higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FOUNDRY THEORY N1

2 AUGUST 2019

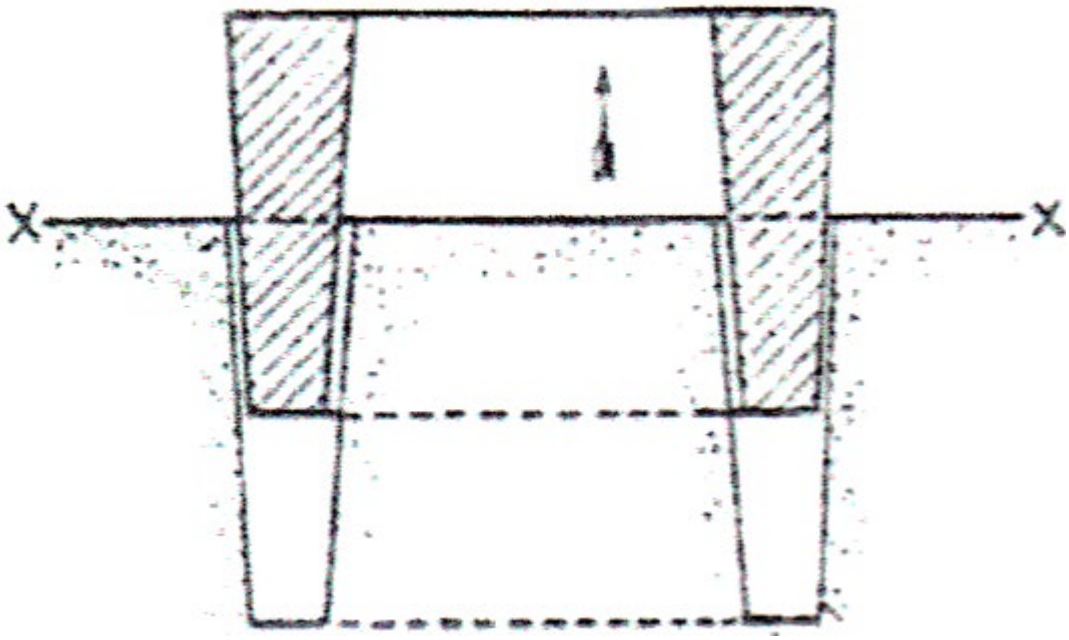
This marking guideline consists of 7 pages.

Copyright reserved

QUESTION 1

- Easily worked, shaped and joined
- Light in weight for handling and working
- Strong, hard and durable (i.e. high strength-to-weight ratio)
- Resistant to wear, abrasion, corrosion and chemical action
- Dimensionally stable and unaffected by variations in temperature and humidity
- Available at low cost
- Can be repaired or reused
- Ability to take a good surface finish **[8]**

QUESTION 2



GREATER TAPER ON INSIDE SURFACES **[2]**

Copyright reserved

QUESTION 3

- Plasticity is the ability of sand to be moulded into shape and retain that shape in a coherent mass.
- Green bond is the strength of sand when in the green or undried state and it is the property which prevents sagging or collapsing of the mould during handling and withstands the wash and pressure of the metal in a greensand mould.
- Fluidity indicates the ease with which movement is transmitted through a mass of sand and it is a desirable property in machine moulding and core making.
- The greater the degree of deformation, the greater the change in volume that sand can undergo without collapsing and it is the property which gives flexibility to a mould enabling it to take up uneven joints or expansion of parts of the mould without cracking.
- Dry bond is the strength of sand in the dry state and it is the property which enables the sand to withstand handling and the flow and pressure of the metal without crumbling or washing. Dry sand should not be strong enough to seriously resist the contraction of the casting which would cause hot tears and cracks.
- Permeability is the property which allows the steam and gas generated in a mould by the hot metal to escape through the pores of the sand. It is an essential property in any moulding material which contains moisture or gas. Insufficient permeability will cause the gasses to escape through the metal instead of the sand which will give rise to porous castings.
- Refractoriness should be sufficient to prevent fusion or softening of the mould or core surface at the temperature of the metal used. Sand which has fused to the casting is difficult to remove and increases fettling costs. (Any 5 × 1) **[5]**

QUESTION 4

- Size of the pattern (original object to be cast)
- Surface finish required
- Detail, undercuts or internal forms
- Number of castings in a production run
- Acceptable cost **[5]**

