CHAPTER 9

E-28 SHORE-BASED EMERGENCY ARRESTING GEAR AND RELATED EQUIPMENT

As an aviation boatswain's mate, handler (ABH), you will need to become familiar with shore-based emergency arresting gear and its related equipment in use today.

When you have finished studying this chapter, you should be able to describe the operation, upkeep, and maintenance of E-28 shore-based emergency arresting gear.

Normally, aircraft can land at a naval air station without the use of arresting gear as required by those landing aboard an aircraft carrier. In an emergency situation—such as a blown tire, an indication that the landing gear has not locked, a sick pilot, or any one of the numerous emergencies that could arise—you must arrest the aircraft and stop it in the shortest distance possible. This is to minimize the chance of an accident that could cause injury to the pilot and crew or damage to the aircraft. Emergency shore-based recovery equipment has been designed for such emergencies.

All emergency shore-based recovery equipment, except the MA-1A overrun barrier, has been designed to recover carrier and land-based aircraft equipped with tail hooks. The MA-1A overrun barrier is designed to stop aircraft not equipped with tail hooks, but the aircraft must have a nose wheel for the barrier to be effective. The MA-1A overrun barrier is always in a standby status in case there is an aborted takeoff or an emergency overrun landing.

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to do the following:

1. Describe the operation of E-28 shore-based emergency arresting gear.
2. Identify the different components of E-28 shore-based emergency arresting gear.
3. Identify the different deck pendant supports of E-28 shore-based emergency arresting gear.
4. Identify the different tools used in maintenance of E-28 shore-based emergency arresting gear.

E-28 SHORE-BASED EMERGENCY ARRESTING GEAR

The E-28 shore-based emergency arresting gear installation described in this manual is designed as a land-based emergency standby gear for arresting hook-equipped aircraft (*Figure 9-1*). It is installed on the runway for the purpose of safely arresting an aircraft in the event of an aborted takeoff or an emergency landing. The arresting engine is a rotary, hydrodynamic energy absorber installed outside the edges of the runway. It is designed to jointly spread out the kinetic energy of a landing aircraft. *Table 9-1* lists the E-28 shore-based emergency arresting gear design characteristics.

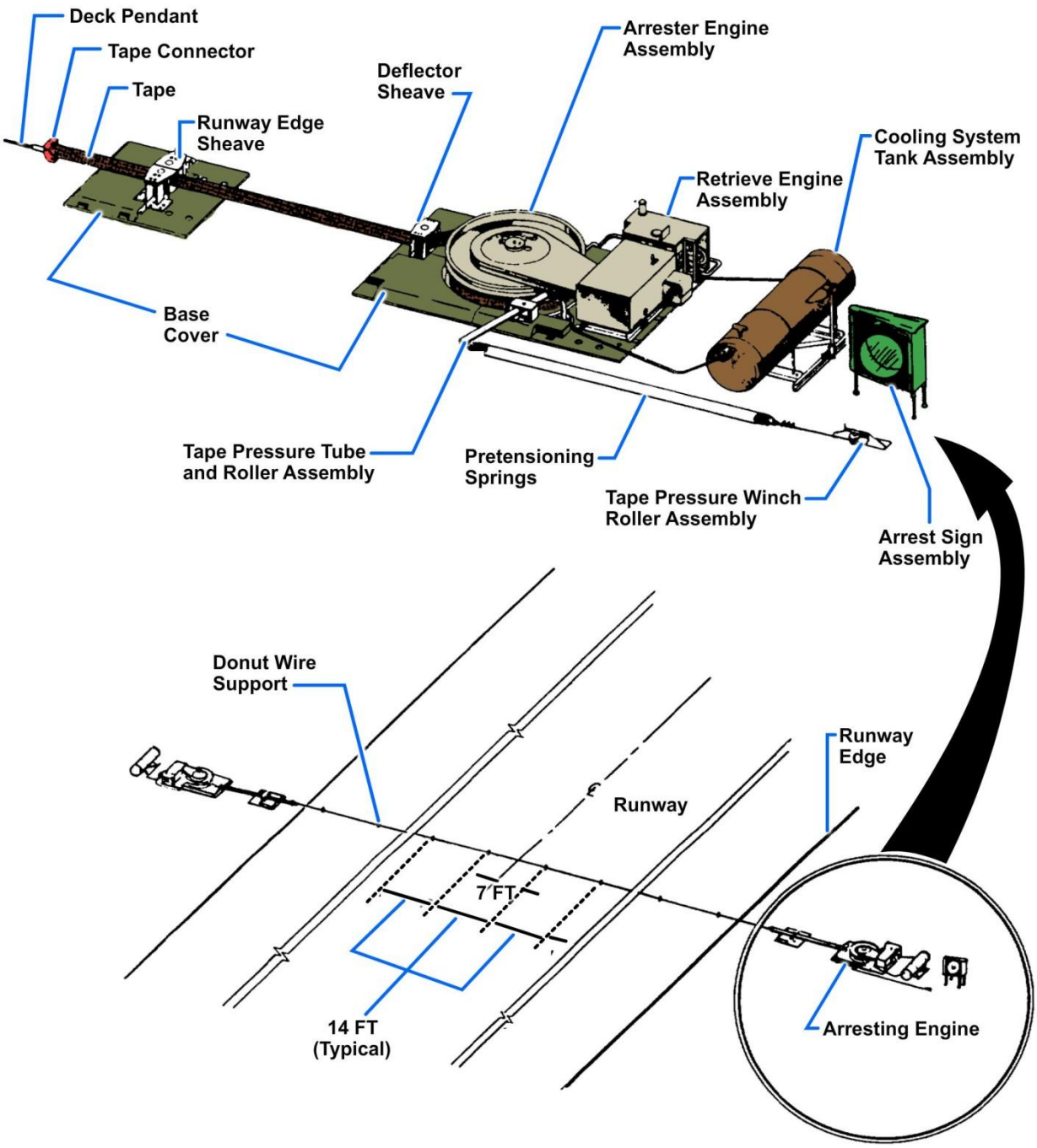


Figure 9-1 — E-28 Shore-based emergency arresting gear installation.

NOTE

Corrective maintenance on E-28 shore-based emergency arresting gear requires a high level of quality assurance (QA) inspection.

Table 9-1 — E-28 Shore-based arresting gear characteristics

Maximum aircraft weight accommodated	78,000 pounds
Maximum aircraft engaging speed	160 knots
Arresting engine gross weight	11,700 pounds
Arresting engine gross length	13 feet
Arresting engine gross height	33 inches
Ambient temperature range	-25 degrees Fahrenheit (F) + 120 degrees F
Fuel/Fuel capacity	Gasoline/9 gallons (gal)
Hydraulic fluid	Ethylene glycol and water
Energy capacity	76 million foot pounds
Purchase tape data	Nylon (8 in wide, 0.344 in thick)
Deck pendant construction	1¼ inch- diameter, preformed, 18x7 non-rotating, improved plow steel
Span	225 - 425 feet
Off-center engaging	Refer to current E-28 aircraft recovery bulletin 46-12
Runout	1,000 feet
Cycle time	80 seconds (sec)
Engagement direction	Bidirectional
Rewind system power	Gasoline engine
Deck pendant length	To suit runaway width

Principle of Operation

Aircraft arrestment is accomplished by engagement of the aircraft arresting hook with a deck pendant that spans the runway. During runout, the kinetic energy of the arrested aircraft is absorbed by the rotary, hydrodynamic arresting engines. The arrestment is entirely automatic. The arresting gear engines are activated when the aircraft arresting hook engages the deck pendant, thereby pulling out the attached purchase tapes. As each tape unwinds, the drum, through the splined shaft, turns a vane rotor between vane stators in a housing filled with fluid (*Figure 9-2*). The fluid resistance decreases the rotational speed of the drums. This action slows down the purchase tape payout, which, in turn, applies a braking force on the aircraft, and the ensuing fluid turbulence converts the aircraft's kinetic energy into heat.

