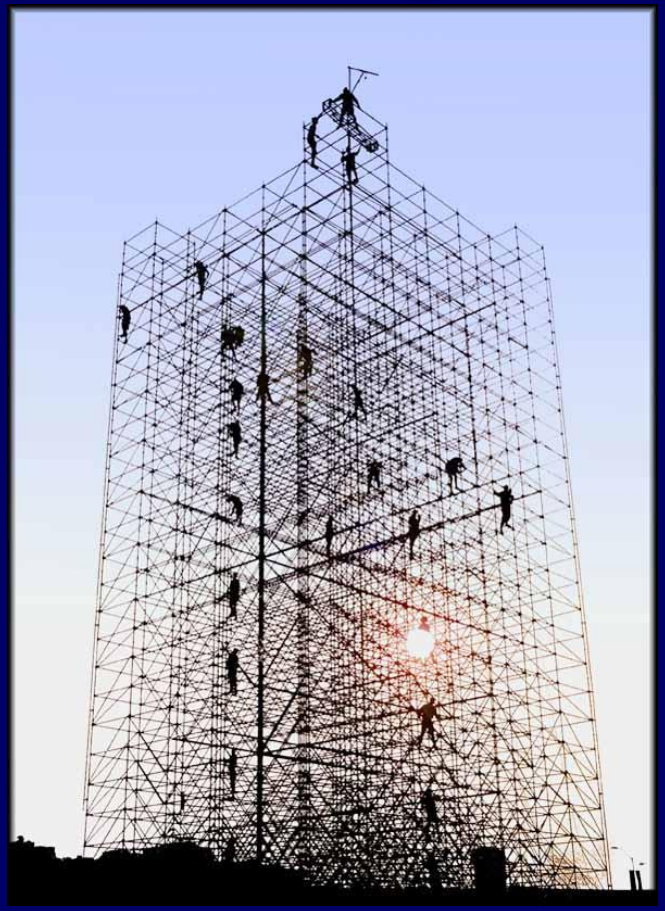
Talk on 'An Overview of Malaysian Standard MS1462 for Metal Scaffolding'

Date: 01 Mac 2016

Organised By:
CIDB

By : Ir. KB Lee
(IEM)



Contents of Talk

- Part 1 - Objective
- Part 2 - Example of Failure/ Collapse
- Part 3 – MS1462 for Metal Scaffolding

Part 1 - Objective

- To promote awareness on the regulating scaffolding to mandatory standard in construction industry
- To introduce Malaysian Standard MS 1462 for metal scaffolding.
- To initial an understanding of the appropriate safety regulations of scaffolding.

Definition of Scaffolding & Falsework

- Scaffolding generally is defined as temporary structure for people to access and perform work.
- Falsework is defined as temporary structure, which enables the permanent structure to be constructed while it is not self-supporting.

Part 2

- Example of

Failure/Collapse

•Collapse of Scaffolding

•Collapse of Scaffolding

•Collapse of Scaffolding

•Collapse of Scaffolding

•Collapse of Scaffolding

Collapse of Falsework

•Collapse of Falsework

•Collapse of Falsework

•Collapse of Falsework

•Collapse of Falsework

•Collapse of Falsework

•Collapse of Falsework

•Collapse of Falsework

•Collapse of Falsework

Part 3 – MS1462 for Metal Scaffolding

- Materials
- Types
- Standards & Acts
- Specifications
- Design Requirements

Materials for Metal Scaffolding:

Two types of material commonly used:

1. Steel
2. Aluminum

Types of Metal Scaffolding:

1. Prefabricated Scaffolds (Steel Frame scaffolding)
2. Prefabricated Scaffolds (Modular System scaffolding)
3. Tubular Scaffolds (Tubes & couplers/ fittings)

Prefabricated Scaffolds (Steel Frame Scaffolding)

VASCO
(A member of Weng Yat Group)

FRAME SCAFFOLDING

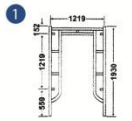
ASSEMBLY OF MODEL

Cross Brace
Never fail to attach the cross brace or strip frame to the first stage to prevent the deformation and torsion of the tower.

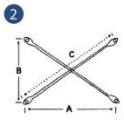
Frame
Connect the frames by joint pins.

Transfer
Never move the tower with the operation on. Confirm the inserted length of the jacks and condition of springs of the casters, so that they may not get loose from the frame.

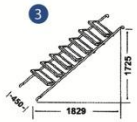
Reserve Pillar
Prepare a reserve pillar for the operation.



Vertical Frame

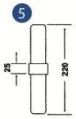


Cross Brace



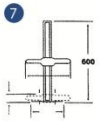
Stair

Walking Board



Joint Pin

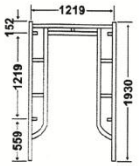
Adjustable U - Head



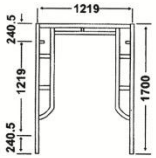
Adjustable Jack Base

VASCO
(A member of Weng Yat Group)

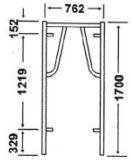
FRAME SCAFFOLDING AND ACCESSORIES



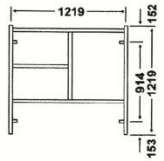
Vertical Frame
WY - 101A



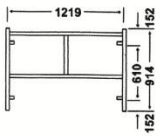
Vertical Frame
WY - 101



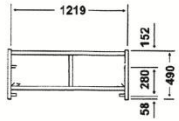
Light Frame
WY - 104



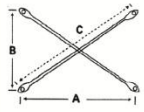
Ladder End Frame
WY - 108



Ladder End Frame
WY - 109

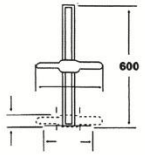


Ladder End Frame
WY - 110

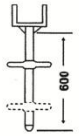


Code	A	B	C
WY - 301A	1829	1219	2198
WY - 301B	1829	914	2045
WY - 301C	1829	610	1928
WY - 301D	1829	280	1850
WY - 301E	1219	1219	1724
WY - 301F	1219	610	1363

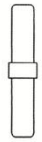
Cross Brace
WY-301



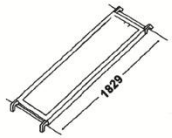
Adjustable Jack Base
WY - 601B



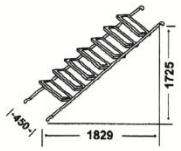
Adjustable U - Head
WY - 602B



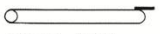
Joint Pin
WY - 701



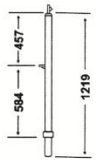
Walking Board
WY - 205



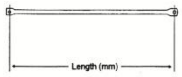
Stair
WY - 514



Wall Tie
WY - 501



Guard Rail Post
WY - 901



Code	Length (mm)
WY - 902	1219
WY - 902A	1829

Guard Rail
WY-902

SCAFFOLDING JIS CLAMP

48.6mm & 48.6mm Swivel Clamp

48.6mm & 48.6mm Fixed Clamp

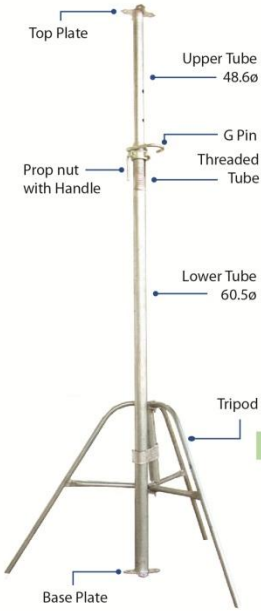
SAFETY NET

Size Available In Meter

Width (W) : 1.8

Length (L) : 5.1

VERTICAL SHORE / STEEL PROP



Specifications

Model No.	Fully Extended	Closed
WY 70	3,500mm (11′ - 5″)	2,000mm (6′ - 5.6″)
WY 90	3,900mm (12′ - 8″)	2,400mm (7′ - 8.7″)

