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An Introduction to defining Cost Estimates for Mechanical and Electrical Services using the NRM1

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An Introduction to defining Cost Estimates for Mechanical and Electrical Services using the NRM1

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Executive Summary:

Determining an accurate value for the supply and installation of mechanical and electrical services is a difficult task due to the level of specialisation and variance within this sector of the industry. The level of specialised knowledge and the ever changing technology has prevented the Quantity Surveyor from taking a firm hold on the cost estimation of these services. Cost estimates have previously been prepared by consultant services engineers or based on costs provided by these consultants.

However, employers nowadays require more cost certainty in the estimates of costs. As a direct result the New Rules of Measurement 1 (NRM1) has been devised. This document can be used in conjunction with both the RIBA Plan of Work and the OGC Gateways.

This assignment looks to identify HVAC and electrical systems which could apply to a building as described in the brief. Once these are defined prices for this installation are to be developed in line with each of the RIBA stages 2, 3 and 4.

Introduction:

The building in discussion within this assignment comprises of a five storey over basement. The construction shown on Drawing No. 406 shows what appears to be a cast in-situ concrete frame with in-situ concrete floors. The perimeter walls, for the purpose, of this project are deemed to be insulated cavity blockwork walls with glazed openings. This drawing shows a suspended ceiling with a 400mm depth of suspension. This should be sufficient for the distribution of the majority of mechanical and electrical services.

The basement houses underground parking and 2no. plantrooms and 2no. lift pits.

The ground floor consists of a retail area, a series of offices, entrance foyer, lecture rooms, stores, reception, kitchen area, lifts and male / female washroom facilities.

All intermediate floors consist of a general office open plan office area, 8no. individual offices, lifts, kitchen and male / female washroom facilities

All washrooms are centrally located around the lifts and each floor. A service riser is present to the left hand side of the lifts. The kitchen is located on the right hand side of the lifts. Generally all services are centrally located and can be easily accessed and distributed. The basement plantrooms are directly beneath this service core.

For the basis of this project it is assumed that the basement carpark is ventilated by means of a natural ventilation via an array of grid covered openings which allows toxic gases to be replaced by fresh air.

TASK 1

Identification of Services:

This section seeks to identify and briefly describe the function of the HVAC and electrical systems that would typically be found within such a building.

Mechanical Services:

A heat source is required to heat any building. Due to the conventional design and construction of this building it has been assumed that the building is heated by use of a gas or oil fuelled boiler. In this instance a modular boiler system is proposed.

A) Modular boilers – A modular boiler system is an array of boilers which are linked together. This allows for the ability to control the number of boilers in use to match for the heating load. This is more efficient than having a larger boiler working to part load. An example would be a five boiler array having only two boilers working at 40% load.

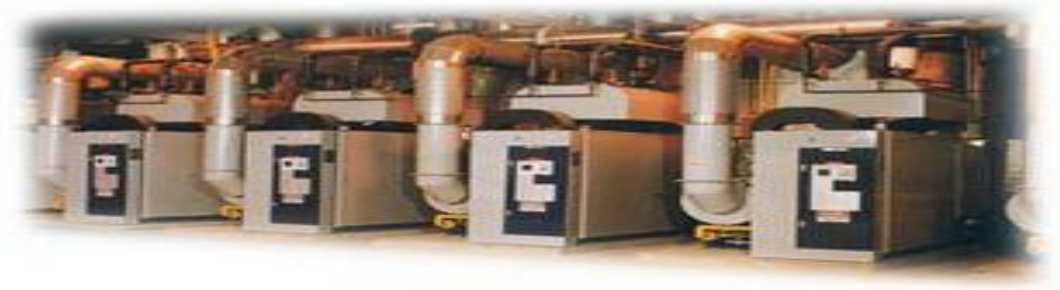

Fig 1. Modular Boilers (www.cleanboiler.org, 2015)

In order to distribute heat around the building from a heat source such as the modular boiler noted above a convector unit is required. Radiators have been chosen to distribute the heat. The temperature of these radiators will be controlled by the use of thermostatic valves. These valves can be set to regulate the temperature of the radiators.

