ISO 9002 in the Malaysian Construction Industry: Guide and Implementation

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Preface

In the past few years, there has been quite a number of books written on ISO 9000, TQM and other related quality topics. Most of the books are written for the manufacturing industry and only a handful of these books are for the construction industry. With their pioneering experience in the implementation, the authors have embarked on the task of writing this book in order to share with readers their views and experiences.

Chapter 1 to chapter 3 are essentially to give the reader some basic understanding on the background of ISO 9000 standard. Chapter 4 to chapter 20 will go in depth on the ISO 9000 elements as applied to the construction industry. Some of the chapters are quite independent as the subject matter discussed are in a specialized field.

Chapter 24 contains the views of Master Builders Association of Malaysia with regard to the implementation of ISO 9000 in the construction industry.

Chapter 21 to chapter 26 highlight the roles of SIRIM and the Construction Industry Development Board in promoting ISO 9000 in the construction industry. The chapters also provide information about the roles and duties of the governing body.

The addition of Appendix VIII as an example of Project Quality Plan is to focus on the requirements of the document as Project Quality Plan is relatively new in terms of application in the construction industry.

The overall terminology used in this book can be easily understood and normally used in the construction industry. The inclusion of flow charts and diagrams is to enable readers to have a better understanding of the subject matter.

Foreword

The construction sector is vital for the development of any nation. It is without doubt that the task of physical nation building rests with the construction sector. In many ways, the pace of the economic growth of a nation can be measured by the degree of activity in the development of physical infrastructures such as roads, buildings and bridges. For the past eight years or so, the Malaysian construction sector has grown in tandem with the economic growth of the nation. In 1995, the construction sector has maintained its double digit growth for the sixth consecutive year, growing at 12.7% and contributing 4.3% to the GDP of the country.

In view of the rapid growth of the industry, expected to double by the year 2000, quality in the building and construction sector has been a major concern to the Government and public alike. There have been many initiatives to institute reforms in this industry over the years. However, the need has never been felt more acutely than now when quality no longer is just an icing on the cake but an essential ingredient in the cake itself. For the industry to survive and remain competitive in the face of intense global competitors, the Malaysian construction industry has to implement quality management in their operations and systems.

Quality is vital not only for the purposes of marketing a company's products and services, but it is a life-line in the survival of the company itself. Through the implementation of quality systems and quality management practices, the safety of products and even of the workers in the factory and the worksite can be enhanced. Quality management

systems also prevent rework and wastage thus reducing unproductive repetition of jobs and ultimately increases efficiency and productivity.

There are just some of the benefits from the implementation of quality systems such as those embodied in the ISO 9000 series standards. The success of the ISO 9000 series of standards represents international consensus on how best to operate and assess quality management systems.

I am pleased that SIRIM's efforts aimed at creating awareness towards quality among manufacturers, particularly through our promotion of Quality Management and ISO 9000 has yielded significant results. Today, there is indeed a greater level of general awareness of the importance of quality. Many manufacturing concerns, including those from the construction industry are aiming to get their quality system certified to ISO 9000.

Thus I feel that the publication of this book is timely and I take this opportunity to congratulate the authors for taking the effort in writing this book which can act as a valuable source of reference, not only for those in the industry but also the general public.

DATO' DR. AHMAD TAJUDDIN ALI
Director-General
Standards and Industrial Research Institute of Malaysia

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Quality and ISO 9000

BACKGROUND

The ISO 9000 series of Quality Systems Standards were published by the International Organization for Standardization (ISO) in 1987. Since its publication, the standards had achieved tremendous success gaining worldwide recognition and acceptance. More than 80 countries had adopted the standards as national standards, including the EC and EFTA countries, Japan, United States and Canada (Table 1.1). Third party certification programmes based on the certification of compliance to the ISO 9000 standards are being operated in 43 countries around the world.

The worldwide impact of the ISO 9000 standards is summarized by Dr Lawrence Eicher, Secretary General of the International Organization for Standardization (Ref. 1) as follows:

(i) The ISO 9000 standards have been directly adopted, without change, as national standards in at least 80 countries, including all of the EC and EFTA countries, Japan and the USA.

(ii) Third party assessment and registration services exist for recognizing conformance to ISO 9000 standards in at least 32 countries. The number of companies on the waiting list to be registered is so long in some countries that the delay in assessment service is running from 9 to 15 months.

Table 1.1 Table of worldwide equivalence of ISO 9000 series of standards (draft data)

(regions adopted: 2, countries adopted: 80, countries in the course of adopting: 10) 1995-09-01

adpt adopted but national nomination not known

(prc) national adoption in process

ISO	ISO 9000-1:1994	ISO 9001:1994	ISO 9002:1994	ISO 9003:1994	ISO 9004-1:1994
CEN/CENELEC	EN ISO 9000-1:1994	EN ISO 9001:1994	EN ISO 9002:1994	EN ISO 9003:1994	EN ISO 9004-1:1994
COPANT	COPANT-ISO 9000-1: 1995	COPANT-ISO 9001: 1995	COPANT-ISO 9002: 1995	COPANT-ISO 9003: 1995	COPANT-ISO 9004-1: 1995
Albania	(prc)	(prc)	(prc)	(prc)	(prc)
Algeria	NA 539	NA 540	NA 548	NA 549	NA 547
Antigua and Barboda					
Argentina	IRAM-IACC-ISO E 9000-1: 1994	IRAM-IACC-ISO E 9001: 1994	IRAM-IACC-ISO E 9002: 1994	IRAM-IACC-ISO E 9003: 1994	IRAM-IACC-ISO E 9004-1: 1994
Armenia					
Australia	AS/NZS ISO 9000.1: 1994	AS/NZS ISO 9001: 1994	AS/NZS ISO 9002: 1994	AS/NZS ISO 9003: 1994	AS/NZS ISO 9004.1: 1994
Austria	ÖNORM EN 29000	ÖNORM EN 29001	ÖNORM EN 29002	ÖNORM EN 29003	ÖNORM EN 29004
Bahrain					

Bahrain					
Bangladesh					
Barbados	BNS 180: Part 1. 1995	BNS 181: 1995	BNS 182: 1995	BNS 183: 1995	BNS 184: Part 1. 1995
Belarus					
Belgium	NBN-EN ISO 9000-1: 1994	NBN-EN ISO 9001: 1994	NBN-EN ISO 9002: 1994	NBN-EN ISO 9003: 1994	NBN-EN ISO 9004-1: 1994
Bolivia					
Brazil	NBR ISO 9000-1: 1994	NBR ISO 9001: 1994	NBR ISO 9002: 1994	NBR ISO 9003: 1994	NBR ISO 9004-1: 1994
Brunei Darussalam	PBD ISO 9000-1: 1994	PBD ISO 9001: 1994	PBD ISO 9002: 1994	PBD ISO 9003: 1994	PBD ISO 9004-1: 1994
Bulgaria	BDS 9.000-89	BDS 9.001-89	BDS 9.002-89	BDS 9.003-89	BDS 9.004-89
Burundi	(prc)	(prc)	(prc)	(prc)	(prc)
Canada	CAN/CSA-ISO 9000-1-94	CAN/CSA-ISO 9001-94	CAN/CSA-ISO 9002-94	CAN/CSA-ISO 9003-94	CAN/CSA-ISO 9004-1-94
Chile	NCh-ISO 9000-1 (1995)	NCh-ISO 9001.Of95	NCh-ISO 9002.Of95	NCh-ISO 9003.Of95	NCh-ISO 9004-1 (1995)
China	GB/T 19000-92	GB/T 19001-92	GB/T 19002-92	GB/T 19003-92	GB/T 19004-92

Colombia	NTC-ISO 9000-1: 1994	NTC-ISO 9001: 1994	NTC-ISO 9002: 1994	NTC-ISO 9003: 1994	NTC-ISO 9004-1: 1994
Costa Rica	INT-ISO 9000-1: 94	INT-ISO 9001: 94	INT-ISO 9002: 94	INT-ISO 9003: 94	INT-ISO 9004-1: 94
Croatia	HRN ISO 9000	HRN ISO 9001	HRN ISO 9002	HRN ISO 9003	HRN ISO 9004
Cuba	NC-ISO 9000	NC-ISO 9001	NC-ISO 9002	NC-ISO 9003	NC-ISO 9004
Cyprus	CYS ISO 9000	CYS ISO 9001	CYS ISO 9002	CYS ISO 9003	CYS ISO 9004
Czech Republic	CSN EN ISO 9000-1: 1995	CSN EN ISO 9001: 1995	CSN EN ISO 9002: 1995	CSN EN ISO 9003: 1995	CSN EN ISO 9004-1: 1995
Denmark	DS/EN ISO 9000-1: 1994	DS/EN ISO 9001: 1994	DS/EN ISO 9002: 1994	DS/EN ISO 9003: 1994	DS/EN ISO 9004-1: 1994
Ecuador	adpt	adpt	adpt	adpt	adpt
Egypt	ES/ISO 9000-1: 1995	ES/ISO 9001: 1995	ES/ISO 9002: 1995	ES/ISO 9003: 1995	ES/ISO 9004-1: 1995
Estonia	EVS-ISO 9000: 1994	EVS-ISO 9001: 1994	EVS-ISO 9002: 1994	EVS-ISO 9003: 1994	EVS-ISO 9004: 1994
Ethiopia	(prc)	(prc)	(prc)	(prc)	(prc)
Fiji					
Finland	SFS-EN ISO 9000-1	SFS-EN ISO 9001	SFS-EN ISO 9002	SFS-EN ISO 9003	SFS-EN ISO 9004-1
France	NF EN ISO 9000-1	NF EN ISO 9001	NF EN ISO 9002	NF EN ISO 9003	NF EN ISO 9004-1
Germany	DIN EN ISO 9000-1	DIN EN ISO 9001	DIN EN ISO 9002	DIN EN ISO 9003	DIN EN ISO 9004-1

Greece	ELOT EN ISO	ELOT EN ISO	ELOT EN ISO	ELOT EN ISO	ELOT EN ISO

Greece	ELOT EN ISO 9000-1: 1995	ELOT EN ISO 9001: 1995	ELOT EN ISO 9002: 1995	ELOT EN ISO 9003: 1995	ELOT EN ISO 9004-1: 1995
Grenada	GDS 4: PART 1: 1994	GDS 4: PART 2: 1994	GDS 4: PART 3: 1994	GDS 4: PART 4: 1994	GDS 4: PART 5: 1994
Guyana	GYS/ISO 9000: 1987	GYS/ISO 9001: 1987	GYS/ISO 9002: 1987	GYS/ISO 9003: 1987	GYS/ISO 9004: 1987
Hong Kong					
Hungary	MSZ EN 29000	MSZ EN 29001	MSZ EN 29002	MSZ EN 29003	MSZ EN 29004
Iceland	IST ISO 9000: 1987	IST ISO 9001: 1987	IST ISO 9002: 1987	IST ISO 9003: 1987	IST ISO 9004: 1987
India	IS/ISO 9000-1: 1994	IS/ISO 9001: 1994	IS/ISO 9002: 1994	IS/ISO 9003: 1994	IS/ISO 9004-1: 1994
Indonesia	SNI 19-9000-1991	SNI 19-9001-1991	SNI 19-9002-1991	SNI 19-9003-1991	SNI 19-9004-1991
Iran, Islamic Republic of	(prc)	(prc)	(prc)	(prc)	(prc)
Ireland	I.S. EN ISO 9000-1: 1994	I.S. EN ISO 9001: 1994	I.S. EN ISO 9002: 1994	I.S. EN ISO 9003: 1994	I.S. EN ISO 9004-1: 1994
Israel	SI ISO 9000-1: 1995	SI ISO 9001: 1995	SI ISO 9002: 1995	SI ISO 9003: 1995	SI ISO 9004-1: 1995
Italy	UNI EN ISO 9000-1	UNI EN ISO 9001	UNI EN ISO 9002	UNI EN ISO 9003	UNI EN ISO 9004-1
Jamaica	JS ISO 9000: 1987	JS ISO 9001: 1987	JS ISO 9002: 1987	JS ISO 9003: 1987	JS ISO 9004: 1987
Japan	JIS Z 9900: 1994	JIS Z 9901: 1994	JIS Z 9902: 1994	JIS Z 9903: 1994	JIS Z 9904: 1994
Jordan	(prc)	(prc)	(prc)	(prc)	(prc)

Kazakhstan					
Kenya	KS 10-1130: PART 1: 1995	KS 10-1131: 1995	KS 10-1132: 1995	KS 10-1133: 1995	KS 10-1134: PART 1: 1995
Korea, Democratic People's Republic of					
Korea, Republic of	KS A 9000-1992	KS A 9001-1992	KS A 9002-1992	KS A 9003-1992	KS A 9004-1992
Kuwait	(prc)	(prc)	(prc)	(prc)	(prc)
Kyrgyzstan					
Latvia					
Lebonan					
Libyan Arab Jamahiriya					
Lithuania					
Malawi	MBS-ISO 9000: 1991	MBS-ISO 9001: 1991	MBS-ISO 9002: 1991	MBS-ISO 9003: 1991	MBS-ISO 9004: 1991
Malaysia	MS ISO 9000: 1991	MS ISO 9001: 1994	MS ISO 9002: 1994	MS ISO 9003: 1994	MS ISO 9004: 1991
Malta					

Mauritius	MS ISO 9000-1:	MS ISO 9001: 1994	MS ISO 9002: 1994	MS ISO 9003: 1994	MS ISO 9004-1:

Mauritius	MS ISO 9000-1: 1994	MS ISO 9001: 1994	MS ISO 9002: 1994	MS ISO 9003: 1994	MS ISO 9004-1: 1994
Mexico	NOM-CC-2	NOM-CC-3	NOM-CC-4	NOM-CC-5	NOM-CC-6
Mongolia		UST/ISO 9001	UST/ISO 9002	UST/ISO 9003	
Morocco					
Mozambique					
Nepal	NS: 300-2050	NS: 301-2050	NS: 302-2050	NS: 303-2050	NS: 304-2050
Netherlands	NEN-EN-ISO 9000-1: 1994	NEN-EN-ISO 9001: 1994	NEN-EN-ISO 9002: 1994	NEN-EN-ISO 9003: 1994	NEN-EN-ISO 9004-1: 1994
New Zealand	AS/NZS ISO 9000.1: 1994	AS/NZS ISO 9001: 1994	AS/NZS ISO 9002: 1994	AS/NZS ISO 9003: 1994	AS/NZS ISO 9004.1: 1994
Nigeria	NIS ISO 9000	NIS ISO 9001	NIS ISO 9002	NIS ISO 9003	NIS ISO 9004
Norway	NS-EN ISO 9000-1	NS-EN ISO 9001	NS-EN ISO 9002	NS-EN ISO 9003	NS-EN ISO 9004-1
Oman	(prc)	(prc)	(prc)	(prc)	(prc)
Pakistan	PS: 3000: 1990	PS: 3001: 1990	PS: 3002: 1990	PS: 3003: 1990	PS: 3004: 1990
Panama					
Papua New Guinea	PNGS 1359: 1990	PNGS 1360: 1990	PNGS 1361: 1990	PNGS 1362: 1990	PNGS 1363: 1990
Peru	NTP-ISO 9000: 1993	NTP-ISO 9001: 1993	NTP-ISO 9002: 1993	NTP-ISO 9003: 1993	NTP-ISO 9004: 1994

Philippines	PNS 1000-1: 1994/ ISO 9000-1: 1994	PNS 1001: 1994/ ISO 9001: 1994	PNS 1002: 1994/ ISO 9002: 1994	PNS 1003: 1994/ ISO 9003: 1994	PNS 1004-1: 1994/ ISO 9004-1: 1994
Poland	PN-EN 29000: 1993	PN-EN 29001: 1993	PN-EN 29002: 1993	PN-EN 29003: 1993	PN-EN 29004: 1993
Portugal	NP EN ISO 9000-1 (1995)	NP EN ISO 900: (1995)	NP EN ISO 9002 (1995)	NP EN ISO 9003 (1995)	NP EN ISO 9004-1 (1995)
Qatar	(prc)	(prc)	(prc)	(prc)	(prc)
Romania	STAS ISO 9000: 91	STAS ISO 9001: 91	STAS ISO 9002: 91	STAS ISO 9003 91	STAS ISO 9004: 91
Russian Federation		GOST 40.9001-88	GOST 40.9002-88	GOST 40.9003-88	
Saint Lucia					
Saudi Arabia	SSA/ISO 9000	SSA/ISO 9001	SSA/ISO 9002	SSA/ISO 9003	SSA/ISO 9004
Singapore	SS ISO 9000-1: 1994	SS ISO 9001: 1994	SS ISO 9002: 1994	SS ISO 9003: 1994	SS ISO 9004-1: 1994
Slovakia	STN ISO 9000-1: 1995	STN ISO 9001: 1995	STN ISO 9002: 1995	STN ISO 9003: 1995	STN ISO 9004: 1995
Slovenia	SIST ISO 9000-1: (1995)	SIST ISO 9001: (1995)	SIST ISO 9002: (1995)	SIST ISO 9003: (1995)	SIST ISO 9004-1: (1995)
South Africa	SABS-ISO 9000-1: 1994	SABS-ISO 9001: 1994	SABS-ISO 9002: 1994	SABS-ISO 9003: 1994	SABS-ISO 9004-1: 1994
Spain	UNE-EN-ISO 9000-1: 1995	UNE-EN-ISO 9001: 1994	UNE-EN-ISO 9002: 1994	UNE-EN-ISO 9003: 1994	UNE-EN-ISO 9004-1: 1995

Sri Lanka	SLS 825: Part 2:	SLS 825: Part 3:	SLS 825: Part 4:	SLS 825: Part 5:	SLS 825: Part 6:

Sri Lanka	SLS 825: Part 2: 1988	SLS 825: Part 3: 1988	SLS 825: Part 4: 1988	SLS 825: Part 5: 1988	SLS 825: Part 6: 1988
Sweden	SS-EN ISO 9000-1: 1994	SS-EN ISO 9001: 1994	SS-EN ISO 9002: 1994	SS-EN ISO 9003: 1994	SS-EN ISO 9004-1: 1994
Switzerland	SN EN 29000: 1990	SN EN 29001: 1990	SN EN 29002: 1990	SN EN 29003: 1990	SN EN 29004: 1990
Syrian Arab Republic	S.N.S: 1148/1992	S.N.S: 1149/1992	S.N.S: 1150/1992	S.N.S: 1151/1992	S.N.S: 1152/1992
Tanzania	TZS 500: 1990	TZS 501: 1990	TZS 502: 1990	TZS 503: 1990	TZS 504: 1990
Thailand	TIS ISO 9000 – 1991	TIS ISO 9001 – 1991	TIS ISO 9002 – 1991	TIS ISO 9003 – 1991	TIS ISO 9004 – 1991
The former Yugoslav Republic of Macedonia					
Trinidad and Tobago	TTS/ISO 9000-1: 1995	TTS/ISO 9001: 1995	TTS/ISO 9002: 1995	TTS/ISO 9003: 1995	TTS/ISO 9004-1: 1995
Tunisia	NT 110.18-1987	NT 110.19-1987	NT 110.20-1987	NT 110.21-1987	NT 110.22-1987
Turkey	TS-ISO 9000-1: 1995	TS-ISO 9001: 1994	TS-ISO 9002: 1994	TS-ISO 9003: 1994	TS-ISO 9004: 1995
Turkmenistan	(prc)	(prc)	(prc)	(prc)	(prc)
Uganda					
Ukraine		GOST 40.9001-88	GOST 40.9002-88	GOST 40.9003-88	

United Arab Emirates	(prc)	(prc)	(prc)	(prc)	(prc)
United Kingdom	BS EN ISO 9000-1: 1994	BS EN ISO 9001: 1994	BS EN ISO 9002: 1994	BS EN ISO 9003: 1994	BS EN ISO 9004-1: 1994
Uruguay	UNIT-ISO 9000-1: 95	UNIT-ISO 9001: 95	UNIT-ISO 9002: 95	UNIT-ISO 9003: 95	UNIT-ISO 9004-1: 95
USA	ANSI/ASQC Q9000-1-1994	ANSI/ASQC Q9001-1994	ANSI/ASQC Q9002-1994	ANSI/ASQC Q9003-1994	ANSI/ASQC Q9004-1-1994
Uzbekistan					
Venezuela	COVENIN-ISO 9000: 1990	COVENIN-ISO 9001: 1995	COVENIN-ISO 9002: 1995	COVENIN-ISO 9003: 1995	COVENIN-ISO 9004: 1990
Viet Nam	TCVN 5200	TCVN 5201	TCVN 5202	TCVN 5203	TCVN 5204
Yemen					
Yugoslavia	JUS/ISO 9000-1: 1994	JUS/ISO 9001: 1994	JUS/ISO 9002: 1994	JUS/ISO 9003: 1994	JUS/ISO 9004-1: 1994
Zimbabwe	SAZS ISO 9000-1: 1994	SAZS ISO 9001: 1994	SAZS ISO 9002: 1994	SAZS ISO 9003: 1994	SAZS ISO 9004-1: 1994

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(iii) The ISO 9000 standards have been cited as the basic building block for the development and operation of the European Organization for Testing and Certification (EOTC). Whether it is true or not, many companies have come to the conclusion that doing business in the newly forming integrated market of Europe will necessitate being recognized as meeting the requirements of ISO 9000 or better.

(iv) Many nationally and internationally recognized product certification systems (for example, the BSI Kitemark in the UK, and the JIS Mark in Japan) have incorporated the ISO 9000 standards as a first phase requirement for approval to use their mark in specific product certification schemes.

(v) Many large industrial companies, particularly, those with operations in many countries have initiated rigorous company programmes to implement the ISO 9000 standards at their operation sites. The list we know includes Volkswagen, Du Pont, Renault, Corning, Exxon Chemicals, Sandoz and many more.

(vi) Numerous large governmental purchasers, including the Ministries of Defence in the UK and Singapore, and the Department of the Navy in the USA have made ISO 9000 registration (or its equivalent) a requirement for their large contract suppliers.

In 1987, The Standards and Industrial Research Institute of Malaysia (SIRIM) launched the Scheme for the Certification of Quality Systems to provide certification of Quality Systems to the ISO 9000 series. This programme is one of the many programmes initiated by the government to create awareness for quality and the adoption of cost-effective quality management systems by Malaysian manufacturers to enhance the competitiveness of Malaysian products in the global marketplace.

Malaysian companies had responded well to this initiative. Up to the end of October 1995, the number of application for certification had reached nine hundred and sixty-five (965). The number of certificates awarded to successful applicants totalled six hundred and eighty (680) as at the end of October 1995.

The slow growth in the number of certificates awarded could be attributed to a number of reasons. Many Malaysian companies, particularly, the small and medium-sized companies are still practising the traditional concept of quality control, i.e. quality by inspection. Very few are aware or understand the terms "Quality Assurance", "Quality Systems" and "Total Quality Management". It is often found that the managers of these organizations practise the "inspect in quality" concept by carrying out inspection-oriented quality control on incoming materials and components, in-process intermediate products and final products.

Other reasons that can be attributed to the failure to achieve the requirements of the standards are as follows:

(i) Lack of the infrastructure necessary to establish and implement the system

(ii) Lack of clear directions, i.e. absence of a quality policy and quality objectives

(iii) Lack of the necessary documentation such as procedures, work instructions and records

(iv) Lack of clear lines of authority and responsibility

(v) Lack of suitably trained personnel

HISTORICAL DEVELOPMENTS

To understand how quality had reached its present state of development, it is appropriate to examine briefly how it had evolved over time. Feigenbaum (Ref. 4) identified the following five stages in the evolution of quality: operator, foreman, inspection department, statistical quality control and total quality control.

In the eighteenth and nineteenth centuries, quality control as we know it today did not exist yet. Manufacturing was performed by skilled artisans and craftsmen. Achievement of quality was one of the essential skills an apprentice had to learn on his way to being qualified as a craftsman. Essentially quality control is determined by examining the individual product made and determining its fitness for its intended purpose.

The industrial revolution, the introduction of mass production and the manufacture of interchangeable parts saw the progression of operator quality control to foreman quality control. This was necessitated by a change in production technique where workers were grouped together to perform in a similar task (division of labour) under the supervision of a foreman, who then assumed responsibility for the quality of their work.

The manufacturing system became more complex during World War I, involving large numbers of workers reporting to each production foreman. As a result, the first full-time inspectors appeared on the scene, initiating the third step, which is known as inspector quality control.

The next step in the evolution of quality was the introduction of statistical quality control. In 1931, W.A. Shewhart published his book titled "Economic Control of Quality of Manufactured Product". In it, Shewhart gave precise and measurable definition of manufacturing control, developed powerful techniques for monitoring and evaluating day-to-day production, and suggested a variety of ways of improving quality. The results of Shewhart's work, the process control chart, is one of the most powerful tools used by today's quality professional (Ref. 5).

The advent of World War II and its mass production requirements resulted in an increase in the application of statistical quality control techniques. Statistical sampling tables based on the concept of acceptable quality levels (AQL) were developed to enhance the efficiency of the inspection process and the inspection departments by eliminating the need to carry out a 100% inspection on all products manufactured.

The concepts of Quality Assurance first appeared with the publication of several works in the 1950s and 1960s by quality gurus such as Juran and Feigenbaum. The theme central to the concept of Quality Assurance is to "Build-In-Quality" as opposed to the traditional concept of "Inspect-In-Quality". This is best illustrated by the definition of Total Quality Control by Feigenbaum (Ref. 4) as "The underlying principle of this total quality view . . . is that, to provide genuine effectiveness, control must start with the design of the product and end only when the product has been placed in the hands of a customer who remains satisfied . . . the first principle to recognize is that quality is everybody's job".

Modern quality assurance, as described by Bulled (Ref. 6) involves the following activities:

(i) Ensuring that the customer's requirements are correctly obtained and interpreted.

(ii) Translating the requirements into design, recognizing the method of manufacture to ensure as far as practical that quality is built into the product.

(iii) Incorporating material into the product which is of the correct standard and reliability.

(iv) Maintaining the responsibility of the supplier until the customer satisfaction has been met.

These principles are illustrated in Figure 1.1. (The Quality Loop). These same principles have now been incorporated in the various quality systems standards published.

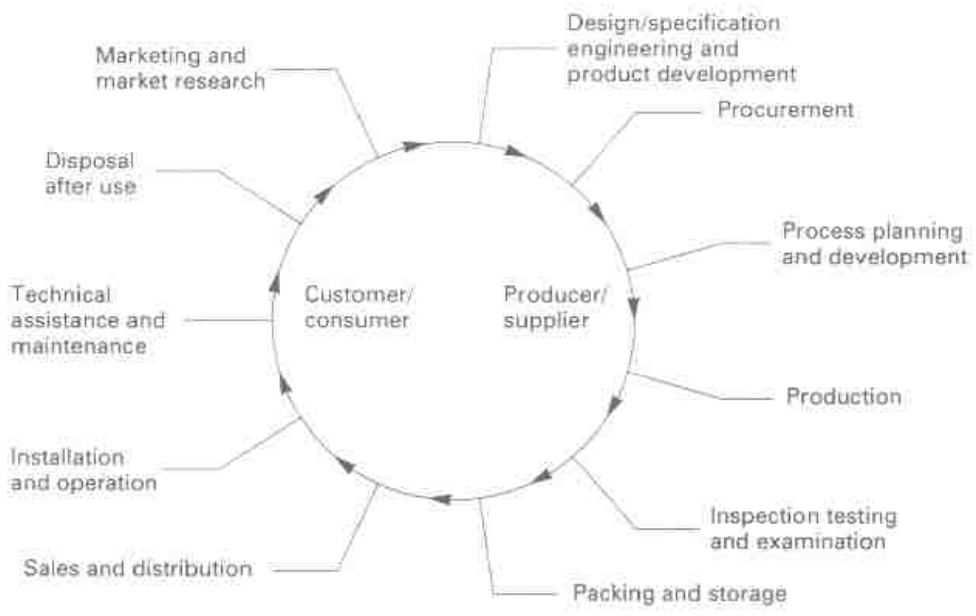


Figure 1.1 The Quality Loop

2

The ISO 9000 Series

In the days before the publication of the ISO 9000 standards, Quality Systems Standards are already in existence. The United States, for example, has MIL-Q-9858, which is used by the US military for its procurement requirements. This specification was adopted for use by the NATO countries as its AQAP (Allied Quality Assurance Publication) series. The AQAP series was in turn adapted for use in procurement by the UK Ministry of Defence as the DEF 05-21 series.