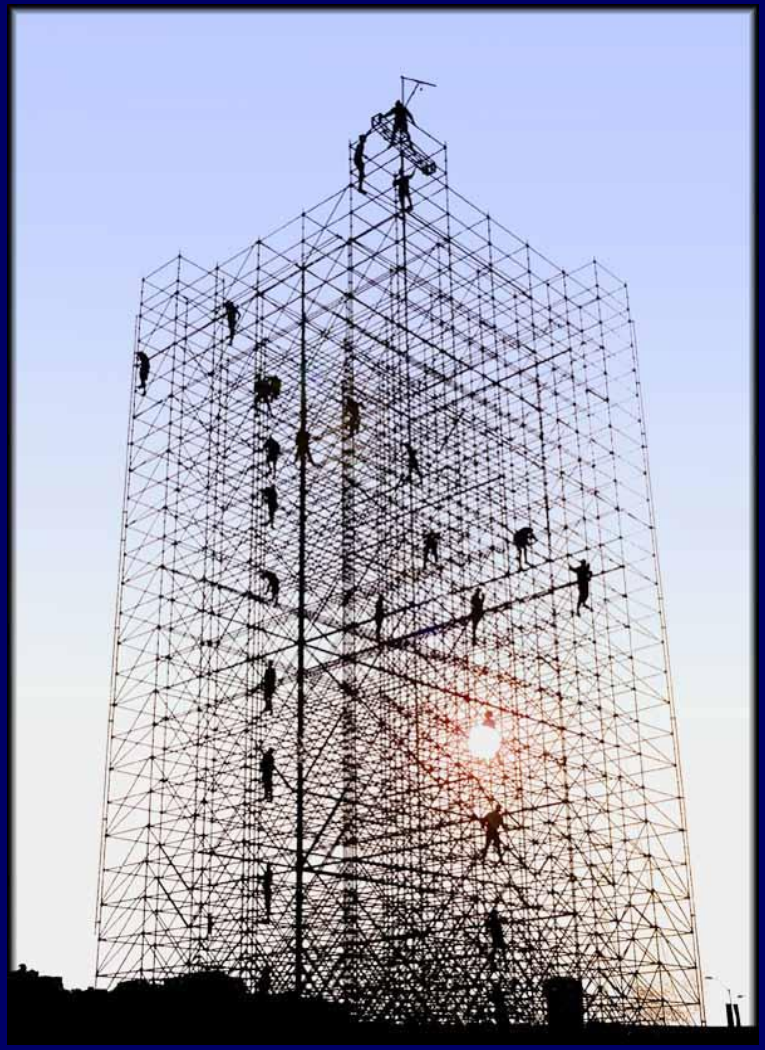
VASCO
(A member of Wing Yat Group)

Prefabricated Scaffolds (Modular System Scaffolding)

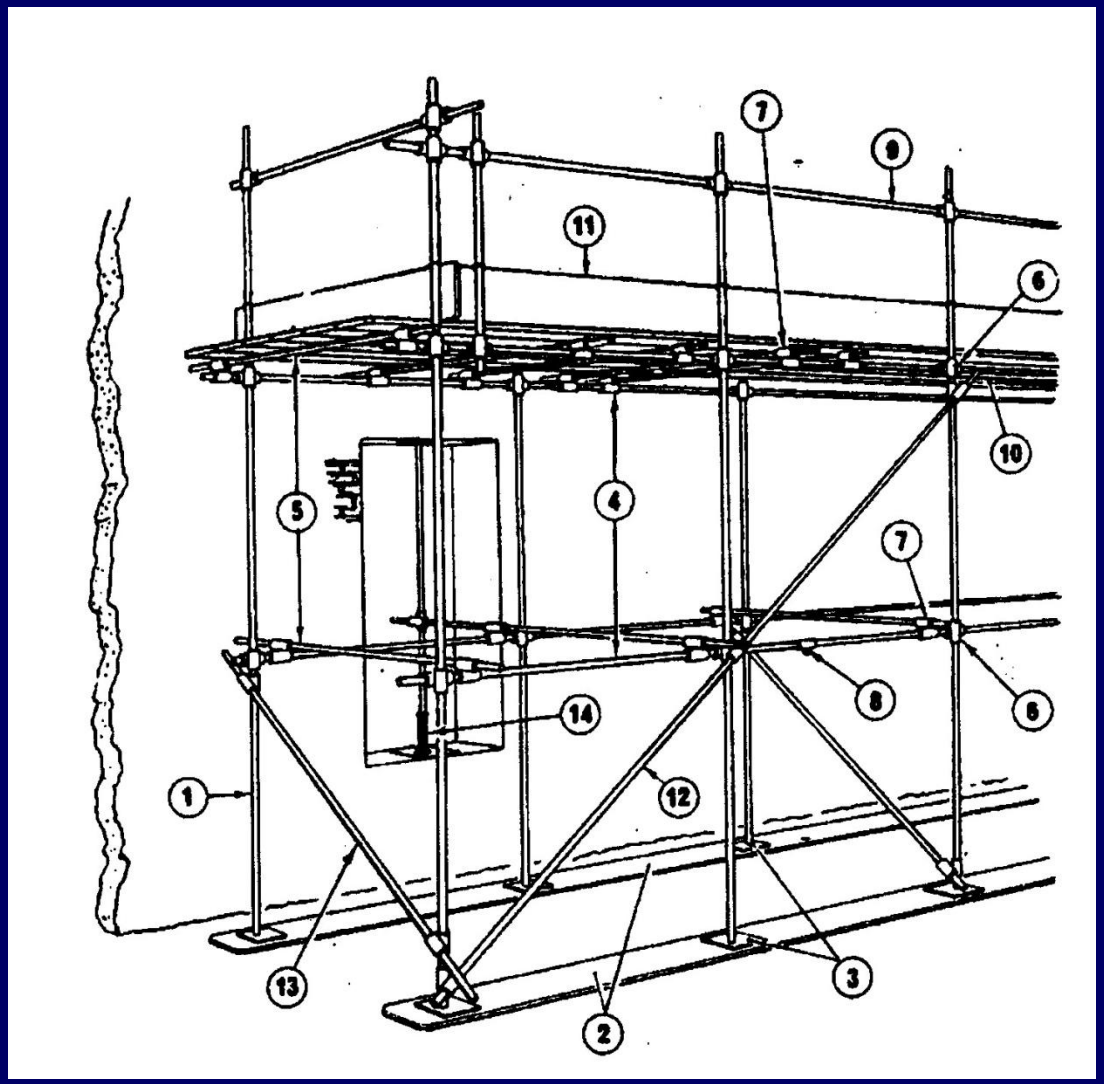
External Scaffolding

Stair Access Tower

Tubular Scaffolds (Tube & Coupler/Fitting)



Typical Component of Tubular Scaffolds

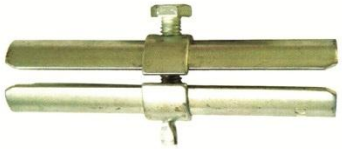


1. Standards
2. Sole-plates
3. Metal Base-plate
4. Ledgers
5. Transoms / Putlogs
6. Right Angle Coupler
7. Putlog Coupler
8. Joint Pin / Sleeve Coupler
9. Guardrail
10. Boarded Platform
11. Toe-board
12. Diagonal Bracing
13. Cross Bracing
14. Reveal Pin

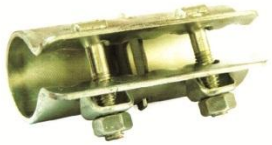
BS 1139 COUPLER / PIPE ACCESSORIES

Swivel Coupler (Forged)

Double Coupler (Forged)

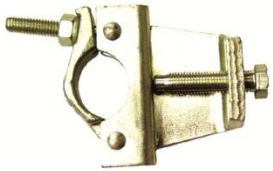


Expanding Joint Pin
Bone Joint



Sleeve Coupler

Putlog Coupler



Beam Clamp Fixed Coupler

G.I PIPE

Thickness 4.0mm B.S 1139

Thickness 2.4mm STK 500

Thickness 2.0mm JIS

VASCO
(A member of Weng Yat Group)

VASCO
(A member of Weng Yat Group)