QUESTION 5

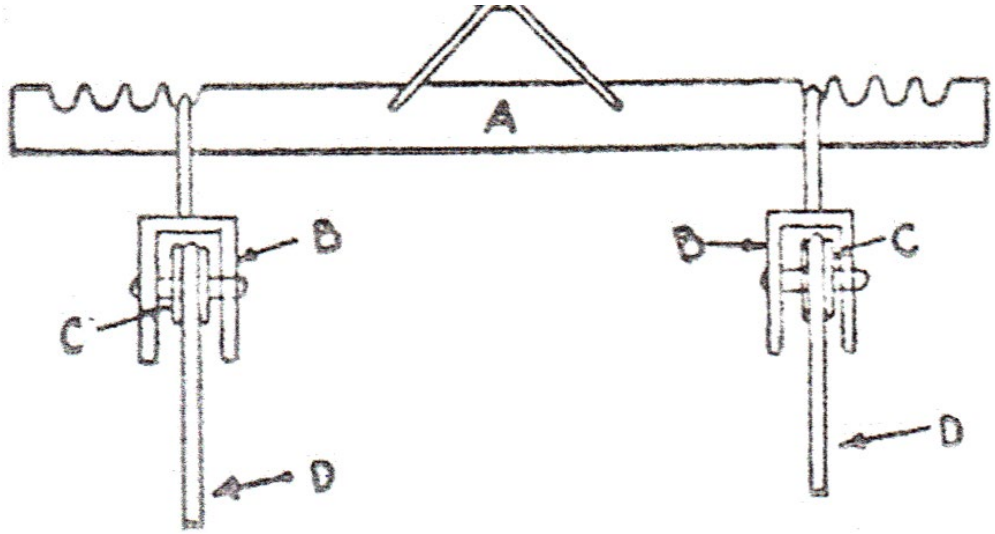
- Pattern making
- Moulding and core making
- Melting and casting
- Fettling
- Testing and inspection **[5]**

QUESTION 6

Each receiver should be provided with a safety valve and stop valve which can be locked and placed between the receiver and the compressor. **[2]**

Copyright reserved

QUESTION 7



The beam is shown at A, the movable struts at B and the chains D revolve on two free pulleys shown at C in the illustration. **[5]**

QUESTION 8

8.1 Greensand is sand in the green or undried condition. Casting into greensand or undried moulds is common practice for the majority of small- and medium-sized ferrous and nonferrous castings.

8.2 Dry sand is sand from which all free or uncombined moisture has been removed, usually by heating in a drying oven or stove. Dry-sand practice is used mainly for the larger castings or where dimensional accuracy and soundness are particularly important. The sand mould is completely dried before the metal is poured into it.

8.3 Facing sand is used against the face of the pattern which forms the face of the mould. It is usually a mixture of old sand and new moulding sand or other bonding materials, prepared for use by milling, sieving and tempering with the right amount of water to give a smooth, firm impression of the pattern and a surface which will not wash or crumble away when the hot liquid metal enters the mould.

8.4 Backing or floor sand is the accumulation of moulding sand from cast-up moulds which are used over and over again as the basis of the facing sand and to fill in the mould at the back of the facing layer. In a number of modern mechanised foundries all sand in the moulding system is circulated through the sand preparation plant, where necessary additions of bonding clay, new sand, coal dust and so on are made. There is no separate facing sand but only a system or unit sand as it is called.

Copyright reserved

8.5 Black sand is foundry-moulding sand or floor sand, particularly in the iron foundry where, because of additions of coal dust to the sand and the action of hot metal, every particle soon becomes coated with a black film and the sand contains a considerable proportion of fine coal and coke particles.

8.6 Synthetic sand refers to moulding sand prepared artificially from sharp or unbounded silica sand by the addition of suitable bonding clays. Synthetic moulding-sand mixtures often contain a proportion of naturally bonded sand. The term in its general sense also includes mixtures bonded with cement or any of the organic materials, oils and cereal binders usually classed under the heading of core binders. Sodium silicate (for CO^2 process) and resins for no-bake, shell and air-setting sands are also binders used in synthetic sands.

8.7 Core sand is used for making cores to produce hollow castings. Usually sands with high silica content, like worn-rounded grains or regular sized and shaped grains, such as sea, river, lake or desert sands are used with special core binders. Ordinary moulding sand is also used for core making to some considerable extent.

8.8 Oil sand is bonded with an organic binder, frequently containing a proportion of linseed oil or other drying oils mainly used for core making. Foundry sands in general are composed of grains of quartz or quartzite crystalline forms of silica or other minerals of a highly siliceous character which may be found in some form of clay. In addition, there are frequently small amounts of other minerals present, such as feldspar, the character of which depends on the nature of the rock from which the sand originated. Sands containing more or less natural bonding clay, comprise the natural moulding sands, while the clay-free sands, usually termed sharp silica sands, are the basis of synthetic moulding sands and oil sands used in the foundry for moulding and core making.

(8 × 2) **[16]**

QUESTION 9

9.1 Green bond is the strength of the sand when in the green or undried state and it is the property which prevents sagging or collapsing of the mould during handling and withstands the wash and pressure of the metal in a greensand mould.

9.2 Dry bond is the strength of sand in the dry state and it is the property which enables sand to withstand handling and the flow and pressure of the metal without crumbling or washing. Dry sand should not be strong enough to seriously resist the contraction of the casting which would cause hot tears and cracks.

9.3 Permeability is the property which allows the steam and gas, generated in a mould by the hot metal, to escape through the pores of the sand. It is an essential property in any moulding material which contains moisture or gas. Insufficient permeability will cause the gasses to escape through the metal instead of the sand and give rise to porous castings.

Copyright reserved

9.4 Refractoriness should be sufficient to prevent fusion or softening of the mould or core surface at the temperature of the metal used. Sand which has fused to the casting is difficult to remove and increases fettling costs.

