FAA Airframe Prepware Sheet Metal Structures Practice Test (Sample)

Study Guide

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Questions

1. What is a crucial factor in the performance of a repair when patching a hole in aircraft skin?

A. Cost of the patch

B. Type of patch material

C. Compatibility with surrounding materials

D. Size of the surrounding structure

2. What is a key factor that determines the minimum space between rivets?

A. Thickness of the sheets being joined

B. Length of the rivets

C. Diameter of the rivets

D. Material of the sheets

3. What is the correct method for allowing for stretching on a sheet metal fitting layout with a single bend?

A. Adding the setback to both legs

B. Subtracting the setback from one leg

C. Subtracting the setback from both legs

D. Leaving the setback unchanged

4. What is the recommended size of the shop head of a rivet in relation to its shank?

A. Equal to the diameter of the shank

B. One times the diameter of the shank

C. One and one-half times the diameter of the shank

D. Twice the diameter of the shank

5. What structural members reinforce the skin on a semimonocoque fuselage?

A. Ribs and frames

B. Longerons and stringers

C. Bulkheads and partitions

D. Spars and formers

6. When replacing a damaged honeycomb core with balsa wood, how should the plug be cut?

A. Diagonal to the skin

B. Perpendicular to the skin

C. Along the grain

D. With the grain

7. Why is the temper designation important in aluminum alloys?

A. It indicates color coding

B. It specifies the alloy's hardness and strength

C. It determines the alloy's resistance to corrosion

D. It affects the melting point

8. What must be done to heat-treated rivets in the D and DD series if they are not used within the prescribed time frame?

A. They must be discarded

B. They must be polished

C. They must be reheat treated before use

D. They must be painted

9. When bending a piece of flat stock to a closed angle of 15°, what is the bending angle needed?

A. 15°

B. 90°

C. 165°

D. 180°

10. Which fastening method is advantageous in applications where high loads are present?

A. Riveting

B. Threaded fastening

C. Hi-Lok fastening

D. Standard nut and bolt

Answers

1. C
2. C
3. C
4. C
5. B
6. B
7. B
8. C
9. C
10. C

Explanations

1. What is a crucial factor in the performance of a repair when patching a hole in aircraft skin?

A. Cost of the patch

B. Type of patch material

C. Compatibility with surrounding materials

D. Size of the surrounding structure

In the context of repairing a hole in aircraft skin, compatibility with surrounding materials is a critical factor. This consideration ensures that the repair patch adheres properly and maintains the integrity of the aircraft structure. When selecting a patch, it is essential to use materials that can endure similar stress, strain, and environmental conditions as the original aircraft skin. This compatibility helps prevent issues such as corrosion, differential expansion or contraction, and structural weakness, which could compromise the safety and performance of the aircraft. While factors such as the type of patch material, cost, and size of the surrounding structure are important to consider, they are secondary to ensuring that the materials used in the repair are compatible with the existing skin of the aircraft. Proper compatibility ensures that the patch will bond effectively and help restore the aircraft's structural integrity, making it a key aspect of a successful repair.

2. What is a key factor that determines the minimum space between rivets?

A. Thickness of the sheets being joined

B. Length of the rivets

C. Diameter of the rivets

D. Material of the sheets

A key factor that determines the minimum space between rivets is the diameter of the rivets. The spacing must account for the rivet's diameter to ensure adequate shear strength and to avoid issues such as material weakening or splitting. When rivets are placed too close together, the load on the surrounding metal is increased, which can lead to structural failure. Adequate spacing allows for the optimal distribution of stress over the material being joined, ensuring that the joint remains strong and durable. Each rivet requires a certain amount of material around it to maintain integrity and support the load, which is primarily influenced by its diameter.