FRAMEWORK ACCESSORIES

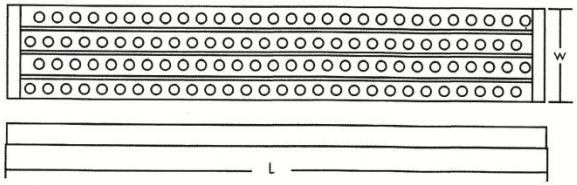
Tie Rod

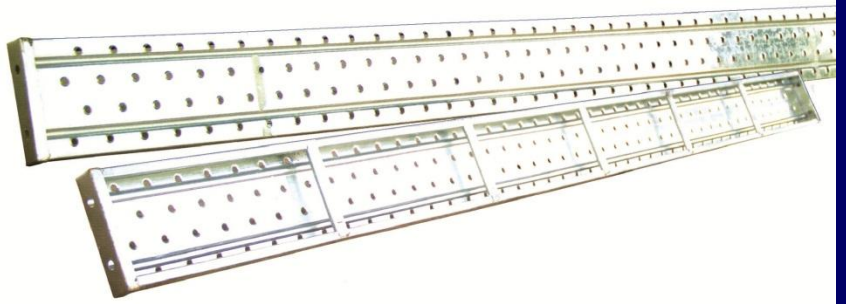
Wing Nut

METAL DECK

Sizes Available In Millimeter

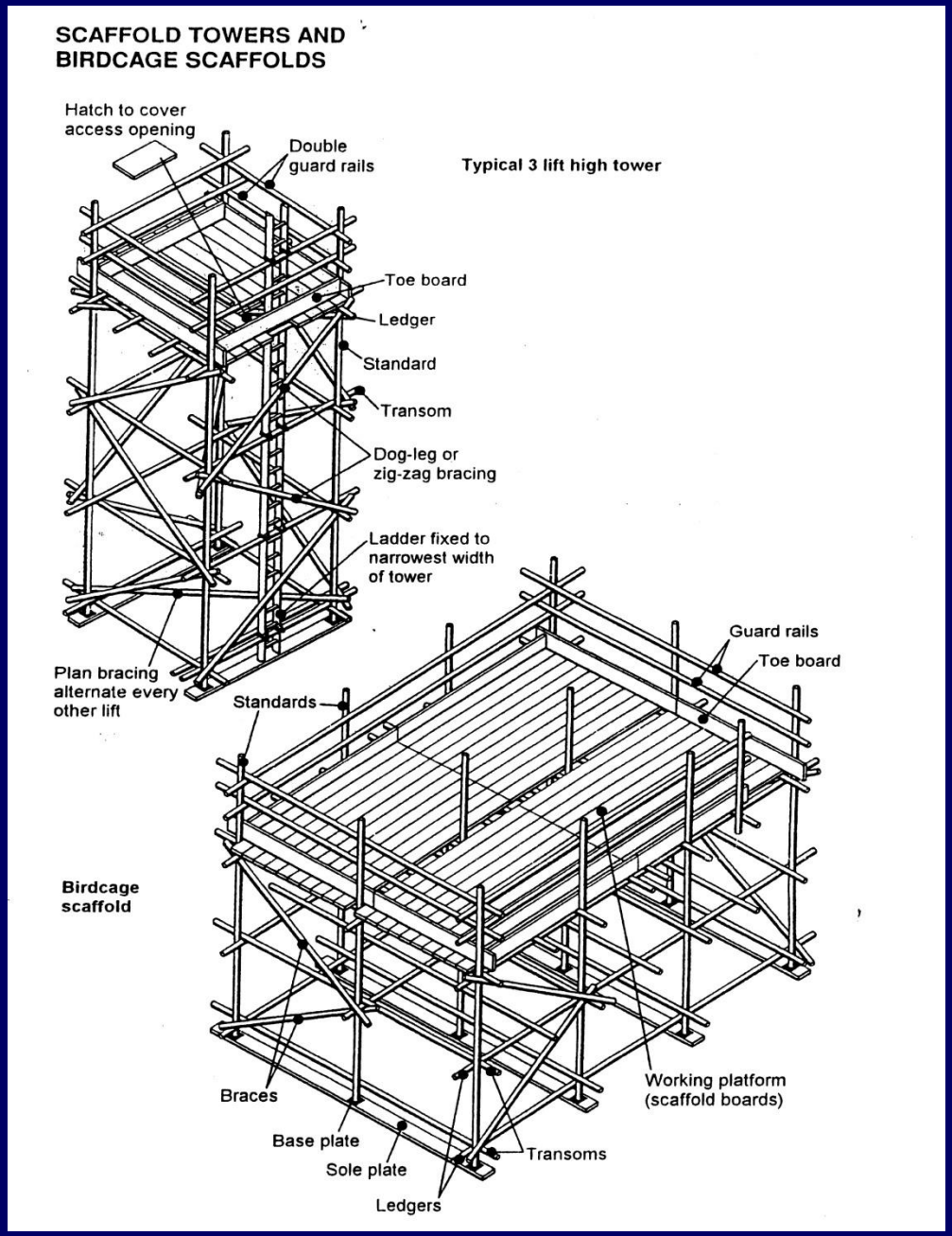
Width (mm)	Length (mm)			
210	1500	2000	3000	4000
240	1500	2000	3000	4000





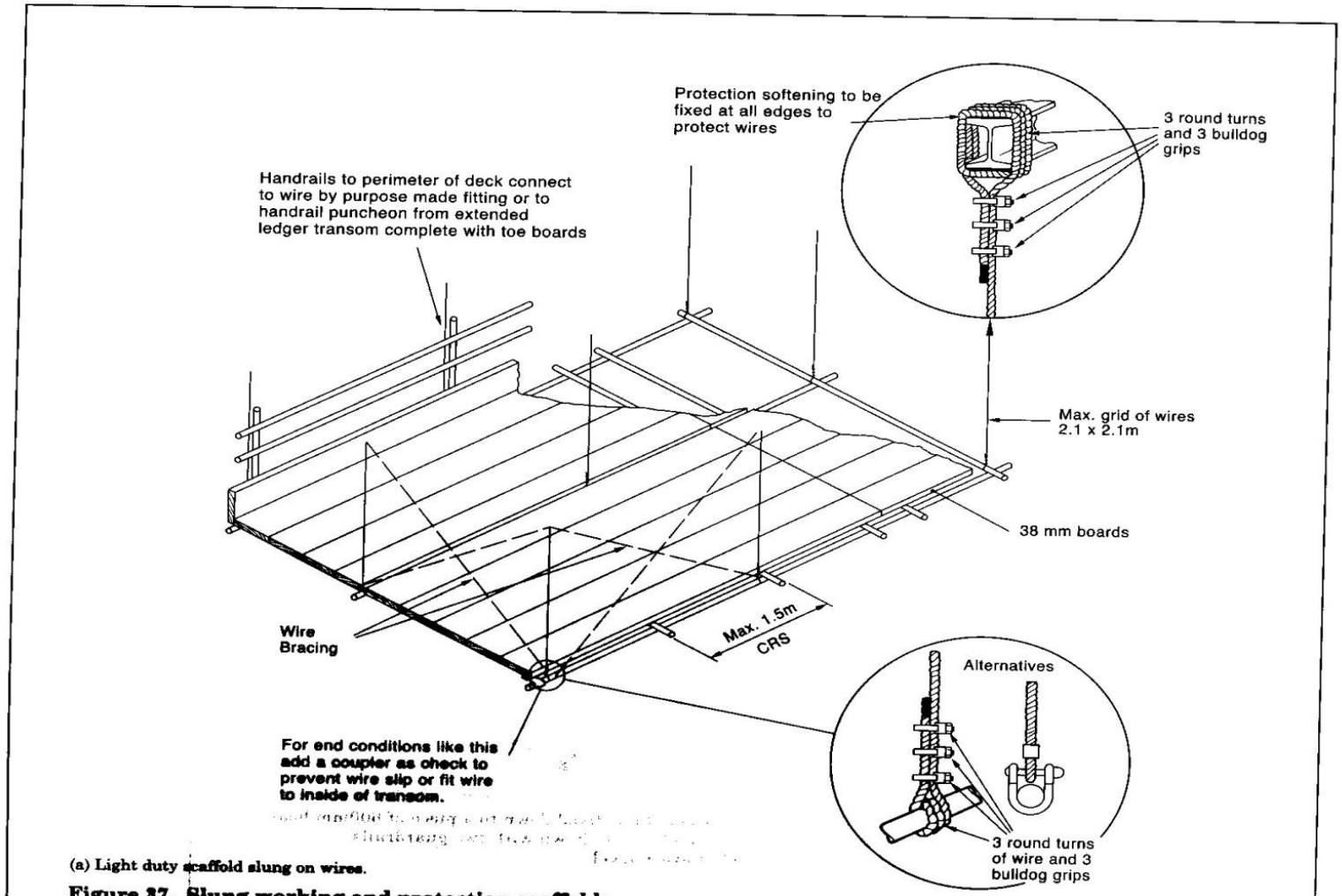
Categories of Scaffolds

1. Independent Scaffold
   - Birdcage scaffold
   - Tower scaffold (sheeted / unsheeted)
2. Putlog Scaffold / Single Pole Scaffold
3. Suspended / Slung (swing-stage) Scaffold
4. Hung Scaffold
5. Mobile Scaffold
6. Special Scaffold
   - Cantilever Scaffold
   - Hanging Bracket Scaffold
   - Spur Scaffold



