CHAPTER 11

PRE-ENGINEERED STRUCTURES: SHORT AIRFIELD FOR TACTICAL SUPPORT

The Short Airfield for Tactical Support (SATS) is a rapidly constructed expeditionary airfield that can be erected near a battle area to provide air support for amphibious Marine forces. In any land-and-sea military/contingency operation, the rapid assembly of a temporary airfield provides ground units with the distinct advantage of continuous air support on foreign soil. Because of this, the Marine Corps has been trying several types of expeditionary airfields since early in World War II. Initial research used wooden planking for the runway surface. Later, during the Korean Conflict, aircraft actually landed on pierced steel mats, known as “Marston matting.”

One of the more important breakthroughs in SATS research was the development of Short Expeditionary Landing Field (SELF). SELF, a bulky predecessor of SATS, was a 4,000-foot runway that served as the landing area. In earlier expeditionary arresting operations, the Marine Corps had been successful with the M-2 Mobile Arresting Gear (MOREST). However, the weight of this gear (74,000 pounds) decreased its usefulness as a portable unit.

In 1956, the Commandant of the Marine Corps established exact specifications for the development of a portable expeditionary airfield. This proposed airfield was to be 1,000 feet long, construction completed in 5 days, and capable of accommodating one squadron of aircraft for 30 days. Additionally, the Marine Corps required that the field be designed to allow both launch and recovery (arresting) operations. These standards included the development of a land-based catapult and lighter arresting gear to replace the M-2 MOREST. In 1958, the runway specification was expanded to 2,000 feet and received official SATS designation. However, because the catapult and arresting gear are no longer available in the ABFC (Advanced Base Functional Components) System, they are not discussed in this chapter.

Because Steelworkers can be assigned to crews assigned to place airfield matting, we will discuss the important parts of SATS. Also, the proper placement procedures for AM-2 matting are discussed and information is also provided on the installation and repair and removal of AM-2 matting.

PARTS OF SATS FIELD

A SATS field incorporates numerous parts. We will not attempt to cover all the parts of a SATS installation but will cover enough to make you familiar with the function of each of the major parts that make a SATS field an effective system.

AM-2 MATTING

The AM-2 mat (fig. 11-1) is a fabricated aluminum panel, 1 1/2 inches thick that contains a hollow, extruded, one-piece main section with extruded end connectors welded to each end. (AM-2 mats may also be fabricated in two- and three-piece main panel extrusions that, when welded longitudinally, form the same size and shape as the one-piece extrusion.) The AM-2 mat comes in full sheets and half sheets and is painted Marine Corps green. The top surface is coated with a nonskid material of the same color. For runways and taxiways, the mats are installed in a brickwork type of pattern. The staggered joint arrangement provides the required stability across the runway and the necessary flexibility in the direction of aircraft travel.

Figure 11-1.—AM-2 mat.
The sides of the mat panels are constructed to interlock with a rotating motion. The end connectors are arranged with the prongs up on one end and down on the other (fig. 11-1 section A-A). By placing the end connector of one mat properly over the end connector of the previous mat, you can form a continuous layer of matting. A flat-locking bar is then inserted into the slot common to the two mats to form a nonseparable joint.

The physical characteristics of AM-2 matting are shown in table 11-1.

AM-2 mats are packaged in two standard pallet loads for storage and shipment. One pallet assembly, designated F11, consists of 11 full-length mats, 2 half-length mats, and 13 locking bars (fig. 11-2). The other mat pallet, designated F15, contains 16 full-length mats, 4 half-length mats, and 20 locking bars (fig. 11-3). The pallets are fabricated end frames that are held together by tie rods or strapping. The end frames fit around the ends of the mats and become the storage place for the locking bars.

The quantity of mats found in the standard pallet assembly (F11) provides a width of two rows (4 feet) on a runway or taxiway that is 72 feet wide. For widths other than 72 feet, more or less coverage (in terms of strip length) is obtained. Since the parking and storage areas need not have a specific mat pattern, as is required on the runways and taxiways, the "extra" half-length of full-length mats that result from the runway construction may be used in these areas. The use of a guide rail and/or keylocks will not affect the amount of coverage to any great extent.

### INSTALLATION

As a Steelworker, you can be assigned to a project placing AM-2 mats for airfield surfaces; therefore, you need to be familiar with the procedures used for installing mats. Primary operations involving site preparation and pallet staging are also discussed. Additionally, information on manpower requirements and the organizational structure of the installation crew is presented.

#### Site Preparation

The soil and subbase materials of the site selected as the SATS field must be suitable for use with the AM-2 landing mats. The subbase material must have a minimum compaction of 95 percent, and the engineering staff will provide you further guidance based on their analysis of the soil type and the available base materials.

The operations that are part of the site preparation that must be completed before mats are installed are as follows:

1. The terrain in the area to be used must be cleared, leveled, and rolled to provide the designated compaction for the matting base. Grading must provide adequate drainage of water away from the field area and the soil must be disturbed as little as possible in obtaining the prescribed finish. These operations will provide a soil having a maximum bearing capacity.

2. The soil in any area under the matting, requiring installation of service, drainpipes, or other objects, must be backfilled and thoroughly compacted.

