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**VOLUME 5 CONTRACT DOCUMENTS  
FOR SPECIALIST  
ACTIVITIES**

**SECTION 7 MECHANICAL AND  
ELECTRICAL  
INSTALLATIONS IN  
ROAD TUNNELS,  
MOVABLE BRIDGES AND  
BRIDGE ACCESS  
GANTRIES**

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**PART 4**

**METHOD OF MEASUREMENT AND  
BILLS OF QUANTITIES FOR  
MECHANICAL AND ELECTRICAL  
WORKS IN ROAD TUNNELS, MOVABLE  
BRIDGES AND BRIDGE ACCESS  
GANTRIES**

**SUMMARY**

This Section of Volume 5 of the Manual of Contract Documents for Highway Works covers the procedural, contractual and technical requirements for the mechanical and electrical installations for road tunnels, moveable bridges and bridge access gantries. Part 4 covers Method of Measurement and Bills of Quantities for Mechanical and Electrical Works in Road Tunnels, Movable Bridges and Bridge Access Gantries

**INSTRUCTIONS FOR USE**

1. Insert Part 4 into Volume 5 Section 7.
2. Archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from the Stationery Office Ltd.

**MANUAL OF CONTRACT DOCUMENTS FOR  
HIGHWAY WORKS**



**THE HIGHWAYS AGENCY**



**THE SCOTTISH OFFICE DEVELOPMENT DEPARTMENT**



**THE WELSH OFFICE  
Y SWYDDFA GYMREIG**



**THE DEPARTMENT OF THE ENVIRONMENT FOR  
NORTHERN IRELAND**

**Mechanical and electrical  
installations in road tunnels,  
movable bridges and bridge  
access gantries**

**Part 4: Method of Measurement  
and Bills of Quantities for  
Mechanical and Electrical Works  
in Road Tunnels, Movable Bridges  
and Bridges Access Gantries**

REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

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1.    Method of measurement for M&E works
2.    Preambles of Bill of Quantities

# METHOD OF MEASUREMENT FOR M&E WORKS

## Definitions

1 In this document entitled Method of Measurement for Mechanical and Electrical Installations in Road Tunnels, Movable Bridges and Access Gantries (hereinafter referred to as 'the Method of Measurement for M&E Works') unless the context otherwise requires, the following words and expressions shall have the meanings hereby respectively assigned to them, that is to say:

- (a) 'Conditions of Contract' means the Conditions of Contract referred to in the Tender;
- (b) words and expressions to which meanings are assigned in the Conditions of Contract have the same meanings in the Method of Measurement for M&E Works;
- (c) words and expressions to which meanings are assigned in the Specification and Drawings referred to in the Conditions of Contract have the same meanings in the Method of Measurement for M&E Works;
- (d) 'Bill of Quantities' means a list of items giving brief identifying descriptions and estimated quantities of work comprised in the execution of the works to be performed;
- (e) items designated 'Provisional' are items for which the quantities of work to be executed cannot be determined with the same degree of accuracy as other items but for which it is deemed necessary to make provision;
- (f) 'Preliminary Item' means an item in respect of works, general obligations and risks antecedent to or involved in the execution of the Contract and which is set out in a 'Preliminaries' section of the Bill of Quantities.

## General Principles

### Method of Measurement

- 2(a) The Method of Measurement for M&E Works is intended for use on contracts for the detailed design, supply, installation, testing and commissioning of mechanical and electrical installations, in road tunnels, movable bridges and bridge access gantries, based on the Model Form of General Conditions of Contract recommended by the Institution of Mechanical Engineers, the Institution of Electrical Engineers and the Association of Consulting Engineers for use in connection with Home or Overseas Contracts - with erection, 1988 Edition (Reprinted in 1992 - with 1989 and 1992 Editorial Amendments) and commonly known as MF/1, and MF/1 Amendments List April 1993, all modified and added to as set out in the Conditions of Contract included in the Model Contract Document for Mechanical and Electrical Installations in Road Tunnels, Movable Bridges and Access Gantries published as Part 1, Section 7 of Volume 5 of the Manual of Contract Documents for Highway Works.
- (b) The Method of Measurement for M&E Works is intended for use in conjunction with the Specification for Mechanical and Electrical Installations in Road Tunnels, Movable Bridges and Access Gantries published as Part 2 Series 700, 7100, 7200 and 7300, Section 7 of Volume 5 of the Manual of Contract Documents for Highway Works (hereinafter referred to as 'the Specification' as defined in the 'Conditions of Contract').
- (c) Where the Contract provides for preliminaries, site clearance and ancillary elements of civil engineering works such parts of the Works shall be separately measured in accordance with the Method of Measurement for Highway Works published as Volume 4 of the Manual of Contract Documents for Highway Works.

