CHAPTER 5

ASSOCIATED LAUNCHING EQUIPMENT

The associated launching equipment discussed in this chapter is used in conjunction with catapults and arresting gear. This equipment includes the jet blast deflectors and nose gear launch equipment.

JET BLAST DEFLECTORS

LEARNING OBJECTIVES: Identify the components of the jet blast deflectors. Describe the operation of the jet blast deflectors. Describe the emergency operations of the jet blast deflectors.

The jet blast deflector (JBD) installation consists of water-cooled panels that are mounted flush with the flight deck. The panels are raised and lowered by hydraulic cylinders connected to mechanical operating gear. When raised, the JBDs serve to protect personnel, equipment and other aircraft from the hot jet exhaust created by an aircraft spotted on the catapult. Seawater, supplied from the ship's firemain, is continuously circulated through the modules of each panel assembly to prevent overheating. Figure 5-1 shows the basic operation of JBDs.

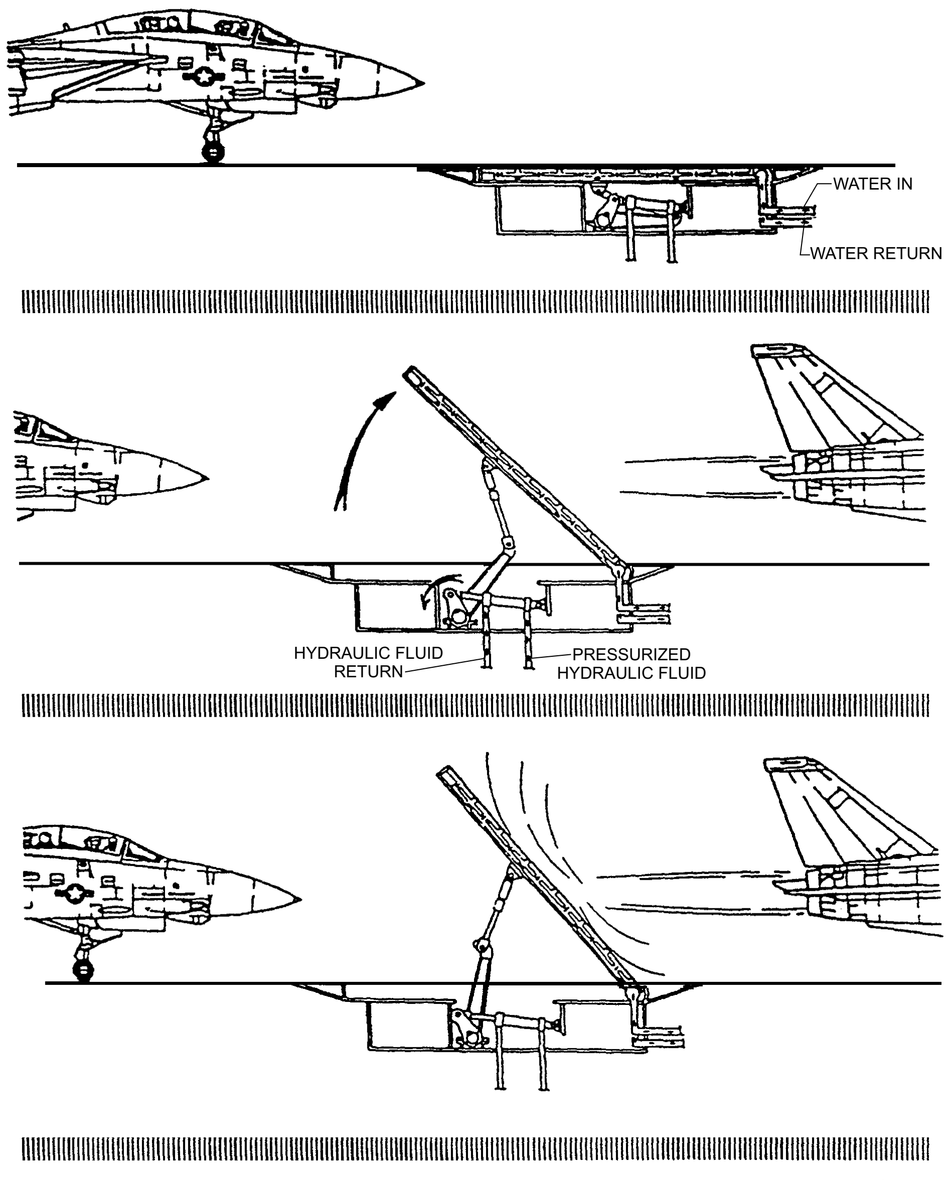

Figure 5-1.—Jet blast deflector operations.

Jet Blast Deflector Assembly

The JBD assembly (fig. 5-2) consists of a series of water-cooled panels and operating gear assemblies. The Mk 7 Mod 0/2 JBD assembly is comprised of six panel assemblies with three sets of operating gear while the Mk 7 Mod 1 JBD assembly has four panel assemblies and two sets of operating gear. The Mk 7 Mod 2 JBD contain two additional sideplate cooling panels. The sideplate cooling panels provide additional cooling which helps to prevent warping of the JBD panels.

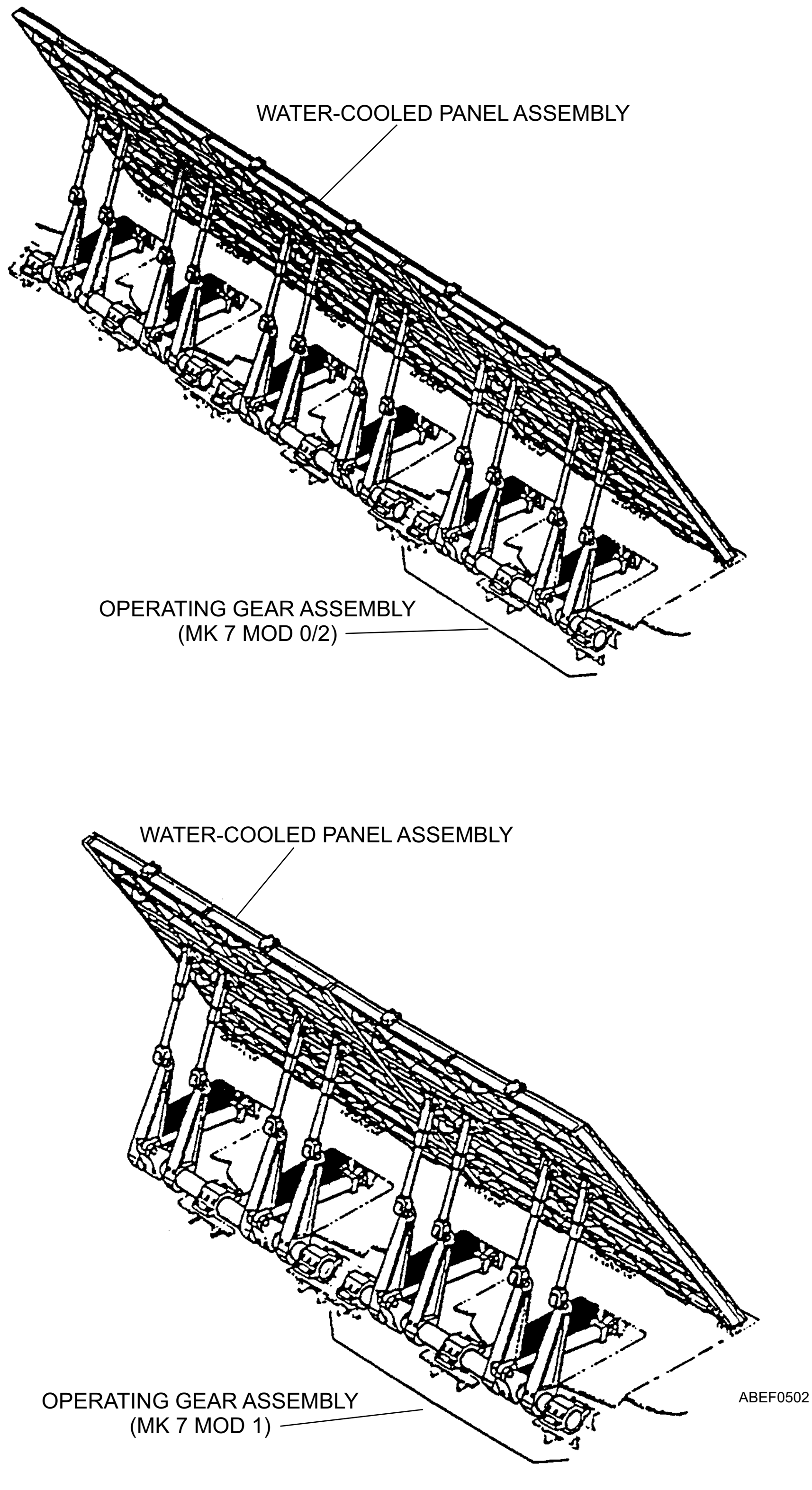

Figure 5-2.—Jet blast deflector assembly.

Regardless of the JBD installation, the operation is the same. A pair of JBD panels is connected to a set of operating gear. The panel assemblies can be raised independently or simultaneously with others in the same installation. By connecting a pair of panels to a set of operating gear, one cylinder can raise or lower a pair of JBD panels in the event of a failure to the other cylinder.

Operating Gear Assembly

The operating gear assembly (fig. 5-3) provides the means of physically raising and lowering the JBD panels. A set of operating gear consists of two hydraulic cylinders, three bearing blocks, one trunnion shaft, two crank assemblies and four linkage assemblies. Each linkage assembly consists of an arm, strut and eye. The linkage for two JBD panels is connected to a single shaft. This method of attachment permits raising and lowering the JBD panels in pairs. The trunnion shaft is mounted and supported by the three bearing block assemblies. The two hydraulic cylinders are connected to the to the trunnion shaft by means of the crank assemblies.

Movement of the hydraulic cylinder piston rods rotates the shaft. Rotation of the trunnion shaft extends or retracts the linkage to raise or lower the JBD panels. Magnets, attached to the linkage arm and eye assemblies, actuate limit switches mounted to brackets on the side of the operating gear deck cutouts to indicate position of the panel assemblies. Removable panel supports can be attached to the operating gear and flight deck to lock panels in the raised position for maintenance, or if access to the area beneath the panels is required.

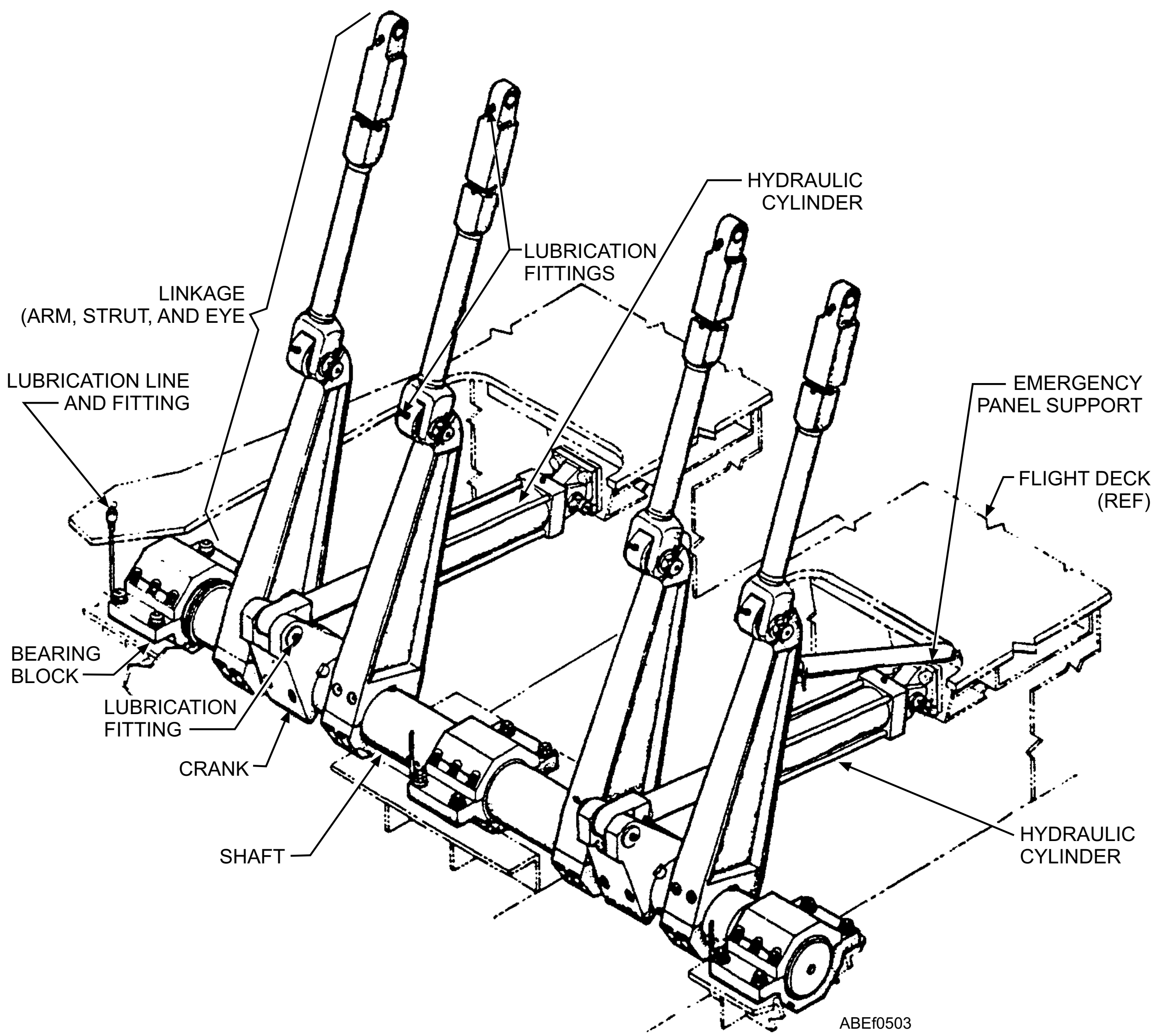

Figure 5-3.—Operating gear assembly.