B) Radiators – generally used as a component of the HVAC system to distribute heat around a building. In this instance the radiators will be used the circulation areas of the building such as the entrance foyer, reception, male / female washroom facilities and corridors.

In order to further regulate both the heating and cooling of the building as a whole it may be necessary to look at a mechanical method of distributing the heat around the building in a more uniform manner. In order to achieve this it has been deemed appropriate to incorporate the use of a series of Air Handling Units (AHU) through the building. The benefit of the use of such units is the ability to actively and accurately monitor and adjust the thermal comfort of building occupants in the various areas of the building.

C) Air Handling Units (AHU) – this will be used to heat and cool the functional areas of the building such as the retail area, lecture rooms, open plan offices and the smaller offices. These units will be mounted with the suspended ceiling. The treated air is distributed via a series of dusts from secondary units. The main (Primary) AHU and chiller units mounted in roof plantroom area 1.

Buildings which have a large footfall through their public areas may be at risk of losing heat at designated public / major access points. This is due to the difference in the internal and external temperatures. This is more prevalent in winter and summer months. In order to overcome this a piece of plant called an air curtain can be provided which can reduce the effect of this temperature change at the point of entry. Two areas have been identified in this building. One is the entrance to the main office foyer and the other the entrance door to the retail unit. It is assumed that only one point of access is available to the retail unit for the benefit of this exercise. Doors which are not principal points of access and egress, such as emergency exits, have not been included.

D) Air curtains – these are provided at all primary entrances such as those to the entrance foyer and to the retail unit. The effect of the use of such items is to minimise the loss of warm air to colder air outside.

Air conditioning is not only about the passage heating and cooling of air, it also caters for air purity. Within this building we note that there are centralised male and female toilet cores and kitchens on a large number of the floors. These are areas which do not require the same level of heating and cooling due to their function. In this regard it is necessary to provide for adequate ventilation to remove odours. A mechanical extract system is used to negatively charged environment which encourages the removal of odour.

E) Extract systems – Used in environments where air becomes directly contaminated by a particular activity or process. In the case of this building this occurs in the male / female washrooms, the kitchen areas.

<u>Electrical Services:</u>

Generally electrical services refers to the circuits for various power, DATA, IT and telecommunication services. However, these are only a small selection of the services now available in modern buildings. Mechanical services generally require power. With this in mind we will take into account the following final circuits.

A) Connections to modular boiler units from the mains distribution board.

B) Connection to the roof mounted AHU and chiller unit from the mains distribution board.

C) Connection to individual ceiling mounted AHUs on each floor from the sub distribution board on each floor.

D) Connection to individual mechanical extracts in toilet and kitchen areas from sub distribution board on each floor.

E) Connection to individual air curtains from the mains distribution board.

F) Earth bonding on all pipework and plant associated with this exercise.

G) Cable containment as described by the New Rules of Measurement 2 (NRM2, Electrical Services)

The following assumptions have been made for the purpose pf this assignment:

1) Only the services associated with the Heating, Ventilation and Air Conditioning have been taken into account in this exercise.
2) Fire dampers within the ventilation ductwork are not electrically controlled.
3) Attenuators on ductwork are manually controlled.
4) Mains and sub distribution boards are existing and have sufficient capacity for the new units.
5) Service routes are available within the structure and so builders work in conjunction with the proposed services are minimal but will be taken into account.
6) Fire detection systems do not form part of this assignment but it is recognised that smoke detectors, heat detectors and aspiration devices and their associated control and alarm installations would be required within such a building.
7) No building management system is installed.
8) A lightening protection installation is in place and was designed with the level of plant noted within this project in mind. No alterations are required.

