



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE CHEMICAL PLANT OPERATION N5

9 April 2020

This marking guideline consists of 5 pages.

QUESTION 1

- 1.1 Heat energy
1.2 Calorie
1.3 Steady-state operation
1.4 Heat of reaction
1.5 Ribbon mixer

(5 × 1) [5]

QUESTION 2

- 2.1 C
2.2 D
2.3 A
2.4 B
2.5 F

(5 × 1) [5]

QUESTION 3

3.1 $\Delta H_1 = \frac{1}{2} \times C_{p1\ 000\ K} H_2 \Delta t + \frac{1}{2} C_{p1\ 000\ K} Cl_2 \Delta t$ ✓
 $= \frac{1}{2} \times 29,46(298 - 1\ 000) + \frac{1}{2} \times 36,45(298 - 1\ 000)$ ✓
 $= (-10\ 340,46) + (-12\ 793,95)$ kJ/Kmol ✓
 $= -23\ 134,41$ kJ/Kmol ✓

$\Delta H_2 = -92\ 300$ kJ/Kmol ✓ *Standard heat of gas formation, at one atmosphere*

$\Delta H_3 = 1 \times 30,00 \times (1\ 000 - 298)$ ✓
 $= 21\ 060$ kJ/Kmol ✓

$\Delta H =$ Heat of reaction at 1 000 K ✓
 $= -23\ 134,41 + (-92\ 300) + 21\ 060$ ✓
 $= \underline{-94\ 374,41}$ kJ/Kmol ✓

(10)

- 3.2 3.2.1
- Steam flows from the centre outwards or from the outside to the centre
 - Pressure drops in the nozzles
 - Velocity increases due to pressure drop
 - Velocity decreases as kinetic energy is given to moving the blades

- 3.2.2
- The steam flow is parallel to the turbine axis
 - Total pressure drop takes place in one set of nozzles only
 - Steam entering at a high velocity is directed to the moving blades
 - and transfers most of its velocity to the moving wheel

(2 × 4) (8)

- 3.3
- Closed-circuit gas turbine system
 - Open-circuit gas turbine system

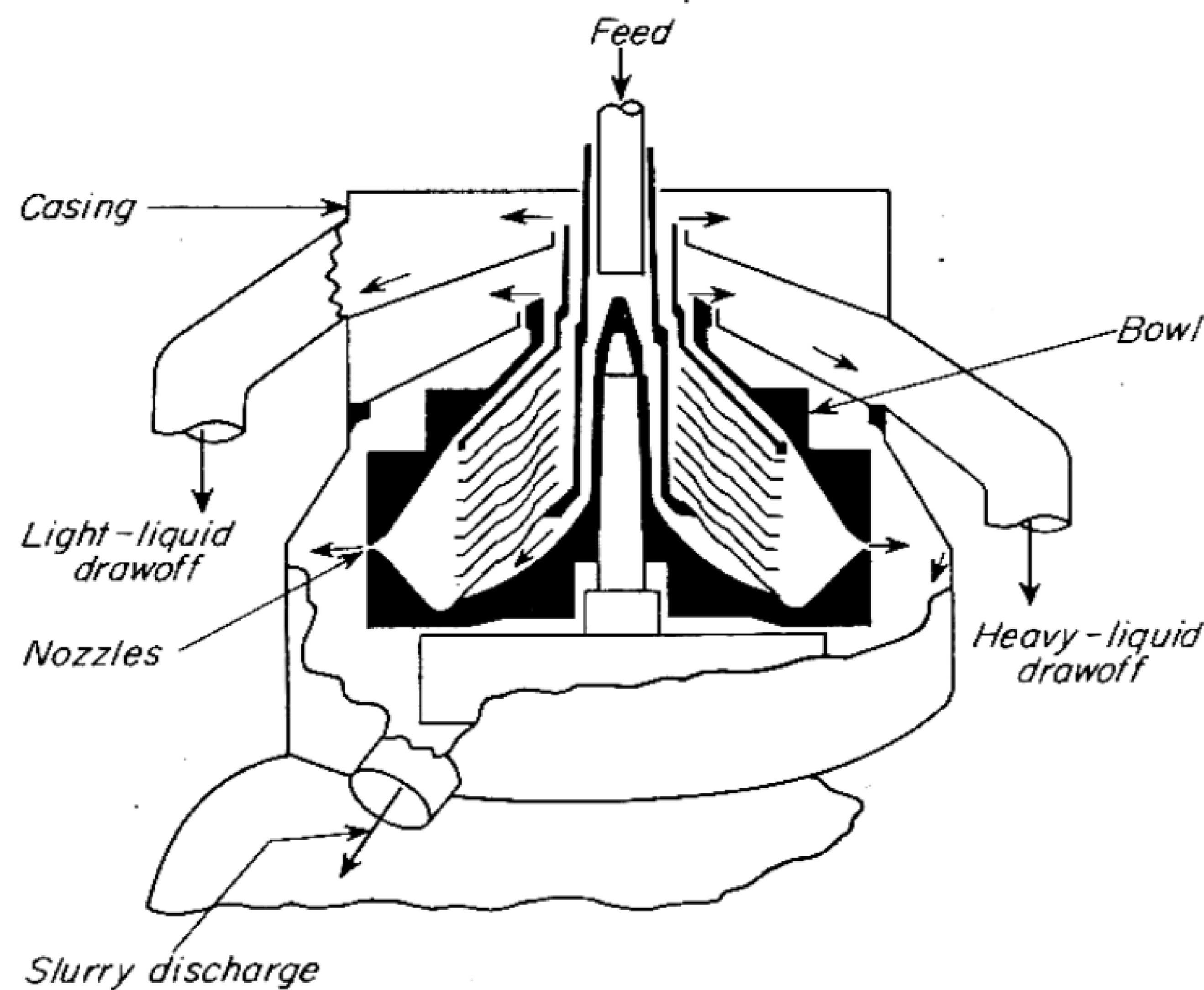
(2)
[20]

QUESTION 4

- 4.1
- Enough air
 - to provide sufficient oxygen to combine with all the combustible elements of the fuel.
 - Thorough mixing (turbulence)
 - of the air and fuel by using an applicable burner. Each particle of fuel must come in contact with the necessary air.
 - Furnace temperature
 - is above ignition temperature of the fuel to ensure that the combination of fuel and oxygen takes place rapidly.
 - Enough time
 - for complete combustion before the fuel strikes the relatively cool surfaces of the furnace, e.g. the boiler tubes.

(8)

4.2



(One mark for each correct label = 7 marks)
(One mark for correct sketch = 1 mark)

(8)

- 4.3
- The incoming dust-laden air receives a rotating motion on entrance to the cylinder.
 - The vortex so formed develops a centrifugal force
 - which acts by throwing the particles radially towards the wall.
 - The path of the air in a cyclone follows a downward vortex or spiral adjacent to the wall until it reaching the bottom of the cone.
 - Particles leave the cyclone at the bottom.
 - The air stream then moves upward in a tighter spiral
 - concentric to the first and leaves through the outlet pipe still whirling. Both spirals rotate in the same direction.

(7)

- 4.4
- Sigma blade
 - Double-naben blade
 - Disperser blade

(Any 2 × 1)

(2)

[25]