higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FOUNDRY THEORY N1

12 APRIL 2021

This marking guideline consists of 6 pages.

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QUESTION 1

Tuyeres give better penetration of air into the Cupola **[2]**

QUESTION 2

2.1 D
2.2 B
2.3 A
2.4 B
2.5 D
2.6 D
2.7 D
2.8 B
2.9 B
2.10 B

(10 × 1) **[10]**

QUESTION 3

3.1 Top box of the mould and bottom box of the mould.✓✓ (2)

3.2 A process in which hot liquid metal✓ is poured over a lip✓ into a mould that contains a hollow cut out of the desired finished shape.✓ (3)

3.3 A sand insert in a mould✓ to shape the interior of the casting.✓ (2)

3.4 The portion of the gate assembly✓ that connects the down gate✓ with the casting ingate or riser.✓ (3)

3.5 A mark or line produced on the cast✓ formed by the junction of parting✓ patterns. (2)

3.6 A loose piece is provided in a pattern✓ when it has a projection which would hinder the pattern from being cleanly✓ drawn from the mould. (2)

3.7 Loss on ignition is a generally accepted test✓ for estimating the quality of the foundry sand.✓ (2)

3.8 AFS is the determination of the average grain size✓ and distribution of moulding sand.✓ (2)
[18]

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QUESTION 4

Two-part mould.

FIGURE 1 shows the pattern for a flat-backed casting of a face plate and in the following description, the making of a mould with two patterns in the box is illustrated in FIGURES 2–11.

Place the patterns and drag on the moulding board, with the pins on the drag down, as shown in FIGURE 2.

Sieve facing sand over the patterns to a depth of about 25 mm. Use your fingers to press the sand down firmly around the edges of the patterns against the moulding board. Shovel the drag full of backing sand as shown in FIGURE 3.

Peen-ram around the sides of the box first and then in between the patterns. Again fill the drag and flat-ram it nearly even with the edge of the drag. With the straight edge, strike off any sand that may be above the edges of the drag. Make vent holes, with a wire 1,5 mm in diameter, about 25 mm apart and reaching from the bottom of the drag (now uppermost) to within 3,2 mm of the patterns, as shown at A in FIGURE 4.

Throw sand, free from large lumps, over the drag to a depth of about 6 mm. Rub the bottom board on the sand until it lies on the drag without rocking. FIGURE 5 shows the drag ready to be rolled over.

Grasp the moulding and bottom boards at the ends with both hands, holding the drag firmly between the two boards, and roll the drag over on the moulding bench. Take off the moulding board. Sleek down the sand with the trowel, to make a smooth parting. With the bellows, blow all loose sand from the drag. Blow all parting powder from the patterns. FIGURE 5 shows the drag ready for the cope.

Place the cope on the drag and ensure that the pins fit into the sockets. Set the down gate pin halfway between the patterns, as shown in FIGURE 6.

Sift facing sand to a depth of 25 mm over the patterns. Fill the cope with backing sand. Ram the cope just as the drag was rammed. Strike off the sand even with the top of the cope. Vent the cope, as was done with the drag.

Remove the down gate pin and cut the runner hole to a funnel shape at the top, as shown in A in FIGURE 7. Pack all loose sand around the runner hole with the fingers before lifting the cope. FIGURE 7 shows the mould rammed, ready for the cope to be lifted.

Lift the cope and place it on the moulding board, with the impression taken from the drag uppermost. The drag, after the cope has been lifted, is shown in FIGURE 8.

The cope, properly place, is shown in FIGURE 9. Blow off any loose sand that may be on the mould. Swab the sand next to the patterns with water, being careful not to get it too wet (blowholes in the castings may result from wet sand).

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Drive the draw spike into each pattern in turn, rapping on all sides of the spike to loosen the patterns. Draw the patterns carefully from the sand not to break the sand. If the sand does break, the broken places must be repaired and all loose sand in the mould must be cleaned out, using a cleaner. If the cleaner is dipped into water, the sand will stick to it better than when used dry. With the gate cutter, cut the gates in the drag. Slightly deepen that part of the gate into which the metal will enter from the down gate. The gates should be about 6,35 mm deep and 12,7 mm wide.