Water-Cooled Panel Assembly

A water-cooled panel assembly (fig. 5-4) is a reinforced ribb-based aluminum alloy structure containing water inlet and outlet piping. Each panel assembly contains 14 tube assemblies and 7 removable module assemblies and attached hinge and lift fittings. The module assemblies are fastened to the panel base by screws, thereby permitting easy removal in the event of module failure. Each module contains water passages connected to inlet and outlet water manifolds by tube assemblies. Seawater, supplied from the ship's firemain is continuously circulated through the individual module assemblies to dissipate heat

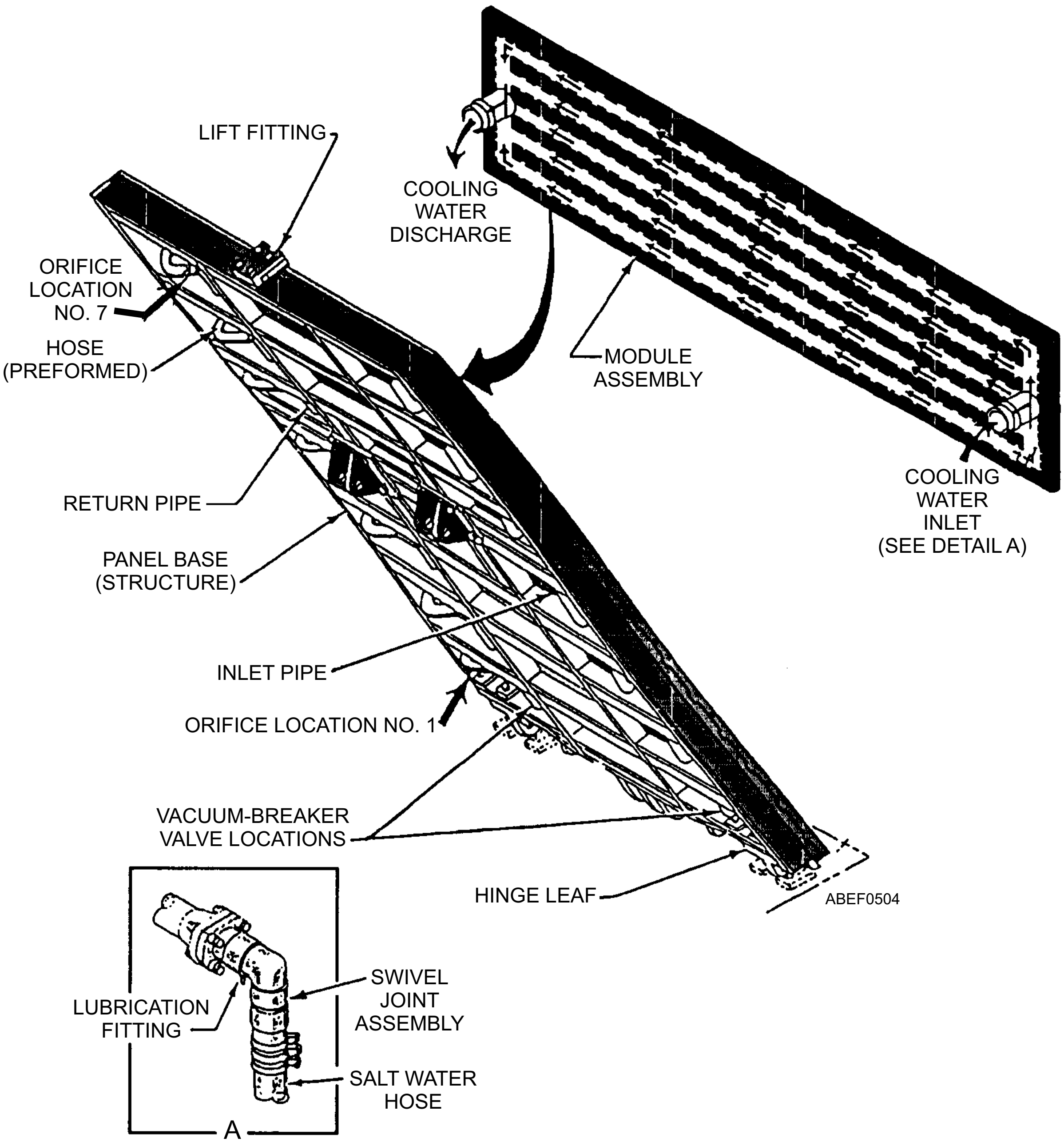

Figure 5-4.—Water-cooled panel assembly.

generated by jet exhaust. An orifice located in the return line connection of each module controls the flow rate of cooling water within the module assemblies. A removable hinge protector plate located below the bottom module of each panel assembly, permits easy access to the hinge bearing and fitting for maintenance.

Cooling Water Piping Installation

The cooling water piping installation (fig. 5-5) consists of a strainer, swivel joint assemblies, orifice flange assemblies, temperature switch, pressure switch, pressure gauges and associated piping and connections. Seawater, supplied by the ship's firemain, is continuously circulated through each module assembly and then discharged overboard. The strainer removes particles, which could clog water passages in the modules. The swivel joint assemblies provide a means of connecting the water manifolds, via hoses, to the seawater supply piping. The swivel joint also permits rotational movement of the piping as the JBD is raised or lowered. Two orifices flange assemblies are provided to regulate the cooling water flow rate. The inlet orifice flange is not used and cooling water flow at that location is line sized. The outlet flange assembly orifice is sized to provide a flow rate of approximately 1,200 gallons per minute.

A temperature switch, located near the water discharge of one of the center JBD panels, will close if the cooling water reaches 210°F and alert the JBD operator by lighting a red temperature light on the control panel. A pressure switch, located in the line leading to the overboard discharge, will close if the water pressure drops below the setting that determined adequate flow rate and alert the JBD operator by lighting a red pressure light on the control panel. Pressure gauges, located on the control panel, provide an indication of cooling water pressure being supplied by the ship's firemain. The cooling water pressure must be maintained at a minimum of 90 psi. An additional pressure gauge, located upstream of the discharge orifice, is provided. A drop in pressure at this gauge indicates blockage within the cooling water system or inadequate firemain pressure. During JBD certification, the normal discharge pressure and pressure switch setting is determined.

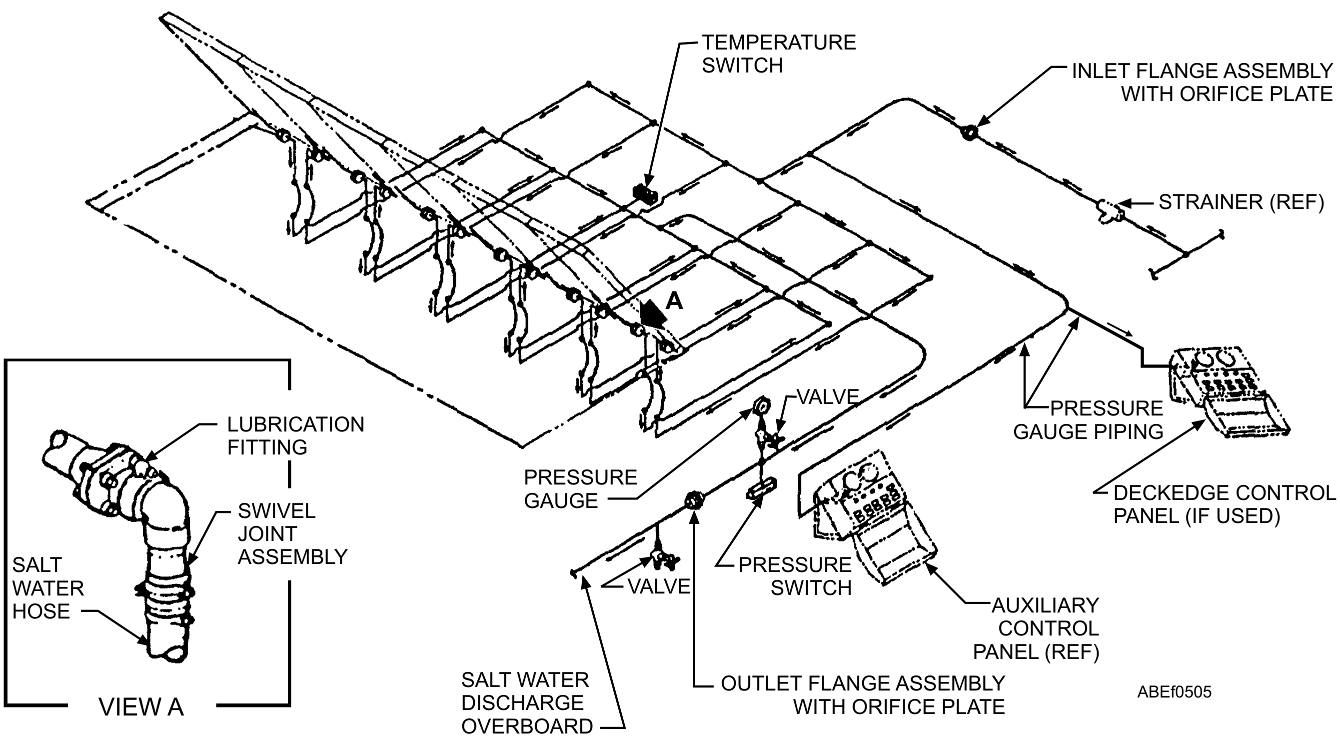

Figure 5-5.—Cooling water piping installation.

Hydraulic Control Piping Assembly

The hydraulic control piping assembly (fig. 5-6) consists of the control valves (stack valves), hose connections, and associated piping and fittings. Hydraulic fluid is provided to the JBDs by an inlet line and shutoff valve connected to the main catapult hydraulic system. The inlet branches off into three lines (Mk 7 Mod 0/2) or two lines (Mk 7 Mod 1) with each line connecting to a stack valve. The stack valve controls the flow of hydraulic fluid to and from the hydraulic cylinders. Emergency-lowering bypass lines and valves are connected to the raising side of each cylinder and to the gravity tank return lines. The bypass lines permit routing of fluid around the stack valve and are only used during an emergency situation to lower the JBD panels.

An orifice assembly is provided in the line to the raising side of the hydraulic cylinders which maintains control of fluid flow for both the raising and lowering sequence. Shutoff valves are located in each line of the hydraulic cylinders for emergency and maintenance purposes. Hose assemblies provide a flexible connection between the hydraulic cylinders and piping to compensate for movement of the cylinders during raising and lowering operations.

