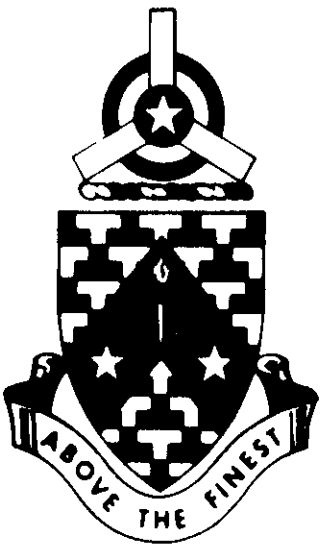
PROGRAMED TEXT

SAFETYING PROCEDURES

AM-7



DECEMBER 1968

UNITED STATES ARMY
PRIMARY HELICOPTER SCHOOL
FORT WOLTERS, TEXAS

PROGRAMED TEXT

PROGRAM TEXT

FILE NO:	**PROGRAM TITLE**
AM-7	Safetying Procedures

POI SCOPE: To acquaint the student with the correct safetying methods and procedures.

INSTRUCTOR REFERENCES:

USATSCH Booklet 010-001 Fort Eustis, Aug 65
USATSCH Adv Sheet 01-679 Fort Eustis, Apr 63

PREPARED BY:	**DATE:**
MAJ Charles F. Koegel TFPL	December 1967

REVISED BY:	**DATE:**
CW2 R. C. McQueen Airmanship Division	December 1968

APPROVED BY:	**DATE:**
DONALD J. LEWIS LTC, SC Chief, OCD	January 1969

TABLE OF CONTENTS

PROGRAMED TEXT
FILE NO: AM-7

PROGRAM TITLE:
Safetying Procedures

PREFACE

Improper or missing safety devices on aircraft control systems and components is an extremely hazardous condition. This condition, if undetected, may lead to aviation accidents, injury to personnel, and loss of vitally needed aircraft. It is essential that you be able to determine types of safety devices used on aircraft and aircraft components, and whether or not they are installed properly.

This programed text has been designed to teach you the different types of safety devices used on aircraft and aircraft components, and the proper installation of those devices.

Complete this text at your own rate. Read and follow the information given on each page.

PERFORMANCE OBJECTIVES

Shown examples of safetying devices, the student will be able to determine if the safetying procedures used are acceptable or not acceptable, and whether or not they comply with the rules of safetying.

FRAME #1

Safety devices are used on helicopter controls and components to prevent the control or component from becoming loose and inoperable during flight. Some of the different types of devices used are safety wire, cotter pins, metal self locking nuts, fiber self locking nuts, plain metal nuts, lockwashers, and lock plates.

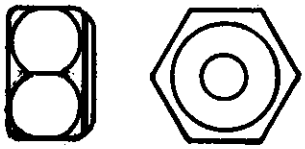
Which of the following items is a safetying device?

a. Bubble Canopy
b. Seat Belt
c. Cotter Pin
d. Tail Rotor Control Cable

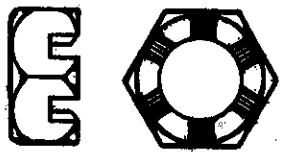
ANSWER: b. No. (Because the loop end does not fit snugly into the castellation.)

FRAME #7

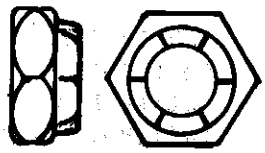
Locknuts and checknuts are frequently used as safetying devices. Locknuts are self-locking nuts of which there are two types; all metal, and metallic with fibre centers. Checknuts are merely plain metal nuts used with another plain nut to provide additional security.



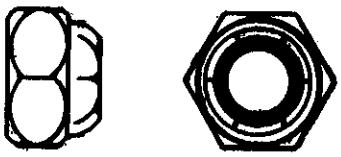
PLAIN METAL NUT



CASTELLATED NUT



ALL METAL LOCKNUT



NUT, SELFLOCKING - FIBRE CENTER

Which of the above nuts is normally used with a cotter pin?

a. All metal locknut
b. Plain metal nut
c. Castellated nut

ANSWER: c. Cotter Pin

FRAME #2

Safety wire is the most positive method of safetying parts or components. Safety wire also serves as an inspection device, since a broken safety wire indicates an unsafe condition on a part or component. Safety wiring is the tying together of two or more parts in such a manner that any tendency of one part to loosen will automatically be counteracted by the tightening of the wire. The most commonly used safety wire is soft annealed steel wire and is treated to resist corrosion.

