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STUDY GUIDE

OC 503 GAC

LC-39 SLA EMERGENCY EGRESS
SYSTEM
(APOLLO 14 & 15)

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for

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THIS DOCUMENT WAS PREPARED TO SUPPORT
COURSE NUMBER OC 503 GAC, LC-39 SLA
EMERGENCY EGRESS SYSTEM (APOLLO 14 & 15).
ITS CONTENTS ARE FOR TRAINING PURPOSES
ONLY, AND WILL NOT BE UPDATED.

TABLE OF CONTENTS

	PAGE
INTRODUCTION.....	1
SEES DESIGN.....	1
PUNCH ASSEMBLY.....	1
PNEUMATIC ACTUATION OF THE PUNCH ASSEMBLY.....	2
CONTROL CAPABILITY AND OPERATION OF CONTROL CONSOLE.....	2
INTERNAL ACTIVATION OF PUNCH ASSEMBLY.....	3
LOCATION OF SLA EGRESS HATCHES.....	3
EMERGENCY EGRESS EVACUATION ROUTES.....	4
SUMMARY.....	4

LIST OF ILLUSTRATIONS

FIG. 1	PAD A LC-39 (LUT/MOBILE SERVICE STRUCTURE IN PAD POSITION....	5
FIG. 2	APOLLO SPACECRAFT/LM INTERFACE.....	6
FIG. 3	IU-SLA PLATFORM/CUTOUT HATCHES.....	7
FIG. 4	PUNCH AND DIE ASSEMBLY.....	8
FIG. 5	PUNCH ASSEMBLY DAVIT MOUNTED.....	9
FIG. 6	"COOKIE-CUTTER" SWITCH.....	10
FIG. 7	CONTROL CONSOLE.....	11
FIG. 8	EGRESS CONTROL CONSOLE LOCATION, LEVELS "3A & 3B".....	12
FIG. 9	EMERGENCY EGRESS ROUTES "-Z" PERMANENT HATCH.....	14
FIG. 10	EMERGENCY EGRESS ROUTE "+Z" PERMANENT HATCH.....	15
FIG. 11	EMERGENCY EGRESS ROUTE SLA CUTOUT "A".....	17
FIG. 12	EMERGENCY EGRESS ROUTE CUTOUT "B".....	19
FIG. 13	EMERGENCY EGRESS ROUTE CUTOUT "G".....	21
FIG. 14	EMERGENCY EGRESS ROUTE CUTOUT "E".....	23
FIG. 15	EMERGENCY EGRESS ROUTE CUTOUT "C".....	25
FIG. 16	EMERGENCY EGRESS ROUTE, HATCH "F" (QUAD II, LEVEL 525).....	27
FIG. 17	EMERGENCY EGRESS ROUTE IU PERMANENT HATCH.....	29

-Introduction-

During the period that hypergolic propellants are loaded into the Lunar Module (LM), through launch, a potentially hazardous condition exists.

To provide a safe, quick path of evacuation for personnel inside and adjacent to the Spacecraft LM Adapter (SLA), should it become necessary, an emergency egress system was devised. Called the SLA Emergency Egress System (SEES), it uses the "cookie cutter" principle to cut holes at several places in the SLA for quick egress.

Emergency evacuation from the Spacecraft LM Adapter (SLA) is through permanent hatches and emergency cutouts. Procedures will be detailed in this document so that successful evacuation and rescue of personnel can be accomplished in the event of an unplanned incident.

Figure 2. shows the SLA location on the Saturn V. Normal SLA ingress and egress is through 2 of the existing permanent hatches. These are the +Z forward hatch, and the -Z aft hatch. Hatch F, at the Quad II (525 level), the third permanent hatch, is used for ALSEP installation and emergency egress only.

The Instrument Unit portion of the spacecraft also has a permanent ingress and egress hatch at the +Y location. This hatch is referred to as the I.U. hatch. (Refer to Figure 3.) No emergency cutouts are provided in the I.U.

Emergency egress from the SLA is through the permanent hatches, and if necessary, through one of the five (5) additional cutouts in the SLA.

-SEES Design-

Dies are installed on the SLA wall. When they are activated they will provide additional openings for emergency egress.

There are two (2) modes for activating the emergency SLA cutouts. The first mode allows internal activation at each cutout location. The second mode allows selective activation of individual cutters or of all at once from a central external control box. For either mode of operation, the design has provided a system which is highly reliable and easily activated during emergency conditions. Use of redundant circuits and components improve the reliability of the system. Design also incorporates sufficient safeguards to preclude inadvertent activation of the emergency cutters.

-Punch Assembly-

The punch assembly, or so called "cookie cutter", will cut an egress hole in the SLA wall. The punch assembly consists of a two part die.

The interior or inner SLA wall is constructed with a thin aluminum skin over a core of honeycomb. The outer SLA wall is also an aluminum skin with a thermal paint covering.

A hole drilled through the SLA, and a dowel at each emergency egress location,

provides alignment of the punch assembly. (See Figure 4.) Inside the SLA, mounted on the dowel is an aluminum frame, the male cutting die, the edge of which contains a sharp blade. Also attached to this frame is a wire screen, which prevents the placing of fingers under the frame at time of activation. The other end of the dowel, which is outside the SLA, is mounted to a piston. This piston is enclosed in a cylinder which forms a part of the external or female die. The female die also consists of an aluminum frame slightly larger than the male die. As a switch is closed, the piston is actuated by introducing high pressure nitrogen into the cylinder. The male and female die are drawn together with sufficient force to drive the male die through the SLA wall and into the female die, producing an egress hole. This is accomplished in 3/10 to 4/10 of a second after switch closure.

-Pneumatic Actuation of the Punch Assembly-

Pressurized nitrogen contained in a standard scuba bottle is used to drive the male die through the SLA wall. A scuba bottle is mounted on the egress davit, at each emergency egress location. (See Figure 5.) The bottle contains 71.2 cubic feet of nitrogen at a minimum pressure of 1950 PSI. A 3/4 inch flexible hose runs to two electrically operated solenoid valves. Operation of either or both of the solenoid valves will discharge the contents of the bottle to the actuating cylinder.

The egress davit acts as a guide to clear the dies and cutout away from the egress hole and to support them once free of the SLA. Support is provided by wire cables from the female (exterior) die attached to the davit arm. At the base of the davit is a pin which rides in a cam on the davit mount.

Once the dies are free of the emergency egress cutout the cam and pin, plus gravity will cause the egress davit to rotate away from the opening. This provides a clear, unobstructed egress cutout. Only 700 to 900 PSIA pressure in the bottle is required to get the cutter through the wall.

-Control Capability and Operation of Control Console-

Sole external activation for SLA cutouts is from the Control Console. (See Figure 7.) Switch "F" deadends at the console. A, B, C, E, and G continue to their respective "cookie cutters". The console is located on the 3A platform just inside the doorway to the left. (See Figure 8.)

During, and after, hypergolic loading, when personnel are inside the SLA, a handle will be inserted into the Control Console to arm the SLA cutout control circuits. (See Figure 7.) Two "SYSTEM ARM" lights, one for each of two redundant circuits on the Control Console, and two lights on each internal switch box will illuminate when system is armed. Also, two "ARMED" lights not shown on Figure 7. will illuminate on the Test Conductor's Console. Two batteries are on constant charge. Each will supply power to one of two identically redundant circuits. When the "ARM" switch is activated, the battery voltage can be read on their respective voltmeters; also the "ARM" lights will illuminate and all switch activation will be armed redundantly.

Activation of the "ALL FIRE" switch, located on the Control Console, will allow current from batteries to flow to the 10 solenoid valves mounted below the scuba bottles.

When the solenoid valves are energized, they allow the pressurized nitrogen to be discharged from the davit mounted scuba bottle. This will activate the pistons of the "cookie cutters" and provide the cutouts for emergency SLA egress. Five (5) separate guarded switches are provided on the external Control Console. Selective activation capability is provided by the guarded "FIRE" toggle switches for each of the corresponding cutouts. Since each cutout contains two solenoid valves, operation of either one or both will operate the "cookie cutter". Each solenoid valve is activated by a separate identical circuit, each energized by a separate battery, which is on constant charge. Failure of any solenoid valve of a pair, one battery or facility power will not prevent operation of the system.

-Internal Activation of Punch Assembly-

On the web of the internal male die at each cutout location inside the SLA will be found the switch box for internal activation of that cutout.

The switch is a guarded toggle, spring loaded to the "OFF" position. (See Figure 6.) Actuation is accomplished by lifting the switch guard and actuating the switch.

As previously mentioned, each switch box has two "ARMED" indicator lights. The lights will serve two purposes; they (1) will indicate when the circuits are "ARMED" (enable), and (2) will act as a guide light to show the switch location in case of facility power failure. The loss of facility power will in no way inhibit operation of the circuit.

WARNING

DO NOT GRASP THE FRAME ON THE MALE CUTTING DIE WHEN ACTIVATING THE SWITCH.
--

-Location of SLA Egress Hatches-

As mentioned, normal egress from the SLA is through existing permanent hatches. These are the +Z forward hatch which leads directly into the IM ingress-egress hatch (forward cabin hatch); and the -Z hatch which leads into the SLA at the rear of IM, both on the 603 level, (See Figure 3.). Also on the 603 level, are three (3) emergency egress ports. The cutout "B" which, when facing IM, is to the left of the +Z forward hatch, while cutout "E" is to the right.

The third, cutout "G", is between the -Z permanent hatch and cutout "E". Thus in an emergency, there will be five (5) egress routes from SLA platform level 603.

Egress through any of the five (5) described routes will take you to a series of service stands referred to as platform 3B. From these stands, ladders lead down to the platform 3A, the enclosed floor level of adjustable platform 3 of the mobile service structure, to be fully described later.

Approximately 8 feet above SLA platform level 603 is SLA platform level 697, accessible by a ladder. There are no normal egress hatches at this level, however, there is an emergency cutout "A". It is located toward the rear of the IM, above and slightly to the right (when facing the IM forward hatch) of the -Z permanent hatch. Emergency egress through this cutout would take you to the enclosed roof of adjustable platform 3. This is referred to as level 3C.