**Bill of Quantities**

- 3(a) In the Bill of Quantities the sub-headings and item descriptions identify the work to be executed. The nature and extent of the work to be performed is to be ascertained by reference to the Drawings, Specification and Conditions of Contract.
- (b) Prime Cost Items included in the Bill of Quantities for work to be executed or goods, materials or services to be supplied by a Named Sub-Contractor shall be followed by a separate item for all costs in connection therewith in the form of a percentage.
- (c) The Bill of Quantities shall identify work in the contract to be executed as new construction or refurbishment in the following locations:
- (i) within Tunnels;
  - (ii) on Approaches to Tunnels;
  - (iii) within Plant rooms;
  - (iv) on Movable Bridges;
  - (v) on Access Gantries;
  - (vi) over water.

**Preparation of Bill of Quantities**

**Method of Measurement for M&E Works**

4 The Works in the Contract specified in accordance with the Specification for Mechanical and Electrical Installations in Road Tunnels, Movable Bridges and Access Gantries published as Part 2 Series 7000, 7100, 7200 and 7300, Section 7 of Volume 5 of the Manual of Contract Documents for Highway Works shall be measured in accordance with Work Section Y 'Mechanical and electrical services measurement' in the Standard Method of Measurement of Building Works, Seventh Edition, 1988 (Reprinted 1989), including Amendment N° 3 dated May 1992, as authorised by agreement with the Royal Institution of Chartered Surveyors and the Building Employers Confederation and commonly known as SMM7, and referred to herein as the 'Method of Measurement for M&E Works'.

**Method of Measurement for Highway Works**

5 Preliminaries, site clearance and ancillary elements of civil engineering works specified in accordance with the Specification for Highway Works published as Volume 1 of the Manual of Contract Documents for Highway Works, when required by the Contract shall be measured in accordance with the Method of Measurement for Highway Works published as Volume 4 of the Manual of Contract Documents for Highway Works.

**Qualifications to the Use of SMM7**

6 The use of the 'General rules' in SMM7 shall be read in the context of mechanical and electrical installations in road tunnels, movable bridges and access gantries and shall be specifically subject to the following qualifications:

- (a) Delete the final sentence in Paragraph 2.6;
- (b) Delete Paragraph 4.6;
- (c) In Paragraph 6.1 delete '... to a catalogue or';
- (d) Delete Paragraph 7 in its entirety;
- (e) In Paragraph 10.1 replace '... an approximate quantity.' with '... a Provisional Sum.';
- (f) Delete Paragraphs 10.2 to 10.6 inclusive;
- (g) In Paragraph 11.1 replace '... a bill of quantities.' with '... the Preambles to the Bill of Quantities'.

**Sub-division of Bill of Quantities**

7 The Bill of Quantities shall be structured so that those items covered by the Method of Measurement for Highway Works shall precede those items covered by the Method of Measurement for M&E Works. The Bill of Quantities shall be further divided into new construction and refurbishment and under each of these 'headings' sub-divided into items at the following locations:-

- (i) within Tunnels;
- (ii) on Approach to Tunnels;
- (iii) within Plant rooms;

- (iv) on Movable Bridges;
- (v) on Access Gantries;
- (vi) over water.

