higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

ENGINEERING SYSTEMS
NQF LEVEL 2

27 FEBRUARY 2020

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 D
1.2 H
1.3 G
1.4 I
1.5 B
1.6 J
1.7 F
1.8 C
1.9 A
1.10 E

(10 × 1) **[10]**

QUESTION 2

2.1 2.1.1 True
2.1.2 True
2.1.3 False
2.1.4 False
2.1.5 True

(5 × 1) (5)

2.2 2.2.1 An electrical circuit is a closed path through which an electric current flows or is conducted.

2.2.2 Power is the rate at which work is done.

2.2.3 Direct current flows in one direction only.

2.2.4 A step-down transformer reduces voltage.

2.2.5 A circuit-breaker is a device with a preset current limit that operates automatically to protect an electrical circuit in case of overload or a short circuit.

(5 × 1) (5)

2.3 2.3.1 The pump develops pressure in a fluid and is used for raising or moving liquids or compressing gases.

2.3.2
- Power transmission
- Lubrication of moving parts
- Cooling/Dissipation of heat
- Sealing of clearance between mating parts
- Cleaning agent *(*Any ONE)

2.3.3 Hydraulic pipes channel the fluid under pressure from the pump to the actuators.

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2.3.4 Actuators change the hydraulic liquid pressure into mechanical movement.

2.3.5 Reservoirs store hydraulic fluid until needed for the operation of the system.

(5 × 1) (5)
[15]

QUESTION 3

3.1 A – Front disc brakes
B – Master cylinder
C – Brake pedal
D – Rear brake shoes
E – Hydraulic pipe

(5 × 1) (5)

3.2
- It allows equipment to be stopped in an emergency.
- It allows a vehicle to remain stationary on an incline.
- It allows equipment to slow down. (3)

3.3 Lubrication will reduce the friction between the brake surfaces,✓ reducing the effectiveness of the brakes✓ which may result in damage to equipment and or injury to workers.✓ (3)

3.4 Due to condensation, the moisture in the air will become liquid.✓ Water will build up in the air tank.✓ This will reduce the efficiency of the brakes✓ and cause corrosion of the components in the braking system.✓ (4)
[15]

QUESTION 4

4.1 4.1.1 $\frac{F_p}{d^2} = \frac{F_R}{D^2}$

$\frac{150}{(0,09)^2} = \frac{780}{D^2}$ ✓

$D^2 = \frac{6,318}{150}$ ✓

$D = \sqrt{0,04212}$

$D = 0,205 \text{ m}$ ✓

Say $D = 205 \text{ mm}$ ✓ (4)

4.1.2

$$P = \frac{F_p}{A_P}$$

$$P = \frac{F_p}{\pi/4\, d^2} \checkmark$$

$$P = \frac{150}{\pi/4\,(0{,}09)^2} \checkmark$$

$$P = 23\,578{,}51 \text{ Pa} \checkmark$$

OR

$$P = \frac{F_R}{A_R}$$

$$P = \frac{F_R}{\pi/4\, D^2} \checkmark$$

$$P = \frac{780}{\pi/4\,(0{,}205)^2} \checkmark$$

$$P = 23\,578{,}51 \text{ Pa} \checkmark$$

(3)

4.2

$$N_W.T_W = N_X.T_X$$

$$N_X = \frac{N_W \times T_W}{T_X}$$

$$N_X = \frac{1\,800 \times 20}{120}$$

$$N_X = \frac{36\,000}{120} \checkmark$$

$$N_X = 300 \text{ r/min} \checkmark$$

$$N_X = N_Y = 300 \text{ r/min} \checkmark$$

$$T_Y = \frac{N_Z \times T_Z}{N_Y}$$

$$T_Y = \frac{30 \times 160}{300} \checkmark$$

$$T_Y = \frac{4\,800}{300} \checkmark$$

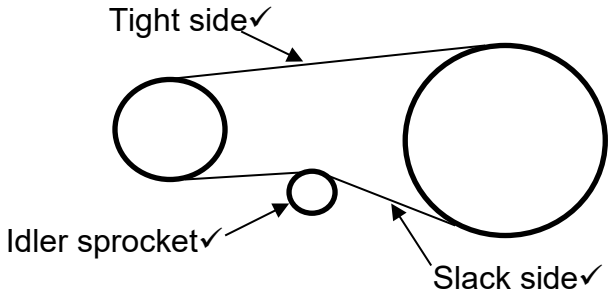
$$T_Y = 16 \text{ teeth} \checkmark$$

(6)

4.3 4.3.1 Voltmeter
4.3.2 Ohmmeter
4.3.3 Ammeter

(3 × 1) (3)

4.4



(1 mark for correctness of drawing) (4)
[20]

QUESTION 5

5.1 Backlash is the small amount of free play between gear teeth. (1)

5.2 Dial gauge (1)

5.3 5.3.1
- Too much backlash will result in noisy gears when a machine is in operation.
- It will delay the gear movement. (2)

5.3.2
- Too little backlash will result in the gears overheating while in operation.
- Gears will break due to incorrect backlash.
- Gears will wear out rapidly.
- Not enough clearance for lubrication and expansion. (Any TWO) (2)

5.4
- Machinery will wear out sooner.
- Machinery will be less efficient resulting in loss of production.
- The chances of breakdown will increase resulting in loss of production.
- Machinery will become unsafe to use.
- Using unsafe machines and unsafe equipment will increase the chances of incidents and accidents. (Any relevant 5 × 1) (5)

5.5
- Inspect the machine to make sure that all guards and other safety devices are in place and in working order.
- Notify all employees who are affected that the machine will be returned to service.
- Check the area to make sure that turning on the energy source and starting the machine will not endanger employees.
- Double check if all bolts were tightened.
- Double check that no maintenance tools have been left in the machine.
- Remove the lockout devices and turn on the energy of the machine or equipment.
- Make sure that rotational machinery does not overheat or make unusual noises and that it is performing to its full capacity. (Any 5 × 1) (5)

5.6
- Changes the speed of motion
- Changes the direction of motion
- Changes the direction of rotation
- Increases or decreases the force of the machine
- Converts to a different type of motion (Any 4 × 1) (4)

[20]

QUESTION 6

6.1
- Roller bearings
- Taper bearings
- Needle bearings
- Ball bearings
- Thrust bearings (Any relevant 4 × 1) (4)

6.2
- Listen: Place a screwdriver or wooden dowel against the bearing housing and place your ear against the other end to listen.
- Feel: Place your hand on the bearing housing to check if the temperature is extremely high.
- See: Check for any sign of lubricant escaping from the bearing. (3)

6.3 6.3.1 Cracks are caused by excessive heat and chemical fumes.

6.3.2 Abrasion may be caused by metal particles and grit.

6.3.3 Excessive stretch is caused by overloading or internal breaks of the belt.

6.3.4 Loss in speed may be caused by incorrect tension.

(4 × 1) (4)

6.4 6.4.1 A – Castle nut
B – Plain washer
C – Pulley
D – Parallel key

(4 × 1) (4)

6.4.2 (a) Check for breaks and twists in the circlip.
(b) Check the bearing for excessive play.
(c) Check if the shaft is bent, worn or corroded.

(3 × 1) (3)

6.5
- Greater safety
- Smaller risk
- Higher quality goods produced
- Lower operating costs
- Longer lifespan of machinery
- Higher end value of goods (Any 2 × 1) (2)

[20]

TOTAL: 100

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