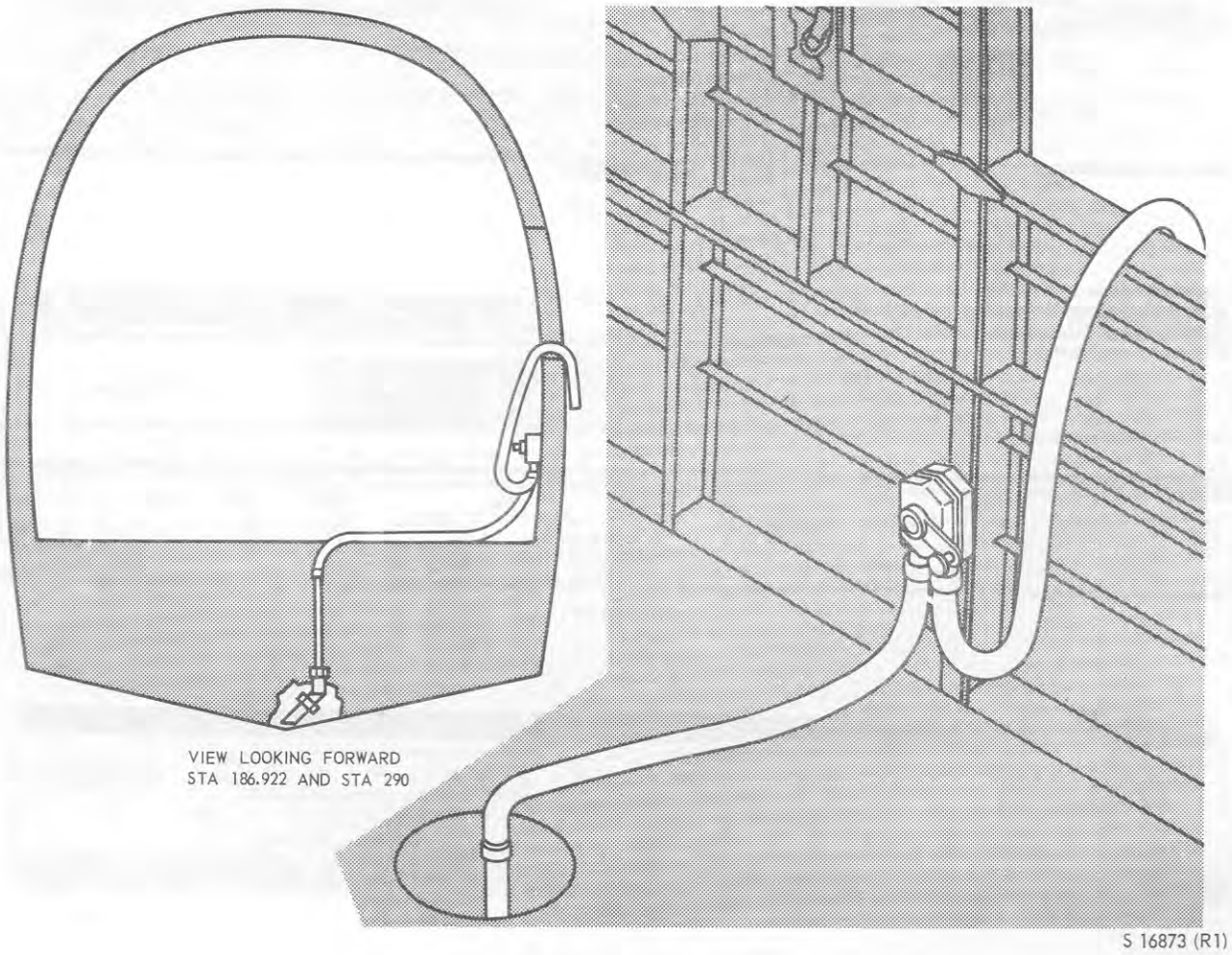


Figure 4-36. Bilge Pump

BILGE PUMP LOCATIONS FOR USE

CARGO COMPARTMENT

WALLS CLEAN	WITH LITTERS	WITH TROOP SEATS
1. Forward: LH side sta. 167, R.H. side sta. 219 upper and sta. 221 lower.	Forward: R.H. side sta. 219 upper	Forward: L.H. side sta. 167, R.H. side sta. 221 lower
2. Aft: L.H. side sta. 321 upper and sta. 323 lower; R.H. side sta. 320 upper and sta. 323 lower.	Aft: L.H. side sta. 321 upper and R.H. side sta. 320 upper	Aft: L.H. and R.H. sides sta. 323 lower

LOAD ADJUSTER.

A slide-rule type load adjuster (figure 4-37) stowed in a case in the pilot's compartment is used for computing CG limits when loading the CH-3E or HH-3E helicopter. Operating proficiency will save the time and effort of having to solve the center of gravity problem by means of mathematical calculations. When used with the charts and forms in the Weight and Balance Manual Data, T.O. 1-1B-40, a safe loading is provided by checking in advance exactly how the balance position will be affected by each item of load added or removed.

INSTRUCTIONS FOR USE OF THE LOAD ADJUSTER.

Colored Top Strip.

The colored top strip of the load adjuster insures safe loading as the red sections show the limits of the loading range. A sloping line defines a limit according to the gross weight of the loaded helicopter, and a vertical line indicates a limit that is constant at all gross weights. The colored top strip also contains a note to "check landing condictions." This note is very important in that the use of fuel and other expendable loads can cause a change in the balance position. The loading must then be rearranged

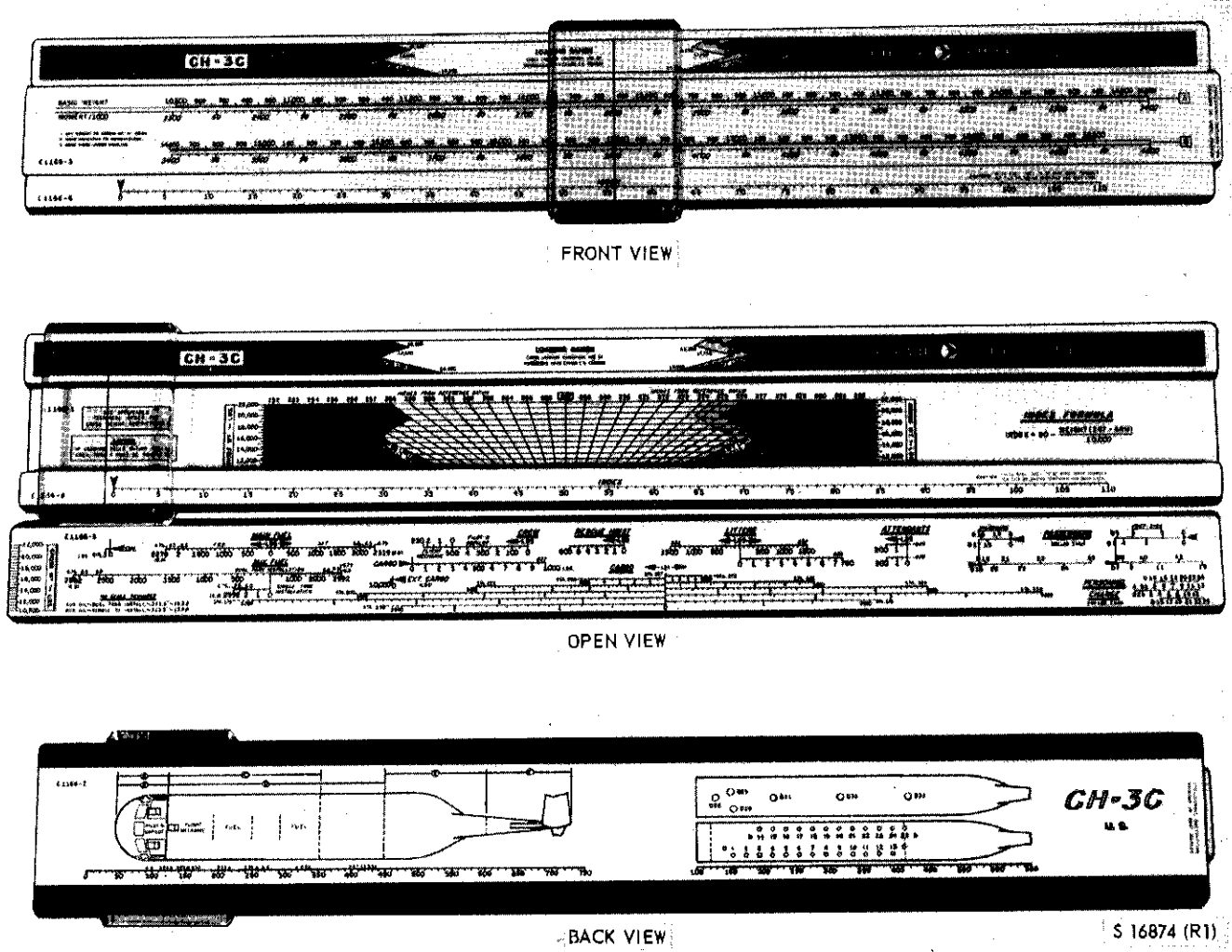


Figure 4-37. Load Adjuster

allow for the CG change, or the allowable limits will be exceeded as fuel or other expendable load is consumed.

Transparent Indicator.

The transparent indicator is movable to translate the change in balance position as the load is changed in terms of the index scale on the bottom of the adjuster. The index scale is merely a simple reference that is mathematically related to the center of gravity grid, or balance diagram, which appears on the inner recess of the load adjuster.

Center of Gravity Grid.

The center of gravity grid is the basis of the load computer's design. The forward and aft red sections show the CG limits in terms of inches from the reference datum, and it is from these limits that the top strip of the load adjuster is devised. The CG position, in terms of inches from the reference datum, may be read directly from this grid. The crosswise lines represent the weight, and diagonal lines represent inches. To convert an index reading to inches from the reference datum, note the point at which the indicator hairline and the gross weight line intersect. The inches from the reference datum are estimated at that intersection. The marks across the top of the grid are inches from the reference datum.

Fuselage Diagrams.

The fuselage diagrams on the back of the load computer will be of great assistance in deciding where to place load items, since they provide information concerning station locations.

Basic Weight and Moment Scales.

The basic weight and moment scales on the inner side of the load adjuster slide determine the basic index, which is the starting point of all loading

calculations. These scales are based on the index formula shown in the recess on the inside of the rule. The procedure outlined below should be followed to arrive at a basic index:

1. Set the indicator hairline at "0" on the index scale.

2. Move the slide until the basic weight is under the hairline.

3. Slide the indicator to the basic moment and read the basic index under the hairline on the index scale.

If the basic moment should happen to be on a scale other than that containing the basic weight, proceed as follows:

4. Move the slide until the basic weight is under the index scale.

5. Move the indicator to the final moment mark at the end of the scale containing the basic weight.

6. Move the slide again until the same moment value at the beginning of the next scale, below, is under the hairline.

7. Move the indicator to the applicable moment figure and read the index under the hairline or the moment value at the end of the second scale.

8. Repeat steps 3 and 4 if the basic moment should appear on the third scale, and the basic weight appears on one of the other scales.

LOAD ADJUSTER OPERATION.

After the basic index has been determined, all loading calculations start with the hairline of the indicator over the basic index. From this point on, it requires two operations to load each of the totals shown on the Form 365F. These two operations are repeated for each loading total that appears on the Form 365F. The computations are made in the order that the times appear on the Form 365F and the resulting index is progressively entered in the index column.

1. Move the slide until the "0" vertical starting line of the scale to be used is under the hairline.

2. Move the indicator until the hairline is over the weight to be added. The new index is then read under the hairline on the index scale at the bottom of the rule.

The effect of the removal or redistribution of a load is determined by following the same two steps above, except the hairline is not set over the "0" line of any given scale, but instead is set over the total weight to be removed and the last recorded index reading. The indicator is then moved to the "0" line of the scale, or to an intermediate weight, and the new index is read under the hairline on the index scale.

NOTE

When moving the slide, ensure that the indicator does not move, and when moving the indicator, ensure that the slide remains in position.

NOTE

The use of the load adjuster shall be required to determine CG condition of the helicopter loading. When load adjuster shows the helicopter to be in the critical (yellow shaded) load condition, Form 365F must be filed.

SAMPLE PROBLEM FOR THE LOAD ADJUSTER.

Suppose that the Chart C of T.O. 1-1B-40 for your helicopter shows a basic weight of 12,500 pounds and a basic index of 60.0. Form 365F is filled out as in the example given here. Index readings for each of the load items have been listed so that you can start using the load adjuster. Check your answers with the index readings given.