### **Price Fluctuation Provisions**

8 Where the Contract provides for Price Fluctuation Provisions these provisions shall apply only to items measured under the Method of Measurement for M&E Works. The Price Fluctuation Provisions consist of Formula 1 and Formula 2 which are to be applied to the 'Supply and deliver' and 'Take delivery and install' parts respectively of each item of work. Consequently this part of the Bill of Quantities shall be divided into two sections under the headings 'Supply and deliver' and 'Take delivery and install' and the same item of work shall be billed under both of these sections. Both Formula 1 and Formula 2 vary depending upon whether the item of work is a 'Mechanical Engineering Item' or an 'Electrical Engineering Item' and in addition there is a variant of Formula 1 where the item contains a significant quantity of stainless steel. The compiler shall categorise each item of work as being a Mechanical or Electrical Engineering item using the Standard Industrial Classification prepared by the Central Statistical office published by HMSO, identify the items of work which contain a significant quantity of stainless steel and using this information complete the table in Paragraph 13 of the Preambles to Bill of Quantities prior to tender.

### **Preambles to Bill of Quantities**

9 The matters set out under the heading 'Preambles to Bill of Quantities' (Paragraphs 1-12) hereafter are always to be included as a preamble to the Bills of Quantities. Paragraph 13 shall only appear in the Preambles to the Bill of Quantities where the contract provides for Price Fluctuation Provisions. Additional numbered preambles may be included on a contract specific basis as necessary.

### **Sample Bill of Quantities**

10 To assist the compiler with the format required for the Bill of Quantities six sample Bill of Quantities pages follow immediately hereafter. Sample Bill of Quantities Page N<sup>o</sup>s 5 and 6 illustrate the format required where the Contract provides for Price Fluctuation Provisions.



Sample Bill of Quantities Page N° 1

New Construction

Location: within tunnel

V Electrical supply/power lighting systems

Item	Description	Qty	Unit	Rate	£	p
	<b>V21 General Lighting</b>					
	<u>Y60 Conduit and cable trunking</u>					
A	Straight 50mm x 100mm stainless steel cable trunking fixed to soffit of roof slab at 1m centres as Specification Clause 'X'.		M			
	<u>Y61 HV/LV cables and wiring</u>					
B	Cable for emergency lighting final circuits using 750 volt heavy duty MICC cable with LSF over sheath drawn into trunking.		M			
	<u>Y73 Luminaires and lamps</u>					
C	Type A1 twin high pressure sodium luminaire with symmetrical light distribution, fixed to suspension system and complete with control gear for switching lamps independently.		Nr			
D	150W SONXL-T lamp to suit Type A1 luminaire.		Nr			

Thames Tunnel M&E Contract

To Collection £

Sample Bill of Quantities Page N° 2

New Construction

Location : on approaches to tunnel

W Communications/security/control systems

Item	Description	Qty	Unit	Rate	£	p
A	<p><b>V21 General Lighting</b> <u>Photometer</u></p> <p>Lighting control photometer in IP65 housing, mounted on a steel column and associated equipment as Specification Clause 'X' on Westbound Approach.</p> <p><b>W20 Radio/TV/CCTV</b></p> <p><u>Radiating Cables</u></p>		Nr			
B	<p>Primary radiating cables on stand-off pillars as Specification Clause 'X' fixed to brickwork cladding within 50m of tunnel portal as shown on Drawing Number 'X' on Eastbound Approach.</p>		M			
Thames Tunnel M&E Contract		To collection £				

Sample Bill of Quantities Page N° 3

New Construction

Location : in plant rooms

U Ventilation/Air conditioning systems

Item	Description	Qty	Unit	Rate	£	p
	<b>U10 General supply/extract</b>					
	<u>Y30 Air ductlines</u>					
	Rectangular straight ducting in galvanised sheet steel as Specification Clause 'X', complete with galvanised steel strap supports fixed at 1.5m centres into blockwork in Radio Room.					
A	400 x 200		M			
B	150 x 100		M			
	<u>Y40-Y46 General air ductline equipment</u>					
C	Extract air fan Type E F1 as Specification Clause 'X', duct mounted, flexible connections and anti-vibration mountings in Radio Room.		Nr			
	<u>Y50 Thermal Insulation</u>					
D	50mm thick mineral wool insulation, reinforced foil faced, vapour seal, banded at 300mm centres, finished with 0.8mm thick aluminium around rectangular 400mm x 200mm air ductline in Pump Control Room.		M			
<b>Thames Tunnel M&amp;E Contract</b>				<b>To collection £</b>		