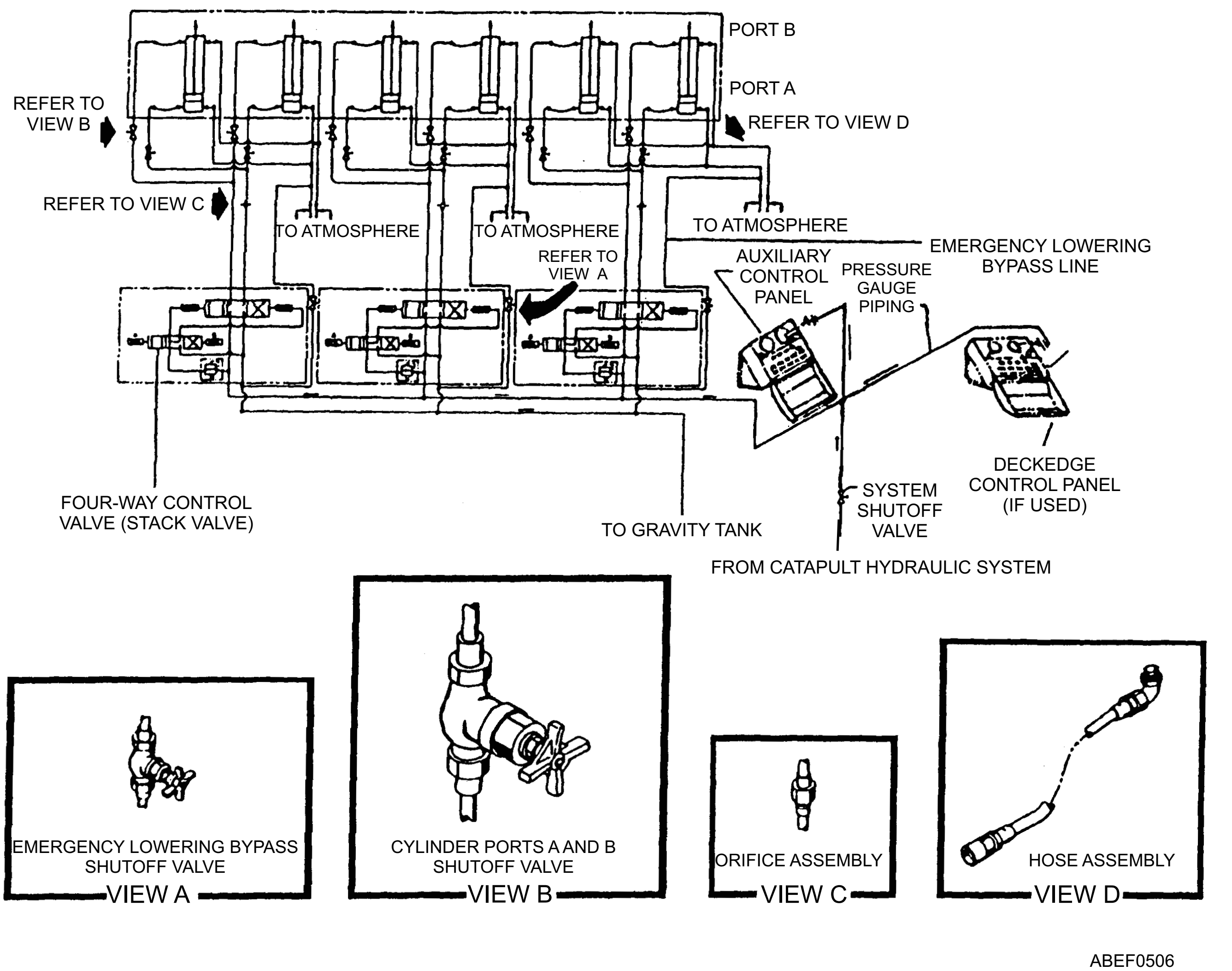

Figure 5-6.—Hydraulic control piping assembly.

Four-way Control Valve (Stack Valve)

A four-way control valve (stack valve) (fig. 5-7) controls the flow of hydraulic fluid to and from a pair of hydraulic cylinders. The stack valve is a solenoid controlled, pilot-operated valve assembly. The stack valve consists of a solenoid-operated valve, a pilot-operated main valve, and a sequence valve. All three valves are secured together to conserve space and simplify connection to a subplate or manifold. One stack valve controls fluid flow for a pair of panel assemblies. Three stack valves are required for Mk 7 Mod 0/2 and two stack valves for Mk 7 Mod 1 JBDs. Hydraulic fluid at 2,500 psi from the associated catapult is supplied to the stack valve with all fluid return lines going to that catapult gravity tank. The operation of a stack valve is described as follows:

1. With hydraulic fluid at normal operating pressure and neither solenoid B (raise) nor solenoid A (lower) energized, fluid flows through the sequence valve and pilot valve to both sides of the slide in the main valve. This pressure to both sides of the slide keeps it centered and blocks fluid flow into and out of both ends of the hydraulic cylinders.

2. When a raise switch is actuated, solenoid B in the pilot valve energizes, shifting the spool and directing pressure to a pilot port at the main valve side. The slide shifts and directs fluid to port A of both hydraulic cylinders. The hydraulic cylinder pistons extend, pushing the crank assembly of the operating gear aft and rotating the shaft. Rotation of the shaft extends the operating gear linkage and raises the associated panel assemblies. During the raise cycle, fluid in the cylinder lower port B vents to the gravity tank through the main valve. If the raise switch is released during the raise cycle, solenoid B deenergizes, a spring returns the solenoid spool to the centered position, and panel movement will stop. Fluid flow will be as described above in step a.

3. When a lower switch is actuated, solenoid A in the pilot valve energizes, shifting the spool and directing pressure to a pilot port at the main valve slide. The slide shifts in the opposite (from raising) direction and directs fluid to port B of both hydraulic cylinders. The pistons retract, pulling the crank assembly of the operating gear forward and rotating the shaft. The rotation of the shaft retracts the operating gear linkage and lowers the panels. During the lower cycle, fluid in the raise port A vents to the gravity tank through the main valve. . If the lower switch is released during the lower cycle, solenoid A deenergizes, a spring returns the

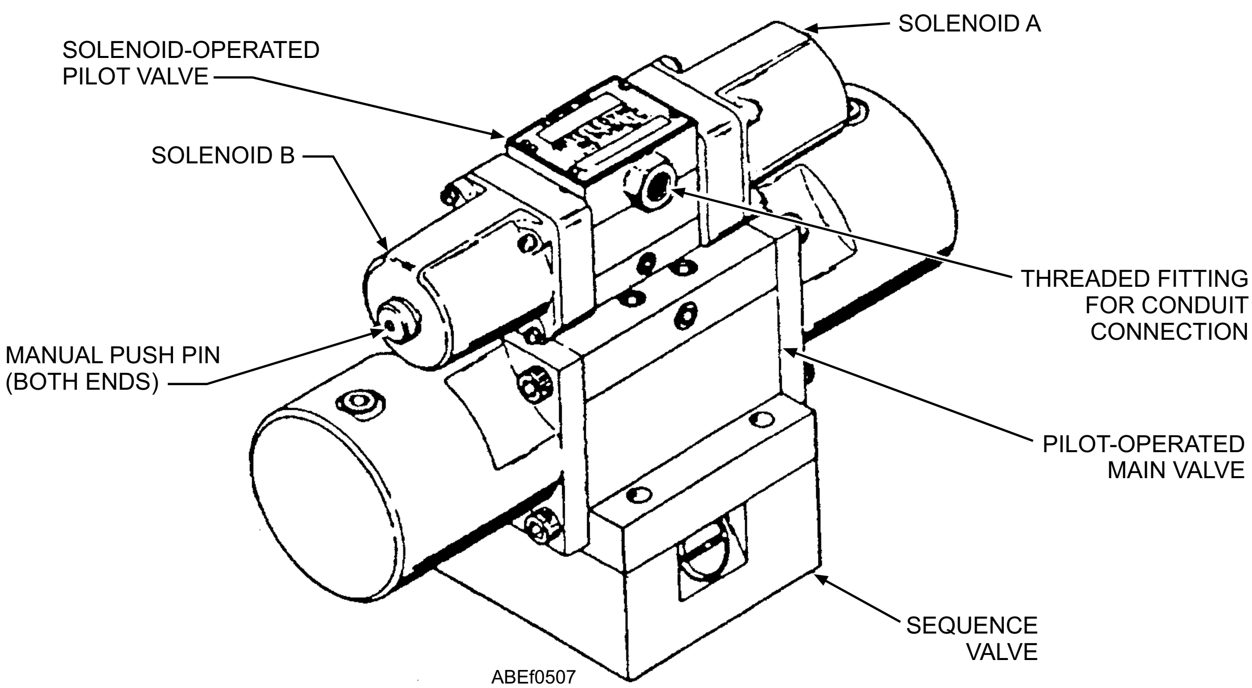

Figure 5-7.—Four-way control valve.

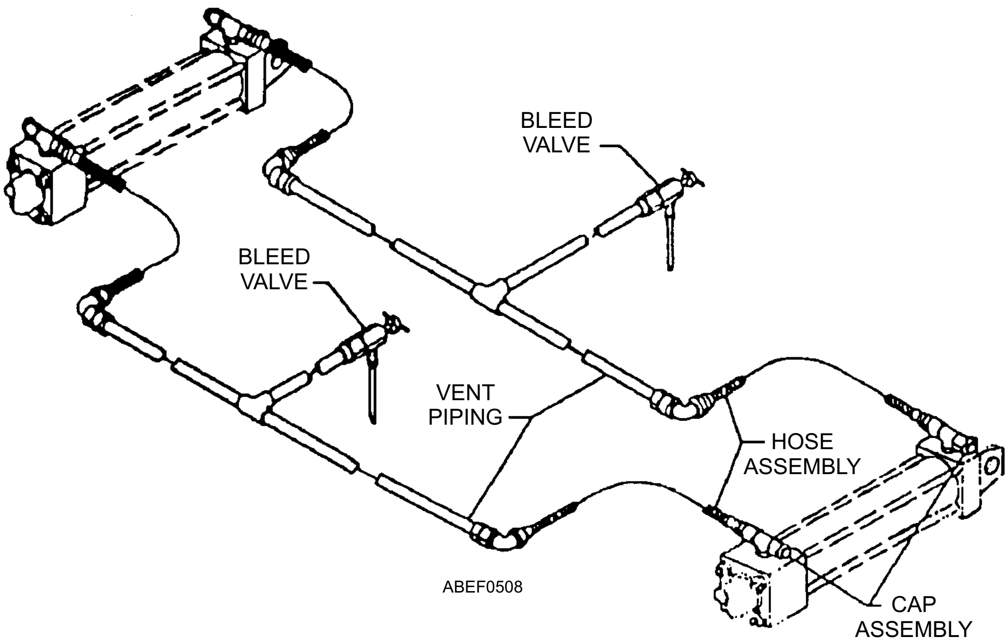

Figure 5-8.—Cylinder vent piping installation.

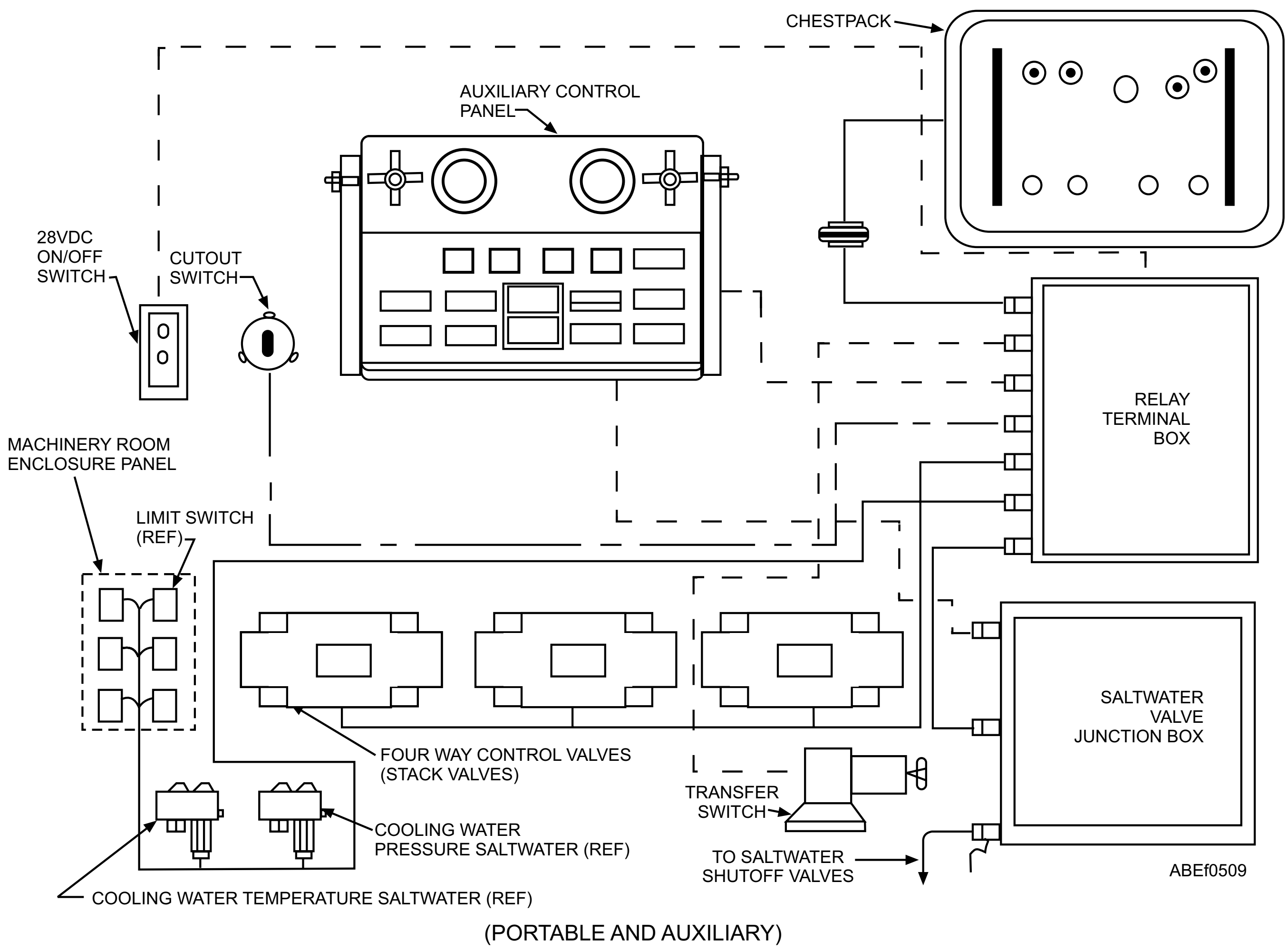

Figure 5-9.—Electrical control assembly.

solenoid spool to the centered position and panel movement will stop. Fluid flow will be as described earlier in step a.