<table>
<thead>
<tr>
<th></th>
<th>ONE-PIECE MAIN EXTRUSION</th>
<th>TWO-PIECE MAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Weight (full-length mat)</td>
<td>144 lb</td>
<td>148 lb EST</td>
</tr>
<tr>
<td>(2) Length (full mat)</td>
<td>12 ft</td>
<td>12 ft</td>
</tr>
<tr>
<td>(3) Length (half-mat)</td>
<td>6 ft</td>
<td>6 ft</td>
</tr>
<tr>
<td>(4) Width</td>
<td>2 ft</td>
<td>2 ft</td>
</tr>
<tr>
<td>(5) Wt/Sq Ft of Coverage</td>
<td>6 lb</td>
<td>6 lb EST</td>
</tr>
<tr>
<td>(6) Locking Bars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>24 in.</td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td>5/8 in.</td>
<td></td>
</tr>
<tr>
<td>Depth</td>
<td>3/16 in.</td>
<td></td>
</tr>
</tbody>
</table>
3. The final grading operation must be adequately level so mats, when laid, do not vary more than \( \frac{1}{4} \) inch in height over a 12-foot distance.

4. Hand raking is necessary to remove small rocks and other debris that would hinder this task as well as the connecting of mats.

5. The overall field configuration must be staked out in its entirety. Accurate longitudinal and transverse center lines must be established to ease the staging of the pallets. When no guide rail is used, both lateral runway edges must be accurately marked to ensure smooth linear edges from which to lay the mat field. The line for the edges of the runway is determined by using a transit and marking them clearly with a chalk line or stakes. This type of survey is also required when taxiways and parking areas are installed. When a guide rail installed, only the center line of the guide rail is established by transit.

**NOTE:** Site preparation may not be required if there is an existing concrete or asphalt runway because matting can be laid over the existing hard surface.

**Pallet Staging**

Under combat/contingency operations, pallets must be staged in a manner to keep manual handling to a minimum. Additionally, staging should maximize all available equipment and manpower coupled with consideration for the climatic conditions in which the construction is started.

Different methods are used for the staging of pallets. The most efficient method is the staging of
pallets by rough-terrain forklifts. This method is the most efficient because the forklift can deliver the pallets directly to the mat-laying crews who disassemble the pallets on the forklift. Pallet disassembly is done at the work area, rather than the storage point, because the mats could be dropped and damaged while being moved if they are uncrated and moved in a loose configuration. The forklift remains on site until the pallet load has been installed. This method presumes that an adequate number of forklifts are available to resupply the laying crews continuously. Round-trip time between the work area and the pallet storage area must be considered to keep the work flowing smoothly and completed in a timely manner.

The primary rough-terrain forklift used in the NCF is the 4K rough-terrain forklift (fig. 11-4). A diesel engine-driven, self-contained, material-handling vehicle, the 4K forklift is designed primarily for the rough-terrain handling and warehousing of materials. The 4K forklift can lift and carry loads up to a maximum of 4,000-pound capacity and is the ideal equipment to use for staging pallets. The hydraulically operated forklift mechanism, mounted on the extreme front of the vehicle, eases the lifting, reaching, tilting, and sliding of loads during material-handling operations.

AM-2 matting in its palletized configuration is vulnerable to damage resulting from improper handling. Lifting eyes are contained in the pallet end frames to receive the sling lifting hooks. Under no circumstances should “choker” type of slings be used because these damage matting side connectors. Normal cargo-handling precautions must be used during AM-2 pallet assembly handling.
Pallet components are vulnerable to damage by misuse of tools, such as cutting torch, bolt cutters, and sledge hammers. Therefore, extreme care must be used during pallet disassembly. No spare components are packaged in the pallet.

**Installation Crew**

Field experience dictates that a 16-man crew provide maximum efficiency and flexibility when laying a runway 96 feet in width. Two crews can be used inlaying a runway and additional crews used for laying other areas simultaneously. A typical crew of 16 would include 1 petty officer in charge, 1 alignment person, 2 pry bar crew members, and 12 (six 2-person teams) mat installation personnel.

The alignment person ensures the field is aligned by adjusting the first mat in each transverse row, so it is flush with the presurveyed lateral boundary before the rest of the mats in that row are laid.

The pry bar crew members adjust individual mats, using a pry bar to provide maximum allowance for thermal expansion and insert the mat-locking bars.

The installation personnel, working with partners, take a mat from the pallet, carry it to the installation point, and then install the mat in place.

**SATS Field Installation Sequence**

The sequence of laying matting for a runway where a guide rail for a catapult system is not required is not the same as for a runway where a guide rail is required. Figure 11-5 shows you what a guide rail looks like. When a catapult facility is used with a SATS installation, a guide rail is needed to provide stability to the dolly and the aircraft during the launch. The guide rail is supplied in 9- and 10-foot lengths and has connectors on both sides to mate with the mat end connectors. A 1/8-inch rubber seal is installed between each section to provide for thermal expansion and to prevent debris and soil from coming up between the rail sections. Dowel pins are used between two holes in the mats at each end of the guide rails to maintain alignment of the sections. The guide rail is installed concurrently with the mat field, and standard mat-locking bars are used to secure it to the mats.

