

## Winter Educational Quiz Answers

This quiz, and the following answers are designed to help folks understand this sometimes complex and often debated topic. Please remember, the purpose of this quiz is to help educate the community about **general guidelines** (not rules!) for assessing bolt quality. In the field, there are always exceptions to these guidelines and hopefully this quiz will help folks figure out some of the basics.

1) Which of the following hangers is/are generally unreliable?

- a) Leeper (See Fig. 1 at the end of this doc.) hangers
- b) Any hanger with easily noticeable rust (more than just a tinge; actual corrosion)
- c) SMC hangers thinner than a quarter, with yellow/rusty tinge (Fig. 2)
- d) Spinners (the hanger spins around the stud) that are still flush to the rock, but don't unscrew the nut when they spin
- e) a, b, and c

Answer: e

*Though spinners are often looked at as a suspect bolt, they are usually fine. When a hanger is screwed down to the rock face, sometimes it only takes a few crystals to break away under the hanger to allow it to spin. However, if the hanger is spinning in a way that it might unscrew the nut that holds it flush to the rock, that is a problem.*

2) Which of the following bolts (we're talking about the actual stud here) is/are generally unreliable?

- a) 1/4 inch bolts, especially 'star drives' (see Fig. 1 for a sexy star drive with a Leeper hanger)
- b) 3/8 inch bolts
- c) 1/2 inch bolts
- d) Glue in bolts
- e) a and d

Answer: a

*Most 1/4 inch bolts were put in decades ago and are now quite unreliable. As for glue in bolts, these are generally some of the strongest bolts out there, especially in softer rock. However, there are a few rare reports of folks not mixing the glue correctly or using cheap hardware store glue instead of what the manufacturer recommends. This has led to catastrophic failure.*

3) How much rust is too much rust? Rate the photos below in order from the most reliable too least reliable.

- a) 2,3,1
- b) 1,3,2
- c) 3,2,1
- d) 1,2,3
- e) If you have to weight a rusty bolt, just hold your breath and you'll be fine

Answer: c

*This one is tricky...most people used to seaside climbing wouldn't flinch at bolt #1 below. Petzl recently removed a number of bolts in Kalymnos Greece that had surface rust on them and they tested to nearly full strength. On the other hand, hangers have also been found at the base of seaside climbs after the bolt rusted away. Generally speaking, rust, on an otherwise good bolt, is only concerning at seaside cliffs. In those locations, it's best to stay clear of anything that has visual corrosion.*

Photos for Question #3 (these are NOT Figures 1-5)

1



2



3 (bottom bolt only)



4) Regarding steel anchors at lower-off points (i.e. rap rings, quick links, cold shuts, quick clips, mussey hooks, etc.), at what point is the hardware too worn through to be reliable for recreational climbing?

- a) 1/4 of the way through
- b) 1/3 of the way through
- c) 1/2 of the way through (see Fig. 3 below for an example of welded cold shuts worn half way through)
- d) 3/4 of the way through
- e) Just don't bounce on it too much and you'll be fine

*Answer a or b are correct*

*This one is debatable. And in fact, some lower offs, particularly open shuts (see fig 3 below and picture the shut without the weld keeping it shut), have tested stronger when they have a good-sized groove worn in them. This is due to the fact that the rope stays in the groove and loads the 'spine' of the shut. Without the grooves, the rope migrates out toward the opening and levers the shut wide open until the rope falls out. However, when any equipment is worn, it often creates sharp edges and can damage the rope. Any lower off that is 1/2 worn through will likely have some sharp edges.*

*Many other varieties of fixed hardware are rated very low (<5-7kn) when they are worn half through, i.e. rap rings, especially if they have been top roped on (they are called rap rings for a reason!).*

5) Which of the following statements is true:

- a) Most button heads (with the exception of 5/16 inch button heads) are unreliable, especially in softer stone, i.e. sandstone (Fig. 4 below)
- b) SCC (stress corrosion cracking) is a failure mechanism that commonly occurs on even the highest quality bolts (with the exception of titanium and glue-in bolts), at seaside cliffs, even if the bolt is never weighted
- c) ½ inch 'drilled angles' are generally reliable for downward but not outward loading (if the eye-hole is downward as shown in Fig. 5)
- d) All of the above
- e) Your grandmother climbs harder cracks than you and is too t-RAD to clip bolts. She wouldn't even take this stupid quiz...see Fig. 6

*Answer: d*

*Button heads in sandstone will often work their way loose over time, especially the smaller diameter varieties. With the exception of 5/16" studs, they are generally unreliable.*

*SCC often happens on seaside cliffs due to the fact that an expansion bolt is always under stress. Salt can make its way into micro fracture in the metal and corrode it from the inside. This can result in catastrophic failure.*

*Drilled angles are often tested to 4-5,000lbs, even in soft stone, i.e. sandstone. However, with cyclical loading, they often loosen in their hole and can easily fail in a tensile load (outward pull). They are most reliable with a shear load (downward pull).*

Figure 1. Star drive with Leeper Hanger.



Figure 2. New, stainless steel SMC hanger on the left; old-style in the middle and right.



Figure 3. Welded cold shuts with grooves.



Figure 4. Button heads;  $\frac{1}{4}$  inch on the left and  $\frac{5}{16}$  on the right.



Figure 5.