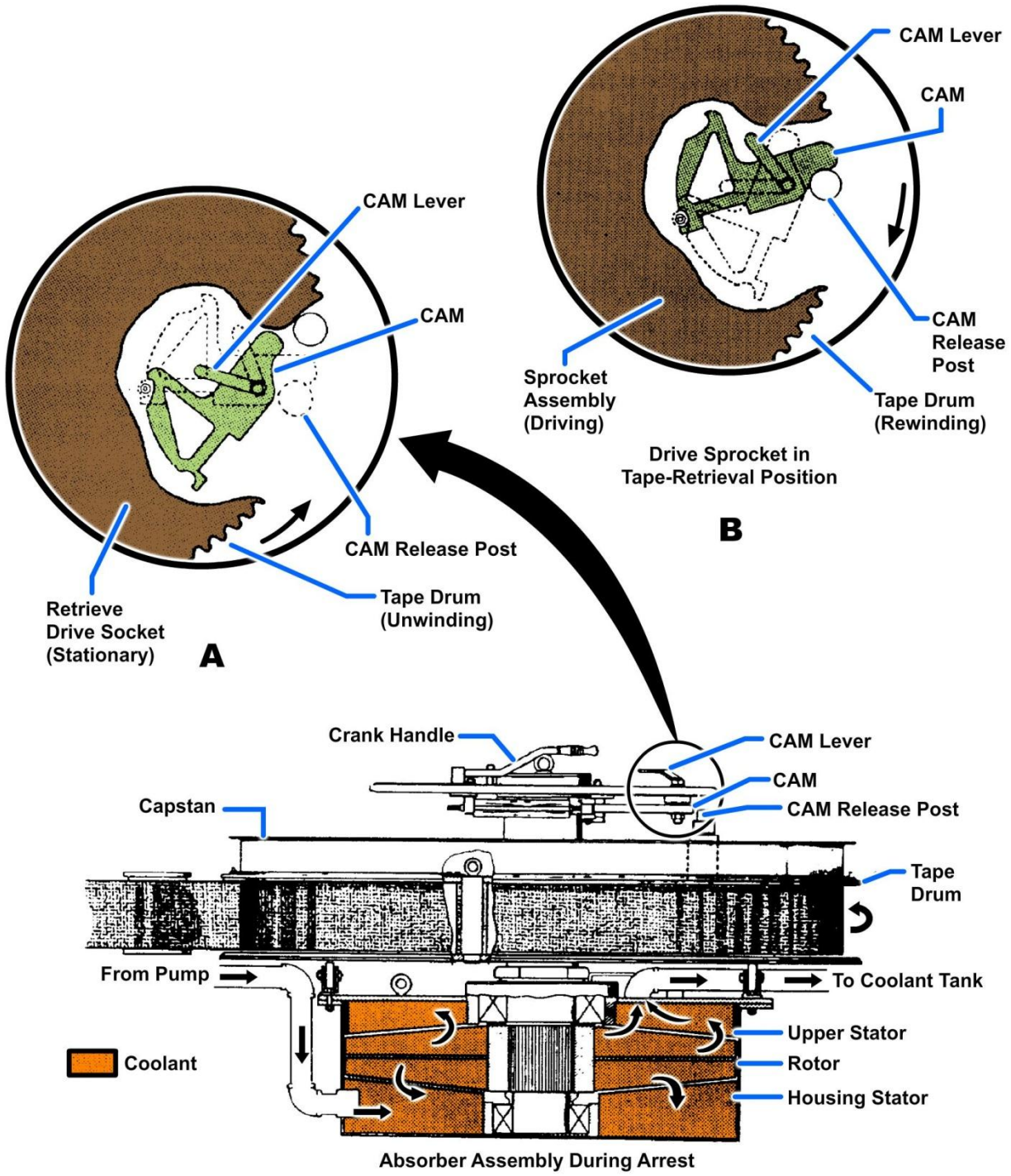


Figure 9-2 — Absorber assembly.

Description and Function

The E-28 shore-based emergency arresting gear installation has two arresting engines installed above the deck on opposite sides of the runway. Each operates a single nylon tape. The tape from each engine is routed through a deflector sheave and a runway edge sheave assembly. It is coupled by means of a tape connector to one end of the deck pendant.

Retrieve System Assembly

The retrieve system assembly consists of an electrical starting system, a torque converter with front disconnect clutch, and a speed reducer with duo-cam clutch. The retrieve system is operated from a control panel mounted on the retrieve system assembly base. The function of the duo system assembly is to rewind the tape and pretension the pendant after each arrestment. The output shaft of the gasoline engine and input shaft of the torque converter are directly engaged by manually positioning the clutch handle.

The output shaft of the torque converter is coupled to the speed reducer input shaft by a universal joint. A sprocket keyed to the vertical output shaft of the speed reducer is connected by a roller chain to the ball bearing mounted sprocket on the absorber unit. On the extension of the speed reducer is a one-way nonreversing duo-cam clutch, which allows the engine to retrieve and pretension the tape, through the system to the stall load of the torque converter. The torque produced by the torque converter at stall load provides the proper pretension of the pendant. When the engine throttle on the control panel is pushed into idle position, or the stop button is depressed to stop the engine, the duo-cam clutch holds the applied torque, thus maintaining the tension applied to the runway pennant.

The entire retrieve assembly is mounted on a base pivoted about one corner and is moved by a jackscrew or positioning cam to provide chain take-up.

Retrieve Engine General Description

The five major components of the arresting engine are tape drum, capstan assembly, retrieve drive sprocket, bearing assembly, and a vane rotor mounted on a common shaft assembled in the vane housing. This energy absorber unit is mounted on a steel base along with a retrieve engine, an arrester sheave, and a tape pressure arm pivot.

The retrieve engine is a four-cylinder, four-stroke cycle, air cooled type, using gasoline fuel. Magneto ignition and a starter cranking are provided. The starter operates from a 12-volt battery, 65-horsepower (hp) engine. An alternator and voltage regulator maintain the battery charge. Crankcase and cylinder lubrication is accomplished by a pressure type oil system and an external line distributing the oil to the governor and gear train. The gasoline tank is mounted beneath the engine, and a gasoline strainer is furnished on the inlet side of the fuel pump. The engine is equipped with a centrifugal fly-ball type governor. The flywheel pulley, using V-belts, drives the battery generator and the energy absorber cooling pump. Engine rotation is clockwise when viewed from the front end (cranking case). Engine controls are located on a panel, mounted at the side of the retrieve system next to the torque converter disconnect clutch.

Torque Converter

The torque converter transmits power from the engine to the tape drum on the arresting engine through a speed reducer during the retrieval operation.

Tape Drum, Shaft, and Rotor

When the splined tape drum and splined rotor are assembled on the shaft, they function as a unit. The shaft rides in self-aligned roller bearings. The lower bearing is mounted in the absorber housing and the upper bearing mounted in the cover. During an arrestment the tape drum drives the rotor, whose motion is resisted by turbulent fluid in the housing, thus decelerating the tape drum. Retrieve Drive Sprocket Assembly.

A retrieve drive sprocket assembly is bearing mounted on the shaft, above the tape drum. At the beginning of the arrestment, the retrieve system is automatically disengaged from the tape drum by the cam release post acting against the automatic release mechanism, which, when armed, is loaded to trip when the tape tension is 6,000 to 6,500 pounds. This reaction allows the tape drum and rotor to run free of the sprocket assembly.

Following arrestment, the retrieve assembly is manually engaged to the tape drum through contact of the arm, spring-loaded cam, and the post release. The sprocket is chain driven by the gasoline engine, which is the power source for rewinding the tape onto the drum.