**NOTE:** The catapult and arresting system is not available currently in the ABFC System. However, it was originally designed for the ABFC System and could be used in the future; therefore, information on guide rails is provided.

**Figure 11-4.—4K rough-terrain forklift.**

![Figure 11-4.—4K rough-terrain forklift.](image)

**Figure 11-5.—Guide rail.**

![Figure 11-5.—Guide rail.](image)

11-5
The general sequence of laying matting for any length of installation where a guide rail is not required is to start at the transverse centerline and work toward each end simultaneously. The starter keylock section is laid, and then individual mats are laid in a brickwork type of pattern from left to right when facing the working area. The left-to-right sequence is dictated by the mat interlock design which is such that reversing the procedure is difficult and inefficient. The coated side is always “up,” and the interlocking prongs on the 2-foot edge are always to the right and up. Survey lines are present to guide at least one edge of the section being laid to maintain proper longitudinal alignment. Other sections of the site may be laid in
the same reamer and at the same time if survey lines have been established, pallet staging has been accomplished, and sufficient personnel are available. A typical keylock section is laid every 100 feet, starting with the 100-foot mark on either side of the starter keylock.

The general sequence of laying mating for the runway with the guide rail installed is to start at one end (at the approach apron) and work toward the opposite end. The guide rail divides the runway into two sections, 18 feet and 78 feet (or 18 feet and 30 feet for a 48-foot runway). Individual mats are laid in a brickwork type of pattern from the guide rail to the outer edge in each section when facing the working area. The starter keylock is not used when laying a runway with a guide rail. Instead, typical keylocks are laid at 100-foot intervals on the runway, and other sections of the SATS field are laid as explained in the previous paragraph.

Be sure to inspect visually upturned sides and end connectors of AM-2 matting for foreign matter before placing them in position. The presence of dirt, chips, stones, and so on, can prevent proper interlocking of the mats. Brooms or brushes can be used to clean foreign matter from the connectors.

Mat-Laying Procedure without a Guide Rail

The sequence for installing AM-2 mats and related components where a guide rail is not required is shown in figure 11-6. The sequence can be modified, so work proceeds on only one row of mats at any given time; however, SPEED OF INSTALLATION IS IMPORTANT. The sequence, as shown in figure 11-6, allows the use of at least two crews with six 2-man teams on each crew carrying and placing mats and keylocks.

When placing AM-2 mats, you should have three types of keylocks: starter, typical, and female. You should use a step-by-step procedure to place the AM-2 mats.

STARTER KEYLOCK.— The starter keylock is a narrow mat that is used to decrease runway installation time by approximately one half (fig. 11-7). Previous mat installation methods required assembling the runway at one extremity and working to the other end. The starter keylock is installed in the middle of the runway only and enables two mat-laying teams to start together and work simultaneously toward each end of a runway, section. Starter keylocks are furnished in 3-foot, 9-foot, and 12-foot lengths to allow for the staggering of joints in matting patterns. The starter keylock is coated with a nonskid material. It is not used in installations having a guide rail.

TYPICAL KEYLOCK.— A typical keylock (fig. 11-8) is inserted every 100 feet in the pattern to permit the easy removal of sections of the matting for a multiple-mat replacement. For this reason, only a maximum of 50 feet of any one section needs to be removed to replace mats that could not economically be replaced as individual units by replacement mats. Typical keylocks are furnished in 3-foot, 9-foot, and 12-foot lengths to allow the staggering of joints of matting patterns. The typical keylock is coated with a nonskid material.

FEMALE KEYLOCK.— A female keylock (fig. 11-9) is used to join two adjacent male mats. The female keylock is coated with a nonskid material.
Steps for Laying AM-2 Mats and Keylocks

The procedure for laying AM-2 mats and keylocks is shown in figures 11-10 through 11-18 and consists of the following steps:

1. Lay starter keylocks on the transverse center line of the runway. (See fig. 11-10.) A 9-foot starter keylock is laid at the outer edge of the runway. Remove the socket head screws from the keylock to allow for extending the locking bars into the next keylock section.

2. Place a 12-foot starter keylock next to, and aligned with, the 9-foot section. Move the 12-foot section against the 9-foot section, and adjust the locking bar so the socket head screws secure the locking bar in each section this procedure secures the 9-foot starter keylock and the 12-foot starter keylock, as shown in detail “A” of figure 11-10.

3. Repeat laying six more 12-foot sections and one 3-foot section of starter keylocks to complete the 96-foot width of the runway.

**NOTE:** Initially, lay several transverse rows of AM-2 matting in one direction only from the starter keylock row. If matting is started on both sides of the starter keylock, a seesaw force could result, disturbing the alignment of the entire field.

4. With the nonskid side of the mat turned up and the upturned prongs on the right, align the first mat (half mat) on the left side with the starter keylock [fig. 11-11]. Align the downturned prongs with the runway edge. Hook the female edge of the mat into the groove on the starter keylock [fig. 11-12] while holding the mat in an angular position. Rotate the mat downward to form the joint. (See fig. 11-12.)

5. Lay the second and all successive mats the same way as the first mat [fig. 11-11] in relation to the starter keylock. The downturned prongs of the second mat should mate with the upturned prongs of the first mat, as shown in figure 11-13. When the mats are properly engaged, a rectangular slot is formed by the engagement of the end connectors.