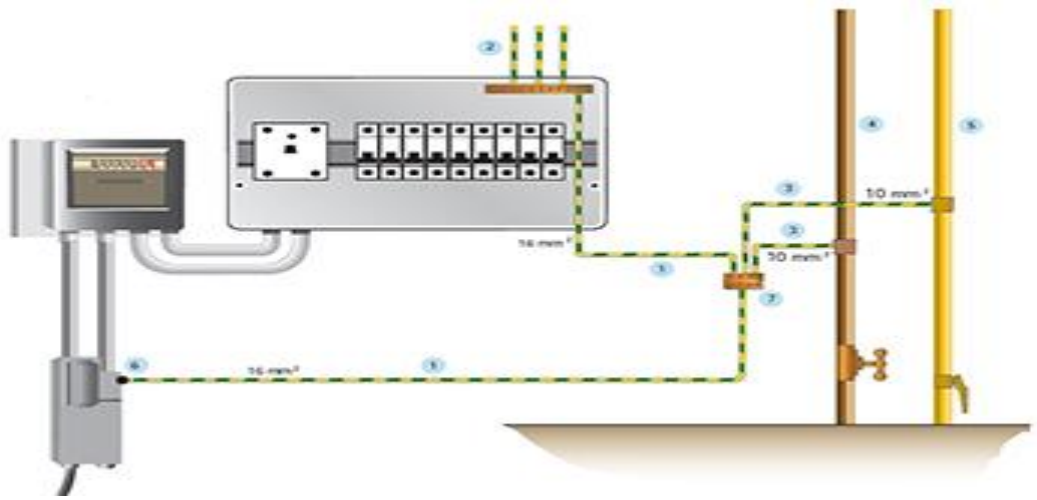

Fig. 2 – Earth Bonding (www.kci.co.ir, 2015)

TASK 2

Development of prices for the building HVAC and electrical services components identified in Task 1 for each of the RIBA Plan of work stages 2013 (2, 3 and 4).

RIBA Stage 2 – Concept Design

This stage refers to the requires the design team to *"prepare **Concept Design**, including outline proposals for ……building services systems, outline specifications and preliminary **Cost Information**…"* (RIBA, 2013)

The New Rules of Measurement 1 (NRM1, 2012) outline the purpose of an order of cost measurement in section 2.2. Specific reference is drawn to the work stage B of the Royal Institute of British Architects (RIBA) 2007 in section 2.2.1 (b).

Section 2.2.2 further defines the purpose of the order of the cost estimate and states that it is to "*establish if the proposed building project is affordable and, if affordable, to establish a realistic cost limit for the building project*" (NRM2, 2012) and goes on to define the cost limit as the maximum expenditure the client is prepared to make in relation to the project as a whole.

The RIBA work stages also provide for the preparation of a number of alternative costs in relation to alternative building types and installation scenarios.

The NRM 2 also sets out the information requirements for the order of cost estimates.

The NRM1 Part 2 defines the element, unit of measurement and the measurement rules for the components of the element.

The information requirements for order of costs estimates are defined in paragraph 2.3.1 (Appendix 1). This outlines the information required from the employer to allow the preparation of the order of costs estimate. Information which is required from the Architect to facilitate the preparation of the order of cost estimates is defined in paragraph 2.3.2 (Appendix 2)

Paragraph 2.4 defines the constituents of an order of cost estimate (Appendix 3). For the purpose of this assignment we have prepared the works cost estimate only. No allowance has been included for project/ design team fees as it is assumed that the design is contractor lead. All other key constituents are acknowledged but do not form part of the example.

For the purpose of preparing the order of cost estimate at RIBA stage 2 we will use the floor area method. This uses the Gross internal floor area (GIFA) of the building multiplied by an appropriate cost/m2.

The equation for this method is $c = a \times b$

Where,

a = GIFA

b = cost/m2 of GIFA for building works

c = building works estimate

The GIFA for this project has been calculated as being 4,416m2 in line with the RICS Code of Measuring Practice (6th Edition).

The cost per m2 has been defined as being in the region of £160/m2 for the HVAC and associated electrical systems. All other services are deemed to be already installed. The figure of £150/m2 of the building is based on a guide figure of £180/m2 (Rawlinson and Dedman, 2010) for the installation of mechanical services generally as cited in Cost benchmarks for the installation of building services (Part 1). This figure has been adjusted to reflect the fact that only the HVAC system is being installed here at this point.