Control Panel

All controls (*Figure 9-3*) for the operation of the retrieve system are located on a single panel located immediately in front of the clutch handle. To assist starting, the choke is located next to the starter button near the mounted pull throttle. A spring-loaded, normally open stop button is used to short the magneto to stop the engine. An engine speed tachometer, oil pressure gage, and ammeter are also mounted on the panel.

Runway Edge and Deflector Sheaves

The sheaves serve as a guide for the nylon tap. The runway sheaves are installed at the runway edge. The deflector sheave is adjacent to the tape drum and mounted on the arrester engine base.

Deck Pendant

The deck pennant is a 1¼-inch-diameter non-rotating wire rope held above the runway by pennant supports. During arrestment, the aircraft arresting hook engages the deck pennant, thereby causing the tape to pay out and activate the arresting engines. Pennant length will vary according to the width of the runway.

Tape Connectors

Tape connectors are used for coupling the nylon tape to the deck pendant.

Tape Pressure Roller

To ensure an even, tight wrapping of tape on the drum during retrieve and also to prevent over spin during arrestment, a pressure roller is provided. The roller is mounted on an arm pivoted in a bracket secured to the arresting engine base. The arm is tensioned by two springs extended by a hand winch in accordance with current maintenance requirement card (MRC).

Base Covers

Covers are provided in those areas where exposed ends of the arrester engine or runway engine sheave hold-down bolts might damage the tape while reeving or during operations.

Mounting

The energy absorber assembly, deflector sheave assembly, pressure roller assembly, and retrieve assembly are mounted on a common base. The runway edge sheave and pressure roller winch have individual bases. All bases are provided with holes for concrete foundation bolts.

Arrest Sign

Arrest signs indicate to approaching aircraft the location of the arresting gear on the runway. The vertical bidirectional illuminated sign is placed on each side of the runway in line with the pendant cable behind the cooling system tank assembly and normally equidistant to centerline of the runway.

WARNING

Electrical shock can result in injury or death to personnel. Verify electrical power is de-energized using a multimeter prior to contacting any exposed wiring.

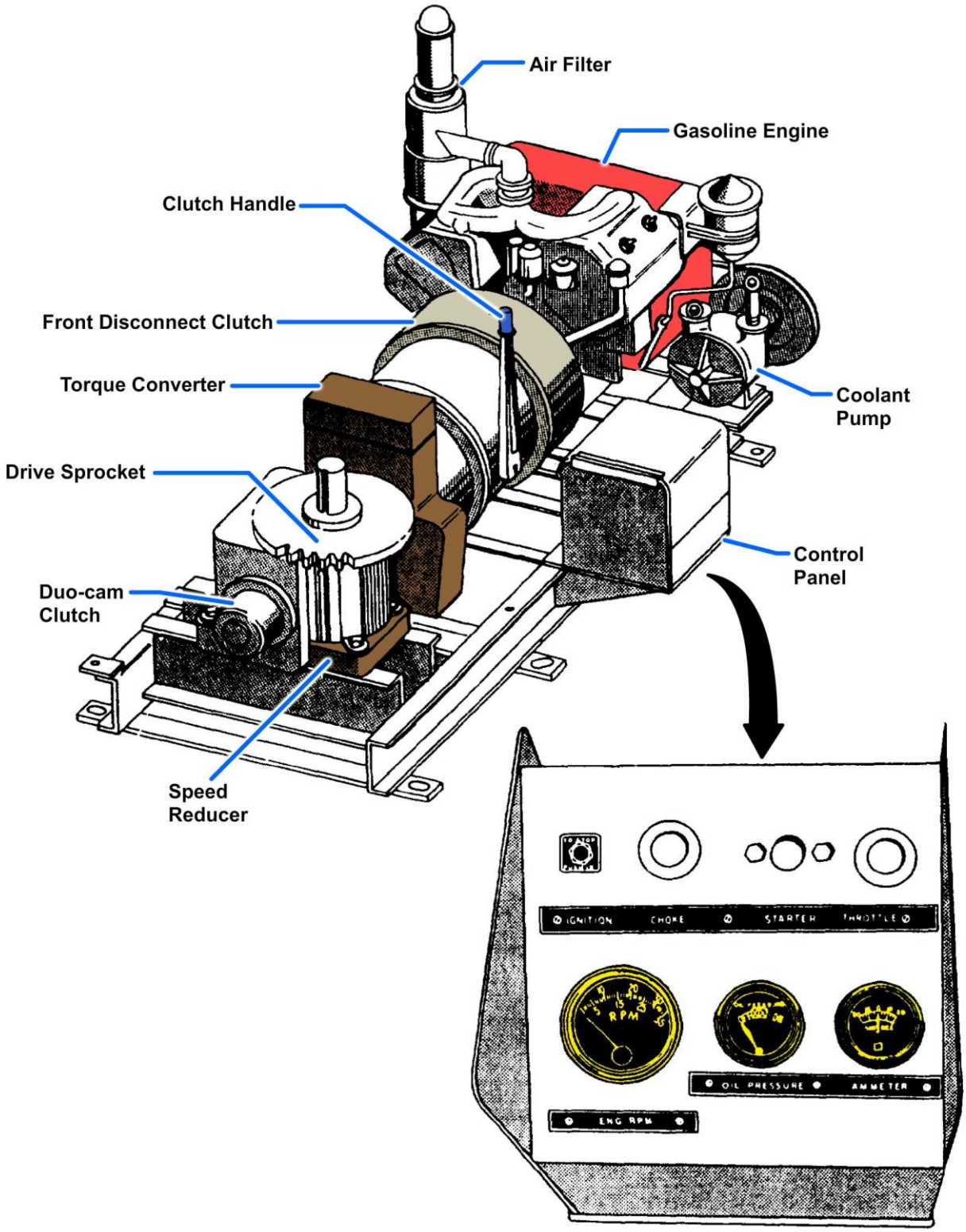


Figure 9-3 — Retrieve assembly and control panel.

Pretension Warning System

The pretension warning system provides continuous indication of the state of pretension in the deck pendant across the runway. Loss of pretension due to aircraft rollover can be detected and corrective action taken in order to prevent possible injury to personnel and equipment during an actual arrestment. The pretension warning system strobe light flashes when the deck pendant pretension is lost.

Deck Pendant Support

The function of the deck pendant supports is to support the deck pendant at the required height above the surface of the runway. This height ensures a positive engagement of the aircraft arresting hook with the tensioned arresting cable across the runway. Three types of supports are used: the donut supports, the polyurethane pendant supports (optional), and the aircraft tire supports (optional).

Installation

Because of runway abrasion, the wear on individual wire supports varies considerably, depending upon the exact condition of the runway surface. The supports may shift from their initial positions under heavy deck traffic conditions, and occasional re-spacing will be required. Some donuts may fail and become detached from the deck pendant during high-speed engagements. After each engagement, donut wire supports must be subjected to a thorough visual inspection for the following conditions:

- Excessive wear
- Radial cracks
- Correct spacing of supports
- Loss of supports

Cooling System

Located near each arresting gear is a fluid supply tank *(Figure 9-4).* It is connected by hoses to the absorber housing through a pump mounted on and driven by the retrieve engine. When the retrieve is running, the positive displacement pump moves fluid from the energy absorber, forcing the heated fluid in the absorber to flow through the outlet to of cooling tank. The large, exposed surface of the tank serves as a heat exchanger, dissipating excess heat to the surrounding air.