6. Lock the first and second mats together, as shown in figure 11-14, by inserting the locking bar [fig. 11-15].

**NOTE:** The first two mats and all mats in the first row should be aligned accurately before inserting the locking bar. Misalignment of mats will prevent proper installation of the second row. Locking bars may stick...
because of the natural waviness in the manufacture of the mat end connectors and the locking bars. A few light taps of a hammer should drive the bar into the proper position.

7. Place the third mat at the start of the second row, as shown in figure 11-16. Ensure that the third mat is aligned on the left side with the mat in the preceding row. Refer to figure 11-12 and step 4 for the engagement procedure, which is the same for the engagement of the third mat with the first and second mats.

**NOTE:** The first row of mats and each alternate row thereafter is laid using half mats at the outer edges of the runway and full mats in between (fig. 11-6). The second row of mats and each alternate row thereafter is laid using full mats only. This method provides a staggered joint for greater matting strength.

8. Complete the first row, installing six more full-length mats and finally a half mat, using the same procedure as described for installation of the second mat. (See step 5.)

**NOTE:** The first row of mats on the opposite side of the starter keylock row are all full mats (fig. 11-6).

**CAUTION**

Align the first row accurately with stakes or guidelines delineating the extent of matting. As work progresses, periodically check the alignment of mats already installed. Any misalignment causes a displacement of the runway from the planned position at the far end of the field.

9. Install the second and succeeding rows according to the procedure for the third mat (first mat in the second row) with one notable exception. The second mat in each row must first be hooked to the
Figure 11-13.—Engagement of the first and second mats.

Figure 11-14.—Locking first and second mat, using locking bar.
preceding row while being held at an angle (fig. 11-12). The mat must then be aligned so when it is rotated downward, the end connectors mate properly, as shown in figure 11-13.

NOTE: The mats are designed with an apparent 'loose fit.' This is to allow for expansion and also to allow for the natural waviness inherent in the extruded mat sections. Because of this, it is possible to have a row of mats "installed" but misaligned so as to prevent the proper engagement of one or more of the mats in the following row. (Such a condition in exaggerated form, and the method of corrections, is shown in figure 11-17.) Locking bars may be used as temporary spacers between the rows to prevent this. Place a locking bar on edge where the ends of two mats join and as the row ends. After three or four rows have been laid using locking spacers, proceed with the remainder of the runway or taxiway by removing the spacers from the furthest row and using them in the row just laid.

CAUTION

If it becomes necessary to adjust matting with a sledge, always place a wooden block
against the mat edge before striking, as shown in figure 11-17.

10. Every 100 feet, install a row of typical keylocks in the matting field (fig. 11-6). Place a 9-foot typical keylock at the outer edge of the runway with the female end of the keylock aligned with the first mat of the preceding row (fig. 11-13). Engage the female edge of the typical keylock with the male edge of the mat in the preceding row (similar to fig.11-12 and step 4).

11. Place a 12-foot typical keylock next to the installed 9-foot typical keylock. Move the 12-foot section against the 9-foot section after first engaging the female edge of the keylock with the male edge of the first two mats in the preceding row. Raise the socket head screw in the male end of the 9-foot keylock until the threaded hole in the female end of the 12-foot keylock is aligned. Then secure the socket head screw in the 9-foot keylock, using the socket head screw wrench.

See detail “A” of figure 11-18 that shows the typical keylocks secured together. Repeat laying of six more 12-foot sections and one 3-foot section of the typical keylocks to complete the 96-foot width of the runway.

NOTE: After the laying of a row of typical keylocks every 100 feet, continue laying AM-2 matting, according to steps 4 through 9, to the ends of the runway.

Runway APPROACH APRONS are required at each end of the main runway. These aprons are ramps made of mats placed to prevent the tail hook of a low
incoming aircraft from engaging or hooking onto the edge of the runway. (See fig. 11-19.)

The aprons are constructed in a brickwork type of pattern but may be entirely of half-length mat units and extend across the full width of the runway. The free end of the apron should fall a distance of 18 to 24 inches below the normal ground level. The ground surface beneath each mat should be shaped to provide full contact across the bottom of the mat. After installation of the ramp, the excavation should be backfilled (ramp covered to the normal ground level). The backfill should be tamped and compacted.

Installation of the ramp at the starting end of the runway can be readily accomplished although the installation procedure is slightly different. Place the side connector under the overhanging lip of the first row of mats and lift until contact is made. The mat is then rotated downward while keeping the two mats in contact. Locking bars are installed as described previously.

MAT END RAMPS are used at the ends of the runways, laid on a hard surface (concrete), to smooth the passage from one surface to the other. The edge connection between the ramp and mat sections is the same as between two rows of matting. The ramp is fabricated from aluminum extrusions and is provided with welded inserts and extension plates, drilled and tapped to allow the ramp sections to be joined and anchored. (See fig. 11-20.)

When installing mat end ramps, you should use the following procedure:

1. Install the first ramp at the right-hand corner, looking toward the opposite end of the runway. Place the next ramp adjacent to it, ensuring that holes in the overlapping plate on the ramp line up with threaded inserts on the matting ramp. Insert five flathead screws in each ramp, using the Allen wrench provided in the toolbox. Apply antiseize compound to the screw threads.