Tower & Bird-cage Scaffold

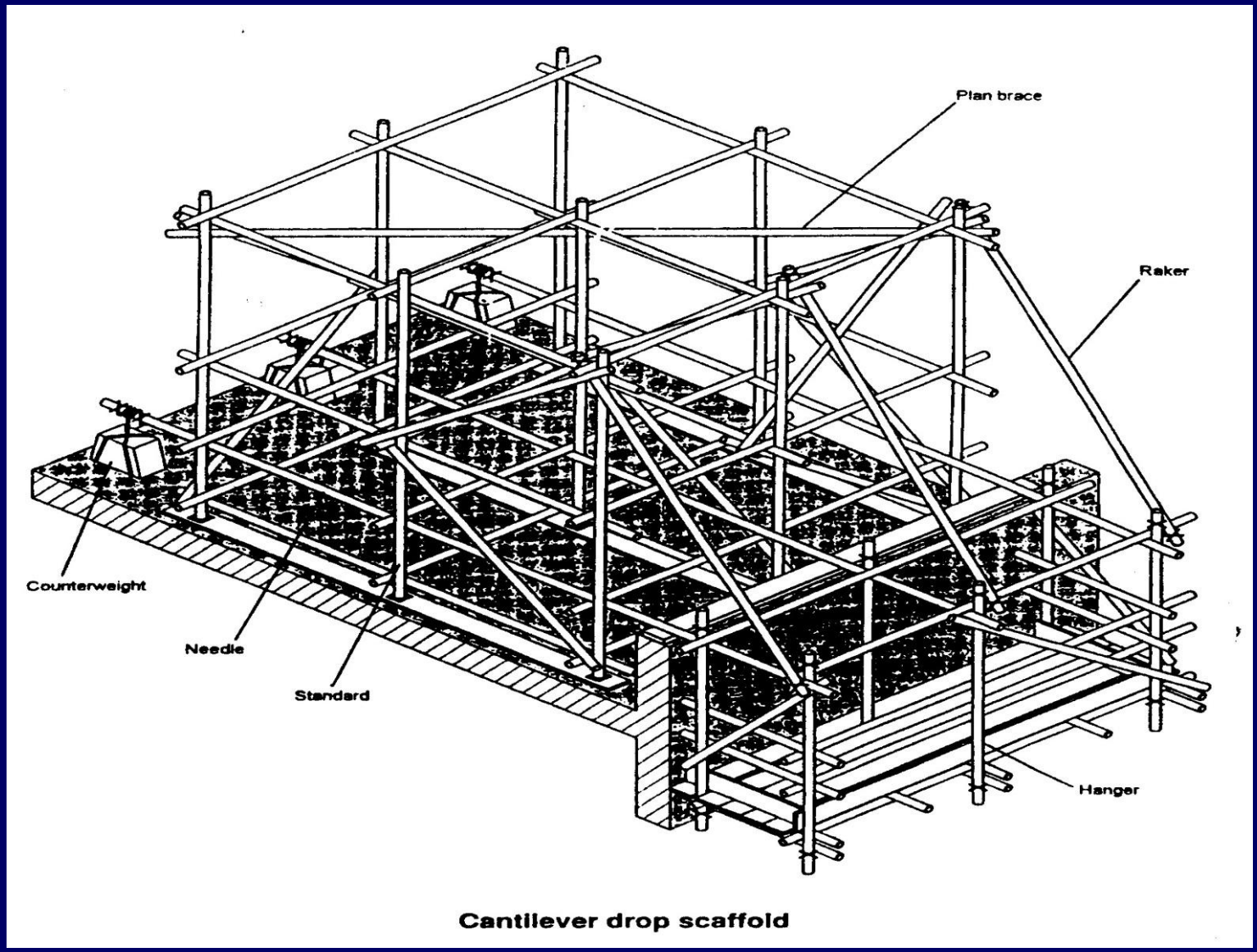
Slung Scaffold



(a) Light duty scaffold slung on wires.