Hence,

£662,400.00 = 4416m2 x €150

RIBA Stage 3 – Developed Design

At this point it is envisaged by the RIBA Plan of works that more "co-ordinated and updated proposals" are being prepared. This will allow for more detailed cost information to be prepared.

This more detailed cost can be developed by calculating the total cost of the building using the elemental format prescribed in the NRM1. This elemental format has a series of elemental groups which may have a series of sub-elements which allows for a more in-depth view of each of the component parts of the structure depending on complexity. The NRM notes the similarity of group pf elements used in the elemental cost planning process as defined by the NRM. The main difference is the choice and number of elements used in the cost breakdown. The choice of these elements is dependent on the level of information available.

Each component is included in its relevant element and sub-element. Where sufficient cost information is available then these costs will be multiplied by the element unit quantities to ascertain an element al cost target. All quantities referred to at this point will be determined in accordance with the measurement rules of the NRM1.

Where insufficient information is available for an element unit quantity then the Gross Internal Floor Area (GIFA) will be used as the alternative quantity.

The total cost estimate for the building works is calculated based on the sum of all the relevant elements.

NRM 1 goes into further detail regarding the measurement rules for components of the elemental cost plan. These rules enable the quantity surveyor to identify what is to be included and excluded under each heading within the cost plan. Where items are noted as excluded from a component the quantity surveyor is directed towards the relevant element or sub-element in order to provide for parity in comparison. The unit of measurement is also defined limit confusion.

For the basis of the example included in this exercise (Appendix 4) we will use Element Group (5) Services. This has a number of sub elements to it and we will be looking at those noted in the table below:

Element Number	Title
5.5	Heat Source
5.6	Space Heating and air conditioning
5.7	Ventilation
5.8	Electrical installations (Relating to HVAC in this example)
5.14	Builder's work in connection with services
9	Contractor's Preliminaries
10	Contractor's overheads and profit

Table 1 – Elements used in preparation of Elemental Cost Plan

For the benefit of this exercise it has been decided to make assumptions on the percentage for preliminaries and for overheads and profits. These are stated in the workings of the example. It has also been assumed that the works are contractor designed and as such the professional design teams associated with the works are absorbed within the costs.

It has also been decided to exclude the calculation of risk, inflation during the construction works and also value added tax (VAT).

RIBA Stage 4 – Technical Design

At this stage of the design all relevant architectural, structural and building services information should be available. This will allow for the preparation of a bill of quantities for the purpose of pricing by tendering parties. An example of a bill of quantities measured in conjunction with the New Rules of Measurement 2 (NRM 2) – Detailed measurement of building works is provided (Appendix 5).

In order to prepare the pre-tender estimate the information used to prepare the bill of quantities will allow for the preparation of estimates on an item by item basis. Guidance on the information required is provided with the NRM 2. This information seeks to provide guidance on the content, structure and format of the bill of quantities.

This guidance in provided in the form of tabulated rules divided into work sections where the rules of measurement for individual components of the structure are defined. This can then be related back to the elemental breakdown for cost comparison.

In relation to the actual pricing of the items measured in the bill of quantities it must be noted that the use of a standard method of measurement such as the NRM2 allows for parity of pricing for all those tendering. A selection of estimated cost examples relating to this assignment are provided in Appendix 6.

The table below provides an overview of the cost estimates at RIBS stages 2, 3 and 4.

	PROJECT STAGE IN RELATION TO THE RIBA Plan of Work (2013)		
Stage	Stage 2 -Concept Design	Stage 3 - Developed Design	Stage 4 - Technical Design
	(Initial Cost Appraisal)	(Elemental Cost Plan)	(Pre-tender estimate)
Accuracy %	<25	<15	<5
Cost £	£662,400.00	£580,962.47	£502,733.53

Table 2 – Summary of developed costs.

Conclusion:

There are many ways to determine cost estimates for elements of a project. In relation to the HVAC system described in this report it has become apparent in the various estimates produced that the higher the level of specification of the system and the level of detail in relation to its integration into the building the more accurate the cost estimate provided.

