not in use. Always connect caps and plugs from cam-lock connections in the water distribution system. A dust plug, seen in figures 5-12 on page 5-13 and dust cap on page 5-13 on page 5-14, respectively.

l. Reducing Tee Assembly, 1½-inch female, 1½ inch male, 1-inch male.
This fitting allows connection of users in the primary loop. It is also used at the entrance and exit of the secondary loop.

5-27. Other components.

a. Pressure Gauge. This vital component measures the water pressure in the distribution system. The gauge is placed at the end of the main loop. Its precise location depends on how the tanks are employed. The location is shown in figure 5-8 on page 5-12. THE PRESSURE GAUGE IS FRAGILE. When not in use, store it in the storage container.

b. Flowmeter. There are two flowmeters provided with the water distribution system. They both have 1 1/2 –inch cam-lock fittings. The flowmeter measures flow rates up to 100 GPM. One flowmeter is placed at the end of the primary loop next to the pressure gauge. The second flowmeter should be installed in the primary loop just beyond the entrance to the secondary loop. This is discussed in more detail in paragraph 5 9h. FLOWMETERS ARE FRAGILE. When not in use, store them in the storage container.

c. Filter Assembly. This assembly has 1 1/2-inch cam-lock fittings and an 80-mesh stainless steel screen. The purpose of the filter is to remove suspended solids, like sand, from the water. Such solids may interfere with the operation of the pump, field sink, or scrub sink. The filter assembly comes with four filters. Do not store filters in the filter assembly when not in use. Keep them in the storage container.

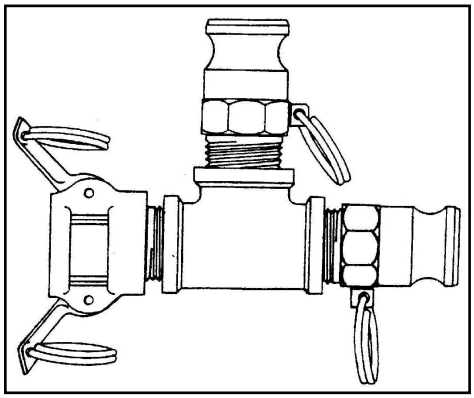


Figure 5-7. Tee Assembly, 1 in., Female-male-male

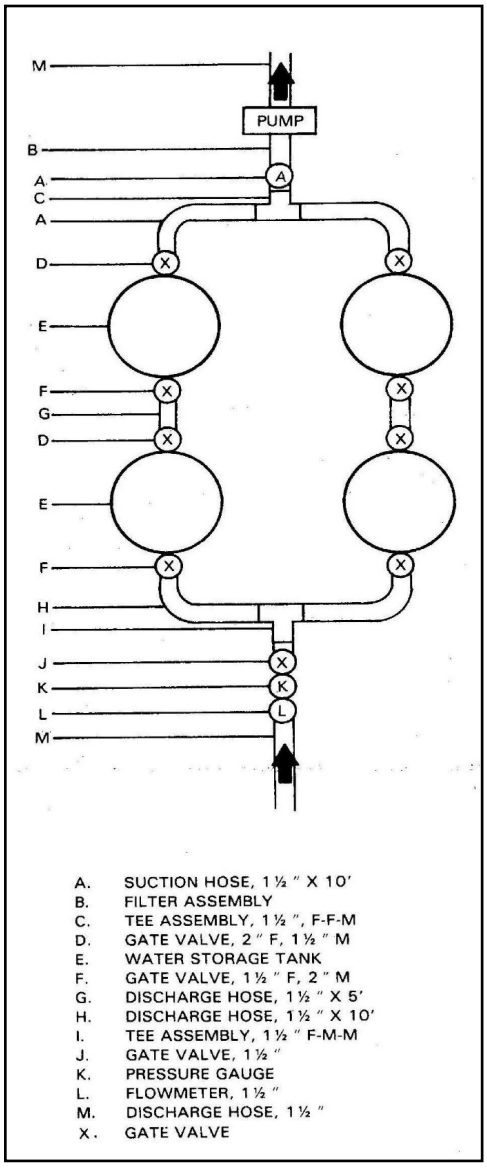


Figure 5-8. Employment of Multiple Water Storage Tanks

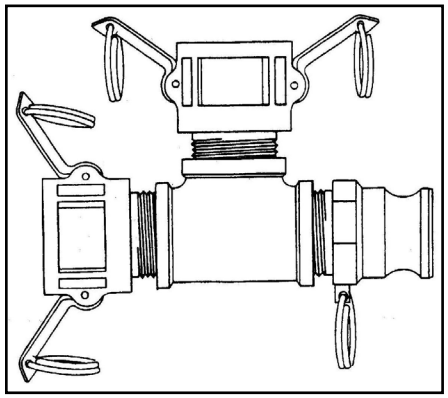


Figure 5-9. Tee assembly, 1 1/2 in., female-female-male

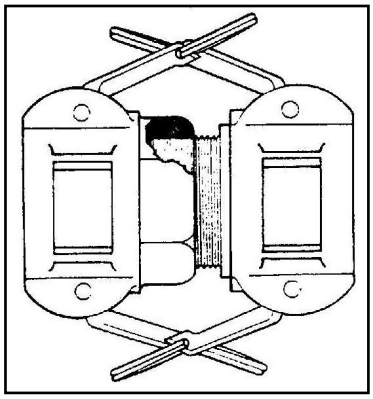


Figure 5-10. Adapter, 1 in., Female-female

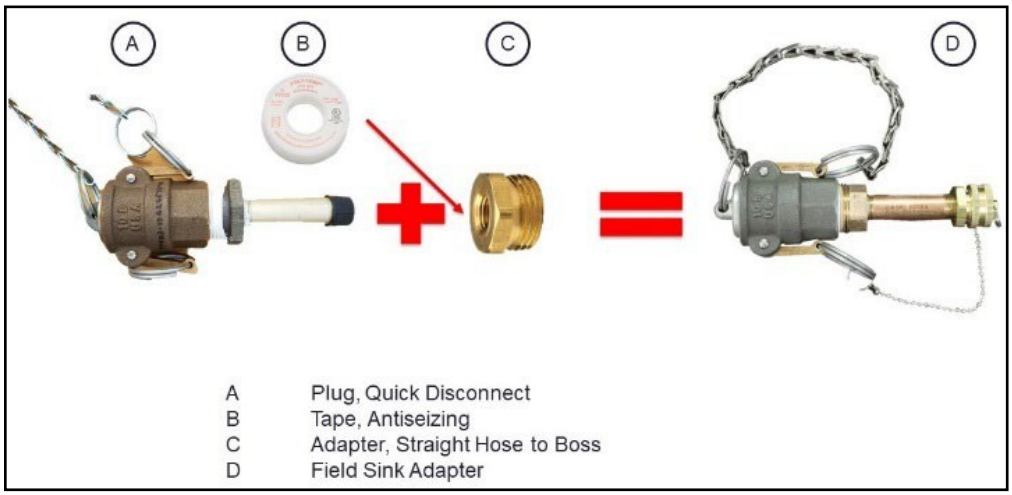


Figure 5-11. Field Sink Adapter

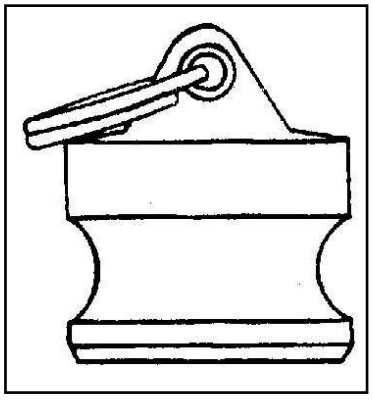


Figure 5-12. Dust Plug

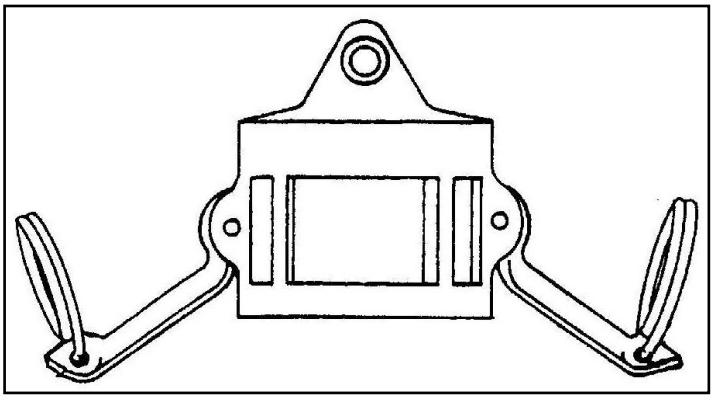


Figure 5-13. Dust cap

d. Stand, Fuel Assembly. Referred to in this chapter as a tripod, this component is used to suspend a water distribution nozzle.

e. Water distribution nozzle. There are three uses for the water distribution nozzles. They are described in detail in paragraph 5-31. A water distribution nozzle is shown in figure 5-14 below.

f. Hose Protection Channels. There are two different hose protection channels which includes:

- The subsurface hose protection channel shown in figure 5-15 seen below must be buried. Dig a trench about 3-inches deep and 4-inches wide across the tent corridor. Lay the hose in the trench, cover it with the protection channel, and backfill with soil. Cover them with the tent floor.

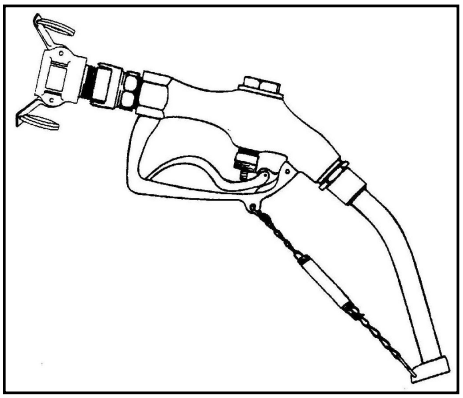


Figure 5-14. Water distribution nozzle

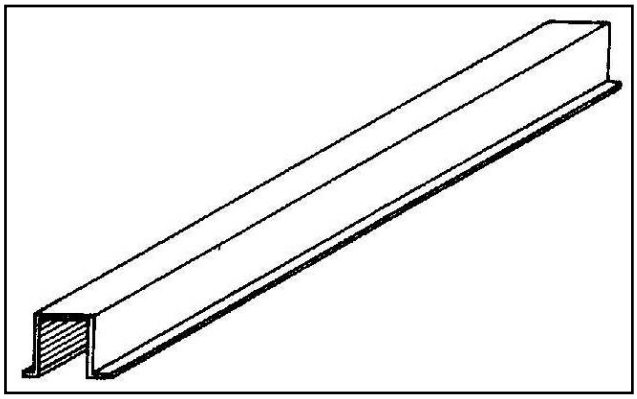


Figure 5-15. Hose protection channel, subsurface

- The hose protection channel surface, (see figure 5-16) below, should not be buried. It is provided for those settings where burying the hose is not practical or possible. This channel lays on the ground, beneath the tent floor. It is not designed for vehicle traffic.

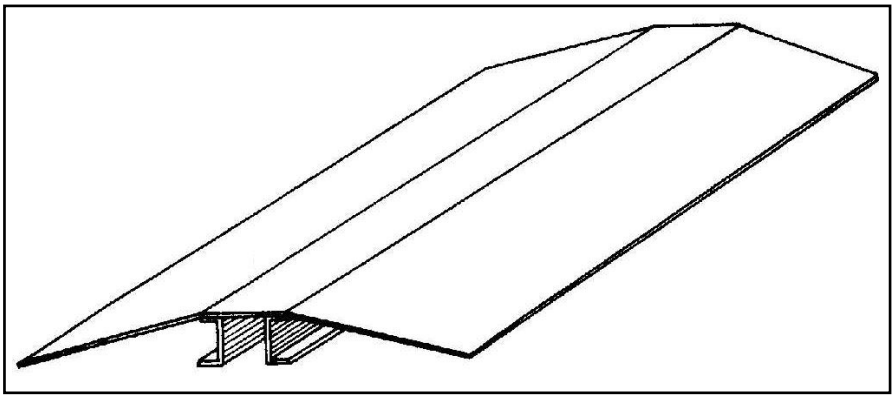


Figure 5-16. Hose Protection Channel, Surface

g. Storage Container. This fiberglass container has padded cutouts for the storage of the fragile components. It is intended for the storage of the pressure gauge, flowmeters, and filters for the filter assembly.