Sample Bill of Quantities Page N° 4

New Construction

Location : on movable bridge

S Piped Supply Systems

Item	Description	Qty	Unit	Rate	£	p
	<b>S72 Hydraulic</b>					
	<u>Y10 Pipelines</u>					
	Hydraulic pipework; stainless steel seamless tube; welded flange fittings as Specification Clause 'X'.					
A	50mm dia straight pipes		M			
B	Extra; made bend to 50mm dia pipe		Nr			
C	Extra; reducing tee, 50 x 25mm		Nr			
D	Extra; flanges, welded to pipe		Nr			
E	Extra; flanged joints, nuts, bolts, washers, and joint rings		Nr			
	<u>Y11 Pipeline Ancillaries</u>					
F	Directional control valves 50mm dia		Nr			
G	Rotary actuators, vane type 50mm dia		Nr			
	<u>Y20 Pumps</u>					
H	Hydraulic pump set, fixed displacement pumps on common base frame, as Specification Clause 'X' and Drawing No. 'X'.		Nr			
<b>Thames Lift Bridge M&amp;E Contract</b>				<b>To collection £</b>		

Sample Bill of Quantities Page N° 5

New Construction 'SUPPLY AND DELIVER'

Location : within tunnel

U Ventilation/Air Conditioning Systems

Item	Description	Qty	Unit	Rate	£	p
	<b>U71 Tunnel ventilation</b>					
	<u>Y41 Fans</u>					
	Flow jet fans, reversible axial type, supports, upstream and downstream attenuators fastening to hot dipped galvanised ends and bell mouths, sheet steel cladding, anti-vibration mountings as Specification Clause 'X', Equipment Data Sheet 'X' and Drawing Number 'X'					
A	Reference VF1 : 900mm dia			Nr		
B	Reference VF2 : 750mm dia			Nr		
<b>Thames Tunnel M&amp;E Contract</b>				<b>To collection £</b>		

Sample Bill of Quantities Page N° 6

New Construction 'TAKE DELIVERY AND INSTALL'

Location : within tunnel

U Ventilation/Air Conditioning Systems

Item	Description	Qty	Unit	Rate	£	p
	<b>U71 Tunnel ventilation</b>					
	<u>Y41 Fans</u>					
	Flow jet fans, reversible axial type, supports, upstream and downstream attenuators fastening to hot dipped galvanised ends and bell mouths, sheet steel cladding, anti-vibration mountings as Specification Clause 'X', Equipment Data Sheet 'X' and Drawing Number 'X'					
A	Reference VF1 : 900mm dia		Nr			
B	Reference VF2 : 750mm dia		Nr			
<b>Thames Tunnel M&amp;E Contract</b>				To collection £		

# PREAMBLES TO BILL OF QUANTITIES

## General Directions

1 The Bill of Quantities has been prepared in accordance with the Standard Method of Measurement of Building Works Seventh Edition, 1988 (Reprinted 1989), authorised by agreement between the Royal Institution of Chartered Surveyors and the Building Employers Confederation and commonly known as SMM7 and except as otherwise stated herein.

2 In the Bill of Quantities the sub-headings and item descriptions identify the work to be undertaken. The nature and extent of the work to be performed is to be ascertained by reference to the Drawings, Specification and Conditions of Contract. The rates and prices entered in the Bill of Quantities shall be deemed to be full inclusive value of the work covered by the several items including the following, unless expressly stated otherwise:

- (a) Labour and associated costs in connection therewith;
- (b) The supply of materials, goods, plant, storage and associated costs including delivery to site. Taking delivery of materials, goods and plant supplied by others. Unloading, storing and protecting materials, goods and plant, return of crates, cartons and packing materials and costs in connection therewith;
- (c) Contractor's Equipment and costs in connection therewith;
- (d) Fixing, erecting, connecting and installing or placing of materials, goods and plant in position;
- (e) The effect of phasing of the Works or any element of the Works to the extent set forth or reasonably implied in the documents on which the tender is based;
- (f) General obligations, liabilities and risks involved in the execution of the Works set forth or reasonably implied in the documents on which the tender is based;
- (g) Establishment charges, overheads and profit;
- (h) Waste;

- (i) Attendance and transport for sampling and testing carried out by the Engineer and supplying results of tests carried out by the Contractor;
- (j) Complying with Quality Assurance schemes and providing certificates of conformity;
- (k) Preparation and supply of detailed working drawings, patterns, models and the like;
- (l) Awaiting approvals and or consents.