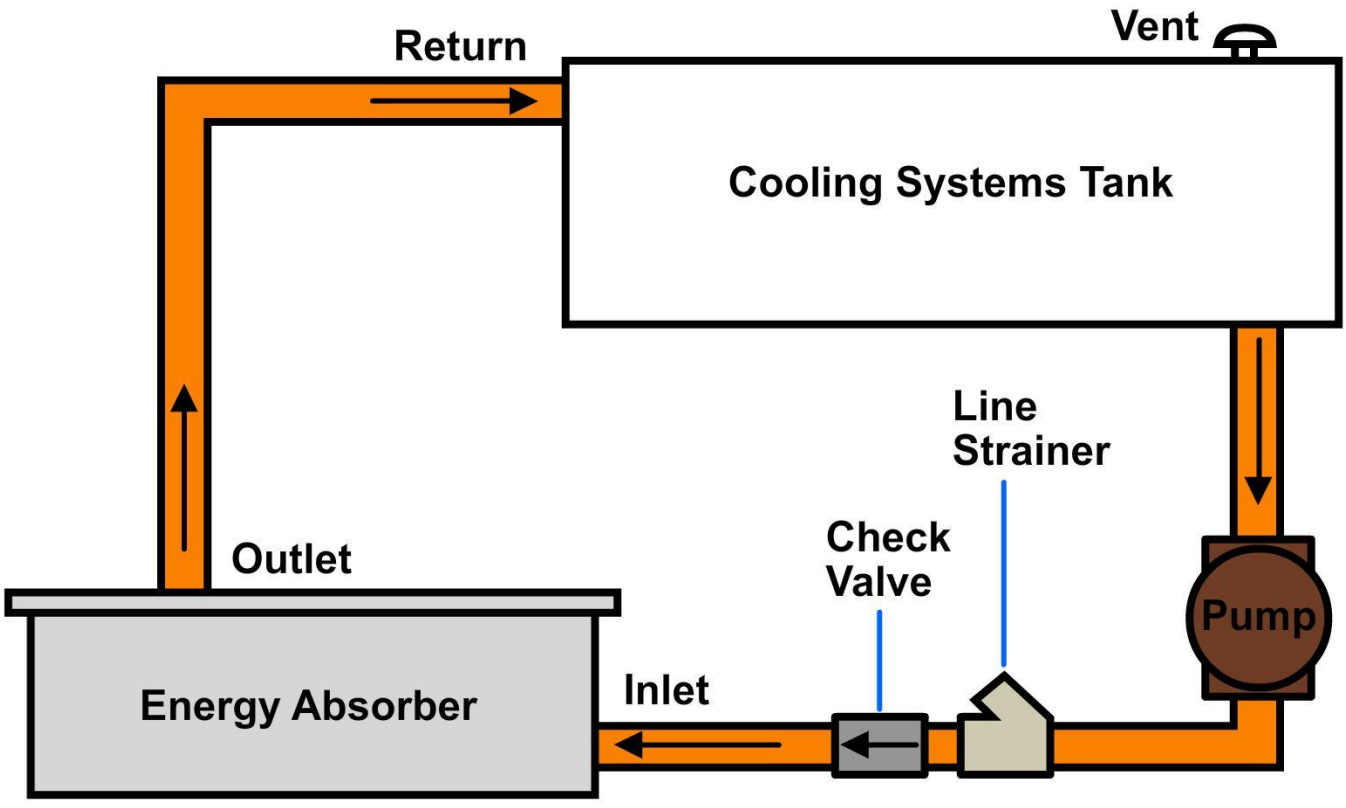


Figure 9-4 — Cooling system.

Aircraft Tire Supports

The aircraft tire may be used as an optional method to support the pendant during normal usage. Tire supports are made from sections of condemned aircraft tires. Positioning of tire supports on the pendant shall be as indicated in *Figure 9-5.* The tire sections are cut from 10-ply to 24-ply aircraft tires. *Table 9-2* is a list of acceptable aircraft tires for use as tire cable supports.

Table 9-2 — List of acceptable aircraft tires for use as tire cable supports

Aircraft Model	Tire Size
F-14	22 x 6.6 Nose Wheel
F-18	22 x 6.6 Nose Wheel

When installing donut wire supports (*Figure 9-5*) on installed deck pendants, you should remove the pretension from the deck pendant, pull out a few feet of tape, disconnect the tape connector from the pendant terminal, and proceed as follows:

1. Place the donut wire support installation tool (*Figure 9-6*) beneath the pendant terminal and pin the tapered cone to the terminal.
2. Apply grease, MIL-G-7711A, to the inside wall of the 1¼-inch-diameter hole of the donut wire support, the tapered cone, and the pendant terminal.

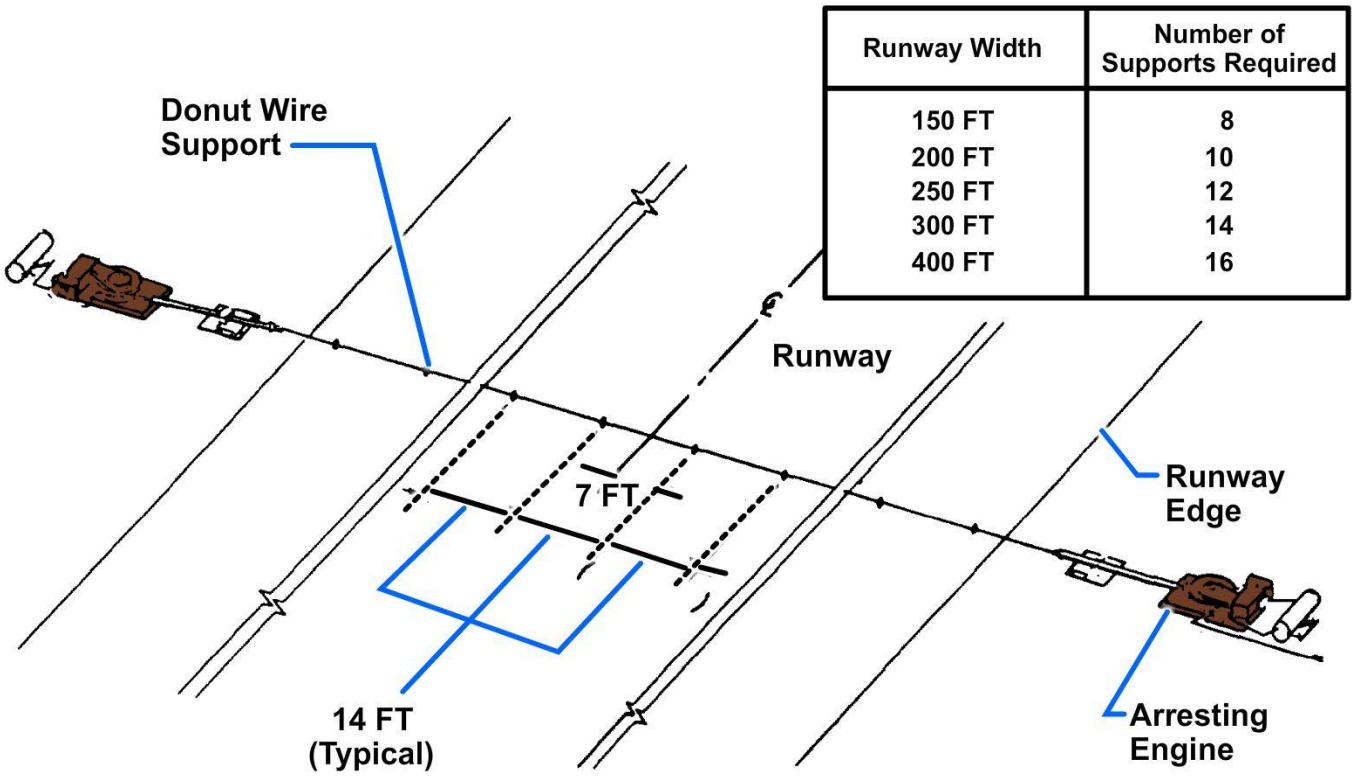


Figure 9-5 — Donut wire support installation.

3. Install the donut wire support on the tapered cone, and pin the cone to the installation tool as shown in *Figure 9-6*.