ITEM	WEIGHT	INDEX
Basic Helicopter	12,500	60.0
Oil	44	59.5
Crew (3 - 200 pounds Each)	600	50.0
OPERATING WEIGHT	13,144	50.0
Takeoff Fuel (Main)		
Forward (6.5 pounds per Gallon)	1,100	44.2
Aft (6.5 pounds per Gallon)	1,100	49.8
Passengers (D1-D8)	1,600	43.0
(D14-D19)	1,200	40.1
Cargo (D27)	1,000	55.0
TAKEOFF CONDITION	19,144	55.0
TAKEOFF CG IN INCHES 269.7"		

Set the INDICATOR hairline over the BASIC INDEX of 60.0 to begin.

1. Move the SLIDE until the "0" vertical starting line of the OIL SCALE is under the hairline.

2. Move the INDICATOR until the hairline is over the 44 pound full oil tick mark. The index will now be 59.5.

3. Move the SLIDE until the "0" vertical starting line of the CREW SCALE is under the hairline.

4. Move the INDICATOR until the hairline is over the 400 pound tick mark on the PILOT & COPILOT portion of the scale. Again move the SLIDE until the starting line of the FLIGHT MECHANIC portion of the scale is under the hairline. Move the INDICATOR to the 200 pound tick mark for the crew loading index of 50.0.

Addition of Fuel.

The foregoing computations produce the balance position for the operating weight of the helicopter. (Reference 8 on Form 365F.) The weight of the fuel must be added to the operating weight before payload distribution can be considered.

1. Set the "0" starting line of the FUEL SCALE (MAIN) under the indicator hairline at the operating weight index of 50.0.

2. Move the INDICATOR until the hairline is over the 1,100 pound tick mark on the forward fuel scale. The result is an index of 44.2.

3. By using the AFT FUEL SCALE in the same manner, the fuel loading index of 49.8 will be determined.

NOTE

When the load adjuster is utilized in computing aircraft balance, auxiliary fuel in the external tanks may be added by use of the station 300 cargo scale. To determine if the weight of the empty auxiliary fuel tanks is included in the weight and balance index, refer to charts A and E of T.O. 1-1B-40.

Distribution of Allowable Load.

The balance of the loading computation, showing the load distribution, is worked on the PASSENGERS and CARGO SCALES, resetting the slide to the zero line before each new addition from Form 365F. For the addition of the passengers in seats D1 - D8:

1. Move the SLIDE until the zero mark of the PORT SCALE is under the hairline at the 49.8 index position.

2. Move the INDICATOR to the D8 position for an index of 43.0.

3. Move the SLIDE until the zero mark of the STARBOARD SCALE is under the halrline at the 43.0 index reading.

4. Move the INDICATOR to the D19 tick mark for an index reading of 40.1.

5. Using the D27 CARGO SCALE in the same manner to load the 1000 pounds will produce a take-off index of 55.0.

Determination of Landing CG.

It is very important to determine that the CG will be safe when landing after fuel has been consumed. This computation is accomplished by the reverse use of the load adjuster scales. For example, let us assume that all but 500 pounds of fuel in each of the tanks has been consumed.

1. Set the INDICATOR hairline at the take-off index of 55.0.

2. Move the SLIDE until the 1100 pound tick mark on the forward fuel scale (MAIN) is under the hairline.

3. Move the INDICATOR to the 500 pound mark, thus removing 600 pounds of fuel. Removing 600 pounds of fuel by using the aft fuel scale in the same manner will produce a landing index of 55.1.

Redistribution of Load.

The same reverse use of the load adjuster scales may be followed for redistributing load when required corrections are to be accomplished by moving cargo. If the corrections are to be produced by relocating passengers, then the PERSONNEL CHANGE SCALE would be used. It will be assumed that a more aft CG position is now to be produced by moving the occupant of seat D1 to D9.

1. Set the D1 tick mark on the PERSONNEL CHANGE SCALE under the hairline at the take-off index of 55.0.

2. Move the INDICATOR to the D9 position, producing the more aft CG reading of 58.9.

Reading the CG Position from the Grid.

To convert the take-off index of 55.0 to inches from the reference datum:

1. Set the hairline at the TAKEOFF INDEX of 55.0 and move the slide so that the gross weight figures on its left-hand side will be conveniently close to the indicator hairline.

2. Note the point of intersection of the hairline and the gross weight line on the grid which is closest to the take-off gross weight. In this problem, that line will be the 19,000 pound line.

3. This intersection occurs between the 269 and 270 lines. Therefore the reading in inches may be estimated at 269.7.

DISTRIBUTION OF ALLOWABLE LOAD (CARGO IN COMPARTMENT).

The cargo compartment is divided into marked stations (figure 4-21) at 25 inch intervals between Station 150 and 375. Cargo loading scales corresponding to these marked stations are provided on the load adjuster enabling the distribution of load throughout the compartment. A cargo load CG, located between the marked stations, may be set up by moving the indicator the proportionate distance between the corresponding points on the adjacent scales.

EXAMPLE: Add 3000 lb. of cargo at Sta 235; with helicopter index already at 55.0, move the slide until the "0" lb. line at Sta 267 is under the hairline. The 3000 lb. mark for Sta 225 is over index 42.4. The 3000 lb. mark for Sta 250 is over index 49.8. Therefore 3000 lb. at Sta 235 will be over index.

$$42.4 + \frac{235 - 225}{250 - 225} (49.8 - 42.4) \text{ or } 45.4$$

WEAPON SYSTEM.

The helicopters are equipped with slightly different weapon systems. CH-3E helicopters 16 , Serial No. AF66-13287, and 25 ▸ are provisioned for a weapon system. HH-3E helicopters 24 ▸ are equipped with a weapon system. HH-3E 23 ▸ 24 are equipped with 7.62MM M60 machine guns which have the ammunition container mounted on the gun and 19 ▸ are equipped with 7.62MM M60D machine guns with the ammunition containers mounted on the floor. Helicopters modified by T.O. 1H-3-577 are equipped with a KB-18A panoramic strike camera. Both systems will be discussed, except for major differences, under common headings as one system. The weapon system is comprised of three 7.62MM machine guns, gun mounts, ammunition containers and feed belt, and armor plate protection. The system is solely operated by aircrewmen with no additional inputs by the pilot other than voice readiness signals. The system is used as a fire suppressive deterrent to ground troops and soft target areas.

7.62MM MACHINE GUN.

The 7.62MM machine gun (figure 4-38) is an air-cooled, link-belt fed, gas-operated weapon. The gun is capable of firing approximatley 550 rounds per minute. Due to the relatively low rate of fire, plus the quick-change barrel feature, the service life of the gun is greatly increased. The primary weapon controls are the latch lever, barrel lock lever, cocking handle, safety lever and trigger (see figure 4-38). The guns are mounted at three stations in the helicopter. One gun is located on a movable platform on the aft ramp, and the other two are located on mounts on the left and right-hand sides of the forward cabin. The right-hand gun has an extension installed to prevent firing into the hoist cable (see figure 4-39).

FORWARD GUN MOUNTS.

Each mount consists of a tube, pintle, cam, cam follower, platform, hinge brackets, supports, tension pins and cables. The right mount is attached to the personnel door armor, and the left is attached to the left cabin wall. When use of the guns is anticipated, the mounts are pivoted on a hinge point from a stowage support and pinned in the firing position. The cam and cam follower limits the field of gunfire which prevents firing into any portion of the helicopter (see figure 4-39).

AFT GUN MOUNT.

The mount consists of a tube, tie rod, cam, cam follower, pintle, brackets, supports, tension pin and cable, and is bolted to the aft gun platform. It prevents the gun firing into any portion of the helicopter (see figure 4-39).

AFT GUN PLATFORM.

The platform consists of armor plates, retainer, mounting pad, brackets, rollers, locking mechanism and handle. It is attached to the tracks on the aft ramp. When use of the aft gun is anticipated, the locking handle is pulled, releasing the lock; the platform is pushed aft to the firing position and the handle is pushed in, engaging the lock. The platform provides protection from small arms fire and support for the aft gun mount (see figure 4-39).

LATCH LEVER.

The latch lever actuates the cover latch, which is spring loaded, and is located at the right rear end of the feed cover. The function of the latch is to secure the cover in the closed postion. When the lever is vertical, the cover is locked closed. Turning the lever to the horizontal position unlocks the cover (see figure 4-38).

CAUTION

Do not turn the latch lever more than required to unlock the cover, as damage to the latch spring will result.

BARREL LOCK LEVER.

The barrel lock lever is located on the right front end of the receiver. The lever is secured to the barrel locking shaft and rotates the shaft to lock and unlock the barrel. When the lever is vertical, the barrel is unlocked. When the lever is horizontal, the barrel is locked in place (see figure 4-38).

COCKING HANDLE.

The cocking handle is located on the right side of the

receiver between the cover and trigger mechanism. Cocking handle function is to charge the weapon manually. When the handle is pulled to the rear, the bolt is cocked (see figure 4-38).

WARNING

Before firing, the handle must be returned to the forward position.

SAFETY LEVER.

The safety lever is located on the left side of the trigger mechanism. Safety lever function is to prevent the weapon from being fired accidentally. The safety has two marked positions: "F" (Firing) and "S" (Safety) (see figure 4-38).

TRIGGER.

The trigger is located below the receiver directly under the feedway. Trigger function is to control firing of the weapon.

GUN STATIONS.

The gun stations are at the personnel door, jettisonable window, and aft ramp. The forward guns are supported on swing-away mounts, providing fields of fire of 70 degrees forward, 50 degrees aft, 65 degrees in depression, and from five to nine degrees in elevation, which is decreased to -30 degrees as the guns are moved toward the auxiliary fuel tank area. The aft gun is supported on a mount and sliding platform attached to tracks on the aft ramp. The tracks permit the platform and mount to be moved into the firing position. This mount provides a rearward field of fire of 80 degrees to each side, 65 degrees in depression, and five degrees in eleva-

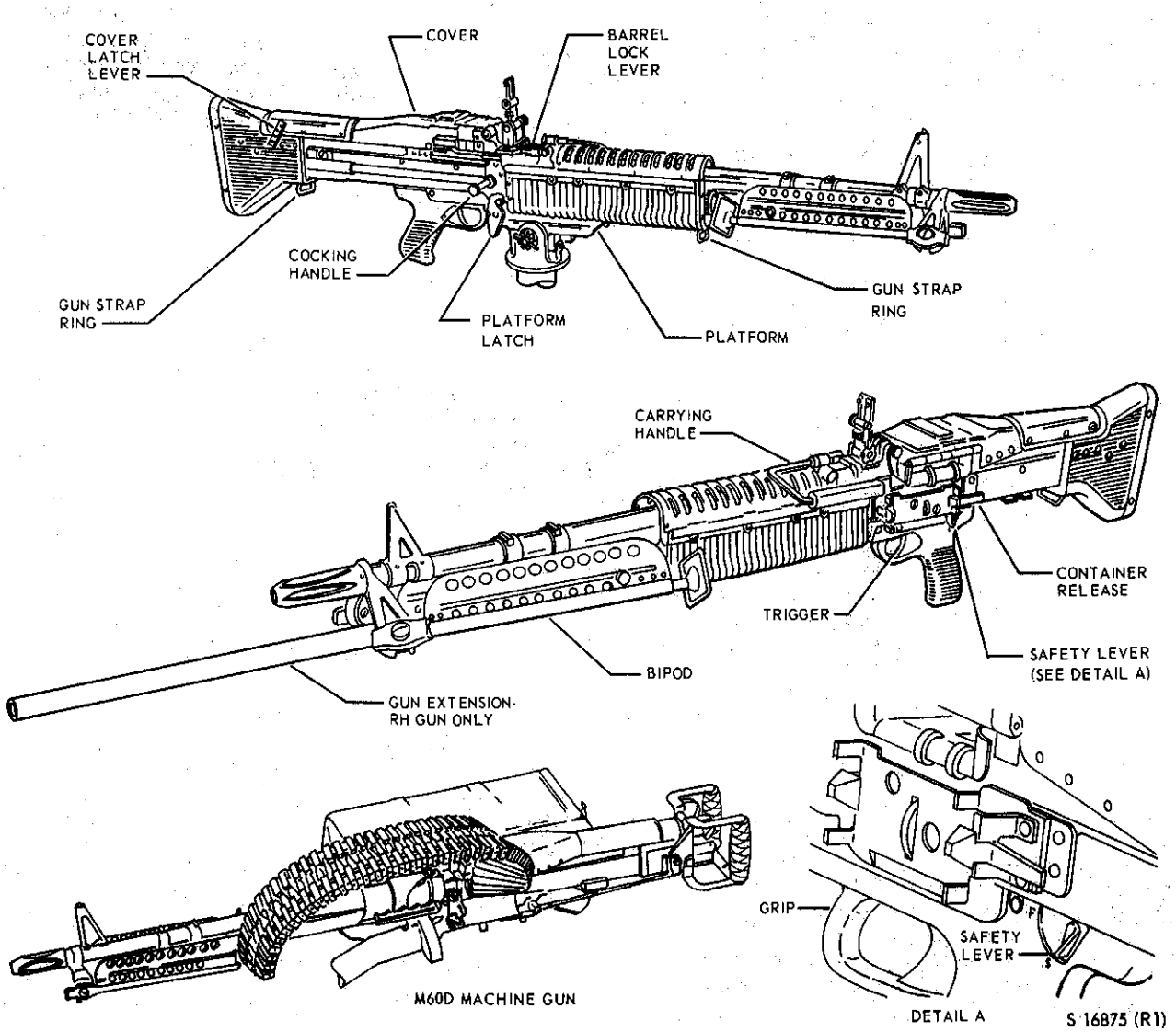


Figure 4-38. M60 Machine Gun (Typical)

