

## SAFETY WIRE

SAFETYING IS THE PROCESS OF SECURING ALL AIRCRAFT BOLTS, NUTS, SCREWS, PINS, AND OTHER FASTENERS SO THEY DO NOT WORK LOOSE DUE TO VIBRATION



#### GENERAL RULES SAFETY WIRE

A PIGTAIL OF 1/4 TO 1/2 INCH (THREE TO SIX TWISTS) SHOULD BE MADE AT THE END.

2. NEW SAFETY WIRE MUST BE USED FOR EACH APPLICATION.

3. ALL SAFETY WIRES MUST BE TIGHT AFTER INSTALLATION.

4. THE WIRE MUST BE APPLIED SO THAT ALL PULL EXERTED BY THE WIRE TENDS TO TIGHTEN THE NUT.

5. TWISTS SHOULD BE TIGHT AND EVEN, AND WIRE BETWEEN THE NUTS AS POSSIBLE WITHOUT OVERTWISTING.

6. THE SAFETY WIRE SHOULD ALWAYS BE INSTALLED AND TWISTED SO THAT THE LOOP AROUND THE HEAD STAYS DOWN AND DOES NOT TEND TO COME UP OVER THE BOLTHEAD CAUSING A SLACK LOOP.



## ADDITIONAL RULES

SAFETY WIRE

•WHEN DRILLED-HEAD BOLTS, SCREWS, OR OTHER PARTS ARE GROUPED TOGETHER, THEY ARE MORE CONVENIENTLY SAFETY WIRED TO EACH OTHER IN A SERIES RATHER THAN INDIVIDUALLY.

•WHEN SAFETY WIRING WIDELY SPACED BOLTS, A GROUP OF THREE SHOULD BE THE MAXIMUM NUMBER IN A SERIES.

•WHEN SAFETY WIRING CLOSELY SPACED BOLTS, THE NUMBER THAT CAN BE SAFETY WIRED BY A 24 INCH LENGTH OF WIRE IS THE MAXIMUM IN A SERIES.

•PARTS BEING SAFETY WIRED SHOULD BE TORQUED TO RECOMMENDED VALUES AND THE HOLES ALIGNED BEFORE ATTEMPTING THE SAFETYING OPERATION. NEVER OVER TORQUE OR LOOSEN A TORQUED NUT TO ALIGN SAFETY WIRE HOLES.



#### HOW TOO

Install the hardware (or bolt (s), etc.) to be wired, and torque them as required. Look and see how much distance there is from the anchor point to the tie-point on the work itself.

First, look at what you need to safety wire, and guesstimate the length of wire required. Think about that a double-stranded run requires a piece of wire equal to twice the work length, plus about 15 or 20 percent for the twisting (the wire "shrinks" as it's twisted), plus an adequate margin for a pigtail and gripping with the pliers.

Second, loop the untwisted wire through the anchor point (for example, the base pad, if you're doing an oil filler plug) and bring half of the wire through the anchor. Try to minimize bending or flexing of the wire. Any over working hardens (embrittles) the wire.

Pull the wire with your fingers until your fingertips are opposite the intended tie point; keep going another Tad or so (for take-up), then, at the "hole" point, grab both strands of wire with your twisting pliers. Lock the pliers by squeezing them and sliding the locking collar into place.

The idea now is to twist the length of wire -- exercising the pull-to-twist feature of the pliers -- to give the desired six to eight turns per inch, with all turns ending just short of the intended (distal) tie point on the work. That is to say, when you've finished twisting the wire run, you should end up with a wire '**Y**' whose nexus barely reaches the tie point. If you go too far, you'll have to start over, so watch it.

To finish, you want to be able to thread one leg of the 'Y' through the work, continue the other leg around the bolt-head (if that's what you've got), mate up the two arms again, and twist them tightly together. (Relocate your pliers as necessary to accomplish this.)

