higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

CIVIL AND STRUCTURAL STEEL WORK DETAILING
NQF LEVEL 2

12 November 2024

This marking guideline consists of 5 pages.

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QUESTION 1: INTRODUCTION TO CIVIL AND STRUCTURAL STEELWORK

1.1 1.1.1 Bolting – bolts are threaded fasteners used with nuts and washers to join steel components. This method is widely used in construction and machinery because it allows for easy assembly and disassembly.

1.1.2 Welding involves fusing steel parts using heat or pressure. This method creates a strong, permanent bond and is commonly used in structural applications.

(2 × 2) (4)

1.2
1.2.1 F✓
1.2.2 A✓
1.2.3 E✓
1.2.4 B✓
1.2.5 D✓
1.2.6 C✓
1.2.7 H✓
1.2.8 J✓
1.2.9 G✓
1.2.10 I✓

(10 × 1) (10)

1.3
- Cement
- Sand
- Aggregates
- Water (4)

1.4 To resist the tension stresses caused by the uniform load (2)

1.5

COLD-FORMED STEEL	HOT-ROLLED STEEL
• It is produced at room temperature • Lightweight material • Products are smoother and have more precise dimensions • It has small deformations with a large number of rolling cycles • Yield strength and hardness are increased • Only simple shapes are available (Any 4 × 1)	• It is produced at high temperatures • Material is heavy • Products have a rounded appearance at corners and edges • It has large deformations with a large number of rolling cycles • Metal remains malleable • Many different shapes are available (Any 4 × 1)

(8)

1.6 Bar list (1)

1.7 Plain bar (1)

[30]

QUESTION 2: STRUCTURAL STEELWORK AND REINFORCED CONCRETE

2.1 Standardised profile lengths in structural steel are essential to ensure:

- Uniformity
- Ease of handling
- Compatibility across different construction projects

These lengths help reduce waste, optimise material usage, and facilitate efficient manufacturing and construction processes. (3)

2.2 Common materials include:
- Steel
- Stainless steel
- Alloy steel (3)

2.3 Modes of failure can be classified as follows:

- Shear failure: Occurs when the bolt is subjected to shear forces that exceed its shear strength. This often happens in applications where bolts connect two parts that slide relative to each other.
- Tensile failure: This happens when the tensile load on the bolt exceeds its tensile strength. This mode is common in applications where bolts hold parts together under tension, such as in structural connections.
- Thread stripping: This occurs when the threads of the bolt or the nut are stripped, leading to a loss of clamping force. This can happen if the bolt is over-tightened or if the materials being fastened are too soft. (3 × 3) (9)

2.4 2.4.1 B✓
2.4.2 B✓

(2 × 1) (2)

2.5
- Efficiency in manufacturing: Standard lengths streamline the production process, reducing the need for custom cutting and minimising waste.
- Cost-effectiveness: By producing profiles in standard lengths, manufacturers can reduce costs associated with storage, handling, and transportation.
- Ease of use: Standard lengths simplify planning and construction, making it easier for builders and engineers to design projects and order materials.

(3 × 3) (9)

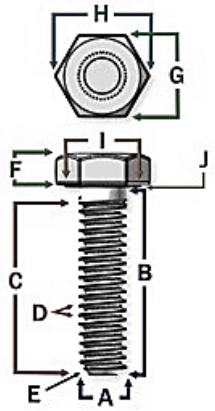
2.6 2.6.1 Number of bars
2.6.2 Type of steel
2.6.3 Bar diameter
2.6.4 Bar mark
2.6.5 Spacing centre to centre
2.6.6 Location

(6 × 1) (6)
[30]

QUESTION 3: BOLTS IN STRUCTURAL STEELWORK

3.1

A) Bolt Diameter
B) Bolt Length.
C) Thread Length
D) Thread Pitch
E) Bolt End Chamfer
F) Head Height.
G) Head Across Flats
H) Head Across Corners.
I) Fillet Diameter
J) Fillet Height



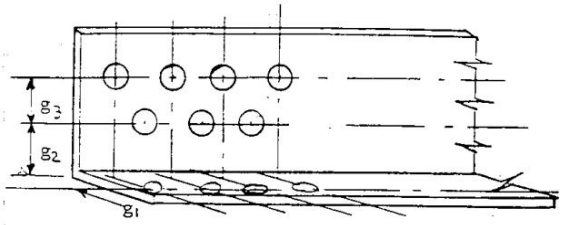
(6)

3.2
- Structures can be set up quickly and easily.
- Structures can be set up faster than welding. (2)

3.3
- Grade 4.8 bolts are typically used in non-critical applications where high strength is not a primary concern.
- Grade 10.9 bolts are used in situations where high strength and durability are crucial. (2 × 2) (4)

3.4 The 's' suffix next to the grade number indicates that the bolt is HSFG (high strength friction grip bolt) (2)

3.5 Staggered bolt hole example (p. 12 notes)



Consider the 7 × 4 × ½ angle shown. The holes are 7/8" in diameter on normal gage lines. The holes are the U.S standard 3" c.c. in each row, but the hole in the interior row is the 7" leg and is offset by 1½" from the other holes, which line up with each other. Find A_n for a two-hole and a three-hole tear line. (6)

[20]

QUESTION 4: WELDING SYMBOLS AND JOINTS

4.1
4.1.1 True
4.1.2 True
4.1.3 False
4.1.4 True
4.1.5 False

(5 × 1) (5)

4.2
- Butt
- Edge
- Lap
- Tee
- Corner

(5)
[10]

TOTAL: 100

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