Approximately 6 1/2 feet below platform level 603 is SLA platform level 525. This is also accessible by ladder. There is one permanent egress hatch at this level, and a cutout. Cutout "C" which is below and to the left of the +Z forward hatch (facing IM forward hatch). Quad II (level 525) permanent hatch designated "F" in egress route sketches is below and to the right of the permanent -Z hatch (facing IM forward hatch). Egress through either of these cutouts will lead directly to the floor level of platform 3, referred to as 3A.

Below the SLA is a cylindrical ring, called the Instrument Unit, (I.U.). It is accessible from the 525 SLA platform level by ladder. The I.U. has a permanent hatch, referred to as the I.U. hatch. It is below and to the left of the SLA +Z permanent hatch (facing IM forward hatch). Egress through this hatch is directly on to Mobile Launcher Swing Arm #7.

It is imperative that individuals entering the SLA acquaint themselves with all egress routes.

Detailed primary and secondary evacuation routes from each of the SLA platforms are included in the subsequent pages of this study guide.

-Emergency Egress Evacuation Routes-

1. The primary emergency egress routes are depicted on Figures 9. through 17. with large black arrows indicating the desired routes to use in the event of an emergency.
2. The secondary emergency egress routes are depicted with small black arrows. Due to the limited space of the secondary route, it should be used only if the primary route is blocked.

SUMMARY

Recognizing that safety of personnel in the SLA is unquestionably of prime importance, Grumman and NASA management initiated action which resulted in the design and installation of the "cookie cutters".

Since you have all been schooled in their operation, you are aware of the fact that activation of the "cookie cutters" will result in the scrubbing of a launch and subsequent Apollo Program impact. Obviously, they should be utilized only under extreme conditions.

PAD A LC-39
(LUT/MOBILE SERVICE STRUCTURE IN PAD POSITION)

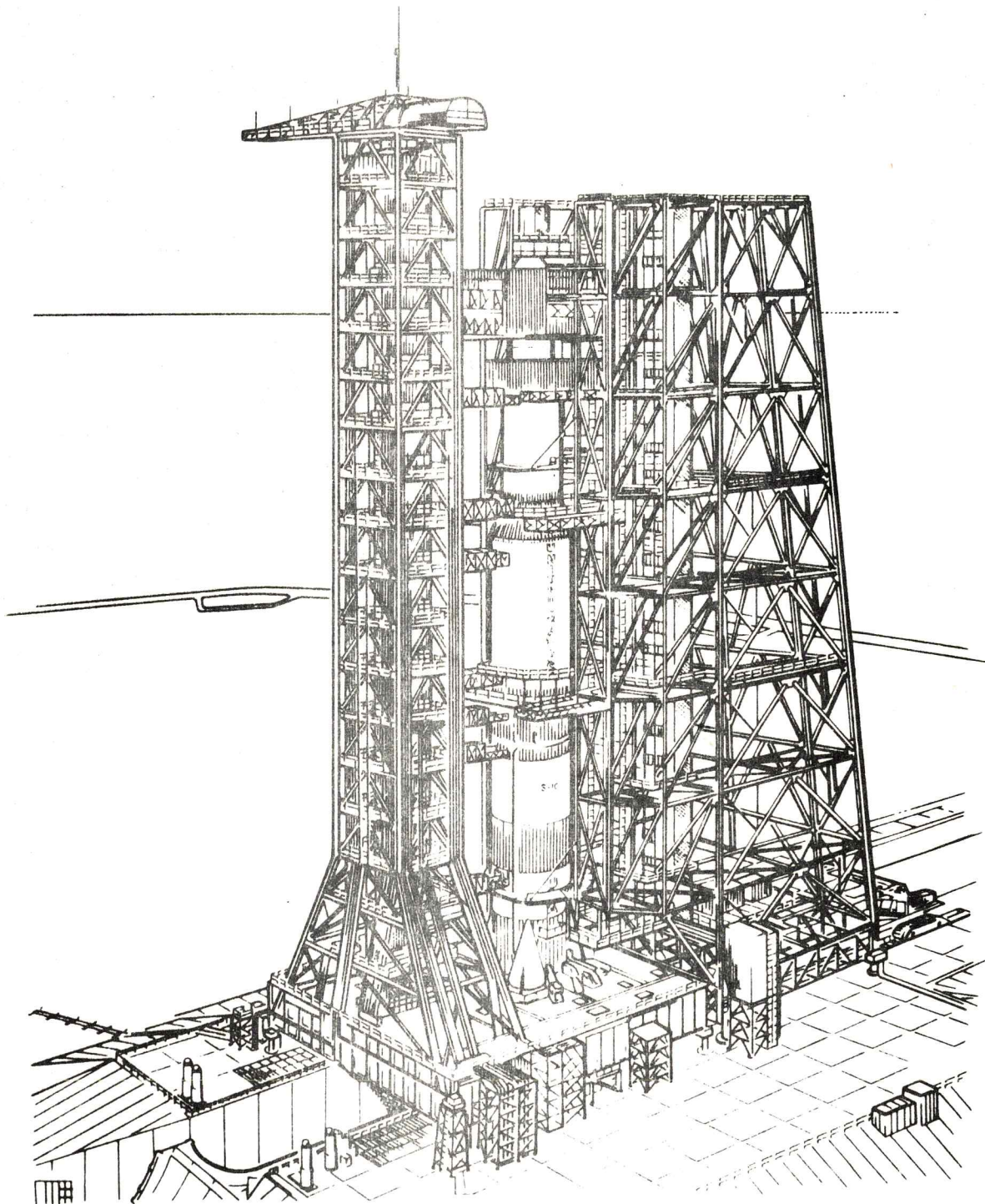
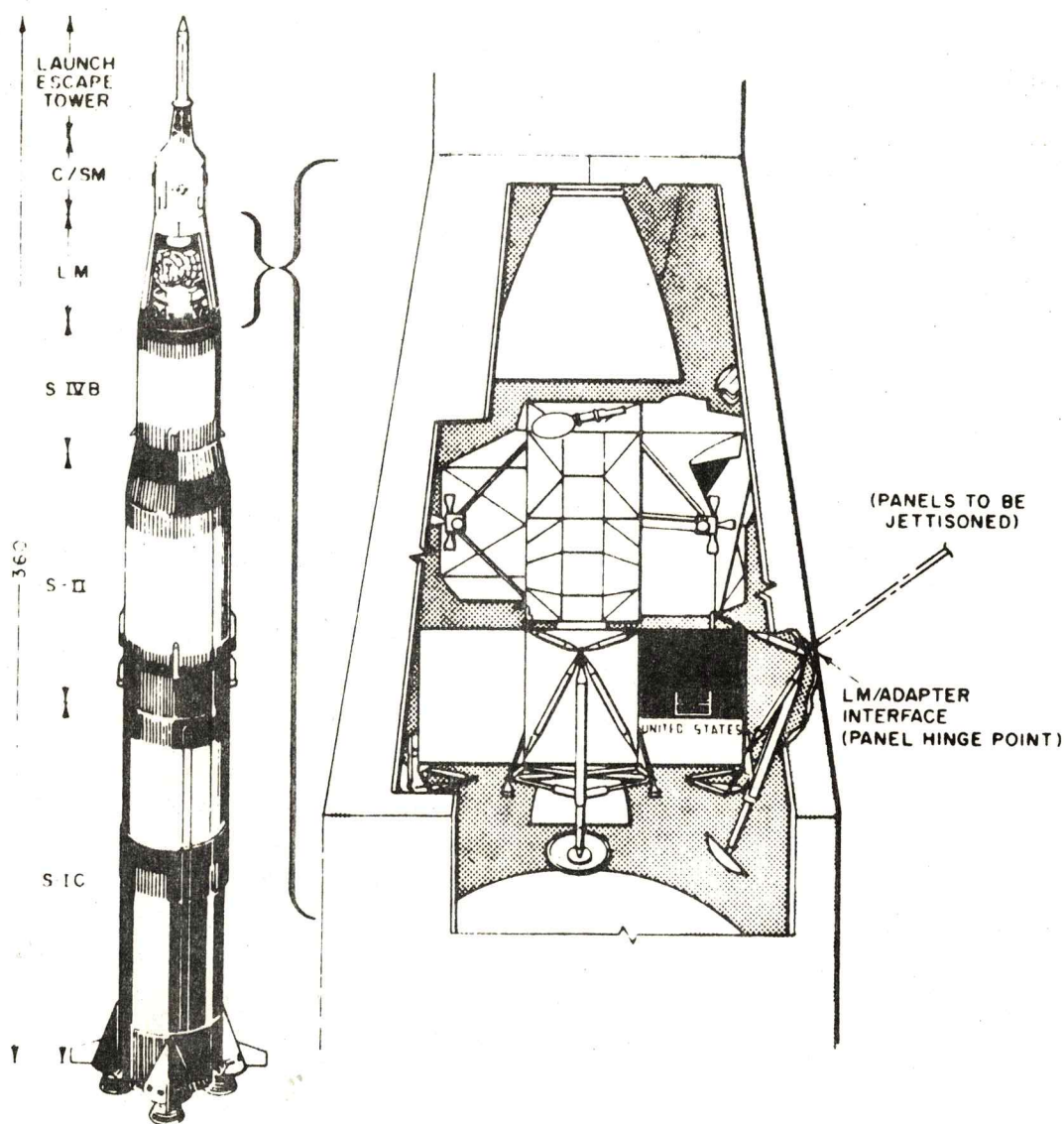


Figure 1.



APOLLO SPACECRAFT/LM INTERFACE

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Figure 2.