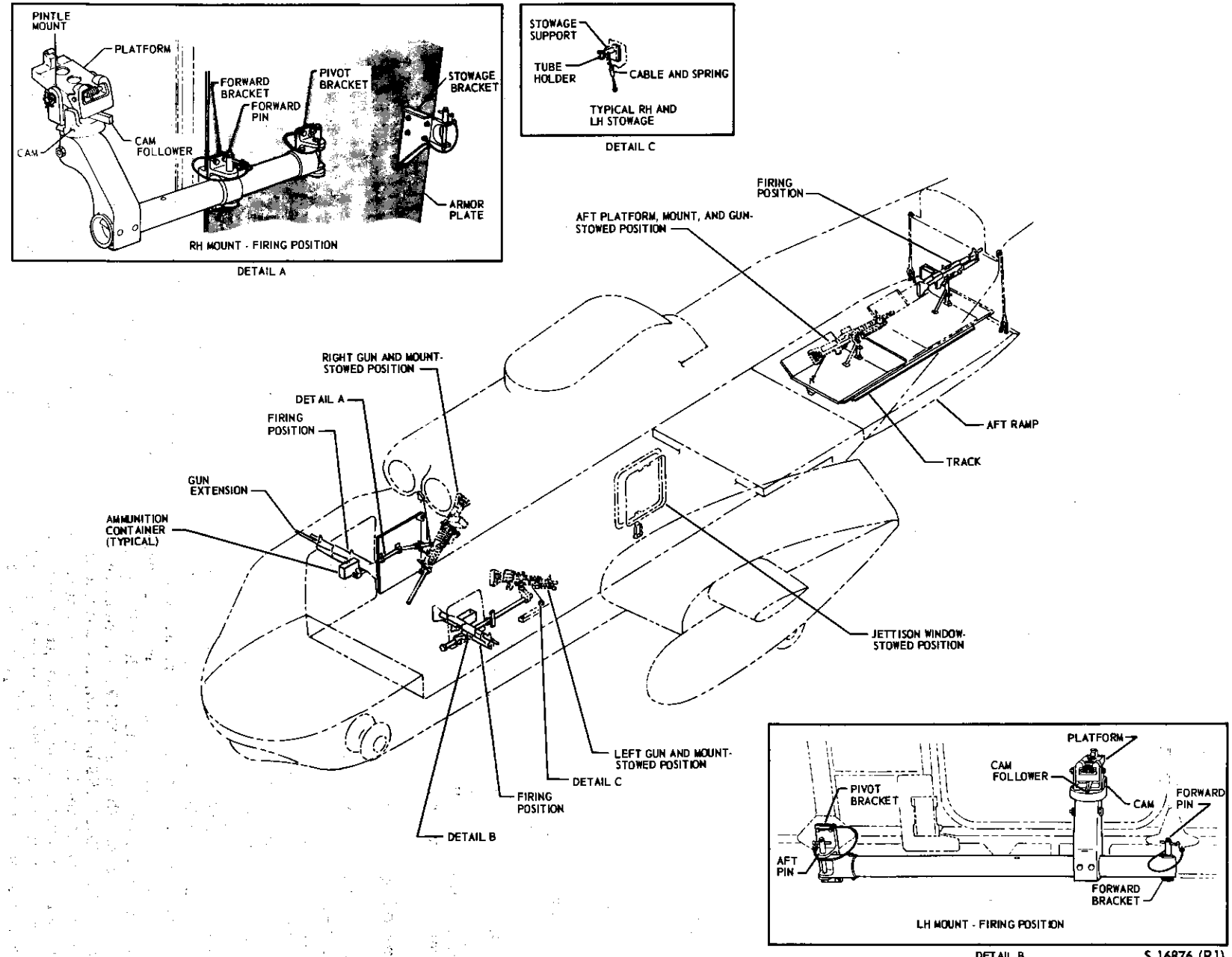


Figure 4-39. Armament System (HH-3E 24 ▶ 25)

tion when fired under the pylon, increased to 20 degrees after clearing the pylon. For fields of fire, see figure 4-41.

WARNING

During gunnery missions, the personnel harness for the gun stations will be worn and connected to the rings and supports.

AMMUNITION STORAGE CONTAINERS.

The containers attached to each gun have a capacity of 200 rounds of 7.62MM ammunition, and the containers mounted on the floor each have a capacity of 750 rounds of 7.62MM ammunition.

CAUTION

Ammunition aboard the helicopter will be handled in accordance with T.O. 11A-1-20.

ARMOR PROTECTION.

The pilot, copilot, crewmen, and vulnerable components of the helicopter are protected from small arms fire by titanium armor plating (see figure 4-42).

KB-18 STRIKE CAMERAS.

Two KB-18 strike cameras are installed on a limited number of helicopters, modified by T.O. 1H-3-577, to give a photographic capability to the mission. One camera is a vertical viewing camera and the other is an aft viewing camera.

Operating Controls.

The cameras are operated by a camera power control panel, located on the lower right side of the cockpit console, an ordnance release panel, located on the lower center of the cockpit console, and two camera operating control panels, located in the middle of the cargo compartment on the right side. The camera power control panel contains two push-to-test CAMERA-ON lights to indicate camera operation, an ON/OFF power switch to supply camera power, and two ON/OFF operate switches for individual operation of the cameras. The ordnance release panel contains a toggle switch with marked positions ARM and SAFE, a pushbutton switch with a RELEASE position, and a frame ID pushbutton switch for frame marking identification. The camera operating control panel have a frame-per-second control knob with positions 4, 2, and 1, and an overrun control knob with positions 1, 2, 3, 4, 5, and 6. The vertical camera has an automatic and manual mode of operation. The automatic mode is controlled by the ordnance release switch and the manual mode is controlled by the operate switch on the camera power control panel. The aft camera has only a manual mode of operation controlled by the operate switch on the camera power control panel.

Operating Procedures.

BEFORE TAKE-OFF.

1. Vertical camera operating control panel.
   a. Frame/sec. control knob - 4.
   b. Overrun control knob - 6.
2. Aft camera operating control panel.
   a. Frame/sec. control knob - 1.
   b. Overrun control knob - 2.
3. Camera power switch - ON.
4. Camera on lights - DEPRESS.
   Press to test for light operation.

IN-FLIGHT.

For manual operation (both cameras).

1. AFT or VERT operate switch - ON.
   When thirty seconds from target, place operate switch ON.
2. AFT or VERT operate switch - OFF, AFTER TARGET RUN.

For automatic operation on (vertical camera only).

1. Ordnance release button - DEPRESS.
2. Frame ID button - DEPRESS.
   (Hold momentarily when frame identification marking is depressed; depress the frame ID button simultaneously with initial depression of the ordnance release button and hold for at least one second.)

BEFORE LEAVING THE HELICOPTER.

1. Check that the camera power and the AFT and VERT operate switches are in the OFF position.

NOTE

When the KB-18 camera has used its film supply, it will automatically cease operating; however, power must be turned off before removing film.

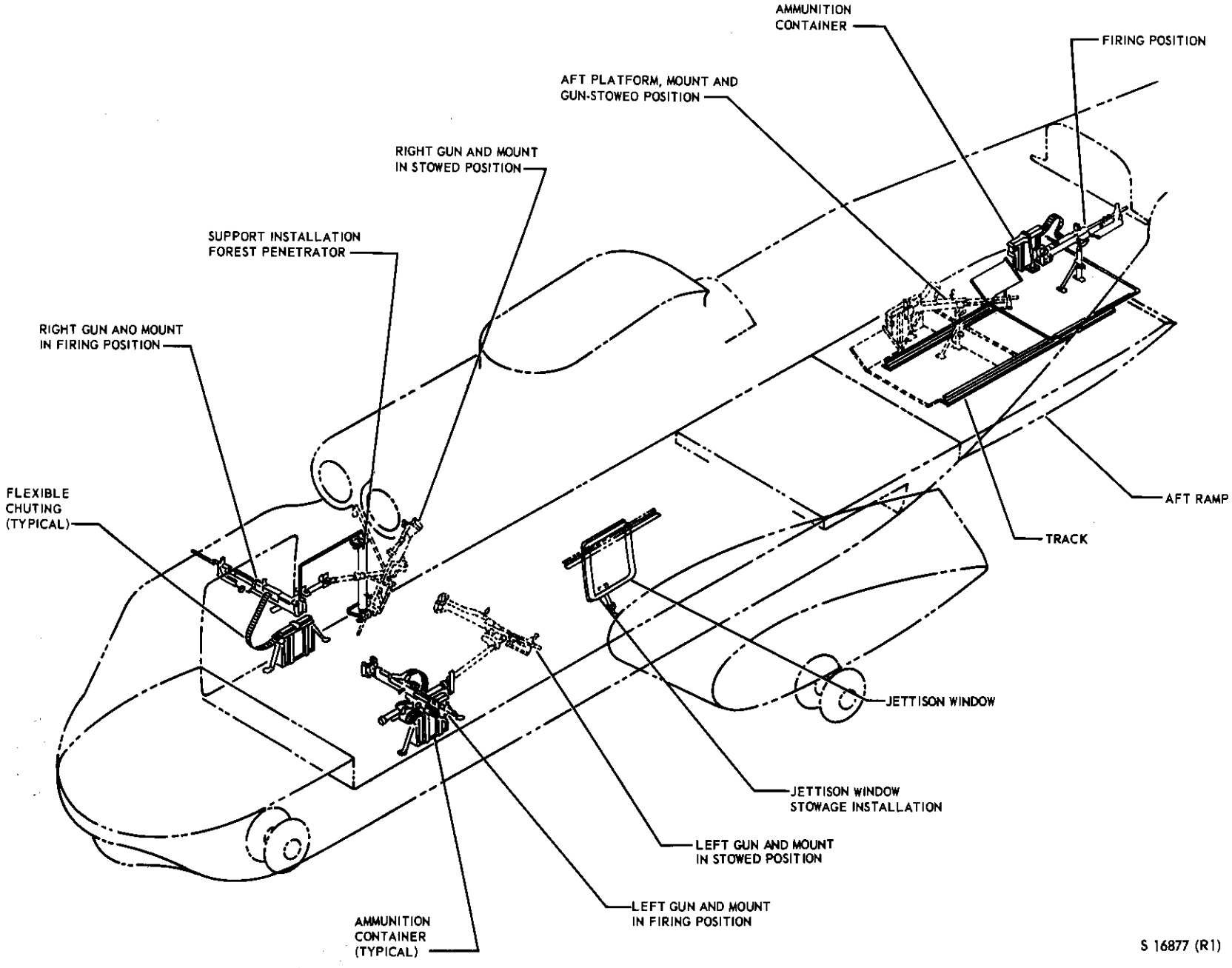


Figure 4-40. Armament System (HH-3E 25 ▶)

