

higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE


NATIONAL CERTIFICATE


AUGUST EXAMINATION


MECHANOTECHNICS N4

31 JULY 2014

This marking guideline consists of 9 pages.


A. J.
Khal


B. H. G. T.

D. T.
M. P.


QUESTION 1**1.1 Special requirements for placing of machines in the workshop****Space around and above each machine**

Sufficient space around each machine is essential, so that the operator can work unhindered. Provision must also be made for sufficient space above each machine, allowing free movement of overhead hoisting apparatus (cranes) to handle heavy work pieces.

Handling of workpiece

Mechanised hoisting of apparatus must be used to handle heavy workpieces during machining.

Transport routes and aisles

Transport routes and aisles should not be used to store materials. They should be kept open at all times for the safe transport of materials and workpieces. Transport routes and passages must also be clearly marked and be wide enough for the movement of handling and conveying equipment.

Storage facilities

Suitable storage facilities in the form of containers for workpieces, before and after machining, must be placed at convenient places near the machine so that the operator can reach them when placing workpieces into them or taking them out. Sufficient space must be allowed around the storage containers for the movement of handling and conveying equipment.

Supply of services

Supply services and service points for electricity, water, gas, steam and compressed air must be within reach and should not obstruct the hoisting and conveying of workpieces. Supply routes and service points should preferably be housed in ducts in the floor or walls and should be protected by steel covers.

Carrying capacity of the floor

Workshop floors have to be reinforced to safely carry the weight of extremely heavy machinery. Floor areas where heavy cranes are used must be sufficiently reinforced to carry the additional burden.

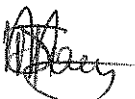
(Any 5 × 2) (10)

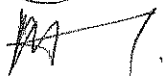
1.2 Advantage of airless spray painting

- There is less overspray
- High pump delivery allows rapid working
- Air pockets in the paint supply are eliminated
- High spraying pressure allows thick paints to be used
- There are bigger savings in thinners
- Overhead spraying is easier

D.T
mp
(6)

R





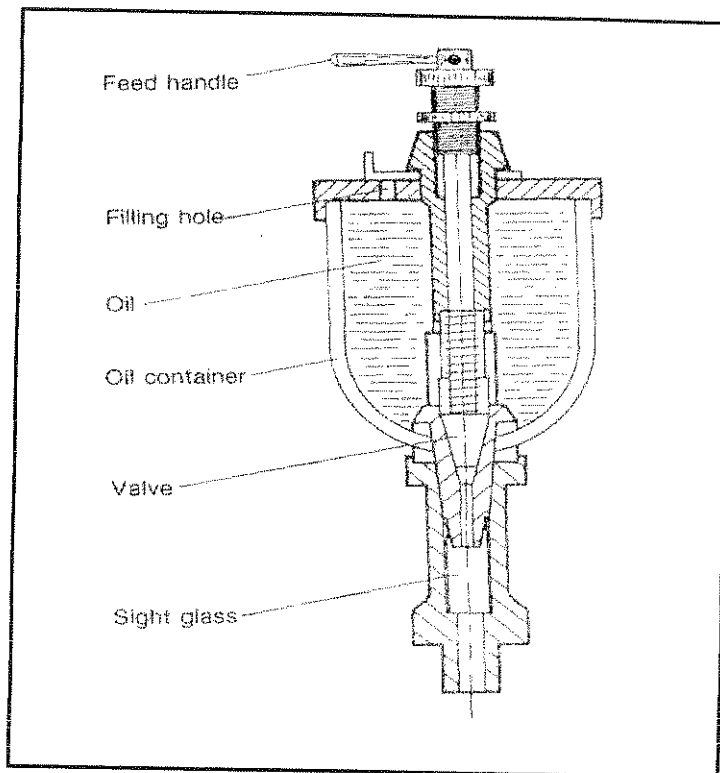

Disadvantage of airless spray paintings

- This is an expensive method
 - The spraying width is only partly controllable
 - The coat thickness of the paint is difficult to control
 - There is possible overlapping of paint stroke when finishing paint is used
- (4)

- 1.3 1.3.1
- Gravity feed
 - Grease lubrication
 - Splash lubrication
 - Forced lubrication
 - Pressure-feed lubrication

(5)

1.3.2



Label (6 × ½) (3)

Drawing (2)

[30]

QUESTION 2

2/1 $v = 95 \text{ m/min}$
 $v = \frac{95}{60}$
 $= 1,583 \text{ m/s}$ ✓

DT
MP
(1)

2/2 $P_f = F_f \times v$
 $= 2\,500 \times 1,583$ ✓
 $= 39\,57,5 \text{ W}$ ✓

R
(2)