After the mould has been patched and all loose sand cleaned out, close the mould by placing the cope on the drag with the pins in the sockets, as shown in FIGURE 10.

If the mould is made in a box that remains on mould while the mould is poured, then it must be clamped together as shown in FIGURE 11.

If the mould is made in a snap flask, the flask must be removed, and a slip jacket put over it and then a weight put on top before it is poured.

MARKS SHOULD BE AWARDED FOR ALL CORRECT ANSWERS IN STUDENTS' OWN WORDS **[10]**

QUESTION 5

5.1 Sand in the green,✓ or undried condition.✓ (2)

5.2 Sand from which all free,✓ or uncombined moisture has been removed.✓ (2)

5.3 The sand used against the face of the pattern✓ and forms the face of the mould.✓ (2)

5.4 This usually refers to sand prepared artificially,✓ mixed with binders, oil,✓ or any organic material. (2)

5.5 Green bond is the strength✓ of the sand and is the property that prevents✓ sagging or collapse of the mould.✓ (3)

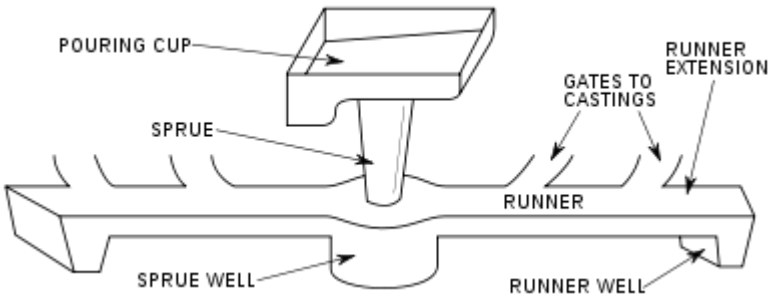
5.6 Is the strength of the sand in the dry state✓ and is the property, which enables the sand to withstand handling✓ and the flow and pressure of the hot metal without crumbling or washing.✓ (3)

5.7 Permeability is the property which allows the steam and gas,✓ generated in the mould by the hot metal,✓ to escape through the pores of the sand.✓ (3)

5.8 The sand should be sufficient to prevent fusion✓ or softening of the mould or core surface✓ at the temperature of metal used.✓ (3)
[20]

QUESTION 6

6.1



7 MARKS FOR THE LABELS AND 3 MARKS FOR THE DRAWING (10)

6.2 The gate should be placed in such a position that the stream from the metal win does not strike heavily✓ against any sand in the mould and be as short as possible to reduce✓ the amount of waste metal.
The metal entering the mould must not spatter on the sides of the mould.✓
Sharp corners in the course of the entry to the mould must be avoided.✓
The stream of metal must not have far to run after entering the mould.✓
The down gates and ingates must be large and numerous enough to fill the mould quickly.✓
The stream of metal should enter the mould in such a way that eddy currents will not be produced.✓
The ingate should be placed where it is easily cut off.✓
The ingate should not be placed where it will pull away from the casting or where it will produce cooling strains.✓
The ingate should not be placed where it will produce a shrinkage cavity.✓ (10)
[20]

QUESTION 7

7.1
- Visual inspection
- Die penetration
- X-rays
- Destructive testing (4)

7.2
- Poorly designed castings, that is, those that have sections that are too light and too heavy.
- A small gun-metal oil box with an 8 to 25 mm wall thickness.
- Allowing the light section of a casting to cool before the heavy section.
- Cracks in castings can be prevented by removing sand from the heavy section but
- allowing it to remain on the light section until the casting is cold. (4)

7.3 Making a mould from sand that is too coarse.
Pouring metal into a mould that is rammed to soft or sand too damp. (2)

7.4
- Having metal too hot when pouring the mould.
- Porous area due to liquid shrinkage – better feeding system. (4)

7.5
- Some castings, when removed from the moulds,✓ are larger than they should be.✓
- A mould rammed too soft will not hold its shape when poured,✓ mould to be rammed harder.✓
- By not pouring the metal too fast✓ or too hot.✓ (6)

[20]

TOTAL: 100

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