5-28. Principles of Installation. The water distribution system is intended to be as flexible in its layout as the Field Hospital (32 bed) itself. THERE IS NO ONE CORRECT WAY TO SET UP THE WATER DISTRIBUTION SYSTEM. The number of possible configurations is almost unlimited. The information in this paragraph provides the basic guidelines necessary to assist you in planning the layout of the system for your hospital. Like other systems, the layout must be planned in advance. Obtain a copy of the hospital layout plan as soon as possible.

a. Location of the water storage tank(s). Siting the water storage tank(s) is the most important decision in setting up the water distribution system.
b. Trafficability. Trucks delivering water need access to the water storage tank(s).
c. Electrical power. The pump will be right next to the water tank(s), and the pump needs electrical power. The electrical cable on the pump is 50 feet long.
d. Near the primary loop. The water distribution system was designed for the primary loop to be near the highest concentration of ISOs.
e. Sufficient area. All hospitals have four onion tanks. Each tank is approximately 10 feet in diameter when full. They can be connected together using gate valves (see figures 5-3 and 5-4 on page 5-9) and 5-foot lengths of 1 1/2-inch hose. They can be connected together using gate valves (see figures 5-3 and 5-4 on page 5-9) and 5-foot lengths of 1 1/2-inch hose.

5-29. Location of the Primary Loop. The ISOs make up the largest number of water users in the hospital. For this reason the primary loop should make its circuit around the highest concentration of ISOs. This approach also has the advantage of reducing the length of the primary loop, as well as reducing the amount of 1-inch hose needed to connect the ISOs. The length of the primary loop is dictated by the number of hospital components being used and their configuration.

5-30. Secondary Loop(s). Secondary loops are normally installed instead of long one-way water lines. Water constantly moves in secondary loops. This greatly reduces the amount of stagnant water and the potential of bacteria growth. Flowing water stays cooler longer in the summer and resists freezing in the winter. Entry and exit connections for the secondary loop(s) should be installed in the primary loop during setup to minimize downtime.

5-31. Water Distribution Nozzles. Water distribution nozzles have several applications in the Field Hospital (32 bed).

a. An important application of the nozzle is to supply water to those parts of the hospital that are not connected to the water distribution system. Evenly distribute as many as four nozzles, each with a tripod, among the wards whose sinks are not connected to the system. More can be used at the sacrifice of other nozzles in the hospital.
b. The nozzle is an efficient way of filling the autoclaves if no distilled water is available. Place a nozzle with tripod near the SPD tent. The hand valve on the nozzle is not very sensitive. For this reason, install a 1-inch, female-male gate valve in the line leading to the nozzle. Use the gate valve to adjust the flow to the nozzle, or else you will have water everywhere except in the autoclave. Locate the valve 20 feet or so away from the nozzle to enable you to move it without also moving the valve.
c. The water distribution nozzle is also an asset for the dining facility. Its use in field kitchen operations reduces the time spent in food preparation and cleanup. The system was designed for a run of 300 feet (six pieces of 50-foot hose) to a nozzle at the field kitchen. This distance can be increased at the sacrifice of other 1-inch hose in the system.
d. Crossing pedestrian and vehicle routes. Hoses should not cross vehicle routes. Hoses crossing pedestrian paths should be kept to a minimum. If a hose must cross a tent, do so at a corridor, and use a hose protection channel.
e. Additional Water Pumps. It is recommended that all pumps provided be installed (in proximity of available power) within the primary loop and one (1) for each secondary loop. The pumps can be separated by a distance along the loop; preferably evenly spaced to provide more even water pressure throughout the loop. Locate near available power. Do not use extension cords.
f. Water Heaters. Do NOT use the system in temperatures below freezing without the heaters, when water is being installed and properly operating. Locate near available power, preferably evenly spaced throughout the system. It is recommended that they be installed near and just downstream of all pumps. Heaters do not affect the water flow if they are not operating, so they should be installed if cold conditions are predicted. Do not use extension cords.

5-32. Assembly.

a. The commander's desired hospital layout will determine the layout of the water distribution system. This section provides some general guidelines and a few hard rules on how to assemble the system. Sketch the layout of the water distribution system over the layout diagram of the hospital.
b. Assemble the water storage (onion) tank(s). Locate them using the information in paragraph 5-28a. Attach the gate valves, see figures 5-3 and 5-4 on page 5-9, (figures 5-3 and 5-4) to each onion tank. Connect two onion tanks together using a 5-foot section of 1 1/2-inch hose. Make sure the gate valves are in the closed position and the cover is on the water tank(s). Attach the filter assembly. The arrow on the filter assembly MUST point in the direction of flow, and the filter element pointed DOWN for correct operation. See figure 5-8 on page 5-12. The location of the filter assembly depends on the configuration of the storage tanks. Refer to figure 5-8 on page 5-12.
c. Connect the suction hose between the pump and lead onion tank. Install additional suction hoses immediately upstream of all other pumps in the primary and secondary loop(s). Again,

this assembly will depend on the configuration of the water storage tanks. Refer to figure 5-8 on page 5-13.

d. Select an open socket on an electrical distribution panel. Make sure the circuit is off. Plug the pump's electrical plug into the electrical socket.

e. Lay the primary loop following the guidance in paragraph 5-29. DO NOT CONNECT the hoses yet. DO NOT REMOVE the caps or plugs. Be aware of the requirement for fittings near the ISO walls that have water receptacles. Connections between hoses in the primary loop should occur near these points. Also be aware of other requirements for breaks in the loop, such as secondary loops, feeder lines to individual users, and nozzles to SPD and dining facility.

f. Lay the 1-Inch hose for the feeder lines between the main loop and the ISOs. This process more clearly defines the need for breaks in the primary loop and for fittings includes:

- The SPD ISO has two water receptacles. All other ISOs, have one water receptacle (except OR, which has none). Figure 5-17 on page 5-17 shows the connection between the main loop and the SPD ISO. The hose (item d) is optional; you can omit it, or use any length (other than 50 foot) needed. Place a 1-inch gate valve next to the tee (item f). Placing the valve here enables you to disconnect an individual ISO without disrupting water supply to the rest of the hospital.

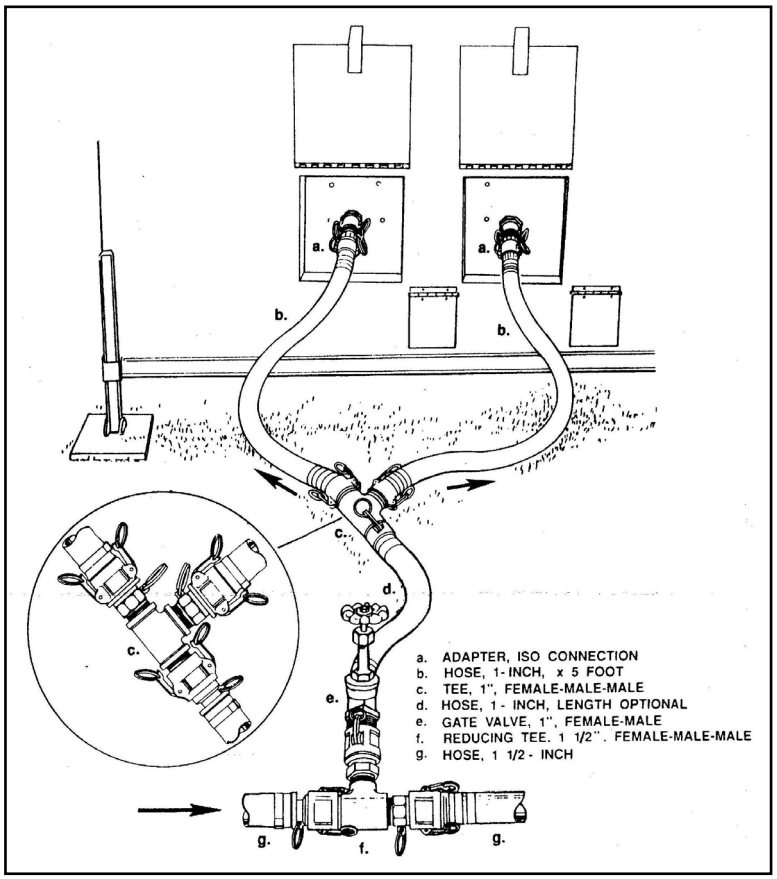


Figure 5-17. Water Hose Connection to the SPD ISO

- Figures 5-18 on page 5-18 and 5-19 on page 5-19 show two different methods to make the connection between the main loop and an ISO with one water receptacle. The hose (item b, figure 5-18, on page 5-18) is optional; you can omit it or put in any length you need. Figure 5-19 on page 5-19, shows the same configuration with the hose omitted. Do not omit the gate valve (item b, figure 5-19 on page 5-19). It allows you to disconnect an individual ISO without disrupting water supply to the rest of the hospital.

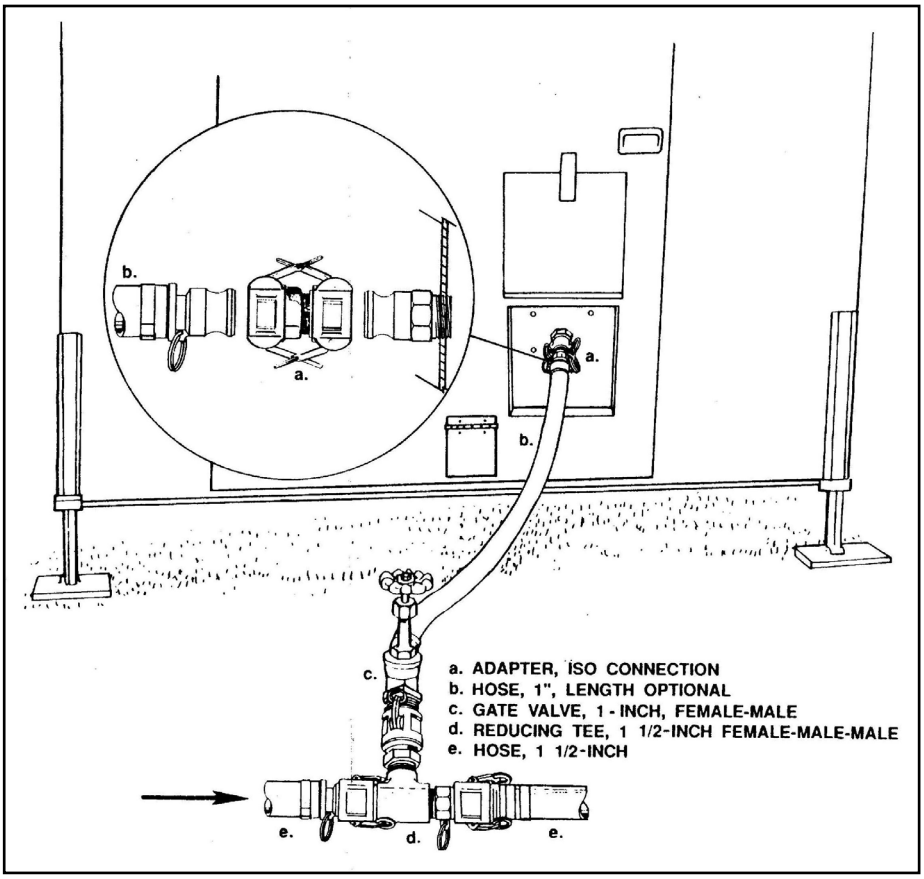


Figure 5-18. Connection to a Single Receptacle ISO (with hose)