## Measurement

3 The quantities in the bill of quantities are the estimated quantities of the work to be executed, they are not to be taken as the actual and correct quantities of the Works to be performed by the Contractor in fulfilment of his obligations under the Contract.

## Pricing of Items

4 Each individual item shall have a rate or price entered against it. Rates and prices shall be expressed to two decimal places.

## Site Limitations and Constraints

5 The Contractor shall allow in his rates and prices for complying with any limitations and constraints on the use of the site.

## Alternative Specified Materials or Designs

6 Where in the Contract a choice of alternative materials or designs is indicated for a given purpose, the description in the Bill of Quantities and the rates and prices inserted shall be deemed to cover any of the permitted alternative materials or designs which the Contractor may use. The rates and prices inserted in the Bill of Quantities shall be deemed to include for any adjustment of work content, rates, costs and the like occasioned by the choice of alternative elected to be installed by the Contractor.

**Labours**

7 Labours in connection with Named Sub-Contractors shall include:

- (i) in the case of work or services executed - for affording the use of existing working space, access, erected scaffolding, working shelters, staging, ladders hoists, storage, latrines, messing, welfare and other facilities existing on Site and the provision of protection, water, electricity for lighting and clearing away rubbish and debris arising from the work;
- (ii) in the case of goods, materials or services supplied - for taking delivery, unloading, storing, protecting and returning crates, cartons and packing materials.

**Work in Specified Locations**

8 The Contractor shall allow in his rates and prices for taking measures required to execute the work separately measured as new construction or refurbishment, at the following locations:

- (i) within Tunnels;
- (ii) on Approaches to Tunnels;
- (iii) within Plant rooms;
- (iv) on Movable Bridges;
- (v) on Access Gantries;
- (vi) over water.

**Engineer's Telephone Calls**

9 The Purchaser will reimburse the Contractor the actual price paid by the Contractor in respect of:

- (i) Engineer's telephone calls - telephone calls charged to the number or numbers allocated to the Engineer. A provisional sum for telephone calls has been included in the Bills of Quantities.

**Equivalent Products and Materials**

10 Where the Contractor offers an equivalent product or material in place of the one identified or specified, which is accepted for incorporation into the Works by the Engineer, then the rates and prices in the Bill of Quantities shall be deemed to include for all the obligations and costs associated with the incorporation of the equivalent into the Works, including design, provision of data and drawings, certificates, awaiting approvals, resubmissions and modifications and amendments to the Works.

Unless specifically stated to the contrary in the Contract the measurement of the Works affected by the incorporation of the equivalent products and materials shall be based on the Tender documents and not on the Works as amended and completed to incorporate the equivalent products and materials.

**Works Designed by the Contractor**

11 Where the Contract requires part(s) of the Works to be designed by the Contractor, the rates and prices in the Bills of Quantities shall include for all the obligations and costs associated with the incorporation of the Contractor's design into the Works, including design, provision of data and drawings, certificates, awaiting approvals, resubmissions and modifications and amendments to the Works.

**Use of SMM7**

12 The use of the 'General rules' in SMM7 shall be subject to the following qualifications:

- (a) Delete the final sentence in Paragraph 2.6;
- (b) Delete Paragraph 4.6;
- (c) In Paragraph 6.1 delete '... to a catalogue or';
- (d) Delete Paragraph 7 in its entirety;
- (e) In Paragraph 10.1 replace '... an approximate quantity.' with '... a Provisional Sum.';
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**Price Fluctuation Table**

13 The following table referred to in the Conditions of Contract as the 'Price Fluctuation Table' shall be read in conjunction with the Bill of Quantities and used to calculate the increase or decrease in the amount payable by the Purchaser to the Contractor in accordance with Clause 6.2 of the Conditions of Contract.

Price Fluctuation Formulae		Bill Number	Bill Page/ Bill Item
<b>Formula 1</b>	Mech Eng		
		Stainless Steel	
	Elect Eng		
		stainless Steel	
<b>Formula 2</b>	Mech Eng		
	Elect Eng		

Notes to Table:

- 1 Where a bill page number is given in the above table then all bill items on that bill page shall be subject to the price fluctuation formula specified.