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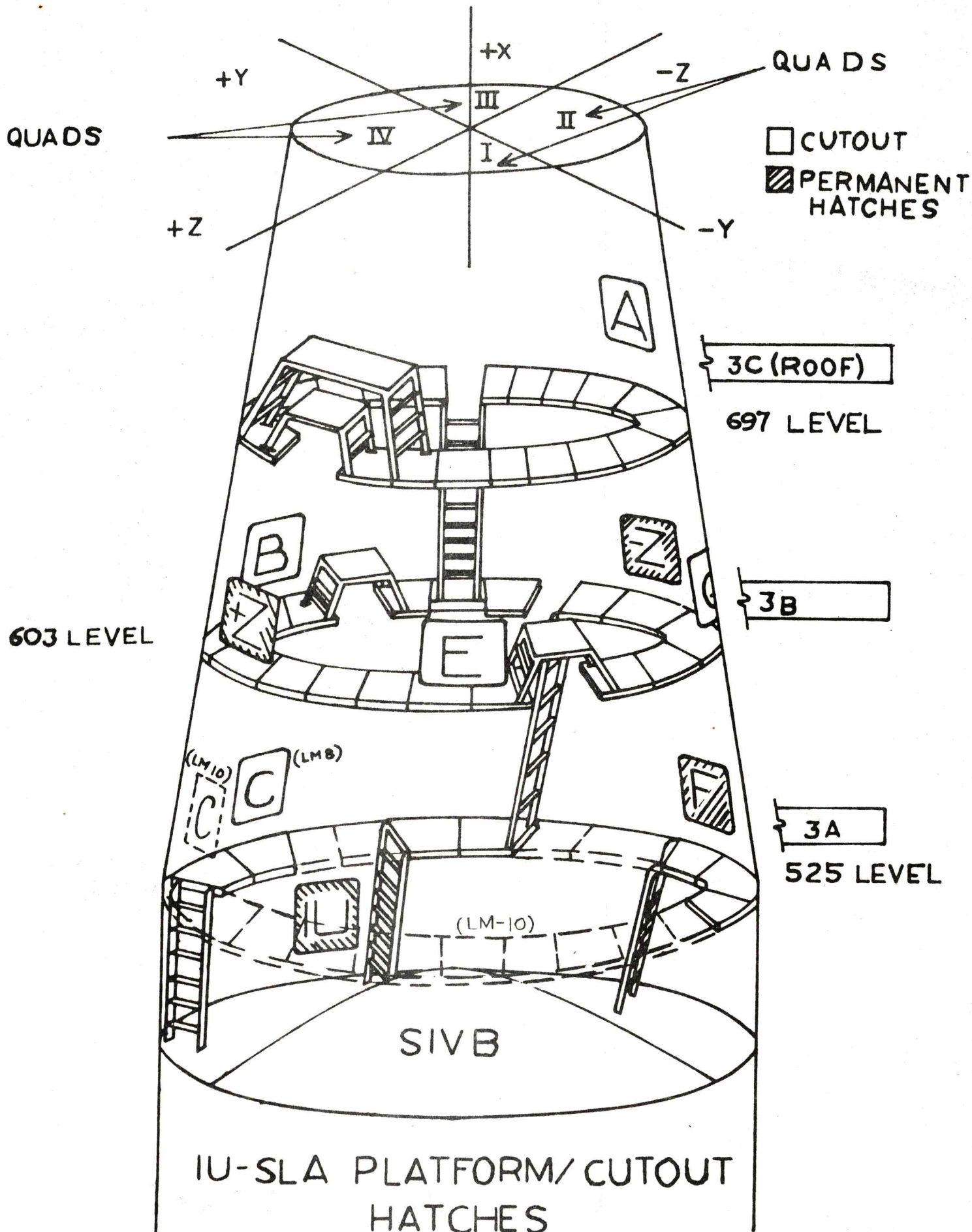
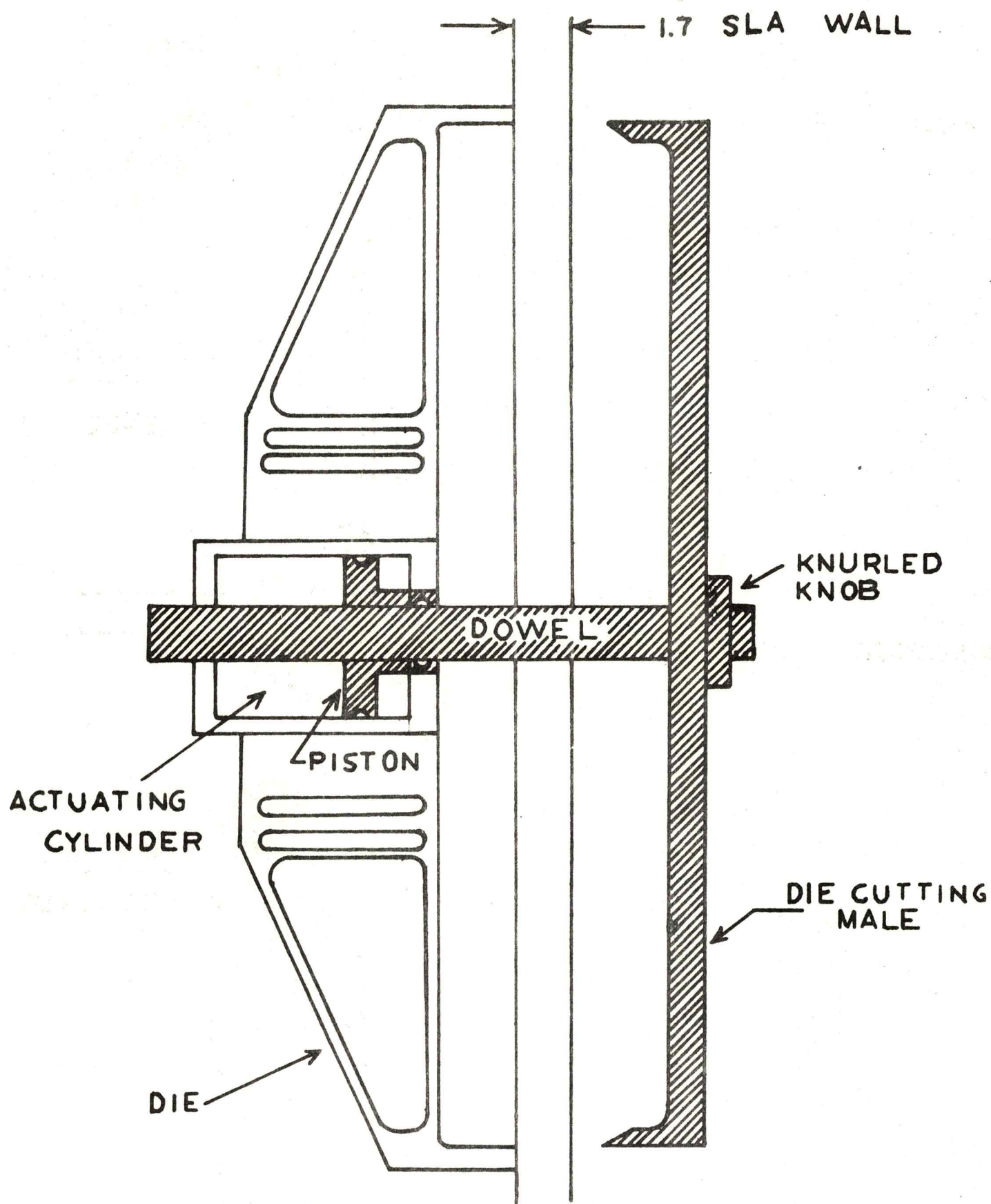
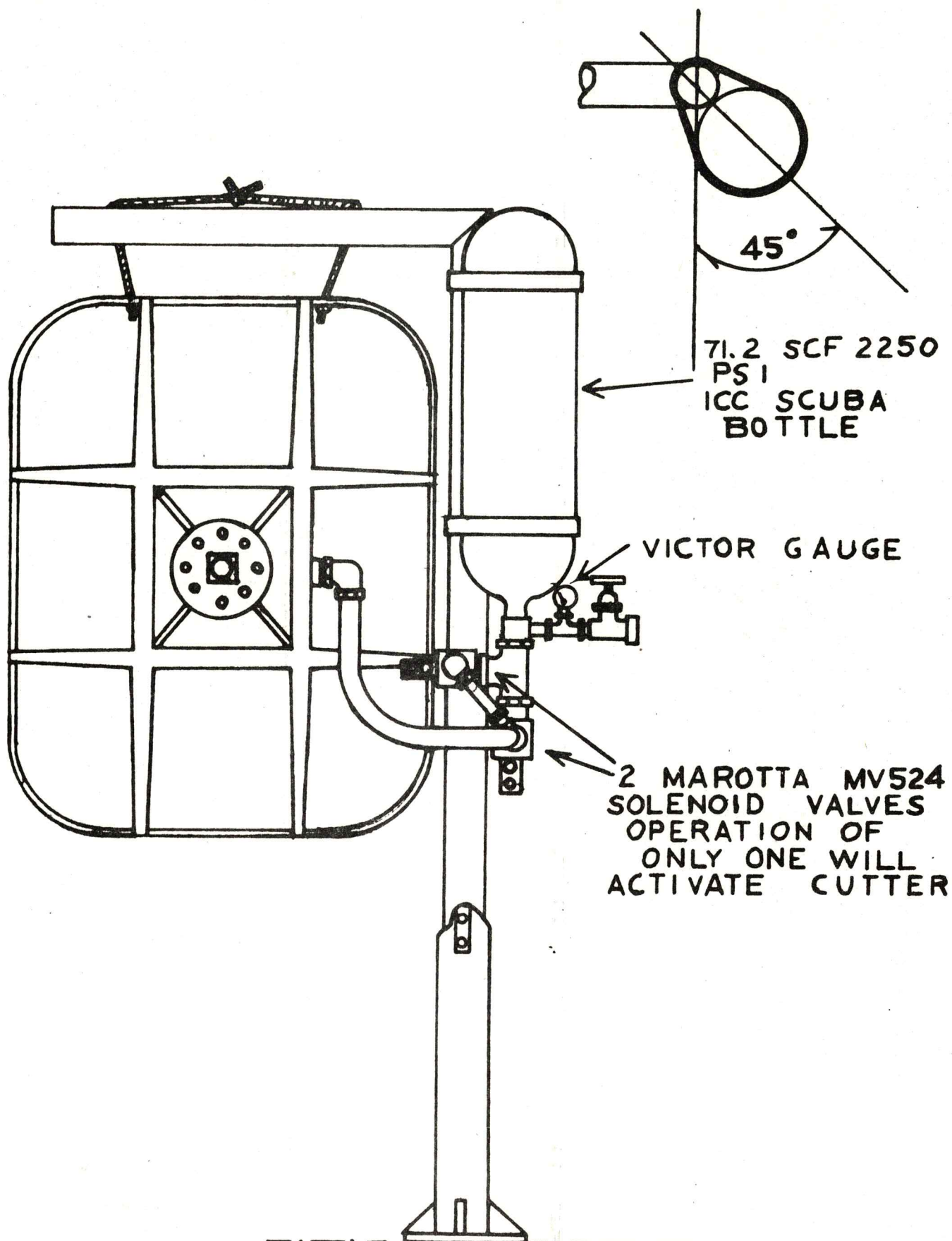


Figure 3.
FOR TRAINING PURPOSES ONLY



PUNCH & DIE ASSY



PUNCH ASSEMBLY DAVIT MOUNTED

Figure 5.