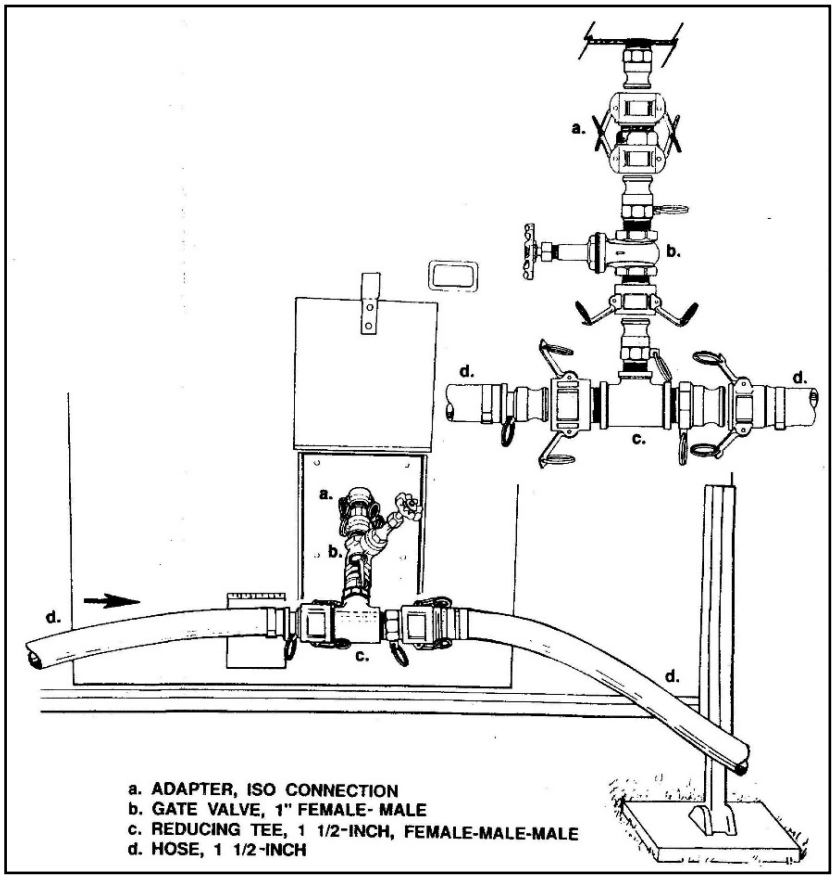
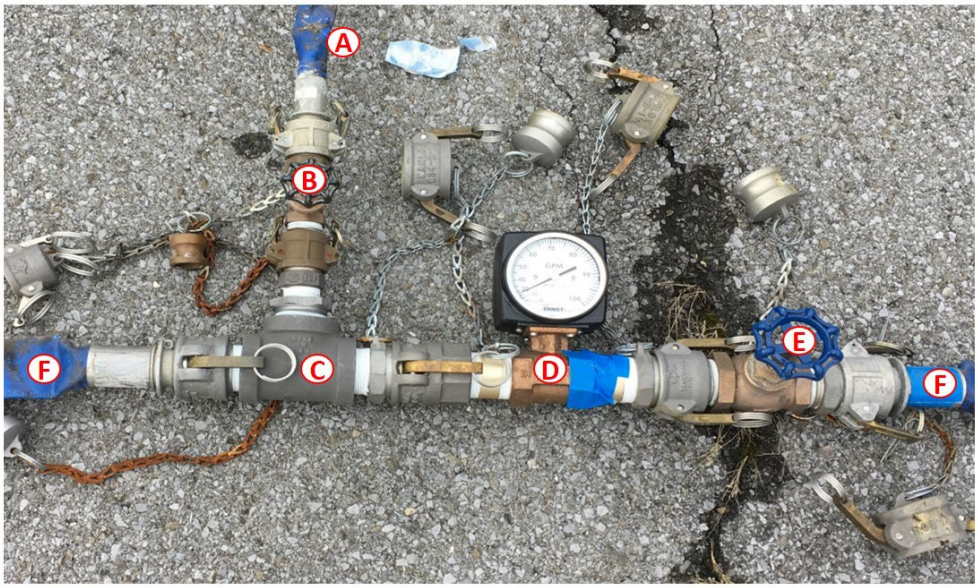


Figure 5-19. Connection to a Single Receptacle ISO (without hose)

- Lay the fittings and hose for the secondary loop(s). The beginning of each secondary loop is configured like that shown in figure 5-20 on page 5-20. The 1-inch gate valves here (item c) and at the end of the loop (item b, figure 5-21 on page 5-20) allows an individual to shut off the water supply in the secondary loop without disrupting water supply to the rest of the system. Always leave this valve open unless you are working on the secondary loop. To force water into the secondary loop, gradually close the 1 1/2-inch valve (item e) until the flowmeter (item b) shows the flow is between 5 and 10 GPM.



ITEM	DESCRIPTION
A	HOSE, 1 inch lengths vary
B	Valve, Gate, 1 inch female, 1-inch male
C	Tee Assembly, Quick Disconnect, 1½ inch female, 1½ inch male, 1-inch male
D	FLOWMETER (OPTIONAL), Potable Water.
E	Valve, Globe, 1½-inch female, 1½ inch male
F	HOSE, 1 ½ inch; lengths vary

Figure 5-20. Fittings at the start side of a 1-in. loop

- The return side of each secondary loop is configured like that shown in figure 5-21 above.
- The gate valve (item b) is used with the 1-inch valve discussed in paragraph h, above. The female-female adapter (item c) is used to connect the male fitting on the secondary loop to the one on the reducing tee (item d) in the primary loop.

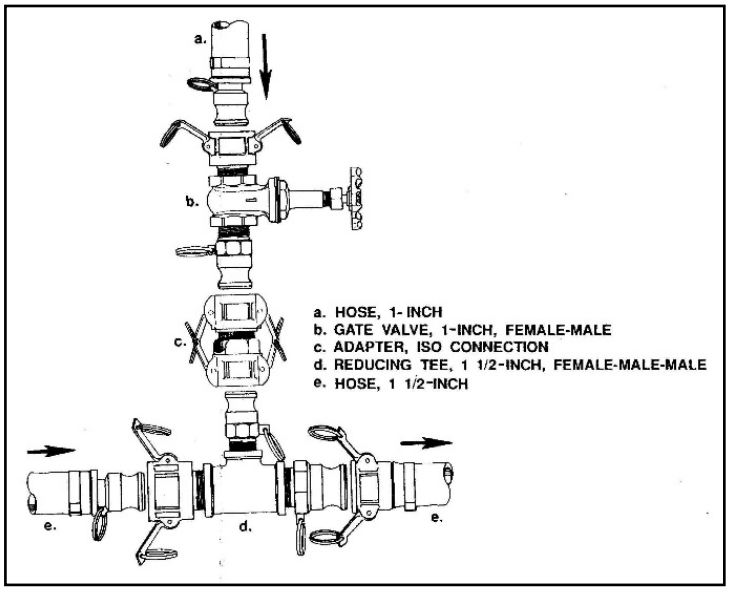


Figure 5-21. Fittings on Return Side of a 1-in. Loop

- TEMPER Air Supported (Airbeam) Branches. With the new TAS, there are only so many access points for the water and waste water hose. Unlike previous TEMPER, the floor is sewn to the walls. The only ingress/egress at present is at access ports located at both ends and on either side of the middle of a shelter. See figure 5-22 below.

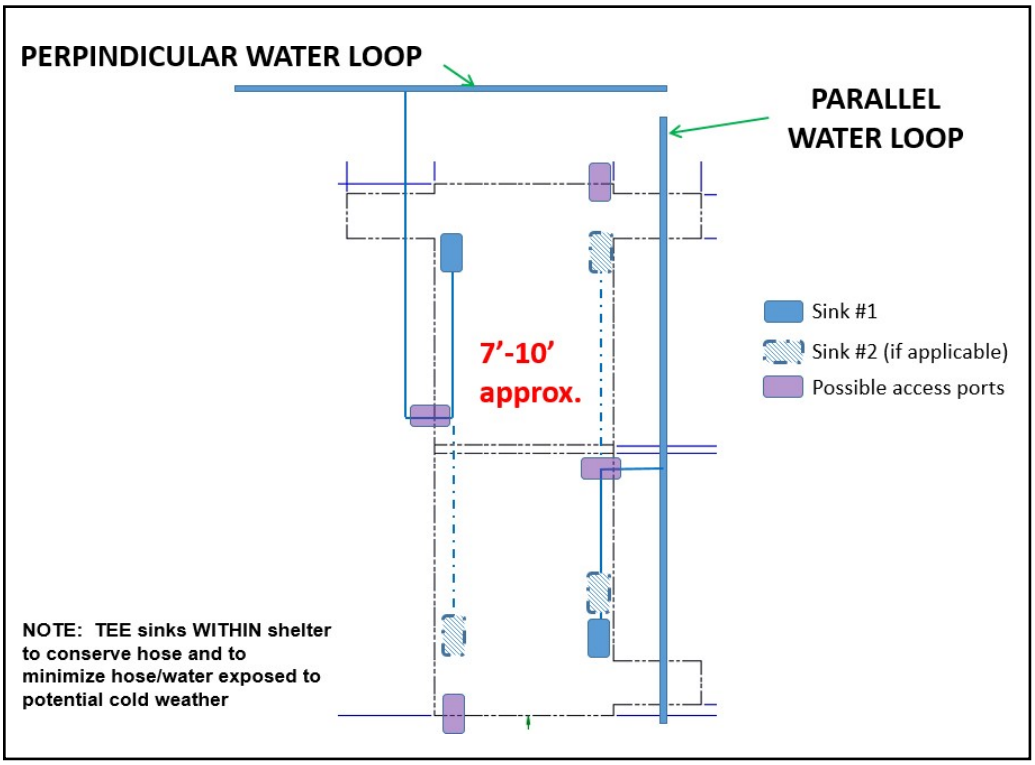


Figure 5-22. TAS Ingress and Egress

- The return side of each secondary loop is configured like that shown in figure 5-22 above. The gate valve (item b) is used with the 1-inch valve discussed in paragraph h, above. The female-female adapter (item c) is used to connect the male fitting on the secondary loop to the one on the reducing tee (item d) in the primary loop.
- The hose assembly to connect the field sink uses the water distribution connection, see figure 5-23 on page 22.
- Lay the necessary fittings and hose to connect the field sinks. A Soldier must thread the field sink adapter (see figure 5-11 on page 5-13) into the field sink fitting (item a). For the short-term, the individual may be able to hand-tighten this fitting. For the long-term, however, apply anti seizing tape to the male threads. Use two pipe wrenches to tighten the connection. See table 5-6 below for two possible connections to the field sink

Table 5-6. Field Sink connections

Field Sink Connections
Option 1 shows the connection from a 1-inch hose line
Option 2 shows the connection from a 1 1/2-inch loop

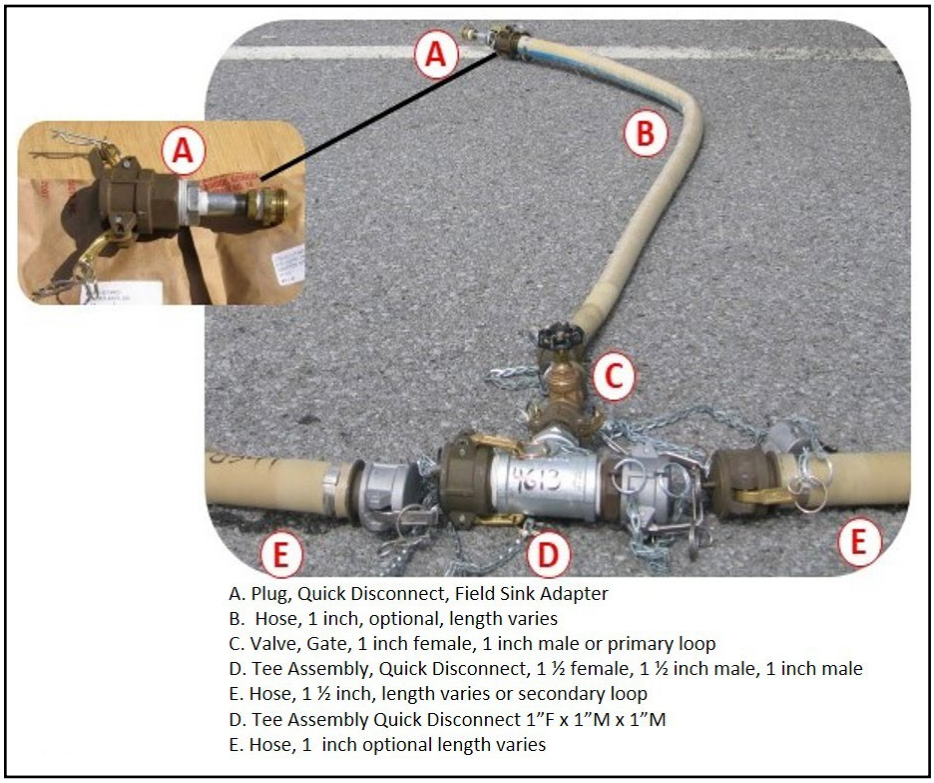


Figure 5-23. Water distribution connection to field sink

- See table 5-7 below for water distribution connection sequence.

Table 5-7. Water distribution connection sequence for field sink

Water Distribution Connection Sequence	
	a. Check valve attached to field sink
	b. Adapter, field sink
	c. Gate valve, 1 in. female-female
	d. Hose, 1 in. (optional)
1	**e**. Tee, 1 in., female-male-male **f**. Hose, 1 in.
2	**g**. Reducing Tee, 1 ½ in., female-male-male **h**. Hose, 1 ½ in.
Legend: Items 1 and 2 are succeeding steps for item d.	

- Lay hose lines to the nozzle locations. Place one nozzle next to each SPD tent. These hose lines need enough slack so the nozzle can reach each autoclave. Place the 1-inch gate valve far enough away from the nozzle so that when the nozzle and hose are moved the gate valve is not dragged.
- Use the hose protection channels for hose crossing tent corridors. If conditions and time permit, you may bury the hose and the protection channel, but it is not necessary. Run the hose under the edge of the tent flap and both layers of the floor. You may need to untie the floor tie-downs. Place the protection channel along the width of the corridor. Do not place a protection channel over a hose connection.

- With the system laid out, it is now time to assemble it. Correct assembly of the cam-lock fittings is absolutely essential to avoid contaminating the inside of the hoses and fittings. Follow the procedure outlined below as close as possible.

CAUTION

Correct assembly of connections is essential to avoid contaminating the system

- See table 5-8 below for cam lock fittings sequence.