2. Next, use the locking bar on the edge between the ramps and edges of the mats to assure the alignment is straight.

3. As the ramps are placed and screwed together, drill holes in the concrete for lag screw shields, using the holes in each ramp as a template. Drill holes to 5/8-inch diameter and 3 inches deep with the drill bit from the toolbox. Insert an expansion shield in each hole drilled in the concrete. Insert a lag bolt and washer in each counterbored hole. Tighten the lag bolts with the offset, square box-end wrench provided in the toolbox.

4. Complete the end ramp installation, as shown in figure 11-21.

Mat-Laying Procedure with a Guide Rail

The sequence for installing AM-2 mats and related components where a guide rail for a catapult system is required is shown in figure 11-22. The guide rail divides the runway into an 18-foot and a 78-foot
Figure 11-19.—Laying of runway approach apron

Figure 11-20.—Mat end ramp.
section. The laying of matting should proceed in one direction only, from one end of the runway. Laying of the guide rail, mats, and related components is as follows:

**NOTE:** The instructions presented here are for a 96-foot runway, but they are also applicable for a 48-foot runway.

1. Establish the guide rail center line, using a transit.

2. Install the first guide rail with dowel pins facing aft (opposite the direction of laying the guide rails). The first guide rail should be 9 feet in length, NAEC (Naval Air Engineering Center) Part No. 6125354, to prevent alignment of the guide rail joint with the mat joint.

3. Install the next four guide rails (10-foot rail) using spacer seals, NAEC Part No. 414233-1, and gap gauges, NAEC Part No. 414219-1, between the guide rail joints before driving the dowel pins. Check for proper position of the pins in the guide rails, using a pin gauge, NAEC Part No. 414212-1.

**NOTE:** As the guide rails and mats are being laid, any visible depressions in the grade should be filled in and raked with the applicable hand tools.

4. Insert the transit target, NAEC Part No. 414691-1, in the center slot of the guide rail and preliminary alignment of each rail.

5. Lay the 18-foot section of AM-2 matting, as shown in figure 11-22. Insert the mat-locking bars between the guide rail and the mat. (See fig. 11-23.)

6. Insert the transit target, NAEC Part No. 414691-1, in the center slot of the guide rail and make the final alignment by shifting the five guide rails and attached mats. The guide rails and mats maybe shifted by pounding the edge of the guide rail or mat with a wooden block and a mallet. The guide rail center line should not vary more than 1/4 inch in 50 feet in the horizontal direction nor more than 1/8 inch in 12 feet in the vertical direction as determined by a 12-foot straightedge. The straightedge should be moved in 6-foot increments.
7. Begin laying the 78-foot side of matting for the length of the guide rail and matting as aligned in step 6. Transverse mat joints should not vary more than 3 inches between the 18-foot and 78-foot-wide section of the runway where joints meet the guide rail and the mat. Installation of the 78-foot side may lag behind the guide rail and the 18-foot side but should never be installed beside the guide rails that have not yet been aligned according to step 6.

8. Install the next five guide rails. Guide rail joints should never be closer than 3 inches in reference to the transverse mat joints. (See fig. 11-23) To ensure the 3-inch distance between the mat and guide rail joints, substitute a 9-foot length of guide rail for a 10-foot guide rail. Lay matting on the 18-foot side and then the 78-feet side. (See steps 5, 6, and 7.) Continue installing the runway until 100 feet of the matting has been laid.

NOTE: A minimum of ten gap gauges should remain installed to the rear of the guide rail dowel pins being installed.

9. Every 100 feet, install typical keylocks across the runway. Typical keylocks cannot be secured to the guide rail. Cut keylocks in 6-foot sections, as necessary, to ease installation on the 18-foot and the 78-feet sides of the guide rail. Refer to the section discussed previously in this chapter on "Mat-Laying Procedures.
without a Guide Rail," steps 10 and 11, for typical installation of keylocks in the field.

10. Install approach aprons at both ends of the runway. Use 90-degree connectors to join the approach aprons to the field matting. (See fig. 11-24.) Connectors are 12-foot-long aluminum "H" sections that allow relative movement and slight misalignment between the adjoining sections of matting.

Field-Laying Procedure

The sequence for laying an entire field is as follows:

1. The main runway
2. The lateral taxiways
3. The taxiway that is parallel to the runway
4. The parking stands and storage areas

The above sequence may be modified in the interest of gaining time in the overall installation by laying the main runway and the parallel runway at the same time. Then the lateral taxiways and parking area can be installed.
CAUTION

If the latter procedure is to be used the distance between the runway and its parallel taxiway must be carefully controlled. Since the mat width is 2 feet, a gap of almost 1 foot could occur at each end of the interconnecting lateral taxiway. The gap between the lateral taxiway and the long taxiway and runway should not exceed 2 inches.

RUNWAY-TAXIWAY CONNECTIONS.—

Install W-degree connectors on the edge of the runway at the point where the lateral taxiways will connect with the runway. The 90-degree connectors may be used at other points where two mat-laying patterns, at 90 degrees to each other, are to be joined.