In 1972, the British Standards Institution adapted the DEF 05-21 series for civilian use and published BS 4891 (Ref. 7) as a guide to quality assurance.

At the same time, major procurement bodies developed their own standards. The Ford Motor Company has, for example, the Q101 specifications which its suppliers must meet with before they can be accepted as a Ford supplier. All of these standards and specifications have a similar basis and is built round the concept of Quality Assurance which is defined as "all those planned and systematic action necessary to provide adequate confidence that a product or service will satisfy given requirements for quality" (Ref. 8).

This proliferation of national and industry specific Quality Systems Standards and specification is now becoming a source of concern and frustration to suppliers in the United Kingdom. To ensure that suppliers meet the standard specifications, they are subjected to a long and tedious assessment by the customer. Consequently, suppliers become subjected to a number of multiple assessments from a variety of purchasing organizations. This practice of independent second party

assessments results in a duplication of effort and creates considerable difficulties for the supplier.

Recognizing this situation of multiple assessments the Warner Report was prepared in 1977. The report recommended that the problem of multiple assessments could be tackled by having a common standard for assessment. This recommendation resulted in a national uniform Standard for Quality Systems, BS 5750 being published in 1979 in the United Kingdom.

In the same year, the British Standards Institution submitted a proposal to the ISO that a new technical committee be formed to prepare international standards relating to quality assurance techniques and practices. The new technical committee on Quality Assurance was given the number ISO/TC 176. When the committee embarked on its task to prepare quality management standards for worldwide application, it drew on the experiences of UK and Canada which already had substantial experiences in implementing Quality Systems Standards. The work of this committee resulted in the ISO 9000 series being published in 1987.

ISO 9000 SERIES

The International Organization for Standardization, ISO, is the specialized international agency for standards making based in Geneva. The membership of ISO is made up of the national standards bodies of 90 countries. The work of the ISO provides industries with many types of standards, such as specifications, performance requirements, test methods, definitions and terminology and symbols. These standards provide a common basis of understanding and agreement useful in international commerce to facilitate international trade and to avoid ''non tariff'' barriers to trade.

The ISO 9000 series of Quality Systems Standards, published in 1987, are generic Quality Systems Standards. The standards require an organization to operate to a structure of written policies and procedures which are designed to ensure that it can consistently deliver a product or service to meet customer requirements.

The standards are not concerned with specifying final product or service quality, which is only referenced by the need to meet customer requirements, but rather with setting out a framework for the systems which an organization should have in place to control its internal "processes". The underlying philosophy is for an organization to be able to deliver consistently a product or service to the expected standard, thus engendering customer's confidence. It must have thought through and have control over all the processes involved.

Since the concept of a Quality Systems is a generic one, the standard can be applied to all types of company and organization.

ISO 9000 (BS 5750) had been described by Bulled (Ref. 6) as a tool to aid organization in the application of quality assurance. The standards allow the development of a structured approach to quality assurance through a formal Quality Systems and provide the framework around which a Quality Systems can be established.

The ISO 9000 had also been described as an essential building block towards the implementation of TQM (Total Quality Management). In a survey conducted by Barrie Dale, Director of UMIST Quality Management Centre (Ref. 9), 41% of the respondents indicated that they had introduced the concept and principles of TQM by first getting their Quality Systems registered to ISO 9000 (BS 5750).

The structure of the ISO 9000 series is illustrated in Figure 2.2.

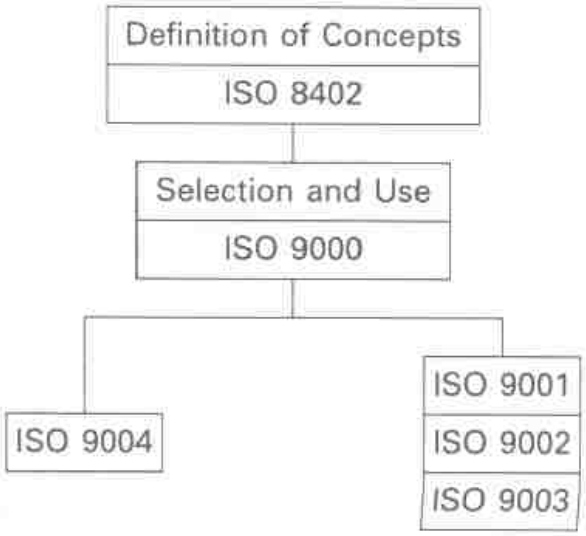


Figure 2.2 Structure of ISO 9000 Standards

ISO 8402 – QUALITY – VOCABULARY

This standard defines the terms used throughout the series for the purpose of mutual understanding in international communications. In this standard, the term quality is defined as ''the totality of features and characteristics of a product or service that base on its ability to certify stated or implied needs''. Other terms which are defined are grade, policy, management, assurance, control, system plan, audit, concept of traceability, non-conformity and specification.

ISO 9000 – 1994 – QUALITY MANAGEMENT AND QUALITY ASSURANCE STANDARDS – GUIDELINES FOR SELECTION AND USE

This standard is sometimes described as the ''road map'' to the system which is designed to help the user to obtain an understanding of what the ISO 9000 system is really about.

The standard serves to clarify the distinctions and interrelationships between the principle quality concepts and to provide guidelines for the selection and use of the appropriate model of Quality Systems, i.e. ISO 9001, ISO 9002 or ISO 9003 for an organization. The standard contains a table which cross-references the quality elements to each of the three models.

ISO 9004 – 1994 – QUALITY MANAGEMENT AND QUALITY ELEMENTS: GUIDELINES

This standard gives general guidelines for developing and implementing the kinds of Quality Systems that are requirements of ISO 9001, 9002 and 9003. The standard considers management responsibility, quality systems principles, structure, auditing and review. It also contains general considerations on the economics of quality-related cost considerations, as well as quality in marketing, specification and design, procurement, production, training and motivation, etc.

ISO 9001: 1994 QUALITY SYSTEMS: MODEL FOR QUALITY ASSURANCE IN DESIGN, DEVELOPMENT, PRODUCTION, INSTALLATION AND SERVICING

This standard prescribes the quality systems requirements for design and development, production, installation and servicing of products or services.

The ISO 9001 standard is applicable where a contract between two parties requires the demonstration of a supplier's capability to design and supply product primarily aimed at preventing non-conformity at all stages from design through to servicing.

This is the most comprehensive of the three Quality Systems Standards and has 20 Quality Systems elements.

ISO 9002: 1994 – QUALITY SYSTEMS: MODEL FOR QUALITY ASSURANCE IN PRODUCTION AND INSTALLATION

This standard is appropriate in a situation where it is required to demonstrate a supplier's capability to control the processes that determine the acceptability of the product supplied.

The ISO 9002 is primarily aimed at preventing and at detecting any non-conformity during production and installation, and implementing the means to prevent its recurrence. This standard has the same Quality Systems elements as ISO 9001 except for one, i.e. design control.

ISO 9003: 1994 – QUALITY SYSTEMS: MODEL FOR QUALITY ASSURANCE IN FINAL INSPECTION AND TEST

This is the least detailed of the three standards and requires only that the conformance covers quality assurance obligation of the supplier in the area of final inspection and test.

The ISO 9003 standard is used where a contract between two parties requires demonstration of a supplier's capability to detect and control the disposition of any product non-conformity during final inspection and test and has only 12 Quality Systems elements.

A cross-reference list of Quality Systems elements of ISO 9001, ISO 9002 and ISO 9003 is illustrated in Table 2.1. Other relevant ISO 9000 standards are highlighted in Table 2.2.

Table 2.1 Cross-reference of ISO 9000 requirements

REQUIREMENTS	ISO 9001	ISO 9002	ISO 9003
(a) Management responsibility	*	*	*
(b) Quality system	*	*	*
(c) Contract review	*	*	
(d) Design control	*		
(e) Document and data control	*	*	*
(f) Purchasing	*	*	*
(g) Customer supplied product	*	*	*
(h) Product identification and traceability	*	*	*
(i) Process control	*	*	
(j) Inspection and testing	*	*	*
(k) Control of inspection, measuring and test equipment	*	*	*
(l) Inspection and test status	*	*	*
(m) Control of non-conforming product	*	*	*
(n) Corrective and preventive action	*	*	*
(o) Handling, storage, packaging, preservation and delivery	*	*	*
(p) Quality records	*	*	*
(q) Internal quality audits	*	*	*
(r) Training	*	*	*
(s) Servicing	*	*	
(t) Use of statistical methods	*	*	*

Source: ISO 9000 series of standard

Table 2.2

ISO 9004-2: 1991	Quality management and quality systems elements – Part 2: Guidelines for services
ISO 9004-3: 1993	Quality management and quality systems elements – Part 3: Guidelines for processed materials
ISO 9004-4: 1994	Quality management and quality systems elements – Part 4: Guidelines for quality improvement Technical corrigendum 1
ISO/DIS 9004-5	Quality management and quality systems elements – Part 5: Guidelines for quality plans
ISO/DIS 9004-7	Quality management and quality systems elements – Part 7: Guidelines for configuration management
ISO 10011-1: 1990	Guidelines for auditing quality systems – Part 1: Auditing
ISO 10011-2: 1991	Guidelines for auditing quality systems – Part 2: Qualification criteria for quality systems auditors
ISO 10011-3: 1991	Guidelines for auditing quality systems – Part 3: Management of audit programmes
ISO 10012-1: 1992	Quality assurance requirements for measuring equipment – Part 1: Confirmation system for measuring equipment
ISO/DIS 10013	Guidelines for developing quality manuals
ISO 8402: 1994	Quality management and quality assurance – Vocabulary
ISO 9000-1: 1994	Quality management and quality assurance standards – Part 1: Guidelines for selection and use
ISO 9000-2: 1993	Quality management and quality assurance standards – Part 2: Generic guidelines for the application of ISO 9001, ISO 9002 and ISO 9003
ISO 9000-3: 1991	Quality management and quality assurance standards – Part 3: Guidelines for the application of ISO 9001 to the development, supply and maintenance of software
ISO 9000-4: 1993	Quality management and quality assurance standards – Part 4: Guide to dependability programme management
ISO 9001: 1994	Quality systems – Model for quality assurance in design, development, production, installation and servicing

ISO 9002: 1994	Quality systems – Model for quality assurance in production, installation and servicing
ISO 9003: 1994	Quality systems – Model for quality assurance in final inspection and test
ISO 9004-1: 1994	Quality management and Quality systems elements – Part 1: Guidelines

3

The Elements of ISO 9000

INTRODUCTION

This chapter will describe the construction industry requirements for each individual element specified in the ISO 9000 standards.

MANAGEMENT RESPONSIBILITY – CLAUSE 4.1

This requirement specifies management shall define and document its policy, objectives and commitment to quality. It must ensure that this policy is understood and implemented at all levels of the construction organizations.

Management is also required to define the responsibility, authority and interrelation of all personnel who manage, perform and verify work affecting quality. All personnel that are involved with verification activities are required to be trained and provided with adequate resources. To ensure the requirements of the standards are implemented and maintained, a person within the organization must be appointed as the management representative and given the appropriate responsibility and authority to carry out his duties.

Periodically reviews of the system by management specified in the standard must be carried out to ensure continuing effectiveness. Records of each review must be maintained.

QUALITY SYSTEM – CLAUSE 4.2

This requirement specifies that the construction organization shall establish and maintain documented Quality Systems as a means of ensuring that the product or service provided meet customer's requirements. The Quality Systems includes quality manuals, work procedures, work instructions, project quality plans, inspection records and resources allocated to meet the ISO 9000 requirements.

CONTRACT REVIEW – CLAUSE 4.3

This requirement specifies that procedures are established to cover the review of all contracts and/or customer orders to ensure that all customer requirements are defined and that the construction organization has the capability to meet contractual requirements. Any difference between what the customer wants and what the construction organization can offer must be resolved before the acceptance of the letter of award.

DESIGN CONTROL – CLAUSE 4.4

This clause is applicable for ISO 9001.

DOCUMENT AND DATA CONTROL – CLAUSE 4.5

This requirement specifies that procedures must be established and maintained to control all documents and data. These documents must be reviewed and approved by authorized personnel prior to issue. The control of documents must ensure that appropriated documents are readily available at the right location and all obsolete documents removed.

The standards also require that changes made to documents must be reviewed and approved by the same authorized personnel.

All documents which include construction drawings, project quality plan, specifications, work procedures and work instructions must be controlled through proper identification and labelling to prevent wrong use and documents being lost.

PURCHASING – CLAUSE 4.6

This requirement specifies that procedures must be established and maintained to ensure that sub-contractors are selected on their ability to meet stated requirements. The performance of sub-contractors and material suppliers must be monitored to ensure their effectiveness.

All purchase documents must contain exact details of purchase including type, grade, specification, construction drawing and other relevant data or information to ensure items or services are purchased correctly. Purchase orders must be reviewed for correctness and approved for adequacy prior to release.

This requirement in the standard also deals with the right of the purchasers to verify at source or upon receipt that purchased product conforms to specified requirements.

CUSTOMER SUPPLIED PRODUCTS – CLAUSE 4.7

The standards require that all items or material supplied by the customer to be properly identified, stored and maintained to prevent any damage or loss. Any materials that are unsuitable for use shall be recorded, segregated and reported to the customers. In construction industry, nominated sub-contractors and nominated suppliers may be classified as customer supplied products or services.

PRODUCT IDENTIFICATION AND TRACEABILITY – CLAUSE 4.8

This requirement specifies that procedure must be established and maintained to ensure all products, components, semi-finished products, work-in-progress are readily identifiable during all stages of construction, delivery, storage and installation. Whenever traceability is a specified requirement, individual product or batches are required to have a unique identification. Records are to be kept for product identification and traceability.

PROCESS CONTROL – CLAUSE 4.9

This requirement specifies that construction and installation must be carried out under controlled conditions. Controlled conditions include:

(i) documented work instructions defining the manner of construction and installation, use of suitable construction and installation equipment, suitable working environment, compliance with reference standards/codes and project quality plan.

(ii) monitoring and control of suitable construction methods and building materials characteristics during construction and installation.

(iii) approval of construction methods for mechanical & electrical equipment.

(iv) criteria of workmanship in written standards or by means of representative sample.

This requirement also specifies that any construction process, for which the results cannot be fully verified by subsequent inspection and testing and where processing deficiencies may become apparent only after the product is in use, should employ continuous monitoring to ensure that the specified requirements are met.

INSPECTION AND TESTING – CLAUSE 4.10

This requirement specifies that incoming building materials, mechanical & electrical equipment, in-progress building materials and finished items shall be inspected and tested according to the project quality plan or documented procedure to verify conformance to specification or defined criteria. In the case of urgent construction, building materials and mechanical and electrical equipment shall be positively identified and recorded in order to allow immediate recall in the event of non-conformance to specified requirements.

Records of such inspection and testing shall be maintained to provide evidence that the product has met the defined criteria.

INSPECTION, MEASURING AND TEST EQUIPMENT – CLAUSE 4.11

This requirement specifies that all measuring and test equipment, either owned by the construction company, on loan, or provided by the customers must be controlled, calibrated and maintained. This is to ensure that all measurements are consistent with the required measurement capability. Inspection equipment includes test hardware such as theodolite, dumpy level, measuring gauge, etc, which are required to be checked for accuracy before use or at prescribed intervals. Calibrations carried out shall be traceable to national standards and in accordance with documented procedures. Records of calibration must be maintained.

INSPECTION AND TEST STATUS – CLAUSE 4.12

This requirement specifies that the inspection and test status of building materials and workmanship must be known through all the construction company operations. Inspection and test status can be indicated by using markings, labels or storage locations. The purpose of this requirement is to prevent the inadvertent use of materials and workmanship that have not passed the required inspection and test.

CONTROL OF NON-CONFORMING PRODUCTS – CLAUSE 4.13

This requirement specifies that procedures are established and maintained to ensure that building materials and workmanship that do not conform to specified requirements are prevented from use or installation. Non-conforming building materials and workmanship must be clearly identified, documented, evaluated, segregated and held pending disposal to prevent unauthorized use, shipment or mixing with good building materials and workmanship.

All non-conforming building materials and workmanship shall be reviewed by authorized personnel in accordance with documented procedures so that a decision can be made to rework, accept under concession, regrade or reject.

CORRECTIVE AND PREVENTIVE ACTION – CLAUSE 4.14

This is a key requirement for providing Quality Systems improvement. It requires procedures to be established and maintained to:

(i) investigate the cause of problems and carry out necessary corrective action to prevent recurrence.

(ii) analyze all construction methods, quality records and customer complaints to eliminate the potential causes of problems.

(iii) initiate preventive action to deal with the problems.

(iv) maintain procedures in response to corrective action taken.

(v) implement and record changes in procedures resulting from corrective action.

HANDLING, STORAGE, PACKAGING, PRESERVATION AND DELIVERY – CLAUSE 4.15

This requirement specifies that procedures must be established and maintained for handling, storage, packaging and delivery of the building materials, mechanical and electrical equipment and precast components.

The procedures must prevent damage or deterioration to building materials, mechanical and electrical equipment and precast components during handling, storage or delivery. An appropriate method for authorizing receipt and despatch to and from storage area must be established.

QUALITY RECORDS – CLAUSE 4.16

This requirement specifies that records pertaining to quality must be maintained to demonstrate achievement of the required quality and the effective operation of the Quality Systems.

Procedures must be established and maintained for the identification, collection, indexing, filing, storage, maintenance and disposition of quality records. Records must be easily retrievable and kept for a predetermined period of time.

INTERNAL QUALITY AUDIT – CLAUSE 4.17

This requirement specifies that a system of planned internal audits must be carried out to verify whether quality activities comply with planned arrangements and to determine the effectiveness of the Quality Systems.

The results of the audit must be documented and brought to the person responsible. Corrective action must be taken to address the deficiencies found by the audit.

TRAINING – CLAUSE 4.18

This requirement specifies that procedures must be established and maintained to identify the training needs of personnel performing activities affecting quality. Records of training must be kept and maintained.

SERVICING – CLAUSE 4.19

This requirement specifies that procedures must be established and maintained under the defect liability period, if specified in a contract, to ensure that service provided meets specified requirements.

STATISTICAL TECHNIQUES – CLAUSE 4.20

Where appropriate, this requirement specifies the identification of suitable statistical techniques to verify the acceptability of process capability and product characteristics.

4

Management Responsibility

INTRODUCTION

This chapter describes the means by which the construction company acknowledges its commitment to quality through the provision of a quality policy statement; the definition and specification of individual management responsibilities; and the operation of a regular quality systems review.

QUALITY POLICY

The quality policy statement defines the company's quality mission and objectives. It is the means by which the company communicates to the company's workforce, to the clients and to the world at large of the company's commitment to quality. The quality policy statement should be signed by the Managing Director or Chief Executive Officer and incorporated within the quality policy manual. Copies of the quality policy statement should be prominently displayed at the workplace including all work sites. The quality policy statement should also be incorporated in all training programmes to the employees.

ORGANIZATION

An organization chart showing functional relationships and area of authority and responsibility should be maintained. Job descriptions for all personnel who manage, perform and verify work affecting the qual-

ity of works and services should be clearly specified. Samples of office and site organization charts are shown in Figures 4.1 and 4.2.

RESPONSIBILITY AND AUTHORITY

A summary of the responsibility and authority of the key personnel is given below:

MANAGING DIRECTOR

Reports to the Board of Directors for planning, co-ordinating and directing the company's operations including Project Management, Accounting and General Administration and maintenance of a Quality Management System.

GENERAL MANAGER

Reports to the Managing Director for the preparation of Tenders, Project Implementation, Contracts Administration, Purchasing, Personnel and Administration as well as day-to-day operations.

PROJECT CO-ORDINATOR

Reports to the General Manager for the implementation of projects including Planning and Co-ordinating. Co-ordinates with the Contracts Department and site teams to ensure projects progress on time and meet employer's representative or consultants requirement.

CONTRACT MANAGER

Reports to the General Manager for contractual matter such as appointment of sub-contractors, issues and re-issues of insurance and bonds to company and nominated sub-contractors as well as handling contractual claims.

Figure 4.1 Office Organization Chart

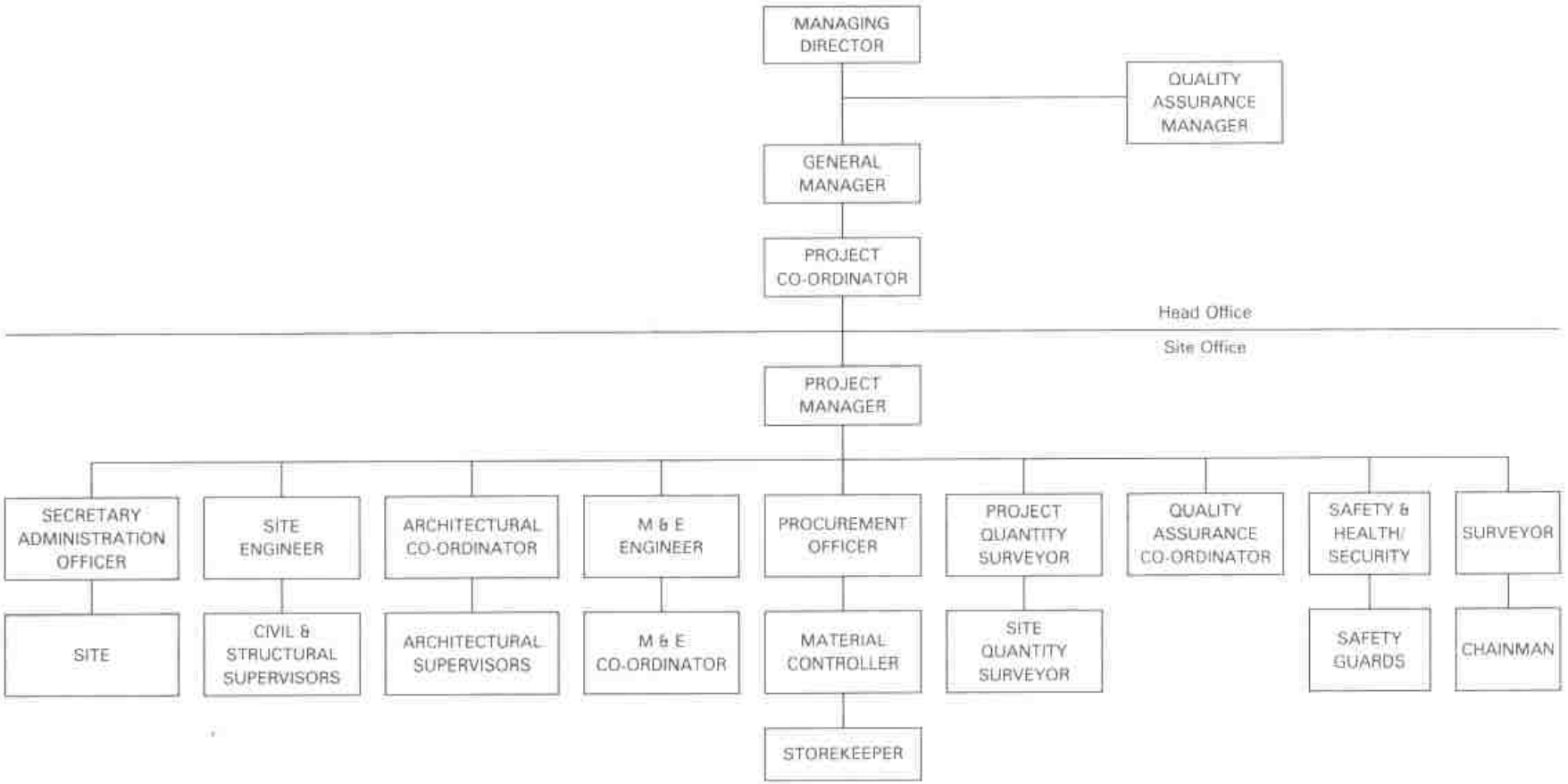


Figure 4.2 Office Organization Chart

QUALITY ASSURANCE MANAGER

Reports to the Managing Director for the development and maintenance of the company's Quality Management Systems. Carries out regular internal quality audits.

ACCOUNTANT

Reports to the General Manager for financial and accounting functions.

ADMINISTRATION OFFICER

Reports to the General Manager for all administrative matters.

TENDER MANAGER

Reports to the General Manager for the timely preparation and completion of tenders. This includes approving tendering rates and any specific requirements such as identifying the need for a Project Quality Plan.

MATERIAL PURCHASING OFFICER

Reports to the General Manager for Purchasing, Sourcing and Selection of 'requirements at the construction sites'. He shall ensure that suppliers maintain a Quality Management Systems which is compatible with the service they supply to the Company.

PERSONNEL OFFICER

Reports to the General Manager for the recruitment of personnel and all related matters.

ALLOCATION OF RESOURCES

Company should provide adequate resources and trained personnel for verification of construction activities, so that where verification is required either as a project or contractual requirement, this can be met

and maintained. The quality management systems should be regularly reviewed to ensure compliance and effectiveness.

Personnel who carry out verification of construction activities should be independent of the areas being verified. They should be provided with adequate training to carry out their responsibilities. Work carried out by Project Managers and Contract Officers is verified by upward delegation.

MANAGEMENT REPRESENTATIVE

The Quality Assurance Manager is appointed by the management as the management representative for the Quality Systems. The Quality Assurance Manager should be given the necessary authority and responsibility to ensure the effective operation of the Quality Systems and that the requirements of ISO 9002 are met and maintained.

MANAGEMENT REVIEW

The Quality Systems should be reviewed at least once a year by the Quality Assurance Manager. The main purpose of the review is to assess the effectiveness of the system and to determine whether any changes in procedures, construction methods or philosophy are considered necessary to meet current and future needs. The review should be minuted and record maintained. The annual Quality Systems review should be held by the Managing Director with all the Heads of Departments. The Quality Assurance Manager should prepare the agenda which may include but not be limited to:

(i) Documentation review

(ii) Internal audit and external audit schedule

(iii) Outstanding audit findings

(iv) Customer complaints

(v) Awareness training of the Quality Systems

5

Quality Systems Documentation

INTRODUCTION

This chapter describes the documentation required for a Quality Systems. The Quality Assurance Manager is responsible for the development and maintenance of the Quality Systems Documentation. The levels of Quality Systems Documentation are divided into quality manual, work procedure, work instruction and project quality plan respectively.

LEVEL OF DOCUMENTATION

Level 1 – Quality Manual (QM)

The Quality Manual describes the company's overall Quality Systems in compliance with ISO 9002 requirements. The Quality Manual should consist of the company background in terms of its business activities, organization chart, quality policy, objective, a brief description of the company commitment for each of the elements of ISO 9000. The Quality Manual should be classified as controlled copy for the purposes of updating and revision. An uncontrolled copy of this Quality Manual can be distributed to clients or potential clients if required.

LEVEL 2 – Work Procedure (WP)

This document describes in further details the procedures covering each element of the Quality Systems. The procedures should be a

controlled document and should not be made available to parties outside the organization.

Work Procedures should be written base on the following heading:

Introduction

To state the objective or intention of the document.

Scope

To define the area, department, group or personnel to which the work procedure applies. The scope of each work procedure should not contain more than one subject unless it is difficult to separate two or more related subjects.

Responsibility

To specify the responsibilities of those involved in the execution of the work procedure and those responsible for ensuring its effective implementation.

Procedure

To describe in detail the steps required in order to meet the requirements of the objectivity of the work procedure.

Reference

To state documents (with reference numbers) that have a bearing on the activities within the work procedure.

The extent of the detail content to be included in each work procedure should be limited to those necessary to ensure that the objective and requirements of the quality manual are met. Work Procedures should be specific enough to ensure the proper execution by the designated personnel. Detail instruction, e.g. how to operate or calibrate an equipment and what to inspect for each work should be defined in the respective work instruction.

Words used should be simple, clear and specific. Flow charts should be provided where applicable for quick reference.

LEVEL 3 – Work Instruction (WI)

This is a specific work instruction issued for carrying out specific jobs or activities. Work instruction can be in the form of written instructions or checklist. They can be issued and controlled by the managers who prepared them. An example of a written instruction for Contract Division is shown in Example 5.1.

Example 5.1 An Example of A Written Work Instruction

(a) Awarding of Contracts To Sub-contractors

Quantity Surveyor should check with the Project Manager if they have any preference for a particular mode of tender award for the purpose of ensuring a smooth running of the progress of works on site.

Quantity Surveyor may request the programme chart, if available, from the Project Manager for the preparation of the Award of Sub-Contractors Schedule.