Furthermore the use of standard reporting systems such as the order of cost estimate detailed in the NRM1 helps to ensure the inclusion of all components and parity in reporting across the industry.

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APPENDIX 1 – NRM1 Order of Cost Measurement

Information required from the employer for an order of cost estimate

2.3 Information requirements for order of cost estimates

2.3.1 To enable preparation of an order of cost estimate, information will be required from the employer as follows:
(a) Location of the site and the availability of the site for commencement of the building project.
(b) A statement of building use.
(c) A statement of floor area (or number of functional units) and schedule of accommodation – in conjunction with the architect.
(d) Requirements for refurbishment (if the project comprises rehabilitation of an existing building) – in conjunction with the architect. Details of the new use and any outstanding maintenance or repairs necessary to give the building fabric the required life expectancy are required.
(e) Initial project/design brief, including statement of quality, sustainability requirements and 'fit-out' requirements – in conjunction with the architect.
(f) Details of any enabling works, decanting or other specific requirements.
(g) Indicative programme, including key dates (e.g. planning application and occupation dates).
(h) Details of any particular restraints to be imposed by the employer, local planners or statutory undertakers – in conjunction with the architect (e.g. work in a secure area, limitations on building position, work in a conservation area, work to a historic or listed building, external appearance and number of storeys).
(i) Details of any particular site conditions – in conjunction with the architect (e.g. sloping site, likelihood of contaminated ground, demolition of existing buildings, adequacy and condition of existing mains services).
(j) Budget/cash flow constraints.
(k) Initial views (if any) on construction procurement options and contract strategies.
(l) Life span (e.g. 10 year, 25 year or 60 year target life span).
(m) An indication of the proposed storey heights of the building – in conjunction with the architect. The introduction of raised access floors for IT cabling or deep suspended ceiling voids for mechanical and electrical services installations could significantly increase storey height, thus increasing estimated costs. Where such requirement is known, it is recommended that this is stated.
(n) Particular requirements in respect of mechanical and electrical services installations – in conjunction with the architect (and mechanical and electrical services engineer – if appointed).
(o) Requirements in respect of:
+ treatment of project/design team fees;
+ approach to other development/project costs;
+ treatment of inflation; and
+ treatment of Value Added Tax (VAT).
(p) Other considerations (e.g. approach to dealing with capital allowances, land remediation and grants).

APPENDIX 2 – NRM1 Order of Cost Measurement

Information required from the architect for an order of cost estimate

2.3.2 To enable preparation of an order of cost estimate, information will be required from the architect as follows:

(a) Design study sketches or drawings for each alternative design/development option to a suitable scale, comprising:
+ floor plans (for each different floor plate configuration/shape and use);
+ roof plan(s);
+ elevations; and
+ sections.
(b) Schedule of gross external areas (GEA), gross internal floor areas (GIFA), net internal areas (NIA) – (i.e. usable area for shops, supermarkets and offices) on a floor by floor basis and site area (SA).
(c) Minimum storey heights.
(d) Schedule of accommodation – in conjunction with the employer.
(e) Number of car parking spaces and whether above ground or below ground.
(f) Indicative specification/design intent for building option(s).
(g) Indicative environmental/sustainability strategy – in conjunction with the mechanical and electrical services engineer.
(h) Advice on likely site constraints.
(i) Advice on likely planning constraints.
(j) Definition of 'fit-out'.
(k) Initial risk register/log.