Figure 37. Slung working and protection scaffolds

Cantilever Drop Scaffold



Cantilever drop scaffold

Hung Scaffold

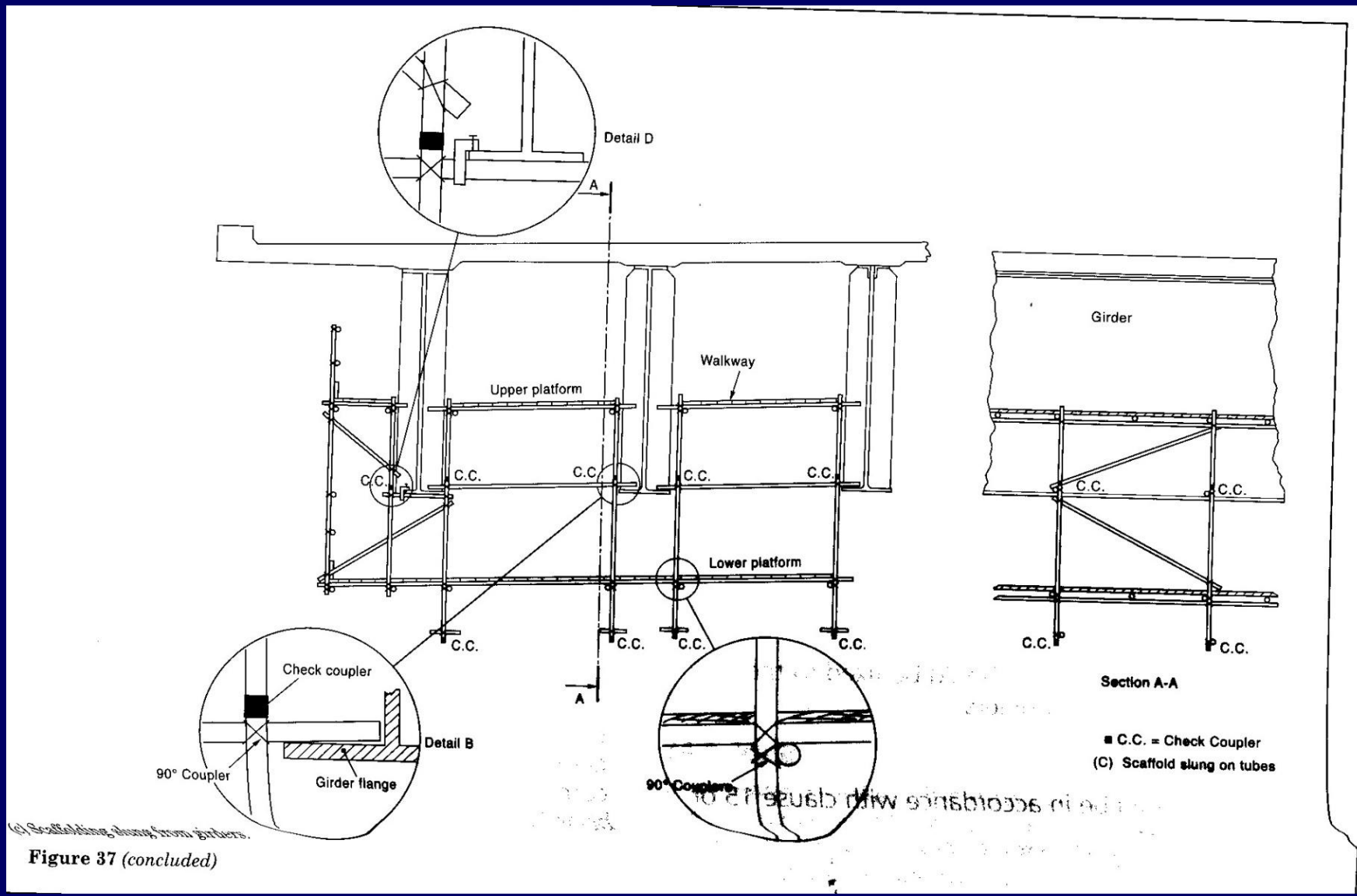
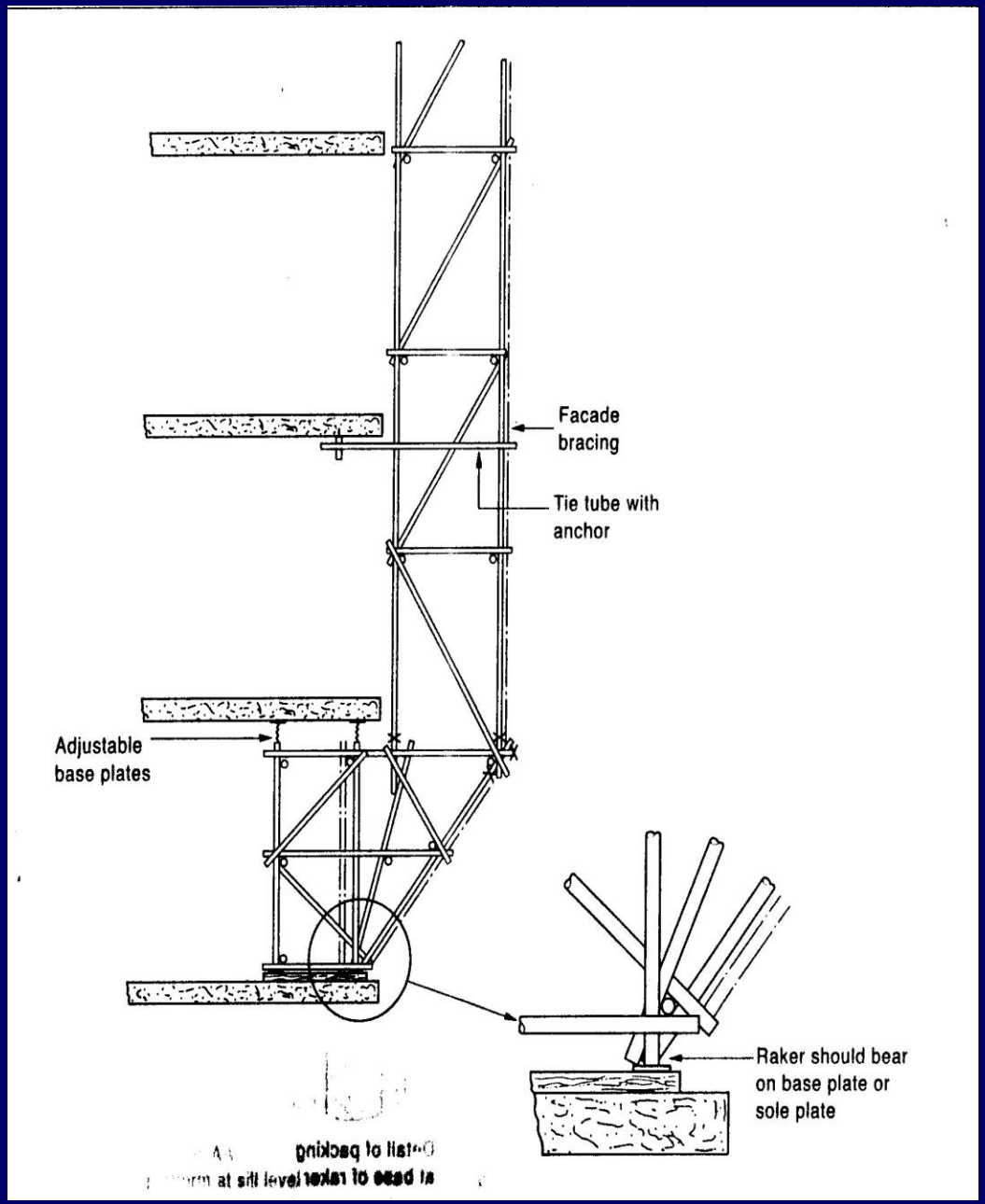
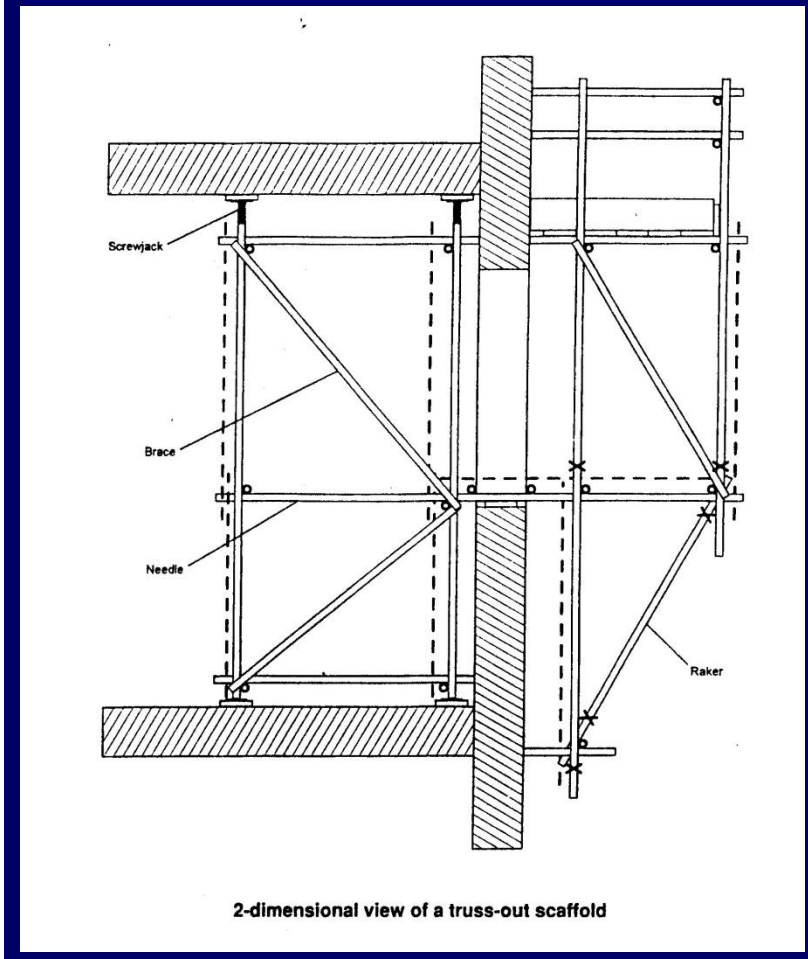


Figure 37 *(concluded)*

Truss-out / Cantilever Spur Scaffold





2-dimensional view of a truss-out scaffold

Standards and Acts

Currently, the design of scaffolding shall be complied with the following Standards & Acts:-

Malaysian Standards for the materials, specifications and design of scaffolding consists 6 standards and 13 parts as follows :-

- MS1462:Part 1:2012 – Prefabricated Scaffolds : Specification for steel frame scaffolding (revision of MS1462:1999)

- MS1462:Part 2-1:2010 – Tubular Scaffolds : Specification for steel tubes (reference BS EN 39)

- MS1462:Part 2-2:2010 – Tubular Scaffolds : Specification for aluminum tubes (reference BS 1139-1.2:1990)
- MS1462:Part 2-3:2011 – Tubular Scaffolds : Specification for steel & aluminum couplers, fitting and accessories (reference BS EN 74)
- MS1462:Part 3-1:2011 – Prefabricated Scaffolds : Specification for steel & aluminum modular system scaffolding (reference BS EN 12810-1:2003)
- MS1462:Part 3-2:2012 – Prefabricated Scaffolds : Particular Methods of Structural Design for steel & aluminum modular system scaffolding (reference BS EN 12810-2:2003)

- MS1462:Part 4-1:2013 – Temporary Works Equipment : Performance requirements and general design (reference BS EN 12811-1:2003)
- MS1462:Part 4-2:2013 – Temporary Works Equipment : Information of materials (reference BS EN 12811-2:2003)
- MS1462:Part 4-3 (TBA) – Temporary Works Equipment : Load testing (reference BS EN 12811-3:2003)
- MS1462:Part 5 (TBA)– Mobile Access and Working Tower made of Prefabricated elements: Materials, dimensions, design loads, safety and performance requirements (reference BS EN 1004:2004)

- MS1462:Part 6 (TBA) – Temporarily Installed Suspended Scaffolds and Access equipment (reference BS 5974:1990)