Which of the following statements is correct?

a. Safety wire is expensive.
b. Safety wire rusts quickly.
(c) Safety wire, when installed properly, is the best method of safetying.
d. Safety wire is hard to work with.

ANSWER: c. Castellated nut

FRAME #8

Self locking nuts with fibre centers should be used only one time because the initial threading action destroys any subsequent locking action. These type locknuts should never be used near extreme heat because heat destroys the fibre center and locking action is lost.

Pick the following aircraft components on which you could not use a locknut with a fibre center.

a. Tail rotor blade assembly.
b. Main rotor assembly.
(c) Engine exhaust stacks.

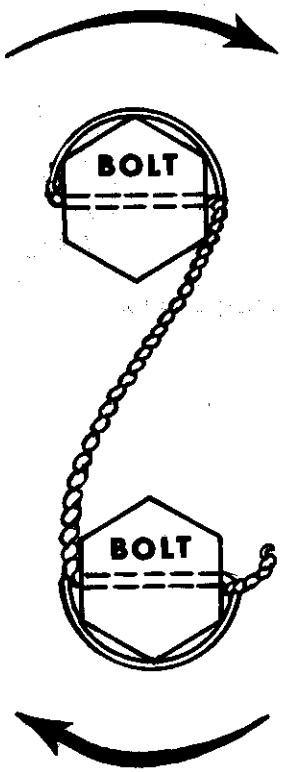
ANSWER: c. Safety wire, when installed properly, is the best method of safetying.

FRAME #3

Safety wire, when installed, must always tend to tighten. The wire must be installed so that it will always counteract any tendency of the part to loosen, thus keeping the part "locked" in place.

In the example given below, has the safety wire been installed properly?

(Right hand thread to tighten)

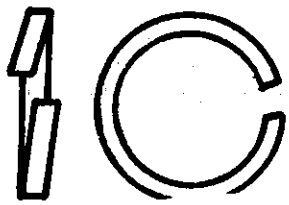


a. Yes
b. No

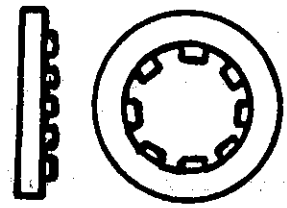
ANSWER: c. Engine exhaust stacks

FRAME #9

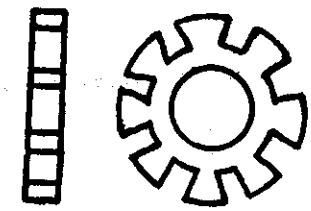
Lockwashers and lockplates are also used as aircraft safeties. Lockwashers are basically plain metal washers with additional features. One type lockwasher is the split washer. The second type has teeth cut into it either on the inside or the outside. A lockwasher with internal teeth is called an internal star. One with external teeth is called an external star. A lock plate is a washer with external tangs. It is used under a nut, and then the tangs are bent upwards around the nut to safety it in place.



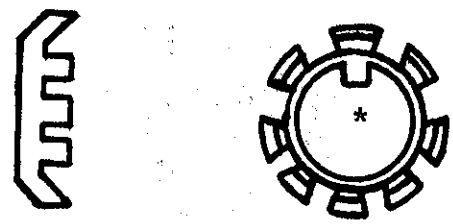
SPLIT WASHER



INTERNAL STAR



EXTERNAL STAR



LOCK PLATE

*Key for slotted bolt or shaft.

ANSWER: a. Yes

FRAME #4

Safety wire must never be overstressed. Extreme care must be exercised when installing to ensure that the wire is tightened securely but not stressed to the point that it will break under a slight load. The wire must not be allowed to rub or chafe against an adjacent part. Safety wire should fill 75% of the hole it is installed through.

Safety wire must be installed tightly to

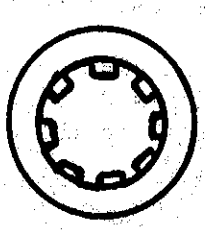
a. allow it to break under a slight load.
b. prevent vibration and failure.
c. get maximum stress on the wire.

FRAME #10

Lockwashers and lockrings only perform the safetying function so long as they are serviceable. If they become broken, they should be replaced. Lockplates, since they are bent to produce safetying effect, should only be used once.

What type of locking device is pictured below?

a. Internal Star
b. Split washer
c. External Star



ANSWER: b. Prevent vibration and failure.

FRAME #5

Safety wire ends must be secured in such a manner that they do not present a hazard to personnel working around the aircraft. The ends should be wrapped neatly around the item being secured. Safety wire should be grasped at the ends with pliers rather than in the middle, since this weakens the wire.