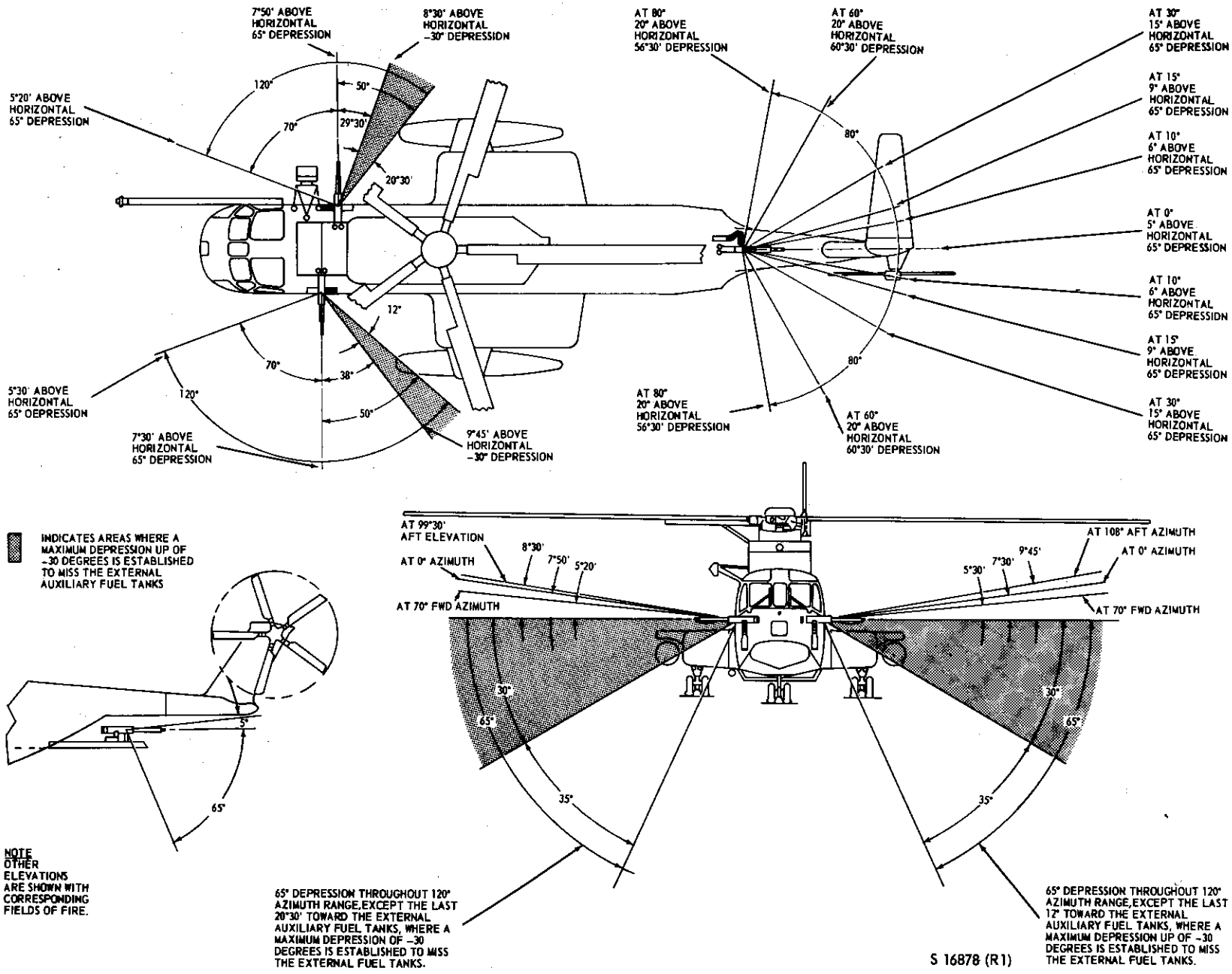


Figure 4-41. Armament Fields of Fire

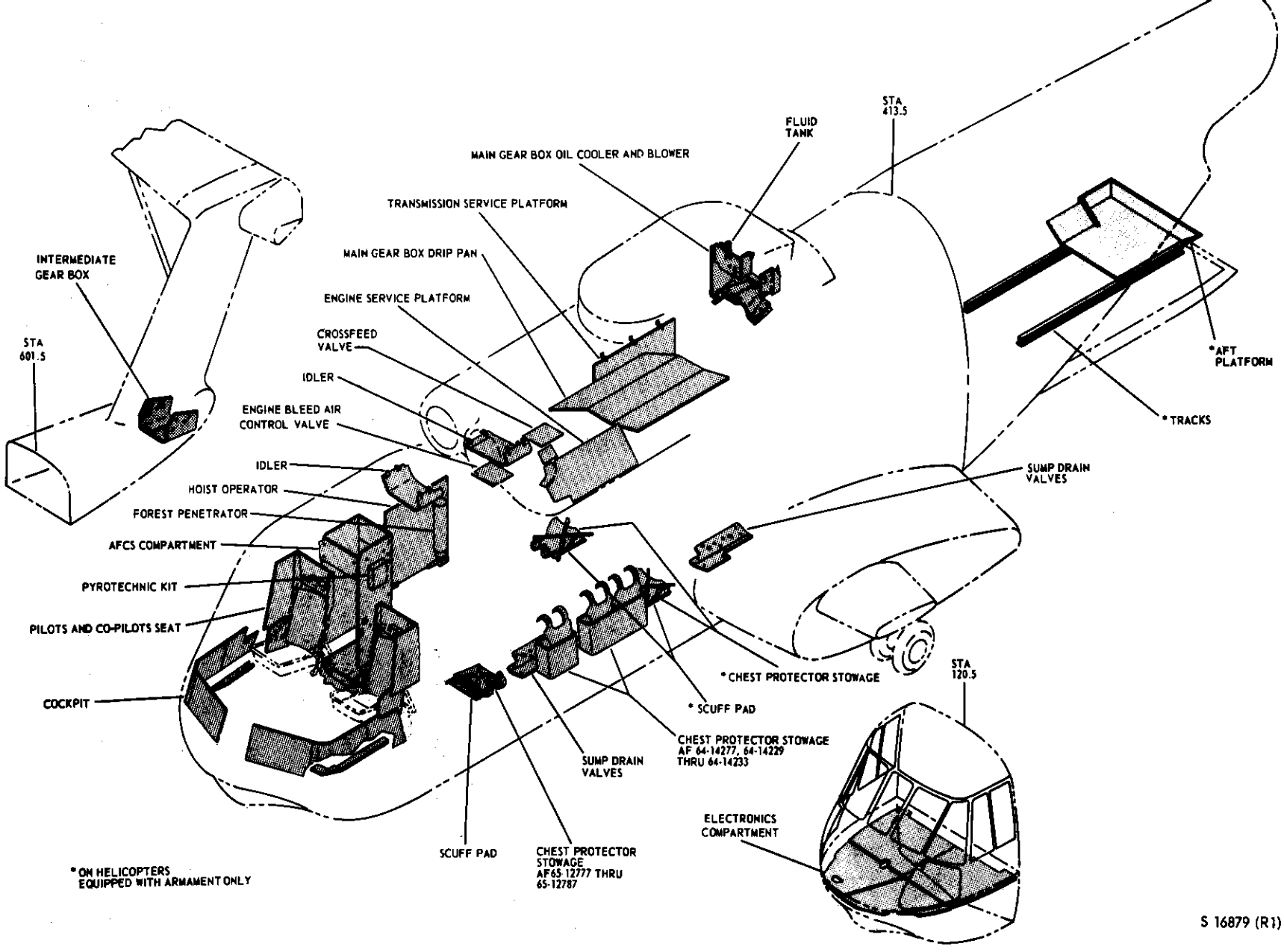


Figure 4-42. Helicopter Armor Protection

FLARE EJECTOR SET AN/ALE-20(V).

The AN/ALE-20(V) flare ejector system (figure 4-43) installed on helicopters modified by T.O. 1H-3-646 is an airborne countermeasure system designed to deceive infrared guidance systems used in certain types of missiles. Deception is accomplished by releasing flares having an infrared energy component large in comparison to the helicopters infrared output so that the missile will fly to the flare instead of the helicopters. The system consists of one power panel, one flare programming control panel, five remote release panels, one flare arming switch, one junction box, and two identical stepping switches with companion flare ejector cases. The AN/ALE-20(V) flare ejector system provides a means of selecting the number of flares to be released, timing the interval between bursts, and igniting and releasing the flares from the helicopter. The AN/ALA-17 flare set is used with the system and provides 16 single flare bursts per system with a maximum of 32 single flare bursts per system with two sets of ejector cases installed in the helicopter. The flares may be programmed to release in bursts of one, two, or three flares at intervals of 2 to 20 seconds between bursts, The flares may also be released at a rate of one flare every 65 milliseconds by depressing the FAST TRAIN switch and all flares may be released in less than 3 seconds. The system electrical dc power is wired through the helicopter squat switch and prevents inadvertent releasing of flares when the helicopter is on the ground. The system is provided with a GRD MAINT switch located above the flare programming control panel. The system is powered by 28-VDC power from the essential dc bus through a 15-ampere circuit breaker and a 10-ampere circuit breaker, and 115-VAC power from the essential ac bus through a 5-ampere circuit breaker. The pilot's flare arming switch must be on to enable ejector set operation.

WARNING

Under normal operating conditions, during inflight refueling or fuel dumping, the AN/ALE-20 flare ejector system will be disarmed at the PILOT'S AN/ALE-20 ARMING SWITCH.

The ignition of a flare within the loading case presents an extreme fire hazard to the helicopter. The following safety features provide for jettisoning the flare case should such ignition occur. A heat sensor within each case will initiate automatic firing of explosive bolts holding the case when temperature in the case rises above the preset limit. The same explosive bolts can be electrically fired by engaging either the RH CASE JETTISON switch or the LH CASE JETTISON switch on the flight mechanic's panel at the right side flare release position. If the explosive bolts fail to jettison the case, the backup manual system can be used. The manual jettison device pulls pins holding the case when the manual release lever, just forward of the ramp, is pulled.

FLARE PROGRAMMING CONTROL PANEL. (Figure 4-44)

The flare programming control panel is located on the forward cabin bulkhead. The control panel supplies the junction box with command pulses at the right times and rates. The panel contains power and automatic signal switches, transfer switch, release switch, fast train switch, flares-per-burst switch, program-in-progress light, RH empty light, bursts-remaining counter, burst interval selector, and a burst selector. Flare releasing may be controlled from the flare programming control panel or any of the five remote release positions.

Power and Automatic Signal Switches.

The power switch is a 2-position (POWER and OFF) toggle type switch that controls 28-VDC and 115-VAC, 400-Hz power to the equipment. The auto switch is a 2-position (AUTO and OFF) toggle type switch that allows the system to accept a release signal from a remote signal source, such as a remote firing panel.

Transfer Switch.

The transfer switch is a 2-position (TRANSFER and OFF) toggle type switch that controls the operation of the relay in the junction box. The purpose of the switch in the TRANSFER position is to transfer electrical power to the right bank of flares, should a malfunction jettison occur in the left bank.

Release Switch.

The release switch is a momentary-contact push-button switch, placarded RELEASE. The switch, when actuated, initiates the firing program established by other control panel settings.

Fast Train Switch.

The fast train switch is a momentary-contact push-button switch, placarded FAST TRAIN. When the switch is actuated, one flare is released every 65 $\pm$ 10 milliseconds until cases are empty.

Program -in-Progress.

The program-in-progress light is a 28-VDC press-to-test light that is placarded PROGRAM IN PROGRESS. This light acts as a reminder to the operator that the flare release program established by the other controls is in progress. The light glows when the fast train switch or the release switch is depressed. The light goes off upon completion of the program, but not in fast train. The light also goes off if power to the system is momentarily

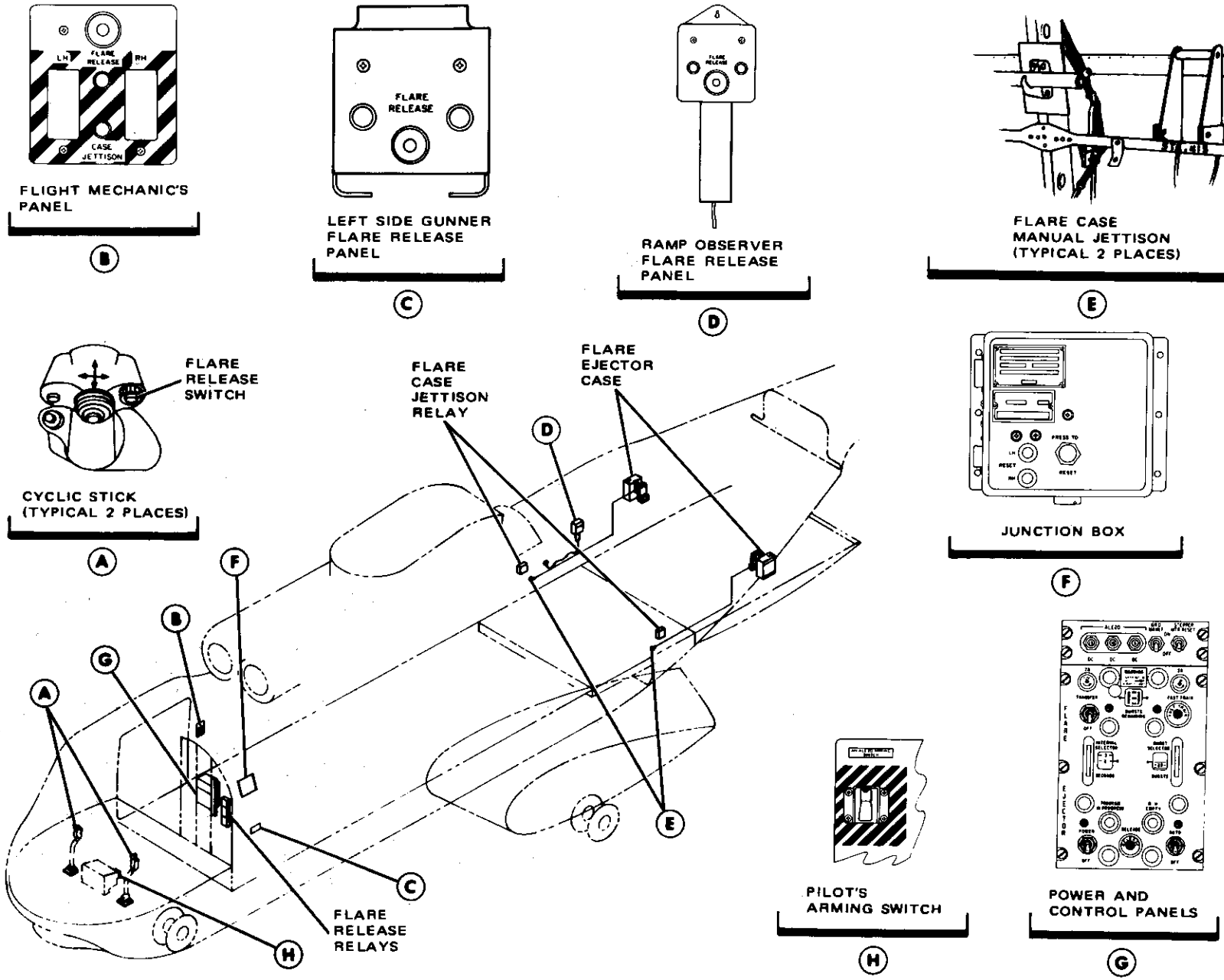


Figure 4-43. Flare Ejector System

lost, thus indicating that the release program must be reinitiated when flares are required.