Cylinder Vent Piping Installation

The cylinder vent piping installation (fig. 5-8) consists of bleed valves, flexible hose assemblies, piping, and associated fittings. Each JBD hydraulic cylinder is vented through flexible hoses connected to vent ports directly above the cylinder raising and lowering ports. The hoses also connect the piping to a nearby vent station and bleed valves.

ELECTRICAL CONTROL ASSEMBLY

The electrical assembly consists of the deckedge, auxiliary and portable (chestpack) control panels, a transfer switch, relay terminal box, cutout switch, and associated wiring and connectors. All JBD assemblies are electrically controlled by means of the individual control panels. Each control panel and chestpack has its own electrical installation and each is operated independently of the other. An auxiliary control panel and transfer switch, located below deck, is provided for emergency operating purposes. The auxiliary control panel is identical to the deckedge panel.

Deckedge and Auxiliary Control Panels

The deckedge and auxiliary control panels (fig. 5-10) are identical in design. The Mk 7 Mod 0/2 control panels contain nine light switches while the Mk 7 Mod 1 panels contain seven light switches. Each panel also contains four fuse lights, a power on light switch, double indicator light, a cooling water and hydraulic fluid shutoff valve, and a cooling water and hydraulic pressure gauge. Six switches (Mk 7 Mod 0/2) or four switches (Mk 7 Mod 1) are used to raise and lower the JBD panels. Two switches are push-to-test and the last switch is an emergency cooling water shut off valve light switch (water-emer-off). The water-emer-off switch, when actuated, closes a remote-controlled shutoff valve in the saltwater line leading to the applicable JBD assembly. The fuse light will provide an indication of a blown fuse and possible trouble in the applicable circuitry. The double indicator lights will provide an indication of low cooling water pressure or high cooling water temperature. A plastic guard, mounted over the up and down switches, prevents accidental operation of the panels.

Chestpack Portable Control Assembly

The chestpack (fig. 5-11) contains three individual raise and lower toggle switches, an “all” raise and lower toggle switch, a defeat interlock toggle switch, an emergency cooling water toggle switch, and a yellow water indicator light. Electrical power is provided by an umbilical cable connected to a receptacle on the rear of the chestpack and another receptacle located in the deck. The defeat interlock switch permits raising and lowering the JBDs during emergencies, such as low cooling water pressure or high cooling water temperature. The emergency cooling water switch, when actuated, closes a motor operated shutoff valve in the saltwater line leading to the applicable JBD assembly. The yellow cooling water indicator light, when lit, indicates a malfunction within the cooling water system. The three individual raise and lower switches allow the operator to raise individual pairs of panels while the “all” raise switch permits raising and lowering of all panels simultaneously. The red (port) and green (stbd) indicator lights show the operator to which JBD the chestpack is connected. All JBD installations currently use the deckedge control for JBD number four. Handles are provided on each chestpack to attach a harness worn by the JBD operator.

Transfer Switch (Chestpack Portable Control System)

The transfer switch (fig. 5-12) for the chestpack portable control is a rotary type with a rotary dial. The dial face is identified with two “portable” and two “aux” positions. The transfer switch is located near the applicable auxiliary control panel. When the transfer switch is in the portable position, the chestpack is operable. Moving the dial to the aux position shifts electrical power from the chestpack to the auxiliary panel.

Transfer Switch (Deckedge Control System)

The transfer switch is a rotary type switch with a rotary dial. The dial face is identified with two “deckedge” and two “aux” positions. The transfer switch is located near the applicable auxiliary control panel. When the transfer switch is in the deckedge position, the deckedge control panel is operable. Moving the dial to the aux position shifts electrical power from the deckedge panel to the auxiliary panel. The only difference between the chestpack and the deckedge transfer switch is the dial face.

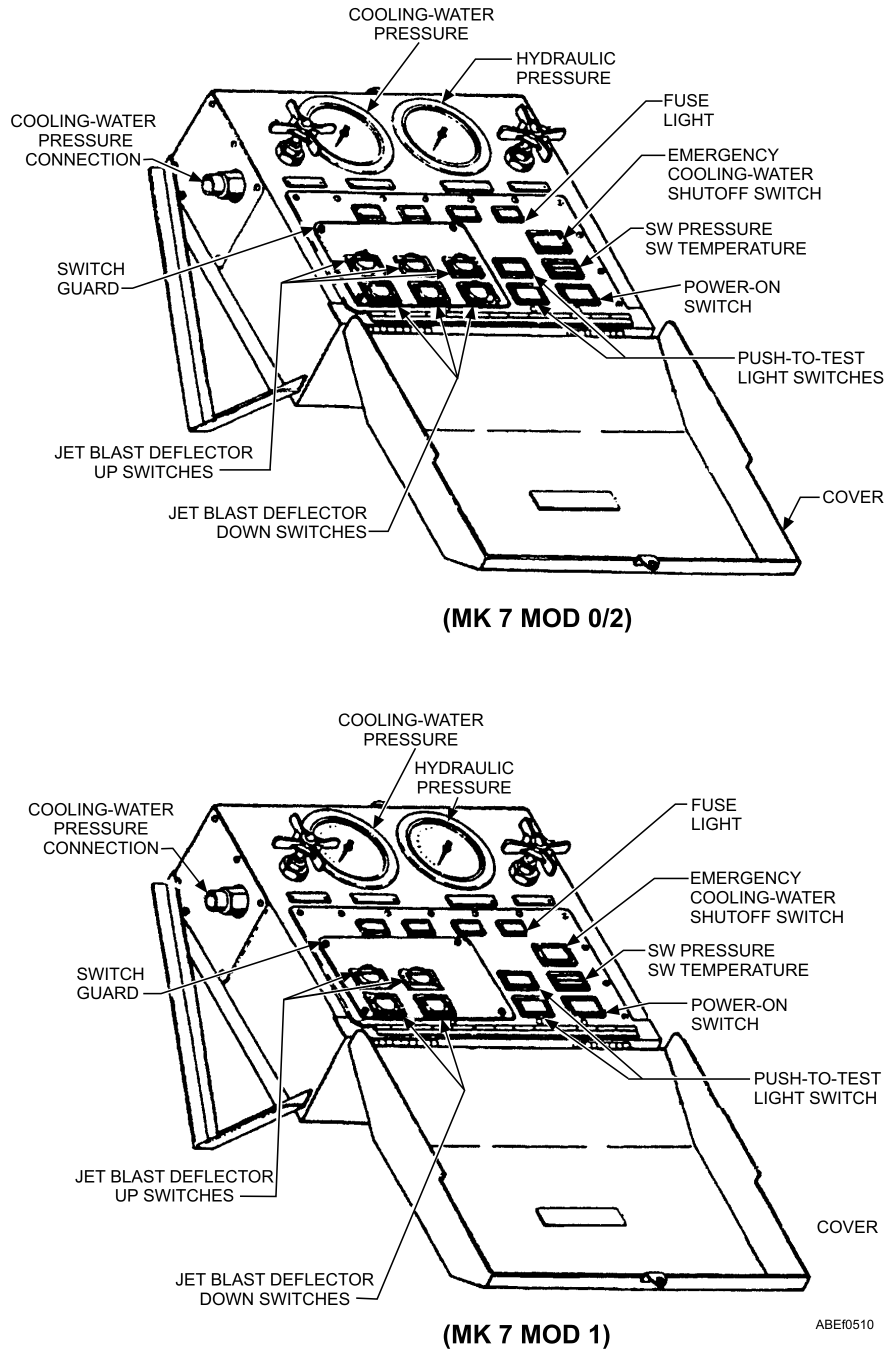

Figure 5-10.—Deckedge and auxiliary control panels.

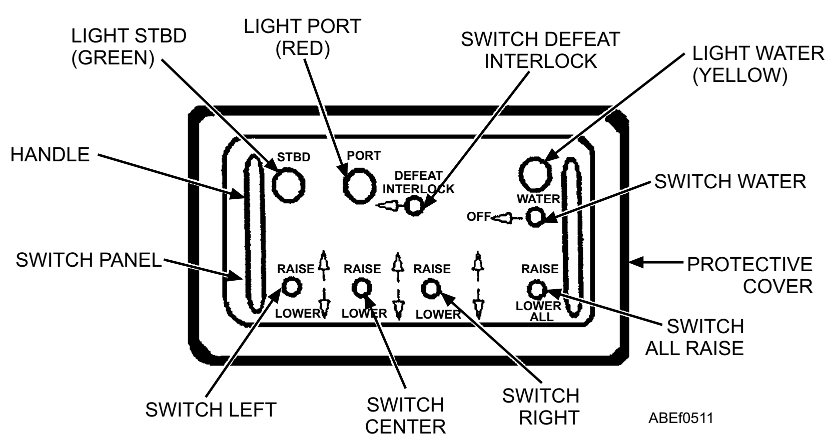

Figure 5-11.—Chestpack portable control assembly.

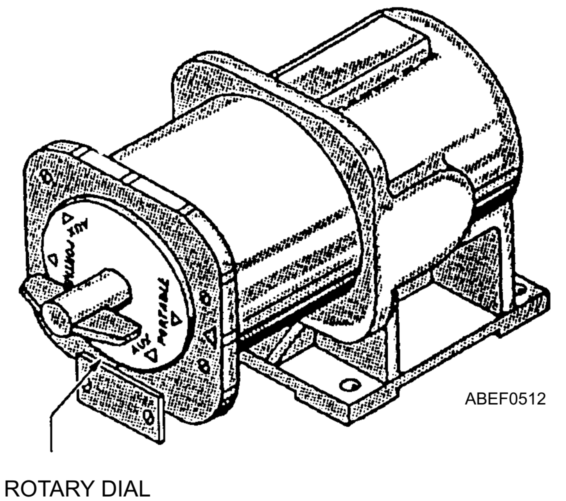

Figure 5-12.—Transfer switch (Chestpack control system).

PANEL SUPPORT INSTALLATION AND EMERGENCY LOWERING DEVICE INSTALLATION

The panel support and emergency lowering device installation (fig. 5-13) consists of the panel support stanchions, panel supports, and an emergency lowering device. Panel support stanchions are to be used anytime panel supports are being installed or removed. The panel support stanchions are positioned between the raised JBD panel and lip of the flight deck. The panel support stanchion is designed to support the weight of a pair of fully raised JBD panels; however, the stanchion will not prevent the lowering of JBDs under pressure.

To provide a total margin of safety, panel supports must be property installed prior to any maintenance

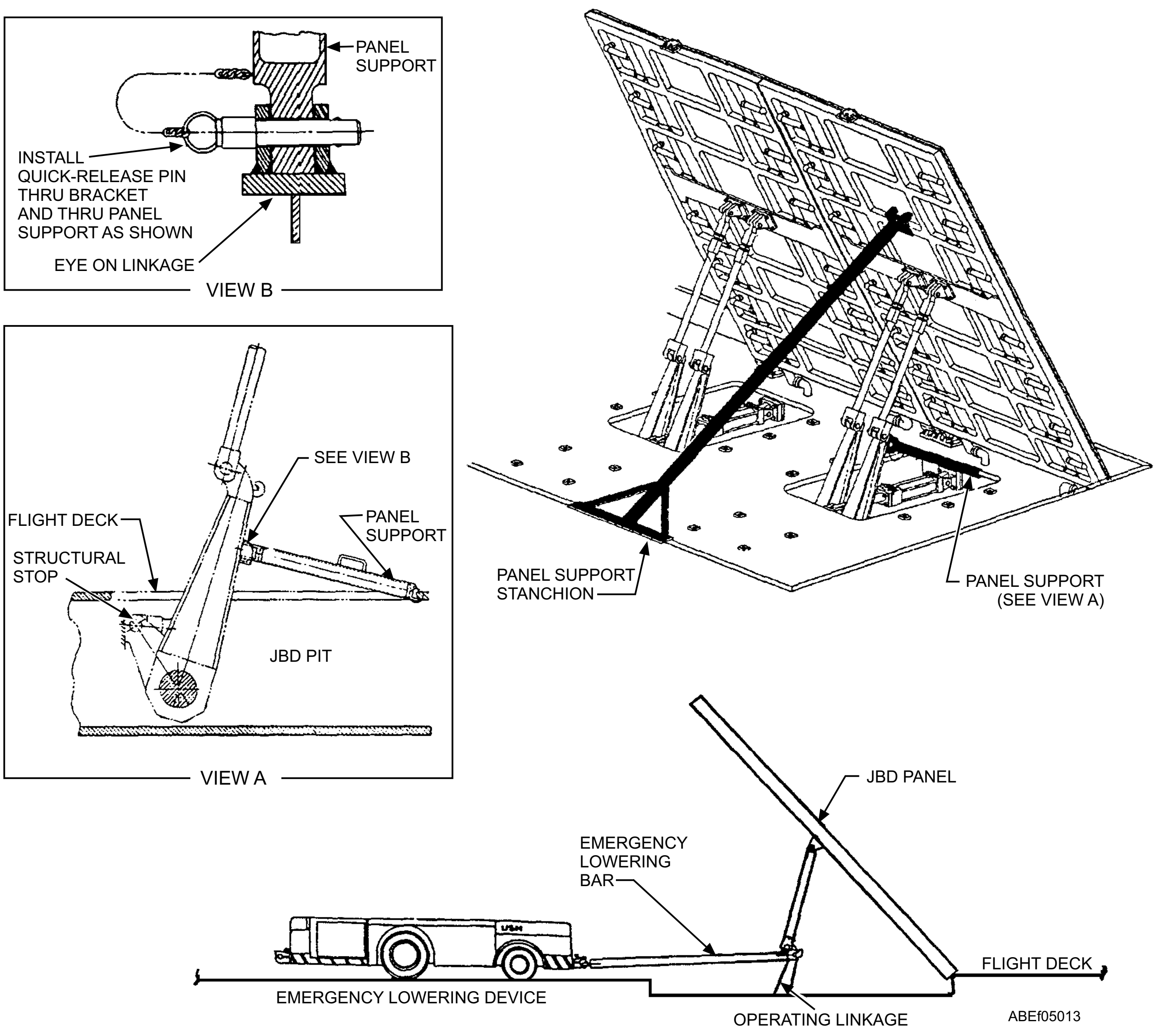

Figure 5-13.—Panel support and emergency lowering installation.

being conducted under JBD panels. The panel supports attache to the JBD operating linkage arm assembly, with a quick release pin and fit into an indentation in the depressed deck area (JBD pit) at the forward end. The panel supports are used to lock panels in the raised position for maintenance purposes or emergencies. A panel support is provided for each set of operating gear, three supports for Mk 7 Mod 0/2 and two for Mk7 Mod 1 JBDs.