Table 5-8. Cam lock fittings sequence

Cam Lock Fittings Sequence	
i.	Open the locking levers for both fittings. DO NOT REMOVE THE DUST CAP OR DUST PLUG.
ii.	Rest the female fitting on anything that allows the opening of the fitting to be face up, or off the ground. The toe of your boot will work. This reduces the chance of contaminants entering the fitting.
iii.	Lay the male fitting across the female fitting.
iv.	Remove the dust plug from the female fitting.
v.	Holding the dust plug in your hand, remove the dust cap from the male fitting.
vi.	Connect the dust plug and dust cap. Close the locking levers and lay them on the ground.
vii.	Connect the male and female fitting without allowing the fittings to touch the ground. Close the locking levers.
viii.	Use this procedure to make all the connections in the system. One exception is the connection at the ISO. The male fitting on the ISO does not have a dust cap. Because of this, the dust plug from the female-female adapter will not have a matching connection.

- Having made all the connections, you are ready for the final checks BEFORE TURNING ON THE WATER. See table 5-9 below for connections final check.

Table 5-9. Connections final check

Connections Final Check	
i.	Open all gate valves in the primary and secondary loop(s) and to the nozzles and ISOs
ii.	Close all valves to the field sinks
iii.	Close the globe valves on the inside of the ISO. Ensure the scrub sinks (figure 5-24 on page 5-24) are ready by closing the— • Drain cock on the pump. • Valve at the top of the pump body. • Heater drain valve.
LEGEND.	
ISO	International Organization for Standardization

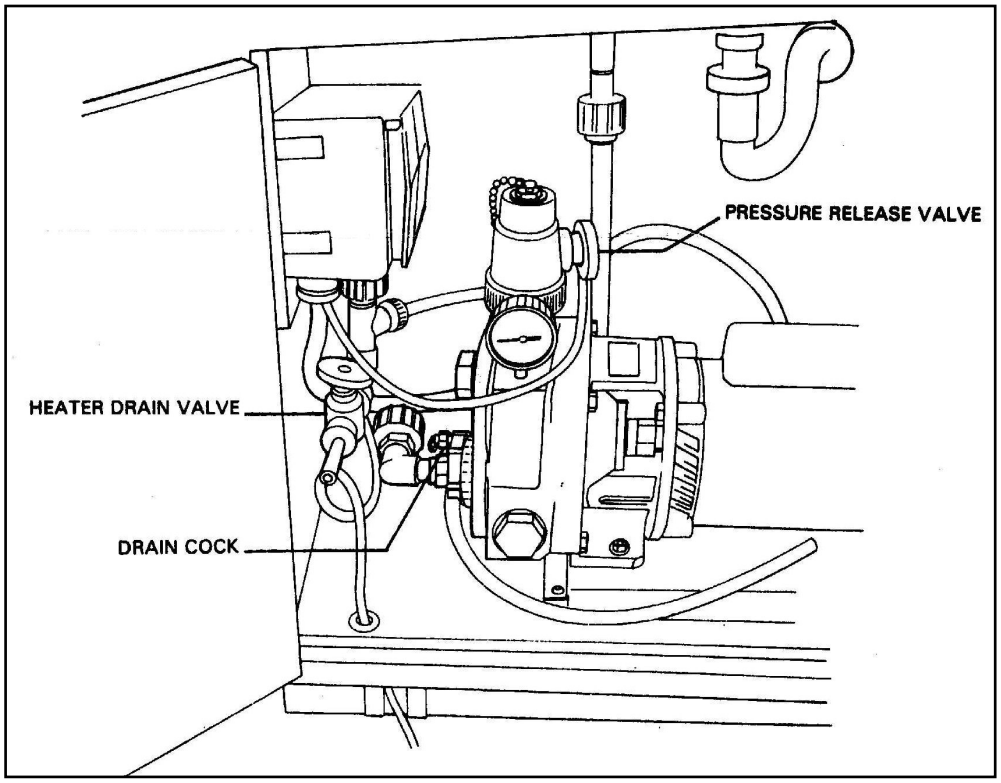


Figure 5-24. Scrub sink

a. Make sure the field sinks are ready. Instruct users of field sinks connected to the system to set them up to the manufacturer's literature.
b. With water in the storage tank(s), make all connections by using table 5-10 below:

Table 5-10. Water storage tank connections

Water Storage Tank Connections	
i.	Open the valve on the storage tank immediately before the pump.
ii.	Open the gate valve at the return side of the distribution system. If you are using more than one water tank, open the valves between the tanks.
iii.	Turn on the circuit for the pump.

- Adjust the rate of flow at the return side of the distribution system. Adjust the rate of flow with the gate valve so the pressure gauge reads between 8 and 12 pounds PSI.
- Adjust the flow at the secondary loop(s). The presence of water in the secondary loops does not mean water is flowing in the loops. To ensure water is flowing, gradually close the 1 1/2-inch gate valve (item e, figure 5-20 on page 5-20). Adjust valve at entry to secondary loop until flow rate in main loop drops by 5 to 10 GPM.
- Return to the gate valve by the pressure gauge. After adjusting the flow for the secondary loop(s), the flow rate here may need adjusting. Use the gate valve to adjust the rate of flow until the pressure gauge reads between 8 and 12 PSI.
- Go to each scrub sink. Instruct the users to double- check that the sinks are ready (paragraph n(3), above). Have them open the globe valve on the ISO wall. Turn on the water. The water may appear rusty. This is rust that was inside the body of the pump in the scrub sink. Allow the water to run until the water clears.
- Go to each field sink connected in the water distribution system. Instruct the users to open the gate valve, but not all the way. If there are leaks anywhere but at the threaded fittings,

defer the sink to maintenance. Users can correct leaks at fittings by tightening them with a pair of pliers. It is up to the user to adjust the rate of flow to the sink with the gate.

- Before the water is used, direct the field sanitation team to chlorinate the water in the water storage tank(s). Then operate EVERY sink in the system for three to five minutes. Operate each nozzle for about one minute. This flushes the system of potential contaminants that may have entered the hoses and fittings since its last use.
- Coordinate with preventive medicine personnel to inspect the system and take water samples. Coordinate also for regular preventive medicine inspections and sampling.

5-33. Operation. The purpose of this paragraph is to ensure that the equipment is operated safely and that the system provides a continuous supply of potable water.

a. Monitor the water supply.
b. Turn off the pump when the depth of water in the onion tank(s) is less than 8 inches. The bearings will burn out if the pump is not pumping a full load of water.
c. The field sanitation team should monitor the chlorine residual in the water supply.
d. Measure chlorine residual at the water supply tanks and at 20 percent of the sinks and nozzles in the distribution system daily. A chlorine residual is essential for preventing biological contamination. However, too high of a chlorine residual will make the water taste bad.
e. Remove and clean the filter in the filter assembly daily. This requires shutting down the pump. In order to minimize downtime, have a clean filter ready for immediate installation. Follow the procedure below to change the filter:
   - Turn off the power to the pump.
   - Close the gate valve by the filter assembly.
   - Change filters in the filter assembly.
   - Open the gate valve.
   - Prime the pump. See table 5-10.
   - Turn on the power to the pump.
   - Clean the old filter and place it in the storage container.

5-34. Disassembly

a. The purpose of the procedures discussed here is to enable you to disassemble the system in a manner that is efficient and minimizes the chance of contamination. The procedure is intended to be independent of any other actions associated with disassembly of the hospital. However, hose lines located inside a tent must be removed before the tent can be disassembled.
b. Disconnecting the cam-lock fittings is not the first thing done in disassembly. However, it is the most frequent task and warrants being discussed first. The intent is the same though; disconnect with minimal risk of contaminating the system (see figure 5-11 on page 5-13).

Table 5-11. Disconnecting cam-lock fittings

Disconnecting Cam-Lock Fittings	
i.	Unlock all four locking levers.
ii.	Separate the fittings. Rest the female fitting on a surface (NOT THE GROUND) with its opening up. The toe of your boot will work.
iii.	Lay the male fitting on the female fitting (or hose) in a way that prevents the male fitting from making contact with anything else.
iv.	Separate the dust cap and dust plug. DO NOT PLACE THEM ON THE GROUND!
v.	Holding onto the dust plug, place the dust cap on the male fitting of the cam-lock.
vi.	Place the dust plug in the female fitting of the cam-lock.
vii.	Close all four locking levers.

c. Turn off the pump and close the valves on the water tank(s).
d. At this point, disconnect a hose section and permit the water in the hose to drain by gravity. If there is not one clearly topographical low point, disconnect the hose at several points to encourage gravity draining.
e. While the hoses are draining, drain the remaining water from the storage tank(s). The location of the tanks may not be well suited for emptying their contents in place. You may wish to connect one or more lengths of discharge hose and drain the tanks away from the hospital. Use the pump to speed up the process. Set the pump up, with suction hose, just as when laying the system out. Use as much hose as necessary to drain the tank wherever you wish. A word of caution: select a spot where the slope of the ground will not carry the water back into the hospital area. Again, use caution to prevent the pump from running when the water level in the tank(s) falls below 8 inches; it could burn the motor up. Use as much hose as necessary to drain the tank wherever desired.

CAUTION

Select a spot where the slope of the ground will not carry the water back into the hospital area. Again, use caution to prevent the pump from running when the water level in the tank(s) falls below 6 inches; it could burn the motor up.

f. Once the tank is empty, tip the pump up to remove any water remaining in the bottom of the pump body. Allow the pump body to air-dry before storage.
g. While the system is draining, disassemble the hose starting at the water storage tanks. Allow the hoses to air-dry before storage.

- Remove the gate valves and tee fittings before rolling hoses for storage. Reattach the dust caps and dust plugs to the fittings as you disconnect them. Place the fittings in the bags of the fittings storage racks. Put similar fittings in the same bag.

CAUTION

To prevent contaminants from entering the system, reattach dust caps and dust plugs to fittings and hoses before storage.

- When rolling hose, leave the far end of the hose open to allow any remaining water to drain. If possible, keep that end off the ground. If this is not possible, rinse the end of the hose before attaching the dust cap or dust plug.
- Several lengths of short hose can be rolled as one piece. For example, connect two or three 10-foot sections of 1 1/2-inch hose and roll them as one section. A 30-foot section of 1 1/2-inch hose serves as the cover for the fittings storage. One-inch hose cannot be rolled like the

1 1/2-inch hose. It must be fed into the rack and coiled in layers. Place one end of the hose against the inside wall and work toward the center of the rack. Begin with the longer (20- and 50-foot) pieces and use the shorter pieces to fill in the voids in the center.

h. Remove the hoses from inside the tents (see table 5-12 below). The instructions here presume that the hose in the tent is part of a secondary loop.

Table 5-12. Hose removal

Hose Removal	
i.	Close all gate valves. This includes the valves to feeder lines, field sinks, and the valves at the beginning and end of the loop
ii.	Disconnect all feeder lines and field sinks from the secondary loop. Leave gate valves attached to the secondary loop
iii.	Break the cam-lock connections immediately outside each end of the tent. Lift one end of the hose and walk it through the tent. Use caution as the fittings could rip the flooring.

CAUTION

Handle the hose inside the tent with care. The fittings may damage the canvas or flooring.

i. As much as possible, store similar fittings in the same compartment of the fittings storage rack. The same principle applies to the hose; store the same lengths of hose in the same storage rack. This practice simplifies the process of unpacking the next time you set up the hospital.

j. Prior to storing the flowmeters and pressure gauges, open the caps and plugs on each item and drain the water. Shake any additional water from each item before replacing the caps and plugs. Store them in the storage container.

k. Advise users of the scrub sink to open the draincock, pressure release valve, and heater drain valve. These steps allow water to drain from the pump and the heater. This prevents the formation of rust and bacteria. These valves are shown in figure 5-24 on page 5-24. This procedure is also discussed in the scrub sink operator's manual.

5-35. Preventive maintenance. The following preventive maintenance checks and services should be done periodically during operation. They should also be done prior to storing the equipment upon completion of a mission or field training exercise.

a. Water storage tanks.

b. Operator maintenance and preventive main furnace check and services (PMCS) are addressed in manufacturer instructions.

c. Pump.

d. Operator maintenance and PMCS are addressed in TM 5-4320-274-14&P.

e. Discharge hose. Check hoses for abrasion, cuts, or gouges. Check for the following:

- Presence of bulges or seepage during operations.
- Presence and condition of locking levers.
- Presence and condition of hose clamps.
- Presence of cap and plug attached by chain and key rings.
- Abrasions on cam-lock fittings.
- Presence and condition of gaskets inside the female fittings and caps.

f. Suction hose. Perform the same checks as for the discharge hose. The shape of this hose is maintained by steel coils and should be generally round. If the hose is deformed (normally caused by vehicle traffic), use a plebeian hammer to restore its shape.

g. Fittings and valves. Check—

- For cracks in the body of the fitting or valve.
- For leakage at the threads.
- For broken or bent handles on gate valves.

- To ensure that the nut at the top of rising stem gate valve is secure.

h. Gauges and flowmeters. In addition to function checks during normal operations, check for the following:

- Cracked or broken glass.
- The presence of caps and plugs attached by chain and key rings.
- Presence and condition of gaskets inside the female fittings and caps.