- Factories And Machinery Act 1967 (Act 139), Part X (Scaffolds)

MALAYSIAN STANDARD

MS 1462-1:2012

Metal scaffolding - Part 1: Prefabricated scaffolds - Specification for steel frame scaffolding
(First revision)

ICS: 93.080.30

Descriptors: steel frame scaffoldings, definitions, materials, dimensional requirements, physical testing

DEPARTMENT OF STANDARDS MALAYSIA

MS1462 : Part 1 (Table 2)

Table 2. Material quality, dimensions and tolerances for components of frame scaffoldings

Member	Component		Material quality	Dimensions (mm)		Tolerances	
				Outer diameter	Thickness	Outer diameter	Thickness
Vertical frame	Vertical post and horizontal member		STK 500 specified in JIS G3444 or equivalent	42.7	2.5	±0.25	±0.3
	Reinforcement member		STK 400 specified in JIS G3444 or equivalent	27.2	2.0		
	Cross brace pin		SS 400 specified in JIS G3101 or equivalent	14.0		±1.0	
Cross brace	Brace member		STK 400 specified in JIS G3444 or equivalent	21.7	2.0	±0.25	±0.3
	Hinge pin		SWRM 20 specified in JIS G3505 (Low carbon steel wire rods) or equivalent	7.5		±0.7	
Horizontal frame	Tube member		STK 500 specified in JIS G3444 or equivalent	42.7	2.5	±0.25	±0.3
	Arm or traverse member		STK 400 specified in JIS G3444 or equivalent	34.0	2.3		
	Clamp or hook		SS 400 specified in JIS G3101 or equivalent		8.0	-	±0.8
Catwalk or tread board	Catwalk member	Steel plate	SPHC specified in JIS G3131 or equivalent	500*	1.2	-	±0.1
	Clamp or hook		SS 400 specified in JIS G3101 or equivalent		8.0	-	±0.8
Adjustable base plate/ U-head	Threaded bar		SS 330 specified in JIS G3101 or equivalent	32**	-	-	-
	Plate for adjustable base plate		SS 330 specified in JIS G3101 or equivalent	120 x 120***	5.4***	-	-
	Plate for U-head		SS 330 specified in JIS G3101 or equivalent	150 x 120***	5.4***	-	-
	Adjusting nut		FCMB 310 specified in JIS G5702 (Blackheart malleable iron castings) or equivalent	-	-	-	-
Bracket	Vertical, lateral & diagonal members		SGP specified in JIS G3452 or SS 330 specified in JIS G3101 or equivalent	-	-	-	-
	Metal fittings	Bolt, nut & pin	SS 330 specified in JIS G3101 or equivalent	-	-	-	-
		Parts other than bolt, nut & pin	SPHD specified in JIS G3131 or equivalent	-	-	-	-
Wall tie	Principal member		SGP specified in JIS G3452 or SS 330 specified in JIS G3101 or equivalent	-	-	-	-
	Gripper metal fittings	Bolt, nut & pin	SS 330 specified in JIS G3101 or equivalent	-	-	-	-
		Parts other than bolt, nut & pin	SPHD specified in JIS G3131 or equivalent	-	-	-	-
	Metal fittings		SS 400 specified in JIS G3101 or equivalent	-	-	-	-

MS1462 : Part 1 (Table 2)

Member	Component		Material quality	Dimensions (mm)		Tolerances	
				Outer diameter	Thickness	Outer diameter	Thickness
Joint pin	Tenon		SGP specified in JIS G3452 or equivalent	95†	2.2	-	-
	Collar			25†		-	-
Arm lock			SS 330 specified in JIS G3101 or equivalent	38 (plate width)	3.1 (plate thickness)	-	±0.3
Global bracing system	Diagonal and horizontal brace		STK 500 specified in JIS G3444 or equivalent	48.6	2.5	±0.25	±0.3
	Clamp or fitting	Body and cover	SPHD specified in JIS G 3131	42.7~48.6	3***	±1.0	-
		Bolt, nut and pin	**SS330** specified in JIS G 3101	12**	-	-	-
Side protection/ Guard rail	Tube member		STK 500 specified in JIS G3444 or equivalent	48.6	2.5	±0.25	±0.3
	Clamp or fitting	Body and cover	SPHD specified in JIS G 3131	42.7~48.6	3***	±1.0	-
		Bolt, nut and pin	**SS330** specified in JIS G 3101	12**	-	-	-
Toe board	Board Member	**lipped channel**	SPHC specified in JIS G 3131 or equivalent	150*	1.2	-	±0.1

* Minimum width
**... Minimum diameter
*** Minimum dimension
† Minimum length

MS1462 : Part 1 (Table 3)

Table 3. Load test requirements for the components of a frame scaffolding system

Component	Load test requirements *)	Method of test
Vertical frame	*Vertical deflection of horizontal tube* For any size of frame, the vertical deflection under a load of 9.8 kN shall not exceed 10mm.	Annex E1
	Compressive strength of vertical tubes Height of frame: 1800mm or lower — Average (kN): 78.5 minimum — Individual frame (kN): 73.5 minimum Height of frame: Exceeding 1800mm — Average (kN): 73.5 minimum — Individual frame (kN): 68.6 minimum	Annex E2
Cross brace	*Compressive strength* — Average : 8.0 kN; Individual : 7.3 kN	Annex F
Horizontal frame	*Deflection and bending strength* 1) The vertical deflection of any individual sample shall not exceed 10mm 2) Bending strength — Average : 5.4 kN; Individual : 4.9 kN	Annex G1
	Shearing strength of clamp (hook) — Average : 19.6 kN; Individual : 17.6 kN	Annex G2
Catwalk (treadboard)	*Deflection and bending strength* 1) The vertical deflection of any individual sample shall not exceed 10mm 2) Bending strength Average : (width of catwalk in mm x 0.0108)kN minimum Individual : (width of catwalk in mm x 0.0098)kN minimum	Annex H1
	Shearing strength of clamp (hook) — Average : (width of catwalk in mm x 0.0392)kN minimum; Individual : (width of catwalk in mm x 0.0353)kN minimum	Annex H2
	Deflection and 'punching' strength of expended metal 1) The vertical deflection of an individual sample shall not exceed 10 mm.	Annex H3
	2) 'Punching' strength — Average : (width of catwalk in mm x 0.0108)kN minimum; Individual : (width of catwalk in mm x 0.0098)kN minimum	
Adjustable base plate/ U-head	*Proof load test* When tested under a load of 59.8 kN, it shall not show any sign of distortion and the function shall not be impaired.	Annex J
Arm lock	The elongation of any sample shall not exceed 2 mm. Maximum load — Average : 6.3 kN minimum; Individual : 5.9 kN minimum	Annex K
Wall tie	Average : 9.8 kN minimum for both tensile and compressive loads. Individual : 8.8 kN minimum for both tensile and compressive loads.	Annex L
Bracket	*Slip test* 1) For all types of brackets, no sample shall show a slip of more than 10mm. 2) Strength tests 2.1 Fixed type — Average : 44.1 kN minimum; Individual : 39.2 kN minimum 2.2 Adjustable type — Average : 25.5 kN minimum; Individual : 22.7 kN minimum	Annex M
Cross brace pin	Strength — Average : 6.3 kN minimum; Individual : 5.9 kN minimum	Annex N

*) 1 N = (1/9.8) kgf

MS1462 : Part 1 (Figure 3)