NOTE: The 90-degree connectors can be used to connect the end of the lateral taxiway with the long taxiway also.

The two procedures for installing 90-degree connectors are as follows:

PROCEDURE NUMBER 1. Where the adjoining pattern has not been laid, install a sufficient number of 90-degree connectors along the 2-foot edge of matting, such as the edge of the runway, equal to the width of the taxiway or other section to be joined. Lay a half-length mat into the first 90-degree connector, so the end of the mat matches the end of the connector. Engage the prongs of a full-length mat into the prongs of the half-length mat previously laid and push into engagement with the 90-degree connector. Continue to lay mats in the above manner until the first row is completed to the length of the 90-degree connectors. Additional mats may then be laid in the usual manner. (See fig. 11-25.)

PROCEDURE NUMBER 2. Where the adjoining mat pattern has already been laid, adjust the last few rows of matting (of the taxiway), so the space

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**Figure 11-25.—Procedure No.1, 90-degree connectors.**

**Figure 11-26.—Procedure No. 2, 90-degree connectors.**
between the runway and the taxiway is between 1 and 2 inches. Place a 90-degree connector in position, as shown in figure 11-26. Using a sledge hammer and a wooden block, drive it into position. The most efficient method is to drive the 90-degree connectors from either edge toward the center of the taxiway. Place a mark at or near the midpoint of the 12-foot length of the mat. Drive the first connector to this mark. The positions of the remaining 90-degree connectors are then automatically established. Care must be maintained while driving the connectors not to allow debris to be scooped up by the forward edges of the connectors.

**INSTALLATION OF TIE-DOWNS.—**
The tie-downs are provided for aircraft anchorage. (See fig. 11-27.) They are shipped in a package or container, as shown in figure 11-28. An individual container contains 120 tie-downs, plus the screws, drilling, and tapping equipment necessary to install the tie-downs.

When tie-downs are to be installed, start by drilling and tapping the AM-2 matting on the prongs-down connector. Drill two holes for each tie-down ring retainer, using tools from the tie-down container. The procedure for drilling is as follows:

1. Secure the sleeve, 412131-1, to the 5/16-inch drill with the setscrew, using the drill fixture, 509044-1, as shown in operation 1, figure 11-29. Orient the sleeve to ensure seating of the setscrew on the body diameter of the drill.

2. Position the drill fixture, as shown in operation 2 (fig. 11-29), and drill one hole, as shown. Proper depth is obtained when the sleeve contacts the bushing.

3. Insert the pilot, 4121301, through the drill bushing into the drilled hole, and drill the second hole, as shown in operation 3 (fig. 11-29).

4. Tap two holes 3/8 inch, 16 threads per inch, unified national coarse class 3B fit. Finish with the bottom tap to obtain 9/16-inch minimum full-thread length.

5. Store the sleeve and the pilot in the holes provided and secure with setscrews.

**PARKING AND STORAGE AREAS.—** The parking and storage areas should be installed next. Mats and locking bars are installed in the same manner as the runway and taxiways, except that the staggered joint pattern is not mandatory. This means that the area can be built up in any random pattern and that all leftover half-length or full-length mats can be used. The 90-degree connectors should be installed between these parking and storage areas and taxiways according to the procedure outlined earlier. Install tie-downs on the matting in these areas, as shown in figure 11-30.

**BLAST DEFLECTOR INSTALLATION.—** To shield the ground area around taxiways and parking areas from the blast effects from aircraft, install blast deflectors as required. Assemble blast deflector adapters to the boundaries of matting that will be
either male edges, female edges, prongs-down ends, or prongs-up ends. Three types of adapters are supplied to fit anyone of the joints. Erect AM-2 mats to the exposed upturned edge of the adapters to provide the blast shield. Use the adapters to support each AM-2 mat. (See fig. 11-31)

**MATTING REPAIR**

During use in the field, matting may become damaged and require repair or overhaul. Some of the repairs that may be necessary are covered here. If you are called upon to make repairs other than those
covered below, consult your leading petty officer for instructions.

INDIVIDUAL MAT REPLACEMENT

If an individual mat is damaged and cannot be satisfactorily repaired, damaged AM-2 mats may be cut out of the installation and replaced with a replacement mat assembly. A replacement mat is shown in figure 11-32. Replacement mats allow the replacement of damaged mats with a replacement item that duplicates the original installation. These mats are complete with a nonskid coating. Replacement mats are prepared from AM-2 mats by cutting off the prongs-up edge and the male connector edge and welding on adapters. Additional adapters must be bolted on at the time of installation.

To replace a damaged mat with a replacement mat assembly, follow the procedure below.

1. Cut out the damaged mat so complete removal can be affected without damage to surrounding mats. This can best be accomplished using a portable circular saw, set for a 2-inch depth of cut. The cut should be made along the male edge and prongs-up connector. (See fig. 11-33)
Figure 11-32.—Replacement mat

Figure 11-33.—Mat cutting for removing mat.
2. Ensure that all recesses in the mats surrounding the repair area are clean. Use a broom or brush to remove any debris.