RH Empty Light.

The RH empty light is a press-to-test light that is placarded R. H. EMPTY. This light serves as an indication to the operator that all flares in the right-hand bank have been released.

Bursts Remaining Counter.

The counter, placarded BURSTS REMAINING, displays the total number of bursts remaining on the helicopters. The counter is equipped with a mechanical reset control mounted on the control panel.

Burst Interval Selector.

The burst interval selector, placarded INTERVAL SELECTOR, controls the burst interval generator. The thumbwheel is detented for positive, easy setting in 1 second increments from 2 seconds to 20 seconds. The drum is marked in 1 second increments and numerals for all even numbered settings.

Burst Selector.

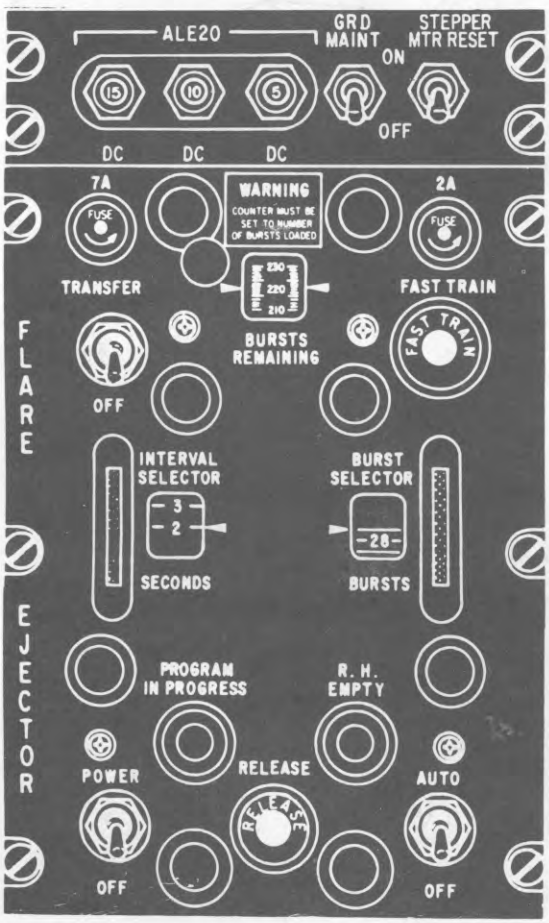
The burst selector, placarded BURST SELECTOR, is used to select the number of flare bursts desired for a particular program. The number of bursts used for a particular program is selected by rotating the thumbwheel control until the desired number of bursts is shown through the window on the control panel. The drum is marked in 1 burst increments from 1 to 29, and numerals for all even numbered settings. When a program is initiated, the burst selector counts subtractively to show the number of bursts remaining in that particular program. When the drum counts to zero, it will automatically return to the number of bursts originally selected.

JUNCTION BOX RESET SWITCH AND RESET LIGHTS. (Figure 4-45)

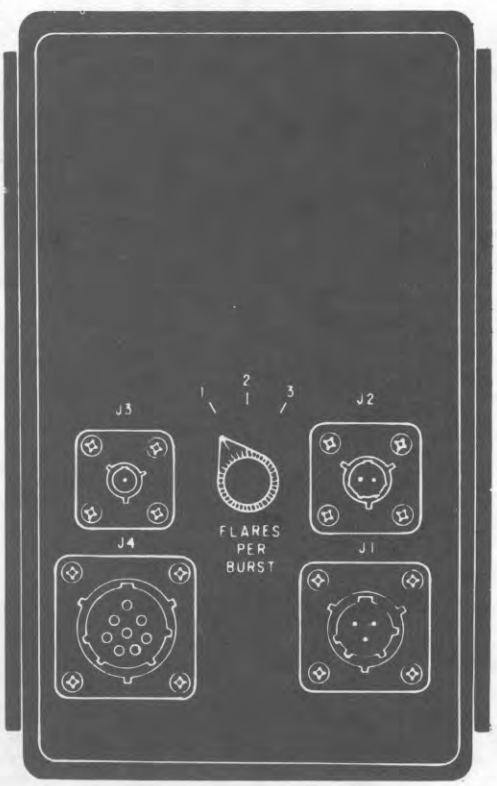
The junction box operates on the receipt of command pulse signals from the control panel. The junction box is equipped with a reset switch and two reset lights.

Reset Switch.

The junction box is equipped with a momentary-contact type switch, placarded PRESS TO RESET. The switch when activated returns the stepping switches to the No. 1 positions and allows the system to start at its initial settings.



FRONT VIEW



REAR VIEW

Figure 4-44. Flare Programming Control Panel and Power Panel

WARNING

The junction box PRESS TO RESET switch is not to be actuated during flight. The switch shall be reset by ground-servicing personnel.

Reset Lights.

There are two press-to-test reset lights, placarded LH and RH, on the junction box. These lights indicate which stepping switches have been reset to the No. 1 position and are ready to be fired again. The reset circuit is such that the LH and RH lamps blink rapidly when reset.

FLIGHT MECHANIC'S PANEL.

The flight mechanic's panel (figure 4-46) contains switches to release flares and to jettison the flare case assemblies. The FLARE RELEASE push-button initiates a flare release signal to the control panel to release the preprogrammed flare burst. The CASE JETTISON switches initiate a signal to the explosive bolt holding the case assembly to the helicopter. The RH switch jettisons the case assembly on the right side of the helicopter. The LH switch jettisons the case assembly on the left side of the helicopter.

CYCLIC STICK FLARE RELEASE SWITCH.

A flare release switch is located on the top right of the pilot's and copilot's cyclic stick to enable the pilot or copilot to release flares. The switches initiate a signal to the control panel to release the preprogrammed flare burst.

RAMP OBSERVER FLARE RELEASE PANEL.

The ramp observer flare release panel is mounted on a bracket and can be removed and hand held. Movement is limited by the length of the connecting electrical cord. The FLARE RELEASE switch initiates a signal to the control panel to release the preset flare burst.

LEFT SIDE FLARE RELEASE PANEL.

The left side flare release panel is mounted to the right of the left forward cargo window. The panel contains a FLARE RELEASE switch that initiates a signal to the control panel to release the preprogrammed flare burst.

FLARE CASE MANUAL JETTISON LEVER.

The flare case manual jettison lever is used to re-

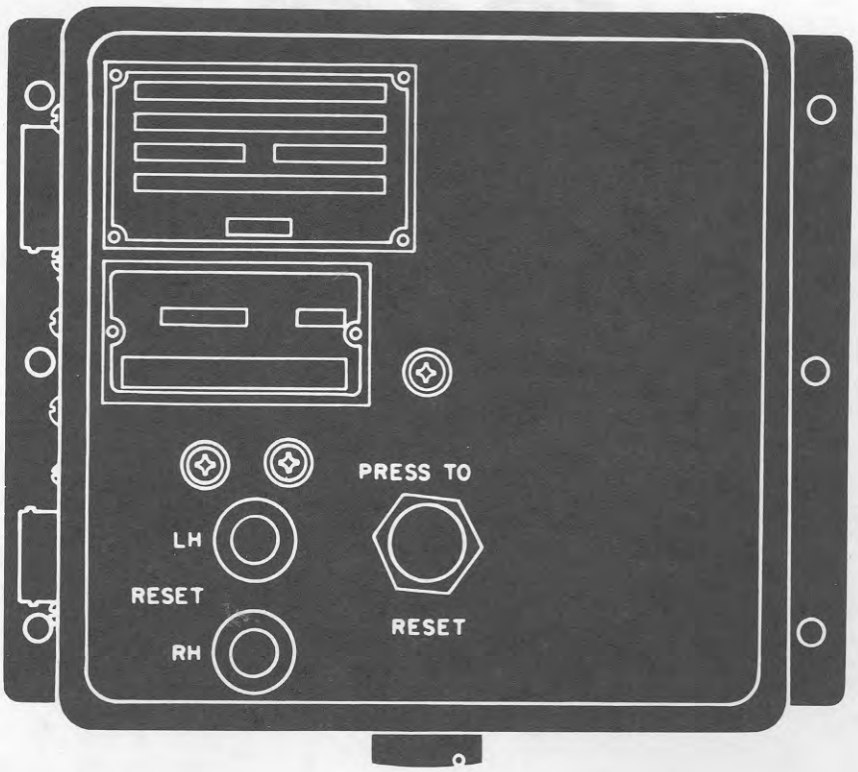


Figure 4-45. Junction Box

lease the case assembly containing the flares from the helicopter in an emergency. The lever pulls two locking pins on the case assembly mount to jettison the case assembly and flares.

FLARE EJECTOR SET POWER PANEL.

The flare ejector set power panel contains two 28-VDC circuit breakers, the 115-volt, 400-Hz circuit breakers, and the two maintenance switches. The STEPPER MTR RESET switch removes power from the case assembly stepping switch assembly reset relay to prevent stepping switch reset until all flares have been released. The GRD MAINT switch applies power to the system when on the ground by bypassing the landing gear interlock.

CASE ASSEMBLY.

Each case assembly contains an AN/ALA-17 flare set containing 8 tubes with 2 flares in each tube, giving a total of 16 flares for each assembly. The helicopter installation contains two fixed-mounted case assemblies for a total of 32 flares. A stepping switch assembly is mounted on the case assembly and is used to supply 28-VDC igniting power to the squib of a flare pellet. The flare is released from the case assembly upon ignition.

AN/ALA-17 FLARE SET.

The AN/ALA-17 flare set consists of a CY-2617/ALA-17 rack and eight M-3529/ALA-17 cartridges. Each cartridge consists of two RR-108/ALA-17 flares (an upper and lower flare crimped together). The cartridges are covered with polyethylene sleeves, which act as a buffer and as a lubricant between cartridges. The cartridges are positioned in the rack and held in place by a locking bar. An assembled flare set is 12-1/2 inches in width, 12-1/2 inches in height, and weighs 41 pounds. The flare set is installed in the case assembly located on each side of the helicopter.

Figure 4-46. Flight Mechanic's Panel

SECTION V

OPERATING LIMITATIONS

TABLE OF CONTENTS

INTRODUCTION.

The operating limitations contained in this section are derived from experience gained during the design, production, and flight test of the helicopter. These limitations, which must be observed if safe and efficient operation are to be attained, should be studied carefully to familiarize the pilot with proper operation of the helicopter and associated equipment. The instruments in the helicopter are marked as shown in figure 5-1 to indicate to the pilot that flight operation is being accomplished in a safe, desirable, or unsafe region. Appropriate explanations are provided where the markings are not self-explanatory. In addition, other limitations on operational procedures, maneuvers, and loading are covered.

NOTE

If any of the operating or red line limits included in any section of the Flight Manual are exceeded, remarks concerning the degree to which the limits were exceeded and the time duration will be entered in the Form 781.

MINIMUM CREW REQUIREMENTS.

The minimum crew required to operate the helicopter is a pilot and a copilot. The basic crew is a pilot, copilot, and flight mechanic. Additional crewmembers may be added at the discretion of the operational commander.

INSTRUMENT RANGE MARKINGS.

Instrument markings shown in figure 5-1 and other operating limitations in this section are not repeated elsewhere in the manual. Unmarked or blank areas between upper and lower radials, or between a green arc and a red radial, indicate regions that should be avoided except for transient conditions such as starting, ground operation, etc.

NOTE

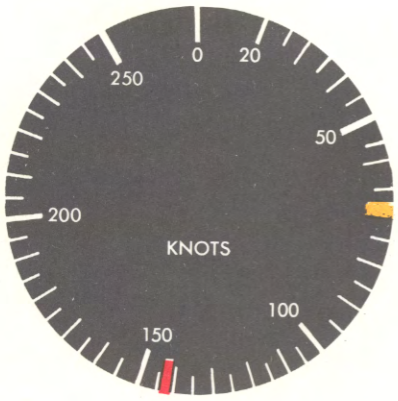
On the power turbine inlet temperature and torque gages, the 30 minute operating limitations between normal and military power is represented as an unmarked area.