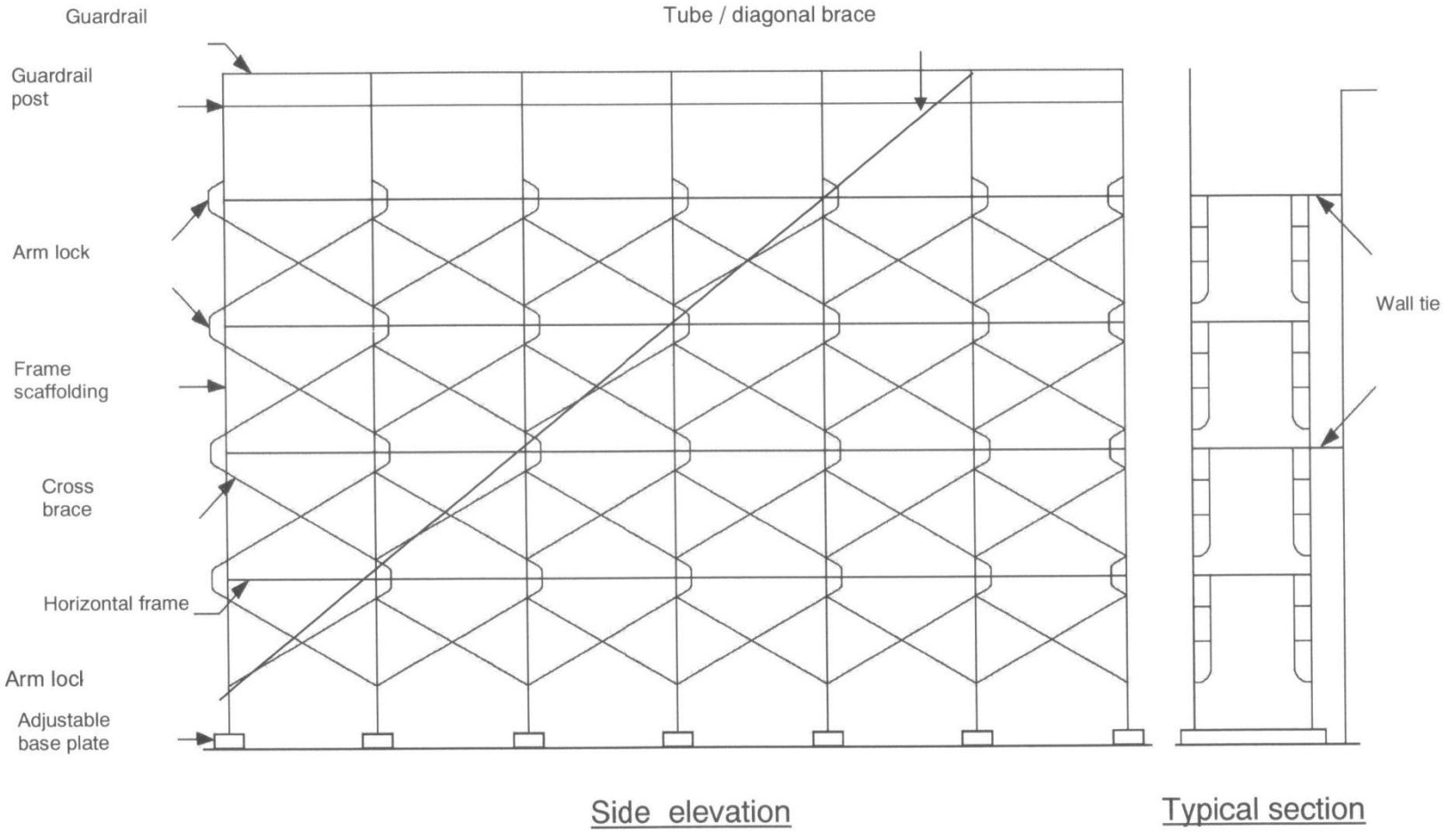
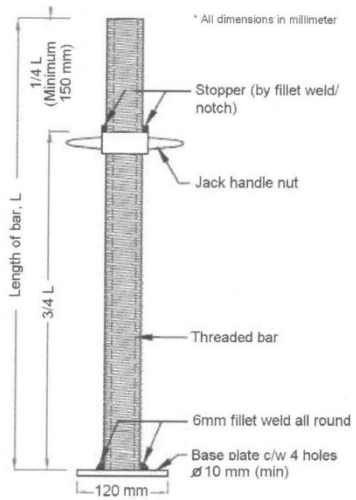
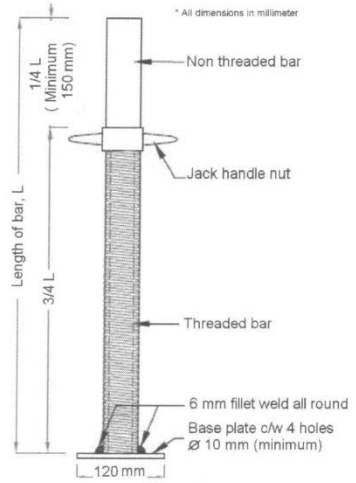


Figure 3. Typical frame scaffolding layout

MS1462 : Part 1 (Figure 4)



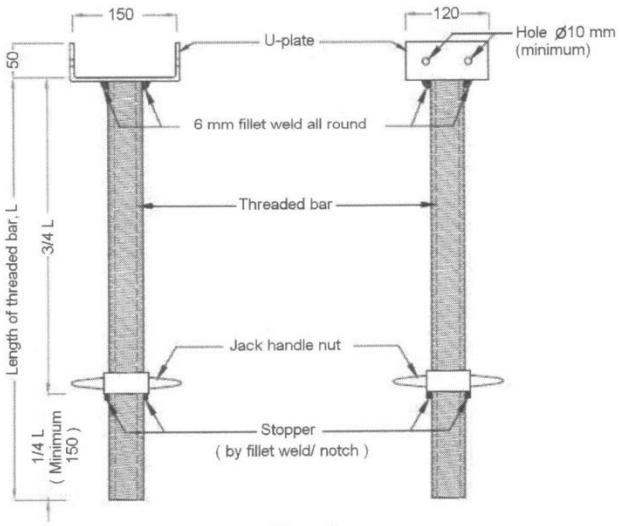
Type 1



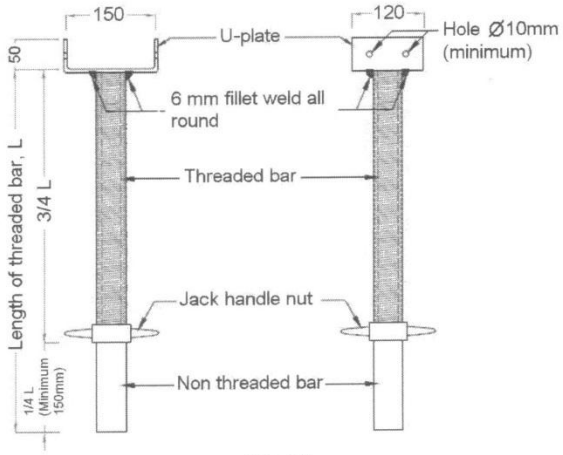
Type 2

Figure 4. Adjustable base plate

MS1462 : Part 1 (Figure 5)



Type 1



Type 2

Figure 5. Types of U-head

MS1462 : Part 1 (Figure 6)

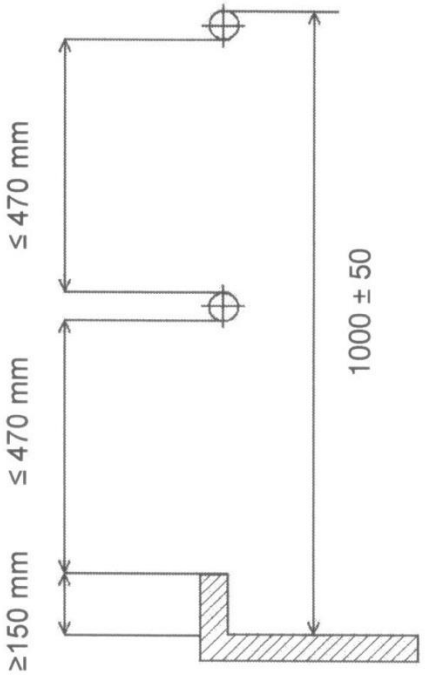


Figure 6. Side protection/guard rail and toe board

MS1462 : Part 1 (Clause 9)

9 Used and refurbished frame scaffolding system

9.1 Frame scaffolding component

The frame scaffolding components should be well maintained and free of appreciative corrosion, crack, dent and bend.

9.2 Methods of maintenance and repair

The methods of maintenance and repair of refurbished or used frame scaffolding components are as follows:

a) the external surface of any part of the components should be well protected by hot-dipped galvanized or painted. If the external surface has been corroded or rusted, the external surface protection should be re-do according to Clause 7;

b) if any crack on the welding has been found on any part of the components, it should be re-welded according to Clause 8; and

c) if any part of the components has been bended or dented, they should be re-aligned to original straightness of the components according to Clause 7.4, MS 1462-2-1.

9.3 Inspection of refurbished and used frame scaffolding

Samples of refurbished or used frame scaffolding components at a site should be well inspected and their conditions recorded by a qualified personnel or competent scaffolder according to Table 2, Clause 9.1 and Clause 9.2. An inspection report for maintenance and repair should be kept.