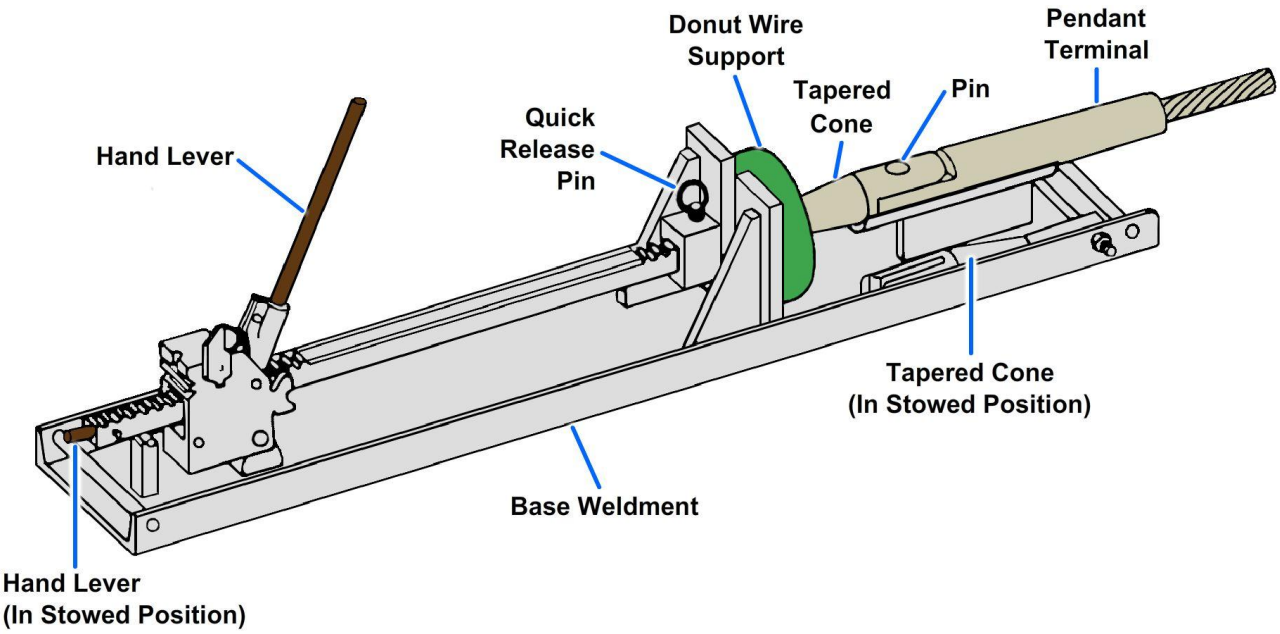


Figure 9-6 — Donut wire support installation tool.

4. Use the hand lever inserted in the ratchet. Jack the tapered cone and the pendant terminal through the 1¼ -inch diameter hole in the donut wire support with a full stroke of the lever.
5. Repeat steps 2 through 4 for each donut wire support required.
6. Install one-half of the required number of wire supports over each terminal according to the previous procedures. This action should reduce the length of cable over which the donut wire support must be turned.
7. Space the donut wire supports by turning each support in the direction of the pendant's helix.

> ⚠ **CAUTION** ⚠
>
> Pushing the donut wire support along the pendant without turning it could reduce the ability of the support to retain its position on the pendant.

8. Pretension the deck pendant and check the minimum deck pendant height. To determine that the minimum deck cable height limit has not been exceeded, check the deck pendant as follows:
    a. Check for minimum cable clearance of 2 inches between the deck and the bottom of the pendant cable at the middle (or lowest) point between adjacent wire supports.
    b. Using the deck cable height gauge, slide the gauge from side to side (about 18 inches to either side of the midpoint) to check for minimum clearance (*Figure 9-7*). Clean the mid span area under the cable, as necessary, to allow a smooth side-to-side sliding of the gauge.
    c. If the gauge is easily passed beneath the cable with no apparent lifting of the cable, the minimum cable height limit of 2 inches has not been exceeded.

d. If the deck cable height gauge does not clear the cable, increase the pendant tension through the retrieve engine adjustment. Then, recheck the pendant height.

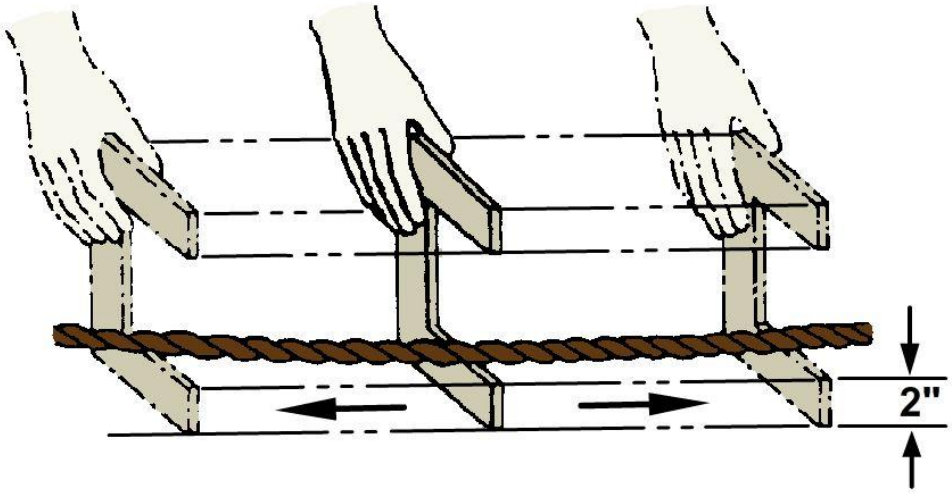


Figure 9-7 — Checking for minimum clearance.

e. Before T-39D aircraft landings and/or takeoffs or where aircraft taxiing speeds over 10 knots are expected, reposition the two center wire supports on the recovery systems, where aircraft rollover is unavoidable. Reposition supports outboard to allow the cross-deck pendant to lie flat on the runway for a minimum of 20 feet on each side of the runway center line.

f. AV-8A, TAV-8A aircraft are cleared to taxi over a supported arresting gear wire up to a maximum speed of 5 knots. If an outrigger is trapped by the arresting gear wire, the pilot will stop the aircraft immediately; then the ground crew must free the aircraft, reposition the donuts or tire supports, and place the arresting gear in the battery position. AV-8, TAV-8A aircraft may cross an unsupported tensioned arresting gear wire at any speed, engine revolutions per minute (RPM), or nozzle angle if the arresting gear wire lies flat on the runway. Therefore, donuts or tire supports should be removed and repositioned as required.

9. After the original donut wire support installation has been approved, paint marks on the runway at the support locations. These marks will expedite repositioning the supports, if necessary, following an arrestment.

> **NOTE**
>
> To provide a capability for immediate pendant replacement when required, install donuts on one or more spare deck pendants.

Replacement Criteria

Should any donut wire support become unserviceable, you should remove it from the deck pendant by cutting it free. The donut wire support should be replaced and the supports replaced according to paragraph 2-6 of *E-28 Shore-Based Emergency Arresting Gear,* NAVAIR 51-5-31.The supports must be replaced if any of the following conditions exist:

- When they have radial cracks of 1 inch or longer
- When the minimum deck pendant height cannot be attained because of excessive wear

For more information about replacement criteria, see *E-28 Shore-Based Emergency Arresting Gear*, NAVAIR 51-5-31.