The emergency lowering device connects to a tow tractor on one end and fits against the operating linkage arm assembly at the other end. This allows the tractor to push the operating linkage "over-center". With the emergency bypass valves open, the weight of the panels will then force fluid from the raise end of the hydraulic cylinders through the emergency bypass valve permitting the panels to slowly lower.

Preparation for Use

When the JBDs are put in operation for the first time or after being idle, use the following procedures:

1. Perform the preoperational inspection according to the applicable maintenance requirement card (MRC).
2. Ensure that personnel, aircraft, and flight deck equipment are clear of the panel area before attempting to raise the JBDs.

CAUTION

Damage by excessive heat can result from jet engine exhaust if cooling water is not flowing at the correct pressure.

3. Check to ensure salt water supplied from the ship's fire main is flowing through the water-cooled panels.
4. Functionally test the JBD hydraulic and electrical system for proper operation and leaks.

EMERGENCY OPERATION PROCEDURES

In the event of an emergency or a malfunction, the procedures discussed in the following paragraphs must be followed. The emergency lowering of a JBD will require a minimum of eight personnel:

- Topside Safety Petty Officer (overall in charge)
- Topside JBD phone talker
- Below decks phone talker/Valve operator
- Two personnel to install emergency lowering device
- Two safety observers (stationed at the port and starboard sides of the JBD panels)
- Tractor driver

Electrical Control Failure

Should the chestpack, deckedge, and auxiliary control panels become affected by an electrical power failure and the hydraulic system is functional, proceed as follows:

1. Station a crewperson to act as a valve operator at the stack valves. The valve operator shall be equipped with a sound-powered phone set. The chestpack or JBD deckedge operator shall remain at his or her station and relay instructions to the valve operator. The JBD deckedge or auxiliary panel operator shall also monitor the pressure gauges.
2. The valve operator, when instructed by the chestpack or JBD deckedge operator, shall raise or lower the JBD panels by the manual push pins of the A and B solenoids of the stack valves. The B solenoid controls the raising of the panels, and the A solenoid controls the lowering.

Hydraulic Control Failure

Should the JBD hydraulic system fail with the JBDs in the FULL-UP position, the following procedures must be used to lower the panels:

1. Establish sound-powered phone communication between the valve operator and the chestpack or deckedge operator.

WARNING

Ensure all tag-out procedures are according to current shipboard instructions.

2. Close the main supply valve and attach a safety tag.
3. Open the applicable emergency bypass valves one-quarter turn or as necessary to control the lowering speed of the panel.
4. Using the panel emergency-lowering device, place the fitted end against the panel linkage

arm and attach the ring end to a tractor tow hook. Push with the tractor until the operating gear linkage unlocks.

WARNING

Once the emergency lowering device is installed, all hands shall stand back at a safe distance from the JBD and around tractor. As the JBD begins to lower, the emergency lowering device will be dragged out of the JBD pit by the tractor utilizing reverse gear.

5. Adjust the panel lowering speed by opening/closing the emergency bypass valve.
6. Once the strut is over-center, the JBD panels will fall under its own weight until it is flush with the deck.

Inoperative Deckedge Control Panel or Portable Electrical System Control Box

In the event of an emergency where the chestpack or the deckedge control panel cannot be used, the auxiliary control panel becomes operational.

1. Station a crewperson at the flight deck or deckedge to man the phone and relay instructions to the auxiliary-control-panel operator.

WARNING

The crewperson, acting as a safety observer, should ensure that the area around the JBD is clear of aircraft, support equipment, and personnel.

2. With the transfer switch in the AUX position, the auxiliary-control-panel operator shall operate the panel by the instructions relayed to him or her from the flight deck or deck edge personnel.

CAUTION

Repair and checkout of the faulty panel or control box operation shall be accomplished at times when the raising or lowering of the JBD would not be prohibited by aircraft movement on the flight deck.

3. Continue operation of the auxiliary control panel until the faulty chestpack or deckedge control panel is completely checked out and restored to proper operating condition.

WARNING

Prior to returning control back to deck operation, verify with the flight deck safety observer that the area around the JBD is clear of aircraft, support equipment, and personnel.

4. Return control of the JBD to the chestpack or deckedge operator.

MAINTENANCE

This section contains preventive and corrective maintenance information and procedures, some of which are general and apply to various items of the system and others which are specific and apply to a particular part of the equipment.

Planned Maintenance

The planned maintenance system furnishes all vessels and stations with MRCs containing specific maintenance instructions. These cards are used at required frequencies to maintain JBD equipment in operating condition and to prevent breakdown and subsequent shutdown of operations. The planned maintenance system and the maintenance data collection system are described in OPNAVINST 4790.4.

Current MRCs include the following inspection and cleaning procedures:

1. Preoperational inspections
2. Postoperational inspections
3. Cleaning and inspecting hydraulic piping orifice plate(s)

WARNING

Before performing any maintenance procedures behind a JBD panel in the raised position, install the panel supports to prevent the panel from lowering. Failure to do this could result in serious injury to personnel.

To ensure dependable operation of the JBD equipment, proper lubrication of the mechanical linkage is essential. Lubrication is part of the preoperational checks given in the MRC. Extension tubes are provided on trunnion bearings and hydraulic cylinder bracket assemblies so that all lube fittings can be reached from the deck.

PROTECTING OPEN EQUIPMENT.—When removing a component from the hydraulic system, cap or plug all openings to prevent entry of foreign matter. Use tape to protect pipe threads.

CLEANING.—Hydraulic system components must be disassembled, cleaned, repaired, and reassembled as specified in the operation, maintenance, and overhaul instructions manual for the specific type of JBD installation on your ship.

WARNING

Before repairing or removing any components connected to hydraulic or water lines, make sure the lines are depressurized. Also, before repairing or removing any electrical component, de-energize the electrical circuit and attach an out-of-service tag.

HOSES, SEALS, AND O-RINGS.—Hoses, seals, and O-rings are selected on the basis of their compatibility with the hydraulic fluid. Therefore, replacement parts should be of the same material as original parts. O-rings must be removed and replaced with care to avoid damage to the O-ring and O-ring sealing surfaces of the various parts. O-rings must be free of cuts and not deformed. New O-rings must be installed at every reassembly of components. Before assembly, all O-rings must be lightly lubricated with the system hydraulic fluid. Hoses are subject to wear and require periodic replacement. When installing hoses, take care to avoid unnecessary bends and overstressing.

To restore the JBD system to operating condition after a down period that required draining fluid, perform preoperational inspection procedures given in the applicable MRC.

For most repairs to the hydraulic system, only portions of the system need be drained. Isolation valves in each of the hydraulic cylinder lines and a shutoff valve between the stack valve and the catapult pumps permit isolation of portions of the JBD hydraulic system.

Troubleshooting

Most problems that occur on JBDs can be recognized as a failure of one of three systems—namely, hydraulic, electrical, or water.

Information that allows operating and maintenance personnel to locate the source of problems or equipment failure is found in the JBD technical manual, in the section covering trouble shooting.

SAFETY PRECAUTIONS

The energy required to operate the JBD is supplied by fluid under pressure; therefore, when operating with fluid under pressure, observe standard safety precautions that apply.

All moving parts and equipment should be checked for rags, tools, or other foreign material before operating any of the machinery. Only qualified operators shall be allowed to operate the JBDs.

The parking of aircraft on the deflector panel should be avoided. The panels are designed to withstand only the temporary weight of the aircraft taxiing over them.

When you perform maintenance on the JBD, comply with the safety precautions listed on the MRC.

Personnel and equipment shall be clear of the JBD machinery enclosure and depressed deck when the panels are being raised or lowered. This includes the times when the panels are being operated during preoperational inspections and maintenance or overhaul tests and inspections.

REVIEW QUESTIONS

Q1. *What provides the means of physically raising and lowering the JBD panels?*

Q2. *Each Mk 7 Mod 0 JBD panel assembly consists of how many tube assemblies?*

Q3. *What permits rotational movement of the piping as the JBD is raised and lowered?*

Q4. *What is the maximum temperature of the cooling water?*

Q5. *What controls the hydraulic fluid to and from the hydraulic cylinders?*

Q6. *What type of valve is the stack valve?*

Q7. *What is the differences between the deckedge and the auxiliary control panel?*

Q8. *The double indicator light will provide what indication?*

Q9. *What is the function of the "all" raise switch on the chestpack portable control?*

Q10. What is the function of the panel support?

Q11. List the personnel required to perform a JBD emergency lowering?

MK 2 NOSE-GEAR-LAUNCH (NGL) SYSTEM

LEARNING OBJECTIVES: Describe the components of the Mk 2 nose gear launch system. Describe the operations of the Mk 2 nose gear launch system.

The nose-gear-launch (NGL) equipment is designed to assist in the launching of aircraft by providing a positive and automatic means of attaching the aircraft launch bar to the catapult shuttle and spreader. This method of launching permits a positive, automatic engagement of aircraft to catapult. Automatic engagement of the aircraft launch bar to the catapult reduces the number of personnel required to be in close proximity to the aircraft during catapult hookup.

The major components of the Mk 2 NGL system include the flush-deck guide track, slide assembly, actuator reset assembly, shuttle spreader, and buffer cylinder assembly. These components and their operation are discussed in the following paragraphs.

NOSE-GEAR-LAUNCH GUIDE TRACKS

The guide tracks (fig. 5-14), which guides the aircraft launch bar into engagement with the catapult shuttle spreader assembly consists of an approach track, buffer-cylinder track, aft slide-access track, forward slide-access track, and a forward track. The approach track contains a V-shaped mouth, which guides the aircraft launch bar into the guide track. Grooves constructed in the individual tracks and top surface of the buffer cylinder guide the launch bar as the aircraft moves forward. Inserts installed in the forward slide-access tracks provide a camming surface, which ensures that the launch bar makes positive contact the buffer hook actuator roller. Inserts installed in the forward track guide the launch bar up and over the spreader assembly for proper launch bar to shuttle hookup.