Quantity Surveyor to request names of sub-contractors that participated in tender from Tender Manager and any recommendation from the Managing Director, General Manager and Project Co-ordinator.

Quantity Surveyor to cross-reference the recommended names with the list of approved sub-contractors for compliance with the ISO 9002 requirements and if the names have not been approved, to request details from the named sub-contractor for evaluation and approval by the Quality Assurance Manager. Quantity Surveyor to call for tender from at least three sub-contractors.

Quantity Surveyor to carry out tender assessment with particular reference to the basis of sub-contractor's quotation and if any rate is too low or too high.

Tender negotiations, if required, will be held with the shortlisted tenderers. This negotiation would be led by the General Manager or Contract Manager. Other interested parties, if attending such negotiation, shall be on an observer role only and shall not interfere with the negotiation process.

Quantity Surveyor to discuss on tender award with the Contract Manager.

Quantity Surveyor to prepare Tender Report and recommendation for approval by General Manager and Managing Director. Prior to approval, the Quality Assurance Manager shall verify that the sub-contractor is an approved sub-contractor.

Contract Manager to inform Project Manager on the successful sub-contractor and the value of sub-contract.

Quantity Surveyor to prepare Letter of Award to successful tenderer and copy to the Project Manager. A meeting shall be held to introduce the sub-contractor to the Project Manager.

Quantity Surveyor to ensure submission of Performance Bond from the sub-contractors to ensure compliance with the requirements of sub-contract.

Quantity Surveyor to prepare Sub-contract Agreement based on standard format used and altered to suit each individual sub-contract requirements.

(b) Award of Nominated Sub-contractors
The Project Co-ordinator is to inform the Contract Manager upon the receipt of nomination from the client.

The Quantity Surveyor shall scrutinize the background of the Nominated Sub-contractor and inform Project Co-ordinator of any reasonable objection on the nomination.

In the event of any objection, the Project Manager shall inform the client. If there is no objection, the General Manager shall sign the Letter of Acceptance to the Nominated Sub-contractor and send out the relevant letters.

The Project Manager shall ensure that the Nominated Sub-contractor submits the Performance Bond, Workmen Compensation and Contractor's All Risk Insurance to the Quantity Surveyor for vetting prior to commencement of works.

Quantity Surveyor to follow up Nominated Sub-contractor Agreement (prepared by client).

(c) Main Contract Requirement By The Client
Upon the receipt of a copy of the Letter of Acceptance of Tender, the following shall be carried out by the Quantity Surveyor:

Request from the Tender Manager the working file during tender for the project.

Submit a request together with the format of Performance Bond to the Accountant for the issuance of a Performance Bond by a Panel Banker.

If Advance Payment is allowed in the Contract, the Quantity Surveyor should submit a request to the Accountant for a Bank Guarantee for Advance Payment.

Quantity Surveyor to call quotations for the insurance as required under the contract and table a report to the Tender Board for the approval of the procurement after the due diligence checks have been made.

Upon the receipt of the Performance Bond and Advance Payment Guarantee, the Accountant shall forward them to the Quantity Surveyor who shall check to ensure that the format issued is correct.

Likewise when the Insurance Cover Notes and/or Policies are received, the Quantity Surveyor shall check and verify.

Upon satisfactory verification, the Quantity Surveyor shall forward the Performance Bond, Advance Payment Guarantee and Insurance Cover Notes or Policies to the Project Co-ordinator.

The Project Department shall then submit the above-mentioned documents to the client.

Likewise, work instruction can be written for specific trades, e.g. concreting, checking of formwork, plastering, etc.

The important thing to remember while writing a work instruction is the language used must be clear, simple and easy to understand in order to prevent any ambiguity in instruction at the work place. Therefore, there is no specific format of writing a work instruction.

Afterall, work instruction is written mainly for the supervisor or operator to carry out Quality Control of the works.

LEVEL 4 – Project Quality Plans (PQP)

Project Quality Plans are prepared specifically to give additional information necessary to support the existing levels of quality systems documentation. Project Quality Plans are widely needed in the construction industry since every project is unique due to the different design, customer expectation and construction methods.

The Project Quality Plans should be drawn up during the mobilization stage for each new project based on the contract document, construction drawings, specification, quality manual, work procedures and work instructions.

The contents of Project Quality Plans should consist of the following particulars:

(a) Names and addresses of the owner, client representative and consultants

(b) The scope of works

(c) Site layout plan

(d) Master programme chart

(e) Project organization structure

(f) Job description of all the site staff

(g) List of approved sub-contractors and suppliers and the telephone numbers

(h) Quality objective

(i) Inspection and test plans to verify all construction activities

(j) Work instructions where applicable

(k) Request for inspection form

(l) Contract information

(m) List of equipment used on site

(n) Construction method statement

In practice, Project Quality Plans are used in the following four situations:

(a) Main requirements, specific to a project, supplementing the Quality Systems.

(b) Changes to the Quality Systems imposed on a specific contract by the client.

(c) Awareness training of contract (temporary) staff where their numbers or nature of work could put the company's Quality Systems at risk.

(d) Complex projects where the Quality Systems has to be expanded.

A Project Quality Plan flow chart is as shown in Figure 5.1. An example of a Project Quality Plan is as shown in Appendix VIII.

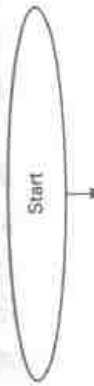
Contract staff should be encouraged to understand and adopt Company's Quality Systems. However, the Project Manager or Site Quality Co-ordinator may identify the need to produce a Project Quality Plan or contract staff highlighting the Quality Systems elements important to such staff.

Project Quality Plans are prepared by the Project Manager with the assistance of the Site Quality Co-ordinator on site. If Project Quality Plans are part of the contract, the Project Manager should ensure that they are complied with, and included in his normal reporting to the client. Where Project Quality Plans are specified, the issuer should have controlled and uncontrolled distribution on a needs basis.

The Quality Assurance Manager or Site Quality Co-ordinator should identify the parts of the project quality plan subject to change. He should ensure that such changes and the parts of the Project Quality Plan affected are documented for easy reference. He should also ensure that these changes are revised where appropriate, expeditiously and accurately. He should also attend to the distribution and records.

The Project Manager or Site Quality Co-ordinator should prepare Project Quality Plans for contract staff where supervision for Quality Assurance is made impossible for the maintenance of the Quality Systems. All such Project Quality Plans should be precise and ''user-friendly''. They should be subjected to document control with revision service and distribution. The Site Quality Co-ordinator should prepare and issue a Project Quality Plan as a Controlled Document. The client may require adoption of a particular format.

The Site Quality Co-ordinator should scrutinize any ''check'' points for inspection as these can directly affect progress of work on site. Where Inspection and Test Plans are to be approved by the client, the plan should be endorsed ''In the event of non-attendance at a ''check'' point, work should progress on expiry of the notice of the ''check'' point after further consultation with the Project Manager.



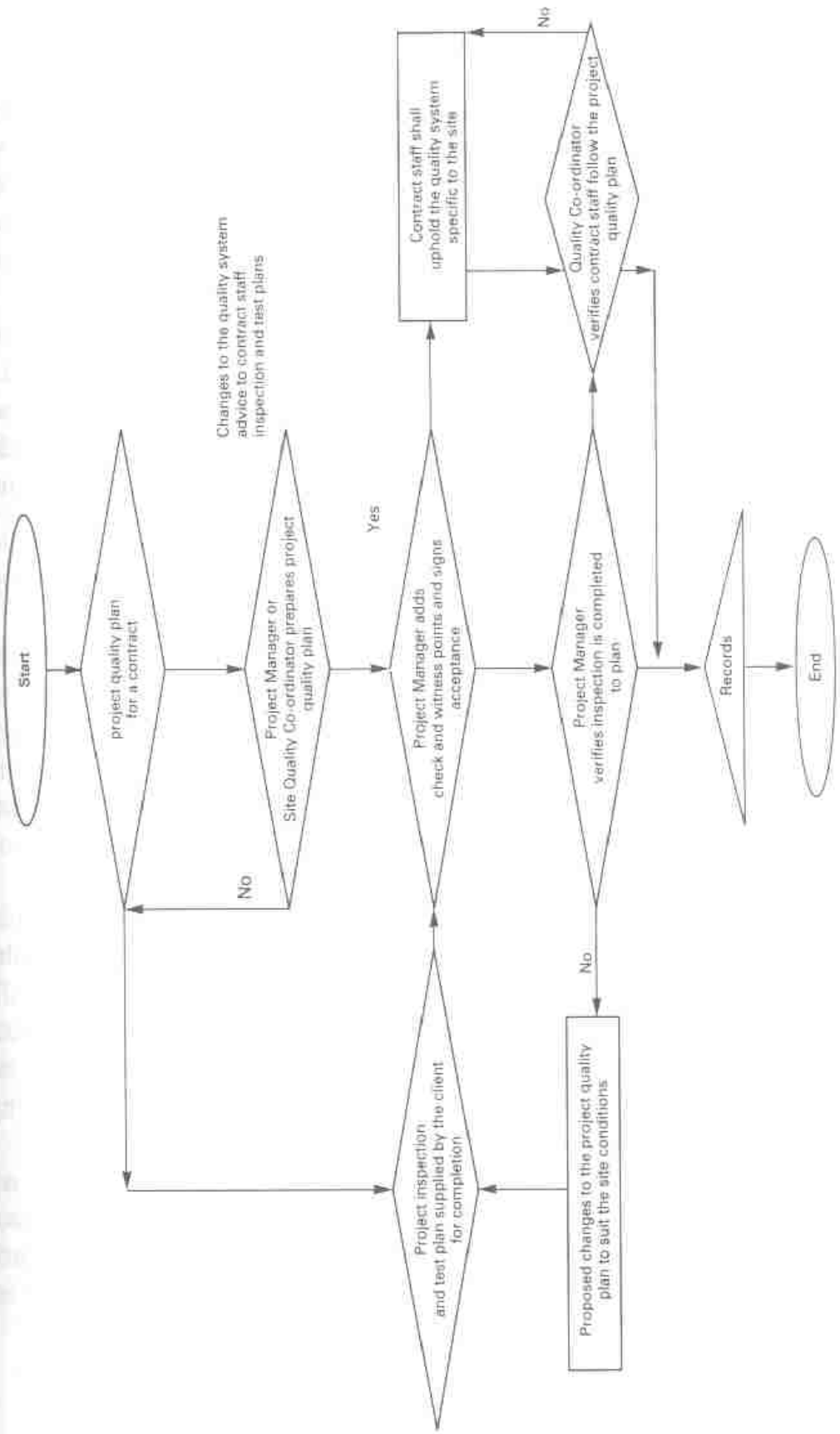


Figure 5.1 Project Quality Plan Flow Chart

MAINTENANCE OF THE QUALITY SYSTEMS DOCUMENTATION

A copy of Work Procedures, Work Instructions and Project Quality Plans issued at the site office should be forwarded to the Quality Assurance Manager for his approval. The Quality Assurance Manager should ensure that such Work Procedures, Work Instructions and Project Quality Plans are not in conflict with the existing Quality Systems Documentation.

Distribution of the Quality Systems Documentation should be controlled at source by maintaining a master distribution list. This is to facilitate the deletion or inclusion of any amendments to the documentation later on. The maintenance of the Quality Systems Documentation can be achieved through awareness training, internal and external audits, and document reviews of the system.

6

Contract Review

INTRODUCTION

Contract review is an essential phase in a construction project. The objective of the contract review is to ensure that all contractual requirements can be met.

The contract document will normally consist of the construction drawings, terms and conditions of the contract, specifications and Bill of Quantities. In most instances, there will be an "or equivalent" clause for the building materials requirement or methods of construction to be employed specified in the contract. However, usage of an equivalent building materials or methods of construction are subject to the approval of the consultants.

Most of the consultants will allow the usage of the latest construction methods or building materials provided that the proposal for the alternative is sound and do not in any way affect the quality of the finished product or affect the work programme of the project. Of course, most consultants will prefer that no additional cost are incurred as they have to work within the stipulated budget allocated to the project by the client.

The advancement in construction technologies have not been tested in time. Some of the defects are due to the latent defect which can only be shown after a long period of time. Therefore, it is important for the project teams to look into the above concerns through the process of contract review.

Contract review covers the two critical stages of pre tender and post tender review.

PRE TENDER REVIEW

This involves the review of tender documents to ensure that tenders prepared are complete, well defined and properly documented before submission. Pre tender review is done when a tender or job opportunity arises and after a decision is made to participate in the tender.

On identifying a tender opportunity or on receiving an invitation to tender, the company shall conduct a pre tender review to arrive at a decision as to whether to tender or otherwise base on the following factors:

(i) Company's technical capabilities and resources to execute the proposed work

(ii) Tender Department's capacity to prepare the tender

The tender document should provide information for computing estimation for the tender. In the event of any discrepancies in the information provided or where queries arise or where additional information are required, the Tender Manager should clarify with the client and consultant. Any meetings arranged for the clarification of the ambiguities of the tender document with the client and consultant should be minuted for record purposes.

The scope of work should be clearly stated by the Tender Manager and verified by the General Manager before submission of a tender. The Quality Systems should be included in any tender estimation.

However, for certain situation where quality requirements differ from the existing Quality Systems, a project quality plan should be prepared by the Project Manager and verified by the Quality Assurance Manager, who should inform the General Manager of any cost implications. A sample of pre tender review form is shown in Appendix VI.

POST TENDER REVIEW

Upon receipt of letter of award and before physical possession of site, there should be a post tender review meeting to review all aspects of the construction drawings, specification, terms and conditions of the contract, scope of works, design aspect, work programme and the methods of construction in order that all parties understand the requirements of the contract. The Project Manager and his team of support site staff should attend the post tender review meeting. This review meeting should examine the whole contract document in detail and decide exactly what building materials and construction methods are going to be used in the project. Any deviation from the construction drawings and specifications in the contract document should be recorded and the consultant's approval obtained.

Such review is essential to control any wastage of materials and loss of time during the implementation of the project. The builder's profit margins are very much dependent on the ability of the project team to complete the project according to contract requirement efficiently.

Essentially, the post tender review shall look into areas as follows:

(a) Mobilization and site facilities review

(b) Specification review

(c) Construction methods review

(d) Building materials review

(e) Plant and machinery review

(f) Construction drawings review

A sample of post tender review form is shown in Appendix VII.

MOBILIZATION AND SITE FACILITIES REVIEW

Mobilization of site facilities normally requires careful planning as to the exact location of site office, consultant office, canteen, toilet, storage yards and the tower crane. A well planned site mobilization will

allow the builder to save a substantial cost before the project gets started. At the same time, all the set-up of the site facilities should be interrelated to ensure efficient site operation while implementation is carried out on the project. Therefore, it is imperative that the builder should have a conducive site facilities for proper performance of his site staff.

SPECIFICATION REVIEW

In a contract document, specifications are normally divided into various sections depending on the types of works required to be accomplished by the builder. In order to prevent any misunderstanding by the site staff, the Project Manager should conduct a project specification review meeting with all parties involved so as to clarify any ambiguities in the specifications which will adversely affect the progress of work on site.

The specification review should also be attended by the sub-contractors and nominated sub-contractors since they may offer the very much needed specialist point of views. Usually, comments on specification of items are noted for follow-up clarification with the consultants.

CONSTRUCTION METHODS REVIEW

The methods of construction use in the project to accomplish the specific works should be reviewed in detail. In turn, the sub-contractors and nominated sub-contractors should review their methods of construction. This review may prevent materials wastage and time loss as the sub-contractors or nominated sub-contractors who are using outdated building technology become aware of more advanced methods of construction to accomplish a better quality product. The bottom line for an efficient building technology is to enable the builder to have a safer way of construction, high productivity, cost saving, better quality, environment-friendly and less time to complete the project.

BUILDING MATERIALS REVIEW

Improved and innovative building materials are constantly available in the global market. The Quality Assurance Manager should con-

stantly keep in touch with such improved building materials. The usage of improved building materials can result in better quality, lower price and reduce time of installation and fixing at site. In conducting a building materials review, alternative building materials should be suggested for comparative advantages analysis. The qualities of the building materials proposed should be recorded down so as to obtain approval of the consultants during the implementation of the project. In a building materials review, all building materials used in the project should also be reviewed at least once to prevent any future dispute.

PLANT AND MACHINERY REVIEW

All plant and machinery used in the project should be reviewed to ensure a more productive use of the machinery. Normally the safety system built in the machinery should be closely looked into to prevent any untoward accidents at the site.

A machinery review will also enable deliberation and consideration on alternate machinery that may be equal or better than the proposed equipment used in the project.

CONSTRUCTION DRAWINGS REVIEW

Each sheet of construction drawings should be thoroughly reviewed to familiarize all parties involved in the project. In most cases, construction drawings discrepancies among the architectural, structural and mechanical and electrical drawings can be discovered at an early stage of the construction process which means a substantial cost saving to the project and better finished products.

Finally, all the above areas of post tender review normally possess a common objective, that is, to ensure that any deviation, amendment or changes in the contract document are properly recorded and investigated by the builder so as not to miss out any important aspect of the quality of work which is in conflict with the contractual requirements.

7

Document Control

INTRODUCTION

The standard specifies that procedures are established to control all documents and data. The main objective of document control is to ensure that all documents and data are properly identified and labelled to prevent wrong use and the loss of important documents and data. Document control which covers all aspects of documentation should extend to all documents which may have a material effect on the quality system.

Documents and data that are subjected to control in the construction industry are the construction drawings, contract documents, technical correspondence between the contractor and the consultants, construction drawings issued to sub-contractors, shop drawings prepared by nominated sub-contractors, quality manual, work procedure, work instruction, project quality plan, inspection and test record, calibration of equipment records, specification, etc.

It is the responsibility of the officer who initiates a document to adhere to the principles of document control. Changes to the document must be reviewed and approved by the same authorized personnel.

The Quality Assurance Manager should ensure that procedures for document control are strictly adhered to. Hence, a copy of all documents issued and any follow-up amendments should be submitted to the Quality Assurance Manager for his approval. A document control flow chart is as shown in Figure 7.2.

RESPONSIBILITY

It is the responsibility of the Contract Department, the Tender Department and the Project Management Department to initiate detailed document control procedures for identification, traceability, easy retrieval, revision, distribution and records for contracts and projects where a need is identified in the project quality plan.

DOCUMENT ORIGINATION/APPROVAL

The originator may raise a document change request (DCR) using a DCR form (and fill in all the relevant information on the DCR). A sample copy of a DCR form is as shown in Figure 7.1.

The DCR (where utilized) together with the said document is sent for approval by the relevant Division Manager. After approval, the said document and completed DCR form [where utilized] should be sent to the Quality Assurance Department. A master listing of all the documents in the Quality Assurance Department with the revision number should be maintained by the document control clerk. The document control clerk can make copies and distribute the approved document to the respective relevant department.

DOCUMENT REQUISITION

A document can be requested from the document control clerk using a Document Requisition Form (DRF) approved by the relevant department manager. Document Requisition Form is used to request for the following documents:

(a) Quality Systems Documents

(b) All the relevant standards, e.g. Malaysian Standard, British Standard and Australian Standard, etc.

The issue or distribution of documents which are termed 'Controlled Document' should be properly recorded to facilitate the issue of updated copies and the withdrawal of obsolete copies in the future.

DOCUMENT CHANGE REQUEST FORM (D.C.R.)

Please phase your ideas and suggestions:

Reasons:

Name/Designation | Signature/Date | Project Site/Company

Comments:

Received by:

Dept. Manager/Name | Signature/Date | Project Site

Replies/Follow-up Actions:

Follow-up By:

Quality Assurance Manager | Signature/Date

Comments:

Authorised By:

Director/Name | Signature/Date

Figure 7.1 DCR Form

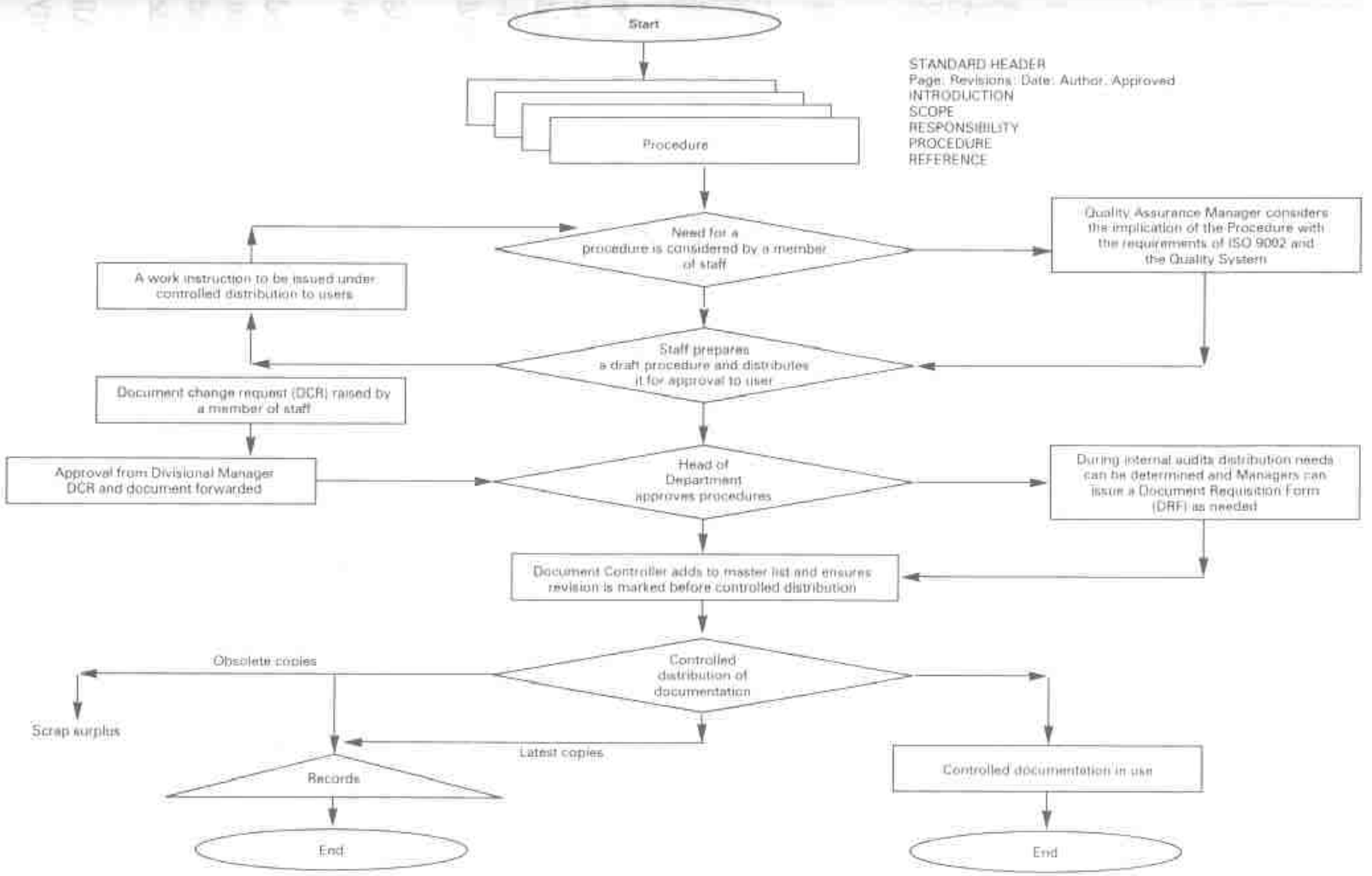


Figure 7.2 Document Control Flow Chart

SUPERSEDED DOCUMENTS

To ensure that only the current version of a particular document is used, it is advisable for the document control clerk to collect and destroy all previous copies of the document before issuing the updated version of the said document. Copies of these superseded documents kept for reference purposes should be stamped ''Superseded''.

REVIEW OF DOCUMENTS

Department manager should regularly review all documents under his jurisdiction for suitability of use. Department manager may instruct the originator of the document to update the document which is no longer suitable for use.

SERVICE DOCUMENTATION

Incoming documentation concerning contracts, tenders and projects should be stamped with a distribution stamp and circulate where appropriate.

Requests for action and confirmation of action taken should be shown by initials and date on the document. Where copies of the document have been taken, the person who initials one copy should ensure other copies do not detract information. An administrative officer is to carry out reconciliation exercise between head office and site of all documents on a monthly basis.

All incoming documents must be properly filed. Fax copies should be copied to prevent fading of records. Copies of all outgoing documentation should be kept in the relevant file.

Incoming and outgoing drawings should be recorded and updated on a master list by the receiver. The receiver should ensure at least one copy of superseded drawings is endorsed accordingly and the rest are to be destroyed. The issue and approval of drawings with the date and revision status should be on each drawing.

On site, a set of master drawings should be kept in the office. All drawings held by the sub-contractor should be retrieved before any amended drawings are issued out to the respective sub-contractor.

Incoming project related mail at head office should be recorded on receipt and verified by the respective head of department. No originals should be removed from the head office files unless a photostated copy is made to record the mail after which the original document must be put back in the relevant files.

Incoming project related mail at site should be recorded on receipt and verified by the Project Manager.

COMPLETION OF ACTION

On completion of an action, the document should be initialled and dated. The document can then go to the respective file unless the issuer specifically requires its return to verify that action has been completed.

PROJECT IDENTIFICATION

Documents can be identified according to project titles. Preferably, the filing system should permit easy retrieval of all files. A sample of document control forms is as shown in Appendix IV.

8

Purchasing And Customer Supplied Products

INTRODUCTION

As stated in Clause 4.6, the performance of sub-contractors and suppliers must be monitored to ensure their effectiveness. This chapter describes the way in which sub-contractors' and suppliers' ability to meet stated requirements are reviewed, assessed and audited. An approved list of sub-contractors and suppliers is a list that has been approved by the Quality Assurance Manager based on the evaluation form and other relevant information submitted by the contract, project and purchasing departments.

The Quality Assurance Manager should be responsible to ensure that all sub-contractors and suppliers are reviewed at least once a year. A standard evaluation form can be used for this purpose.

SCHEDULE

The Quality Assurance Manager shall prepare a yearly schedule of sub-contractors or suppliers to be audited. A copy of this schedule should be submitted to all Heads of Department.

The Quality Assurance Manager shall appoint an auditor or a team for each of the audits to be carried out.

STANDARD EVALUATION FORM FOR SUB-CONTRACTORS AND SUPPLIERS

For the purpose of evaluating the performance of sub-contractors, a standard evaluation form can be used (see Figure 8.1). The sub-contractor's performance can be measured based on the overall score tabulated during the audit. The nominated auditor shall make the appropriate recommendation to the Quality Assurance Manager based on the overall score tabulated. In the case of sub-contractors which have been classified under the poor category, the Quality Assurance Manager should refer to the Managing Director before the sub-contractors are deleted from the approved list of sub-contractors.

In the case of suppliers, a standard evaluation form can also be used (see Figure 8.2) for the purpose of review. A review similar to that for sub-contractor's audit can be carried out.

For labour or labour and material sub-contractors, the Contract Manager shall be responsible for providing the following information to the Quality Assurance Manager for approval:

(a) Memorandum and Articles of Association

(b) Financial status for the recent year (one year only)

(c) Record for the past five to ten years' projects

(d) If it is existing sub-contractors and suppliers under the approved list, standard evaluation form should be attached together with the above documents

(e) If it is a new labour or labour and material sub-contractors, a company search on the background of the company are normally required by the Quality Assurance Manager

For material suppliers, the Purchasing Officer shall be responsible for providing the following information to the Quality Assurance Manager for approval:

(a) Relevant test certificate from the manufacturer and necessary technical catalogue to counter-check with the contract specification

Date: _____

Job Ref : _____

Report By : _____

Attention : _____

Name of Sub-Contractor : _____

Description of Work : _____

Criteria	Rating			Remark
	Good	Average	Poor	
Workmanship				
Performance to Schedule				
Level of Co-operation				
Material Control				
Effectiveness of Supervision				
Safety Practices				
Quality Control				
Manpower Available				
Technical Knowledge				
Consideration to Other's Works				

Sub-Contractor Overall Rating:

Good	Average	Poor

Recommendations: _____

Figure 8.1 Sub-Contractor Evaluation Form

(b) If it is existing suppliers under the approved list, an evaluation form should be attached together with the above documents

APPROVED LIST OF SUB-CONTRACTORS AND SUPPLIERS

Sub-contractors and suppliers should be classified in the approved list through an initial assessment by the contract and purchasing department based on their abilities to fulfill the customer needs. The inclusion of the sub-contractors and suppliers in the approved list is the responsibility of the Quality Assurance Manager.