Polyurethane Pendant Support (Optional)

The polyurethane pendant support, part number 618717-1, is intended for high-usage runways. It is not a replacement for the donut wire support. Consideration for usage is dependent on whether the arresting gear pendant must be in the battery position immediately upon retraction from a previous arresting to receive the next aircraft. However, the pendant support may be used to support an arresting gear pendant for other reasons peculiar to an individual installation. Polyurethane pendant supports must be positioned properly and secured to the runway as shown in *Figure 9-8.*

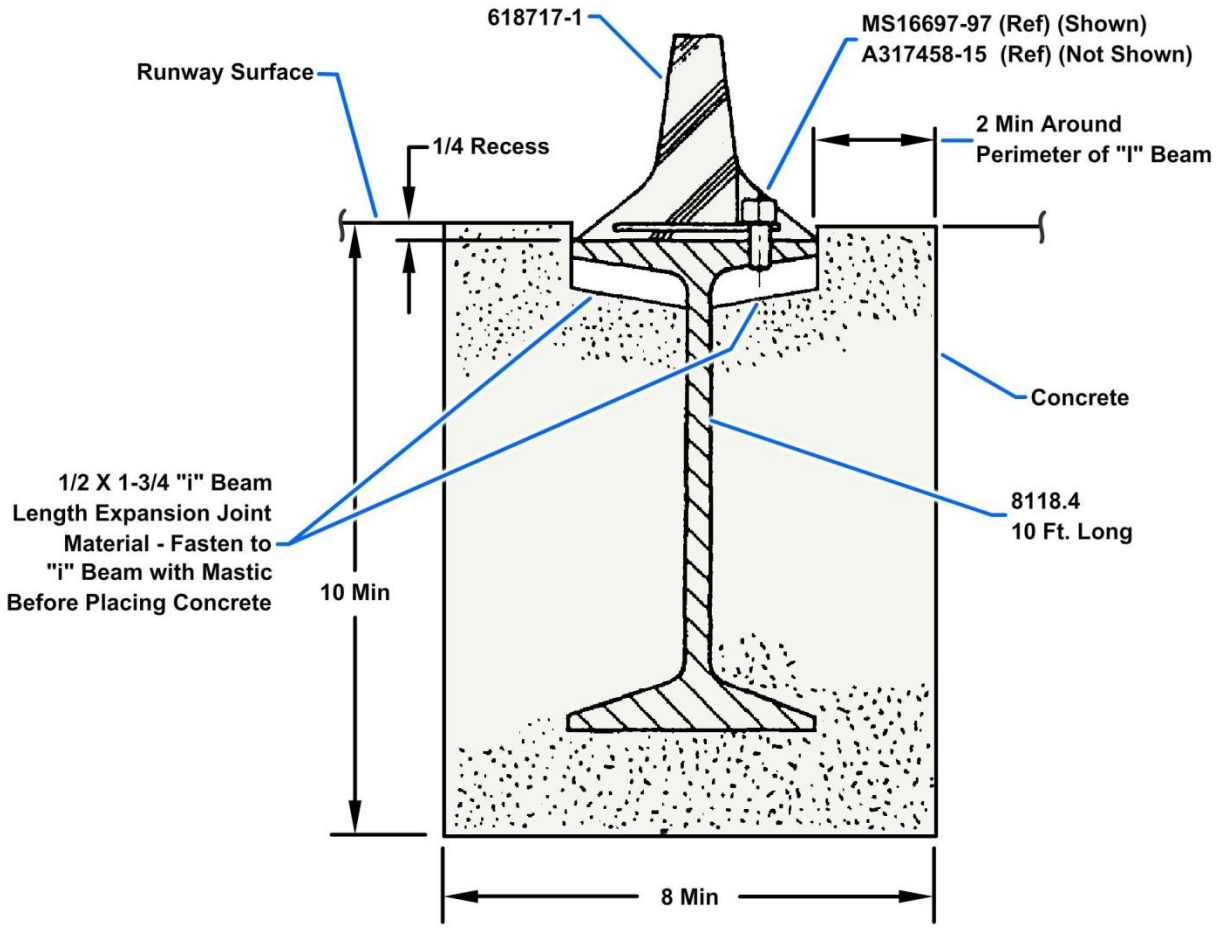


Figure 9-8 — Pendant support installation.

Inspection of Arresting Gear

A functional inspection of the arresting gear equipment must be performed every 30 days. This inspection means operating the equipment through a complete cycle. The complete installation is inspected for stability. Every visible moving part is inspected for security, freedom of motion, quiet operation, and alignment. When this inspection is performed diligently with the accomplishment of necessary corrective maintenance, malfunctions and inoperative time will be reduced, and trouble-free operation will help ensure the safety of the personnel operating the equipment.

Tapes

The tapes are essentially woven nylon belts having outer weaves and longitudinal fibers that are the primary load-bearing members. They are so constructed that the fibers are secured in a series of bundles of longitudinal fibers with longitudinal binders between the bundles. See *Figure 9-9.*

Maintenance of Tapes

The maintenance of tapes is necessary to prevent breakdowns of equipment and, most of all, to prevent accidents and ensure personnel safety.

Inspection of Tapes

Because of runway abrasion, the wear on individual tapes varies considerably depending upon the exact condition of the runway surface. Inspection of the entire length of pulled-out tape must be made after each arrestment before retraction, during functional inspection, and during any other pullout. Daily, before the day's operations, and after each arrestment if time permits, those exposed sections of the tape in the vicinity of the tape connectors should be examined with extreme care. This examination is described as follows:

- Visually inspect the tape for any evidence of cuts, abrasions, or wear.
- Examine the log to determine the number of engagements to which the tape has been subjected.
- Examine the log to determine the number of months the tape has been in service.

Replacement Criteria of Tapes

The replacement criteria of tapes should be according to the latest information in the current MRCs.

Deck Pendants

The wire rope used to make the new deck pendants, Naval Air Engineering Center (NAEC) part numbers 515053-180-0, 515053-190-0, 515053-290-0, and 515053-390-0, is a higher strength non-rotating 1¼-inch-diameter polypropylene core.

Deck Pendant Inspection

Inspection of the deck pendants must be performed in conformance with *E-28 Shore-Based Emergency Arresting Gear*, NAVAIR 51-5-31. These inspections ensure the pendants are in good condition for the next arrestment. You should visually inspect the deck pendant for the following conditions:

- Kinking
- Evidence of a pulled-through through kink
- Broken wires
- Excessive wear
- Necking down