Wheel guides bars are provided to guide the aircraft nose wheel along the guide track. The inner wheel

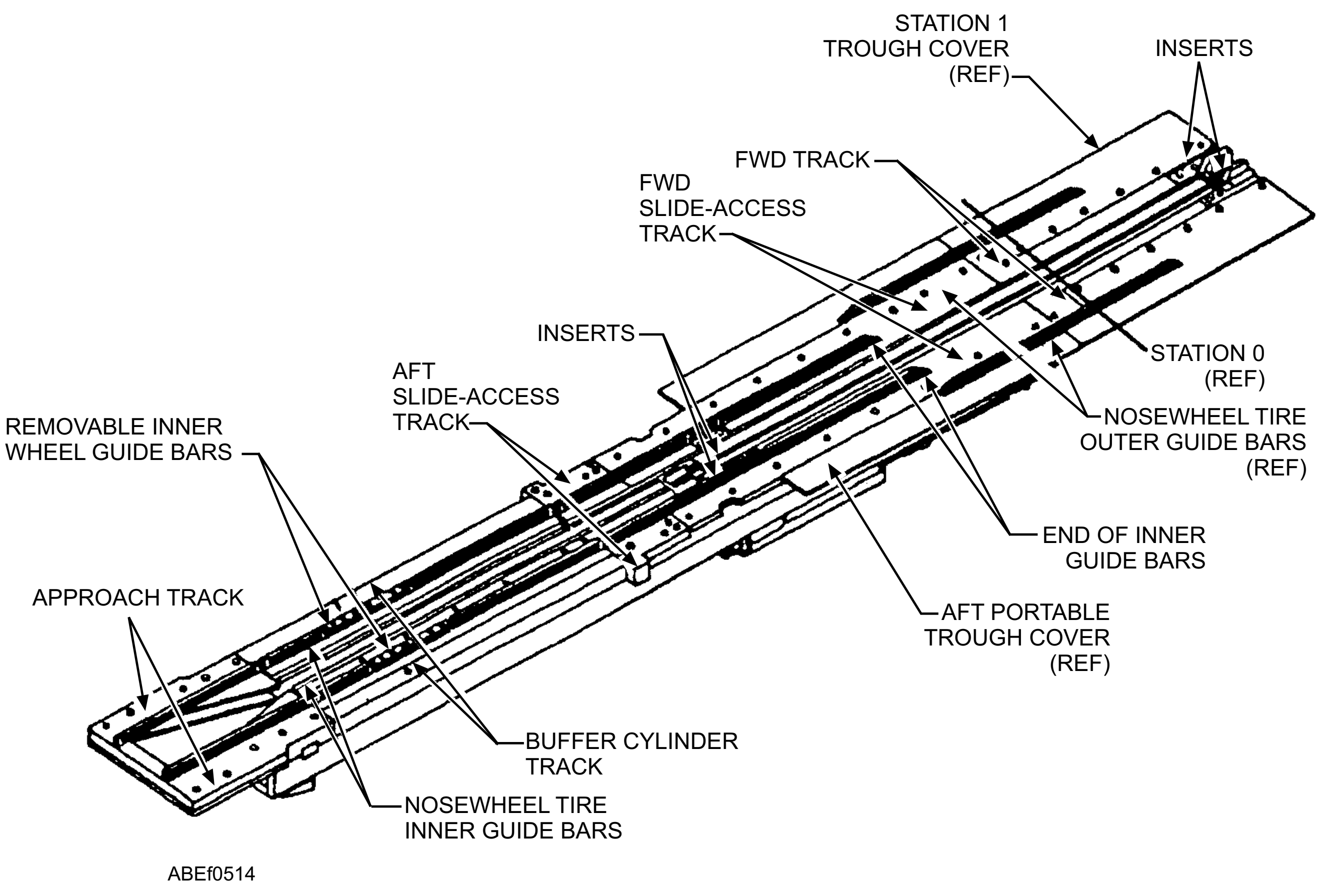

Figure 5-14.—Nose-gear-launch guide tracks.

guide bars keep the nosewheel straight during forward movement. The outer wheel guide bars prevent the nose wheel from sliding side to side once the nosewheel clears the inner guide bars and aid in proper alignment of launch bar to spreader assembly.

NOSE-GEAR-LAUNCH (NGL) ASSEMBLY

The NGL assembly consists of the slide assembly, reset assembly, forward and aft slide-access tracks, buffer cylinder assembly, tensioner cylinder assembly, housing, drain pan assembly, and a shock absorber.

Slide Assembly

The slide assembly (fig. 5-15) consists of a body containing rollers, which reduce friction during forward and aft movement of the assembly; the buffer hook, which engages the aircraft hold-back bar; and the buffer-hook actuator assembly, which raises the buffer hooks to flight deck level. The slide assembly is mechanically connected to the buffer-cylinder piston rods by three links.

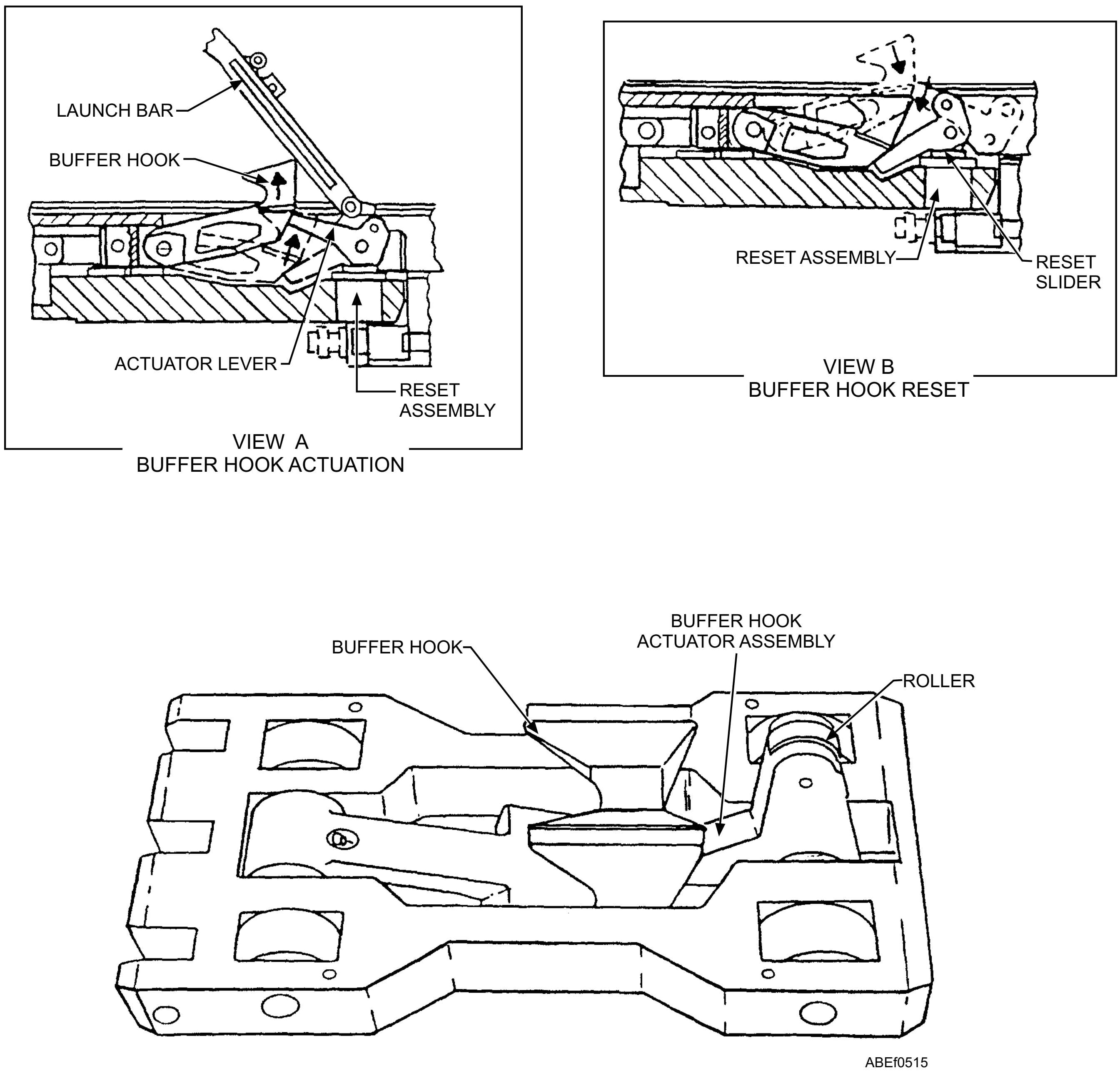

Figure 5-15.—Slide assembly.

During operation, (see view A, fig. 5-15) as the aircraft moves forward, the launch bar, sliding in the track-guide grooves, contacts the buffer- hook-actuator-assembly roller, forcing it to rotate forward and down. When the buffer hook actuator is forced down, its forces against the underside of the buffer hook and raises the hook into position to engage the aircraft holdback bar. As the aircraft continues forward, the holdback bar engages the buffer hook and pulls the slide assembly forward. The slide assembly, connected to the buffer cylinder piston rods, pulls the three rods from the buffer cylinder assembly. Hydraulic resistance within the buffer cylinder assembly decelerates the aircraft. When the aircraft stops, it is in position for catapult shuttle hookup.

After launch, the piston rods are retracted into the buffer cylinder assembly automatically. As the slide assembly moves aft, the buffer hook assembly contacts the reset assembly slider (see view B, fig. 5-15), causing the actuator lever to rotate down. This action permits the buffer hook to drop below deck level through an opening in the track into the deck housing. The slide assembly is now ready for the next aircraft hookup.

Reset Assembly

The reset assembly (fig. 5-16), which resets the buffer hook, causing it to drop below deck at the end of the buffer-cylinder-assembly retract stroke, is located below the slide assembly in the deck housing. The reset assembly consists of a housing, slider, slider actuating spring, and retainer. The slider contains a stellite surface that reduces wear due to contact with the buffer hook actuator lever. Grooves machined in the top of the slider provide a path for the flow of lubricant between the slider and the inner walls of the housing. The housing is chrome-plated to prevent corrosion. The actuating spring is housed in a hole in the bottom of the slider. The slider and spring are secured in the housing by means of the retainer.

During operation when the slide assembly is forward, the reset-assembly slider is not restrained by the actuator assembly but is held above the surface of the housing by the slider actuating spring. After launch, as the slide assembly retracts, the buffer hook actuator contacts the extended reset slider, causing the actuator assembly to rotate downward. This action permit the buffer hook to drop below the deck through the track opening into the deck housing cavity (see view B, fig. 5-15). When the buffer hook is below deck, the actuator assembly lever holds the reset-assembly slider down in the reset assembly housing.

Forward and Aft Slide-Access Tracks

The slide-access tracks retain the slide assembly in the housing. They also serve to guide the aircraft launch bar to ensure proper engagement with the catapult shuttle spreader. Inner and outer guide wheel bars are attached to the aft and forward slide-access track to keep the aircraft nosewheel straight during forward movement of the aircraft. Inserts installed in the forward slide-access tracks provide a camming surface, which ensure that the launch bar contacts the buffer hook actuator roller.

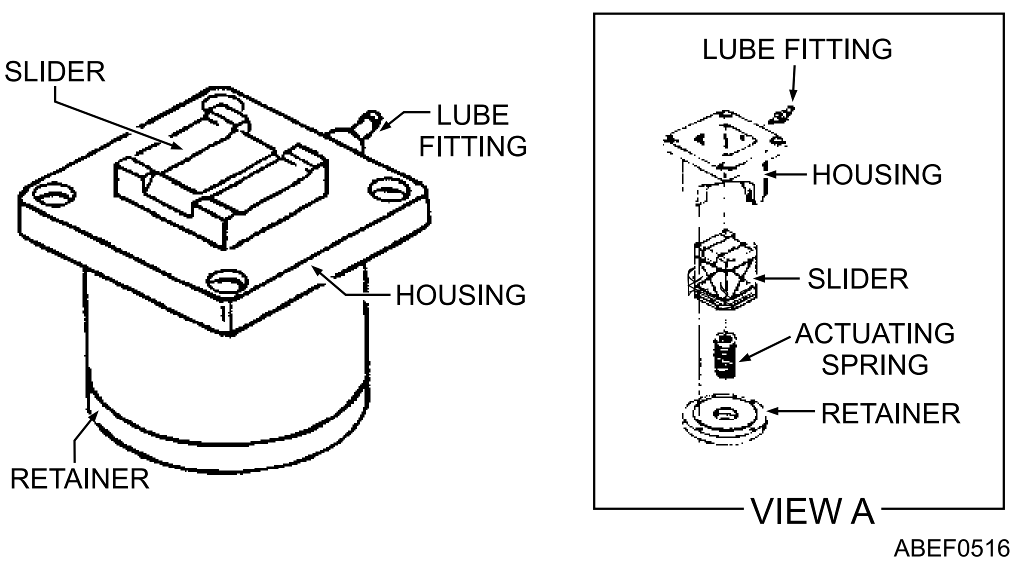

Figure 5-16.—Reset assembly.

Buffer Cylinder Assembly

The NGL buffer cylinder (fig. 5-17) is located in the deck housing between the approach track and the aft slide-access track. The buffer-cylinder body has integral guide tracks on its top surface and contains three hydraulic cylinders. The two outer cylinders contain hollow piston rods; the center cylinder piston rod is solid. The forward end of each piston rod is attached to the slide assembly. Within each outer piston rod is an orifice tube, which meters fluid flow through the outer cylinders to absorb the forward energy of the aircraft during the buffering stroke.

Prior to aircraft holdback bar/buffer hook engagement, the buffer cylinder assembly is in the standby cycle (fig. 5-18) with the three piston rods fully retracted into the buffer cylinders. While in the standby cycle, hydraulic fluid is constantly circulated between the hydraulic system and the buffer cylinder assembly through two metering orifice screws at a rate of approximately 8.5 gpm. This metered flow, which is nonadjustable, is to maintain the hydraulic fluid in the system at the proper temperature.

When the aircraft holdback bar engages the buffer hook, the slide assembly moves forward, pulling the three piston rods from the cylinders. As the piston rods move forward, fluid in front of each outer-cylinder piston is forced through the holes around the periphery of each outer-cylinder piston and through the metering holes in the two orifice tubes. As the pistons continue forward, the number of metering holes in the orifice tubes is progressively reduced, causing an increasing resistance to forward motion of the slide assembly, thus decelerating and bringing the aircraft to a smooth stop at the end of the buffing stroke.