During a pre-flight inspection of your aircraft, you notice a wire safety which has been scarred in the center. What action would you take?

a. Check to see if it is tight.
b. Go ahead and fly aircraft.
c. Fly aircraft 3 hours, then re-inspect it.
(d) Have wire replaced, because it is weakened.

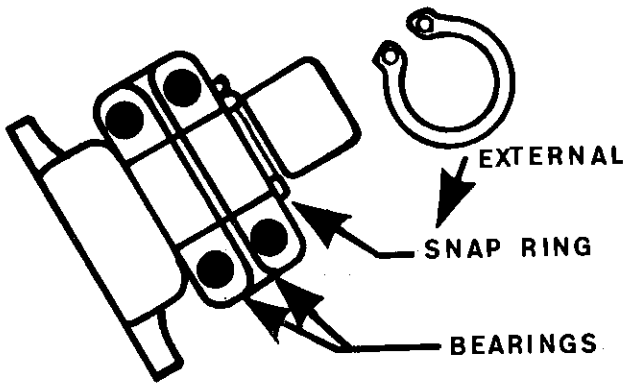
ANSWER: a. Internal Star

FRAME # 11

Snap rings, which are either expanded or contracted by the use of a special tool, are used to secure parts inside a component or on an external shaft. The snap ring should be installed so that it is firmly seated inside the groove.

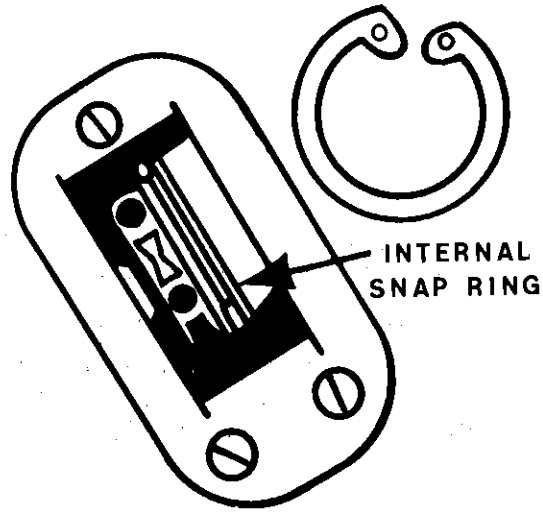
(FIGURE 1)

The two bearings are secured by the external snap ring which has heen placed into the maching groove on the shaft.

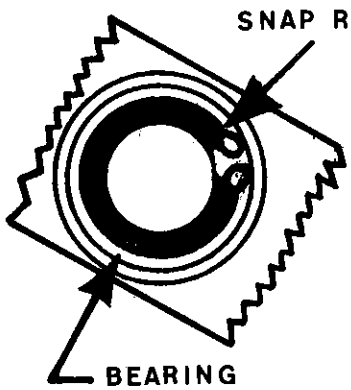


(FIGURE 2)

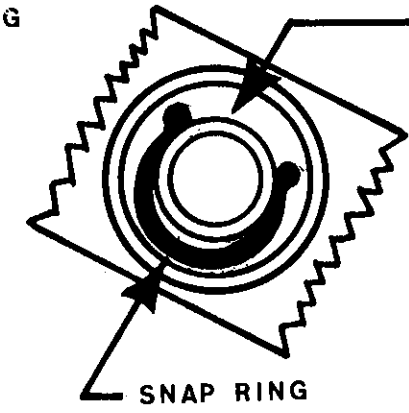
The bearing has been secured inside this casting by an internal snap ring. The snap ring was contracted, inserted inside the casting and allowed to expand into the machine groove.



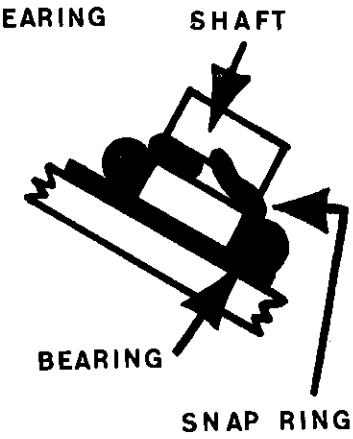
In which of the following installations is the snap ring safety acceptable?