The Quality Assurance Manager shall maintain an approved list of sub-contractors and suppliers as below.

The approved list shall consist of the sub-contractors and suppliers who have proven record that they have:

(a) a Quality Systems based on ISO 9002

(b) met the customer's Project Quality Plan requirement

(c) where applicable to the work, all or part of the following:

(i) For Sub-contractors

- a Quality Assurance System which is compatible with the customer's
- effective supervision of works on site
- ability to co-ordinate with the main contractors
- ability to perform work to the main contractor programme
- safety system that satisfied the Occupational Safety and Health Act 514, 1994
- control of non-conformance of works
- speedy corrective action to rectify all non-conformance of works
- document and record control

(Form 'SEF')

Job Ref :

Attention : QA Department

Name of Supplier :

Product Description :

Criteria	Rating			Remark
	Good	Average	Poor	
Response to Queries & Quotations				
Reasonable Pricing Policy				
Flexibility To Urgent Request				
Technical Assistance				
Ability To Source				
Response to Product Warranties				
Product Certificate				
Billing (DO & Invoice)				
Sample Materials				
Response To Corrective Action				

Overall Remarks:

Evaluated By,

Purchasing Officer

Date: _____

Criteria	Rating			Remark
	Good	Average	Poor	
Delivery On Schedule				
Packaging/Handling				
Quality As Per PO/DO				
Quality Control At Site (i) Conformance To PO				
(ii) Visual Inspection				
(iii) Ability To Provide Testing				
Response To Corrective Action				
Level Of Co-operation				
Rate Of Rejection				
Inspection On Manufacturer Production Facilities				
Manufacturer's Quality System				
Manufacturer's Testing Facilities				

Overall Remarks: _____

_____

_____

_____

Evaluated By,

_____

Material Controller/Storekeeper

Figure 8.2 Supplier Evaluation Form

- control of material wastage
- calibration of all measuring and test equipment
- good and clean housekeeping
- skilful workforce
- sound financial status if possible

(ii) For suppliers who have a proven track record such as:

- performance to delivery schedule
- safe delivery of materials
- protection against damage for supplied goods
- control of non-conformance goods
- speedy corrective action as and when requested by the customer
- co-ordination with the main contractors
- product certification by the approved authorities
- ability to provide an alternative sourcing for materials

Sub-contractors and suppliers who have previously given satisfactory service can be approved for that type of service again. The approved list of sub-contractors and suppliers should be reviewed at the management review or contract review. The approved list of sub-contractors and suppliers should be categorized under the limitation of certain range of contract sum depending on the financial status, past and present records of respective sub-contractors and suppliers. An example of approved supplier flow chart is as shown in Figure 8.4.

SUMMARY

The Quality Assurance Manager shall prepare a yearly summary of all the audit carried out on the sub-contractors and suppliers and a copy of this summary shall be forwarded to the Managing Director for his information and action. As part of the auditing procedures, the

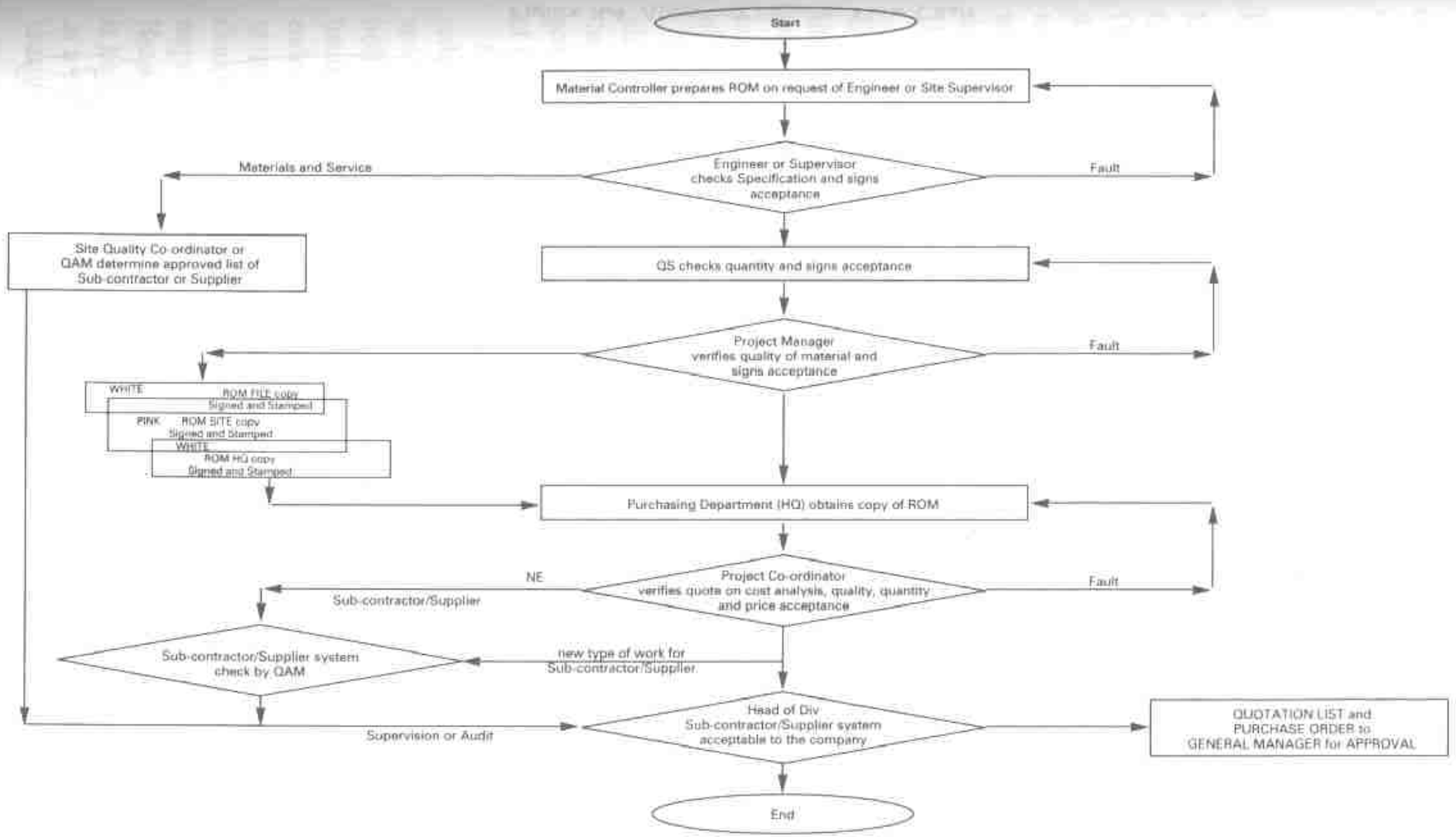


Figure 8.3 Purchasing Flow Chart

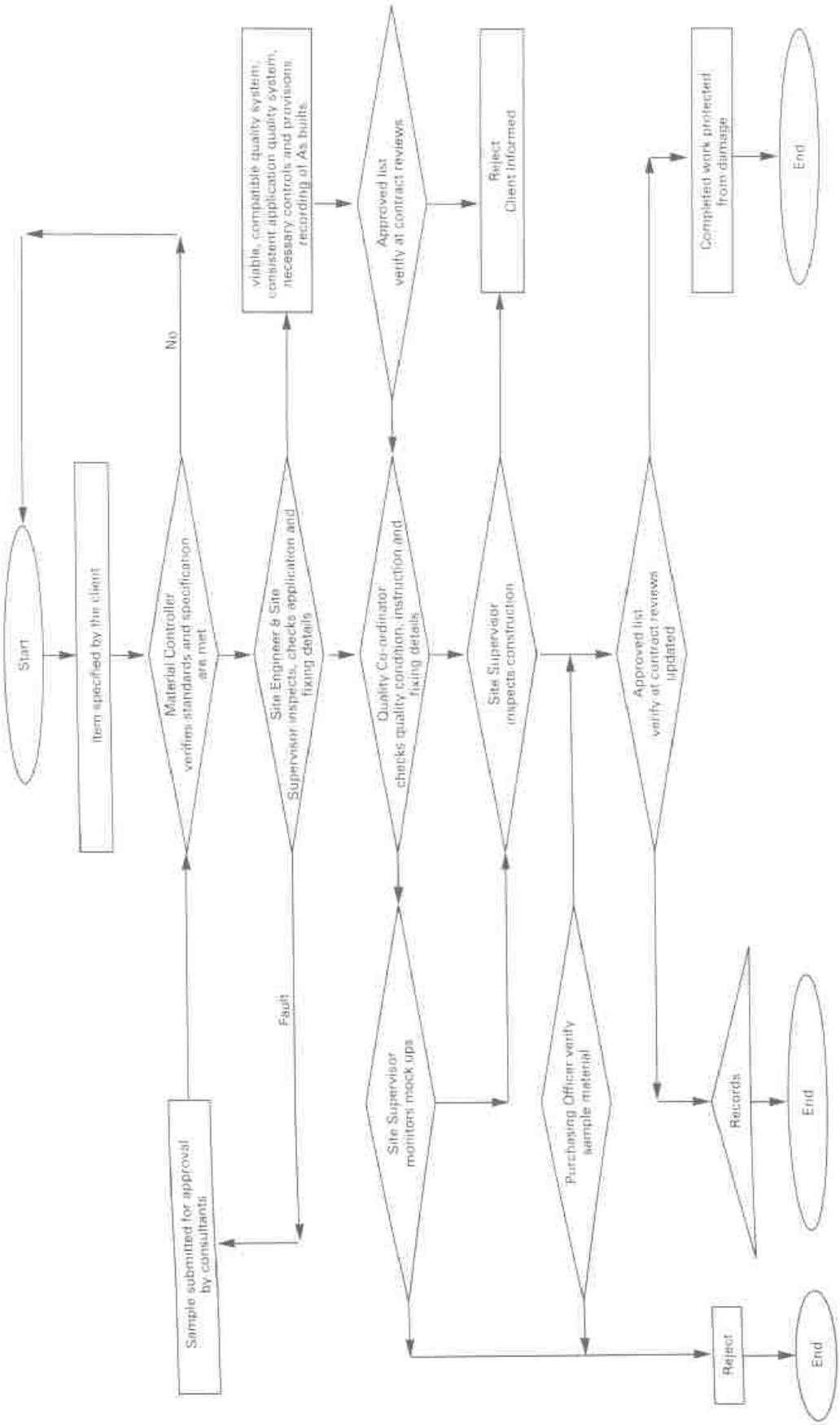


Figure 8.4 Approved Supplier Flow Chart

quality systems documentation should be reviewed to determine compatibility with the objectives of the business and continued compliance with national and other quality standards.

PURCHASES OF MATERIALS AND SERVICES

Material requisition form will be raised by the project staff or site Quantity Surveyor and approved by the Project Manager. At Head Office Level, material requisition forms are raised by the respective department and approved by department heads. A copy of material requisition form must be kept by the site personnel and two copies sent to the Purchasing Department. For Head Office purchases, all the three copies of materials requisition form will be kept at the Purchasing Department.

Upon receiving the material requisition form, the purchasing clerk or officer will check the urgency of the requisition with the Site Quantity Surveyor and cross-reference the quantity and quality requested with the budgeted quantity and quality and determine whether the purchases is for own use or the purchases are to be made on behalf of sub-contractors.

Purchasing clerk will raise the purchase order for all approved requisitions of material and attached the material requisition form with the purchase order for approval by the Project Manager. After approval, the purchase order will be forwarded to the supplier. A copy of the purchase order will be filed into individual files.

Supplier will send in the requested goods together with a delivery order. The goods inwards will be checked by the Material Controller and the delivery order will be signed upon receipt. The Material Controller will state whether the purchase are on behalf of the sub-contractors on the delivery order itself. All the delivery orders should be endorsed by the Project Manager for control purposes. A photocopy of the delivery order will be made and filed by the Material Controller. Goods received notes will be raised by Material Controller and the respective delivery order and goods received notes will be sent to the Head Office Purchasing Department. A copy of goods received notes is kept at site. The goods received notes served as a despatch list and as a proof for documents passed to Head Office. An example of purchasing flow chart is as shown in Figures 8.3 and 8.5.

Figure 8.4 Approved Supplier Flow Chart

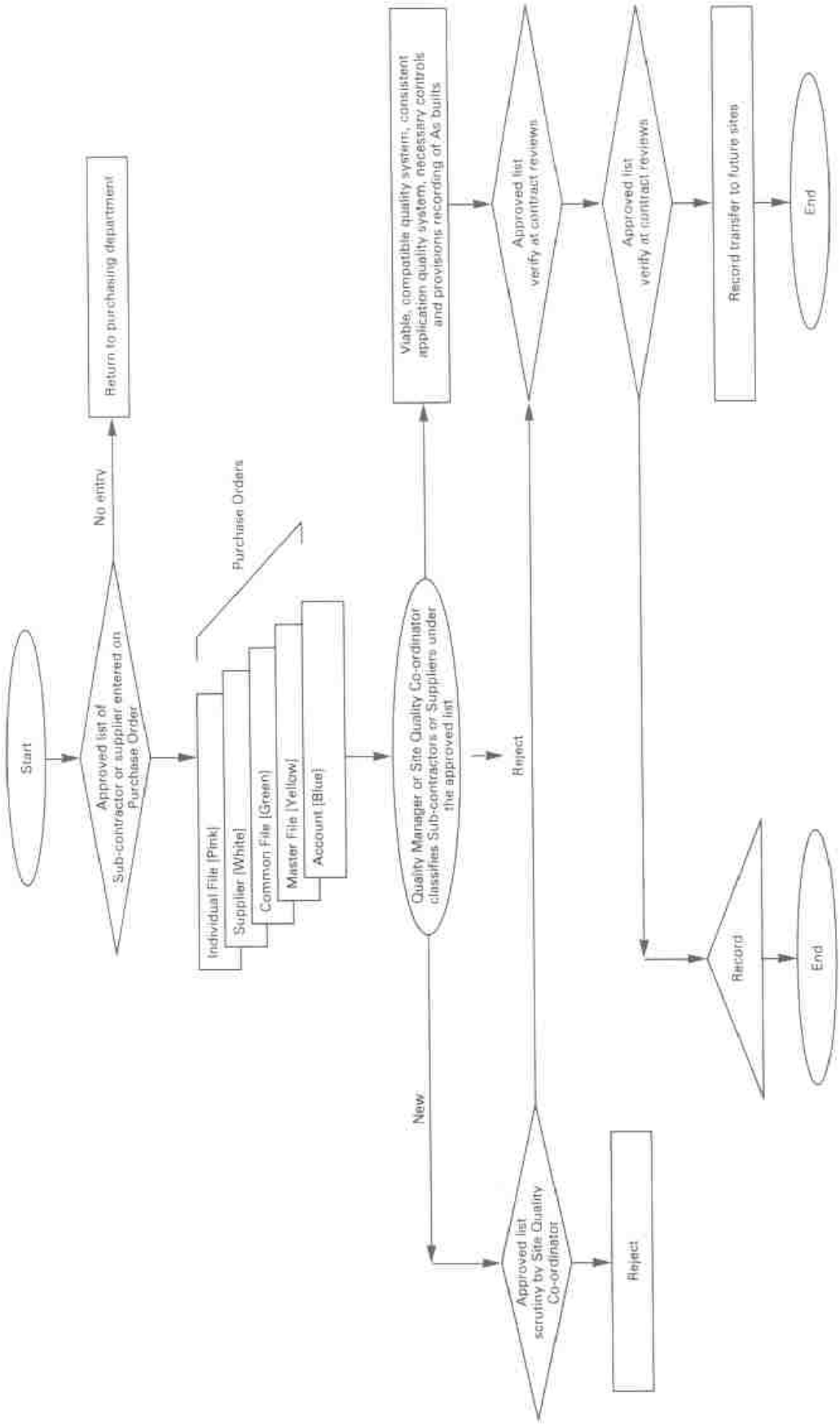


Figure 8.5 Sub-Contracting and Purchasing Flow Chart

URGENT SITE PURCHASE

Guidelines should be provided when critical machinery spare parts, equipment and building materials are purchased on site in cases of urgency. However, cement, reinforcement and formwork are excluded from urgent purchase as these items are normally bought in bulk quantities by the Purchasing Department. Where purchases are made in an urgent situation, the purchaser is responsible for preparing the requisition of material form. They should request for a purchase order number retrospectively where applicable through telephone call to the Purchasing Officer.

Also, the sub-contractors or suppliers should be recorded in the approved list. This implies that the work of the sub-contractors and suppliers will come under close scrutiny at all times. The Purchasing Department should be informed of the nature of any purchase. Details of the purchase should be entered on the Purchase Order and signed by the Project Manager. When in doubt, an immediate evaluation should be carried out by the Material Controller to ensure the urgent purchase comply with the specifications required in the contract. Any staff who requires an urgent purchase should use due diligence and ask for information before taking such an action. He should be required to take corrective action in the event of a non-conformance. An example of urgent site purchasing flow chart is as shown in Figure 8.6.

CUSTOMER SUPPLIED PRODUCT

The customer supplied item can be classified under three main categories which are as follows:

(a) Free Issue Items

(b) Nominated Sub-contractors

(c) Nominated Suppliers

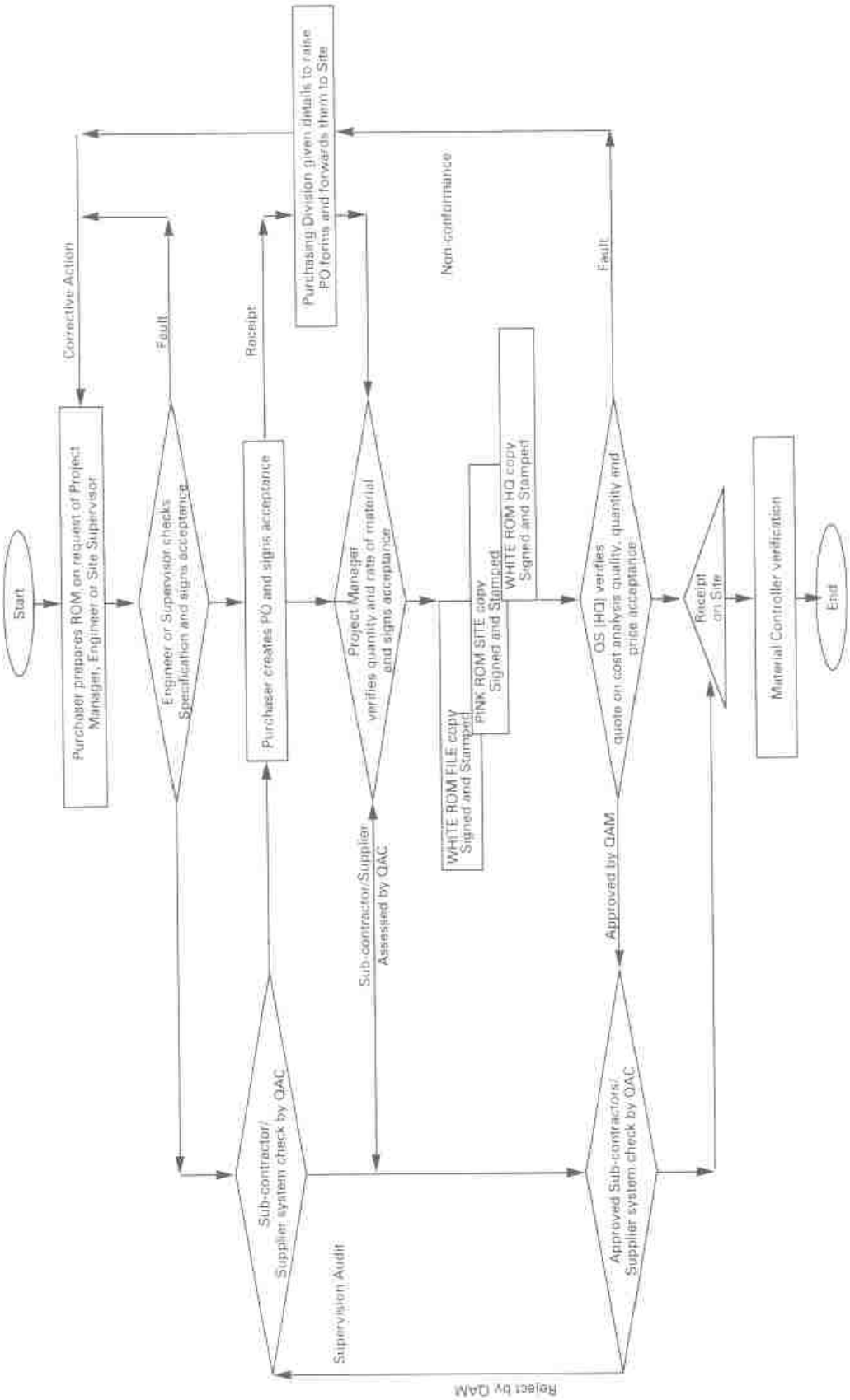


Figure 8.6 Urgent Site Purchasing Flow Chart

(a) Free Issue Items

Where the customer supplies "Free Issue" items for inclusion in the project, the item shall be given the same care, attention and protection as an item under the control of the main contractor. If the "Free Issue" items do not come under the control of the main contractor, the Project Manager should ensure sub-contractors are advised accordingly. Any customer supplied item which is lost, damaged or otherwise unsuitable for use, it should be recorded and reported to the customer.

(b) Nominated Sub-contractors

Customer supplied item also covers nominated sub-contractor from the customer. The customer should be advised if the nominated sub-contractor fails to uphold a quality systems enforced by the main contractor on site.

The Project Manager may resort to serving a non-conformance or elect to adopt a project quality plan to the nominated sub-contractors. In each case, he should advise the Quality Assurance Manager accordingly.

(c) Nominated Suppliers

Customers may specify certain building materials or components to be supplied by them or their designated suppliers. The project team should familiarize themselves with the specifications of the building materials. The Project Manager should assign the Material Controller to take charge of handling the building Material. The quality and quantity should be checked against specifications and delivery orders. Building materials not conforming to specifications including inconsistency in colours, shades or sizes should be notified to the customer by the Project Manager.

Figure 8.6 Urgent Site Purchasing Flow Chart

9

Process Control

INTRODUCTION

This chapter describes the work site procedures and Head Office support functions from the commencement of a project until completion to ensure that construction are carried out under controlled condition as specified under Clause 4.9.

This procedure covers physical construction:

(a) Civil and structural work

(b) Quality control on site

(c) Architectural, Mechanical and Electrical Works

RESPONSIBILITIES

Job responsibility of site staff can be summarized as follows:

Project Manager

- Reports to Project Co-ordinator
- Checks on quality of work and also safety at site
- Arranges all site facilities before commencement of work
- Liaises with Clients and Consultants

- Implementation of Quality Control Procedures
- Attends all clients and consultants meetings
- Prepares and submits master work programme to client
- Conducts regular sub-contractors and suppliers meetings
- Monitors performance of sub-contractors
- Head of site administration
- Monitors progress of work and cash flow
- Leads a team of Engineers, Quantity Surveyors, Land Surveyors, Site Quality Co-ordinator and Supervisor in implementation of the project

Quantity Surveyor

- Reports to Project Manager
- Prepares progress payment claims and variation orders
- Assists Project Manager in the preparation of material schedule and cash flow
- Verification of material requisition
- Advises Project Manager on contractual matters
- Prepares sub-contractors payment certificates
- Attends monthly progress meeting organized by the client's representative

Site Engineer

- Reports to Project Manager
- Supervision and co-ordination of site work
- Ensuring quality work by sub-contractors
- Assists Project Manager in planning and monitoring

- Liaises with consultants
- Advises sub-contractor on technical matters
- Document control
- Relates all instruction from Project Manager to sub-contractors
- Maintains daily progress report
- Attends meetings where required

Quality Control Inspector

- Develops, maintains and improves the quality management system
- Reports to Quality Assurance Manager on matters relating to quality systems
- Reports to Project Manager

Mechanical and Electrical Engineer

- Reports to Project Manager
- Co-ordination of Mechanical & Electrical works
- Liaises with Mechanical & Electrical Clerk-Of-Works to ensuring quality of work

Material Controller

- Reports to Procurement Officer
- In charge of material delivery, storage and usage
- Assisting Procurement Officer in monitoring materials wastage control
- Material requisition
- Compiling records of material received
- Feedback to Head Office on status of materials

Safety/Health Officer

- Advises Project Manager on safety construction regulations, health and safety at work
- Practises relevant safety matters
- Promotes safe conduct of work, ensures personnel protection equipment is worn, improves existing method of working
- Ensures that fire precaution equipment and first aid kit are readily available
- Determines the cause of any accident and recommends means of prevention
- Observes and rectifies any unusual or hazardous construction method

Assistant Quantity Surveyor

- Reports to Quantity Surveyor
- Assists Project Quantity Surveyor
- Preparation of sub-contractors' payment certificates
- Preparation of material schedule and cash flow
- Taking-Off quantities/site measurements

Architectural Co-ordinator

- Reports to Project Manager
- Mobilization, organization, co-ordination of all architectural activities
- Ensures quality of work
- Guides architectural supervisors on architectural works

Civil and Structural Supervisor

- Reports to Site Engineer
- Supervision and co-ordination of civil and structural works
- Ensures quality of work

Surveyor

- Sets out the project boundary, building alignment, etc
- Checks levels
- Prepares as built drawings
- Co-ordinates external works
- Liaises with consultants on any setting out discrepancies

Administrative Officer

- Assists Project Manager on all site administrative matters
- Prepares minute of meetings
- Liaises with Head Office Administrative Department

Store Keeper

- Assists Material Controller
- Checks, records, unloads and delivery of material

Clerk

- Reports to Administrative Officer
- Reception
- Typist
- Documentation

Civil and Structural Works

The Project Manager should set up the organization to carry out the day-to-day work on site. In this respect he requires the support of Head Office and site staff allocated to him. The Quality Systems should be implemented and a Project Quality Plan prepared by the Site Quality Co-ordinator for approval by the Quality Assurance Manager.

The Project Manager should establish work instructions based on the scope of works specified in the contract document and request for inspection forms required on his particular site. This will be included in the Project Quality Plans by the Site Quality Co-ordinator. This documentation should form a database to be maintained by the Quality Assurance Manager. Any new request for inspection forms issued should be recorded and forwarded to the Quality Assurance Manager for future projects.

Request for inspection forms should also be used to meet the requirements of the public works department and any other statutory requirements as and when these come into force.

In the execution of work, the Project Manager and his staff should also maintain a monitoring and recording role for the client. The need for work instructions and request for inspection forms may be initiated at any stage or may be imposed by the client. Such documentation can be used to control the progress of work on site.

The issue of work instructions and request for inspection forms should be controlled and included in the Project Quality Plans. The Project Quality Plans then become the site first level document (equating to the Quality Manual) which will be used as the main reference material for implementing and controlling the Quality Systems on site.

A site letter or memo is considered a Work Instruction if it contains:

(a) Signature of authority

(b) Date of issue

Issue of such instructions must come from staff empowered to do so. Work Instructions obtained from the Quality Assurance Manager's database should be endorsed as above before being used on site.

In the absence of any site staff, delegation of works should be carried out by the Project Manager unless this is given in a documented Work Instructions. The Project Manager should ensure that the instructions received from the client are forwarded to the sub-contractors. He should also ensure that the Construction Method is maintained and effective; and the request for inspection records are properly maintained.

Documented Work Instructions to site support staff should be initialled and dated by the staff concerned on completion of the work involved. Copies of work instructions issued for information only need not be endorsed. As built drawings should be initialled and dated in a similar manner to verify work completed.

Sub-contractor's progress payments should be made at the specified times and should be verified within one week of receipt of the statement of claim by the Site Quantity Surveyor. The Site Quantity Surveyor should carry out a site evaluation and make the necessary adjustments which should be approved by the Project Manager before submission to the Project Co-ordinator.

The progress payment certificate should be endorsed by the Project Co-ordinator and approved by the General Manager before submission to Accounts Department for payment.

Site Quantity Surveyor should prepare the interim payment claims and submit to the employer's representative at the specified times for approval.

Variation orders approved by the Superintendent Officer should be prepared by the Quantity Surveyor together with the interim payment claims before submission to the consultants by the Project Manager.