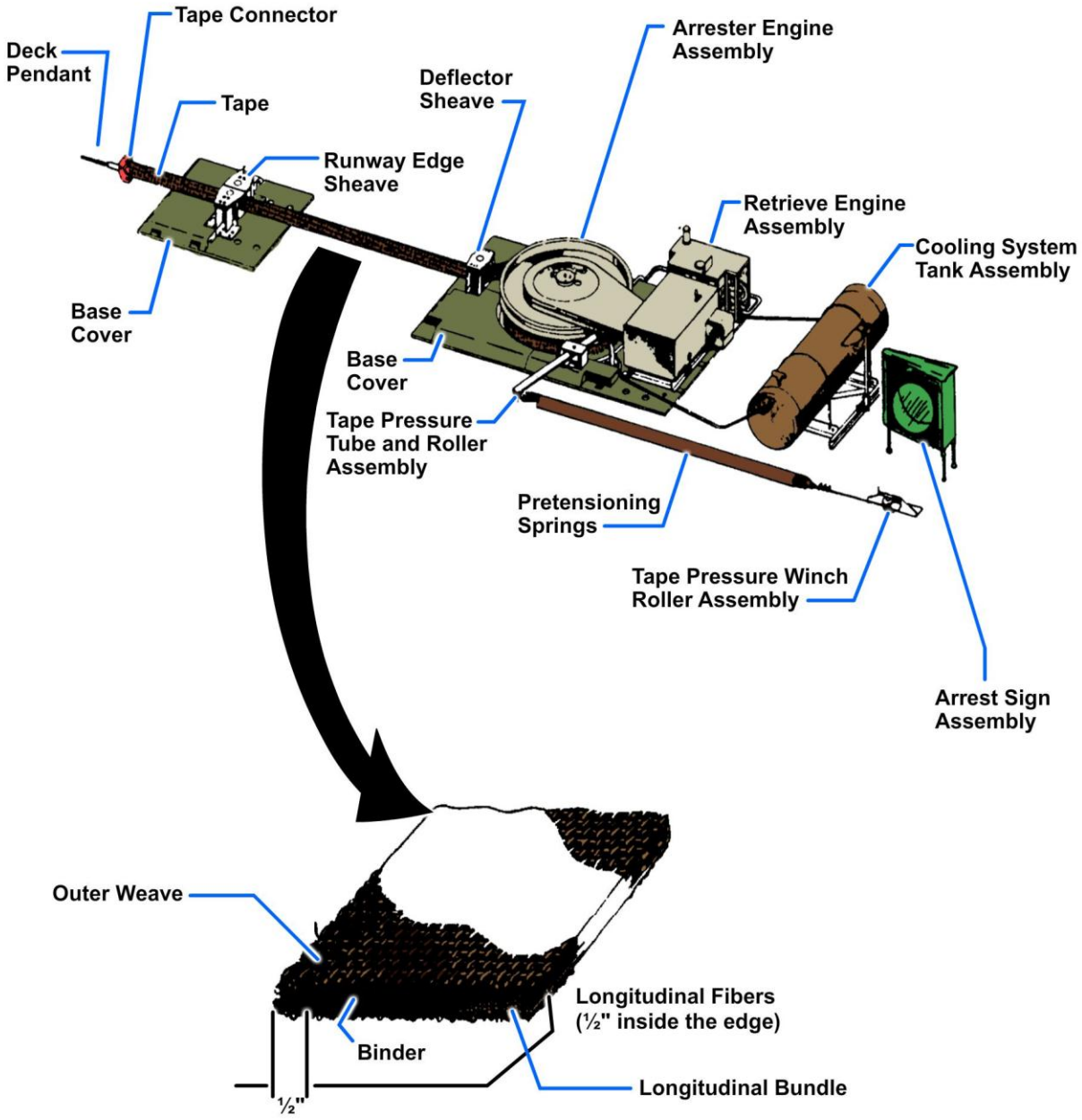


Figure 9-9 — Tape.

Kinking

Retraction sometimes causes formation of long, loose helical loops in the deck pendant. Such loops are usually eliminated as tension increases on the pendant. Occasionally a loop, instead of being eliminated, tightens into a small loop called a kink. Kinks can also form if the retraction cycle is halted abruptly; if the retraction is not a smooth, continuous operation; or if the torque is allowed to build up in the cable. *Table 9*-3 lists the replacement criteria for the deck pendant.

Pulled-Through Kink

It is possible for a kink to form during retraction. This may result in one or more of the following conditions:

- Bird caging — opening between the cable strands

- Strand distortion — unlaying of strands from their normal lay
- Wire distortion — unlaying of wires from their normal lay

> **NOTE**
> Bird caging is usually caused by kinks or bends in the rope. The pendant can be tensioned or un-tensioned.

Broken Wires

Close inspection is required to detect broken wires in preformed cable. Each broken wire has two ends that may or may not protrude from the cable. In counting broken wires, you should identify how many wires are actually broken.

> **NOTE**
> In the event that speed is required, passing a gloved hand along the cable may help to locate broken wires, but caution should be observed to avoid puncturing or cutting your hands.

Necking Down

Necking down is a noticeable reduction of the cable diameter at a particular area, usually at or adjacent to one of the terminals, caused by an excessively high-speed engagement.

Excessive Wear

Excessive wear is indicted by flats on the wire cable crests.

Frequency of Deck Pendant Inspection

Deck pendants must be thoroughly inspected as often as operations permit. Deck pendants should be inspected as follows:

- Daily before each day's operations and, if possible, before an arrestment
- After each arrestment or series of arrestments

For deck pendant replacement criteria, see the current maintenance requirement card, MRC code 5861(series).

Table 9-3 — Deck Pendant Replacement Criteria

Maximum service life	24 months
Uncrated/Exposed (not installed)	24 months
Maximum arrestments	One arrestment over 180 knots
	Four arrestments between 160 and 180 knots
	35 arrestments over a period of 12 months of which 3 arrestments may be between 160 and 180 knots

Table 9-3 — Deck Pendant Replacement Criteria (cont.)

Material condition	Kinking, bird caging, nine broken wires over entire length
	Five or more broken wires within one cable pitch length
	Strand separation and displacement of one or more strands from the normal lay pattern so that gaps larger than 1/8 inch are evident; gaps up to 1/8 inch are also cause for pendant replacement where accompanied by unlaying of the strands to the extent that they are loose enough to be moved by finger pressure
	Excessive wear; 30 or more flat spots ½ inch or more in length in one complete strand for one cable pitch length
	Necking down; a noticeable reduction of the cable diameter at a particular area, usually at or adjacent to one of the terminals caused by excessive high-speed engagement

Hydraulic Fluid

The hydraulic fluid in the arrester engine has a service life of 24 months. Before the hydraulic fluid in the arresting gear system is filled or replenished, the arresting gear maintenance officer or his or her designated representative determines the acceptability of the hydraulic fluid by accomplishing the following inspection:

1. Make sure the hydraulic fluid being added or changed has the same specification number of the fluid presently being used in the arresting gear system.
2. Visually inspect the markings of each individual container to be used to ensure the following are listed:
    a. Nomenclature-hydraulic fluid, arresting gear
    b. Specification-MIL-H-5559A
    c. NAEC part number 91782-5, national stock number (NSN) 9150-00-224-8729 (5 gal can)
    d. NAEC part number 91782-55, NSN 9150-00-243-1987 (55 gal drum)
3. After verification of the containers' markings, open each container and withdraw a sample of fluid to visually inspect for color and contamination.
4. When the fluid is colorless and free of contaminants, smell the sample. The sample should be odorless.
5. After an acceptable hydraulic fluid container has been emptied, remove or cover all the printed markings on the drum or destroy the container.

NOTE

Should any of the previous checks made show that the fluid might not be acceptable, your type commander should be notified. A sample of the fluid should be forwarded to the nearest naval testing facility for analysis. Be sure you make a record of all data on the container for possible future location of the source of supply.

Arresting gear maintenance criteria requires the changing of the fluid mixture on an 18-month basis. This change is to be accomplished according to the following instructions:

1. Disconnect the hose assembly at the pump inlet, place it in a suitable container, and drain the tank.
2. Flush the tank with clean water.
3. Remove the hose assembly from the absorber outlet and tank inlet.
4. Disconnect the pipe at the absorber inlet and place it in a suitable container.
5. Connect the hose assembly, removed in step 3, to the absorber inlet and pump inlet.
6. Start the gasoline engine and proceed to pump the fluid from the absorber housing. During this operation, continually flush the housing by pouring clean water into the absorber outlet until all traces of the fluid are gone.
7. Clean the fluid strainer.
8. Reconnect the piping as originally installed.
9. Idle the engine and fill the system with a fresh coolant mixture consisting (by volume) of two parts arresting gear hydraulic fluid and one part distilled water. See paragraph 8-57 of *E-28 Shore-Base Emergency Arresting Gear*, NAVAIR 51-5-31.

Tools

On E-28 shore-based emergency arresting gear, there are several tools that are used almost every day, particularly during preoperation and postoperation. Each particular type of these tools has a specific purpose. If you use the wrong tool when performing maintenance or repairs, you may damage the equipment you are working on or damage the tool itself. Remember, improper use of tools results in improper maintenance. Improper maintenance results in damage to equipment and possible injury or death to you or others.

WARNING

During night operations, do **NOT** attempt to speed up the preoperational inspection of arresting gear components or operation. Sufficient time should be taken to eliminate the possibility of accidents due to fluid leaks, loose components, an insecure deck pendant, or other causes.

Dynamometer

A dynamometer is an instrument for measuring force or energy. It has a spring to be compressed, combined with an index (scale) to show the amount of tension obtained.

When a hydrostatic test is performed on arresting gear engines, a dynamometer is connected between the tape connector and a tractor capable of pulling 8,000 pounds. The tape is pulled out perpendicular to the center line of the runway until the retract cam is disarmed. When the observed reading is 5,500 pounds, cam pre-tensioning is properly adjusted.