A



B



C

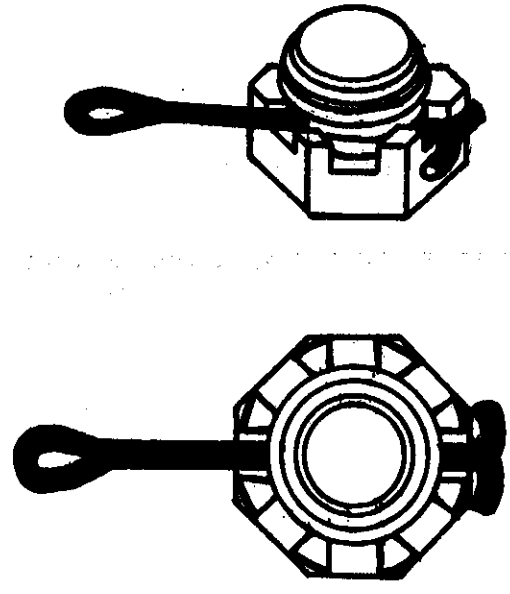
ANSWER: d. Have wire replaced, because it is weakened.

FRAME #6

Cotter pins are another safetying device used extensively on aircraft. They are usually associated with castellated nuts. Cotter pins should fill 75% of the hole in which they are installed. The loop end must fit snugly into the castellation of the nut. Cotter pins are never used to safety a castellated nut on a normal stud, because even though the nut is safetied, the stud could back out of the basic assembly. A normal stud is one which is threaded on both ends, and one end is screwed into a socket or other basic assembly.

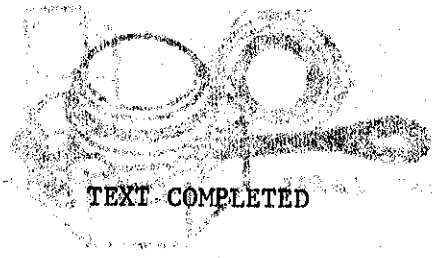
In the example given below, is the cotter pin installed correctly?

a. Yes
b. No



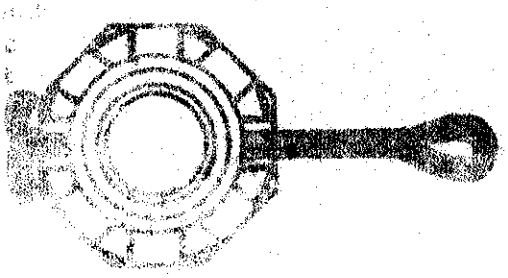
RETURN TO PAGE 2 FOR FRAME 7

ANSWER: A



TEXT COMPLETED

CONTINUE TO SELF EVALUATION EXERCISE

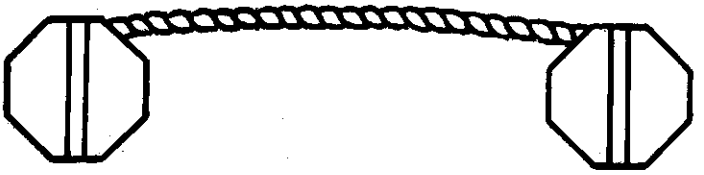


SELF EVALUATION EXERCISE

AIRCRAFT COMPONENT SAFETYING DEVICES

To indicate your answer, place an "X" next to your selected choice.

1. During a pre-flight inspection of your aircraft, you find that a bolt is loose which has been safetied with safety wire.



What does this indicate to you?

a. Mechanic used wrong type safety wire.
b. Safety wire has stretched.
c. Safety wire is installed wrong, and does not tend to tighten.
d. Vibration has weakened the wire.

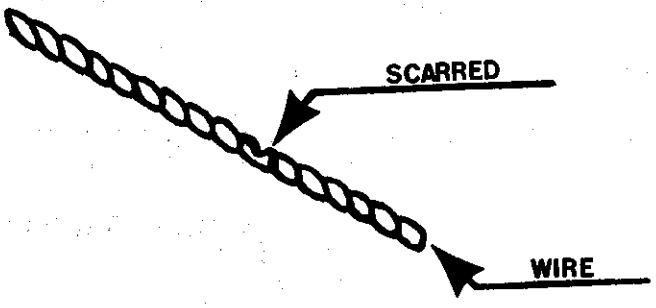
2. If safety wire is installed so that it is extremely tight between safetied points, it is

a. a good safety.
b. overstressed and will tend to break under a slight load.
c. capable of withstanding more stress.
d. an indication that the safetied parts have shifted.

3. The ends of installed safety wire should be secured by what method?

a. Wrap ends around item being safetied.
b. Bear ends flat with hammer.
c. Cut ends off so they do not stick out.
d. Tie ends together.