QUALITY CONTROL ON SITE

When materials are purchased, the quality is controlled by the Material Controller on site. The proper handling and storage of materials are supervised by the Material Controller upon unloading to avoid damage and wastage. To produce quality work, the correct use of plant and machinery is incorporated into the Construction Methods. During construction, the quality of all works are monitored to ensure results are within contract specifications and any non-conforming works are identified and rectified. The measuring instruments (level, theodolite, weighing machines) and test equipment (rebound hammer) are prop-

erly maintained and calibrated if required. The responsibility of the Project Manager includes implementing the Project Quality Plans with assistance from the Site Quality Co-ordinator. Periodic meetings are conducted on site to discuss Construction Methods and analysis to think of better methods of carrying out their tasks.

All site staff are encouraged to think and search for the best value for money alternative (value engineering) and having found a better alternative, proceed to implement the alternative. In special construction works like welding and non-destructive testing, where the quality cannot be verified fully by visual inspection, specimen testing should be carried out. Continuous monitoring of conformance to procedures and adequacy of Construction Methods are followed to ensure service quality. Any changes in the contract as a result of Variation Orders, e.g. Addition or Omission should be followed up by Project Managers. Before handing over, the Project Team should ensure that the constructed works are of quality required by the client prior to handing over.

ARCHITECTURAL, MECHANICAL AND ELECTRICAL WORKS

Mechanical and electrical sub-contracted work and architectural fittings are considered as below:

Approved supply items may be:

(a) Specified by the client or Superintendent Officer

(b) Submitted for approval by client

The Quality Assurance Manager and the Site Quality Co-ordinators are responsible for the listing of approved sub-contractors and suppliers.

The Purchasing Officer is responsible for purchases up to the point of delivery. He should ensure that specifications are adhered to.

Samples submitted by suppliers should be kept in the sample room by the Purchasing Officer.

Architectural supply items are received by the Material Controller. The installation and fixing instructions of the architectural, mechanical and electrical fittings are examined by the Site Supervisors or the Site

Engineers before installation are carried out on site. Site Engineer and Site Supervisor should supervise works through the usage of work instructions and record sheets.

Materials received on site should be documented or photographed for records, particularly pertaining to:

(a) Quality and Quantity

(b) Specification and Condition

(c) Instruction for use (where applicable)

Where mock-ups are required by the client or Superintendent Officer, the Site Supervisor should monitor work to:

(a) Approve the process installation & fixing

(b) Note any discrepancies and alternative solutions

(c) Ensure the mock-up reflects the finished work

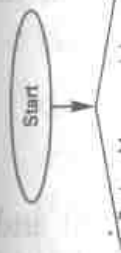
(d) Note variations from specifications

On finished work, the Site Supervisors should ensure workmanship meets the requirements as agreed to, during mock-up trials. Sub-contractors should supply controlled issues of shop drawings, where applicable.

Free issue items should receive the same care and attention as those supplied by the Company.

Where architectural supply items involve nominated sub-contractors, the client should be advised if the sub-contractors fails to conform to or is not compatible with the Company's Quality Systems.

Mechanical & Electrical Sub-contractors' works which are classified in the approved list will require co-ordination with other trades, e.g. mechanical & electrical sub-contractors should be informed of concrete casting dates to allow for mechanical and electrical openings. A process control flow chart is as shown in Figure 9.1.



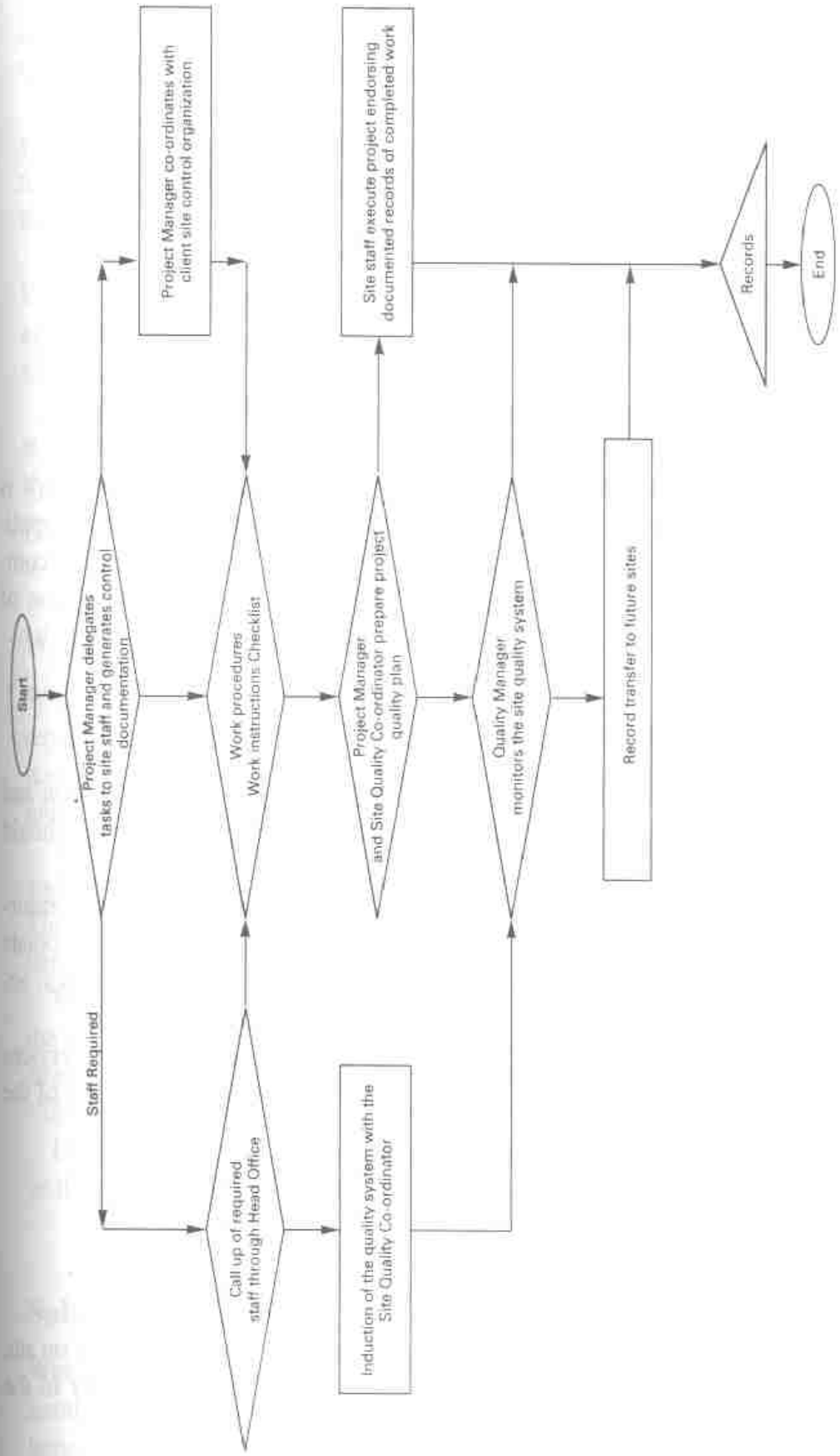


Figure 9.1 Process Control Flow Chart

10

Inspection and Testing

INTRODUCTION

This chapter describes the manner in which materials and work is inspected and tested throughout the project or contract. This is applicable to all visual inspection on materials and works for ensuring compliance with contract requirements. This also covers verification of tests done by a third party.

RESPONSIBILITY

The Material Controller should be responsible for the inspection and verification of incoming materials on site. The Project Manager should have the authority for their final disposition.

The Project Manager and site staff should be responsible for ensuring that inspections and tests are carried out at defined ''check'' points and a final inspection and test are carried out on finished works, according to work instructions and request for inspection forms.

The Quality Assurance Manager should ensure that test services from testing laboratories are compatible with the requirements of the work involved.

PROCEDURE

Incoming Material Inspection

The Material Controller should ensure that materials delivered on site meet the purchase requirements. He should inspect the quality of the

materials delivered by referring to the Purchase Order and Delivery Order and take note of any visual defects.

This is to enable him to consider the proper course of action, i.e. whether to reject or obtain concession from the client, as to whether to withhold/release payment and whether to delete the suppliers from the approved list.

Any non-conformances noted must be reported immediately to the Purchasing Officer, Site Quality Co-ordinator and the Project Manager. All items received must be properly identified to allow for possible recall.

Samples should be taken for testing where specified in a work instruction. Where tests are conducted off site, these must be carried out by approved test laboratories. Approved test laboratories are those approved by international accreditation or by the client in writing.

Work Instruction and Testing

When client's inspection form is used, the Project Manager and client's representative must agree on the "check" and "witness" points. On reaching a "check" or "witness" point, the client's representative must be informed in writing.

The Project Manager and site staff should ensure that inspections and testings are carried out at defined "check" and "witness" points. The inspection and test results should be checked against the acceptance criteria determined by the client.

Where the Superintendent Officer has been sufficiently informed of the proposed dates for the inspection and testing and should he fail to attend, then the Project Manager can carry on with the work past the "check" and "witness" points.

Faulty work which has been identified should be rectified according to the contractual requirement.

Sub-Contract Work

When on the approval list, the Sub-contractor is an extension of the company site organization, either following the company Quality Systems or having an approved system of their own. The Superintendent

Officer may accept the approved system but is not contractually bound by it.

Final Inspection and Testing

The Project Manager should ensure that no finished work is presented to the Superintendent Officer before a final inspection and test have been carried out.

Only finished work which satisfies the acceptance criteria determined by the Superintendent Officer should be released or delivered to Superintendent Officer.

The Project Manager and site staff should ensure that final inspection and test are carried out according to defined work instructions/ methods statement/inspection forms.

The results of the final inspection and test should be recorded and verified by the clients, where required.

A standard request for inspection form used for checking Civil and Structural works, Mechanical and Electrical works and Architectural works are as shown in Appendix II and III. An inspection and testing flow chart is as shown in Figure 10.1.

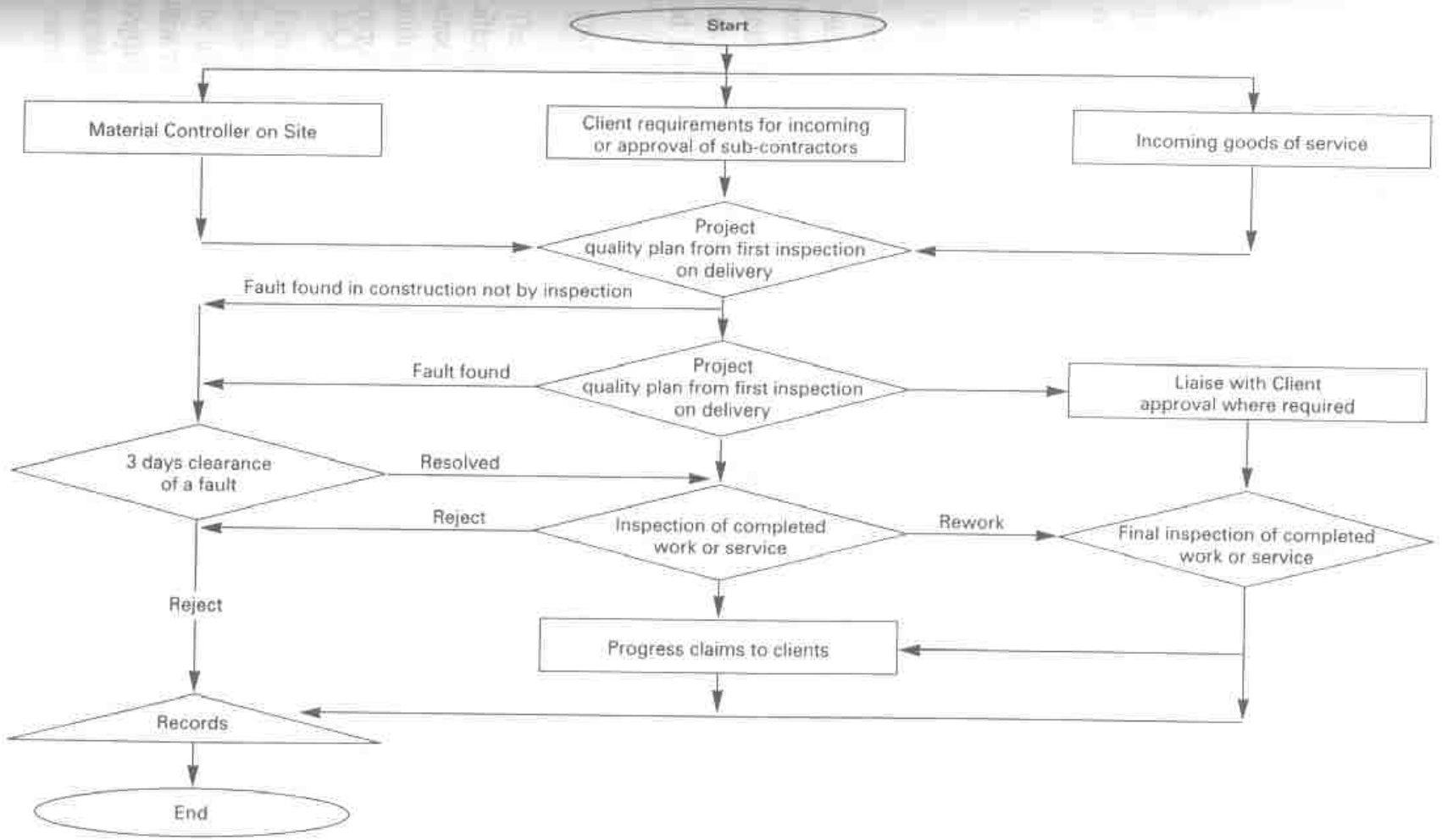


Figure 10.1 Inspection and Testing Flow Chart

11

Inspection, Measuring and Test Equipment

INTRODUCTION

This chapter describes the procedures to ensure inspection, measuring and test equipment in use are maintained to the required accuracies specified in the manufacturer specification. The procedures described in this chapter are applicable to all measuring, survey and testing equipment used on site. A master list of all inspection, measuring and test equipment which are used to ensure product quality should be maintained.

RESPONSIBILITY

The Project Manager on site is responsible for establishing specific calibration of equipment and to ensure the accuracy of measurements using these instruments. Surveyors should practise self calibration methods, closing traverses and returning to known Temporary Benchmarks.

EQUIPMENT CALIBRATION REQUIREMENT

Surveyors/Technicians on site should advise the Project Manager with regard to the list of equipment that require calibration. The Project Manager should determine the recalibration based on recommendation

by Calibration Lab or Equipment Manufacturer. Equipment subject to calibration should be marked to reference calibration certification. Re-calibration dates should be scheduled and recorded. Any changes to this schedule must be authorized by the Project Manager. A standard calibration registered form for site may be used.

SELF CALIBRATION

The following principles should be observed when using survey equipment:

(a) Survey equipment should be inspected before use to determine any damage to the equipment not noticed earlier or out of calibration.

(b) Close traverses, return to Temporary Benchmarks should be carried out at each survey. Measuring tapes should be calibrated against an unused new tape (doubling as a spare) at weekly intervals.

(c) After use, the equipment should be subjected to another inspection. Damaged equipment should be repaired and recalibrated before use again.

IDENTIFICATION OF EQUIPMENT

The Project Manager should maintain a list of instruments under his control. All measuring and surveying instruments and test equipment should be identified.

EQUIPMENT CALIBRATION

Equipment should be calibrated according to the calibration schedule. Reference standard and reference equipment due for calibration should be identified and sent to the approved calibration facilities for calibration to achieve traceability to National or International Standards. The Project Manager or a staff delegated by him should ensure that calibration is properly carried out and keeps records of all calibration carried out.

OUT OF CALIBRATION/EXCEEDING TOLERANCES

Equipment found out of calibration or exceeding preset tolerance, either due to expiry of calibration or damages, should be clearly identified by marking a red dot on the name-plate of the instrument and segregated from use. The Project Manager should determine which elements of work require re-checking. The Project Manager should also take the appropriate action for any non-conforming products.

UNCALIBRATED INSTRUMENTATION

Instruments that do not require calibration by virtue of the nature of measurement being carried out need not have identification on the name-plate.

SUB-CONTRACTORS' INSTRUMENTATION

Sub-contractors using instruments on site should either:

Comply with the same procedure or have a similar procedure giving the same degree of control and approved by the Project Manager.

Sub-contractors should be required to keep a copy of calibration certificates of their instruments on site. Project Managers on each site should have access to such information and verify it where accuracy of sub-contractors' instruments is in doubt.

12

Inspection and Test Status

INTRODUCTION

This chapter describes the establishment of the status of a project. The progress report is recorded for site and head office information.

RESPONSIBILITY

The Purchasing Officer and Material Controllers should know the status of purchased materials.

The Site Quality Co-ordinators and the Quality Assurance Manager are responsible for listing the Sub-contractors and Suppliers when they are approved. They should also know the status of the Quality Systems in their location.

The Project Manager and the Project Co-ordinator have details of the overall project status, as recorded on progress charts and progress reports.

PROCEDURE

Progress report should consist of the following information:

(a) Actual vs Scheduled of work done

(b) Detail Work Programme

(c) Photograph presentation of progress of work on site

(d) Work force deployment record

(e) Site organization chart

(f) Plant and equipment on site

(g) Weather record

(h) Mechanical & Electrical progress of work on site

(i) Architectural and Civil & Structural progress of work on site is by monthly progress report to the client. This is normally dictated by the client, but where such requirements are not dictated, the Project Co-ordinator determines the reporting procedures.

INSPECTION AND TEST STATUS

Where included in a contract, a client's inspection and test plan should be updated to give the status of work. The Project Manager may elect to develop a Site Check Plan depending on the contract complexity. The Project Manager can determine the status of inspection and testing from site records at any time. The means of obtaining this information is at the discretion of the Project Manager and the Project Co-ordinator.

SERVICE/PRODUCT IDENTIFICATION AND TRACEABILITY

The status of works are identified and traced from the tendering stage to project and finally as built. All the heads of departments are responsible for their own operations. However, up-to-date details of the site operations are provided by the Project Managers.

The Project Manager should identify items of work by a site generated system as required by the complexity of the contract, and/or contract requirements laid down by the client.

The Project Manager should determine any identification system required on a particular site. Identification systems should be entered into the Project Quality Plans, with updating where revisions occur.

13

Control of Non-Conformance (Faults)

INTRODUCTION

This chapter describes and specifies the provisions made within the company to identify, report, dispose and control of supplied materials and work services found not to conform with the specified requirements.

This chapter applies to all activities required for the execution of project for which the company has contractual responsibilities. It also defined non-conformance raised by any staff which is not related to internal, external, sub-contractors and suppliers auditing.

RESPONSIBILITY

It is the responsibility of all personnel detecting a non-conformance to raise a "CAR" form to ensure that this is properly identified and reported to the responsible manager and a copy is sent to the Quality Assurance Manager.

The Project Manager is responsible for the maintenance of records of non-conformance and any resulting disposition on site.

The Quality Assurance Manager is responsible for co-ordinating with the Project Co-ordinator and Heads of Departments in the timely dispositions and maintenance of audit records relating to any non-conformance. A control of non-conformance flow chart is as shown in Figure 13.1.

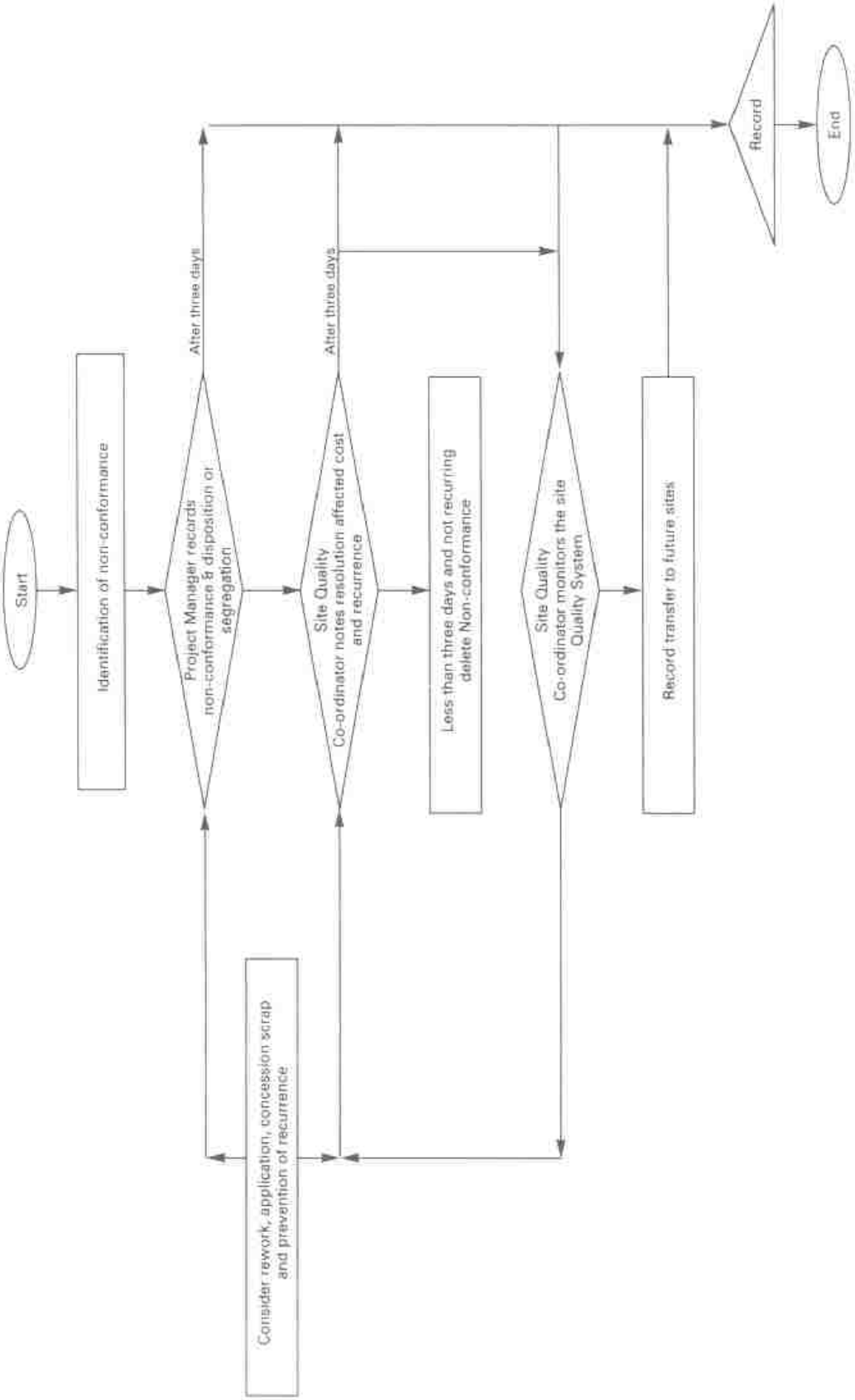


Figure 13.1 Control of Non-Conformance Flow Chart

PROCEDURE

Identification

All employees should:

(a) Identify and report any non-conformance that does not fulfill contractual requirements.

(b) Segregate any item or area of work at fault to enable other work to proceed without interruptions until corrective action is taken.

Project Managers and Heads of Departments should record all incidents of failure into the project files.

Site Faults

An item of work is considered a site non-conformance when it:

(a) is not resolved within three days

(b) materially affects the structure

(c) is a reporting fault

A non-conformance must be properly recorded and corrective action taken should also be recorded accordingly. Staff are responsible to report the detection of a non-conformance to their respective department manager so that necessary action can be taken promptly. Details of the non-conformance should be documented. If the problem is not resolved within three days or when it recurs, the following action should be taken:

(a) An observation (category 3) non-conformance should be resolved within three days. If a non-conformance cannot be resolved within three days, a corrective action request form (FORM "CAR") under the heading of minor non-conformance will then be issued to the responsible manager with a copy to the Quality Assurance Manager. A sample of CAR form is shown in Appendix V (figure 1).

Figure 13.1 Control of Non-Conformance Flow Chart

(b) A minor finding or non-conformance should normally be resolved within two weeks. If a minor non-conformance cannot be resolved within two weeks, a new CAR form under the heading of major non-conformance will then be issued to the responsible manager with a copy to the Quality Assurance Manager.

(c) A major non-conformance should normally be resolved within one month. If a major non-conformance cannot be resolved within one month, the Quality Assurance Manager should then refer to the General Manager and the Managing Director for further action. The above system is designed to ensure that the responsible manager take prompt corrective action to resolve any non-conformance reported within the stated time frame.

(d) All personnel detecting a non-conformance other than the internal and external audit, sub-contractors and suppliers auditing should raise a "CAR" form (Corrective Action Request Form) to the responsible manager and a copy to the Quality Assurance Manager. The Quality Assurance Manager or Site Quality Co-ordinator should then followed up with the Corrective Action Request until the above-mentioned non-conformances are completely resolved within the stated time frame.

Analysis

Respective managers should analyze any non-conformance on each occurrence. On sites, the Project Manager should review non-conformances. This should include but not limited to:

(a) rework to meet specified requirements;

(b) revised use or application;

(c) concession from the client;

(d) reject and rework anew;

(e) prevention of recurrence.

14

Corrective and Preventive Action

INTRODUCTION

This chapter outlines the corrective action that needs to be taken on discovery of non-conformances.

This applies to head office and sites for problems associated with:

(a) Identification of unsatisfactory work

(b) Customer's complaints (Defect liability period)

(c) Internal Quality Audits

DEFINITION

A non-conformance is a deficiency in characteristic, documentation or procedure which renders the quality of an item unacceptable to the customer. A non-conformance can be further divided into Major Non-conformance and Minor Non-conformance. A time frame is then set for corrective action to be carried out for a Major Non-conformance and a Minor Non-conformance.

(a) Minor Non-conformance of works should be resolved within two weeks.

(b) Major Non-conformance of works should be resolved within one month.

Examples of Non-conformance of works are as follow:

(a) Test cube failure

(b) Serious honey combing

(c) Collapse of formwork

(d) Missing of reinforcement bars

(e) Use of commercial reinforcement bars

(f) Roof leak

(g) Structural crack and difference settlement

(h) Customer complaints

(i) Failure to comply with Quality Systems such as Quality Manual & Work Procedure

(j) Failure in submission of Mechanical & Electrical shop drawings as requested by the consultant

(k) Failure to carry out equipment calibration

(l) Failure to follow the work instruction as stipulated in the Manual

(m) Poor plastering

(n) Failure to update construction drawings

(o) Bulging of formwork

(p) Surface honey combing

RESPONSIBILITY

All staff who receive or identify a fault should report it in writing to the responsible manager with a copy to the Quality Assurance Manager. A site non-conformance is an item which persists after three days

without resolution, or an item which could repeat after the completion of the corrective action.

The Project Manager is responsible for corrective action on site. Heads of Departments are responsible for corrective action in their respective departments or under project maintenance.

The Head of Department has the ultimate responsibility for corrective action following the identification and reporting of faults. He should be assisted by the Quality Assurance Manager in monitoring the corrective actions taken to rectify the faults reported.

PROCEDURE

Support Staff

Every office staff should assist in identifying and rectifying faults. This includes records where applicable.

Site Supervisors should assist the Project Manager in identifying and rectifying faults. This includes records when the non-conformance is verified by the Site Quality Co-ordinator.

Client Complaints

Client complaints should be recorded, signed and dated by the Project Manager. Action should not be taken until the right party responsible and authorize to take action is established. When the action is completed, the record should be endorsed and dated with a copy forwarded to the Quality Assurance Manager. Where a client complaint involves the Company Quality Systems, the Quality Assurance Manager should be given a copy of the record immediately. He may advise the Managing Director but he cannot make corrective action. A corrective action flow chart is as shown in Figure 14.1.