5-36. Repair procedures. The water distribution system has an accessory kit that includes the repair parts and tools needed to maintain the system. The kit will be fielded with the rest of the system. It is the user's responsibility to replenish the components as needed.

a. Hose. The repair procedures discussed here apply to both suction and discharge hose. The line repair procedures (see table 5-13 below).

- Broken, torn, or punctured hose. The principal behind repairing damaged hose is to make two good hoses from one damaged hose. Dispose of pieces of hose shorter than 2 feet.
- Hose fittings. Replace missing or damaged caps, plugs, chain, and key rings as needed.

Table 5-13. Hose repair procedure

Hose Repair Procedure	
i.	Use a hacksaw to cut the hose and remove the damaged portion
ii.	Place two hose bands (from accessory kit) over the newly cut end
iii.	Insert a hose coupling in the newly cut end as far as it will go
iv.	The coupling must be the opposite gender of the cam-lock fitting on the other end of the hose
v.	Position the hose bands near the end of the fitting as shown in figure 5-25 below
vi.	Use the banding tool from the accessory kit to tighten the band and trim the excess
vii.	Attach key rings, chain, and caps or plugs
viii.	Repeat steps (ii) through (vi) for the other piece of the hose

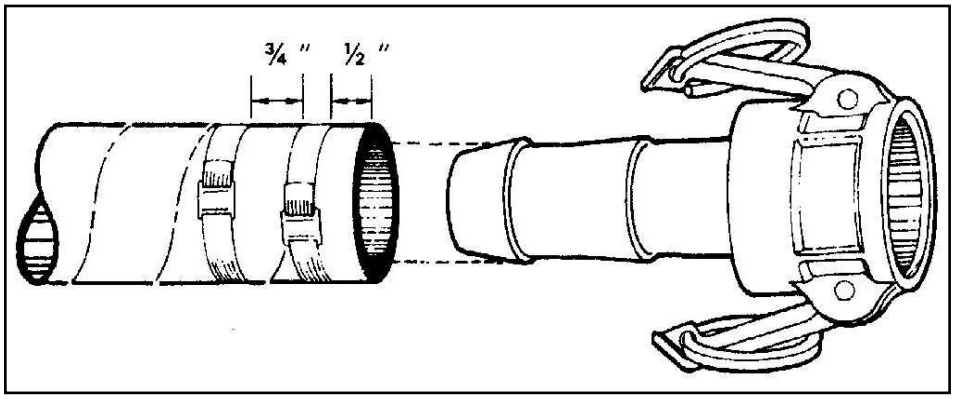


Figure 5-25. Repair of hose

b. Fittings and valves. Replace missing or damaged caps, plugs, chains, and key rings as needed. The fittings and valves are made up of individual parts which must be requisitioned separately. Should a fitting or valve become unserviceable, retain the serviceable parts for use in reassembling the fitting or valve. This can also be applied to the nozzle, flowmeters, and pressure gauge.

c. Hose and fittings storage racks. Defer repair of these items to a general support maintenance activity with the capability of aluminum welding.

d. Hose protection channels. These items are not currently in the supply system. Information about requisition of replacements will be provided when available.

SECTION III – WASTEWATER

5-37. This section discusses the water usage which generally results in wastewater, which in turn, requires disposal. It elaborates on the Water Distribution and Waste Water Management System (WDWWMS) and the Waste Water Management System (WWMS).

WATER SANITATION OPERATIONS

5-38. Depending on the source, wastewater may contain suspended solids and particulate matter, organic material, dissolved salts, biological and pathogenic organisms, and toxic chemical elements. Just the volume alone can cause significant problems in the field.

a. Policy. Army policy requires that all wastewater and water-borne wastes be collected and disposed of in a manner that protects water resources and preserves public health. These procedures must have minimal impact on unit readiness. The Army is required to comply with federal, state, and local environmental pollution and wastewater laws. When operating on Continental United States (CONUS) installations, units must comply with installation environmental regulations. Outside Continental United States (OCONUS), units will have to comply with host country laws and procedures as determined by the theater commander. In a true contingency operation, the theater commander will determine if local environmental laws apply in the area of operations. Regardless of laws and regulations, proper wastewater disposal is essential to protecting the health of the force. Proper disposal precludes the contamination of water supplies and development of rodent and insect breeding sites. Large volumes of wastewater may impact on unit operations; it may even aid the enemy in locating and identifying the unit.

b. Responsibilities. Units generating wastewater in the field are responsible for its collection and disposal. Hospitals are large volume wastewater producers and therefore will normally require engineer support. Theater combat engineers will provide this support during OCONUS deployments or contingency operations. In any event, the commander is responsible for coordinating the proper disposal of wastewater.

c. Factors of consideration. The method of wastewater collection, treatment, and ultimate disposal depends on a number of following factors:

- Volume and characteristics of the wastewater.
- Operational considerations (length of stay at a given site, intensity of combat).
- Geological conditions (type of terrain, soil characteristics, and depth of water table).
- Climatic conditions.
- Engineer support available.
- Accessibility of installation/fixed sewage collection, treatment, and disposal systems.
- Applicability of environmental regulations.

5-39. Sources and collection. Hospitals produce significant volumes of wastewater in relation to the volume of water consumed as specified in paragraphs 5-9 through 5-18. No definitive studies have been done to quantify the volume of wastewater generated by the various hospitals. A conservative estimate for planning purposes is that about 80 percent of all water used (other than human consumption) ends up as wastewater. The largest volumes are generated by laundry, showers, and nutrition care operations. While this wastewater is not unique, it contributes to the total volume requiring collection and disposal. The WDWWMS is the primary means for the receipt and storage of bulk potable water and for wastewater management for the hospital under tactical conditions. The total capacity of waste collection tank for the WDWWMS is 20,000 gallons. Refer to TB MED 577, Sanitary Control and Surveillance of Field Water Supplies for WDWWMS components and more specific information. Refer to Army Training Publication (ATP) 4-25.12, Unit Field Sanitation Teams.

Note. The wastewater collection site must be at least 300 feet (100 yards) from the hospital boundary, and should never be on a higher terrain level than the freshwater tank(s).

a. Waste Water Management Set. The WDWWMS has an entire system of pumps, hoses, fittings, valves and a tank to collect and later dispose of hospital waste water in a safe manner. The WWMS is NOT a loop. It uses gravity and suction to collect the waste water from sinks and drain funnels. The location of Water Distribution Set (WDS) components (Section II) will determine the layout of the WWMS hoses and receptacles. Waste follows potable. Further information regarding the WDWWMS and WWMS can be found at the following link: https://partners.usammda.army.mil/index.cfm/whpe/wdwwms.

Note. The WWMS is not designed to operate in extreme cold. Daily checks should be made to the entire system to ensure it is free of ice and that the system continues to flow. Inspection of the suction pump(s) is (are) mandatory.

CAUTION

In the practice of safe hygiene, it is essential to maintain complete separation of the WDS (Section II) and the WWMS (Section III). There are two (2) colors of Joint Modular Intermodal Containers (JMICs) provided with the WDWWMS for storage of components. Tan JMICS are for WDS components and Green JMICs are for WWMS components. In the event that WDS and WWMS components are co-mingled details on cleaning, disinfecting and decontaminating the components are outlined in TB MED 577, Sanitary Control and Surveillance of Field Water Supplies.

b. Field sinks. Sinks are primary sources of wastewater from staff handwashing, patient hygiene, and instrument cleaning. Sinks are connected to the wastewater management system of the WDWWMS via provided hoses and adapters. This wastewater will be generated intermittently; volumes will vary, depending on the functional area and daily operations. Secondarily, sinks can be operated with the drain line placed in an empty 5-gallon water can if not connected to the WWMS.

CAUTION

Always keep the sink drains plugged when not actually draining water. Leaving them open will degrade the system and may burn out the suction pumps.

Note. Extreme care must be taken to ensure that cans used for wastewater are not confused with those for potable water. Clear labeling and physical segregation are essential. There are two (2) colors of cans provided with the WDWWMS. Tan cans are for potable water and Green cans are for wastewater.

c. Field showers. Field showers are located to support the hospital patients and staff. Quartermaster personnel operating the showers are responsible for collecting and disposing of shower wastewater the hospital general population. In some cases, this disposal may be in conjunction with that of the hospital.

d. Field laundries. Field laundries may also be collocated within the hospitals. They will be the largest source of wastewater. As with showers, quartermaster personnel operating the laundry are responsible for wastewater collection and disposal. Studies are also underway to evaluate the recycling of laundry wastewater.

e. Field kitchens. The hospital kitchen and food sanitation center are a significant source of wastewater. In addition to volume, greases and particulate matter present a complicating factor. As such, grease traps must be constructed to remove food particles and grease before the wastewater is collected and disposed of. Design criteria for filter-type and baffle-type grease traps are in TM 3-34.56, Waste Management for Deployed Forces. They can also be obtained from preventive medicine personnel.

5-40. Disposal. The wastewater disposal method depends on the factors listed in paragraph 5-38c. The options should be considered in each case for following:

- Connection to established installation sanitary sewer system.
- Collection and holding of wastewater for engineer/contractor removal to a fixed treatment facility.
- Engineer construction of semi-permanent wastewater collection and disposal systems.
- Field expedient wastewater disposal systems.

a. Fixed facilities.

- Existing installation disposal facilities should be used in most CONUS training scenarios. This also holds true for many OCONUS noncombat operations, especially in the more developed countries. Existing installation disposal facilities should be used in most training scenarios in the CONUS. A point of contact (POC) should be established with the host nation, via joint task forces (JTF) or civil affairs. In some operations, preplanned hospital sites can take advantage of local sewer systems. Facility engineer assistance is needed to make the required connections and access the system. Pretreatment will not be required since the composition of wastewater is roughly equivalent to that of a fixed installation. Grease traps or filters may be required in areas, such as the dining-facility stream, to remove grease and particulate matter because they could affect the operation of the wastewater pumps.
- If unable to use the installation sewer system, collect wastewater in containers such as expandable pillow tanks or drums. The containers can then be moved to a sewage treatment plant or sanitary sewer access by engineers or contractors. Storage containers, wastewater tank trucks, and pumps are not organic equipment so this option requires extensive prior planning and coordination.
- Semi permanent collection, treatment, and disposal facilities may be possible in permanent training sites and preplanned deployment sites. Small package plants are also available. Extensive engineer support is required to design, construct, and operate such systems.

b. Field facilities.

- Actually may not be permitted in most CONUS training areas or developed countries OCONUS. However, personnel must know how to construct and operate these field expedients, even with limited or no engineer support. Obviously, some engineer support is almost always needed. Earth moving equipment may be necessary due to the volume of wastewater generated. This support must be included in site preparation planning.
- Traditional field expedient disposal methods consist of soakage pits, soakage trenches, and/or evaporation beds. The effectiveness of these methods depends on geological conditions, soil composition, and the climate. These devices, especially soakage pits, are generally constructed for small volumes of wastewater. With proper design and operation, they can be effective for larger volumes. Since these methods result in final disposal, some wastewater pretreatment may be necessary to remove grease, particulate matter, and organic material that might reduce the process effectiveness. Guidance is also available from supporting engineers and preventive medicine. These methods are generally appropriate for short periods only. Consider the alternatives in paragraph 5-40a, if occupying the same site for more than two weeks.
- Soakage or evaporation may be impossible in arctic environments, or under certain geological or climatic conditions. The only alternative may be to collect wastewater in tanks or drums for removal by engineers or contractors. As in paragraph 5-40a, this option requires extensive prior planning and coordination.

SECTION IV – HUMAN WASTE

5-41. This section discusses the importance of protecting the Soldiers and environment, simultaneously, during hospital operations from the result of human waste. This includes planning for fixed facilities, patient facilities and latrines.

SANITATION OPERATIONS

5-42. Proper management of field waste is critical in protecting the health of Soldiers and the environment. Improper handling can create dangerous working conditions, damage vital natural resources, impede mission accomplishment, and cause irreparable harm to training areas. Poor waste management practices can also lead to criminal and civil penalties, substantial cleanup costs, and detract from the military's relationships with local communities and host nations. As a result, the DOD demands integration of environmental considerations into all military planning and decision making. Sound environmental stewardship helps keep the Army relevant and ready. See TB MED 593, Guidelines for Field Waste Management.

a. Policy. Army policy directs that human waste be disposed according to the applicable environmental regulations and good sanitary engineering practices. As with solid waste and wastewater, the Army must comply with federal, state, and local environmental laws for human waste. However, few laws specifically address human waste disposal in the field. Nevertheless, proper human waste disposal is essential and requires command emphasis at all levels.
b. Responsibilities. At installation level, facility engineers are responsible for constructing, maintaining, and operating fixed sewerage systems. The commander is responsible for providing human waste disposal facilities in the field. Engineer support may be required to construct some types of field disposal devices. Refer to TB MED 593.