FOR TRAINING PURPOSES ONLY

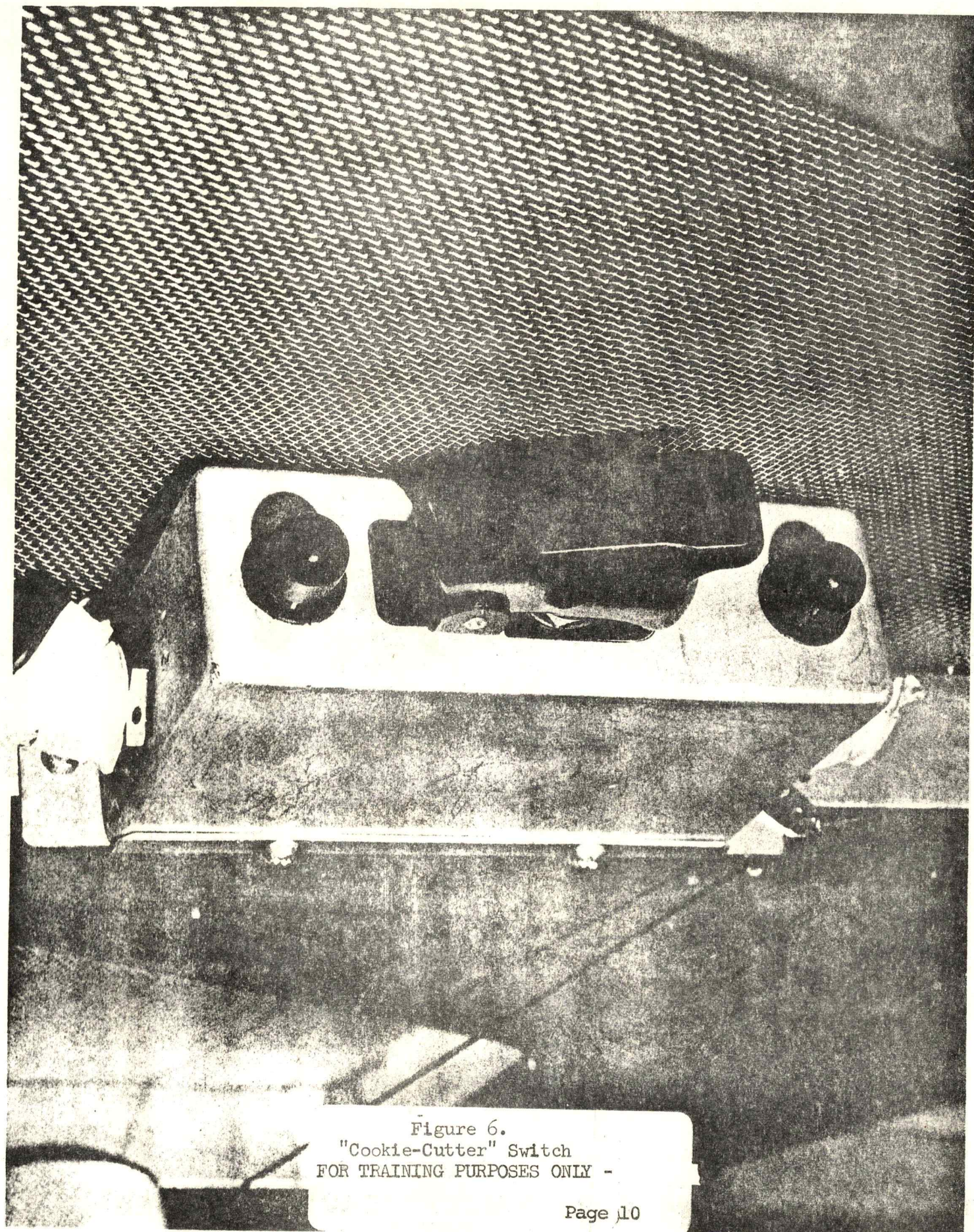
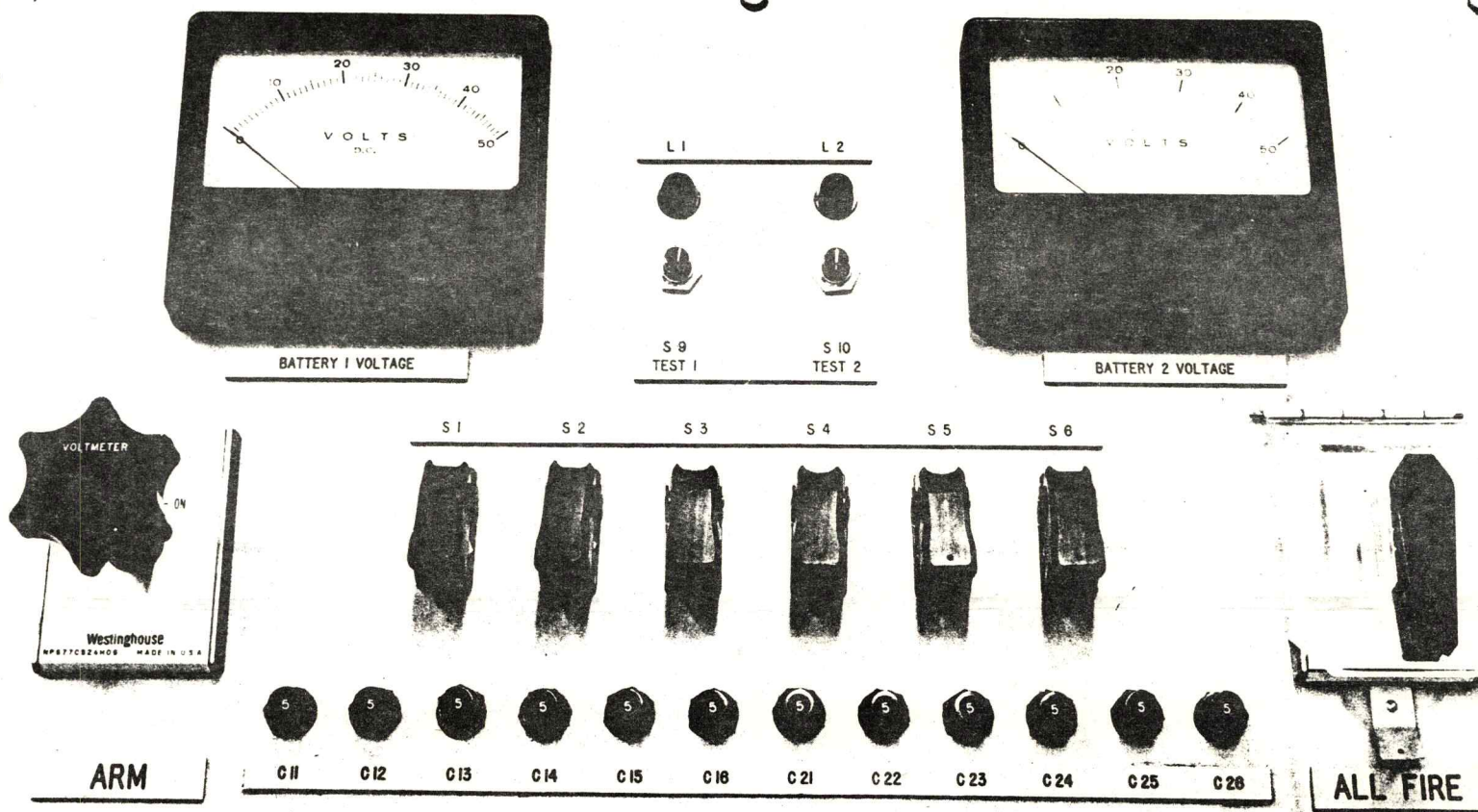