INDEX MARK.

A white index mark appears on all instruments having range markings to indicate possible movement of the glass and subsequent incorrect interpretations of the markings.

ENGINE OPERATING LIMITATIONS.

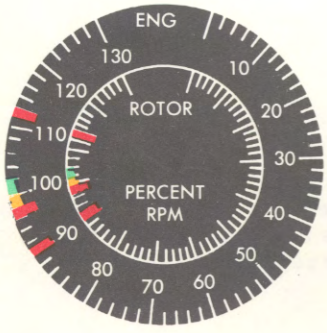
Engine operating limits are illustrated in figure 5-1.



FUEL GRADE - JP4/JP5

AIRSPEEDS

YELLOW RADIAL	70 KNOTS	LANDING GEAR - DOWN
RED RADIAL	142 KNOTS IAS MAXIMUM	



TRIPLE TACHOMETER
(Nf/Nr)

RED RADIAL	91%	MINIMUM POWER - OFF
RED RADIAL	98%	MINIMUM POWER - ON
YELLOW ARC	98 - 100%	PRECAUTIONARY, INDICATES APPROACH TO MINIMUM N_r FOR YAW CONTROL AUTHORITY WITH POWER ON
GREEN ARC	100 - 103%	NORMAL OPERATING RANGE
RED RADIAL	112%	MAXIMUM POWER - OFF OR NO LOAD CONDITION

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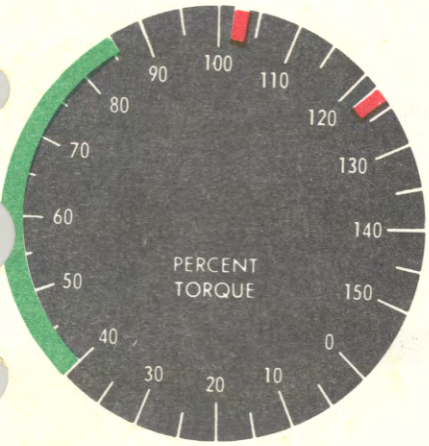
Figure 5-1. Range Markings (Sheet 1 of 4)

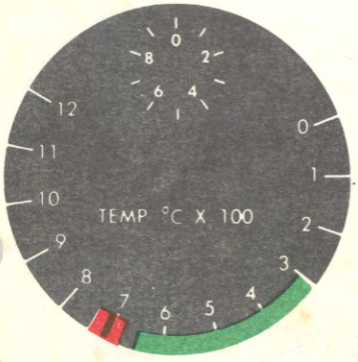
FUEL GRADE - JP4/JP5



TORQUEMETER

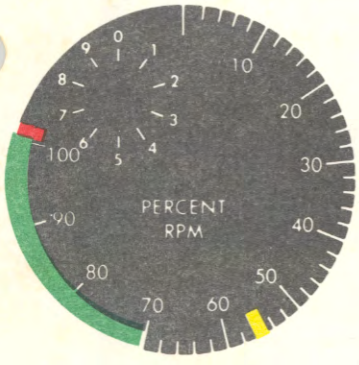
GREEN ARC	40 – 86% Q	NORMAL OPERATING RANGE
RED RADIAL	103% Q	MAXIMUM TWIN ENGINE POWER
RED RADIAL	123% Q	MAXIMUM SINGLE ENGINE POWER

NOTE: The 86% limit is established by the main gear box maximum continuous input limit. The main gear box is rated @ 2100 HP maximum continuous power.



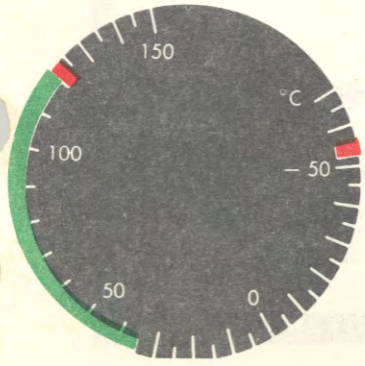
POWER TURBINE INLET TEMPERATURE T_5

GREEN ARC	300° TO 660°C T_5	NORMAL OPERATING RANGE
RED RADIAL	696°C T_5	END OF 30 MINUTE LIMIT RANGE
RED RADIAL	721°C T_5	END OF 5 MINUTE LIMIT RANGE (MAXIMUM EXCEPT FOR STARTING AND TRANSIENT CONDITIONS



GAS GENERATOR (N_g) TACHOMETER

YELLOW RADIAL	56% Ng	(GROUND IDLE ± 3%)
GREEN ARC	70 – 102.7% Ng	NORMAL OPERATING RANGE
RED RADIAL	102.7% Ng	MAXIMUM



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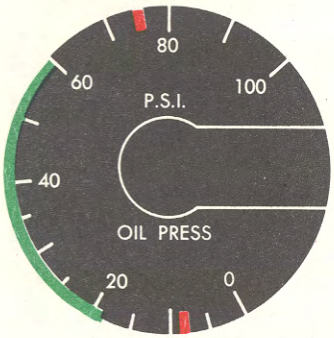
ENGINE OIL TEMPERATURE

RED RADIAL	-54°C	MINIMUM
GREEN ARC	35° TO 121°C	NORMAL RANGE
RED RADIAL	121°C	MAXIMUM

S 16880.3 (R1)

Figure 5-1. Range Markings (Sheet 2 of 4)



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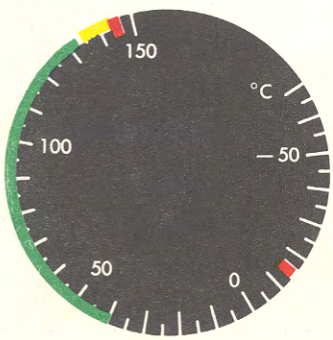
ENGINE OIL PRESSURE

RED RADIAL	8 PSI	MINIMUM
GREEN ARC	19 TO 60 PSI	NORMAL RANGE
RED RADIAL	75 PSI	MAXIMUM



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TRANSMISSION OIL TEMPERATURE

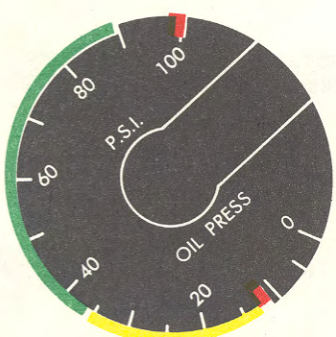
THE TRANSMISSION OIL TEMPERATURE INDICATOR IS CONNECTED TO AN OIL TEMPERATURE BULB ADJACENT TO THE MAIN GEAR BOX OIL OUTLET PORT.

RED RADIAL	−15°C	MINIMUM
GREEN ARC	40° TO 135°C	NORMAL
YELLOW ARC	135° TO 145°C	PRECAUTIONARY, MAXIMUM TIME LIMIT 60 MINUTES
RED RADIAL	145°C	MAXIMUM

TRANS OIL HOT

CAUTION LIGHT

THE TRANSMISSION OIL TEMPERATURE CAUTION LIGHT WILL COME ON WHEN THE TRANSMISSION OIL TEMPERATURE REACHES 120°C (248°F) AT THE MAIN GEAR BOX OIL INLET PORT.



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TRANSMISSION OIL PRESSURE

TRANSMISSION OIL PRESSURE INDICATOR IS ACTUATED BY A PRESSURE TRANSMITTER CONNECTED TO MAIN GEAR BOX OIL INLET PORT.

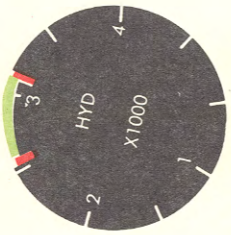
RED RADIAL	12 PSI	MINIMUM
YELLOW ARC	12-35 PSI	PRECAUTIONARY INDICATES PRIMARY OR SECONDARY PUMP FAILURE OPERATING RANGE
GREEN ARC	35-90 PSI	NORMAL OPERATING RANGE
RED RADIAL	100 PSI	MAXIMUM

TRANS OIL PRESS.

CAUTION LIGHT

TRANSMISSION OIL PRESSURE CAUTION LIGHT COMES ON WHEN THE MAIN GEAR BOX OIL PRESSURE DROPS BELOW 4 PSI AS IT ENTERS THE LAST OIL PRESSURE JET IN THE GEAR BOX.

Figure 5-1. Range Markings (Sheet 3 of 4)



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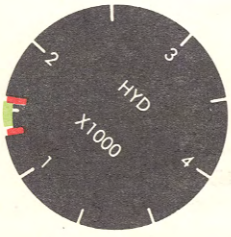
UTILITY HYDRAULIC PRESSURE

RED RADIAL	2600 PSI	MINIMUM
GREEN ARC	2600 TO 3150 PSI	NORMAL RANGE
RED RADIAL	3150 PSI	MAXIMUM



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AUXILIARY HYDRAULIC SERVO PRESSURE

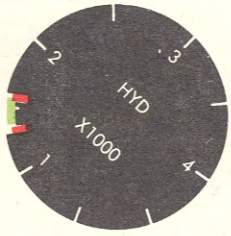
RED RADIAL	1300 PSI	MINIMUM
GREEN ARC	1300 TO 1600 PSI	NORMAL RANGE
RED RADIAL	1600 PSI	MAXIMUM

AUX SERVO PRESS.

CAUTION LIGHT

THE AUXILIARY SERVO PRESSURE CAUTION LIGHT WILL COME ON WHEN PRESSURE DROPS BELOW 1000 PSI.

*THESE INSTRUMENTS ARE POSITIONED SO THAT UNDER NORMAL OPERATING CONDITIONS THEIR NEEDLES ARE AT APPROXIMATELY THE NINE O'CLOCK POSITION.



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PRIMARY HYDRAULIC SERVO PRESSURE

RED RADIAL	1300 PSI	MINIMUM
GREEN ARC	1300 TO 1600 PSI	NORMAL RANGE
RED RADIAL	1600 PSI	MAXIMUM

PRI SERVO PRESS.

CAUTION LIGHT

THE PRIMARY SERVO PRESSURE CAUTION LIGHT WILL COME ON WHEN PRESSURE DROPS BELOW 1000 PSI.

S 16880.5 (R1)

Figure 5-1. Range Markings (Sheet 4 of 4)

POWER LIMITATIONS

T58-GE-5 Engine

	Gas Generator Speed - % N_g	Power Turbine Inlet Temp ^{o}C T_5	Torque % Q	Time Limit
Maximum Power	102.7	721°C	103	5 minutes
Military Power	N/A	696°C	103	30 minutes
Maximum Continuous Power	N/A	660°C	86	None

NOTE

Torque may exceed 103 percent Q on one engine to a maximum of 123 percent, provided that the power of the other is reduced so that total torque for both engines does not exceed 206 percent Q for 30 minutes or 172 percent continuously, and that the single engine N_g, T_5 and Q limits are not exceeded. The governing parameter is the limit which occurs first.

Figure 5-2. Power Limitations Table

CAUTION

Dependent upon free air temperature and pressure altitude, the N_g, T_5, or Q power limits may be reached first. This parameter determines whether the 30-minute operating limit or the 5-minute operating limit are effective. For variation of power available with temperature and altitude, refer to the Appendix.

CAUTION

Extended use of maximum power will reduce engine life. Therefore, maximum power will not be used more than 5 minutes at one time. Immediately after operating at maximum power for a cumulative total of 5 minutes, operate engines 15 minutes at continuous power/660° C T5 or below for cooling in event maximum power is again required.

ENGINE OVERSPEED AND OVERTEMPERATURES.

Exceeding the normal engine operating limitations will result in reduced engine life. These critical operating limitations reflect the absolute limitations of the engine and should only be used when required by an extreme operational situation.

Power Turbine Speed (N_f).

The lower unmarked area on the N_f tachometer indicates a precautionary range for transient operation with engine power on. The upper unmarked area is a transient power range used during ground checks, reduced power operations, and prior to takeoff to allow for engine droop.

CAUTION

During reduced or partial power descents, and practice autorotations with minimum collective pitch, Nf may exceed 103% up to a maximum of 112% (21275 rpm), at which time the rotor (N_r) and N_f pointers should split if the rotor speed is increased above limits. If the N_f pointer does not split at this point, indicating failure of the engine drive shaft to properly disengage from the transmission, power should be applied to bring N_f within limits.

The overspeed limits for these engines are as follows: Operation between 112 and 128% N_f; no inspection required. Operation between 128 and 133% N_f for 15 seconds or less; inspection of the power turbine section required. Operation above 128% for more than 15 seconds, or operation above 133% for any time period; removal and overhaul of the power turbine section required.

Gas Generator Speed (N_g).