5-43. Latrine planning considerations.

a. The type of field latrine selected for a given situation depends on a number of factors: number of personnel (staff and patients); duration of stay at the site; and geological and climatic conditions. Preventive medicine personnel and the unit's field sanitation team can assist in determining the appropriate type of latrines, their location, number, and size. Specific guidance on selection and construction is in ATP 4-25.12.
b. Close and mark latrines according to the local policy and good field sanitation practices.
c. Planning for field expedient facilities. The number of users, environmental conditions (type of soil, water table) will determine how many can use the facility and how long it can be used. Caution should be used when using field expedient facilities when operations dictate that a single site will be used for more than 90-days to ensure latrines will be operational the needed period. Factors influencing capacity of field expedient sites are: type of soil (porous vs non-porous), depth of water table (shallow vs deep), volume of hole dug, elevation, and proximity to water source (river, lake, etc.).

5-44. Fixed and installation facilities. As discussed in paragraph 5-40b, the construction and use of field expedient facilities may be prohibited. In such cases, the only option is installation facility engineer and/or contractor support.

a. The option of choice is to establish the hospital in an area with latrine facilities in place and connected to an installation sewage system. This may be possible in permanent training areas or predesignated deployment sites.
b. An alternative option is engineer construction of a stand-alone sewage system and fixed latrines. Again, this may be possible in predesignated training areas or deployment sites.
c. Finally, an option commonly used in CONUS and OCONUS is contract-supported latrine facilities such as chemical toilets or self-contained vault toilets in which a contractor is responsible for emptying the contents on a scheduled basis.

5-45. Patient facilities.

a. Ambulatory patients generally use the same types of latrines as the staff. The number of latrines depends on the number of staff and anticipated patient load. Where possible, staff and patient latrines should be separate. Patient latrines should be close to the wards for convenience of access. They must still maintain the required distance from dining facilities and water sources.

b. Non ambulatory patients require bedpans and urinals. Disposal and bedpan sanitation are of primary concern. One or more hospital latrines should be designated for bedpan disposal. An area must also be designated for bedpan cleaning and sanitation. Do not use hospital sinks for bedpan disposal or washing. The bedpan wash and sanitize area may be established along the lines of a mess kit laundry line. Garbage cans and immersion heaters must be clearly marked that they not be used for any other purpose.

SECTION V – SOLID WASTE (NON-HAZARDOUS)

5-46. This section briefly discusses solid waste policy and responsibilities. It also mentions in what manner to dispose the sources of solid waste.

GENERAL

5-47. The accumulation and disposal of solid waste is a major problem on the AO. Not only does this waste impact on military operations, it may also contribute to environmental contamination. It may serve as breeding sites for rodents and insect disease vectors.

a. Policy. Army policy directs that all solid and hazardous waste (HW) be disposed of in an environmentally acceptable manner. Disposal must be consistent with good sanitary engineering principles and mission accomplishment. The Army is required to comply with federal, state, interstate, and local requirements for the collection and disposal of solid waste. Most legislation is not specifically oriented toward a field environment. Army regulations, though, have substantially adopted the provisions of federal laws that deal with solid and HW. Units on training exercises in CONUS must comply with installation environmental regulations and policies. Outside CONUS, in training or actual contingency scenarios, the theater commander determines the applicability of both US and host country regulations and policies. In all cases, proper waste disposal is required to protect the health of the force.

b. Responsibilities. Depending on the nature and volume of waste, units generating the waste are generally responsible for its collection and disposal. Certain types of waste, as described below, require special handling that may be beyond the unit's capability. Large waste generators, such as hospitals, may not have the resources or equipment to properly dispose of all solid waste. In these cases, installation facility engineers or theater engineers are responsible for solid waste disposal support.

c. Solid waste. This includes:

- Liquid kitchen waste.
- Garbage, rubbish or trash.
- Regulated medical waste (RMW).
- HW.
- Human waste.
- Scrap material, such as wood and metal.
- Used petroleum, oil and lubricant products. These maybe classified as HW under certain conditions.

d. Sources. The primary sources of general waste are routine troop support operations, maintenance and motor pool operations, administrative functions, and field dining facilities. A major effort must be made to reduce the amount of waste generated. This in turn will reduce the burden on disposal systems.

e. Disposal methods. Most general wastes can be transported in unit or contract vehicles to a disposal point, usually a sanitary landfill. Installation facility engineers or theater engineers are responsible for constructing and operating landfills. In most cases, the volume of waste alone is an operational concern. With prior approval and according to the local regulations, small amounts of some general wastes may be burned using field expedient incinerators.

f. Source Reduction and Reuse, Refer to TB MED 593.

g. Recycling, Refer to TB MED 593.

- Food waste from dining facilities may not be hazardous or infectious of itself. However, it can present a serious aesthetics problem as well as a breeding site for disease-carrying rodents

and insects. These wastes must be removed and disposed of as soon as possible, especially in warmer weather.

- Used POL products may be classified as HWs in some cases. Engineer and preventive medicine authorities can advise on legal requirements and disposal procedures. Refer to TB MED 593 for additional guidance on common field waste.

SECTION VI – HAZARDOUS WASTE

5-48. This section briefly HW and special waste disposal of discarded and contaminated materials during hospital operations.

GENERAL REVIEWS

5-49. Certain types of solid waste, especially chemical, are classified as hazardous waste HW. These require special handling, transportation, disposal, and documentation. Engineers and preventive medicine personnel can provide guidance and assistance on HW disposal. Specific guidance for management of HW is in TB MED 593.

a. Hazardous waste. Hazardous waste is a regulatory term for certain discarded materials that are potentially harmful to human health or the environment. Examples of common HWs found in field settings include used solvents, compressed gas cylinders, and contaminated soil from fuel spills.

b. Special waste. Special wastes are discarded materials that do not meet the criteria for classification as an HW, but still pose hazards to human health or the environment. Units must often manage special wastes separately from regular trash. Examples include used oil or antifreeze collected for recycling, alkaline batteries, and asbestos-containing materials.

SECTION VII – MEDICAL WASTE

5-50. This section discusses the different types of medical waste. The management of regulated waste from the accumulation, handling, transportation and its disposal.

REGULATED MEDICAL WASTE

5-51. Regulated medical waste is a term that describes wastes generated by medical, veterinary, and dental treatment facilities in the diagnosis, treatment, research, or immunization of human beings or animals which are potentially capable of causing disease, and may pose a risk to either individuals or community health if not handled or treated properly. Do not assume that all hospital waste is RMW which requires special disposal. Specific guidance for management of HW is in TB MED 593.

a. Isolation waste. Wastes generated by hospitalized patients who are isolated to protect others from highly communicable diseases. Includes all discarded materials contaminated with blood, excretion, exudates, or secretions.

b. Microbiological waste. Cultures and stocks of infectious agents. These include specimens, discarded vaccines, and culture dishes from hospital laboratories.

c. Blood and blood products. All waste blood and blood-related products. Examples are blood bags, blood tubes, and material contaminated with blood.

d. Contaminated sharps. Used hypodermic needles, syringes, pipettes, glass tubes, and scalpel blades. In addition to the physical hazard, the potential for transmission of pathogenic organisms in the event of a puncture wound is high. Discarded, but unused, sharps should also be included because of the same puncture hazard. It is also difficult to distinguish between used and unused material.

e. Surgical waste. Waste material contaminated with blood and other body fluids from surgical cases. Examples include soiled dressings, sponges, drapes, drainage tubes, and surgical gloves.

f. Pathological waste. This includes tissues, organs, and body parts removed during surgery or autopsy. Human corpses are not considered pathological waste. Human remains are handled through graves registration channels.

5-52. The accumulation sources will come from the various patient care areas, especially the EMT/triage, OR, SPD, and ICU, are major sources of medical waste. All patient care areas contribute, though, as well as ancillary functions such as the laboratory. There have been no definitive studies on solid waste generated in a field environment. However, rough estimates of 15 pounds per bed per day (not all medical waste) may be used as a guide. The actual amount of medical waste generated depends on the intensity and nature of medical operations.

5-53. Handling.

a. The key to an effective hospital solid waste program is the segregation of medical waste from general waste at the point of generation. Medical waste is collected in impervious containers with tight fitting lids. It is marked with the universal biological hazard symbol, see figure 5-26 below, or otherwise clearly labeled according to the unit SOP. Containers should be double lined with colored plastic bags or otherwise clearly marked to distinguish medical waste from general waste. All bags are sealed by lapping the gathered open end. They are bound with tape or a closure device to prevent liquids from leaking. Place sharps in rigid, clearly marked, puncture resistant containers. Needle/syringe clippers are no longer authorized. Blood, blood products, and semisolid waste is placed in unbreakable capped or stoppered containers. Medical waste is stored in designated areas that are secured or under direct physical control. It should not remain at the point of generation more than 24 hours or in storage areas more than 72 hours.

b. Medical waste is transported within the hospital in rigid, leak-proof containers. The containers are marked and used exclusively for the transport of medical waste. Vehicles transporting medical waste to a disposal site should, if possible, be used exclusively for medical waste. If used for other purposes, the vehicle must be thoroughly cleaned and sanitized before use.

Figure 5-26. Universal Biological Hazard symbol

5-54. Disposal. The purpose of proper treatment and disposal of medical waste, see table 5-14 on page 5-36 is to render it nonpathogenic and/or inaccessible. Depending on the quantity and type of waste, applicability of regulations and policies, and the availability of appropriate disposal facilities and engineer support, the options are available include:

a. Environmental regulations in CONUS and in many OCONUS locations prohibit the disposal of medical waste via field expedient methods. Furthermore, the quantities and types of medical waste generated during training are relatively small due to limited actual patient care. As such, the option of choice is to transport medical waste to the installation medical facility for treatment and disposal. While this does not provide ideal training, it may be the only realistic option available. Internal requirements for proper segregation and handling remain critical. It should be an essential part of training.

b. Some types of RMW, particularly small quantities, can be rendered noninfectious by steam sterilization. This is especially appropriate for laboratory waste such as cultures, culture plates, and blood tubes. To ensure complete disinfection, the sterilizer must operate at a minimum of 250°F (121°C) for 90 minutes. Appropriate biological indicators should be used to demonstrate sterilization effectiveness. Waste that has been properly steam sterilized is considered general waste. It can be disposed of as such, if state and local regulations permit.

c. Controlled incineration is the best method for most types of medical waste. However, proper incineration requires incinerators that are specifically designed for the various types of medical waste. Pathological incinerators are necessary to completely burn pathological waste with a high moisture content, such as tissues and body parts. A two-chamber incinerator, capable of producing temperatures in excess of 2000°F (1093°C) is required for all other medical waste. Obviously, these incinerators do not exist in the field. They are quite often not available even at the installation. A fielded product, however, may be several years in the future. With prior approval from higher headquarters, field expedient incinerators may be used. An inclined plane incinerator can be constructed to burn small amounts of medical waste. Controlled open burning is an option if no other options are available. All other options must be thoroughly considered prior to open burning though. In all cases, ash from waste incineration must be properly buried.

d. As a last resort, if local regulations permit, medical waste can be buried in a properly designed and operated landfill. Engineer support is required for landfill design and construction. The waste must be covered immediately after disposal to ensure inaccessibility. All previous options should be pursued prior to accepting this option. Close coordination with engineers, preventive medicine personnel, and local authorities is essential.

Table 5-14. Treatment and disposal of medical waste

Treatment and disposal methods for types of RMW	Method of treatment	Method of disposal
Microbiological	Steam sterilization[1] Chemical disinfection Incineration	Municipal landfill Municipal landfill Municipal landfill
Pathological	Incineration[2] Cremation[2] Chemical sterilization[3] Steam sterilization[3]	Municipal landfill burial Domestic wastewater treatment plant Domestic wastewater treatment plant
Bulk blood & suction canister waste	Steam sterilization[4] Incineration[4]	Domestic wastewater Treatment plant Municipal landfill
Sharps and sharps containers	**Steam sterilization** **Incineration**	**Municipal landfill** **Municipal landfill**
1. Preferred method for cultures and stocks because they can be treated at point of generation.		
2. Anatomical pathology waste (that is, large body parts) must be treated either by incineration or cremation prior to disposal.		
3. This only applies to placentas, small organs and small body parts that may be steam sterilized or chemically sterilized, ground, and discharged to a domestic wastewater treatment plant.		
4. Bulk blood or suction canister waste known to be infectious must be treated by incineration or steam sterilization before disposal.		

GENERAL

5-55. Finally, this section on field waste briefly states that it is imperative to use proper human waste disposal to prevent disease during contingency operations and training exercises.

SECTION VIII – FIELD WASTE

5-56. A camp or bivouac site without proper waste disposal methods can quickly become an ideal breeding ground for flies, rats, and other vermin and may result in disease among Soldiers. There are several methods available for human waste disposal; however, it is important to do so properly based on local, state, Federal, and host nation regulatory requirements. See ATP 4-25.12 for specific information and guidance on the proper construct, use of latrines, urinals and wastewater disposal.