Figure 6.
"Cookie-Cutter" Switch
FOR TRAINING PURPOSES ONLY -



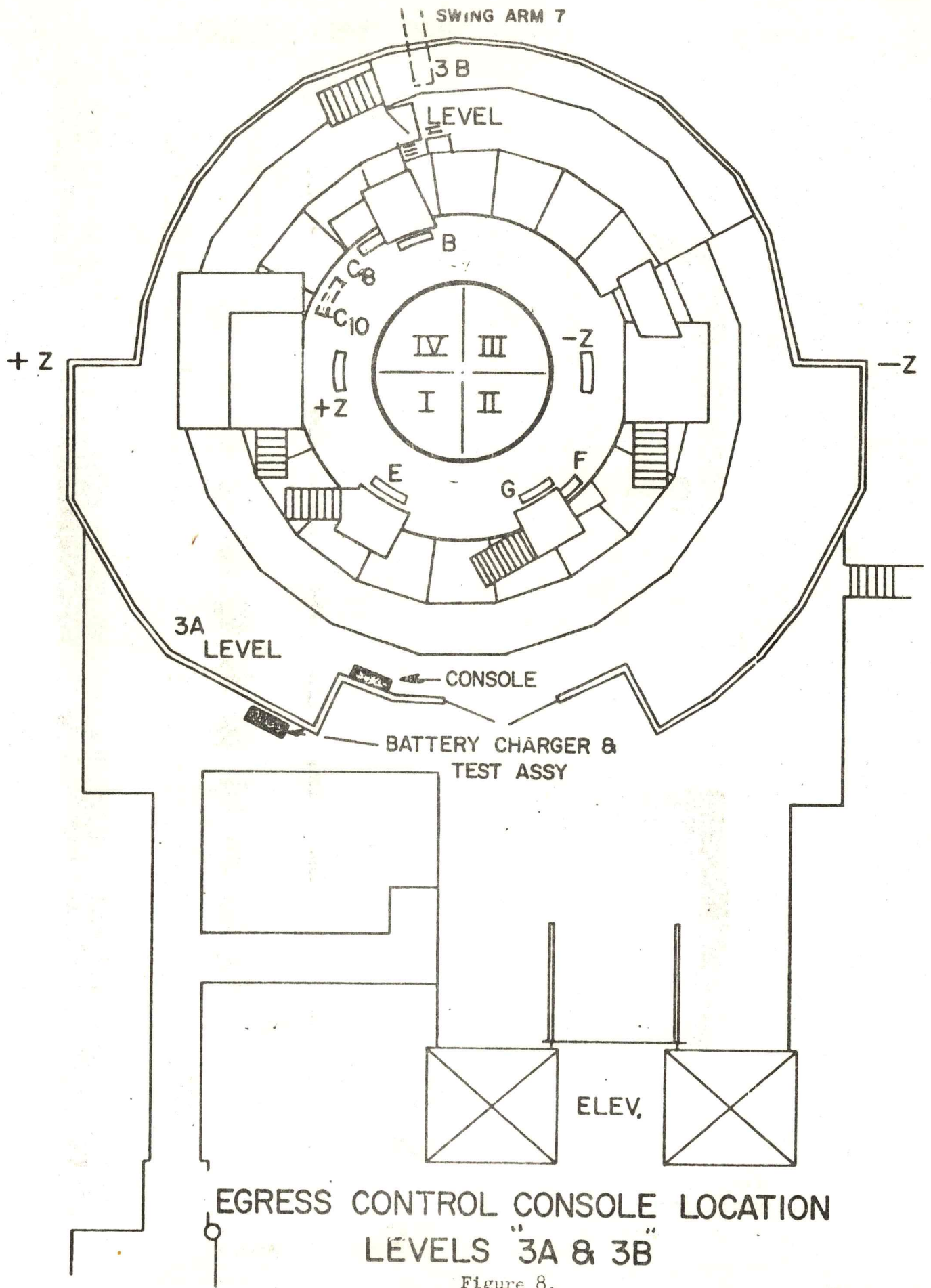


Figure 8.
FOR TRAINING PURPOSES ONLY

EMERGENCY EVACUATION EGRESS ROUTES

A support platform at the -Z of the SLA at an elevation of approximately 279 feet provides normal access through the -Z permanent hatch. This permits access to the inside of the SLA at the 603 platform level for servicing the exterior LM. (See Figure 9.) Once inside the SLA, personnel may progress to all SLA and I.U. platform levels via vertical ladders. The only two normal accesses to the interior of the SLA are through the I.U. permanent hatch and the -Z permanent hatch. A drawbridge extends between support platforms at -Z permanent hatch and the 3B level platform.

Another support platform, approximately elevation 279 feet, complete with cabin cleanliness enclosure and tunnel, provides access to LM cabin through the +Z permanent hatch. The cabin cleanliness enclosure and tunnel will be removed during SCAPE operations. (See Figure 10.)

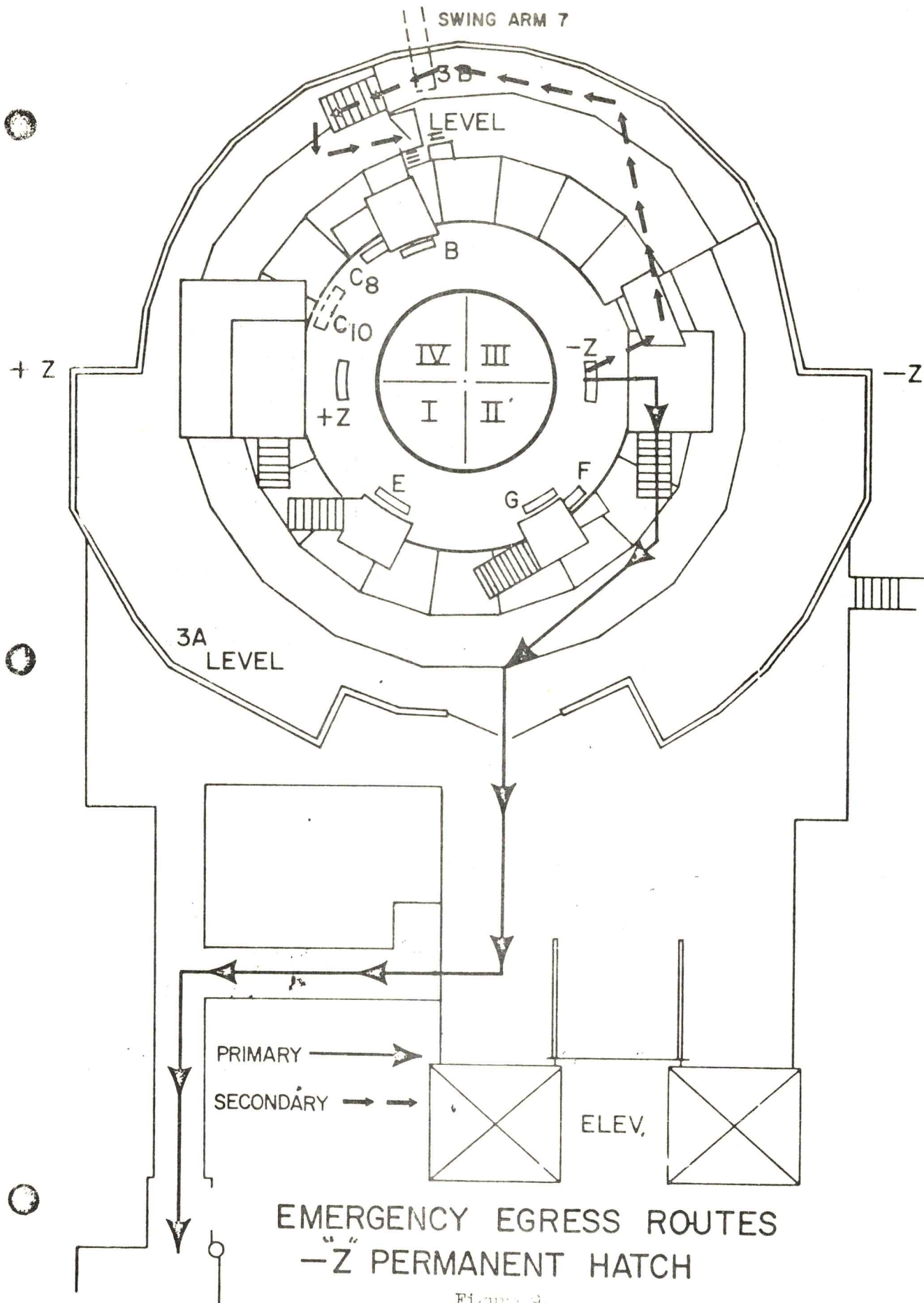


Figure 9.
FOR TRAINING PURPOSES ONLY

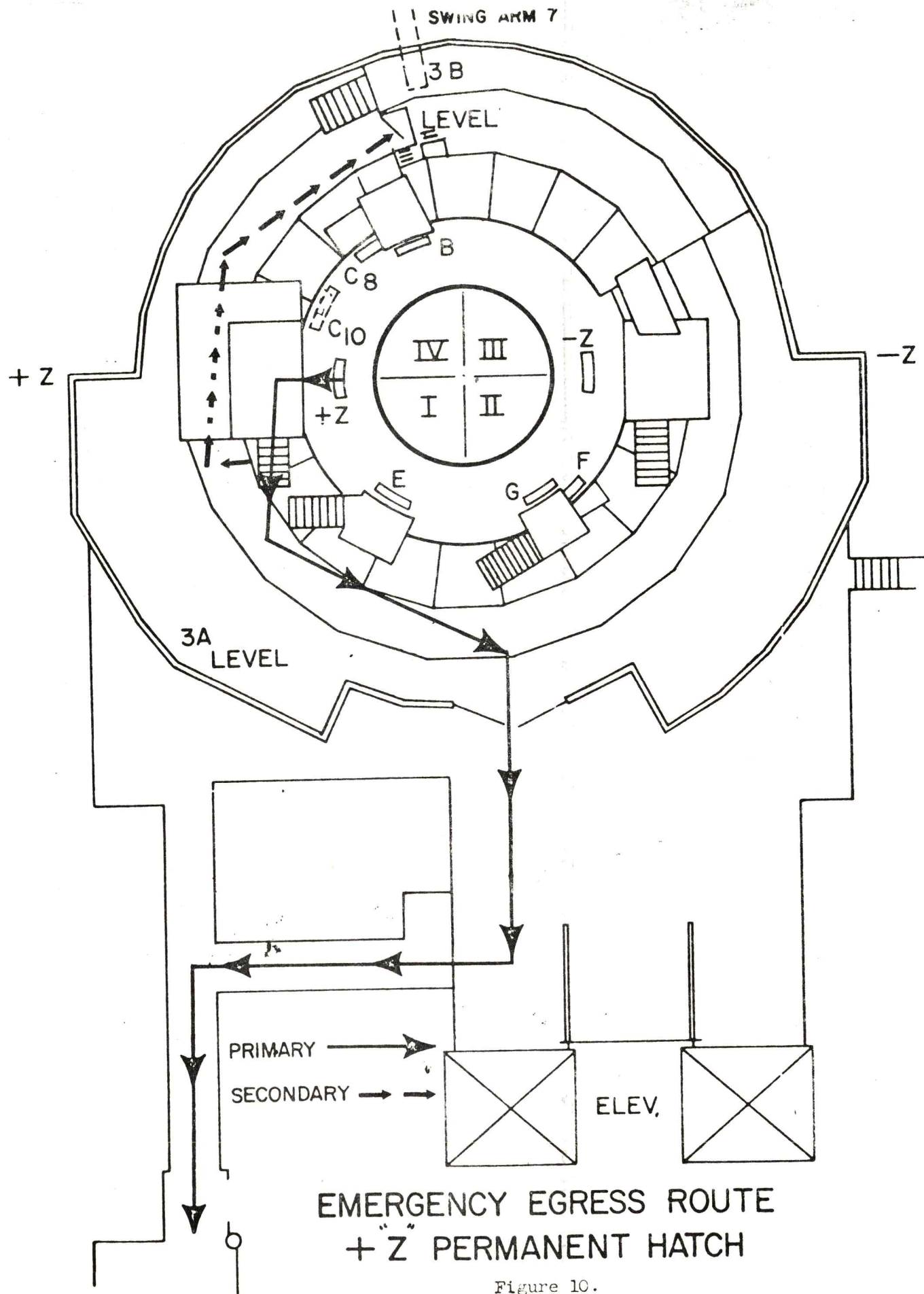


Figure 10.
FOR TRAINING PURPOSES ONLY Page 15

EMERGENCY EVACUATION EGRESS ROUTES

Cutout "A" is toward the rear of IM, above and slightly to the right of the -2 permanent hatch, when facing the IM forward hatch, on the SLA 697 platform level. The opening will be a few feet higher than the SLA platform level. The cutout will swing out when the "cookie cutter" is actuated.