The following overspeed limits are provided for information in case of fuel control malfunction or improper settings. Operation between N_g topping limit and 106% N_g; no action is required. Operation between 106 and 108% N_g for 15 seconds or less; no action is required. Operation between 106 and 108% N_g for more than 15 seconds or above 108% N_g for any time period; removal of the engine is required.

Power Turbine Inlet Temperature (T_5).
(See figure 5-3.)

If the maximum T_5 attained during compressor stalls

or any other overtemperature is not observed, it is to be assumed that the limits have been exceeded.

Limiting T_5 Rise for Salt Water Operation.

Hovering over salt water is limited by the T_5 rise experienced at the same N_g and torque values as adjusted for the change/variance from the established N_g/T_5 baseline. This limit is 35°C. See Section II for computation instructions.

TRANSMISSION LIMITATIONS.

Main gear box oil temperatures and pressures are shown in figure 5-1. In addition, the transmission system has input torque limits which require certain actions when exceeded. These are provided for information.

MAIN GEAR BOX OIL TEMPERATURE.

The normal operating temperature is 40° C to 135° C. Temperatures above 120°C on the indicator generally result from operating in high ambient temperature, unusual flight attitudes, malfunction of the cooling system or an over serviced condition. Operating within the range of 120°C to 135°C is permitted and does not result in flight deviation or transmission inspection. Gear boxes operated between 135°C and 145°C for periods not exceeding 60 minutes requires a serviceability check. Gear boxes operated between 135°C and 145°C for periods exceeding 60 minutes or above 145°C for any length of time must be replaced.

MAIN GEAR BOX OIL PRESSURE.

Main gear box oil pressure fluctuations of 2 to 3 psi are normal; however, fluctuations up to 10 psi (± 5 psi from a steady position) are allowable provided no indications of a malfunction are apparent.

TWO ENGINES OPERATING.

Transient operation between 206 and 240% total torque is permissible for periods not exceeding 5 seconds. Operation between 206 and 240% total torque for more than five seconds or over 240% torque for any time period requires removal and overhaul of the main gear box.

ONE ENGINE OPERATING.

Transient operation between 123 and 130% for more than 5 seconds or over 130% for any time period requires removal and overhaul of the main gear box.

ROTOR LIMITATIONS.

Normal rotor limitations are shown in figure 5-1. When operating with power on, do not operate continuously below 100% or above 103% N_r. Operations above the continuous limit for significant percentages of mission flight time will degrade the service life of main rotor components. It is recommended that during extended instrument approaches and repeated closed traffic patterns, the continuous limit be observed by beeping speed selectors to maximum during the final phase of the approach if maximum N_r is desired. During autoration, do not operate below 91% or above 112% N_r.

CAUTION

Should the lead lag or droop stops be contacted in flight during a main rotor droop, the main rotor head dampers and rotating scissors assemblies must be removed and returned to overhaul for inspection. The main rotor blades must be inspected in accordance with existing inspection requirements.

ROTOR OVERSPEEDS.

Overspeed of the main rotor subjects components to abormal forces which may cause damage. The following overspeeds and action to be taken are provided for information. Rotor speeds between 117 and 126% N_r require inspection of rotor head, bifilar assembly, and control rods. Speeds between 126 and 130% N_r require removal and overhaul of the rotor head and bifilar assembly. Speeds between 117 and 130% N_r require inspection of the rotor blades. Speeds in excess of 130% N_r require retiring of rotor blades, replacement of the bifilar weight attaching bolts, and overhaul of the swashplate, dampers, and scissor assemblies.

AIRSPEED LIMITATIONS.

The maximum permissible airspeed is 142 knots IAS. Figure A-37 shows the maximum airspeed at various gross weights, density altitudes, and rotor rpm. Sideward flight is limited to 35 knots. Rearward flight is limited to 30 knots. Maximum airspeeds for maneuvering flight are determined by using the Blade Stall Chart and Blade Tip Mach Chart in the Appendix.

CROSSWIND LIMITATIONS.

The maximum cross wind component for landing is 35 knots.

MANEUVERS.

The helicopter is restricted to normal flying maneuvers. No aerobatic maneuvers are permitted and flight controls should not be moved abruptly. Hovering turns should not exceed a rate of 360 degrees in 15 seconds. Maximum angles of bank, dependent on airspeed and blade load factors are determined using the blade stall chart in the Appendix. The maximum angle of bank is 50 degrees.

JETTISON OF EXTERNAL FUEL TANKS LIMITATIONS.

The following limitations apply to either empty or full tanks:

WARNING

Do not jettison tanks when both engines have failed.

1. The recommended airspeed for jettisoning the external fuel tanks is 70 KIAS or less.

CAUTION

Do not jettison external fuel tanks above level flight speeds of 75 knots IAS, above rates of descent of 300 feet-per-minute, during autorotation, or asymmetrically during climb.

2. The external tanks should not be jettisoned at rates-of-descent of 300 feet-per-minute or greater, due to the possibility of released tanks striking the main or tail rotor blades.

3. Asymmetric jettison of the external tanks during climb can result in rapid attainment of excessive roll rates and roll attitudes (20° roll in 0.2 seconds).

CENTER OF GRAVITY LIMITATIONS.

It is possible to exceed the CG limits if the helicopter is not properly loaded. To determine placement of load for anticipated missions, refer to the Manual of Weight and Balance Data, T.O. 1-1B-40 and LOAD ADJUSTER, section IV. The CG limitations will vary according to the gross weights of the helicopter. To determine the most fore-and-aft CG locations for a given gross weight, see figure 5-4. The takeoff and anticipated landing gross weight should be obtained prior to each mission and determined to be within specified limitations. If a locally standardized weight and balance clearance, Form 365F, showing the helicopter to be within limits is not on file, a Form 365 will be completed. The load adjuster may be used to compute the Form 365F. For additional information refer to LOAD ADJUSTER in Section IV, WEIGHT LIMITATION, in this section, Manual of Weight and Balance, T.O. 1-1B-40; Basic Weight Checklist and Loading Data, T.O. 1H-3(C)C-5; Cargo Loading Manual, T.O. 1H-3(C)-9, and USAF Aircraft Weight and Balance, T.O. 1-1B-50.

WEIGHT LIMITATIONS.

The basic design or normal gross weight of the helicopter for structural analysis is 19,500 pounds at a limit load factor of 2.5 G's. The maximum allowable gross weight is 22,050 pounds at a limit load factor of 2.21 G's. The maximum gross weight for hovering charts in the Appendix give detailed information on the maximum gross weights at which the helicopter may be operated under varying conditions of temperature, altitude, wind velocity, and type of takeoff or landing. Gross weight of the helicopter may be determined by referring to the takeoff and landing data (TOLD) card.

MARGIN OF SAFETY AND LOAD FACTORS.

It must be realized that as a structure is loaded to higher weights, its ability to withstand additional loads resulting from maneuvers or gust conditions becomes increasingly less. The margin of safety is the amount of additional load that the structure will sustain before failure occurs. When planning any helicopter mission, consideration must be given to the fact that the maximum permissible weight may depend on the margin of safety desired for the various supporting structures (main rotor, fuselage, landing gear, flooring, etc.). If the mission requires excessive maneuvering or flight through turbulent air, it is advisable to maintain a larger margin of safety than if smooth level flight were contemplated. However, the larger the margin of safety, the lower the maximum permissible weight will be. Flight load factors are used as an indication of the margin of safety available for helicopters. Therefore, the structural margin of safety will be equal to the difference between the limit load factor determined for the gross weight and the flight load factor the helicopter is sustaining at any given moment. For example, should the helicopter be loaded so that it is capable of making good a limit load factor of 2.5, and during various phases of flight, flight load factors (G loads) due to maneuvers or gusts of 1.5 and 2.0 are imposed on the helicopter; the margins of safety during these phases would be: 1.0 and 0.5 flight load factors, respectively. Therefore, it is important that the maximum flight load factors that will be encountered during a mission be anticipated in order that the helicopter will be loaded in such a manner that the load limit factor it was designed for will never be exceeded during any phase of the flight.

LANDING GEAR LIMITATIONS.

There are no structural limits affecting the extension or retraction of the landing gear in flight. The landing gear is designed for landing at the design normal gross weight of 19,500 pounds, with ground contact at a sinking speed of 480 feet per minute. Caution should be used in taxiing the aircraft in the most critical condition of a braked roll, pivoting and clockwise turning (nose gear only).

CAUTION

A hard landing will be entered in the Form 781 if the limits of figure 5-5 are exceeded, or if any reasonable doubt exists as to the firmness of a landing.

EQUIPMENT LIMITATIONS.

1. Aft ramp shall not be operated in flight at airspeeds above 115 knots. In no case shall the ramp be opened below the horizontal position in flight.