(4 × 2) **[8]**

QUESTION 10

ADVANTAGES	DISADVANTAGES
• Lower cost of sand maintenance and no sand to dump • Improved impermeability and lower moisture with less chance of blown or porous castings, chilling, etc. • Easier to work on mass production moulding • Enables semiskilled operatives to do machine moulding • Possible to use up old core sand and reclaimed sand	• It has high first cost. • Drying out gives friability and washes. • Patching is difficult. • Balling up may give poor finish. • Synthetic sand needs more careful control than naturally bonded sand.

(5 + 5) **[10]**

QUESTION 11

- Top gate
- Parting gate
- Bottom gate **[3]**

QUESTION 12

- Is feeding a necessity?
- Which class of castings should be fed?
- How should feeding be done? **[3]**

QUESTION 13

13.1 Square
13.2 Triangle
13.3 Circle
13.4 Sphere
13.5 Cone

(5 × 1) **[5]**

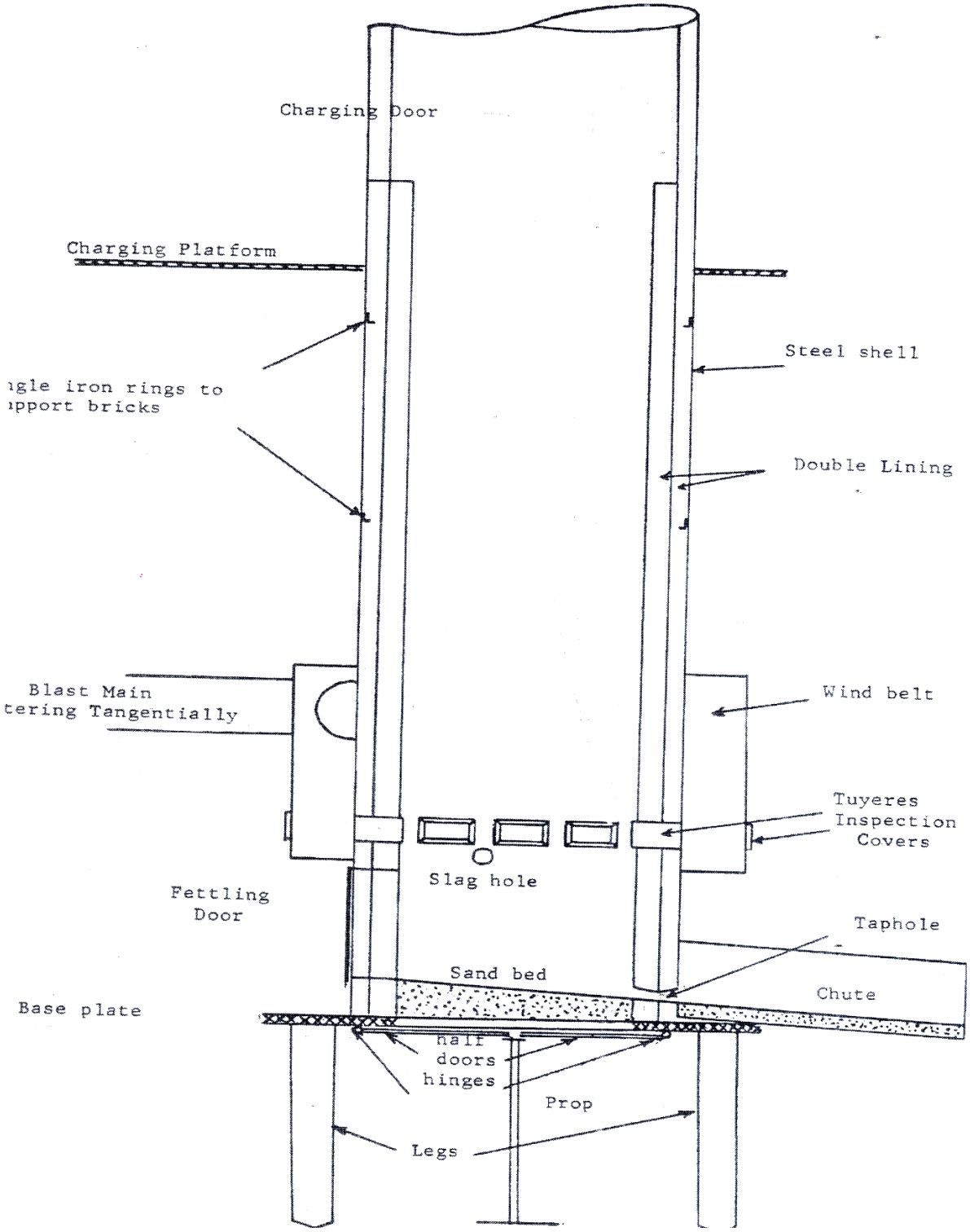
QUESTION 14

- Vent wire
- Wax vent
- Nylon vent
- V-grooves (Any 3 × 1) **[3]**

Copyright reserved

QUESTION 15

CHARGING DOOR



[20]

TOTAL: 100

Copyright reserved