Nut and Bolt Drawing: Threaded Fastener Construction

Original tasks 1, 2, 3 / complete keys

Task 1

A bolt head has an across-flats width of 30 mm. Using the hypothetical proportion that head thickness is 0.7 times across-flats, calculate the head thickness. Then state how many thread spaces result from a 45 mm threaded length with a 3 mm pitch.

Answer: Head thickness = 30 mm × 0.7 = 21 mm. Thread spaces = 45 mm ÷ 3 mm = 15 spaces.

Reason: Multiply across-flats by the thickness proportion to get head thickness. Divide threaded length by pitch to get the number of spaces.

Check: Divide 21 mm by 30 mm to recover 0.7. Multiply 15 spaces by 3 mm to recover 45 mm.

Task 2

A nut has an across-flats width of 18 mm. Calculate the across-corners width using the hypothetical formula across-corners = across-flats divided by cosine of 30 degrees (0.866). If the nut thickness is 12 mm and the shaft diameter is 10 mm, state the side-view rectangle dimensions for the nut.

Answer: Across-corners width = 18 mm ÷ 0.866 ≈ 20.8 mm. Side-view nut rectangle is 18 mm wide (across-flats) and 12 mm thick, with a 10 mm central hole.

Reason: The across-corners width uses the cosine relationship for a regular hexagon. The side-view rectangle width equals across-flats, height equals thickness, and the hole equals shaft diameter.

Check: Multiply 20.8 mm by 0.866 to recover about 18 mm. Check that the hole diameter equals the shaft diameter of 10 mm.

Task 3

A bolt has a shaft diameter of 12 mm and a threaded length of 24 mm. Choose a hypothetical pitch of 3 mm. Calculate the number of thread spaces and the length of each space. Then describe how the threaded end appears in end view.

Answer: Thread spaces = 24 mm ÷ 3 mm = 8 spaces. Each space is 3 mm long. In end view, the threaded end is a circle of 12 mm diameter with a smaller inner circle representing the thread root.

Reason: Divide threaded length by pitch for spaces; each space equals the pitch. End view shows the shaft circle and a smaller root circle.

Check: Multiply 8 spaces by 3 mm to recover 24 mm. Confirm the outer circle diameter equals the shaft diameter of 12 mm.

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Original tasks 4 / complete keys

Task 4

A matched nut and bolt have an across-flats width of 20 mm and a shaft diameter of 14 mm. The nut thickness is 14 mm and the bolt head thickness is 14 mm. State the side-view dimensions of the nut and head, and explain one check to confirm they mate correctly.

Answer: Both side-view rectangles are 20 mm wide and 14 mm thick. The nut has a 14 mm central hole matching the shaft diameter. Check that the nut hole diameter equals the shaft diameter and that both across-flats widths are 20 mm.

Reason: Matched parts share across-flats width and shaft diameter. Side-view width equals across-flats and height equals thickness.

Check: Measure the nut hole and shaft diameter to confirm both are 14 mm; measure both across-flats widths to confirm 20 mm.

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Source rubric / reflection

- [ ] Hex head and nut are regular hexagons with equal sides and angles in end view.
- [ ] Side-view head and nut widths match the across-flats dimension and thickness proportions are consistent.
- [ ] Shaft diameter and length are consistent between side and end views.
- [ ] Thread pitch spacing is even and the number of thread spaces matches the chosen pitch and threaded length.
- [ ] Nut and bolt mating surfaces share the same across-flats width and shaft diameter.
- [ ] Shading follows a single light direction and does not obscure thread detail; alternative shading styles are accepted if consistent.
- [ ] Line weights follow the defined convention or a clearly stated alternative, with construction lines removed.
- [ ] All numerical values are labeled as hypothetical examples and units are consistent.

Reflection: What did you check, what did you change, and what will you try next?