3. Remove the male connector and adapters from the replacement mat, using socket head screw wrenches taped to the pallet. Be careful to retain the dowel pin in the lower adapter. (See view A of figure 11-34)

4. Place the lower adapter prong under the lower prong of the prongs-down end of the adjacent mat A, keeping the dowel pin up. (See view A of figure 11-34)

5. Place the middle and upper adapters on the lower adapter, using the dowel pin as a locating device. Ensure that the locking bar tongue on the middle adapter is in the locking bar slot of mat A and the upper adapter prong mates with the upper prong of the prongs-down end of the adjacent mat A. (See view B of figure 11-34)

6. Place the male connector into the female connector of adjacent mats B and C. (See view C of figure 11-34)

7. Place the female connector edge of the replacement mat over the grooves of the male connector edges of adjacent mats E and F [fig. 11-34] in the same manner that AM-2 mats are connected. Gently lower the replacement mat into place, being careful to lift the dowel pin into the hole in the connector adapter and the male connector adapter into the groove in the male connector. (See views A and C of figure 11-34)

8. Align the holes between the upper, middle, and lower adapters and the connector adapter. The dowel pin will provide at least approximate alignment, although some minor shifting of the replacement mat with a pry bar maybe necessary. Insert and tighten the four socket head cap screws with the 5/16-inch box wrench provided. (See view B of figure 11-34)

9. Place a clamp over the male connector. Alignment of holes can be accomplished by sliding the clamp in the adapter grooves. Insert and tighten the ten socket head screws with the 5/16-inch wrench. (See view C of figure 11-34)

Figure 11-34.—Replacement mat installation.
10. Using the 5/32-inch socket head screw wrench, loosen the two setscrews retaining the locking bar. Insert a screwdriver or similar instrument in the holes next to the setscrews, and force the locking bar toward mat D as far as possible. This will lock the replacement mat and clear the setscrew holes. Bottom the setscrews so that the locking bar remains in plain. (See view D of fig. 11-34.)

SECTION OF RUNWAY REPLACEMENT

A section of runway replacement maybe required when groups of mats are damaged beyond repair or when excessive mat deflection and roughness, due to cavities under the mats, must be corrected.

The procedure for replacing a section of runway is essentially the same with or without a guide rail installation. However, with a guide rail installed, removal of typical keylock sections will proceed from the outer edge of the runway regardless of which side of the guide rail the repair is to take place. Without a guide rail and when starter keylocks are used, typical keylocks must be removed from the right-hand edge of the runway (or taxi way) when facing the end of the runway from the transverse center line. This edge of the runway exposes the female end of the keylock into which the special removal tool must be inserted.

The replacement of a section of the runway is accomplished in the following manner:

1. Remove the first typical keylock action by loosening the socket head screw at the first inboard connection. This screw only needs to be loosened until it is free of the male end of the adjoining keylock (about 7/16 inch). The screw should not be removed further since it is designed to be self-retaining and reassembly can be affected from this position.

2. Insert the prong of the removal tool under the turned down lip of the female connector and slide the keylock from its position, as shown in figure 11-35.

NOTE: The initial 3-foot or 6-foot keylock section will have to be pried out since the exposed end is merely an unfinished cross-sectional cut and will not accept the removal tool.

3. Loosen the next and subsequent connectors, as described previously, and remove the remaining keylock sections. If mat distortion is minimal, you may be able to remove more than one keylock section at a time.

4. Use blocking and pry bars to lift the first row of mats high enough to allow the locking bars to clear. Each mat has one pry bar. All pry bars should be operated at the same time for the full width of the runway (or taxi way) to prevent warping of the mats. The mats will readily hinge at the first longitudinal mat joint.

NOTE: If a guide rail has been installed, the adjacent mat maybe cut parallel to the guide rail. This cut must be made so it severs the locking bar to allow the locking bar and the end connector to be removed from the guide rail.

5. With the row of mats raised, insert a bent rod or wire in the locking bar hole and remove each locking bar including the bars securing the cut piece of the guide rail. The first row of matting may then be disassembled and removed. (See fig. 11-36)

![Figure 11-35.—Typical keylock removal tool.](image-url)
6. With the clearance now provided, removal of the remainder of the matting and additional guide rail, as necessary to affect the repair, may be readily accomplished. Remove the cut piece of guide rail aft of the repair area by removing locking bars and disconnecting the guide rail pins, using a pin remover, NAEC Part No. 414223-1. Slide the guide rail out of the mats.

7. Repair the ground surface, as necessary, before installing the guide rail and new or refurbished matting.

8. The installation procedure must be the same as that for the original installation. Replace the locking bars.

9. Reinstall matting over the repair area until the last row of matting is in place. At this point, this row of matting must be raised in unison with pry bars to permit installation of locking bars.

**NOTE:** It will not be possible to insert locking bars between the guide rail and adjacent mats for this row. Therefore, a replacement mat should be installed next to the guide rail. A locking bar is built into the replacement mat.

10. Insert the typical keylocks in the reverse order in which they were taken out. Always use wood blocking between the hammer and connector if force is necessary to drive the sections into place.