T58-GE-5 ENGINE

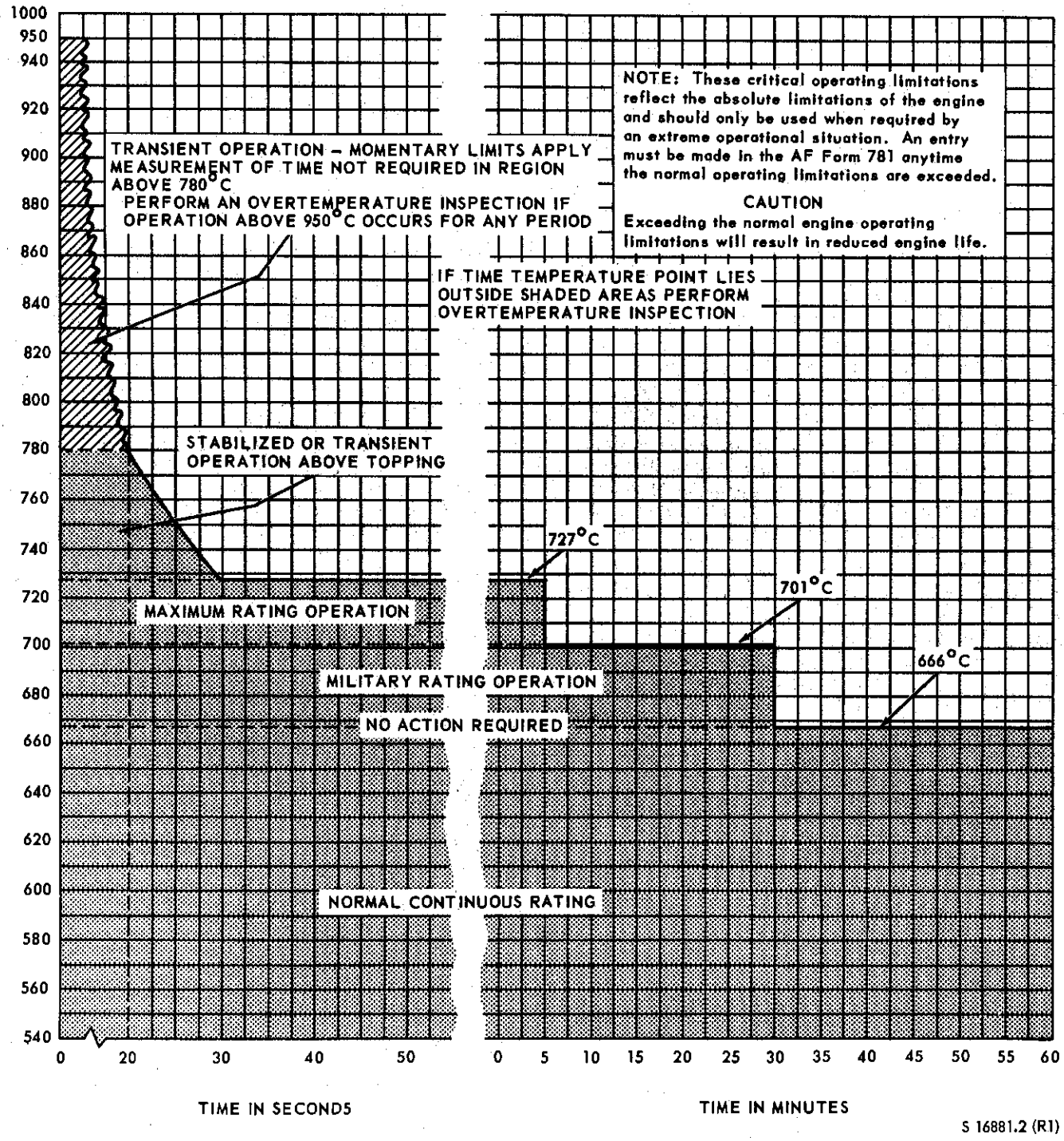

Figure 5-3. Action To Be Taken Following an Overtemperature Condition

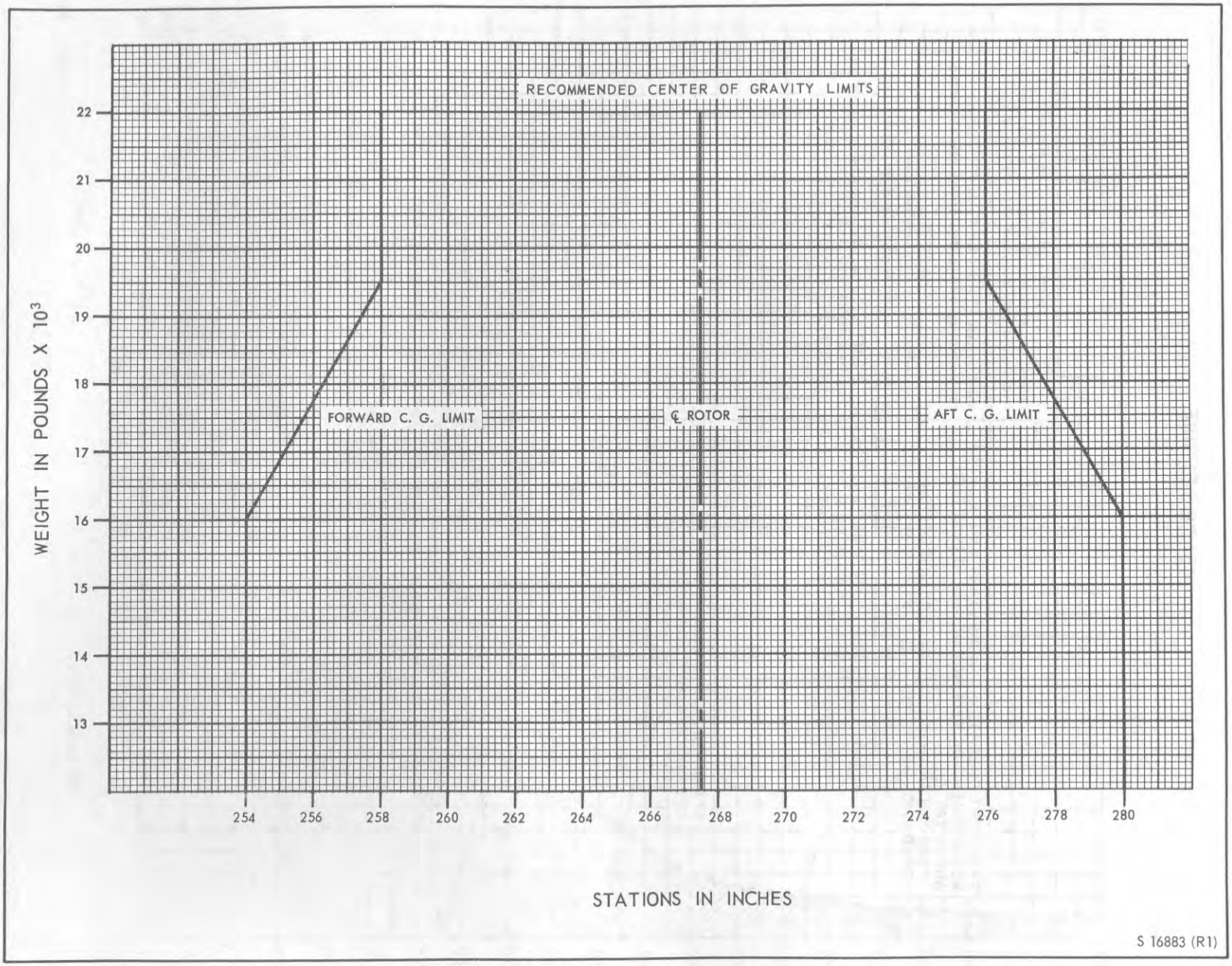

Figure 5-4. Center of Gravity Limitations Chart

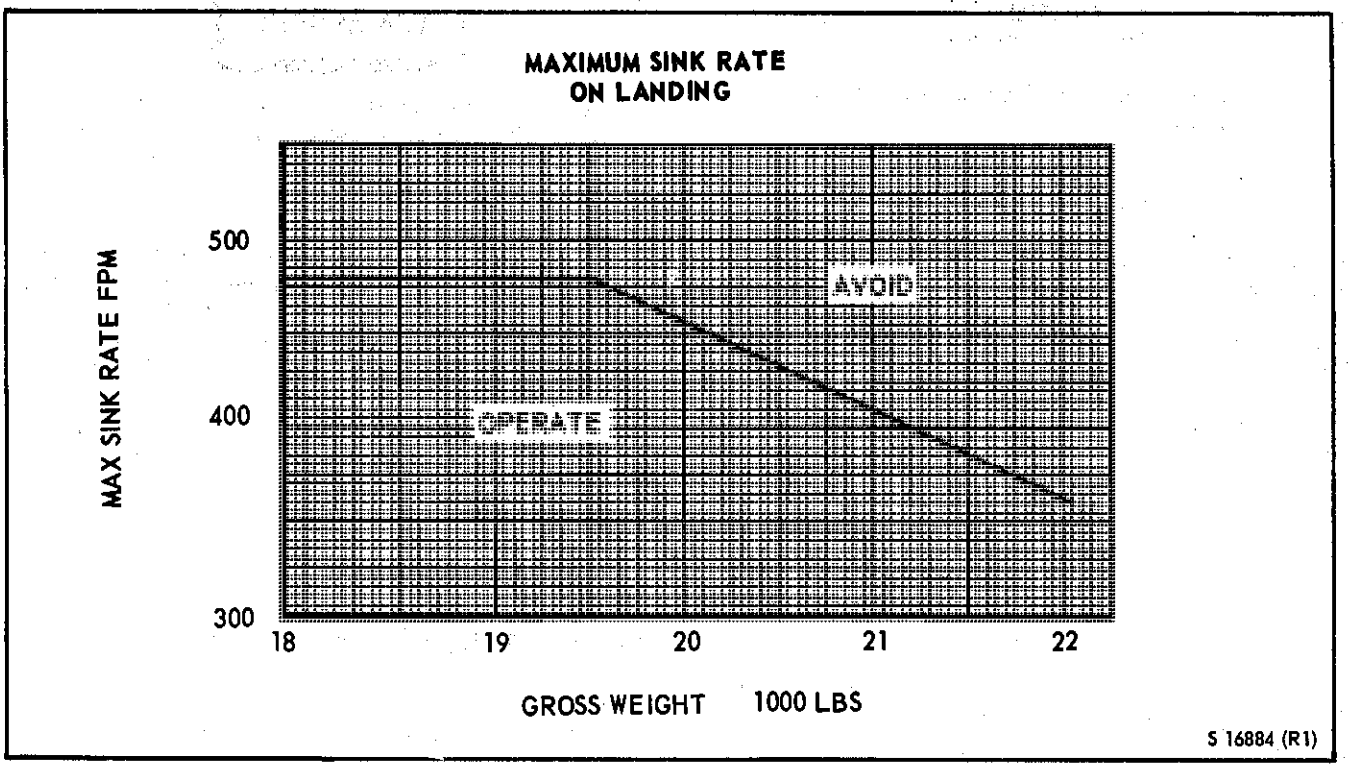

Figure 5-5. Maximum Sink Rate on Landing Chart (Retractable Landing Gear)

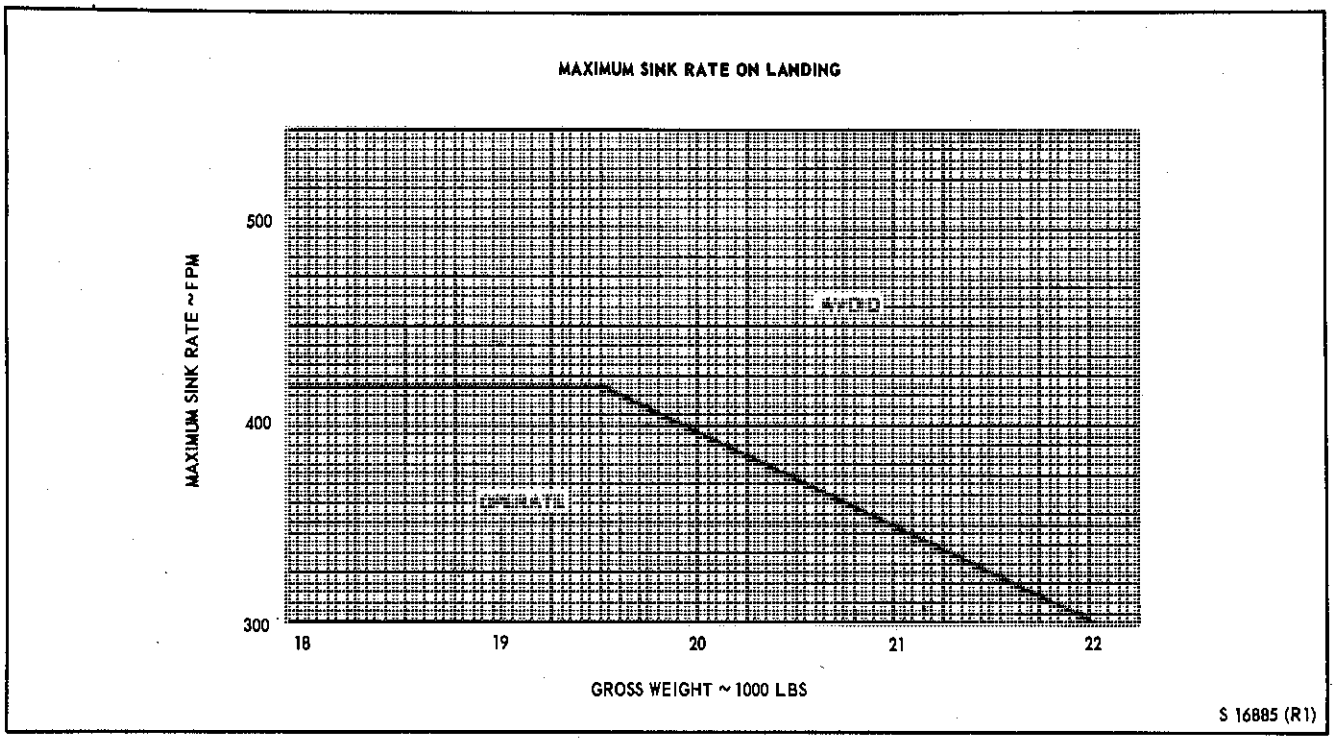

Figure 5-6. Maximum Sink Rate on Landing Chart (Fixed Landing Gear)

CAUTION

Ramp safety cables must be installed at all times during flight.

2. The personnel door should not be opened or closed during flight at airspeeds above 115 knots.

3. Use of the cargo slings is limited to maximum weights as follows:

a. External cargo sling (cable suspended) 6000 pounds.

b. External cargo sling (low response) 8000 pounds.

4. Use of the hydraulic rescue hoist is limited to a maximum of 600 pounds when raising a load and 300 pounds when lowering a load. Rescue hoists that have a letter Z stamped on the nameplate are limited to a maximum of 550 pounds when raising a load and 300 pounds when lowering a load.

5. The helicopter will not be flown in known icing conditions or visible moisture when temperatures are at or below plus 5 °C (41 °F), without a foreign object deflector installed.

6. One fuel boost pump per engine must be on and functioning to ensure continuous fuel supply to the engine driven fuel pumps while engines are operating under any of the following conditions:

a. Above 5000 feet pressure altitude.

b. Above 25°C OAT.

NOTE

High temperatures will normally cause flameout on number two engine first because of greater heat build up in the fuel control area.

c. Below 600 pounds of fuel per tank.

d. Whenever a fuel filter bypass caution light is illuminated.

e. Whenever a fuel low pressure warning light is illuminated.

WARNING

Engine flame out can be expected if the aircraft is operated without a boost pump functioning in each tank under any of the above conditions.

7. Do not change altitude more than 200 feet with BAR ALT engaged without depressing the BAR REL switch or completely disengaging the BAR ALT. Damage to the altitude controller will result if altitude is changed more than 500 feet with BAR ALT engaged.

8. Hoist operations using the winch installation (CH-3E prior to serial No. 66-13285 not modified by T.O. 1H-3(C)C-561) is limited to use in actual emergency rescue or for training purposes using a dummy.

9. The cabin jettisonable windows should not be removed or installed above 70 knots.

SLOPE LANDING LIMITATIONS.

1. To achieve a hovering condition with at least one wheel on a slope, the following limits apply:

CONDITION	SLOPE LIMIT
Nose-up Slope	30 Degrees
Nose-down Slope	8 Degrees
Cross Slope	25 Degrees

2. To achieve a landing and rotor shutdown, the following limits apply: (CG listed is the most critical which would apply for each slope condition.)

CONDITION	SLOPE LIMIT	MOST CRITICAL CG
Nose-up Slope	8 Degrees	280 inches
Nose-down Slope	8 Degrees	254 inches
Cross Slope	10 Degrees	254 to 280 inches

NOTE

A 20 knot down slope wind condition will reduce nose-up and cross slope capability by approximately 1 degree. Effects of a moderate up slope or cross wind slope will be negligible.