4. When any portion of a safety wire is scarred, it means

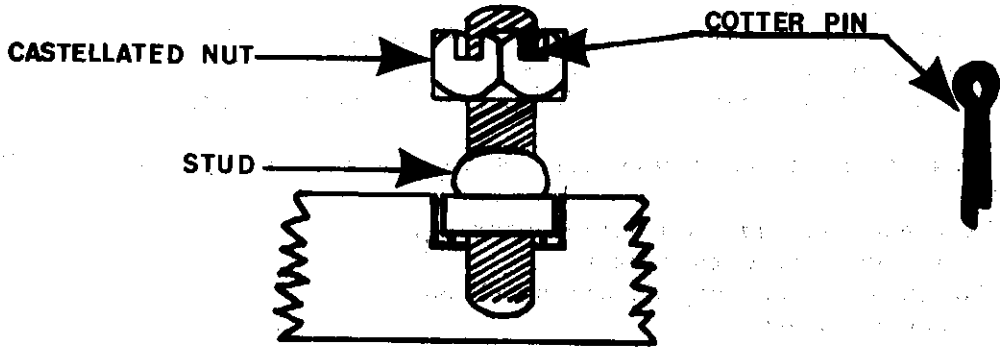


a. that the safety is tight enough.
b. that something has fallen against it.
c. that it has been pulled too hard.
(d) that it has been damaged at that point, and is weakened.

5. When cotter pins are used for safetying, they should fill

a. 30% of the hole.
(b) 75% of the hole.
c. 50% of the hole.
d. 100% of the hole.

6. Cotter pins are never installed with a normal stud because



a. cotter pins tend to break when used with a normal stud.
b. some normal studs are inaccessible.
(c) stud could back out of basic assembly along with cotter pin.
d. vibration level associated with normal studs is too high.

7. Why is a checknut sometimes used as a safety device?

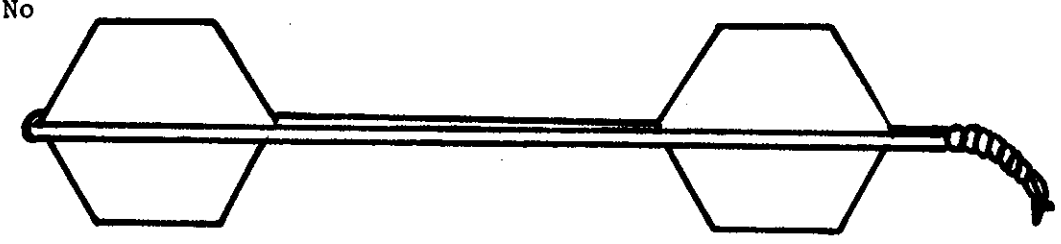
a. It is the only one available.
b. To provide additional security of a second nut.
c. To cover up unused threads on a stud.
d. To attain additional torque on a stud.

8. Metallic locknuts with fibre centers may be used how many times?

a. Never more than once.
b. Twice.
c. As many times as necessary.
d. Unrestricted use if mechanic thinks they are serviceable.

9. In the example below, is this safety wire installed properly?

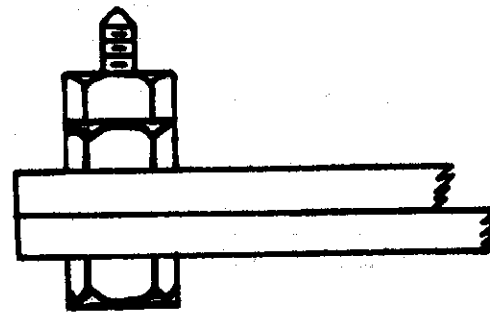
a. Yes
b. No



10. The following is which type of nut?

a. Pal nut
b. Castellated nut
c. Self Locking nut with fibre center
d. Plain nut

11. The safety method installed below is what?



a. Castellated nut
b. Pal nut
(c) Check nut

INTENTIONALLY LEFT BLANK

KEY TO SELF EVALUATION EXERCISE
FOR
AIRCRAFT COMPONENT SAFETYING DEVICES

1. c. Safety wire is installed wrong, and does not tend to tighten.

2. b. overstressed and will tend to break under a slight load.

3. a. Wrap ends around item being safetied.

4. d. that it has been damaged at that point, and is weakened.

5. b. 75% of the hole.

6. c. stud could back out of basic assembly along with cotter pin.

7. b. To provide additional security of a second nut.

8. a. Never more than once.

9. b. No

10. c. Self Locking nut with fibre center.

11. c. Check nut

L1902 Army--Ft. Sill, Okla.