Cutout "A" egress platform is approximately 25 inches below this opening. The egress platform is connected to the 3C level platform via a small drawbridge. Emergency egress would be across the drawbridge to platform level 3C, and out the swinging double doors. (See Figure 11.)

In the event this route is blocked, egress can be accomplished down to the 603 or 525 SLA platform levels, out any of the cutouts or permanent hatches at those levels, and out the swinging double doors at the 3A level platform. Also egress can be accomplished by continuing down to the I.U. section, out the I.U. permanent hatch and across Mobile Launcher Swing Arm No. 7. (See Figure 3.)

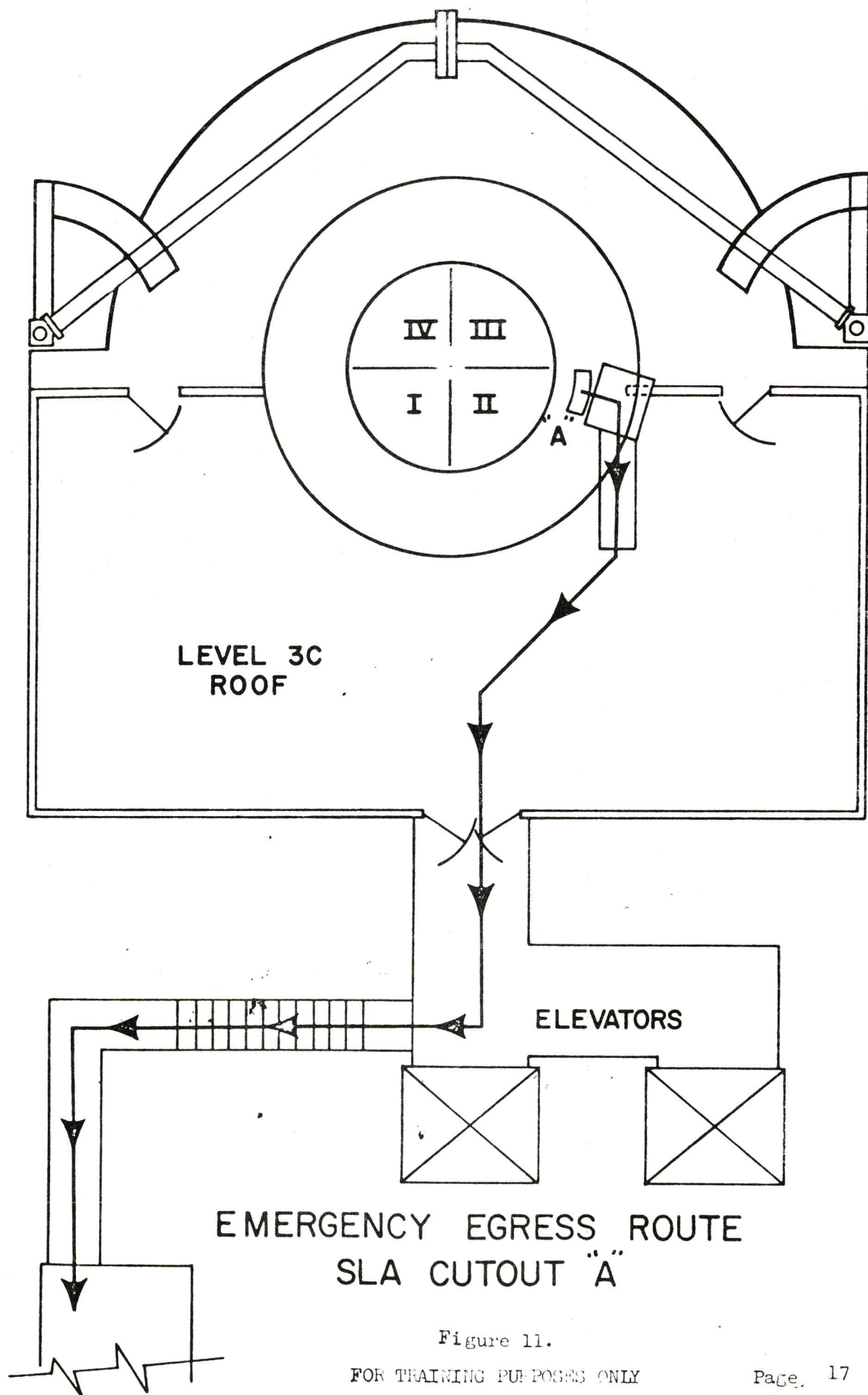


Figure 11.

FOR TRAINING PURPOSES ONLY

EMERGENCY EGRESS EVACUATION ROUTES

Cutout "B". when facing IM, is to the left of the +Z forward hatch on the SLA 603 level platform. The opening will be a few inches higher than the SLA platform level. The cutout will swing open when the "cookie cutter" is actuated. (See Figure 12.)

Cutout "B" egress platform is $21 \frac{5}{16}$ inches below this opening. This will provide access to the 3B level platform. From this level egress can be in either direction, depending on the situation, down a ladder to the 3A level platform, through the double doors and out.

In the event this route is blocked egress may be accomplished using the secondary route down a steel ladder to Swing Arm No. 7. Egress may also be accomplished by the internal SLA ladders to the 697 level and out cutout "A" which is on the 3C level or down to the I.U., through the I.U. permanent hatch and out Swing Arm No. 7. (See Figure 3.)

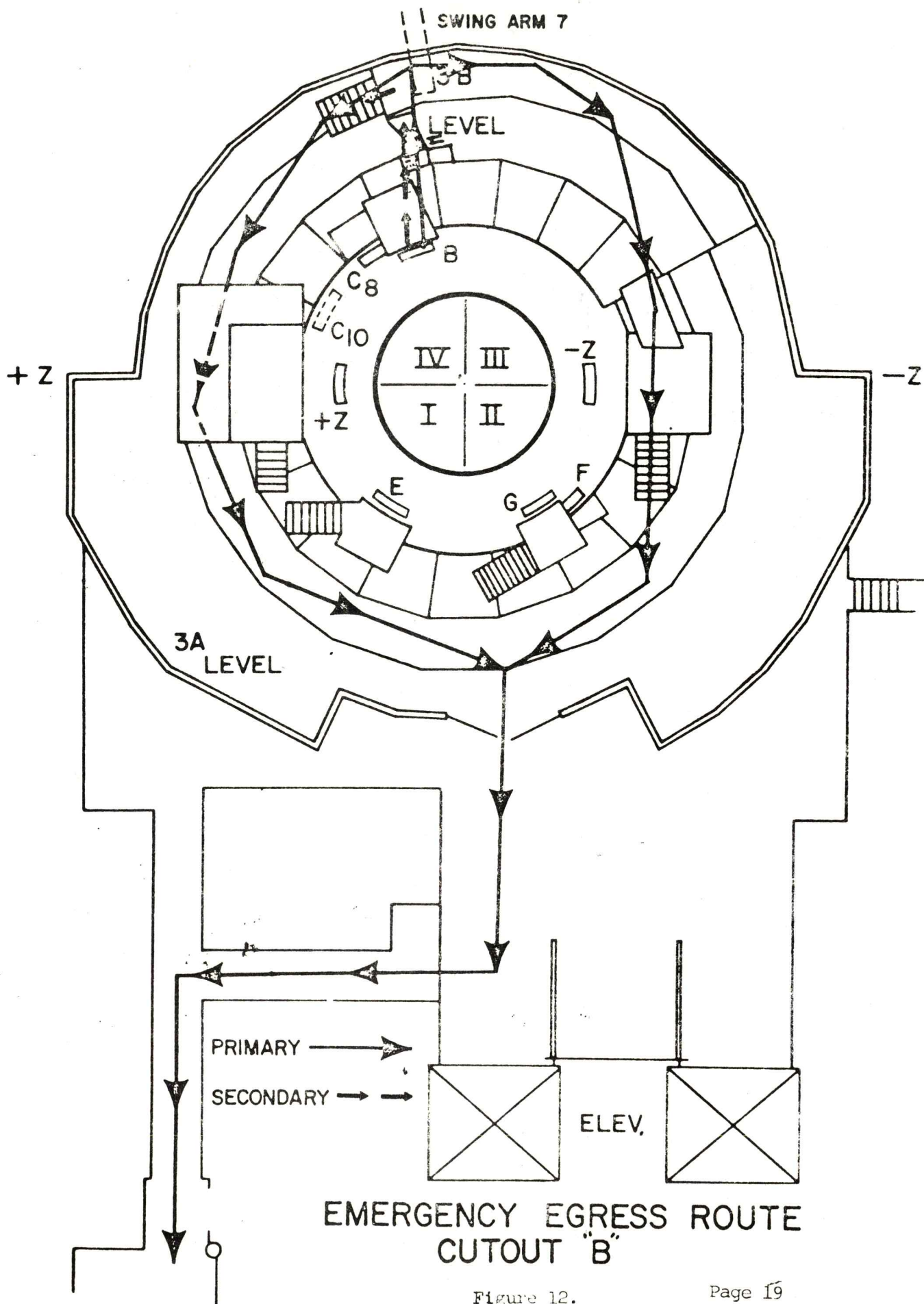


Figure 12.