APPENDIX 3 – NRM1 Order of Cost Measurement

Order of Cost Estimate Template

2.4 Constituents of an order of cost estimate

2.4.1 The key constituents of an order of cost estimate are as follows.

Constituent	
Facilitating works estimate (1)	See paragraph 2.5
Building works estimate (2)	see paragraph 2.6
Main contractor's preliminaries estimate (3)	See paragraph 2.10
Sub-total (4) [(4) = (1) + (2) + (3)]	
Main contractor's overheads and profit estimate (5)	See paragraph 2.11
Works cost estimate (6) [(6) = (4) + (5)]	
Project/design team fees estimate (if required) (7)	See paragraph 2.12
Sub-total (8) [(8) = (6) + (7)]	
Other development/project costs estimate (if required) (9)	See paragraph 2.13
Base cost estimate (10) [(10) = (8) + (9)]	
Risk allowances estimate (11) [(11) = (11(a)) + (11(b)) + (11(c))+ (11(d))]	See paragraph 2.14
(a) Design development risks estimate (11(a))	
(b) Construction risks estimate (11(b))	
(c) Employer change risks estimate (11(c))	
(d) Employer other risks estimate (11(d))	
Cost limit (excluding inflation) (12) [(12) = (10) + (11)]	
Tender inflation estimate (13)	See paragraph 2.15
Cost limit (excluding construction inflation) (14) [(14) = (12) + (11)]	
Construction inflation estimate (15)	See paragraph 2.16
Cost limit (including inflation) (16) [(16) = (14) + (15)]	
VAT assessment	See paragraph 2.17

2.4.2 The base cost estimate is the total of the building works estimate, main contractor's preliminaries estimate and main contractor's overheads and profit estimate, project/design team fee estimate and the other development/project costs estimate. The base cost estimate is to contain no allowances for risk or inflation.

2.4.3 Allowances for risk and inflation are to be calculated separately and added to the base cost estimate to determine the cost limit for the building project.

2.5 Measurement rules for facilitating works

2.5.1 Facilitating works is a term used to describe specialist works which, normally, need to be completed before any building works can commence (e.g. demolition works, works involving the removal of hazardous and deleterious materials, and soil stabilisation). The terms facilitating works and enabling works must not be confused. Enabling works is a term commonly used to define a package of works, which often includes facilitating works, temporary works and new permanent works (e.g. a combination of major demolition works, intrusive site investigations, a new access road, and the provision of mains services by statutory undertakings).

2.5.2 Quantities for facilitating works shall be based on either the site area (SA), the area affected (in m^2), linear meters (m), enumerated (nr) or itemised (item) as deemed appropriate. Where the

APPENDIX 4 – Order of Cost Estimate Example

SALFORD UNIVERSITY - ACADEMIC CONSULTANCY LTD					
ORDER OF COST ESTIMATE					
ITEM	**ELEMENT**	**QTY**	**UNIT**	**COST**	**TOTAL**
Group Element (2) - SUPERSTRUCTURE					
A	(5) HEAT SOURCE				
	BOILER (Assumed)	120	kW	£250.00	£30,000.00
B	(6) SPACE HEATING AND AIR				
	CONDITIONING	4416	M2	£38.60	£170,457.60
C	(7) VENTILIATION	4416	M2	£58.53	£258,468.48
D	(8) ELECTRICAL INSTALLATION	4416	M2	£10.00	£44,160.00
E	(14) BWICS	4416	M2	£2.50	£11,040.00
	SUB-TOTAL				£514,126.08
Group Element (9) - Main Contractor Preliminaries					
	Preliminaries (assumed)	5	%	£514,126.08	£25,706.30
Group Element (10) Main Contractor's Overheads and Profit					
	Main Con O/H/P (assumed)	8	%	£514,126.08	£41,130.09
	TOTAL COST OF INSTALLATION EXCL. VAT				**£580,962.47**
NOTES:					
1)	M2 is defined by the calculation of the gross internal floor area (GIFA) in accordance with the RICS Code of Measuring Practice 6th Edition				
	Sum of the areas of all floors (Basement to 3rd floor) excluding service voids and lift shafts				
		4416	M2	£131.56	£580,962.47
2)	The designin this installation is contractor lead				