3. What is the correct method for allowing for stretching on a sheet metal fitting layout with a single bend?

A. Adding the setback to both legs

B. Subtracting the setback from one leg

C. Subtracting the setback from both legs

D. Leaving the setback unchanged

When preparing a sheet metal fitting layout that involves a single bend, the approach to account for stretching is critical in ensuring that the final dimensions are accurate. The correct method involves subtracting the setback from both legs of the fitting. In sheet metal work, the setback is the distance from the bend line to the edge of the material, which accounts for material deformation due to bending. When a bend is made, the material on the inside of the bend compresses while the material on the outside stretches. To achieve the desired final dimensions, it is necessary to adjust both legs of the fitting layout to reflect this deformation. By subtracting the setback from both legs, you ensure that the total length of the part remains correct after the bend is formed. This adjustment takes into account how the metal will react during the bending process, which is vital for producing components that fit together properly in assembly. Hence, accurately subtracting the setback from both legs allows for the proper compensation for stretching and creates a fitting that will match the intended design dimensions when completed.

4. What is the recommended size of the shop head of a rivet in relation to its shank?

A. Equal to the diameter of the shank

B. One times the diameter of the shank

C. One and one-half times the diameter of the shank

D. Twice the diameter of the shank

The recommended size of the shop head of a rivet is one and one-half times the diameter of the shank. This standard ensures that when the rivet is properly set, the shop head provides adequate surface area for a secure connection without compromising the integrity of the materials being joined. A larger shop head increases the bearing surface against the materials, which helps distribute the load over a wider area. It also prevents the rivet from pulling through the material under load, ensuring a strong, durable connection. This proportion has been established through industry standards and practices to promote the effectiveness and safety of riveted joints in various applications, particularly in aviation where structural integrity is critical. Choosing a shop head size smaller or equal to the diameter of the shank may not provide sufficient surface area or strength, leading to potential joint failure. Thus, specifying a shop head that is one and one-half times the diameter of the shank is a crucial rule of thumb in rivet design and application.

5. What structural members reinforce the skin on a semimonocoque fuselage?

A. Ribs and frames

B. Longerons and stringers

C. Bulkheads and partitions

D. Spars and formers

In a semimonocoque fuselage design, longerons and stringers serve as critical structural members that reinforce the skin of the aircraft. Longerons run the length of the fuselage, providing longitudinal strength and rigidity. This helps the aircraft withstand various loads, such as pressure changes during flight and structural stress from maneuvers. Stringers, on the other hand, are horizontal reinforcements that run between the longerons and the skin, helping distribute the loads evenly across the fuselage and preventing buckling. Together, longerons and stringers form a framework that complements the skin, allowing for a lightweight yet strong structure that is characteristic of modern aircraft design. While ribs and frames, bulkheads and partitions, and spars and formers play important roles in other aspects of aircraft structure, it is the combination of longerons and stringers that specifically reinforces the skin in a semimonocoque fuselage. Ribs and frames are generally more associated with wing structures, bulkheads serve to separate sections of the fuselage, and spars are typically found in wings. Therefore, the correct answer highlights the specific components that provide structural support to the fuselage skin.

6. When replacing a damaged honeycomb core with balsa wood, how should the plug be cut?

A. Diagonal to the skin

B. Perpendicular to the skin

C. Along the grain

D. With the grain

When replacing a damaged honeycomb core with balsa wood, the plug should be cut perpendicular to the skin. This orientation is crucial because it ensures that the new core material bonds effectively with the skin of the aircraft structure. When the plug is cut perpendicular, it allows for a stronger and more reliable joint between the balsa wood and the skin. Cutting the plug in this manner helps maintain the structural integrity of the assembly by allowing for even distribution of stress across the bonded surfaces. It is essential to create a surface that has maximum surface area contact with the skin, promoting better adhesion and reducing the chances of any delamination or separation under load. Additionally, cutting the plug perpendicular helps to maintain the geometric integrity of the structure, as this alignment matches the load paths. In contrast, other cutting methods could compromise the plug's strength and the overall structural performance of the repair.