[Handwritten signatures]

$$\frac{T_1}{T_2} = e^{\frac{u\theta}{57,3}}$$

$$= e^{\frac{0,3 \times 1850}{57,3}}$$

$$T_1 = 2,634T_2 \quad (1)$$

$$T_2 = \frac{T_1}{2,634}$$

$$= \frac{35\,500}{2,634}$$

$$= 13\,477,6 \text{ N} \quad (2)$$

$$P_i = (T_1 - T_2)V$$

$$= (35\,500 - 13\,477,6) \times 1,583$$

$$= 34\,861,459 \text{ W} \quad (2)$$

$$P_i = P_g + P_f$$

$$P_g = P_i - P_f$$

$$= 34\,861,459 - 3\,957,5$$

$$= 30\,903,959 \text{ W} \quad (2)$$

$$P_g = mgh$$

$$m = \frac{P_g}{gh}$$

$$m = \frac{30\,903,959}{9,81 \times 35}$$

$$= 90,007 \text{ kg/s}$$

$$= 90,007 \times \frac{3\,600}{1\,000}$$

$$= 324,025 \text{ t/h} \quad (4)$$

[14]

D.T
MP

QUESTION 3

3.1 3.1.1

$$V = \frac{\pi DN}{60}$$

$$= \frac{\pi \times 0,2 \times 2\,500}{60}$$

$$= 26,18 \text{ m/s} \quad \checkmark$$

$$P_o = F \times V$$

$$= 60 \times 26,18 \quad \checkmark$$

$$= 1\,570,8 \text{ W} \quad \checkmark$$

T = F \times R
= 60 \times 0,1 \quad \checkmark
= 6 N.m
 USE $P = \frac{2\pi NT}{60}$ (3)

3.1.2

$$P_{in} = \frac{P_o}{\eta}$$

$$= \frac{1\,570,8}{0,85} \quad \checkmark$$

$$= 1\,848 \text{ W}$$

$$= 1,848 \text{ kW} \quad \checkmark$$

(2)

3.1.3

$$T = \frac{P \times 60}{2\pi N}$$

$$= \frac{1\,848 \times 60}{2\pi \times 1\,500} \quad \checkmark$$

$$= 11,7647 \text{ N.m} \quad \checkmark$$

(2)

3.2 3.2.1

$$T = \frac{P \times 60}{2\pi N}$$

$$= \frac{3\,500 \times 60}{2\pi \times 1\,750} \quad \checkmark$$

$$= 19,1 \text{ N.m} \quad \checkmark$$

(2)

3.2.2

$$P_o = \eta \times P_i$$

$$= 0,8 \times 3\,500$$

$$= 2\,800 \text{ W} \quad \checkmark$$

(1)

$$T = \frac{2\,800 \times 60}{2\pi N}$$

$$= \frac{2\,800 \times 60}{2\pi \times 3\,500} \quad \checkmark$$

$$= 7,64 \text{ N.m} \quad \checkmark$$

D.T

(2)

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MP
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 Please turn over

3.2.3

$$T = \frac{P \times 60}{2\pi N}$$

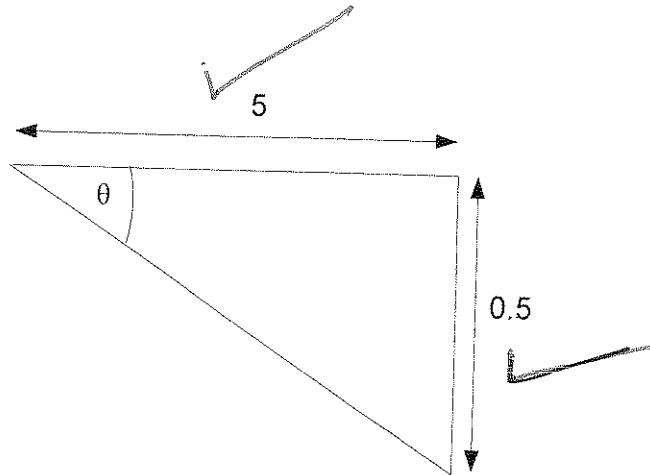
$$= \frac{2800 \times 60}{2\pi \times 25}$$

$$= 1069,52 \text{ N.m}$$

(2)
[14]