Special Tools

In addition to the daily tools used in pre-operation and post-operation, *Figure 9-10* shows special tools used also for maintenance and overhaul of the arresting gear.

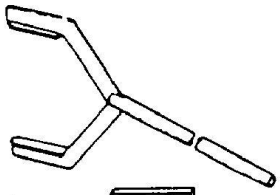
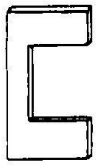
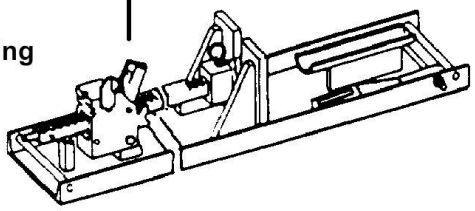
Item No.	Nomenclature	Part No.	Use	Illustration
1	Spanner Wrench	514010-1	Adjusting and Removing Absorber Shaft Packing Nut.	
2	Deck Height Gauge.	32063-1	Measuring Minimum and Maximum Deck Pendant Height.	
3	Donut Wire Support Installation Tool	616479-1	Installing Donut Wire Supports On Deck Pendant. Note: Lubricate Moving Parts As Required, Using Lubricating Oil, Specification MIL-L-2104, SAE 10.	

Figure 9-10 — Special tools.

Safety Precautions

The purpose of this section is to familiarize you with the safety precautions that you should use when operating, maintaining, or overhauling the E-28 shore-based emergency arresting gear.

The arrestment and recovery of aircraft involve many constantly existing hazards. Careful installation, maintenance, and inspection of the arresting gear and coordination of personnel and equipment are of prime importance. You, as a key person engaged in the operation of the arresting gear, must be thoroughly trained and conversant with its operation and characteristics. Safety is the result of trained personnel knowing and performing their duties to the best of their ability. Any disregard for safety creates hazards and potential dangers. Complete attention to every detail and awareness of each malfunction greatly reduces the possibility of accidents due to improper operations.

The safety precautions listed in this section must be observed by all operating and maintenance personnel and any other persons located in the arresting gear area.

1. Make sure the unit is in an operational readiness condition.
2. Keep fire equipment in an accessible location.
3. Make sure all preoperational inspections have been completed.
4. Do not anticipate commands.

5. Keep all unnecessary personnel clear of the area.
6. Make sure the torque converter clutch is disengaged before starting the retrieve engine.
7. Do not attempt any equipment adjustments or repairs during operations.
8. Make sure all personnel that could be endangered by backlash stand clear of the area should the tape or pendant fail during an arrestment.
9. Stand clear of the tapes and the pendant during retraction.
10. Make sure retraction is done slowly and steady.
11. Correct any unusual operating conditions such as loose components, fluid leaks, and unusual noise.
12. Do not attempt to remove pendants while tapes are pretensioned.
13. Secure the retrieve engine before inspecting the cooling system.
14. Shut down the retrieve engine before lubricating the drive system components.
15. Always reinstall the chain guard after chain lubrication and/or adjustment.
16. Always keep in mind to reverse tape only once.
17. Make sure all personnel stand clear when the energy absorber is lifted during overhaul until it is returned to ground level.

Troubleshooting

For possible common equipment malfunctions, their probable cause, and remedial action, refer to *Table 9-4.*

Table 9-4 — Troubleshooting chart

Part	Malfunction	Probable cause	Corrective measure
Pendant	Loss of tension	Loose tape wrap	Tighten tape pressure roller
		Premature cam release	Adjust or replace springs
		Duo-cam clutch slipping	Flush clean or replace clutch, as necessary
Tape	Excessive edge wear	Misalignment of sheaves or guides are gouged	Realign sheaves; polish guides smooth or replace guides as necessary
		Tape retracted with edges contacting runway	Retract tape with tape edges parallel to ground
Runway Edge and Deflector Sheaves	Leaking grease	Faulty grease seals	Replace seals
	Do not move freely	Lack of lubrication	Repack bearings
		Worn, damaged, or dirty bearings	Replace bearings if worn or damaged; clean foreign matter and repack bearings
	Unusually noisy	Lack of lubrication	Repack bearings
Sprocket Assembly	Unusually noisy	Lack of lubrication	Repack bearing; lubricate chain
	Cam binds or drags	Lack of lubrication	Lubricate linkages

Table 9-4 — Troubleshooting chart (cont.)

Tape Reel	Does not rotate freely	Worn, damaged, or dirty bearings	Replace bearings if worn or damaged; clean foreign matter
Absorber	Leaking fluid	Loose packing nut	Tighten nut
		Faulty packing	Replace packing
Reduction Gear	Grating noise or binding	Lack of lubrication	Fill to midpoint of sight glass
	Squealing noise		
Universal Joint	Excessive looseness	Worn pins	Replace joint
	Unusual noise	Lack of lubrication	Lubricate as directed
Torque Converter	Loss of power	Loose drive flange	Locate on shaft and secure setscrew
	Loose handle action	Out of adjustment	Remove cover; turn adjusting ring clockwise as required to get firm engagement pressure
Belts	Squealing	Loose or worn	Tighten; replace
Battery	Poor starter turnover	Loose or dirty connection	Clean and secure terminal connectors
		Low electrolyte	Fill to marker
Engine	Decrease in RPM during preoperational inspection	Worn throttle	Replace

End of Chapter 9

E-28 Shore-Based Emergency Arresting Gear and Related Equipment

Review Questions

9-1. What type of starting system does the retrieve system assembly on the E-28 arresting gear use?

A. Automatic
B. Electric
C. Gasoline
D. Hydraulic

9-2. What is the total number of cylinders in the engine of the retrieve assembly of the E-28 arresting gear?

A. Two
B. Three
C. Four
D. Six

9-3. During an aircraft arrestment with the E-28 arresting gear, what reaction actually applies a braking force on the aircraft, bringing it to a stop?

A. Cam release process
B. Engine power
C. Fluid resistance
D. Torque conversion

9-4. What is the width of the E-28 purchase tape?

A. 5 inches
B. 6 inches
C. 7 inches
D. 8 inches

9-5. What is the thickness of the E-28 purchase tape?

A. 0.0344 of an inch
B. 0.0445 of an inch
C. 1 inch
D. 1.25 inches

9-6. Which of the following indicates that the cross deck pendant of the E-28 arresting gear is no longer under the required tension?

A. Cable clearance
B. Flag display
C. Strobe light
D. Slight cable movement

9-7. The tape pressure roller of the E-28 arresting gear is under tension by the _____.

A. Duo-cam
B. roller weight
C. springs.
D. tape weight.

9-8. What is the function of the retrieve engine assembly on the E-28 arresting gear?

A. Cycle fluid
B. Rewind and tension tape
C. Slow down the aircraft
D. Stop the aircraft

9-9. The purchase tape is made of what type of material?

A. Abaca
B. Polyurethane
C. Nylon
D. Woven polyester

9-10. How many feet are the donut wire supports positioned apart from each other?

A. 13
B. 14
C. 15
D. 16

9-11. How would you identify the original and exact location of cross deck pendant wire support positions on the runway?

A. Cable position
B. Runway grooves
C. Paint marks
D. Tick marks

9-12. Wire supports must be replaced when they show excessive wear and have radical cracks of- _____ or longer.

A. 1 inch
B. 1½ inches
C. 2 inches
D. 2½ inches

9-13. What is the minimum cable clearance of the cross deck pendant?

A. 1 inch
B. 2 inches
C. 3 inches
D. 4 inches

9-14. The cross deck pendant is made of what type of wire?

A. Non-preformed
B. Non-rotating
C. Rotating
D. Wrought iron

9-15. How often is a functional check performed on the E-28 arresting gear?

A. Every day
B. Every 20 days
C. Every 30 days
D. Every 60 days

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