7. Why is the temper designation important in aluminum alloys?

A. It indicates color coding

B. It specifies the alloy's hardness and strength

C. It determines the alloy's resistance to corrosion

D. It affects the melting point

The temper designation is crucial in aluminum alloys because it specifies the alloy's hardness and strength. Aluminum alloys can undergo various heat treatment processes that alter their mechanical properties, such as yield strength and tensile strength. The temper code designates these processes, which can include solutions treatment, aging, or annealing, allowing manufacturers and engineers to select the appropriate alloy for specific applications that require certain strength levels. Each temper designation provides valuable information regarding how the alloy was processed and, consequently, its mechanical properties. This allows for better predictions about how the material will perform under stress or load, making it essential for applications where strength and reliability are critical, such as in aerospace and automotive fields. Other options may relate to aluminum's properties but do not provide the direct relevance of the temper designation in relation to hardness and strength, which is the primary concern when selecting materials for structural integrity and performance in these applications.

8. What must be done to heat-treated rivets in the D and DD series if they are not used within the prescribed time frame?

A. They must be discarded

B. They must be polished

C. They must be reheat treated before use

D. They must be painted

Heat-treated rivets, specifically in the D and DD series, have a predetermined shelf life once they are manufactured. This shelf life is designed to ensure that the rivets maintain their desired mechanical properties and structural integrity. Over time, if these rivets are not utilized, they can lose their strength due to changes in the material structure that might occur during storage. If the rivets have exceeded their prescribed usage time, reheat treating them before use is necessary to restore their mechanical properties and ensure they perform as expected in structural applications. Reheat treating involves subjecting the rivets to specific temperature controls that re-align the material grain structure, thus reinstating the hardness and strength characteristics that are critical for their performance in an application. Discarding the rivets would not be the best choice as it does not allow for possible reuse after proper re-treatment. Polishing and painting do not address the underlying material properties that may have deteriorated, so they would also not be viable solutions to ensure the rivets meet performance standards. Hence, reheat treating is the proper approach to ensure these rivets are safe and effective for use in sheet metal structures.

9. When bending a piece of flat stock to a closed angle of 15°, what is the bending angle needed?

A. 15°

B. 90°

C. 165°

D. 180°

When bending a piece of flat stock to achieve a closed angle of 15°, it's important to consider how angles are measured in metalworking, particularly when it comes to bends. The bending angle is the amount the metal is bent away from the flat position, which is usually measured in relation to a reference position. In this case, to create a closed angle of 15°, you need to account for the total degrees around a point. A total of 180° represents a straight line. Since you want to end up with a 15° angle between the two arms of the metal after bending, you must adjust for the angle being formed. Specifically, to create a closed angle, you are bending the metal such that the two arms of your bend must total 180° – with one arm at 15° and creating the rest with the bend itself. Thus, to achieve the desired 15° angle, you need to bend the flat stock to 165°. This is because the original straight position is at 180°, and bending down to reach the 15° closed angle requires 180° - 15° = 165°. Hence, the correct bending angle needed is indeed 165°.

10. Which fastening method is advantageous in applications where high loads are present?

A. Riveting

B. Threaded fastening

C. Hi-Lok fastening

D. Standard nut and bolt

The Hi-Lok fastening method is particularly advantageous in applications where high loads are present due to its unique design that combines the benefits of both rivets and bolts. Hi-Lok fasteners feature a high-strength pin that is inserted into a pre-drilled hole and locked in place with a collar, providing a secure grip even under extreme stress. This locking mechanism helps distribute loads more evenly across the joint and minimizes the risk of loosening under vibration or thermal cycling, making it ideal for high-load and critical structural applications. In addition, Hi-Loks are easier to install in tight spaces, and they don't require the same level of access for tightening as traditional nuts and bolts. This aspect allows for quicker assembly in complex structures, which is highly beneficial in aerospace and other engineering industries where weight saving and performance integrity under high stress are essential. Riveting also offers high strength, but once installed, rivets cannot be easily removed or adjusted, which may limit their utility in certain applications. Threaded fasteners and standard nut and bolts can also hold significant loads, yet they are more prone to loosening. Thus, for high-load applications, the combination of strength, reliability, and ease of installation makes Hi-Lok fasteners the preferred choice.