QUESTION 4

4.1



$$\tan \theta = \frac{0.5}{5}$$

$$\theta = \tan^{-1} 0.1$$

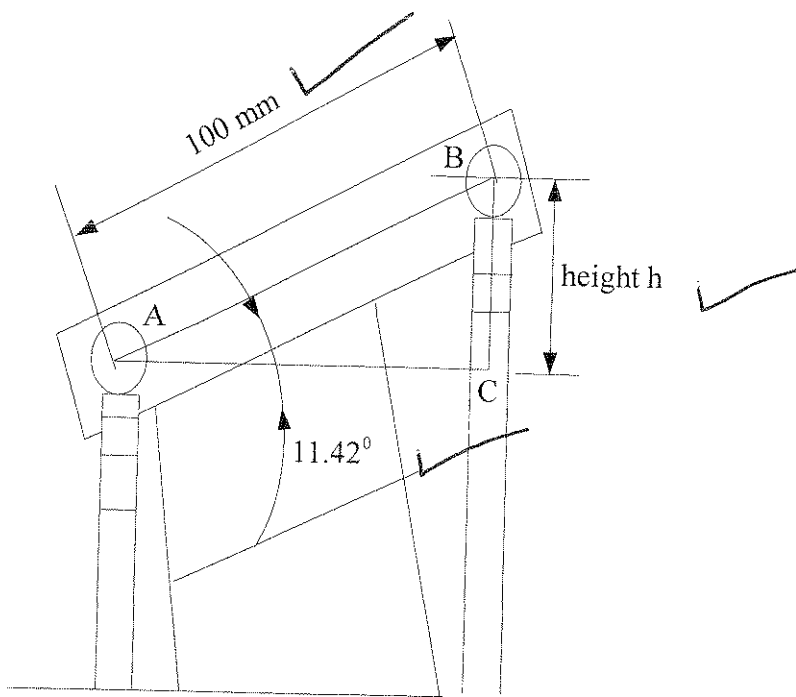
$$= 5,71^\circ$$

$$\text{Inclined angle} = 2 \times 5.71$$

$$= 11,42^\circ (11^\circ 25')$$

2 (A)

4.2



3 marks for label

2 for drawing

DT

MP

(5)

4.3 In ΔABC ✓
 $\sin 11,42 = \frac{h}{100}$ ✓
 $h = 100 \times \sin 11,42$ ✓
 $= 19,8 \text{ mm}$ ✓

(4)
[14]

QUESTION 5

| NO. | CONDITIONS | A | B | C | D |
|-----|---------------------------------------|---------|---------------------------|-----------------------------|-------|
| 1 | Fix arm D and rotates; A + 1 rev | +1 ✓ | $\frac{64}{18} = 3,556$ ✓ | $-\frac{64}{28} = -2,286$ ✓ | 0 ✓ |
| 2 | Multiply by x and add y | X + y ✓ | 3,556 + y ✓ | -2,286 x + y ✓ | y ✓ |
| 3 | $N_C = ?$ $N_A = 0$ $N_D = 150$ | 0 ✓ | | $N_C = ?$ ✓ | 150 ✓ |
| 4 | $N_A = ?$ | N_A | | 0 | 150 ✓ |

8

5.1 $x + y = 0$
 $y = 150$
 $x = -150$ ✓
 $N_C = -2,286x + y$
 $= -2,286 \times (-150) + 150$ ✓
 $= 342,9 + 150$
 $= 492,9 \text{ r/min}$ ✓

3 #

5.2 $y = 150$
 $-2,286x + 150 = 0$
 $-2,286x = -150$
 $x = 65,617$ ✓
 $N_A = x + y$
 $= 65,617 + 150$ ✓
 $= 215,617$ ✓

D.T

[Handwritten signatures]

(3)
[14]

[Handwritten initials]

QUESTION 6

6.1

$$A_t = \frac{\pi d_t^2}{4}$$

$$= \frac{\pi \times 0,05^2}{4}$$

$$= 0,002 \text{ m}^2 \quad \checkmark$$

(1)

6.2

$$A_a = \frac{\pi d_a^2}{4}$$

$$= \frac{\pi \times 0,04^2}{4}$$

$$= 0,0013 \text{ m}^2 \quad \checkmark$$

(1)

6.3

$$V_t = \sqrt{2gh}$$

$$= \sqrt{2 \times 9,81 \times 3}$$

$$= 7,672 \text{ m/s} \quad \checkmark$$

(1)

6.4

$$V_a = \sqrt{\frac{gx^2}{2y}}$$

$$= \sqrt{\frac{9,81 \times 2,5^2}{2 \times 0,55}}$$

$$= 7,4658 \text{ m/s} \quad \checkmark$$

(1)

6.5

$$Q_t = V_t \times A_t$$

$$= 7,672 \times 0,002 \quad \checkmark$$

$$= 0,01534 \text{ m}^3/\text{s} \quad \checkmark$$

(2)

6.6

$$Q_a = V_a \times A_a$$

$$= 7,4658 \times 0,0013 \quad \checkmark$$

$$= 0,009705 \text{ m}^3/\text{s} \quad \checkmark$$

(2)

6.7

$$C_d = \frac{Q_a}{Q_t}$$

$$= \frac{0,009705}{0,01534} \quad \checkmark$$

$$= 0,6327 \quad \checkmark$$

(2)

D.T

M.P

6.8

$$C_v = \frac{V_a}{V_t}$$

$$= \frac{7,4658}{7,672}$$

$$= 0,973$$

(2)

6.9

$$C_c = \frac{A_a}{A_t}$$

$$= \frac{0,0013}{0,002}$$

$$= 0,65$$

(2)

[14]

TOTAL: 100

Ph
H

AA 7.

R
J.T
MP