During the buffing stroke, fluid in front of the center-cylinder piston is forced through a port in the cylinder and through the hydraulic line into the NGL valve-manifold accumulator, which acts as a cushion and fluid reservoir. After launch, the fluid pressure established by the valve-manifold reducing valve acting on the forward side of the center cylinder forces the center piston aft, thus retracting the three rods into the cylinders.

Buffer Accumulator Assembly

The buffer accumulator assembly (fig. 5-19) is located below deck in line with and aft of the buffer cylinder assembly. The buffer accumulator consists of a hydraulic accumulator mounted in a support with a tee fitting and associated hardware.

During operation, as the buffer cylinder piston rods are pulled forward, hydraulic fluid flows from the accumulator, through the tee fitting and associated piping into the aft end of the buffer cylinder assembly filling the void created as the piston rods move forward.

After the launch, the buffer piston rods retract into the buffer cylinder forcing fluid from the buffer cylinder back to the accumulator. Fluid continues to flow into the accumulator until the pressure buildup exceeds the spring-load of the check valve located

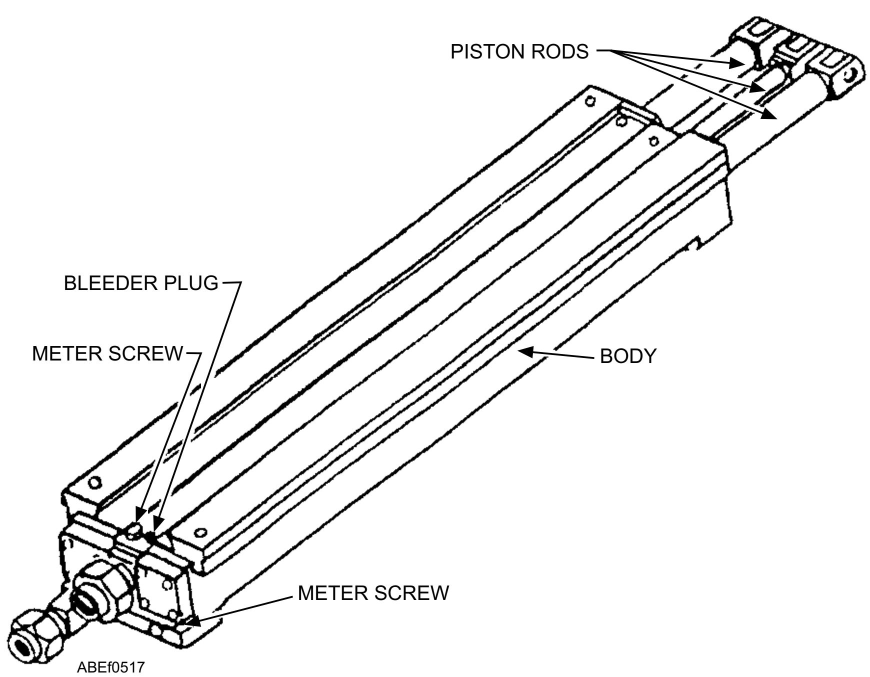

Figure 5-17.—Buffer cylinder assembly.

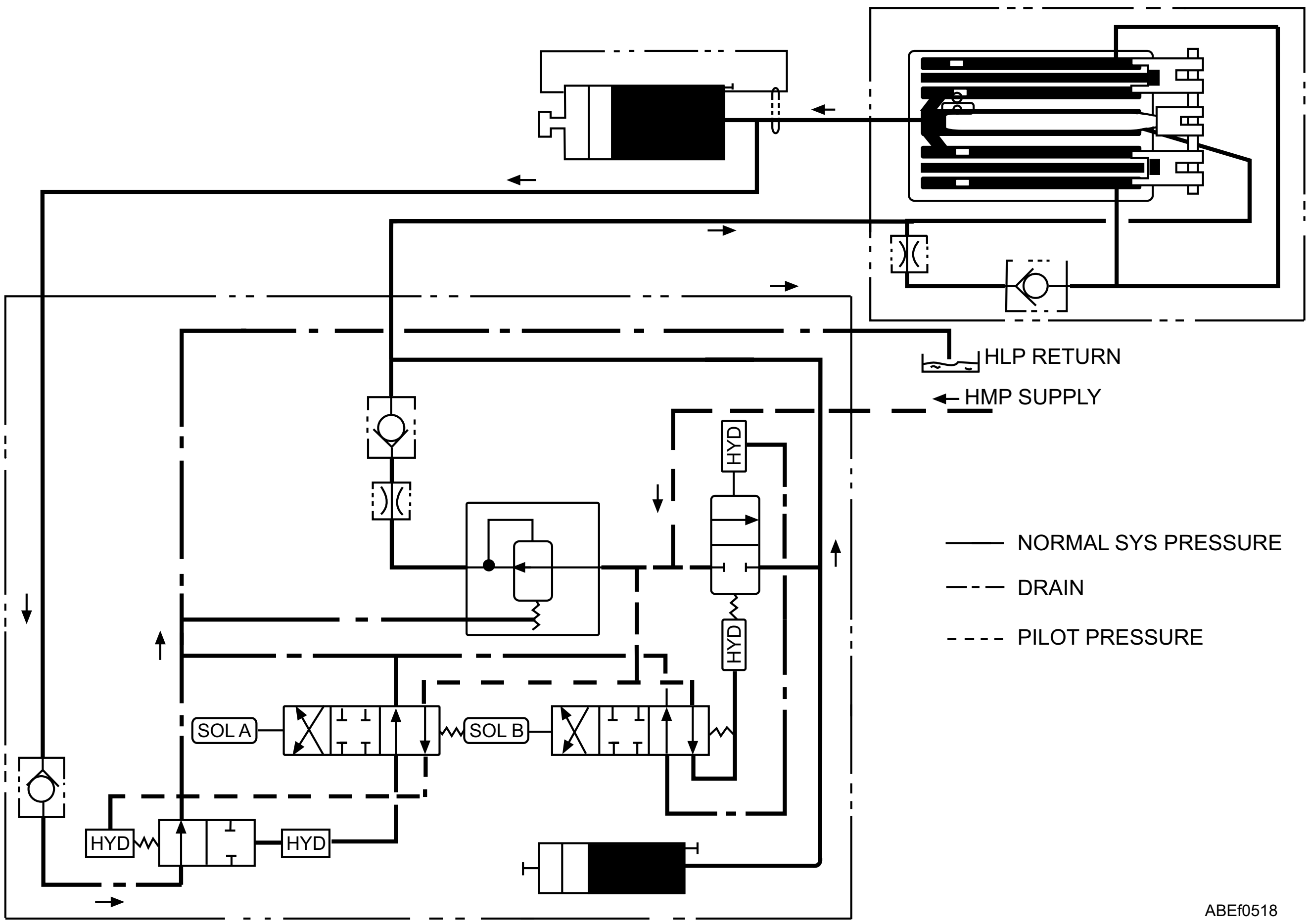

Figure 5-18.—Standby cycle.

down stream from the accumulator. Opening of the check valve permits excess fluid from the buffer cylinder to be returned to the catapult gravity tank.

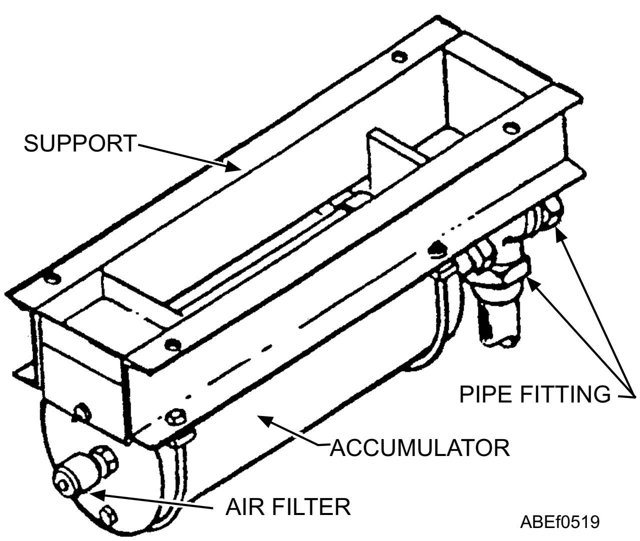

Figure 5-19.—Buffer accumulator assembly.

Drain Pan Assembly

The drain pan assembly (fig. 5-20) is located on the underside of the NGL assembly directly below the tensioner cylinder. The drain pan supports and protects the two quick disconnect, self sealing hydraulic

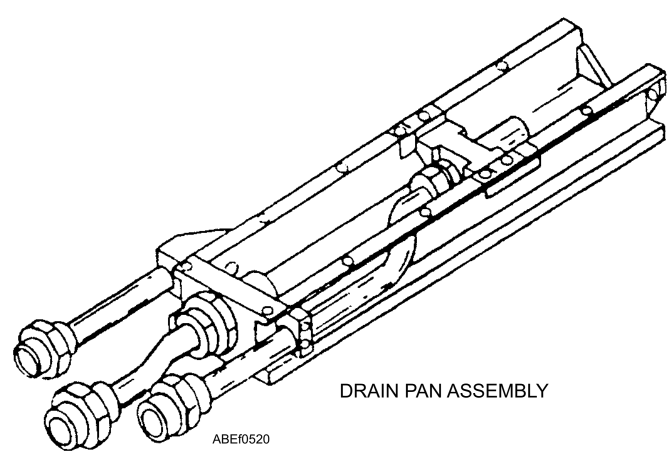

Figure 5-20.—Drain pan assembly.

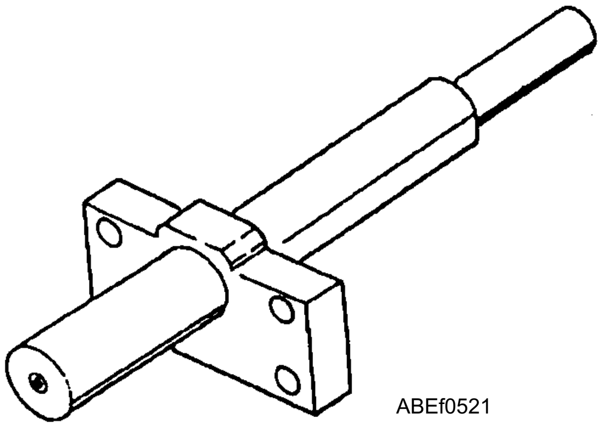

Figure 5-21.—Shock absorber assembly.

coupling which connects the tensioner cylinder to the catapult hydraulic system. The drain also provides a reservoir and drain for all fluids entering the track slot.

Shock Absorber (Soft-Stop) Assembly

The shock absorber assembly (fig. 5-21) is mounted horizontally at the forward end of the NGL assembly. During the catapult retract cycle, the shock absorber provides uniform deceleration of the shuttle to bring it to a smooth, soft stop, eliminating impact forces that could cause damage to the grab assembly or the NGL assembly. The shock absorber is a compact, self-contained, sealed unit consisting of an all steel body with an inner pressure chamber and an all steel chrome-plated piston rod that requires no maintenance or adjustments.

Valve Manifold Assembly

The valve manifold assembly (fig. 5-22) controls the flow of fluid from the catapult hydraulic system to the buffer cylinder assembly. The valve manifold assembly is located below decks and consists of a support structure, two two-way flow control valves, two four-way solenoid control valves, a reducing valve, a piston-type accumulator, a terminal box to house electrical connections, and associated piping.

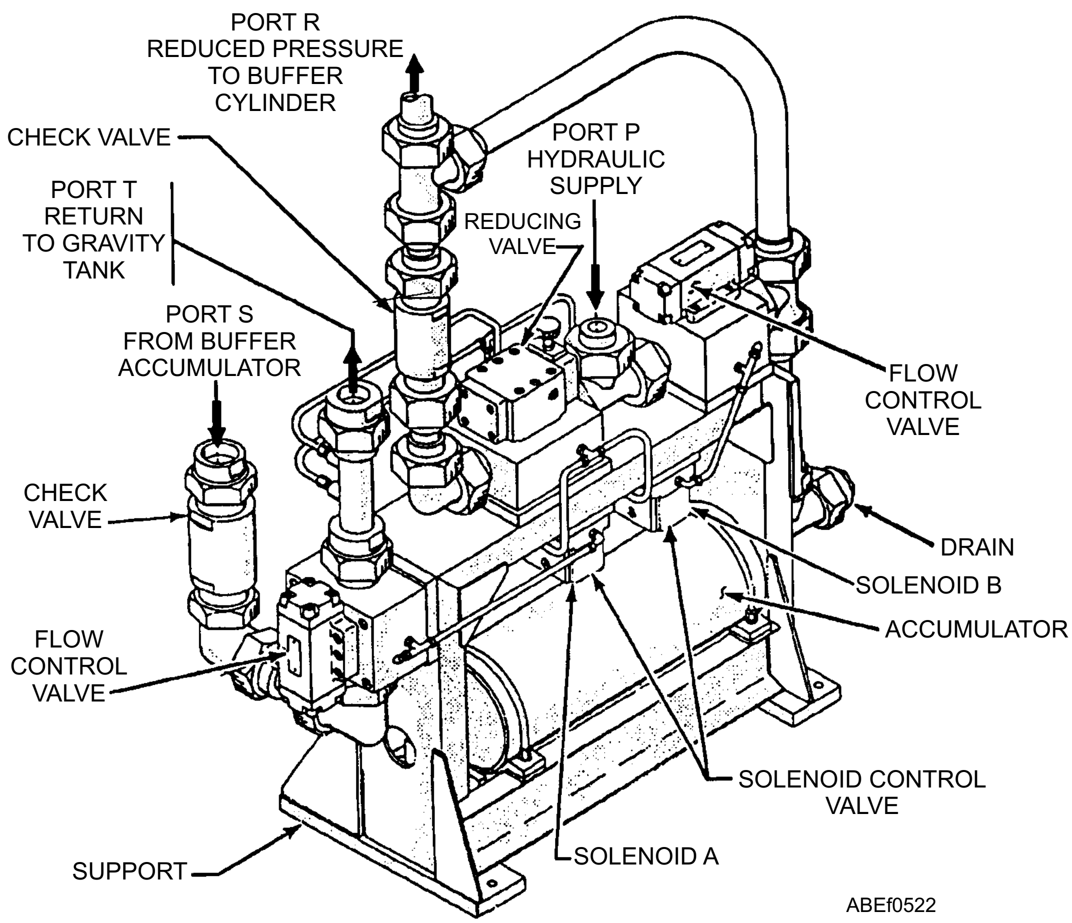

Figure 5-22.—Valve manifold assembly.