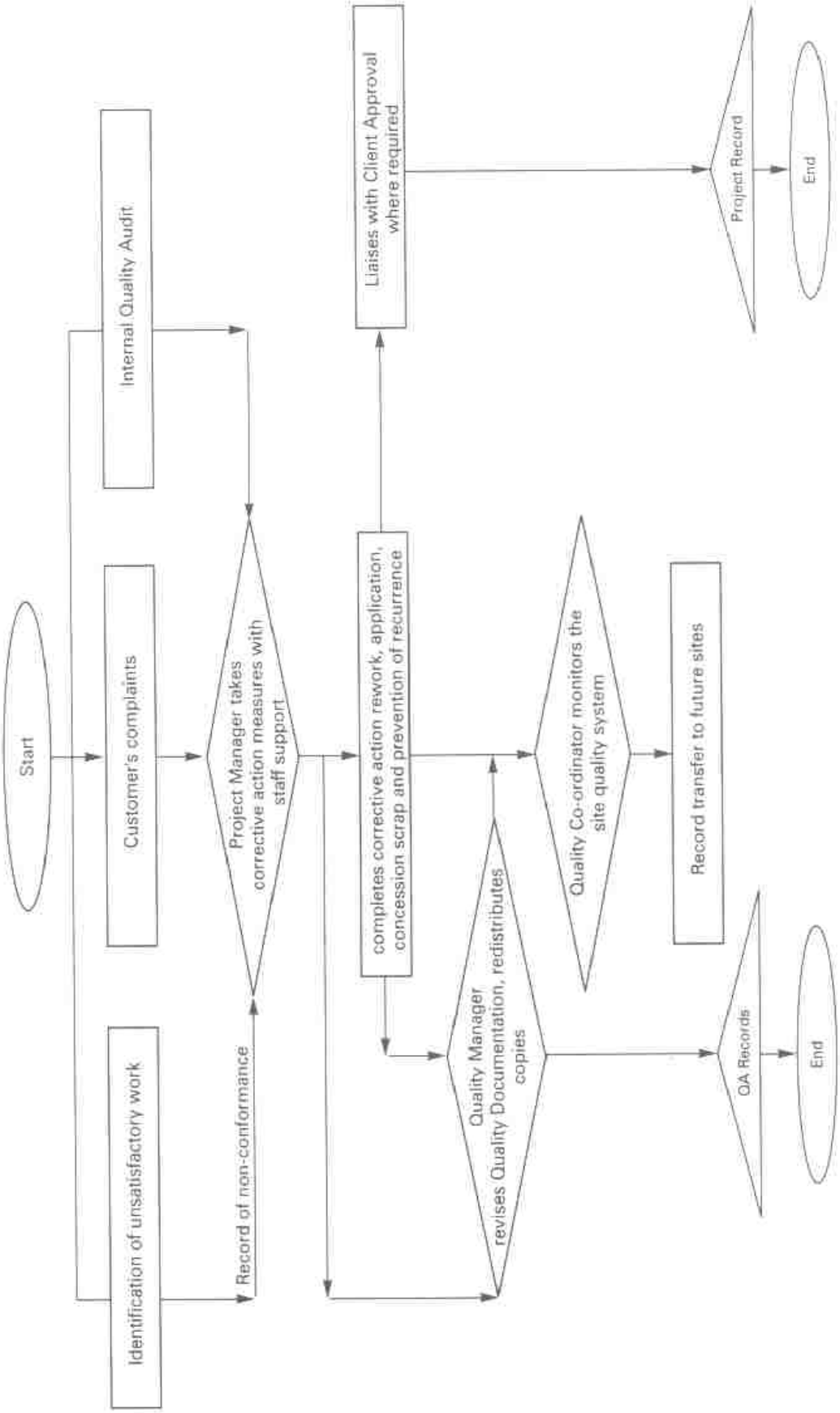


Figure 14.1 Corrective Action Flow Chart

Figure 14.1 Corrective Action Flow Chart

15

As Built Protection, Handling, Preservation and Storage of Building Material

INTRODUCTION

This chapter describes and specifies the manner in which ''product quality'' is maintained up to the completion of construction, installation and progressive operation work, including final handover of the project.

This chapter is applicable to all activities on protection of construction/rehabilitation and installation works on site.

RESPONSIBILITY

The Project Manager is responsible for the documentation of control measures and inspection for the protection of the client's property.

The Material Controller is responsible for the movement of ''Material Stock'' from storage areas.

PROCEDURE

Storage and Protection of Material Stock

Proper storage and protection of material stock encompass the following:

- Identify suitable storage areas for "Material Stock" to prevent damage or deterioration.
- Arrange proper fencing, barricading, security and patrolling control measures for protection of "Material Stock".
- Record all "In-and-out" movement of "Material Stock" from the storage areas, based on security requirements.
- Check the presence of a manufacturer's, supplier's part numbers/description label or other markings for each item, whenever available.

Identification of Deteriorable Items

All deteriorable items should be identified so that prompt action can be taken to segregate and replace deteriorated items. The following procedures should be adopted:

- Check on the condition of "Material Stock" available at the storage areas at defined intervals and, if not stated, should be done on a monthly basis.
- Identify and segregate all deteriorated and damaged items from the good items.
- Take immediate action to replace the deteriorated and damaged items.

Protection on Installed and Constructed Items

The following procedures are designed to ensure that all installed and constructed items are adequately protected to prevent loss or damage.

- Arrange necessary follow-up inspection for protection of all installed items. This may involve call up of expert opinion or use of work instruction check sheets.
- Make physical check on all installed items at defined intervals.
- Ensure that the site is safe, where access is possible.
- On-going assessment until handover to the client.

Handling of Materials On Site

During unloading and loading, some damaged goods may be found through visual inspection by the Material Controller. If it is left to untrained operator to unload, damage may be caused and defective items not noticed and realized. Therefore, Material Controller should carry out check prior to and during unloading, with a final check on the method of handling of materials. The Project Manager should be aware of the range and capabilities of plant and should at all times plan to minimize the amount of materials handling. By introducing an effective materials handling system, loss of human life, material and machinery can be prevented. An as built protection flow chart is as shown in Figure 15.1.

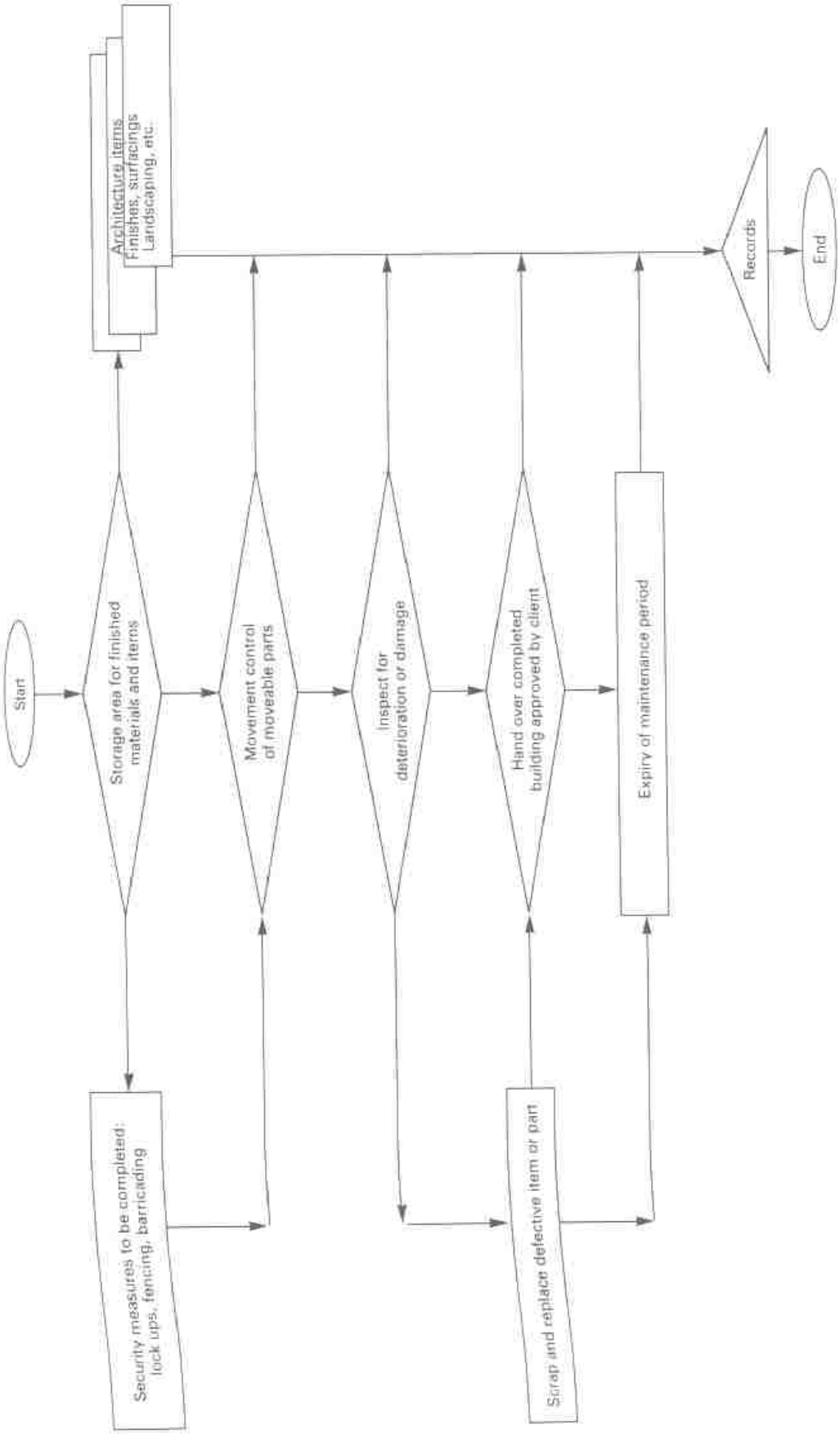


Figure 15.1 As Built Protection Flow Chart

on

Figure 15.1 As Built Protection Flow Chart

16

Quality System, Contract, Project and Material Records

INTRODUCTION

This chapter describes the way in which records generated are identified, stored and maintained.

The types of records covered by this chapter shall comprise, but not be limited to the following:

(i) Quality System Records

  (a) Controlled document, e.g. Quality Manual and Work Procedure

  (b) Defect reports

  (c) Internal audit reports

  (d) Training

  (e) Management review report

  (f) Project quality plan

  (g) Sub-contractors and suppliers information

(ii) Contract Records

  (a) Customer contract

(b) Sub-contractor's agreements

(c) Tender report for sub-contractor

(d) Sub-contractor's quotation

(iii) Material Records

(a) Purchase order

(b) Material certificates

(c) Goods delivery notes

(d) Requisition of materials

(e) Catalogue of materials

(f) Transfer notes [material and equipment]

(g) Reconciliation reports

(h) Material price lists

(i) Suppliers information

(iv) Project Records

(a) Construction drawings

(b) Test and inspection records

(c) As built drawings

(d) Certificate of Practical Completion

(e) Progress report

(f) Variation orders

(g) Test cube result

RESPONSIBILITY

The Quality Assurance Manager is overall responsible for all records related to the Quality System. These records should be checked and approved by the Quality Assurance Manager and maintained and controlled by the document control clerk.

The Project Manager is responsible for all site records. These site records should be checked by the Project Co-ordinator and maintained and controlled by the Administrative Officer at the head office.

The Purchasing Officer should be overall responsible for all material records. These records should be checked by the Purchasing Officer and maintained and controlled by the Purchasing Clerk.

The Administrative Officer has the additional responsibility of co-ordinating the maintenance and retrieval of all records covered under this procedure. He should also establish and maintain a master list of these records kept in the head office.

The Personnel Officer is overall responsible for records relating to training and recruitment of staffs.

The Contract Manager is overall responsible for the contract records.

The Tender Manager should be overall responsible for the tender records.

PROCEDURE

Incoming and outgoing information on documents should be distributed by the respective heads of departments' secretaries to the responsible persons concerned in the head office or at the site office.

The responsible persons should check records received by signing and dating on the records. The Quality Assurance Manager, Administrative Officer, Project Co-ordinator, Contract Manager, Tender Manager, Personnel Officer, Purchasing Officer and Project Manager should establish and maintain a list of records kept by their respective departments.

The Administrative Officer should designate and identify records to a project title.

All quality records should be centrally stored in a department or at the site office. The respective department managers should ensure the proper storage and control of these records in their departments. These records should only be accessible to authorized personnel and where a record is to be taken out, approval must be obtained from the respective managers in charge.

These quality records should be made available to the customer when specified in a contract.

These quality records should be kept and retained for a period of five years except for training records or unless otherwise specified in a contract with a client. Disposal of records are authorized by the Managing Director at the end of retention period. A quality system, contract, project and material records flow chart is as shown in Figure 16.1.

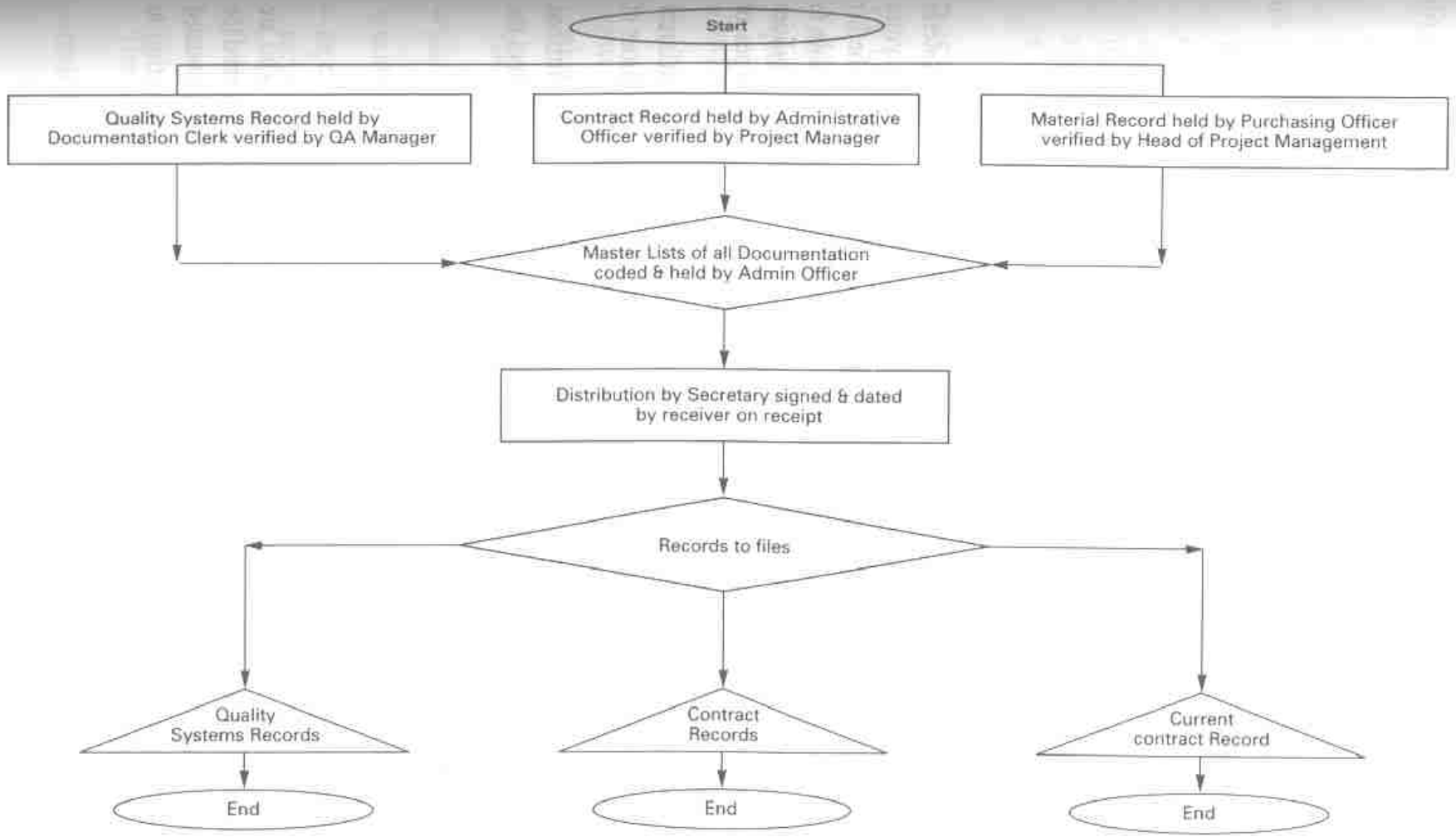


Figure 16.1 Quality System, Contract, Project and Material Records Flow Chart

17

Auditing

INTRODUCTION

As specified in Clause 4.1, internal quality audit or quality systems review should be carried out to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve the stated objective. This chapter describes the responsibilities of the Quality Assurance Manager, Auditor and Auditee, types of audit, audit schedule and audit procedures.

Audits carried out in the construction industry are very different from financial audit carried out by the external or internal auditors of an organization.

In construction industry, audits are carried out to ensure the finished products, e.g. buildings, bridges, power stations, roads, etc., meet the requirements specified in the contract.

TYPES OF AUDIT

(a) Internal Quality Audit

An audit carried out within the company by personnel who are independent of the areas being audited or reviewed to assessed the effectiveness of the Quality Systems, compliance with stated policies and procedures and to recommend corrective action to maintain the required ISO 9000 standards.

(b) External Audit

An audit carried out on department within the company by an external party (including a certifying authority).

(c) Sub-contractors and Suppliers Audit

An audit carried out by the Quality Assurance Department on sub-contractors and suppliers to assess the effectiveness of the sub-contractors and supplier's Quality Systems, to determine whether they meet company's quality standard requirement and to make the appropriate recommendation for inclusion or exclusion from the Approved List of sub-contractors and Suppliers.

RESPONSIBILITIES

The Quality Assurance Manager is responsible for:

- the overall planning, supervision, co-ordinating and implementing quality audit
- establishing audit work schedules to carry out quality audits
- co-ordinating internal and external quality audit efforts
- reviewing all audit reports and ensuring that follow-up actions are taken on all reported audit findings

The nominated auditor is responsible for:

- planning the quality audit
- examining and evaluating information
- reporting the results of his audit work and making appropriate recommendations
- following up to ascertain that appropriate action is taken as reported in audit findings

The auditee is responsible for:

- reviewing all audit findings reported

– taking appropriate action to correct any deficiencies noted during the audit

AUDIT SCHEDULE

The Quality Assurance Manager shall establish a schedule for carrying out quality audits on a regular basis (e.g. every six months) and covering all aspects of the Quality Systems at all work sites including the head office. He shall review all current work procedures to ensure all aspects are covered in the quality audit.

Unscheduled audits may be included as and when the situation warrants it.

AUDIT PLAN

The auditor shall prepare an audit plan and a checklist for the audit.

The audit plan shall consist of the following:

(a) Definition of audit scope and objectives

(b) Identification of auditee and auditors

(c) Time schedule

(d) Reference to relevant standards/requirements

(e) Audit procedures

(f) Reporting procedures

PROCEDURES PRIOR TO AUDIT LAUNCH

The Quality Assurance Manager shall advise the Head of Department of a scheduled audit one week before the audit. The steps taken include:

(a) Notification of scope, time and place of an intended audit.

(b) Request for the presence of all personnel involve in the audit at the audit opening meeting especially the Head of Department.

AUDIT CHECK SHEET

The check sheet is used by the auditor during an audit. Appropriate clauses and sections of the work procedures and quality manual are listed with the requirement outlined if necessary.

Non-conformance (findings) established during an audit are marked in the results column as:

(a) Major finding (category 1)

(b) Minor finding (category 2)

(c) Observation (category 3)

A major finding is a non-conformance which shows a breakdown in the Quality Systems. A minor finding is an oversight or mistake. An observation is a comment which is not mandatory. Details are recorded on the check sheet.

AUDIT OPENING MEETING

A brief meeting should be held with the management of the organization to be audited. This serves to clarify the audit plans with the auditee, introduction of the auditor(s) and the finalization of audit procedures.

CLOSING MEETING

At the end of the audit, the auditor should also hold a closing meeting with the auditee. The main purpose of the meeting is to present and clarify all audit observation and supporting evidence so that auditee can initiate necessary corrective action effectively and without delay.

The auditor shall also agree on the date of follow-up visit to close out all corrective action requests raised.

CORRECTIVE ACTION REQUEST(CAR)

The corrective action request is issued as a 'finding' under an audit when non-conformances with the Quality Systems are observed during the audit.

A corrective action request is 'served' on the person who is in a position to take the necessary corrective action. It shall be returned within 14 days with a proposed corrective action.

A corrective action request can be divided into four distinct parts as follows:

(a) Non-conformance (or finding)

(b) Corrective action

(c) Completion of corrective action

(d) Follow-up and close out

When a corrective action request is returned, the auditor shall ensure that the relevant information on the corrective action request is complete and satisfactory by signing the completed form.

The auditor who serves a corrective action request shall verify that corrective action is taken within the stated time frame. The Quality Assurance Manager shall be advised in any case where the time frame is exceeded. He may then serve a further corrective action request or refer to the Managing Director.

AUDIT REPORT

At the end of the audit, the auditor shall prepare an audit report and submit to the Quality Assurance Manager for approval.

The Quality Assurance Manager shall distribute copies of the audit report to the Project Co-ordinator and other relevant parties.

For major findings, the Quality Assurance Manager may make a recommendation in the audit report for the termination of contract with the sub-contractor or supplier concern.

The auditor completes the audit report by cross-referencing the audit schedule form, checklist and corrective action requests. The report is factual, based on objective evidence and excluding any personal opinion. A standard audit report form as shown in Appendix V can be used.

REJECTION OF A FINDING

Where a corrective action request is rejected by the auditee, the auditor (unendorsed by the auditee) shall refer to the Quality Assurance Manager. The Quality Assurance Manager can either resubmit the corrective action request to the auditee, or refer the matter to the Head of Department.

FOLLOW-UP VISIT

Auditor shall verify that all corrective action requests have been effectively completed. He shall proceed to close out the corrective action request.

If the auditor finds any corrective action requests not complete, the auditor shall issue a new corrective action request and it shall be categorized as a major corrective action request (which could result in termination of contract).

18

Training

INTRODUCTION

All employees of the organization should be provided with adequate training in their respective field so as to enable them to execute their job responsibilities efficiently. Training should be provided to all of the head office staff and permanent staff assigned to the sites. Contract staff are generally not covered in any training programme except on the request of the management.

RESPONSIBILITIES

Each respective department manager is responsible for identifying the training needs and provides training for staff under his supervision. This is to ensure that they have the basic competence skills and experience necessary to perform their tasks.

The Quality Assurance Manager is responsible for promoting the Quality Management System in the company especially new employees of the company by means of awareness training. He should also conduct internal auditing course for staff delegated to carry out auditing.

ALL TRAINING COURSES

In order to develop the skills and knowledge of their staff, the Heads of Departments should identify training needs during counselling or evaluation of staff. The Head of Department should be concerned with

career mapping and the Personnel Officer should monitor courses and training provided to ensure that the company gains the maximum benefits from internal and external training.

All training needs should be met wherever possible by in-house training courses or on-the-job training. Where this is not possible, the departmental manager should recommend an external course to fulfill the need.

Heads of Departments should ensure that company's staff gain from courses attended by examining evaluation reports and appraisal sheets from training courses. This documentation should be obtained by the Personnel Officer within two weeks at the end of any training course.

For permanent site staff, courses should be taken when the progress of works on site activities reduced.

QUALITY SYSTEMS TRAINING

All staff, both permanent and contract, should comply with the Company's Quality Systems. Awareness training is controlled by the Quality Assurance Manager and Site Quality Co-ordinators. It is the responsibility of Site Quality Co-ordinators to provide awareness training to site staff.

Non-permanent staff should also be governed by the Company's Quality Systems, as instructed at an awareness training course.

Awareness training should also be carried out where a Project Quality Plan is in place where either there is a specific change to the Quality Systems or Inspection and Test Plans are required.

The Personnel Officer should advise the Quality Assurance Manager whenever there is recruitment of new employees so that they may be given awareness training on the Quality Systems. A training flow chart is as shown in Figure 18.1.

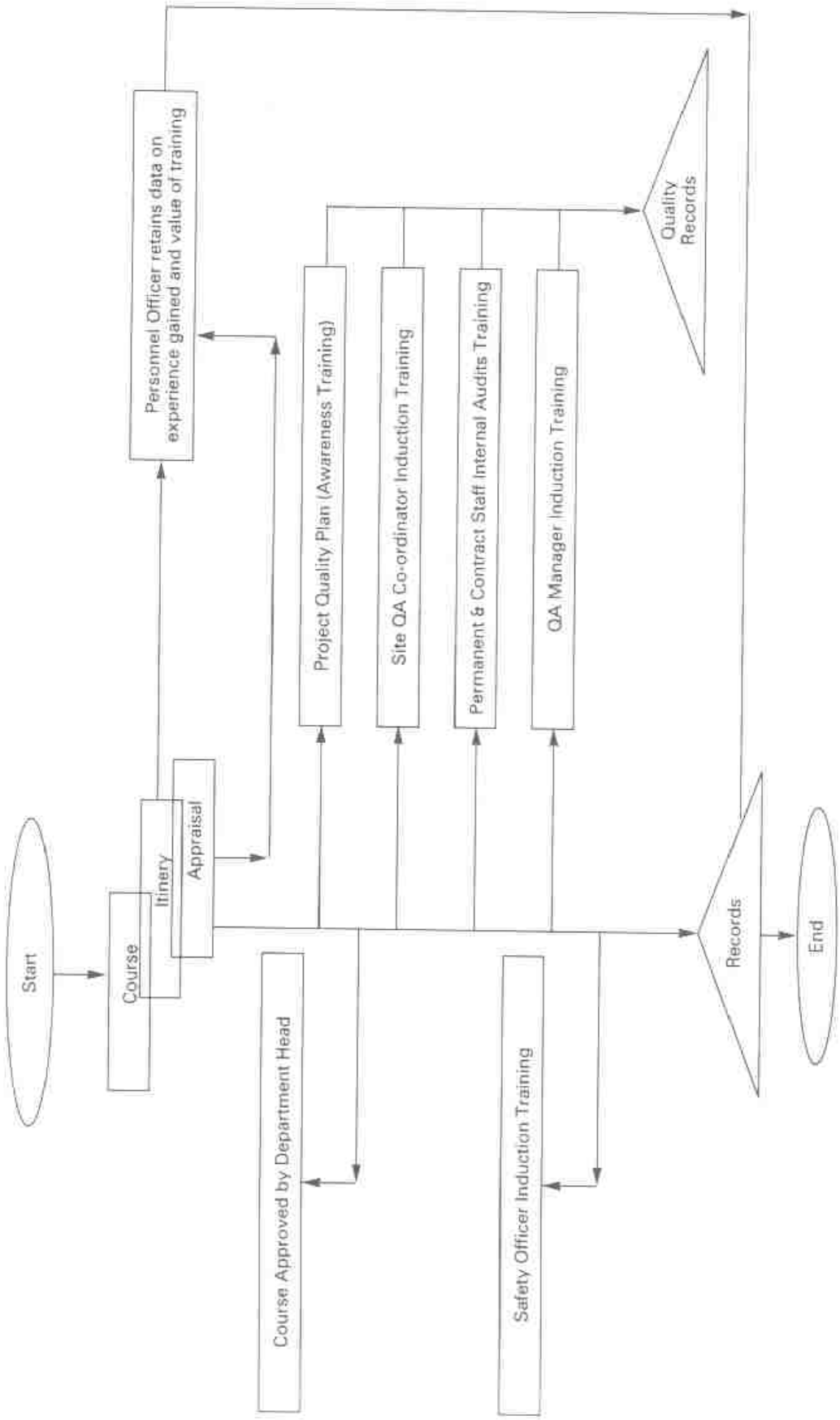


Figure 18.1 Training Flow Chart

19

Servicing

INTRODUCTION

This chapter describes the procedures to ensure that at any time during the defects liability period (as stated in the contract document), any defects, shrinkages or other faults which may be due to design, materials, workmanship or equipment should be made good within a stated time frame.

This chapter applies to all Building and Civil Engineering works undertaken by the Company as the main contractor.

RESPONSIBILITY

The Project Co-ordinator is responsible for ensuring that all defects raised during the defects liability period are made good to the satisfaction of the client.

The Project Co-ordinator is assisted by the Project Managers to carry out repairs on all defects raised by the client. However, the Project Manager may delegate the task to the Site Engineers or Site Supervisors. However, the Project Manager is ultimately responsible for the repair of all defects and should report the status of repair works to the Project Co-ordinator.

Figure 18.1 Training Flow Chart

PROCEDURE

All complaints on defects received should be channelled to the Project Manager. In the event of any disputes to the contractual liability regarding the defective works, the Project Manager should seek the advice from the Project Co-ordinator before attending to it.

For complaints involving main contractor's works

All complaints involving main contractor's works should be forwarded to the Project Manager. The Project Manager should then appoint a Site Engineer or Site Supervisor to attend to the defective works. Upon rectification, the Site Engineer or Site Supervisor should report to the Project Manager, who should then arrange for a joint inspection with the client.