9.4 Compliance of refurbished and used frame scaffolding

The refurbished or used frame scaffolding components should be tested and should comply with the requirements according to Clause 4. The selection of sample for testing and sample size or frequencies should be decided by the relevant authority.

Design Requirements

As stated in the Factory & Machinery Act, the design and drawings of scaffolding shall be endorsed by a Professional Engineer for the following conditions :-

1. Height of tubular scaffolding (Tube & Couplers) exceeding 40m.
2. Height of other type of scaffolding (Frame / Modular System Scaffold) exceeding 15m.

Factor of Safety

According to the Factories And Machinery Act 1967 (Act 139), Part X (Scaffolds):-

Factor of Safety for designing of scaffolding is 4.0

Work at Site
i) Erection & Dismantling

The erection, alteration (modification) and dismantling of scaffolding should be performed by qualified/competent scaffolders (registered with the Department of Occupational Safety and Health – DOSH/JKKP).

ii) Inspection

All completed scaffolding structure must be inspected by the qualified/competent scaffolder prior to the usage of the scaffolding.

The result of inspection should be recorded in writing (checklist) and kept properly. Action shall be taken to correct any faults of scaffolding structure.

Appendix A

SCAFFOLD CHECKLIST

Inspection No. : _____ Date : _____ Time : _____

Contractor : _____

Project & Add. : _____

Location : _____Area : _____Drawing No. : _____

No	Description	Yes	No	Remark
1	FOUNDATION			
	a) Scaffold erected on firm ground			
	b) Ground properly compacted			
	c) Scaffold not endangered by open excavation			
2	SOLE PLATES			
	a) Proper sole plates used			
3	BASE PLATES			
	a) Base plates are fitted to all standards			
4	ALLIGNMENT OF SCAFFOLD			
	a) Standards or frames vertical			
	b) Ledgers and transoms levelled			
5	SCAFFOLD COMPONENT CONNECTION			
	a) Connections are tightened and secured			
6	BRACING			
	a) Braces are tightened and secured			
7	WALL TIE			
	a) Wall Tie placed in position as per drawing.			
8	WORKING PLATFROM			
	a) Working platforms are secured or locked			
9	LADDER			
	a) Ladders are securely attached to the scaffold			
10	GUARD-RAIL			
	a) Guard-rails are fixed and secured			

General comments:

Inspected by :

Name :
Position :

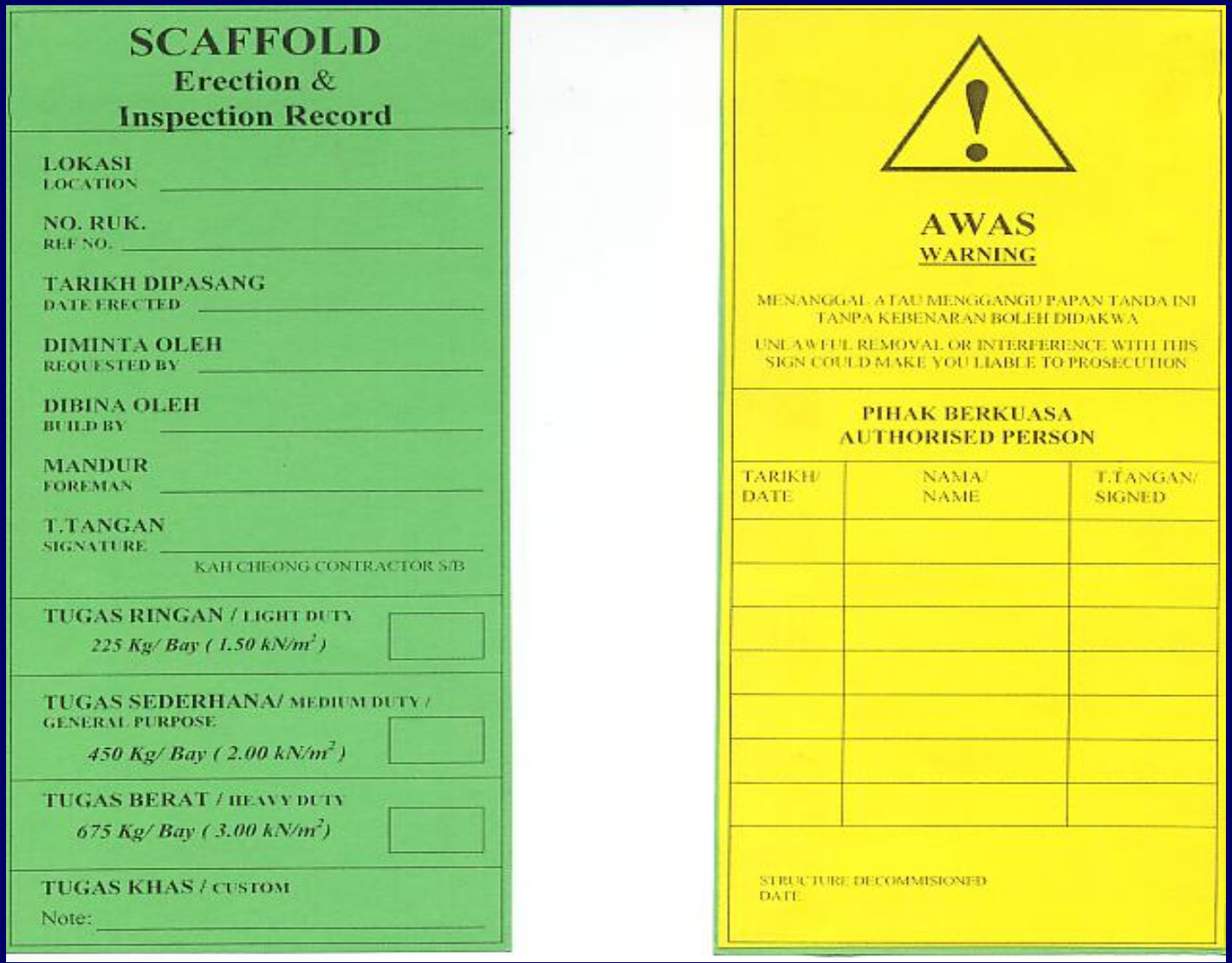
Received by :

Name :
Position :

Scaffolding Tag

- Green Tag
  - Inspected and certified safe to use
  - Contain information related to scaffolding: Duty Type of Working Platform
- Red Tag
  - Prohibited to use
  - Display when first start erection
  - During alteration and dismantling
  - When scaffold is unsafe to use

Sample of Green Tag



SCAFFOLD
Erection &
Inspection Record

LOKASI
LOCATION _____

NO. RUK.
REF NO. _____

TARIKH DIPASANG
DATE ERECTED _____

DIMINTA OLEH
REQUESTED BY _____

DIBINA OLEH
BUILD BY _____

MANDUR
FOREMAN _____

T.TANGAN
SIGNATURE _____

KAH CHEONG CONTRACTOR S/B

TUGAS RINGAN / LIGHT DUTY ☐
225 Kg/ Bay (1.50 kN/m^2)

TUGAS SEDERHANA/ MEDIUM DUTY / GENERAL PURPOSE ☐
450 Kg/ Bay (2.00 kN/m^2)

TUGAS BERAT / HEAVY DUTY ☐
675 Kg/ Bay (3.00 kN/m^2)

TUGAS KHAS / CUSTOM
Note: _____

AWAS
WARNING

MENANGGAL A TAU MENGGANGU PAPAN TANDA INI TANPA KEBENARAN BOLEH DIDAKWA

UNLAWFUL REMOVAL OR INTERFERENCE WITH THIS SIGN COULD MAKE YOU LIABLE TO PROSECUTION

PIHAK BERKUASA
AUTHORISED PERSON

TARIKH/ DATE	NAMA/ NAME	T.TANGAN/ SIGNED

STRUCTURE DECOMMISIONED
DATE

Sample of Red Tag

As mentioned in the Factory & Machinery Act, any scaffold shall be inspected as follows:

1. Seven (7) days after previous / last inspection.
2. Any alteration/modification of scaffolding.
3. Exposure to bad weather conditions.

To avoid any failure during dismantling of scaffolding, the following precaution should be observed :-

- do not remove all the ties
- do not remove all the bracing first
- do not remove all the intermediate and end transoms
- do not remove all intermediate guardrails


THE END
THANK YOU