APPENDIX 5 – Bill of Quantities Example

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Charles Mitchell

(38) Mechanical Services

Student Number @00330617

		Quantity	Unit	Rate	total €
	Primary Equipment				
A	Modular Boiler unit; located in basement (Store 1) Fleet Vertical - Three-High F40V-120, A-rated efficiency, load 50/30C 120kW, with proprietary casing on integrated frame and anti-vibration mountings fixed to concrete slab with M12 stainless steel bolts.	1	Nr	32000.00	£32,000.00
B	Offload and position of boiler	1	Nr	250	£250.00
	Terminal Equipment and fittings				
	Heating				
C	Quinn Slieve horizontal double radiator, steel, white, 505x1800mm, 2941 Watt at 50 degree C, mechanically fixed to blockwork with M10 diameter stainless steel fixings incorporating wall anchors	81	Nr	1440.82	£116,706.42
D	Daikin Biddle recessed air curtain, overall length 2000mm 150mm wide, 80kW output, remote operated (hand held unit included), fitted withing suspended ceiling void, fixed to soffit of concrete slab above using unistrut hanger system or equal approved.	2	Nr	6095.05	£12,190.10
	Pipework				
	Qualpex flexible poyehthelene pipework in risers				
E	20mm diameter; fixed to concete walls	581.4	M	39.66	£23,058.32
F	15mm diameter; fixed to concete walls	581.4	M	36.57	£21,261.80
	AIR HANDLING UNITS				
G	Primary Air Handling Unit - Roof mounted size, capacity loading and rating as per the consultant engineer's specification. Housed within a galvanised steel frame with galvanised sheeting. Fixed on anti vibration mating and secured to concrete roof slab.	1	NR	33788.22	£33,788.22
H	Chiller unit - Roof mounted with size and capacity and loading and rating as per the consultant engineer's specification. Housed within a galvanised steel frame with galvanised sheeting. Fixed on anti vibration mating and secured to concrete roof slab.	1	NR	8750	£8,750.00
		To collection			£248,004.86

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Charles Mitchell

(38) Mechanical Services

Student Number @00330617

		Quantity	Unit	Rate	total €
A	Ceiling mounted AHU mounted in ceiling voids. Size, loading and rating as per the consultant engineer's specification. Finished flush with ceiling grid.	56	NR	1521	£85,176.00
	Qualpex flexible povehthelene pipework in risers				
B	20mm diameter; fixed to concete walls	524	M	39.66	£20,781.84
C	15mm diameter; fixed to concete walls	524	M	36.57	£19,162.68
	Venitlation Ducts				
D	200x200mm rectangular sheet metal ducting as per Engineer's specification. Suspended in ceiling voids and in service risers on unistrut and hanger system or equal approved	524	M	152	£79,648.00
	Duct Ancillaries				
E	Supply and installation of 1hr fire dampers in rectangular ducts as per engineer's requirements	38	NR	158.17	£6,010.46
	Mechanical Extracts				
E	Vent-axia T-Series ceiling mounted extract fan 310x303mm Model TX6PL. Mounted in suspended ceiling as per manufacturers specifications	20	NR	150	£3,000.00
F	100mm flexible PVC ducting as specified including fittings and the likes.	82	M	55	£4,510.00
G	Testing of mechanical systems (assumed)		Item		£2,000.00
H	Commissioning as per specification (assumed)		Item		£2,000.00
J	Drawing Preparation (As built) (assumed)		Item		£500.00
	To Collection				£222,788.98

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Student Number @00330617

(38) Mechanical Services

		Quantity	Unit	Rate	total €
	Pg 38/1				£248,004.86
	Pg 38/1				£222,788.98
	To Summary Page				£470,793.84

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(38) Mechanical Services

Student Number @00330617

		Quantity	Unit	Rate	total €
	SUMMARY PAGE				
	Preliminaries (5% assumed)				£23,939.69
	(38) Mechanical Services				£470,793.84
	(39) Electrical Services (assumed)				£8,000.00
	TOTAL COST (Excluding VAT)				**£502,733.53**

APPENDIX 6 – Estimated Costs Examples

EXAMPLE COSTS

SALFORD UNIVERSITY - ACADEMIC CONSULTANCY LTD

ITEM: 15mm diameter pipework

Description	Unit Cost (£/m)	Number	Length (M)	Total
Pipework (Spons)	2.74 + 9.12		581	£6,890.66
Brakets fixed to walls (2 per m)	0.68+3.45	1162		£4,799.06
90degree elbow (male / Female)	1.30+15.47	50		£838.50
Equal tee	33.62+20.20	162		£8,718.84
PAGE 1	TO COLLECTION			£21,247.06