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Chapter 6
Other Considerations

Several other considerations are important when providing Role 3 hospitalization support. Army Health System support planning, medical evacuation, the Law and of Land Warfare, and nutrition care operations are important factors to consider.

GENERAL

6-1. The following content is about planning, medical evacuation, the Law of Land Warfare, the Geneva Conventions of 12 August 1949, and medical field feeding operations. Metric conversion is located in Appendix C.

PLANNING

6-2. Planning is an essential element, which facilitates the successful accomplishment of the MEDCoE mission. The medical planner, by carefully applying MEDCoE doctrine and principles, is able to provide the best for all Army operations. The MEDCoE provides support to forces deployed across the full range of military operations with its various operational arrangements. It is a system-of-systems of interrelated and interdependent medical functions which provide a continuum of medical treatment from point of injury or wounding through successive roles of medical care to definitive, rehabilitative, and convalescent care in the area of operations, as required. The medical functions align with medical disciplines and specialty training with the capabilities required to provide state-of-the-art care to Soldiers regardless of where they are deployed or assigned.

6-3. Reference ATP 4-02.55, Army Health System (AHS) Support Planning, provides guidance to the medical commander, medical planner, and command surgeon at all levels of command in planning support for unified land operations. The medical commanders, command surgeons, their staffs, and nonmedical commanders involved in medical planning are the principal audience for this publication. Commanders, staffs, and subordinates ensure their decisions and actions comply with applicable U.S., international, and in some cases, host-nation laws and regulations, see ATP 4-02.55.

a. Provides an overview of the characteristics of the AHS, its principles, functions, the role of medical care, and medical planning factors. It also discusses the fundamental aspects used by medical planners to determine the best possible AHS to support Army operations.
b. Describes the medical functions and how they are aligned with specific medical disciplines of HSS or force health protection or sustainment medical tasks. It also provides the primary purposes of the functions to give the medical planner a planning reference point to work from.
c. Provides guidance for some of the unique complexity inherent to AHS planning. It also provides a brief review of and references the Army planning process and how it applies to AHS planning.
d. Discusses some of the many different and unique factors, terms, and computation the medical planner can use to develop the AHS estimate.
e. Provides a detailed example of estimate with planning considerations.
f. Provides an explanation of rate calculations and provides some of the more commonly used rate formulas.
g. Provides an example and guidance on the preparation of an operation order or operation plan.
h. Provides the methodology to manually calculate hospital bed requirements.

6-4. For additional information see ATP 4-02.55.

MEDICAL EVACUATION

6-5. Medical evacuation operations are relevant to ATP 4-02.2. It provides doctrine and techniques for conducting medical evacuation and medical regulating operations. Medical evacuation encompasses both the evacuation of Soldiers from the point of injury (POI) or wounding to a MTF staffed and equipped to provide essential care in theater and further evacuation from the theater to provide definitive, rehabilitative, and convalescent care in CONUS and the movement of patients between MTFs or to staging facilities. Medical evacuation entails the provision of en route medical care; supports the joint HSS system; and links the continuum of care. In addition, it discusses the difference between medical evacuation and casualty evacuation (CASEVAC), as well as coordination requirements for and the use of nonmedical transportation assets to accomplish the CASEVAC mission. Army Training Publication 4-02.2, Medical Evacuation, contains the following:

- Theater Evacuation Policy.
- Medical Evacuation Resources.
- Operational and Tactical Evacuation Planning.
- Army Medical Evacuation.
- Medical Evacuation in Specific Environments.
- Medical Regulating.

6-6. For additional information see ATP 4-02.2.

THE LAW OF LAND WARFARE

6-7. The Law of Land Warfare provides authoritative guidance to military personnel on the customary and treaty law applicable to the conduct of warfare on land and to relationships between belligerents and neutral states. Although certain of the legal principles set forth herein have application to warfare at sea and in the air as well as to hostilities on land, this manual otherwise concerns itself with the rules peculiar to naval and aerial warfare only to the extent that such rules have some direct bearing on the activities of land forces. Topics covered include Basic Rules and Principles, Hostilities, Prisoners of War, The Wounded and Sick, Civilian Persons, Occupation, Non-Hostile Relations of Belligerents, Remedies for Violation of International Laws; war crimes and Neutrality. The conduct of armed hostilities on land is regulated by the Law of Land Warfare. This body of law is inspired by the desire to diminish the evils of war by which include:

- Protecting both combatants and noncombatants from unnecessary suffering.
- Safeguarding certain fundamental human rights of persons who fall into the hands of the enemy, particularly detainees or EPWs, the wounded and sick, and civilians.
- Facilitating the restoration of peace. The Law of Land Warfare places limits on the exercise of a belligerent's power in the interest of furthering that desire (diminishing the evils of war).
- Refraining from employing any kind or degree of violence, which is not actually necessary for military purposes.
- Conducting hostilities with regard for the principles of humanity and chivalry.

For additional information refer to DoD Directive 2311.01, DoD Law of War Program, Field Manual (FM) 6-27, The Commander's Handbook on the Law of Land Warfare and ATP 4-02.5, Casualty Care.

GENEVA CONVENTION

6-8. The U.S. is a party to the Geneva Convention of 12 August 1949. These international treaties afford protection for medical personnel, facilities, and evacuation platforms (to include aircraft on the ground). All medical personnel should thoroughly understand the provisions of the Geneva Convention that apply to medical activities. Violation of these conventions can result in the loss of the protection afforded to them. Medical personnel should inform the operational commander of the consequences of violating the provisions of these conventions. The consequences can include the following:

- Medical evacuation assets subjected to attack and destruction by the enemy.
- Medical capability degraded.
- Captured medical personnel becoming POWs rather than detained persons. They may not be permitted to treat fellow prisoners.

- Loss of protected status for medical unit, personnel, or evacuation platforms (to include aircraft on the ground).

6-9. Other concerns for Geneva Convention include:

a. Loss of protection of medical establishments and units. Medical assets lose their protected status by committing acts "harmful to the enemy." (Article 21, Geneva Convention Relative to the Treatment of Prisoners of War [GWS].) A warning must be given to the offending unit and a reasonable amount of time allowed to cease such activity.

b. Acts harmful to the enemy. The phrase "acts harmful to the enemy" is not defined in the convention, but should be considered to include acts the purpose or effect of which is to harm the enemy, by facilitating or impeding military operations. Such harmful acts would include, for example, the use of a hospital as a shelter for able-bodied combatants, as an arms or ammunition dump, or as a military observation post. Another instance would be the deliberate sitting of a medical unit in a position where it would impede an enemy attack.

c. Warning and time limit. The enemy has to warn the unit to put an end to the harmful acts and must fix a time limit on the conclusion of which he may open fire or attack if the warning has not been complied with. The phrase in all appropriate cases recognizes that there might obviously be cases where no time limit could be allowed. A body of troops approaching a hospital and met by heavy fire from every window would return fire without delay.

d. Use of smoke and obscurants. The use of smoke and obscurants during medical evacuation operations for signaling or marking landing zones does not constitute an act harmful to the enemy. However, employing such devices to obscure a medical element's position or location is equivalent to camouflaging; it would jeopardize its entitlement privilege status under the GWS. Refer to Army ATP 4-02.2 for additional information on the use of smoke and obscurants for medical evacuation operations.

MEDICAL FIELD FEEDING OPERATIONS

6-10. The Army Medical Field Feeding System (AMFFS) was constructed to support nutrition's role in patient care. The goal is to maximize food service technological advances to support the hospital center. Due to the complexity of medical field feeding, it is crucial that nutrition care personnel be involved in the initial planning of any field exercise and as far in advance as is practical for deployments. Medical field feeding impacts: hospital layout, transportation requirements, water supply, supply of cleaning and sanitizing agents, nutrition team staffing, operational rations procurement, and patient specific therapeutic nutrition rations and supplies procurement needed to support the variety of patients' medical conditions. Operational rations, and supplemental rations and supplies for feeding patients must be ordered in advance to ensure availability.

a. System description. The AMFFS is designed to support hospital nutrition care services including: feeding patients, using operational rations and therapeutic nutrition rations as needed; provide medical nutrition therapy to support the patient's care plan; consult with the commander on nutrition-related health and performance issues, as well as feeding the staff working in the hospital center. The nutrition and nutrition issues related to the local population if deemed appropriate; support nutrition-focused health promotion; and, team, composed of nutrition care specialists and a registered dietitian must maintain the critical wartime skills and readiness of all section equipment and supplies for deployments.

b. Equipment preparation. The tools for preparation, service and sanitation measures in this equipment support the modernization of medical treatment efforts for the hospital center in a 24-hour operations. This support includes the capability to create modified diet meals and forced fluids for hospitalized patients using operational rations ordered from the DOD.

c. Components. The major system components used are the Containerized Kitchen (CK), Field Sanitation Center (FSC), modern burner unit version three, and the multi-temperature refrigerated container system. The CK and required supplementary equipment must be maintained in serviceable condition at all times. Supplementary equipment, such as blenders for supporting blenderized diets, are critical to support the medical nutrition therapy and thus patient's nutritional status during hospitalization.

Containerized Kitchen

6-11. The CK is a mobile, self-contained field kitchen configured in an 8 ft. x 8 ft. x 20 ft. ISO container. It is designed for the Army's divisions and those units requiring high mobility. It can be set up in approximately 45 minutes by four trained Nutrition Care Specialists (68M). It is capable of preparing all Army field rations, including perishables when augmented with refrigeration. The kitchen consists of standard field cooking equipment protected by the ISO Container structure.

Food Sanitation Center

6-12. Food sanitation center is for sanitizing utensils and equipment used with the CK. The FSC requires water and JP-8 modern burner units (MBU's) to operate. It can be set up in separated or connected tents to increase kitchen sanitation capability. There are two types of FSCs, the FSC-90 (NSN 7360-01-277-2558) and the upgraded model, FSC-2 (NSN 7360-01-496-2112). This equipment can be ordered to support the hospital. This system is superior to, and is replacing, the fuel/water/labor mess kit laundry. More information on the FSC can be found in TM 10-7360-211-13&P. The FSC consists: of the following major components.

Modern Burner Unit

6-13. The MBU is the primary heat source for the kitchen and sanitation equipment found within all Army field feeding systems. Details on this equipment can be found in TM 10-7310-281-13&P.

Multi-Temperature Refrigerated Container System (MTRCS)

6-14. The MTRCS is an 8 ft. x 8 ft. x 20 ft. insulated container capable of storing and transporting temperature sensitive cargo. The MTRCS is designed to keep perishable food items at an appropriate storage temperature during transport over land or sea. This unit setup includes an electric motor-driven refrigeration unit, powered by a diesel engine or external power source. The MTRCS also consists of an insulated container with an electrical and multi-fuel capable mechanical refrigeration unit and internal partition allowing the interior of the insulated container to be divided internally into both frozen and chilled compartments.

6-15. The CK structures itself as an expandable structure. The FSC is comprised, currently, from either a small tent or Modular General Purpose Tent System tent with an internal Y-pole. The tents are components of the FSC and will come included with the order of the NSN annotated for FSC.

6-16. Employment of the AMFFS.

a. The allocation of equipment modules and support equipment is based on the number of meals required to support staff and patients. A CK is capable of preparing and serving up to 800 Army field menu meals up to three times per day.
b. A nutrition and diet therapy team in a hospital center consists of two CKs, two FSCs and one MTRCS. When set up, the AMFFS is set up away from the hospital center according to the field sanitation guidelines.

6-17. Support equipment. Other support equipment items for the medical field feeding operations are the Light Medium Tactical Vehicle; 1 ½ ton trailer, Flat Rack, 10 kW Generator; 400-gallon water trailer or other water supply equipment. For additional information on policies, guidelines and dietary needs of patients, see ATP 4-02.5 and TC 8-502 for Nutrition Care Operations.

Appendix A

Planning Checklist

While there are numerous ways commanders and staffs plan and execute medical support operations, there are many helpful tools to guide their processes. Checklists are invaluable in ensuring details are considered prior to the execution of a task or response to an event.

SECTION I – PLANNING AND ADMINISTRATION

a. Warning order issued to subordinate commanders.
b. Route reconnaissance accomplished and reported.
c. Quartering party dispatched.
d. Quartering party report for units with communications capability.
e. March table, march order, graph, and strip map prepared.
f. Additional transportation requested to move the unit, if required.
g. Loading plans checked.
h. Personnel and equipment inspection completed.
i. Class I, Class III, and Class V supply requirements identified.
j. Personnel briefed on the operation.
k. Preparatory maintenance accomplished.
l. Weight markings on all vehicles.
m. Knowledge of situation by individual Soldiers.
n. Communications checked.
o. Weapons checked.
p. First and last vehicles of convoy properly marked.
q. Area secured during planning.
r. Safety briefing conducted.
s. Strip maps issued.
t. Convoy control numbers.
u. Vehicle fuel tanks filled.
v. Compliance with readiness requirements of higher headquarters for unit deployment.