EMERGENCY EGRESS EVACUATION ROUTES

Cutout "G" is between the -Z permanent hatch and cutout "E" on the SLA 603 level platform. The cutout will be a few inches higher than the SLA platform level. The cutout will swing open when the "cookie cutter" is actuated.

Cutout "G" egress platform will be approximately 3 5/16 inches below the opening. The ladder from the platform leads to the #A level. Normal emergency egress would be out the double doors. (See Figure 13.)

In the event this route is blocked egress may be accomplished using the secondary route down a steel ladder to Swing Arm No. 7. Egress may also be accomplished by the internal SLA ladders to the 697 level and out cutout "A" which is on the 3C level or down to the I.U., through the I.U. permanent hatch and out Swing Arm No. 7. (See Figure 3.)

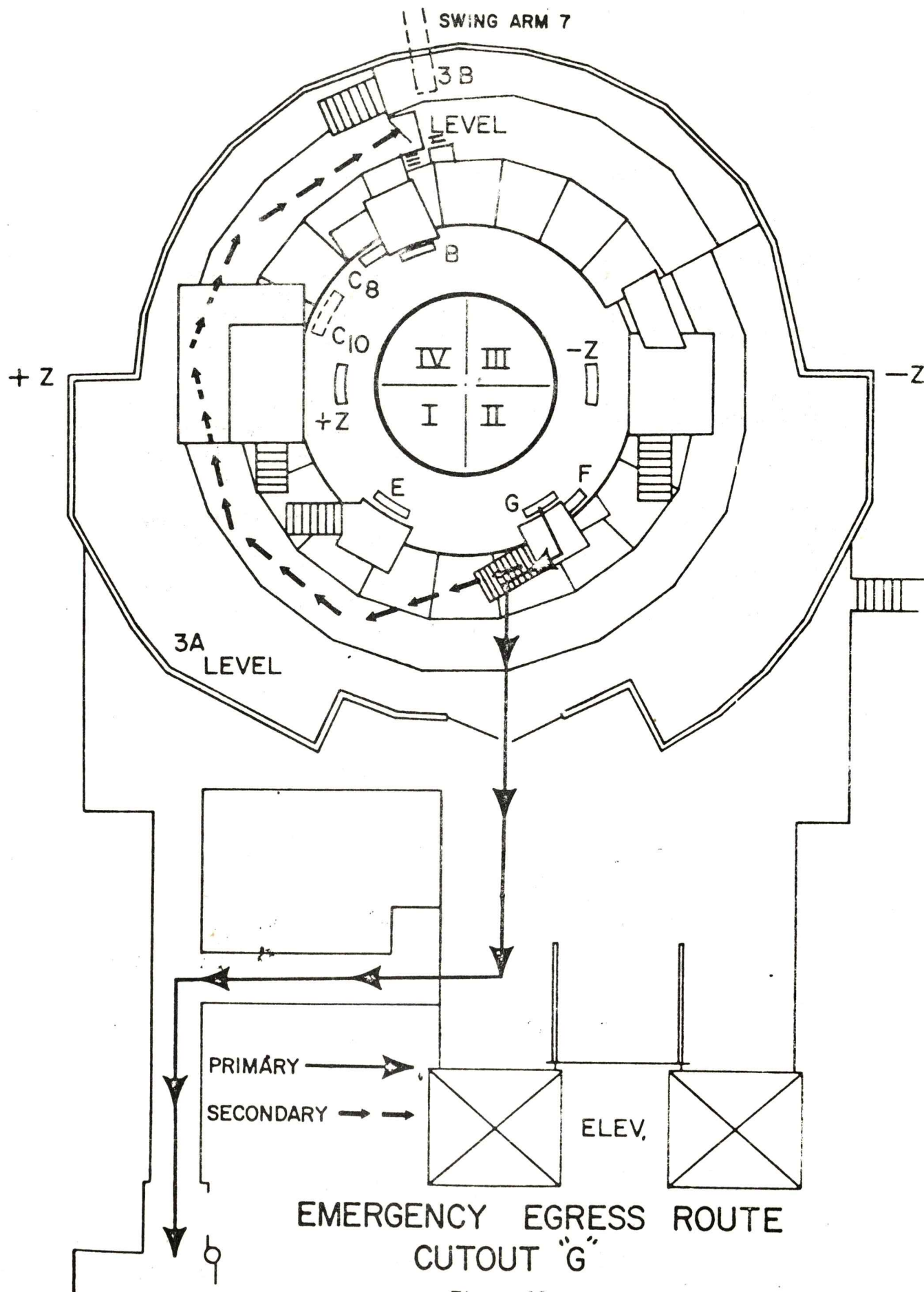


Figure 13.
FOR TRAINING PURPOSES ONLY

EMERGENCY EGRESS EVACUATION ROUTES

Cutout "E" is to the right of the +Z forward hatch, when facing IM, on the SLA 603 level platform. The opening will be a few inches higher than the SLA platform level. The cutout will swing open when the "cookie cutter" is actuated. (See Figure 14.)

Cutout "E" egress platform stand will be approximately 3 5/16 inches below the opening. The ladder from the platform leads to the 3A level. Normal emergency egress would be out the double doors.

In the event this route is blocked egress may be accomplished using the secondary route down a steel ladder to Swing Arm No. 7. Egress may also be accomplished by the internal SLA Ladders to the 697 level and out cutout "A" which is on the 3C level, or down to the I.U., through the I.U. permanent hatch and out Swing Arm No.7. (See Figure 3.)

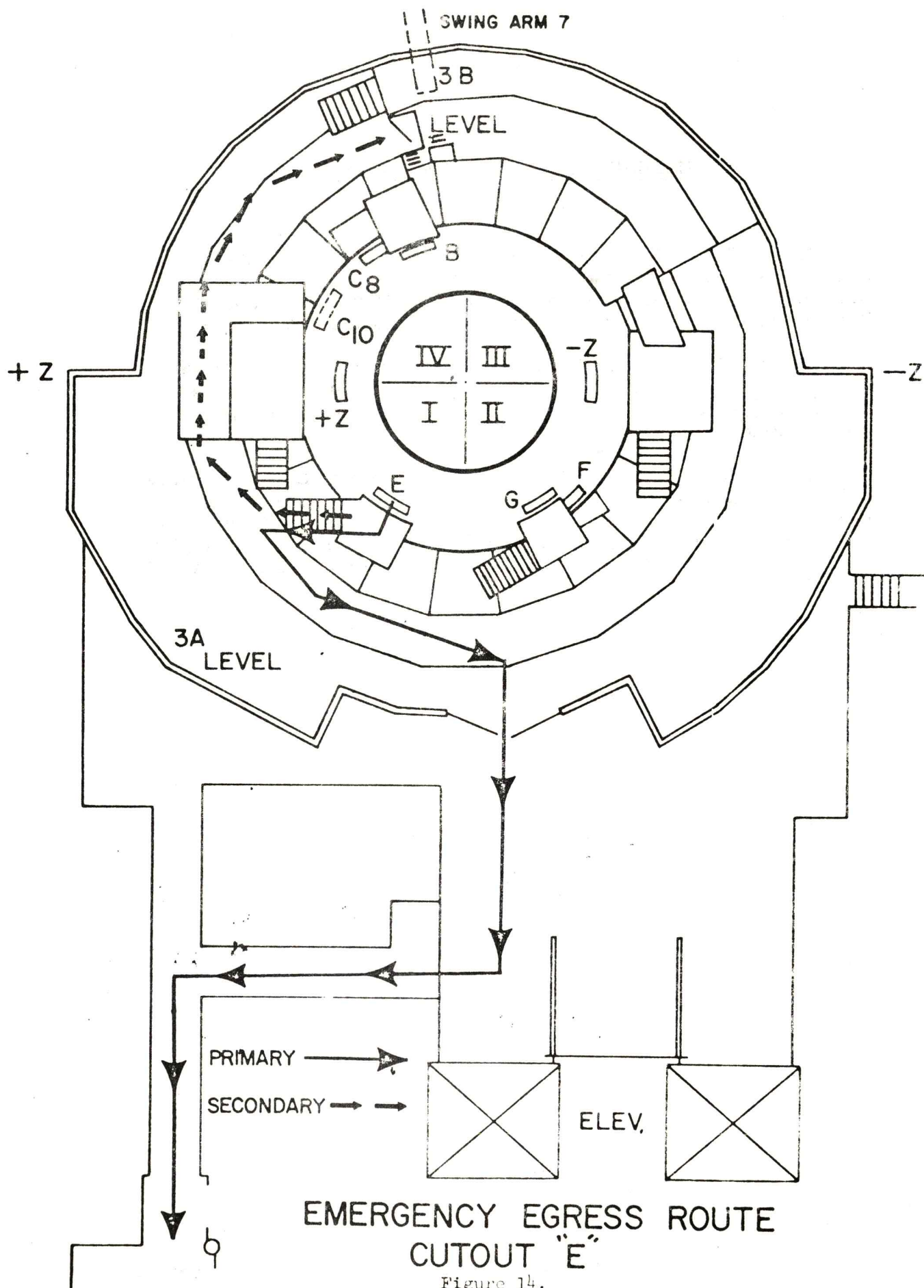


Figure 14.
FOR TRAINING PURPOSES ONLY Page 23

EMERGENCY EVACUATION EGRESS ROUTES

Cutout "C" is below and to the left of the +2 forward hatch, when facing IM forward hatch, on the SLA 525 level platform. This is several inches higher than the SLA platform. The cutout will swing out when the "cookie cutter" is actuated.

Cutout "C" egress platform is approximately 4 11/16 inches below this opening. The platform level 3A is just 3 3/4 inches below that, so egress would be out onto the 3A level and out the swinging double doors. (See Figure 15.)

In the event this route is blocked egress may be accomplished using the secondary route down a steel ladder to Swing Arm No. 7. Egress may also be accomplished by the internal SLA ladders to the 697 level and out cutout "A" which is on the 3C level, or down to the I.U., through the I.U. permanent hatch and out Swing Arm No. 7. (See Figure 3.)