EXAMPLE COSTS

SALFORD UNIVERSITY - ACADEMIC CONSULTANCY LTD

ITEM: 20mm diameter pipework

Description	Unit Cost (£/m)	Number	Length (M)	Total
Pipework (Spons)	3.22+9.12		581	£7,169.54
Brakets fixed to walls (2 per m)	0.76+3.45	1162		£4,892.02
90degree elbow (male / Female)	1.90+20.94	50		£1,142.00
Equal tee	33.62+27.10	162		£9,836.64
PAGE 2	TO COLLECTION			£23,040.20

EXAMPLE COSTS

SALFORD UNIVERSITY - ACADEMIC CONSULTANCY LTD

ITEM: VENTILATION DUCTS 200mm Rectangular Galvanised Sheet metal

Description	Unit Cost (£/m)	Number	Length (M)	Total
200 x 200 mm galvanised sheet metal	7.51+22.22		524	£15,578.52
200mm 90deg segmented radius bends	10.50+11.24	40		£869.60
Unistrut supports	53.51+10.73		524	£33,661.76
200mm Branches	20.45+22.22	30		£1,280.10
Insulation 1/2 hour	43.22+24.19		419.2	£28,258.27
PAGE 3	TO COLLECTION			£79,648.25

EXAMPLE COSTS

SALFORD UNIVERSITY - ACADEMIC CONSULTANCY LTD

ITEM: Air Handling Unit (roof mounted) 10m3@700Pa

Description	Unit Cost (£/m)	Number	Length (M)	Total
AHU	17,083.33+2463.84	1		£19,547.17
E/O inlet and discharge attenuators	5,432.26+320.20	2		£11,504.92
Extra for external location	2736.13+0.00	1		£2,736.13
PAGE 4	TO COLLECTION			£33,788.22

EXAMPLE COSTS

SALFORD UNIVERSITY - ACADEMIC CONSULTANCY LTD

ITEM: Air Handling Unit (ceiling mounted)

Description	Unit Cost (£/m)	Number	Length (M)	Total
Ceiling mounted AHU	1166.13+98.55	56		£70,822.08
DCC Control pack	207.24+49.28	56		£14,365.12
PAGE 5	TO COLLECTION			£85,187.20

EXAMPLE COSTS

SALFORD UNIVERSITY - ACADEMIC CONSULTANCY LTD

ITEM: Air Curtains

Description	Unit Cost (£/m)	Number	Length (M)	Total
Air curtains 240V 2500 x 590 x 270	5,673.73+421.32	2		£12,190.10
PAGE 6	TO COLLECTION			£12,190.10

EXAMPLE COSTS

SALFORD UNIVERSITY - ACADEMIC CONSULTANCY LTD

ITEM: RADIATORS - Twin Panel

Description	Unit Cost (£/m)	Number	Length (M)	Total
Radiators (twin Panel) 500X2000mm				
100mm deep	1,311.64+73.18	81		£112,170.42
Therostatic Valves (assumed)	28	162		£4,536.00
PAGE 7	TO COLLECTION			£116,706.42

APPENDIX 7 – Schedule of Mechanical Equipment

UNIVERSITY OF SALFORD								
						Charles Mitchell		
MECHANICAL & ELECTRICAL QUANTITY SURVEYING						**Student Number @00330617**		
Mechanical Services Schedule								
PLANT	**DESCRIPTION**	**Basement**	**Ground**	**1st**	**2nd**	**3rd**	**Roof**	**Total**
Boiler	Modular Boiler	1						1
Radiator			15	22	22	22		81
AHU - Ceiling unit			14	14	14	14		56
AHU - Main Unit							1	1
Chiller							1	1
Mechanical Extract			5	5	5	5		20
Air Curtain			2					2