SECTION II – TRAINING MOTOR MARCH

a. Entrucking.
b. Assembling of column.
c. Cross the start point (SP) on schedule.
d. Control of column and communications.
e. Halts (timing and locations).
f. Security during march and halts.
g. Maintenance en route and at halts.
h. Guides and route markings established.
i. Rate of march.
j. Adherence to local traffic regulations.
k. Accident reporting.
l. Passive defense measures during march and halts.
m. Proper distance between vehicles.
n. Cross release point (RP) on schedule.

SECTION III – OCCUPATION AND ORGANIZATION FOR DEFENSE

a. Action of quartering party at bivouac site.
b. Smoothness and discipline of operation.
c. Dispersion of personnel and vehicles.
d. Detrucking.
e. Initial security outposting.
f. Organization and coordination of ground fire plan.
g. Rapidity of operation, interior arrangements: supply, mess, command post (CP), latrines, and others.
h. Adequacy of defense and warning systems.
i. Use of natural cover and concealment.
j. Communication and control within the perimeter.
k. Maintenance undertaken on arrival in operational area.
l. Vehicles refueled.
m. Vehicles tactically parked.
n. Unit SOP or prearranged plan for occupying field location.
o. Active defense measures including password and challenges.
p. Passive defense measures.

SECTION IV – TACTICAL MOTOR MARCH

a. Dissemination of situational information to subordinate leaders.
b. Entrucking and detrucking of personnel.
c. Proper loading of cargo carriers.
d. Timely clearance of area.
e. March safety precautions.
f. Proper formation of columns.
g. Light and noise discipline.
h. Adequacy of prearranged plans and/or SOP.
i. Guides and/or route markers posted.
j. Driver proficiency.
k. Coordination and control.
l. Security of march column.
m. Adherence to march column.
n. Knowledge of situation by individual Soldiers.
o. Selection of SP, critical points, and RP.
p. Passive defense measures during march and at halts.
q. Proper distance between vehicles in column.
r. Reports properly prepared and submitted.
s. Unit's capability to perform mission after march.

SECTION V – ROADBLOCK

a. Personnel react according to the convoy SOP.
b. Dismounting of personnel.
c. Dispersion of vehicles.
d. Organization for reaction against roadblock.
e. Movement and deployment of squads.
f. Roadblock and vicinity checked for mines and booby traps.
g. Mines and booby traps removed correctly.
h. Disposition of removed mines and booby traps.
i. Emergency treatment of assessed casualties.
j. Reporting of casualties, equipment damage, and intelligence information to higher headquarters in a situation report (SITREP).
k. Reorganization and continuation of march.

SECTION VI – OCCUPATION AND ORGANIZATION FOR TECHNICAL OPERATIONS

a. Action of quartering party including handling of incoming column.
b. Smoothness and rapidity of complexing for technical operation.
c. Suitability of location for control, coordination, and supervision of assigned units.
d. Interior arrangements: CP, supply, latrines, mess, and others.
e. Local communications installation.
f. Use of natural concealment features (passive defense).
g. Organization and coordination of ground fire plans.
h. Coordination with adjacent units on area defense plan.
i. Adequacy of perimeter defense and warning system.
j. Vehicle dispersion and maintenance operations.
k. Vehicles refueled.
l. Vehicles tactically parked.
m. Unit SOP or prearranged plan for occupying field location.
n. Unit SOP for patient security during attack.
o. Unit SOP for unloading ground and air evacuation vehicles.
p. Handling of wounded enemy prisoners of war (EPWs).
q. Handling of contaminated patients.
r. Handling of psychiatric patients.
s. Handling of patients requiring quarantine.

SECTION VII – ENEMY NUCLEAR ATTACK

a. Passive defense measures to include use of foxholes, ditches, vehicles, and other shielding materials.
b. Monitoring and reporting dose rates.
c. Warning procedures in contaminated areas.
d. Procedures for operating in or crossing contaminated areas, to include preparation of vehicles and equipment.
e. Collection of radiological intelligence.
f. Reporting of casualties, equipment damaged, and intelligence information.
g. Ability to handle, sort, and decontaminate patients from a contaminated area.
h. Radiological survey methods.
i. Decontamination procedures for individuals, equipment, supplies, and immediate ground area.
j. Reorganization of the unit, replacement requirements for personnel and supplies, and use of immediate ground area.
k. Triage and emergency treatment of assessed casualties.
l. Ability to cope with large and/or unexpected patient loads.
m. Dispersal to reduce vulnerability to nuclear attack.
n. Planning for alternate positions.
o. Action for clarity of orders issued by unit leaders.

SECTION VIII – CHEMICAL ATTACK

a. Adequacy of detection systems and warning procedures.
b. Adequacy of SOP for defense against chemical agents.
c. Actions of individuals during and after chemical attack.
d. Reporting of casualties, equipment damage, and intelligence information.
e. Immediate and proper first aid for assessed casualties.
f. Decontamination procedures (individual and collective).
g. Ability to maintain technical operations.
h. Ability to cope with large and/or unexpected patient loads.
i. Check and replacement of personnel, equipment, and supplies.
j. Mess operations in chemical situation.

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Appendix B

Movement Data Transportation Weights and Measures

Hospitals have a lot of equipment that must be maintained, prepared for deployment, and transported to an area of operations. Detailed information about the weight and size is important for the planning of these activities.

SECTION I – INDIVIDUAL COMPONENTS

B-1. See table B-1 below for individual components.

Table B-1. Individual components

LIN	ITEM	LENGTH	INCHES WIDTH	HEIGHT	POUNDS WEIGHT	FEET CUBE
L28351	Kitchen Field, Trailer Mounted	177.4	92.8	93.8	4,200	893.6
L48315	Laundry Unit, Trailer Mounted	198.0	96.0	93.0	9,010	1,023.0
T05028	Truck, Utility 3/4 T, M1009	191.4	85.4	75.0	5,220	709.4
T49255	Truck, Fork Lift	166.0	79.0	78.0	9,7000	592.0
T59346	Truck, Cargo, 5/4 T, M1008	216.5	79.6	75.8	5,7000	756.0
T59482	Truck, Cargo, 5/4 T, M1008	216.5	79.6	75.8	5,900	773.1
V19950	Tank Unit, Trailer Mounted	72.5	61.0	56.0	410	143.3
W95537	Trailer, Cargo, 3/4 T	147.0	73.5	50.0	1,350	312.6
W95811	Trailer, Cargo, 1 1/2 T	166.0	83.0	55.0	2,670	438.5
W98825	Trailer, Tank, Water	161.4	83.0	76.0	2,260	589.2
X40009	Truck, Cargo, 2 1/2 T	264.8	95.4	80.8	13,180	1,181.2
X40794	Truck, Cargo, 5 T	313.1	97.5	86.1	22,020	1,521.1
X63299	Truck, Wrecker, 5 T	354.4	98.3	105.0	34,820	2,116.9
J35801	Generator, 100 kw	195.5	97.0	82.1	8,550	901.0
D34883	Dolly Set, M1022	197.5	96.0	110.0	5,580	653.0
M72936	ISO, MMS, OR	240.0	96.0	96.0	14,143	1,280
M72482	ISO, MMS, Lab	240.0	96.0	96.0	13,474	1,280
M48737	ISO, MMS, Blood Bank	240.0	96.0	96.0	16,387	1,280
X90968	ISO, MMS X-ray (LC)	240.0	96.0	96.0	9,320	1,280
M47987	ISO, MMS, Med Maint.	240.0	96.0	96.0	9,548	1,280
M73118	ISO, MMS, Pharmacy	240.0	96.0	96.0	8,923	1,280
M08417	ISO, MMS, SPD	240.0	96.0	96.0	13,140	1,280.0
X38238	ISO, MMS, X-ray,	240.0	96.0	96.0	14,152	1280.0
Z02020	Air Conditioner/Heater AE 32C-39	71.0	48.0	32.0	920	63.1

SECTION II – HOSPITAL SYSTEMS (MEDICAL AND NONMEDICAL)

B-2. See table B-2 below for hospital systems.

Table B-2. Hospital systems (medical and non-medical systems)

System:	Combat Support Hospital
Cubic Feet:	51,757
Short Tons:	318.0
Measurement Tons:	1,294.0
System:	Hospital Center
Cubic Feet:	106,661
Short Tons:	794.0
Measurement Tons:	2,667

Appendix C

Metric Conversion

Hospitals often operate in areas where the metric system is more common. Therefore, hospital personnel may need to convert size, weight, distance and other measurements in requests for support from other than United States forces.

See table C-1 below for converting to metric system.

Table C-1. Metric conversion

U.S. TO	METRIC	MULTIPLY BY
acres	square meters	4047
BTU	kilowatt hour	2.928×10^{-4}
cubic feet	cubic meter	.0283
Fahrenheit	Celsius	(oF-32) x 5/9
feet	meters	.3048
foot pounds	kilogram per meter	.1383
gallons	liters	3.785
horse power	watts	745.7
inches	centimeters	2.54
knots	kilometers per hour	1.85
miles	kilometers	1.609
pounds	grams	453.59
quarts	liters	.9463
square feet	square meters	.0929
square miles	square kilometers	2.59
tons (long)	kilograms	1016
tons (short)	kilograms	907

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Glossary

Use chapter intro style for glossary introduction.

SECTION I – ACRONYMS AND ABBREVIATIONS

AHS	Army Health System
AIT	Advanced Individual Training
AMEDD	Army Medical Department
AMFFS	Army Medical Field Feeding System
AO	Area of Operations
AR	Army Regulation
ASD (HA)	Assistant Secretary of Defense (Health Affairs)
ATP	Army Techniques Publication
BTU	British Thermal Unit
CASEVAC	Casualty Evacuation
CBRN	Chemical, Biological, Radiological, Nuclear
CK	Containerized Kitchen
CONUS	Continental United States
CP	Command Post
CSH	Combat Support Hospital
DA	Department of Army
DES	Dental Equipment Set
DFIS	Dental Filmless Imaging System
DISE	Distribution Illumination System Electrical
DLA	Defense Logistics Agency
DMSB	Defense Medical Standardization Board
DOD	Department of Defense
DODD	Department of Defense Directive
ECU	Environmental Control Unit
EMT	Emergency Medical Treatment
EPW	Enemy Prisoner of War
FDECU	Field Deployable Environmental Control Unit Model
FM	Field Manual
FMTV	Family of Medium Tactical Vehicles
FSC	Field Sanitation Center
FY	Fiscal Year
GP	General Purpose
GPM	Gallons per Minute
GWS	Geneva Convention Relative to the Treatment of Prisoners of War
HR	Hour

HSS	Health Service Support
HVAC	Heating, Ventilation and Air Conditioning
HW	Hazardous Waste
IASH	Improved Army Space Heater
ICU	Intensive Care Unit
JMICs	Joint Modular Intermodal Containers
ICW	Intermediate Care Ward
IECU	Improved Environmental Control Unit
IFR	Individual Field Ration
ISO	International Organization for Standardization
kW	Kilowatt
LCPT	Lightweight Collapsible Pillow Tank
LHS	Land Handling System
LIN	Line Item Number
LTP	Large Tactical Power
MBU	Modern Bureau Unit
MCW	Minimal Care Ward
MEDCoE	Medical Center of Excellence
MIL-STD	Military Standard
MILVAN	Military-Owned Demountable Container
MMS	Medical Material Set
MTF	Medical Treatment Facility
MTV	Medium Tactical Vehicle
MTRCS	Multi-Temperature Refrigerated Container System
MUST	Medical Unit, Self-Contained, Transportable
MVS	Monitor Patient Vital Signs
MOG	Medical Oxygen Generator
NSN	National Stock Number
OB/GYN	Obstetrics and Gynecology
OCC	Orthopedical Cast Clinic
OCONUS	Outside Continental United States
OGFP	Oxygen Generator Field Portable
OR	Operating Room
OT	Occupational Therapy
PDC	Power Distribution Center
PDISE	Power Diustribution Illumination Systems Electrical
POI	Point of Injury
POL	Petroleum, Oil, and Lubricants
PIV	Pump Intravenous Infusion
PMCS	Preventive Maintenance Checks and Services
PODS	Patient Oxygen Distribution System
POST-OP	Postoperative
PRE-OP	Preoperative

PSI	Pounds Per Square Inch
PT	Physical Therapy
RMW	Regulated medical Waste
RS	Release Point
RTCH	Rough Terrain Container Handler
RTD	Return to Duty
SITREP	Situation Report
SOP	Standard Operating Procedure
SP	Start Point
SPD	Sterile Processing Department
TAS	TEMPER Air Supported
TB MED	Technical Bulletin Medical
TC	Training Circular
TM	Technical Manual
TOE	Tables of Organization and Equipment
TRADOC	Training and Doctrine Command
TQG	Tactically Quiet Generator
UA	Unit of Allowance
U.S.	United States
VAC	Volt Alternating Current
WDS	Water Distribution Set
WDWWMS	Water Distribution and Waste Water Management System
WWMS	Waste Water Management System

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TC 8-13
25 February 2021

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