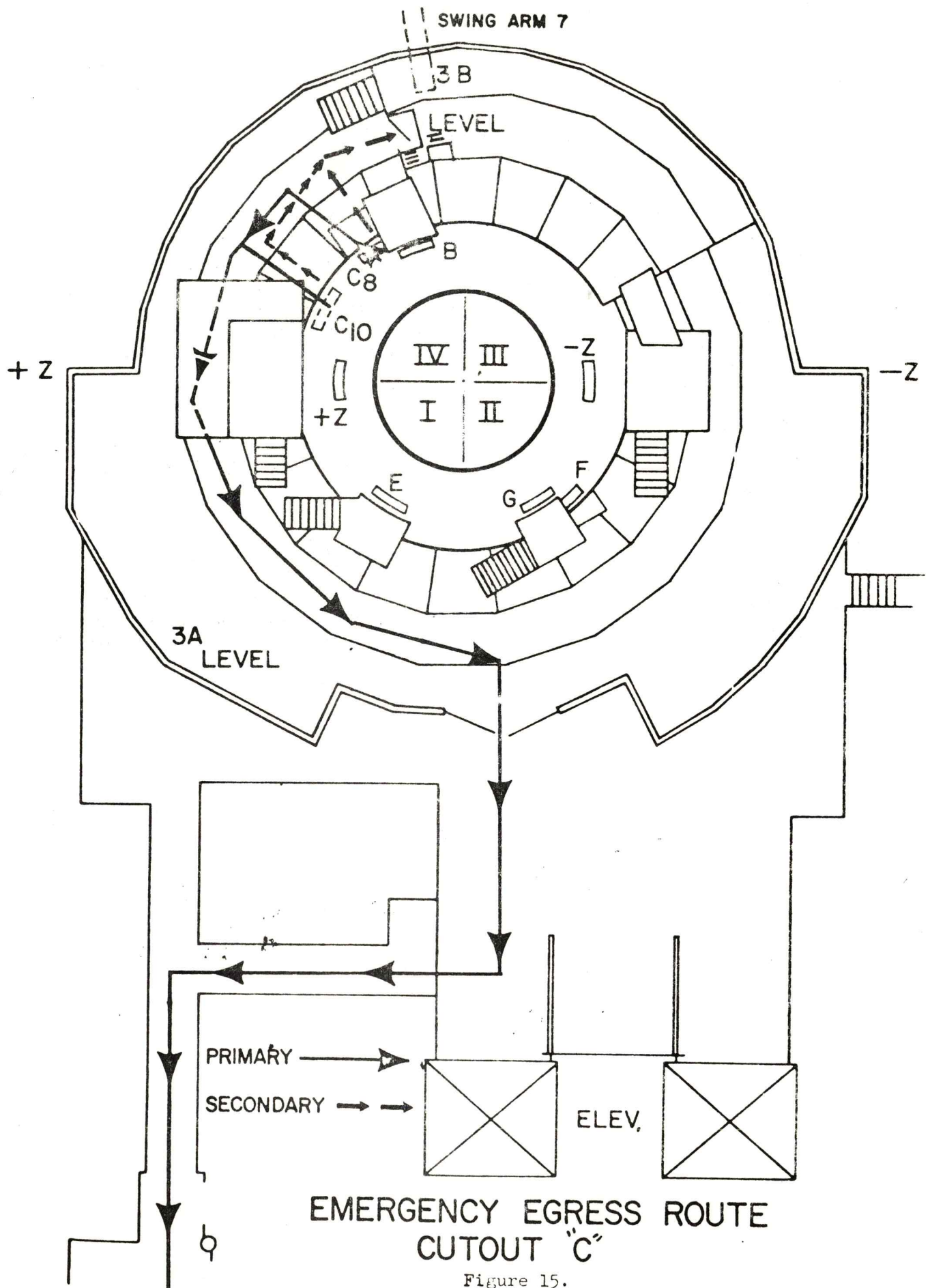


Figure 15.
FOR TRAINING PURPOSES ONLY Page 25

EMERGENCY EVACUATION EGRESS ROUTES

Hatch "F" is below and to the right of permanent -Z hatch, facing LM forward hatch, on the SLA 525 level platform. This opening will be a few inches higher than the SLA platform. Until immediately prior to actual launch, hatch "F" will be closed by a GSE hatch, latched, but spring-loaded to open. To operate from inside the SLA, press the trip bar which runs horizontally across the center of the hatch. The hatch will spring open, and remain open until manually reclosed. To operate from outside the SLA, actuate the handle at the left side of the hatch, pressing handle downward.

Hatch "F" egress platform is approximately $7 \frac{5}{16}$ inches below this opening. The platform level 3A is just $3 \frac{13}{16}$ inches below that, so egress would be out onto the 3A level and out the swinging double doors. (See Figure 16.)

In the event this route is blocked egress may be accomplished using the secondary route down a steel ladder to Swing Arm No. 7. Egress may also be accomplished by the internal SLA ladders to the 697 level and out cutout "A" which is on the 3C level, or down to the I.U., through the I.U. permanent hatch and out Swing Arm No. 7. (See Figure 3.)



Figure 16.

EMERGENCY EVACUATION EGRESS ROUTES

Normal ingress and egress for the I.U. area, the lower SLA, and the IM descent stage is through the permanent I.U. hatch.

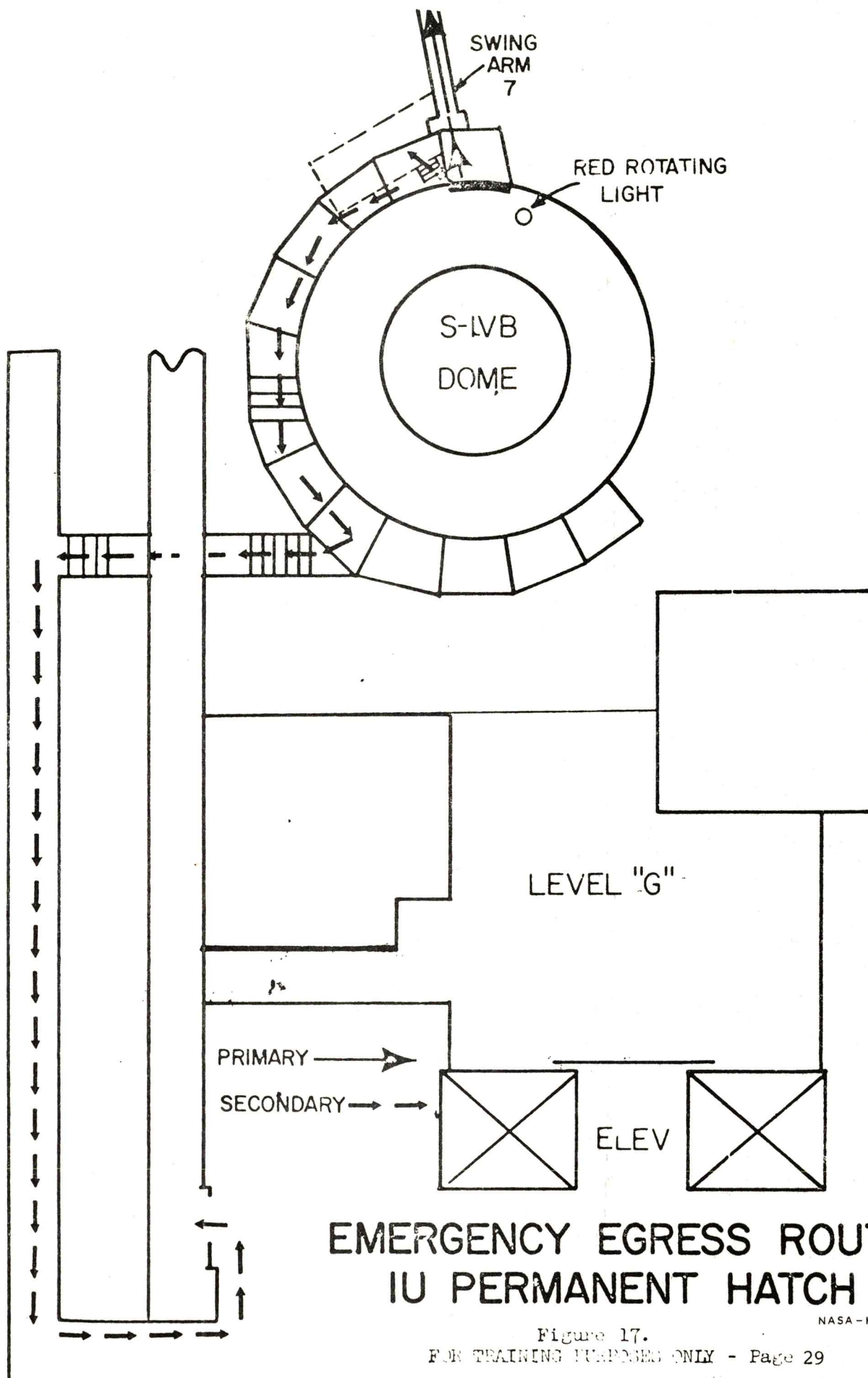
If Swing Arm No. 7 is blocked, personnel working in the I.U. area may egress up to the 603 level and out one of the permanent hatches or cutouts to the 3A level and out the double doors. Limited space is also available around the platform from Swing Arm No. 7 to "G" level of the MSS and down the stairs. (See Figure 17.)

I.U. EMERGENCY RED LIGHT

An emergency red light has been installed in the I.U., it is located just to the left of the permanent hatch. This warning light is to be used only in emergencies to clear the I.U. Stage of all personnel.

It will be the responsibility of the I.U. Monitor to:

- (a) Activate the red emergency light in the I.U. whenever the fire, emergency, or evacuation horn is activated or the Instrument Unit Test Conductor (CUTC), Instrument Unit Pad Leader (PUPL), Launch Vehicle Test Conductor (CLTC), or the Complete Vehicle Test Supervisor (CVTS) direct evacuation.
- (b) He will also be responsible to see that all personnel are clear of the I.U. and the MSS Catwalk.
- (c) Contact the Instrument Unit Test Conductor (CUTC), Launch Vehicle Test Conductor (CLTC, or the Complete Vehicle Test Supervisor (CVTS), and inform him of the emergency or condition of the area, and verify that all personnel are clear of the area.



EMERGENCY EGRESS ROUTE IU PERMANENT HATCH

Figure 17.
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