Excessive mat deflection and roughness, which can be attributed to cavities under the mats, can be repaired in the following manner:

1. Remove all mats that show excessive wear and deformation according to the instructions given earlier.

2. Fill all cavities under the mats and cover cavity areas with old matting. Areas should be reinforced with any available matting: M9M1, M9M2, AM-1, or damaged AM-2 mats. The mats in the bottom layer need not be joined together to save material and manpower. It is advisable to have the reinforcing mats touching, but it is not imperative that the mats in the bottom layer be interlocked. The mats in the bottom layer must be placed with the long dimension of the mats at right angles to the mats in the top layer. A double layer of matting should be considered in all cases where sandy areas can cause excessive mat roughness due to movement of the sand.

3. Replace the top layer of matting according to the instructions given earlier.

Before proceeding, note that a heavy-duty mat, as shown in [figure 11-37](#), has been developed.
Heavy-duty mats are used under arresting cables to eliminate excessive dents and other external damage that occurs to regular matting during aircraft arrestment procedures. These mats are only used on the end of the runway where aircraft touch down. Heavy-duty mats are 6 feet in length and 18 inches wide after connectors are attached. They are painted Marine Corps green, color No. 23; the top surface is also coated with a nonskid material of the same color. Locking bars used to secure heavy-duty mats together are approximately 6 feet in length.

**EDGE REPAIRS**

To straighten male and female integrally extruded edges of AM-2 mats, you use a mat connector repair edge tool, 510827-1. Edges that are slightly damaged during shipping and handling can be straightened with the edge tool to allow the edges to be interlocked during installation.

Figure 11-38 shows the use of the edge tool for the lower female edge of the mat, figure 11-39 shows the use of the edge tool for the upper female edge of the mat, and figure 11-40 shows the use of the edge tool for the male edge of the mat.

The procedure to follow in straightening the edges of AM-2 mats is given below.

1. To straighten the edges of a mat, place it on blocks to raise it off the ground and provide sufficient clearance to use the edge tool.

2. Orient the mat properly; that is, place the top of the mat faceup, as shown in figure 11-40, and place the bottom of the mat faceup, as shown in figures 11-38 and 11-39, as required to allow the edge tool to be used in an upright position.

3. Engage the tool with the mat edge, as shown in figures 11-38, 11-39, or 1140, at the beginning of the bent area.

4. To straighten the edge, apply a lateral form on the tool handle to bend the edge lip toward a straightened position. Be certain that the tool fully engages the mat edge lip by applying a constant force on the tool handle toward the mat.

5. Move the tool into the bent area in small increments and straighten gradually until the entire length of the bent section has been straightened. Do not attempt to straighten the bent section in one pass; make several passes with minimum bending per pass until the area has been straightened.

**CAUTION**

Care should be taken during bending to prevent cracking.

**REMOVAL PROCEDURES**

Disassembled pallets should be distributed in the same pattern that was used for installation of the field mats to facilitate repackaging, as the various components are removed. With the use of typical keylock sections, disassembly can be done at several
points simultaneously consistent with the available personnel and handling equipment. Speed of removal of matting will be considerably greater if disassembly takes place in the opposite direction of assembly; that is, the female connector is removed from the male connector.

**MATTING REMOVAL WITHOUT A GUIDE RAIL**

In a SATS system where a guide rail is not used, matting removal at points other than exposed ends of matting requires removal of typical keylock sections as the initial step.

The procedure for removal is composed of the following steps:

1. Remove typical keylocks by loosening the socket head screw at the first joint until it is free of the lower thread (about 7/16 inch). Do not remove further as this screw is self-retaining, and disassembly and future assembly are accomplished from this position. If the exposed end of the typical keylock is a cut end, that particular section must be pried out or pulled out. If the female end is exposed, the section may be removed using the special removal tool. (See fig. 11-35.)

2. The backfill must be removed from the runway approach aprons that may be accomplished as the center portions of the runway are being disassembled.

3. The 90-degree connectors are independently removable by sliding individual connectors lengthwise. However, the mat disassembly procedure should be planned so that the matting engaged on the 12-foot edge is removed first. This occurs, for example, where the lateral taxiway matting (12-foot edge) meets the runway (fig. 11-26), then 90-degree connectors can be removed more easily than by sliding connectors lengthwise.

4. Tie-downs must be removed before parking area disassembly.

5. Disassembly of a mat row may proceed from the end with the overlapping mat. Remove the locking bar from the adjacent mat by inserting a bent rod or wire into the hole in the locking bar and pulling it straight out. (See fig. 11-35.) The most efficient procedure requires disassembly in reverse order of assembly. Therefore, starter keylocks will be the last component removed from the runway. Remove the starter keylocks by removing the socket head screws from each adjoining starter keylock. Insert the connector bar from each starter keylock just removed to the second hole (the bar will protrude 1 inch), and tighten the screw. Replace and tighten the screw in the adjacent keylock.

**MATTING REMOVAL WITH A GUIDE RAIL**

In a SATS system where a guide rail is used, portions of the installation, other than the runway, may be disassembled in the same manner as described previously. However, the presence of the guide rail prevents the removal of matting other than from one end. Runway aprons that do not include guide rail sections are an exception. These portions may be removed at any convenient time after the backfill has been removed. Removal of the runway matting and guide rail must start at the same end at which the runway was completed. In addition to the removal of locking bars between the mats, the locking bars connecting the mats to the guide rail must also be removed. Removal of guide rail locking bars is accomplished in the same manner as for mats. (See fig. 11-35.)