For complaints involving Nominated Sub-contractors or Specialist works

All complaints involving nominated sub-contractors or specialist works should be forwarded to the respective nominated sub-contractors by the Project Manager for rectification. Upon completion, the nominated sub-contractor should inform the Project Manager who should then arrange for a joint inspection with the client.

In areas where defective works can be very serious, the Project Manager should handle the defective works himself. At the same time, the Project Manager should seek expert advice and report to the Project Co-ordinator accordingly.

20

Statistical Sampling Techniques

INTRODUCTION

This chapter describes the application of statistical sampling techniques in the Construction Industry.

In addition to the assessment of concrete strength by cube crushing and associated statistics, the Company should use statistical sampling techniques to assess improvement to works.

RESPONSIBILITY

The Quality Assurance Manager and the Project Manager should advise on the statistical sampling techniques to be used in any applications and the recording of results obtained.

PROCEDURE

The identification of any area of work which is to be examined using statistical sampling techniques should come from the Project Co-ordinator in discussion with the Head of Department.

The Quality Assurance Manager is then required to identify the scope of work and to recommend the sampling techniques to be employed. He should then identify and recommend the statistical sampling techniques suitable for the area of work specified.

The Quality Assurance Manager should ensure that the right statistical sampling technique is applied. He should not do the work himself

as he would be required to verify the results later on. Department Heads should provide the staff competent to carry out the statistical sampling techniques.

Verification of the results of the statistical sampling techniques should not be delegated by the Quality Assurance Manager prior to reporting to the Project Co-ordinator.

Sampling techniques used in the construction industry statistical sampling or random sampling are normally carried out on bulk building materials since it is almost impossible to test everyone of them. Bulk building materials such as cements, reinforcement timber, sand, aggregates, premix, test cube results, etc., are normally subjected to random sampling and testing since they are delivered in batches.

Random sampling should be carried out by the Material Controller and Site Quality Co-ordinator as and when situation arises. Results obtained-from approval laboratories should be subjected to verification by the Quality Assurance Manager.

Statistical sampling can also be applied on labour constant for all Building and Civil Engineering trades.

In short, statistical sampling technique can be used when testing for every item is too costly. However, results from statistical sampling are normally only an indication of test results obtained from the bulk materials.

Therefore, Quality Assurance Manager should determine the accuracy of the results obtained from the sampling before relying on the results. Statistical sampling techniques can be applied to the following works:

(a) Rates of machinery, manpower and material

(b) Test result

21

Quality Systems Certification

PRINCIPLES AND CERTIFICATION

Conformity certification is defined in Certification Principles and Practices (Ref. 10) as "the action of certifying by means of a certificate of conformity that a product or service is in conformity with specific standards or technical specifications".

Demand for third party certification worldwide is seen to be increasing. The reasons for this trend could be attributed to the following reasons:

(i) legislation

(ii) demands of insurers

(iii) pressure from users requiring that assurances be given that products are safe

(iv) consumers, now better organized and more vocal, are demanding a greater degree of protection from misdescription and are insisting on accurate information and more assistance in making purchasing decisions in markets providing an ever-increasing variety of products

(v) last but not least, there is a worldwide move for the reduction of transfrontier trade barriers as evidenced by the Agreement on Technical Barriers to Trade (often referred to as the Standards Code) being negotiated under the aegis of the General Agreement on Tariffs and Trade (GATT)

Certification Principles and Practices (Ref. 10) lists eight types of third party certification systems. These are:

1. Type testing.
2. Type testing followed by subsequent surveillance through audit testing of samples purchased on the open market.
3. Type testing followed by subsequent surveillance through audit testing of factory samples.
4. Type testing followed by subsequent surveillance through audit testing of samples from both the open market and the factory.
5. Type testing and assessment of factory quality control and its acceptance followed by surveillance that takes into account the audit of factory quality control and the testing of samples from the factory and the open market.
6. Factory quality control assessment and its acceptance only.
7. Batch testing.
8. 100% testing.

These eight systems of certification are summarized in Table 21.1.

Quality systems certification to ISO 9000 is thus a Type 6 Certification System. Under this system of certification, the manufacturer's capability to produce a product in accordance with the required specification, including the manufacturing methods, quality control organization and type and routine testing facilities are assessed and approved, in respect of a discrete technology. This system can be applied, particularly, where the specification covers a type of manufacture, possibly a material, but where the end product may take a variety of forms which there are no particular specifications.

Table 21.1 Certification Systems

continuing exercised by	surveillance certification	of product body	manufacturer's control and audited by body	quality investigated certification
Third party certification system no.	Yes	No	Yes	No
1		X		X
2	X			X
3	X			X
4	X			X
5	X			
6		X	X	
7		X		X
8	X			X

SIRIM'S ROLE IN THE IMPLEMENTATION OF ISO 9000

The Standards and Industrial Research Institute of Malaysia is incorporated by an Act of Parliament, the SIRIM Incorporation Act 157 in 1975. The objective of SIRIM as defined in its mission statement is "To enhance Malaysia's international competitiveness through partnership in industrial technology and quality".

One of primary functions of SIRIM is to raise the level of quality of Malaysian-made products to enhance their competitiveness in the international marketplace. The product certification scheme was launched in the early 1970's. This is a Type 5 certification scheme (Ref. 10) which certifies a product to a national or international standard. A key requirement for product certification is that a national or international standard (e.g. a Malaysian Standard or British Standard) must be available for the product.

It was soon realized that many products are not specified in any national or international standards. The rapid pace of technological development and shorter life cycle of products render the development

of standards either on a national or international level for such products impractical and impossible. The absence of such standards thus render product certification inapplicable to such products.

The launching of the national car project gave impetus to the need to provide some form of certification for an emerging automotive components industry which are the main manufacturing industry. At the same time, Malaysia is a major exporter of commodities and components, particularly, in the electronics sector. Recognizing the need to enhance the quality image of Malaysian-made products in the national and international markets, SIRIM launched the Scheme for the Assessment and Registration of Quality Systems, as it was then called, in 1987.

The scheme is a voluntary scheme which is meant to complement the national effort to upgrade the quality of Malaysian products to meet the demands and challenges of the global marketplace. The primary objective is to act as a catalyst to the adoption of cost-effective quality management systems by Malaysian manufacturers.

ASSESSMENT AND REGISTRATION PROCEDURES

There are five major steps in the assessment and registration process. These are as shown in Figure 21.2.

Figure 21.2 Certification Process

APPLICATION

An official application together with the application fees would have to be submitted to start the certification process. Basic information on the organization, the scope of registration, the process flow chart, the Quality Systems, etc., would have to be supplied on an Initial Survey Questionnaire to be submitted with the application.

SYSTEMS (ADEQUACY) AUDIT

At this stage, an applicant is required to demonstrate that he has a Quality Systems in place and the system is comprehensively documented. It is usual to have three or four tiers of documentation consisting of:

* Quality Manual
* Procedure Manual
* Work Instruction
* Project Quality Plans

In the Quality Manual, top management must set out its quality policies and objectives and must state how it addresses each of the requirements of the standard.

The Procedure Manual sets out how the company will organize each of its processes. The procedure will specify how alternate situations are to be dealt with, who will do what, when, where and how. Procedures are usually kept at the administrative level to provide the departmental interfaces and to aid overall comprehension.

Detailed technical instructions, such as details of how a building component is to be made, or field by field instructions for entering data onto a computer, are best contained in a third level manual of work instructions.

Each of these manuals must be clearly cross-referenced, as must any forms used in the system.

When an applicant has completed his documentation, he puts in a request for a systems (adequacy) audit. The objective of this audit is to ensure that all the requirements of the required standard had been

addressed in the documentation. Corrective action would have to be satisfactorily completed to remedy any shortcomings before the compliance audit.

COMPLIANCE AUDIT

The compliance audit is carried out to establish that documented procedures are actually being implemented. The auditor would be looking for objective evidence that the auditee is working to the documented system by inspecting test and production records, observing the activities being carried out and interviewing the auditee's staff and workers.

APPROVAL

Approval is granted by the Council of SIRIM on successful completion of the audits. A certificate of registration of Quality Systems, which is subjected to annual renewal, is issued to the applicant.

FOLLOW-UP SURVEILLANCE

Regular follow-up surveillance audits would be made to ensure the maintenance of the system by the certified company. Currently, the requirement is for two surveillance visits a year.

INTERNATIONAL RECOGNITION OF CERTIFICATION

The prime concern of SIRIM when the scheme for the certification of Quality Systems (ISO 9000) was formulated in 1987 was the international credibility and acceptance. SIRIM realized that to meet the above criteria, the scheme must firstly be based on some internationally-accepted criteria and secondly, assessment must be carried out by qualified and competent auditors.

To meet the first criteria, SIRIM has decided to adopt EN 45012: 1988 "General Criteria for Certification Bodies Operating Quality Systems Certification" (Ref. 11) as the basis of our scheme. EN 45012 specifies the requirements that must be met by certification bodies offering Quality Systems Certification and it forms the basis by which

certification bodies are accredited. For example, in the United Kingdom, certification bodies are accredited by the National Accredited Council for Certification Bodies (NACCB) against the criteria specified in EN 45012. SIRIM has chosen to harmonize its system to this standard in order to promote mutual recognition and acceptance.

The cornerstone of any internationally-recognized Quality Systems Certification scheme is in the competence of the auditors who carry out Quality Systems assessments. It is very clear that to achieve recognition, quality systems auditors must be given the type of training that would enable them to perform their duties in a fair and impartial manner. The training that SIRIM decided on, in the absence of an international system for qualifying quality systems auditors, Lead Assessor training course accredited by the Institute of Quality Assurance, United Kingdom. Quality Systems auditors who pass the course and who had acquired the necessary auditing experience can then register as Lead Assessors/Assessors with the Institute of Quality Assurance. Currently five auditors in SIRIM are registered as Lead Auditors while another two are registered as Assessors.

Besides encouraging its auditors to register with the Institute of Quality Assurance, SIRIM has its own internal register of auditors and lead-auditors. To qualify for listing in this register, auditors have to meet the training and experience requirements specified in ISO 10011 Part 2 "Qualification Criteria for Quality Systems Auditors" (Ref. 12).

The credibility of the certification of the Quality Management System depends largely on the ability of the certification body to comply fully to the EN 45012 and ISO 10011 standards. In this case, SIRIM had built its certification system on the foundation of these standards.

ISO 9000 REGISTERED COMPANIES IN MALAYSIA

It has been noted that since the launching of the certification programme, SIRIM had received a total of nine hundred and sixty five (965) applications for registration until the end of October 1995. During this same period, a total of six hundred and eighty (680) certificates of registration were awarded.

The growth in the number of applications is growing exponentially, and the same pattern of growth is also experienced by some overseas certification bodies.

Table 21.3 shows the pattern of the numbers of local companies applying to SIRIM for certification and the number of certified ISO 9000 companies in Malaysia.

Table 21.3 Applications and Registration of ISO 9000 Certified Companies in Malaysia

YEAR	APPLICATION	REGISTRATION
1987	29	0
1988	17	5
1989	58	10
1990	29	11
1991	107	37
1993	320	210
1994	580	450
Oct 1995	965	680

SOURCE: SIRIM

GUIDELINES FOR IMPLEMENTING ISO 9000

A survey on the audit reports compiled on 75 companies in chapter 22 indicates that the road to the implementation of ISO 9000 is not an easy one. The following guidelines may assist organization that are interested in implementing an ISO 9000 Quality Systems.

(i) There is a need for total commitment and support from the top management of the organization. Top management must not only take the lead but they must be seen to take the lead. The ultimate responsibility for quality cannot be delegated to subordinates who do not have overall control and responsibility in the organization.

Juran, in summarizing the transformation of Japan into an industrial power since the second world war, attributed the success of Japanese industries that created the revolution in quality to:

(a) a massive quality-related training programme

(b) annual programmes of quality improvement

(c) upper management leadership of the quality function

A survey conducted by the American Society for Quality Control/ Gallup in 1989 (Ref. 14) (Appendix I) in the United States indicated that 85% of the senior executives polled believe that top management leadership is vital to the success on quality improvement.

(ii) An organization needs to be very clear on the reasons for implementing the standard. The standard must not be implemented just to satisfy the contractual requirement of major customers or to obtain ISO 9000 certification for marketing purposes. To enjoy the benefits of successfully implementing the standard, an organization must set its vision on achieving customer's satisfaction through getting quality right first time and every time.

(iii) A conducive environment is an essential element in the successful implementation of the standard. Participation and commitment from everyone in the organization, particularly, from personnel from the non-traditional areas of quality such as purchasing and marketing, is essential in order to gain full support from employees which will ensure the smooth implementation of the standard.

(iv) Training is required on quality in general and on the Quality Systems in particular. This is to ensure that all employees have the right behaviour and attitude towards the Quality Systems which will encourage total participation. Proper education on quality will reduce resistance to change and other likely obstacles. The same ASQC/Gallup survey in 1989 (Appendix I) indicated that 84% of the executives polled believed that training is critical to the success of improving quality.

(v) Accurate procedures which include operating and work instructions are required. Such procedures must be practical, workable and easily implemented. Personnel that is going to use such procedures must be involved in its documentation as they have the necessary understanding to ensure that the procedures documented are meaningful and workable. Documenting their own working procedures would also promote ownership over their work which helps eliminate resistance to implementation at the working level.

22

Analysis of Audit Reports

INTRODUCTION

This study involved examining the audit reports compiled on 75 companies during the process of obtaining certification from SIRIM.

The companies selected for this study were from the small and medium category as the findings of the study were meant to help this category of companies to overcome the problems that are likely to be encountered when implementing the ISO 9000. It is the author's experience that the bigger companies do not face the same problems that most small and medium scale companies face, e.g. the lack of financial and human resources.

The sample of companies selected for this study is all certified to ISO 9002 standard which is representative of the state-of-the-art of Malaysian industry, i.e. the majority of Malaysian companies are not involved in the design of the product that they manufacture but are typically manufacturing to already established designs. Out of the total of 680 certificates awarded (up to end October 1995) by SIRIM, only 25 are awarded for ISO 9001 certification.

COMPANIES BACKGROUND

The analysis was carried out on 75 companies. Figure 22.1 shows the different industrial sector groups which are involved in this study. Building and construction materials group is the largest industrial sector which comprises 17(22.7%) companies. This group of companies

include mainly those involved in the manufacture and supply of construction and building materials such as precast concrete piles, ready-mixed concrete and other concrete-based products.

Companies producing automotive components are the second largest group. This group comprises 16(21.3%) companies which are involved in the manufacture of automotive components such as automotive shock absorbers, batteries, seat belts, springs, radiators and bolts and nuts for supply to the automotive industry.

The third largest industrial sector group is the consumer electronics sector. This sector comprises 13(17.3%) companies which are involved mainly in the assembly of audio/visual equipment such as hi-fi sets and televisions.

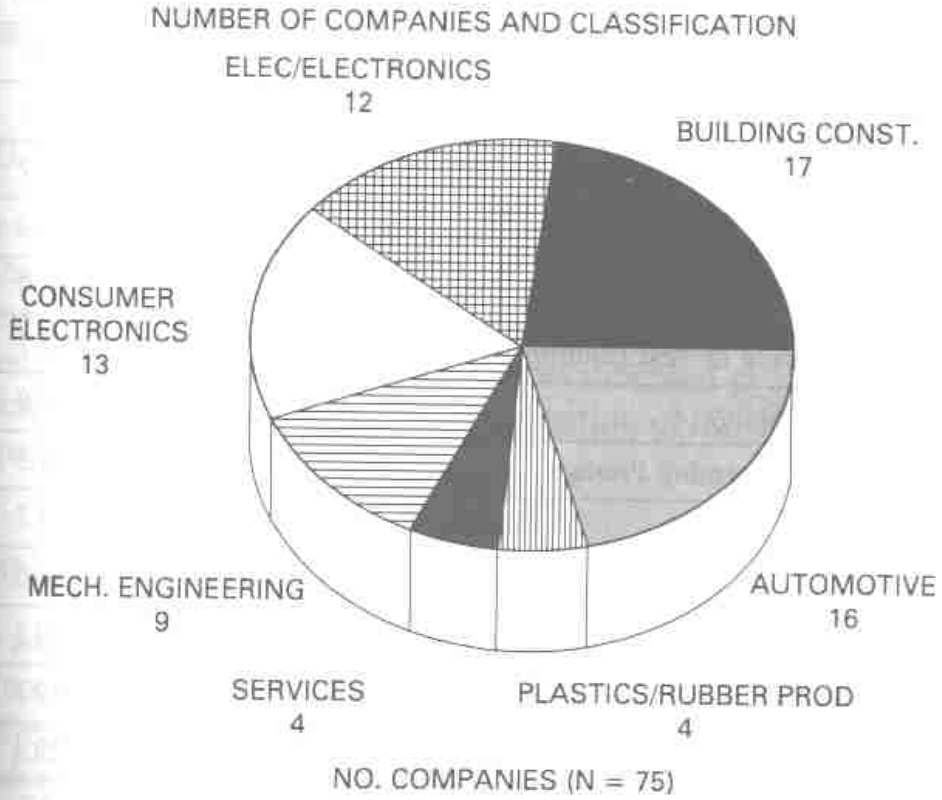


Figure 22.1 Gives the Breakdown of the Different Industrial Groupings in a Pie-Chart

REQUIREMENTS AND FINDINGS

This section will discuss the main discrepancies found in the audit reports. The findings of the audits will be discussed under each of the

main headings of ISO 9002: 1994 as none of the companies surveyed was certified to ISO 9001: 1994.

A summary of the findings is shown in Table 22.1.

Table 22.1 Number of Companies That Failed To Comply With The Clauses

Clauses of ISO 9002	Number of Companies That Failed To Comply	Percentage of Companies Surveyed
Management Responsibility	28	37.3
Quality System	4	5.3
Contract Review	11	14.7
Document Control	51	68.0
Purchasing	33	44.0
Purchaser Supplied Product	3	4.0
Product Identification & Traceability	14	18.7
Process Control	40	53.3
Inspection & Test	45	60.0
Inspection, Measuring & Test Equipment	47	62.7
Inspection & Test Status	15	20.0
Control of Non-Conforming Product	16	21.3
Corrective Action	26	34.7
Handling, Storage, Packaging & Delivery	27	36.0
Quality Records	22	29.3
Internal Quality Audits	37	49.3
Training	22	29.3
Statistical Techniques	2	2.7

MANAGEMENT RESPONSIBILITY

Out of the sample of 75 companies studied, 28(37.3%) of the companies were found to fail to comply with this requirement. Analysis of the audit reports indicates that although the companies have a written

policy on quality, failure to disseminate this policy to all levels of the organization, as required by the standard, is a major problem.

Another major problem that leads to failure to meet the requirements of this section of the standard is the failure to clearly define the responsibility and authority to all personnel who manage, perform and verify work affecting quality. This is particularly important in the areas where the authority to accept or reject products and to stop production must be clearly defined.

The third major area of discrepancy is on the management review of the quality system to ensure its continuing suitability and effectiveness. Very often reviews are carried out on an ad-hoc basis on specific problem areas rather than on the system as a whole. Reviews carried out in such a manner would not be able to establish the overall effectiveness of the system.

QUALITY SYSTEM

The section of the standard does not present a problem to the majority of the companies. Only four (5.3%) of the companies audited failed to meet this requirement. In most instances, failure to meet this requirement is related to the absence of documented procedures or work instructions and the effective implementation of the documented quality procedures and instructions.

CONTRACT REVIEW

The audit reports reveal that 11(14.7%) of the companies in the study did not meet this requirement. In most instances, failure to meet this requirement relates to failure to document and review the requirements of job orders or the requirements of customers.

DOCUMENT CONTROL

This is the most common problem faced by companies implementing the ISO 9000 standards. A total of 51(68.0%) of the companies failed to meet this requirement. Most common lapses relate to the use of unauthorized/obsolete documents, unapproved alterations and revisions

to documents, the identification and labelling of documents and the availability of documents at the point of use.

PURCHASING

Thirty-three (44.0%) of the companies surveyed faced difficulties in implementing this requirement of the standard. Most of the failures relate to the requirement for assessment and selection of vendors, correctly specifying product requirements on purchasing documents, approval of purchasing documents and the maintenance of a list of approved suppliers.

PURCHASER SUPPLIED PRODUCTS

Three (4.0%) of the companies surveyed failed to meet this requirement. The low incidence of failure could be attributed to the fact that this clause of the standard is not applicable to most organization. Failure to meet this requirement is due to the failure to properly identify, store and maintain materials/equipment which are supplied by the purchasers.

PRODUCT IDENTIFICATION AND TRACEABILITY

Fourteen (18.7%) of the companies failed to meet this requirement. Among the causes of failure identified were no system and procedures available for the identification and traceability of products and the mixing of products from different batches during the manufacturing process.

PRODUCT CONTROL

From the analysis of the audit reports, 40(53.3%) of the companies failed to meet this requirement. The most common causes of failure are the lack of process specifications and the failure of production personnel to ensure that processes are operated within specified control limits.

INSPECTION AND TESTING

From the audit reports, it was found that 45(60.0%) of the companies failed to satisfy the requirement of the standard. The major cause of failure is the lack of documented procedures for inspection and testing as required by the standard. In many instances, although documented procedures are available, failure to follow these procedures is a problem.

The lack of inspection and test equipment in some instances also result in failure to meet this requirement. Very often under these circumstances, inspection are carried out only visually while bought-in-materials are accepted on the strength of certificates of quality supplied by suppliers.

INSPECTION, MEASURING AND TEST EQUIPMENT

This requirement is the second most common cause of failure to meet the requirements of the standard. Of the 75 companies surveyed, 47(62.7%) of the companies failed to satisfy this requirement. Among the most common failures to meet this requirement are:

(i) failure to maintain a master list of all test and measuring equipment requiring calibration

(ii) failure to calibrate test and measuring equipment on schedule

(iii) failure to specify the accuracy of calibration

(iv) failure to establish and maintain documented calibration procedures

(v) failure to maintain calibration records

(vi) calibration not traceable to national standards

INSPECTION AND TEST STATUS

Fifteen (20%) of the companies surveyed failed to meet this requirement. The main cause of failure is failing to indicate the inspection and test status of materials, work-in-process and finished products by the use of labels, coloured stickers or route cards.

CONTROL OF NON-CONFORMING PRODUCT

Sixteen (21.3%) of the companies surveyed failed to meet this requirement. The audit reports indicate that failure is due to a lack of adequate controls to prevent mixing non-conforming products with good products. In some instances, there was an absence of documented procedures to review non-conforming products.

CORRECTIVE ACTION

Twenty-six (34.7%) of the companies surveyed failed to meet this requirement. The main cause of failure is the absence of documented procedures to deal with customer's complaints and procedures for investigating the cause of non-conforming products to prevent recurrence.

HANDLING, STORAGE, PACKAGING AND DELIVERY

From the audit reports, it was found that 27(36.0%) of the 75 companies handled and stored their products in an unacceptable manner that is likely to result in damage or deterioration to the product. In many instances, there is a lack of identification of stored materials and products.

QUALITY RECORDS

The standard requires that all records pertaining to quality must be maintained to demonstrate achievement of the required quality and the effectiveness of the quality system.

From the audit reports, it was found that 22(29.3%) of the companies surveyed failed to keep records as required by the standard. Failure to identify and index records and to specify the retention times for the records are also major causes of failing to meet this requirement.

INTERNAL QUALITY AUDIT

The audit reports indicate that this is another major problem area for companies implementing the ISO 9000 standards. Of the 75 companies surveyed, 37(49.3%) of the companies failed to comply to satisfy this

requirement. Failure to come up with a schedule for the internal audit, to carry out the internal audits according to schedule, to implement corrective action on non-conformances raised during the audits and the non-independence of auditors are some of the problems that lead to the failure to satisfy this requirement.

TRAINING

Twenty-two (29.3%) of the 75 companies surveyed failed to meet the requirement for training specified in the standard. Failure to identify training needs, provide the necessary training and maintain records of training are the major problems.

STATISTICAL TECHNIQUES

Only two (2.7%) of the companies are found to be deficient in this requirement. Many of the companies surveyed in this report indicated that statistical techniques are not applied in their organizations.

23

Problems and Solutions in the Implementation of ISO 9000

INTRODUCTION

As mentioned in Chapter 22, an analysis of the audit reports reveals some of the common problems encountered by organizations in the implementation of the ISO 9000. This chapter will discuss some of the problems and propose solutions to overcome these problems.

PROBLEMS AND SOLUTIONS

Management Commitment

Results of the survey indicated that 37.3% of the organizations surveyed encountered problems with this requirement of the standard. Reasons that can account for the lack of commitment are as follows:

(i) lack of awareness of the benefits of quality management systems and

(ii) implementing a quality system because of market pressures

Many of the organizations that had been audited are still practising the traditional concept of quality, i.e., "inspect in quality". Customer's satisfaction is to be achieved by supplying defect free products by inspecting and rejecting products not meeting specification. Many

do not realize that the cost of these "rejects" are already built into the cost of the good products that are supplied, i.e. the customer is made to pay for products that are rejected.

These companies are not aware that quality assurance with its concept to "build-in-quality" is a more cost-effective way of delivering defect free products to customers. The concept of grade and quality is not widely understood as many have not heard of Juran's "Gold in the Mine" concept. The prevailing thinking is that higher quality means higher cost.

Many of the companies too had been "forced" into implementing the ISO 9000 by market pressures. A major customer could have included the ISO 9000 as a condition of supply, or that a major competitor had already implemented an ISO 9000 quality system. To stay competitive and to ensure its survival, the organization is thus "forced" to comply with market requirements.

In so doing, commitment is lacking, and like other management systems, this lack of commitment of the system would lead to the breakdown of the system. A lack of management commitment is often indicated by the failure to commit adequate resources (manpower and equipment), to establish and maintain the system. Inadequate training, unwillingness to purchase critical items of testing equipment and poor discipline in the maintenance of quality records are also indicative of the lack of management commitment.

Interpreting the Requirements of the Standards

The ISO 9000 standards are generic standards that had its origin in the engineering industry. As generic standards, some of the terms used in the standards could be misconstrued as being vague, ambiguous and imprecise. Confusion also arise as there is a lack of definition of these terms in the standards. Examples of vagueness are terms such as appraisal and evaluation; inspection and examination; supplier, vendor and sub-contractor; and verification and validation.

The impreciseness of the standard is not only limited to definitions of terms. There is confusion also as to the extent of documentation that is required. For some clauses in the standard, the requirement is to establish and maintain procedures while some other clauses would

specify, establish, document and maintain procedures. Is it therefore necessary to document all procedures or document only where the standards specifically require documentation?

Another difficulty that is widely recognized is the applications of the standards to sectors of industry not related to engineering, for example, the chemical process industry, the service sector such as banks and hotels or the construction industry. As the terminology used in the standards are engineering based, considerable amount of difficulty is encountered when one tries to interpret the requirements of the standards in the context of these industries.

The way to overcome the problem of interpretation is to have the services of personnel with relevant experience in the particular sector of industry to establish and implement the quality system. It must be remembered that the ISO 9000 standards only specifies WHAT needs to be done but the actual technique or method employed, i.e. HOW it is done is left to the organization concerned. Thus, different kinds of organizations can interpret the requirements to suit their operation. The experience and skill of the Quality Manager or consultant could then be utilized to assist the organization to meet the requirements of the standard.

Documentation

A key requirement of the standards is documentation. However, what is required to be documented or how much to document is not clearly specified in the standards. Most organizations, therefore, take the conservative approach, i.e. to document everything.

Ignorance of the documentation requirements usually result in the generation of a huge amount of paperwork which may or may not be used at all. The excessive bureaucracy that is generated have a negative impact on the control of documents. This is reflected in the high percentage of companies surveyed (68.0%) failing to meet this requirement. The most common problems encountered in the control of documents are obsolete documents being used, unauthorized amendments to documents, revisions to documents not being circulated to all document holders and unauthorized duplication of documents.

The reason for this failure is the inability of organizations to recognize or comprehend what the fundamental requirements are. The

fundamental principle is that documents should only be generated where they have a direct impact on the Quality System and where its absence could possibly result in a quality problem. To be useful, documents must be integrated with the particular organization's operational system, resources available, culture, management and type of product or service.

Thus to avoid over-documentation, an organization would have to thoroughly examine its business process and needs. It then makes its decision on the quantity and depth of documentation that is required to satisfy the requirements of the standards, bearing in mind that the documentation produced represents a true and useful account of how its Quality System operates and that the documentation is to help those operating that system.