It's important to continue twisting well past the final anchor or loop point in this fashion, so that the bolt head is firmly gripped by the wire. Generally, a pigtail of half an inch is sufficient. (Be careful cutting off the excess: Wire pieces are extremely hazardous to unprotected skin and eyes.) Wear safety glasses!!!!!

Using your pliers as encouragement, carefully bend the pigtail around the hex (or back and out of the way if no hex is present). Avoid grazing your arm against the sharp pigtail.

Now stop and examine your work. Is there any slack? Did you remember to make the run go in a direction that tends to tighten the bolt? cut and discard the wire if there's any doubt about the quality.

Do not feel bad if you end up having to redo the job more than once to get it just right; the important thing isn't to get it perfect on the first try, after all.

The important thing is that you do get it right regardless how many tries it takes. There should be six to eight turns of wire per inch.



- Examples 1, 2, and 5 illustrate the proper method of safety wiring bolts, screws, square-head plugs, and similar parts when wired in pairs.
- Example 3 illustrates several components wired in series.
- Example 4 illustrates the proper method of wiring castellated nuts and studs. (Note that there is no loop around the nut.)
- Examples 6 and 7 illustrate a single-threaded component wired to a housing or lug.
- Example 8 illustrates several components in a closely spaced closed geometrical pattern, using a single-wire method.



### **Stainless Steel Aerospace Lock wire**

Standard materials: Stainless steel type 302/304 ASTM A 580, 305 and 316 stainless. Part Number with Nominal Diameter •NASM / MS20995C15 ASTMA580.020 •NASM / MS20995C20 ASTMA580.021 •NASM / MS20995C25 ASTMA580.025 •NASM / MS20995C32 ASTMA580.032 •NASM / MS20995C41 ASTMA580.041 •NASM / MS20995C47 ASTMA580.047

•NASM / MS20995C51 ASTMA580.051

#### **Inconel Aerospace Lockwire**

Nominal Diameter

Part Number with •NASM / MS20995N20 ASTM B166.020 •NASM / MS20995N25 ASTM B166.025 •NASM / MS20995N32 ASTM B166.032 •NASM / MS20995N40 ASTM B166.040 •NASM / MS20995N51 ASTM B166.051 **Copper Nominal Diameter** •ASTM B3 .0126 •ASTM B3 .016 •ASTM B3 .0201 •ASTM B3 .022



## **COTTER PINS**

•CASTELLATED NUTS ARE USED WITH BOLTS THAT HAVE BEEN DRILLED FOR COTTER PINS.

•COTTER PINS CASTELLATED NUTS ARE USED WITH BOLTS THAT HAVE BEEN DRILLED FOR COTTER PINS.

•THE COTTER PIN SHOULD FIT NEATLY INTO THE HOLE, WITH VERY LITTLE SIDEPLAY.



## GENERAL RULES COTTER PINS

1. THE PRONG BENT OVER THE BOLT END SHOULD NOT EXTEND BEYOND THE BOLT DIAMETER. (CUT OFF AS NECESSARY.)

2. THE PRONG BENT DOWN SHOULD NOT REST AGAINST THE SURFACE OF THE WASHER. (CUT OFF AS NECESSARY).

3. ALL PRONGS SHOULD BE BENT OVER A REASONABLE RADIUS. SHARP-ANGLED BENDS INVITE BREAKAGE. TAPPING LIGHTLY WITH A MALLET IS THE BEST METHOD OF BENDING THE PRONGS.

# TORQUE AND TORQUE WRENCHES

USING THE PROPER TORQUE ALLOWS THE STRUCTURE TO DEVELOP ITS DESIGNED STRENGTH AND GREATLY REDUCES THE POSSIBILITY OF FAILURE DUE TO FATIGUE

## TORQUE AND TORQUE WRENCHES

•ALWAYS USE THE PROPER TORQUE - ALLOWS THE STRUCTURE TO DEVELOP ITS DESIGNED STRENGTH AND GREATLY REDUCES THE POSSIBILITY OF FAILURE DUE TO FATIGUE.

