26-10 Solution

Drilling Test

➲ Answers to questions - PART 1 - GENERAL:

1. Spot drill depth is calculated from these two dimensions - specified hole diameter (D) and selected chamfer size (C):

   $$\text{Spot drill depth} = (D + 2 \times C) / 2$$

2. The constant for 135° is 0.207, therefore the drill point length will be $0.5 \times 0.207 = 0.1035$

3. Depending on the hole size, 0.25 to 0.5 chamfer is reasonable - smaller holes have a smaller chamfer and vice versa.

4. The constant is 0.3

5. Tap drill is a regular drill used to pre-drill a hole for subsequent tapping operation.
   Its size is always selected with respect for the tap diameter.

6. Chamfer diameter is diameter at the top of a hole, defined by the hole diameter (D) and twice the chamfer (C):

   $$\text{Chamfer diameter} = D + 2 \times C$$

7. The formula to calculate the tool point length P for a 118° drill point angle and a given diameter D is:

   $$P = 0.3 \times D$$

8. ½-13 tap has the pitch of 0.0769 (1/13). About 1.5 to 2.5 times the pitch is required for a breakthrough,
   so any amount between 0.115 and 0.192 will be reasonable (0.1 to 0.2 would be more practical)

9. Most drills used in machine shops have a 118° point angle.

10. In spot drilling, the programmed Z-depth is always one half of the chamfer diameter.

➲ Answers to questions - PART 2 - DRAWING RELATED:

11. As the full diameter depth is often given in drawings, the programmed Z-depth has to be calculated by adding the drill point length. If the drill angle is not specified, standard drill is used, with its angle of 118°.
For the ∅8 mm hole, the depth will be:

$8 + 8 \times 0.3 = 10.4$ (Z-10.4 in the program)

12. Feedrate F (per time) for tapping is always the spindle speed S multiplied by the pitch P:

$F = S \times P = 560 \times 1 = F560.0$

13. The hole C has ∅16. For a standard drill, the drill point length will be $16 \times 0.3 = 4.8$.
As the part thickness is 15 mm, the programmed depth will be $15 + 2 + 4.8 =$ Z-21.8

14. The holes D-G start 6 mm below the part zero in Z. In order to have the physical clearance above the holes 2.5 mm, the R-level must be R-3.5.

15. The X-coordinate (absolute value) is X45.0

16. If the chamfer size is 0.35, and the hole diameter is 8, the chamfer diameter will be $8 + 2 \times 0.35 = 8.7$.
The spot drill depth is always one half of the chamfer diameter, so the programmed Z-depth will be Z-4.35.

17. In metric, the pitch is specified directly - M6 × 1 means the pitch is 1 mm.

18. For spot drilling the most common fixed cycle used is G82, often called a ***drilling cycle with dwell***.

19. The nominal size of the tapped holes is 6 mm. A reasonable chamfer will be 0.3, so the chamfer diameter will be $6 + 2 \times 0.3 = 6.6$.

20. Based on a chamfer diameter of 6.6, the depth of the spot drill will be Z-3.3.

21. The tap drill for M6 tap is usually ∅5 mm drill.

22. Minimum dwell (for 1 spindle revolution) is calculated as 60 / S, where S is the spindle r/min. For 3 revolutions and 685 r/min, the programmed dwell will be $3 \times 60 / 685 = 0.263$ second (263 milliseconds).

23. The metric formula to calculate r/min is $(1000 \times \text{m/min}) / (\pi \times \varnothing) = (1000 \times 27) / (3.14 \times 16) = 537$ r/min.

24. If the tap drill is ∅5 mm, its point length will be $5 \times 0.3 = 1.5$ mm.

25. Tapping program (in metric mode, selected at the beginning of the program) - block numbers are just an example:

```
N31 T07
N32 M06
N33 G90 G54 G00 X15.0 Y8.0 S560 M03
N34 G43 Z10.0 H07 M08
N35 G99 G84 R-3.5 Z-17.0 F560.0          (2 TO 4 PERCENT UNDERFEED IS ALSO OK)
N36 G91 X15.0 L3                         (OR K3 ON SOME CONTROLS)
N37 G90 G80 Z10.0 M09
N38 G28 Z10.0 M05
N39 M01                                  (OR M30 IF AT PROGRAM END)
```

Twice the pitch amount has been used for the tap breaktrough.