NOSE-GEAR-LAUNCH CONTROL SYSTEM

On ICCS ships the operation of the NGL equipment is automatic under normal operating conditions. The only controls provided are the buffer fwd and the buffer aft push buttons installed on the monitor control console, deckedge, and the central charging panel (CCP).

On non-ICCS ships, the operation of the NGL equipment is automatic under normal operating conditions. Two control panels (fig. 5-23) are provided for the operation of the NGL system. One panel is located adjacent to the catapult deckedge station for use during normal operations. A second panel is located in close proximity to the aft end of the catapult trough for emergency operations. The control panels are identical and houses a relay, terminal board, power on indicator light, buffer fwd and buffer aft switches with integral indicator lights and associated wiring. Panel selection is made by rotating a transfer switch (fig. 5-24) from its normal position to its emergency position.

OPERATIONS

Buffer Forward

The buffer forward push button is used during an aircraft launch abort operation to move the buffer hook forward of the holdback bar so that the release element and holdback bar can be removed from the aircraft.

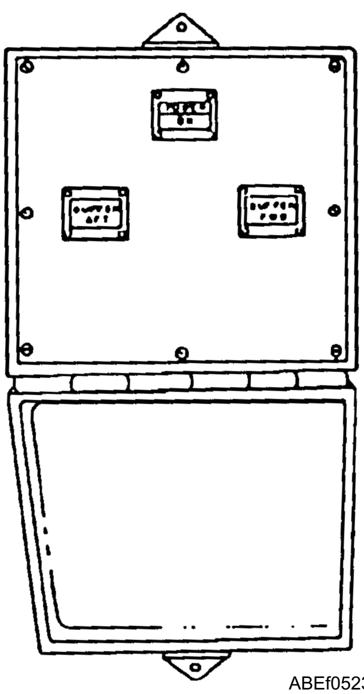

Figure 5-23.—Deckedge and emergency control panel.

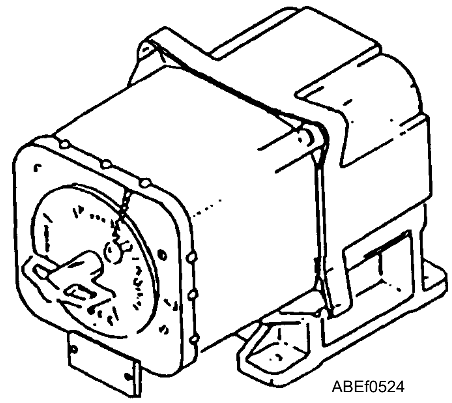

Figure 5-24.—Transfer switch.

When the BUFFER FWD push button is pressed, the buffer forward solenoid (A) is energized (fig. 5-25), shifting the buffer forward solenoid valve, allowing medium-pressure hydraulic fluid to shift the piston of the flow control valve. When the piston of the flow control valve shifts, fluid flow from the aft end of the buffer cylinder assembly to the gravity tank is shut off. This causes a pressure buildup on the aft end of the buffer cylinder assembly pistons. Since the area on the aft side of the pistons is larger than the area on the forward side, the pistons, piston rods, and attached slide assembly are driven forward.

Buffer Aft

The buffer aft push button is pressed during an abort operation when the aircraft holdback bar is connected to the buffer hook; the fluid pressure acting on the forward side of the buffer pistons will tow the aircraft aft. When the buffer has moved back 4 to 10 inches, the abort force is reduced because hydraulic pressure is bled off through exposed holes in the buffer-cylinder assembly orifice tubes. Aircraft braking is required prior to releasing the push button to hold the aircraft against its thrust load. When the NGL BUFFER AFT push button is pressed after the aircraft is removed from the catapult and the buffer hook is forward, hydraulic fluid pressure will return the pistons, piston rods, and slide assembly fully aft. When the slide assembly is retracted, the buffer hook returns to a position below deck.

When the BUFFER AFT pushbutton is pressed, the buffer aft solenoid (B) is energized (fig. 5-26), shifting the buffer aft solenoid valve, allowing medium-pressure hydraulic fluid to shift the piston of the flow control valve. Medium-pressure hydraulic fluid flows through the flow control valve to the buffer cylinder

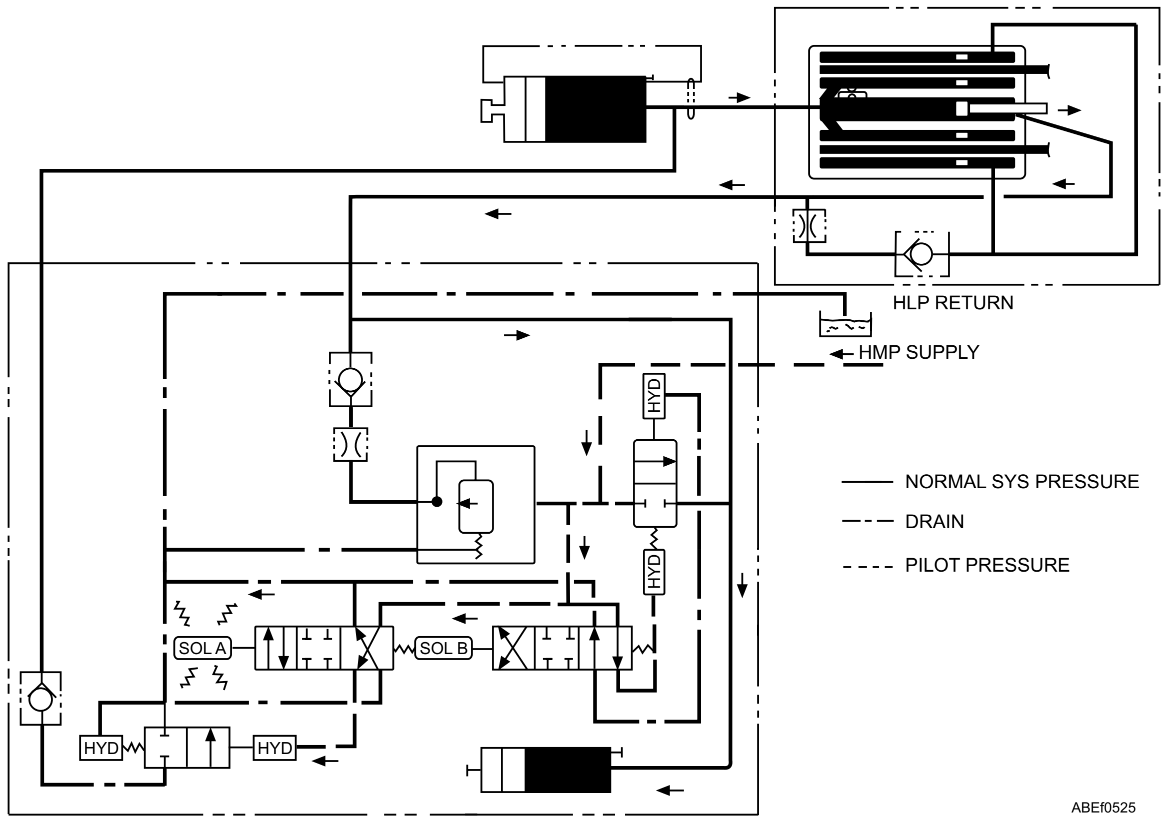

Figure 5-25.—Abort aircraft-buffing forward cycle.

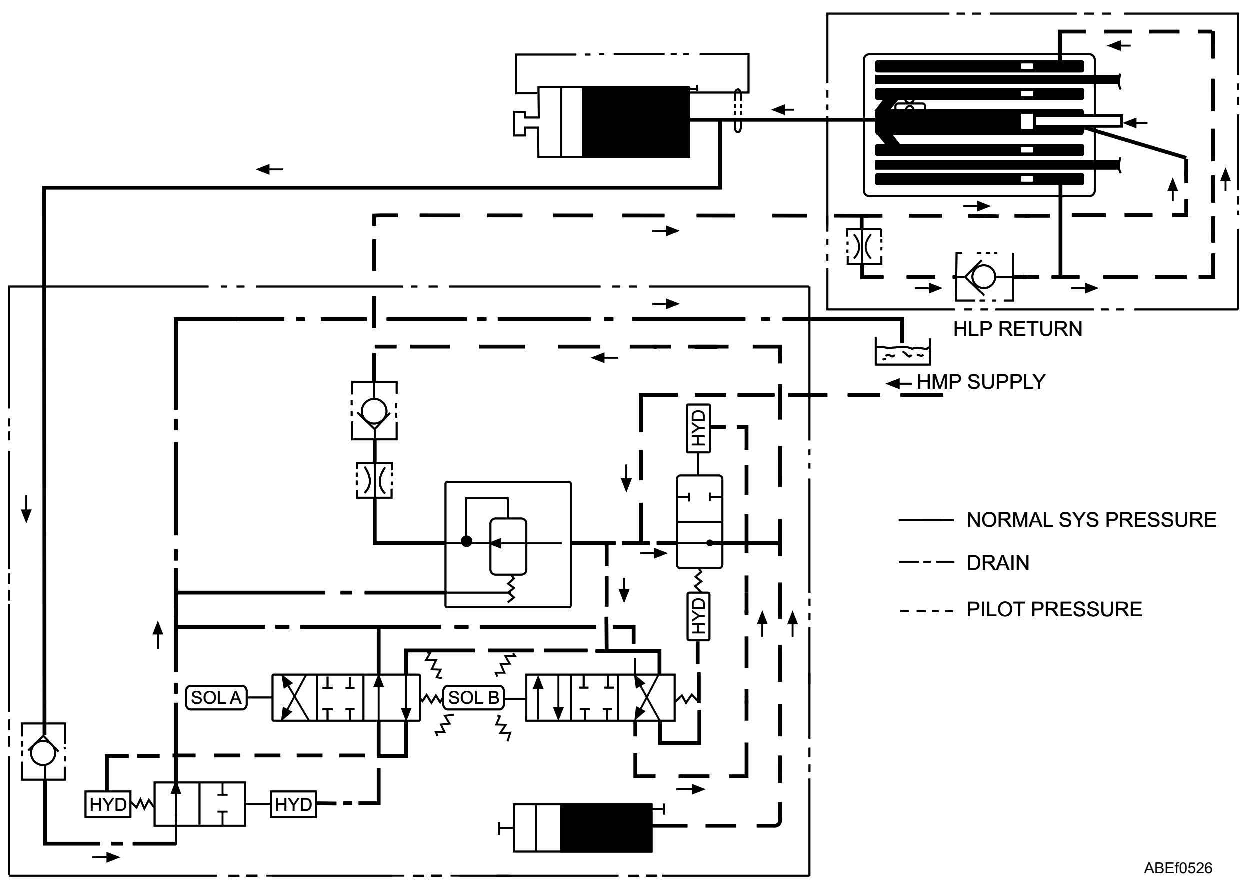

Figure 5-26.—Abort aircraft-buffing aft cycle.

assembly. Fluid pressure is applied to the forward side of the buffer pistons; and the pistons, piston rods, and slide assembly move aft. As the pistons move aft, fluid is forced out of the aft end of the buffer cylinder assembly, through a check valve and the other flow control valve, to the gravity tank.

REVIEW QUESTIONS

Q12. List the NGL guide tracks.

Q13. The slide is mechanically connected to what component?

Q14. What component resets the buffer hooks?

Q15. What ensures the launch bar makes contacts with the buffer hook actuator roller?

Q16. The orifice tube is located in which cylinder of the buffer cylinder assembly?

Q17. The void created as the piston rods move forward is filled with hydraulic fluid from what assembly?

Q18. On ICCS ships, the buffer fwd and buffer aft pushbuttons are installed on what control panels?

SUMMARY

In this chapter we have discussed the functions and operating procedures for the JBDs and Mk 2 NGL equipment. For additional, in-depth descriptions of this equipment, see the applicable NAVAIR technical manuals.