Problem of Implementation

Very often the task of establishment and documentation of a Quality System is assigned to a single person, i.e. the Quality Manager. Unless the Quality Manager is very conversant with the entire business process of the organization, the documentation that results may not reflect what is actually happening or would not achieve its purpose in the most effective way. Very often then, such procedures would be ignored by the people who are supposed to be using it.

Another problem with implementation is that organization mistakenly perceive that all it needs to comply with the standards is to document its Quality System. They fail to realize that it is just as important to train the people involved in implementing the system.

The failure to adequately train its employees to implement the documented system had resulted in the high failure rates for process control (53.3%) and inspection and testing (60.0%) requirements of the standards.

The way to overcome this problem is to involve everyone in the organization in writing their own procedures and work instructions, with the Quality Manager as the facilitator or co-ordinator. This way it creates ownership instead of having the procedures written by a third party and having it imposed on them. Writing their own procedures promotes understanding of the system, thereby, ensuring that it is followed by the whole workforce.

Training is another important factor to ensure the effective implementation of a Quality System. Everyone in the organization must be given effective instruction, training and supervision to ensure that he performs his job effectively.

Resistance to Change

In a study conducted in the United States by Blair and Whitehead (Ref. 13), the authors identified that middle management's resistance to change as one of the main obstacles to the successful implementation of quality programmes. Middle level management had remained sceptical of a process which demands a radical change to traditional management techniques, particularly, when tangible benefits cannot be immediately realized.

The implementation of Quality Systems to the ISO 9000 standards may be perceived by middle managers to be bureaucratic and interferes with their work. This may be particularly true where it involves the non-traditional areas of quality such as purchasing, training and marketing whose managers may feel that quality is the Quality Manager's problem and not theirs.

It is important for organizations embarking on a programme to implement the ISO 9000 standards to communicate to all in the organization the real purpose of implementing Quality Systems. That is to improve the effectiveness of the organization in meeting customer's requirements by creating a systematic approach to Quality Assurance thus demonstrating its commitment for quality to both its customers and employees. And that this commitment involves everyone in the organization.

An ongoing programme of education and training in the principles and concepts of quality management and the total involvement of everyone in the organization in the establishment and implementation of the Quality System would reduce the resistance to change.

USAGE OF COMPUTER TECHNOLOGIES

With the advancement in the field of computer technology, both in the field of software and hardware, the construction industry is moving towards a paperless quality system documentation. With the appropri-

ate computer software, a lot of documentation relating to the quality system can be stored and transmitted via the electronic media. In fact, all the pre tender and post tender records can be stored in inter-related database software that unites the quality system document, design aspect, work program and the specification.

Computer software packages available in the market now can be used for:

(a) Preparation and updating of Quality Manual, Work Procedure, Work Instruction and Project Quality Plan.

(b) Document control that is control status of document whether New, Current and Archive.

(c) Maintenance of training records.

(d) Preparation of Internal Audit Report and monitoring status of audit findings.

(e) Monitoring Corrective Action Request Forms.

(f) Interface with other systems to enable the flow of information to authorize personnel immediately and as when required to.

(g) Maintaining sub-contractors and suppliers performance records for purpose of evaluation.

Future computer program will allow an entire construction method and contract requirements to be tested by computer simulation which are as follows:

(a) Building Defects

(b) Architectural and Structural Design

(c) Cost Control

(d) Value Engineering

With the improvement in computer hardware in terms of memory and storage capacities, it is becoming possible for consultants and supervisors to retrieve construction details through computer notebooks. Hence, in the near future, we may be seeing more consultants and supervisors moving around with their computer notebooks rather than bulky construction drawings while carrying out their tasks on site.

24

An Interview with the Master Builders Association of Malaysia

INTRODUCTION

A tape recorded interview was carried out at Mr Lau Mun Cheong's office on 12th October 1995 from 10.00 am to 12.00 noon with regard to some of the problems faced by the construction industry and the implementation of ISO 9000 in the Malaysian Construction Industry.

Mr Lau Mun Cheong is the Secretary General of Master Builders Association of Malaysia. He is also a Professional Engineer. Currently, he is the Executive Director of Sekimas Holdings Sdn Bhd.

Question 1

What's the role of M.B.A.M. in our construction industry?

Answer 1

On behalf of the President and Council of Master Builders Association of Malaysia (M.B.A.M.), I am pleased to give a report of the Association's achievement and activities in the year 1994.

The construction industry had performed extremely well in the year 1994. It has achieved a growth rate of 15 per cent during the year. This is the fourth year in succession that the construction industry had

recorded a double-digit growth. Industry analyst had forecast the current boom to maintain at least for the next three years. However, the current construction boom has also created some very pressing problems such as quality control, shortage of skilled workers, industrial accidents, shortage of building materials, etc. It is, therefore, of paramount importance for the Association to take stock of the current scenario with the aim to improve on the various aspects mentioned, in order to keep pace with the expectation of the public, in general.

It is, therefore, the prime objective of the Association to provide members with such information and assistance in the years to come. The Association shall continue to maintain its close rapport with the various Government departments and agencies to ensure that the views of the Association in the current issues related to the industry will be taken into consideration during the formation of the various policies as well as during the stage of implementation.

In the year 1994, the construction industry had also witnessed the passing of two very important legislations affecting the construction industry, namely the OCCUPATIONAL SAFETY AND HEALTH ACT 514, 1994 and the CONSTRUCTION INDUSTRY DEVELOPMENT BOARD ACT 520, 1994. The Association is keeping a very close watch in the development of these two legislations and had responded with numerous dialogues and discussions with the relevant authorities in order to safeguard the interest of the construction industry.

The Association will continue to monitor the development and ensure proper representation in the CIDB's working committee in order to achieve our objectives.

Question 2

Do you agree that implementation of an effective quality management system that meets the ISO 9000 standard can lead to cost and time savings and better quality projects?

Answer 2

Construction industry involves various parties, e.g. developers, contractors and the consultants, various construction methods and other inputs from both the public and private sectors. The level of success

in carrying out such construction and development activities depends very much on the quality management system, construction technology and teamwork of all parties involved in the construction industry. As such, a quality management system approach is necessary to deal with the pre contract and post contract stage of a project. The demand for the continuous improvement in the Malaysian Construction Industry is to be given top priority to ensure national success. The construction industry is a dynamic and complex industry as it involves so many parties.

Therefore, the performance of the construction industry as a whole depends very much on the following key elements:

- Manpower resources, e.g. architects, engineers, surveyors, builders, technicians, skilled, semi-skilled and manual workers.
- Building materials resources, e.g. from raw materials to the component parts of the building.
- Machinery resources, e.g. heavy and light equipment.
- Construction technology, e.g. advance building technology to improve quality, safety and efficiency of the project.
- Quality management system, e.g. good management principles, codes of practice and other management technique applicable to the construction industry.

My understanding of the requirements of the ISO 9002 is essentially to document all critical construction process or methods, whose absence would affect the quality of the finished products or services. At the same time, ISO 9000 has a built-in management review, contract review, construction methods review to streamline the construction processes.

On top of this, there is also the internal and external quality audit and sub-contractors and suppliers audit carry out within the quality management system to ensure all parties comply with the requirements of the ISO 9000 standard.

ISO 9000 standard embraces the twenty clauses of good management practice. In my opinion, I agree that the implementation of an effective quality management system that meets the ISO 9000 standard can lead to cost and time savings and better quality projects.

Question 3

Hong Kong's and Singapore's C.I.D.B. have made ISO 9000 Certification a mandatory requirement for contractors tendering for Government projects. Do you think that the Malaysian C.I.D.B. should follow the above trends?

Answer 3

Master Builders Association of Malaysia (M.B.A.M.) has always encourage all its members to embark on the implementation of ISO 9002 in the Malaysian Construction Industry. However, M.B.A.M. cannot force its members to implement ISO 9000 if the members do not want to do so. Bear in mind a lot of its members are small time contractors who might not have enough resources to implement ISO 9000 in their organizations. In my opinion, C.I.D.B. Malaysia should follow the Hong Kong's and Singapore's C.I.D.B. footsteps of making the ISO 9000 Certification a mandatory requirement for all contractors tendering for Government projects.

Question 4

How can M.B.A.M. contribute towards solving the following problems face by the construction industry presently?

(a) Customer practice of awarding contract to the lowest bidder

(b) Lack of skilful foreign workers

(c) Shortage of building materials

(d) Lack of Continuous Professional Development

(e) Lack of funds for Research and Development

(f) Poor building materials

(g) Rising price of building materials

(h) Short construction period imposed by the customers

Answer 4

(a) It is a commercial problem.

(b) Current inflow of foreign workers has helped in reducing the pressure on the supply of labour. A lot of times, however, construction companies end up getting workers who have not been trained at all in the construction fields. We feel that a grading mechanism to classify the type of workers coming into the country is needed to ensure that we get the right people for the jobs. This effort will be best carried out on a Government to Government basis.

(c) We expect the current buoyant economy to continue. Construction industries will be kept busy for some more years to come. We appeal to the supporting industries (i.e. bricks, tiles, cement, steel bars, electrical wires, etc.) to build up the efforts and prepare for the future volume of works.

We are aware that the Ministry of Domestic Trade and Consumer Affairs has appointed Arthur Anderson HRM (Management Services) Sdn Bhd to conduct a survey on the supply and demand of the various building materials covering up to the year 2000. We are looking forward to the report of the survey so that the relevant industries related to the construction industry will be able to benefit from this report and to chart their future strategies accordingly.

(d) We would like the Government to extend its tax incentives to include a rebate for in-house training activities conducted for the construction professionals, sub-professionals and workers in addition to the training conducted by the approved institutions. These incentives will help to reduce the pressure due to the acute shortage in the supply of manpower in the construction industries.

(e) We congratulate the Government on the setting up of the Construction Industry Development Board. We hope that the establishment of C.I.D.B. will further stimulate R & D activities in the construction industries.

(f) The international market for construction activities is truly a very competitive market. In order to stay and survive in the market, we need to enhance our competitiveness. We urge the Government to ensure that our local manufacturers of construction materials to live up to the competitiveness in terms of quality, price and consistency of supply. We hope to bring our local building materials with us together to the international market. However, it can only be realized if the materials are of international standard and quality at competitive price.

We also appeal to the Government to work together with SIRIM and its counterparts in the foreign countries to establish a reciprocal certification system to ease the entrance of our construction materials into the countries.

(g) The Government should exercise flexibility in the event when building materials prices are found to be escalating or when material supplies are in critical shortages.

Temporary lifting on the ban of the importation of certain materials should be considered to overcome the shortages and/or to stabilize the escalating prices. We note with concern that prices of aluminium sections, PVC products, electrical cables and bricks have been increased substantially. Currently, the construction industry is facing critical shortage in the supply of clay bricks, roofing tiles and cements. We would like to see more Government efforts to curb the rising prices. The inflationary prices on the essential materials will only limit our capability in providing affordable housing scheme to the needy.

(h) It is a commercial problem.

25

Critical Steps in the Implementation of ISO 9000 in a Construction Company

INTRODUCTION

This chapter describe the critical steps in implementation of ISO 9000 in a construction company. The Quality Assurance Manager has to plan for implementation of ISO 9000 covering the whole duration from feasibility study to its final completion. Ideally, a construction company would require approximately 15 to 18 months to achieve the ISO 9000 Certification. A period of six months is quite sufficient to prepare all the necessary documents such as Quality Manual, Work Procedure, Work Instruction and Project Quality Plan. Another nine months will be required to ensure all employees are familiar with the documented procedures. Familiarization of the documented procedures can be carried out though Internal and External Awareness Training, Management Review, Internal Quality Audit, etc. This is only a rough estimation of the time frame for the implementation of ISO 9000. The actual time required depends very much on the complexity of an organization. However, companies are advised not to plan for too long a time frame as this could result in a loss of momentum in the implementation of ISO 9000. Therefore, it is essential for the Quality Assurance Manager to plan out all the critical events in his programme and to allocate sufficient time and resources for each of the event.

The critical steps in the implementation of ISO 9000 are given below. The flow chart in Figure 25.1 provides a quick overall view on the flow of events in the implementation of ISO 9000:

STEP 1 – Decision by the Managing Director to go ahead with the ISO 9000.

STEP 2 – (i) Appointment of Quality Assurance Manager responsible to implement the Quality System into the Company. The Quality Assurance Manager should preferably to be someone with technical background.

(ii) To set up steering committee consisting of all the Heads of Departments to monitor the progress of implementing the ISO 9002 and resolve interdepartmental problems.

STEP 3 – Prepare an implementation plan and identify the critical path by allocation of sufficient resources.

STEP 4 – The Company may then submit its application to the certification body to ensure date for the assessment.

STEP 5 – Writing up of Quality Manual by the Quality Assurance Manager subject to approval by the Managing Director.

STEP 6 – Quality Assurance Manager to prepare flow charts on all important processes after further consultation with the various heads of departments.

STEP 7 – Write-up of all Work Procedures and Project Quality Plans subject to further discussion with the various heads of department.

STEP 8 – Implementing the Quality System documentation both in the head office and on site by conducting frequent awareness training course.

STEP 9 – To carry out internal audit on site and head office to check on the effectiveness of implementing the Quality System. It is recommended that internal auditor be sent for training through external seminar.

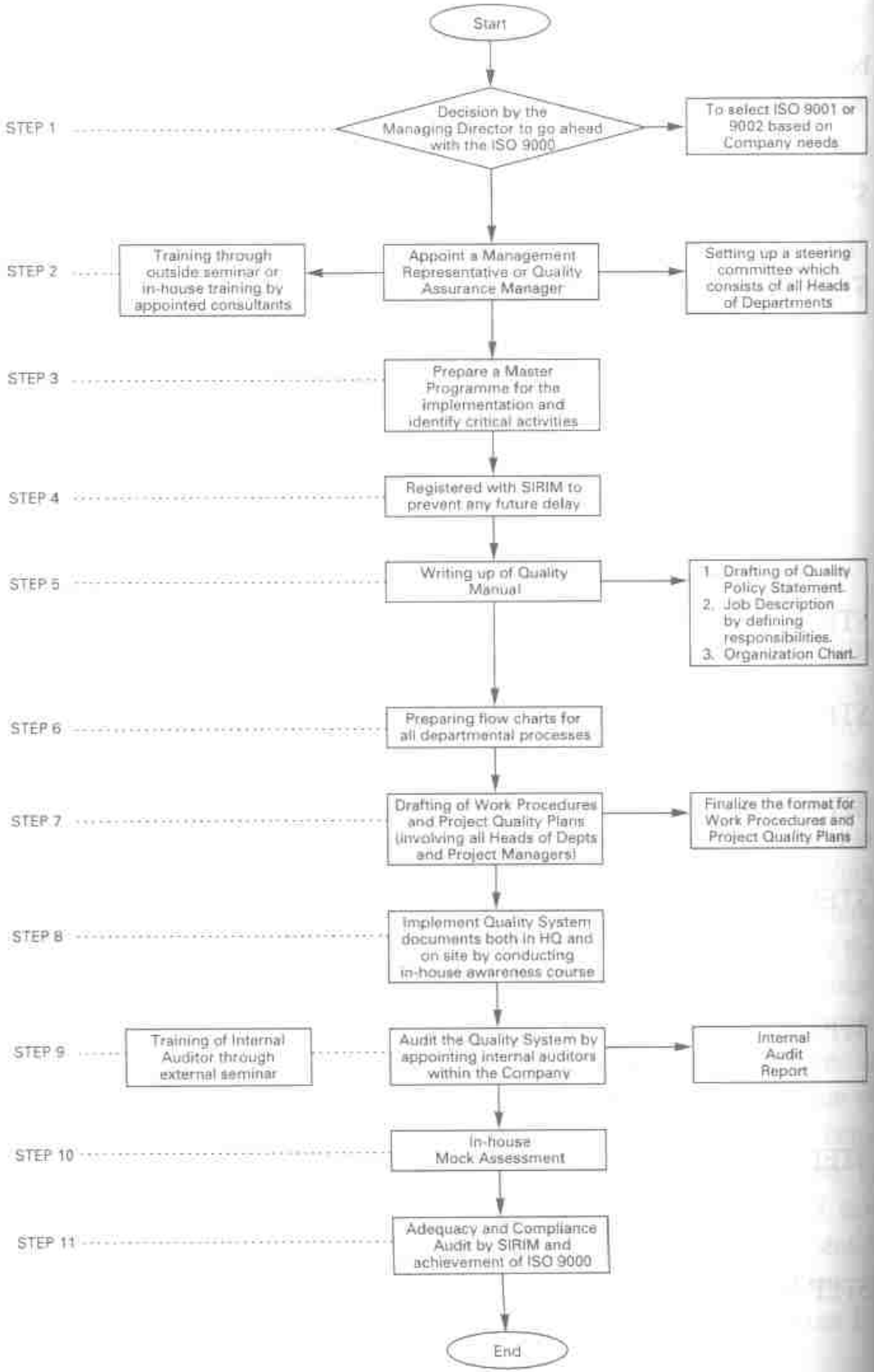


Figure 25.1 Implementation of ISO 9002 Flow Chart

STEP 10 – Prior to the external audit, it is recommended that a mock assessment through internal audit should be conducted to establish the organization's readiness. Sometimes, an external auditor may be appointed to carry out an independent assessment.

STEP 11 – For adequacy audit, a company's quality manual and work procedures are normally submitted to certification body for review against the requirement of ISO standard.

For compliance audit, to ensure whatever written down in the Quality Manual and Work Procedure are implemented as per document.

ADVANTAGES OF ISO 9000 REGISTRATION FOR THE CONSTRUCTION INDUSTRY

Some of the advantages of an effective certified quality management system are given below:

- Optimized resources use in the company organization
- Improved awareness of company's policy and objective
- Improved communication between various departments in the same Organization
- Improved traceability to root 'causes' of quality problems
- Cut down material wastage on site
- Formalized systems to ensure consistency in quality of services
- Documented system provides useful reference and training tool
- Fewer rejects, therefore, less repeated work and warranty costs
- Errors rectified at the earliest stage
- Improved relationships with the clients, sub-contractors and material suppliers
- Improved corporate quality image

- Continuous improvement through Quality System review
- Improved records and easy retrieval in case of litigation
- Ensure project completed within the stipulated time frame required by the contract

ISO 9000 is a matter of good management practice, therefore, endorsing ISO 9000 have many advantages which far outweigh the disadvantages.

Summary

A Total Quality System is critical in today's competitive business environment. In an era of globalization where economic competition is becoming more intensified, it is a sound business strategy to develop and implement a quality management system that meets international requirements.

Implementing an ISO 9000 Quality System will bring about improved competitiveness for an organization as a result of the following activities:

(i) Focusing on customer's needs

(ii) Applying a supplier/customer relationship with well-defined and mutually agreed upon requirements

(iii) Developing a prevention attitude throughout the organization

(iv) Establishing clear documented procedures and instructions understood by everyone concerned.

For the construction industry, implementing ISO 9000 Quality Systems can complement and spur the industry towards adopting innovative and efficient construction technology and practices in order that projects can be completed within a stated period of time and with less wastage, giving adequate consideration to quality and safety requirement's as well as giving due regard to the environmental and aesthetic aspects.

No doubt, to establish and implement an ISO 9000 quality management system requires a lot of effort from an organization. Organization may face difficulties and problems during the implementation and maintenance of an ISO 9000 quality system.

For one, obtaining a clear understanding of the requirements of the standards is not easy as the ISO 9000 series of standards is generic. They represent the minimum requirements for an effective Quality System to assure that products or services will meet customer requirements. It may require much planning, management and implementation focused on results at using the Quality System. The standards are written for all suppliers of goods and services regardless of the size of the organization and the sector of industry. Thus, the terminology employed have often been described as vague and imprecise resulting in difficulty in interpretation and understanding.

The standards tell you what you must have in a Quality Systems but do not tell you how you can achieve it. This has caused great difficulty in its implementation, particularly, for the small organizations which do not have the resources to engage Quality Consultants.

However, with Total Management Commitment, full support and co-operation from all levels of personnel who have been adequately trained, all difficulties and problems can be overcome.

There has been argument that the ISO 9000 standards cannot be implemented in the Malaysian Construction industry due to the following reasons:

(a) Customer practice of awarding contract to the lowest bidder

(b) Lack of skilful workmanship, e.g. mostly consist of foreign workers whose only forms of training are on-the-job training on site

(c) Outdated Construction Technology due to lack of funds for Research and Development

(d) Lack of Continuous Professional Development

(e) Poor building materials which do not meet the specifications

(f) Poor design by inexperienced Architect and Engineers

(g) Short construction period

(h) Conflict of interest among the contractual parties

Though the proponents of such line of thoughts may have a basis for their arguments, the authors are of the opinion that the shortcomings as stated above are temporary and can be corrected through the adoption of more innovative and efficient construction technology and practices. Indeed, implementing ISO 9000 Quality System will be the right step to take to spur the construction industry onwards.

However, it should be emphasize that the ISO 9000 Quality System, cannot be regarded as the cure all for all of the industry's ill presently faced.

All parties involved in the Construction Industry; the developers, the consultants, the approving authority as well as other regulatory bodies should all play their part in ensuring that the industry attain a competitive edge in the global arena.

In the final analysis, the benefits that can be obtained from implementing an ISO 9000 Quality System is well worth all the effort, time and money put in. For an organization that aims to improve continuously the way in which it runs its business to serve its customers, the achievements of ISO 9000 standard certification represents a milestone in the quest for quality.

Since the introduction of the ISO 9000 standards in Malaysia and the launching of SIRIM's certification scheme in 1987, there has been an increasing realization by Malaysian industry of the need to incorporate quality practices into their business operations. This development will place Made-in-Malaysia products in a better competitive position in the global markets. A step which will positively contribute to the achievement of the objectives of VISION 2020.

26

The Role of Construction Industry Development Board (C.I.D.B.) in the Construction Industry

PERFORMANCE AND SCENARIO OF THE CONSTRUCTION SECTOR

The construction industry has undergone rapid growth parallel to the economic growth of the nation. This is clearly seen from the progressive levels of construction activities undertaken in the past, currently being undertaken and those ambitious programmes earmarked for the future. For the period between 1991 until the year 2000, the construction sector is expected to enjoy a double-digit growth rate and the sector's contribution to Gross Domestic Product (GDP) is expected to double by the year 2020.

From 1991 to 1995, the industry contributed about 4.0% to 4.2% to the GDP. Even though this contribution is comparatively small, the construction sector enjoyed a double-digit growth rate of over 13% annually from 1992 to 1994 and in 1995 alone, it registered a growth rate of 15.5%. This trend is expected to continue in view of more ambitious development programmes which are in the pipeline.

The construction sector play a very important role in the expansion of the national economy in that it provides vital support to other sectors and it acts as a catalyst to the growth of these other sectors. Despite

this impressive growth, this sector is segmented and compartmentalized due to the presence of too many players, each carrying out their own independent activities without proper co-ordination and control. There is also no single agency or body which can integrate and co-ordinate the formulation of policies and to tackle current issues and problems faced by this sector. There is also no national resource centre for this sector.

BOARD'S MISSION

It is recognized that as a result of uncontrolled and unorganized growth, the construction sector is saddled with many problems. There are alarming signs of lack of emphasis on quality and safety on construction sites. There are records of injuries, sometimes fatal on construction sites. Further the quality of completed work leaves much to be desired. Also there are signs of premature failures and defects on recently completed projects. These problems are compounded by an acute shortage of construction workforce especially skilled workers. It must be admitted that the growth of this sector is sustained almost entirely by a foreign workforce. Besides the shortage of manpower, this sector is also experiencing shortage of some basic construction materials.

The C.I.D.B.'s mission is to address all these issues and to steer this sector towards the right direction so that it can spearhead and stimulate a balanced growth in tandem with the aspiration of the national economic policy. The main focus, therefore, will be to develop the construction industry so that it becomes a major contributing sector to the national economy capable of producing and delivering high quality construction works, with value for money and responsive to the nation's need.

The focal point of development of the construction industry sector is certainly the overall improvement of quality. In construction, quality refers to not only to the quality of the end product i.e. the quality of whatever is being build, but also of equal importance is the quality of process and practices and other factors of production that lead up to the end product.

The other equally important aspect of quality improvement that needs to be addressed is in the area of safety standards. Safety is a

universal concern and in construction we need to address safety not only in relation to those who are being employed on site but also the public at large during the stages of construction. Records show that the frequency of accidents and injuries on construction sites are much higher than those in other sectors of industry. Looking at the record of fatal accidents alone in 1994, there were 24 deaths on construction sites in and around Kuala Lumpur and the State of Selangor. Within the first quarter of 1995 there were 11 deaths on construction sites within the same region. This is an indication of the grim situation if no concrete effort is made to check this rising trend.

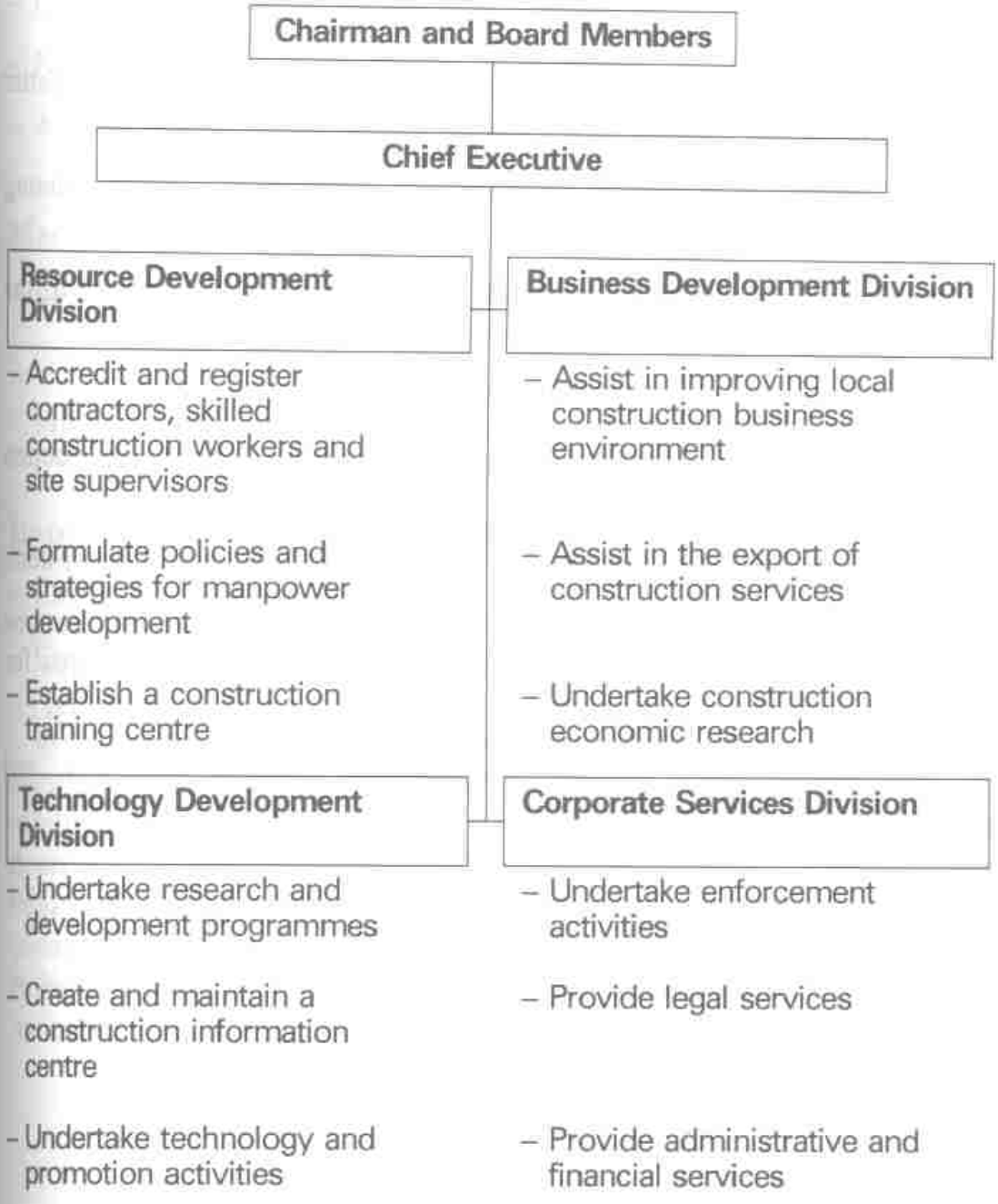
The next move towards enhancing this sector's contribution to the national economy is to concentrate on exporting construction services into the international market. Those programmes for the upgrading of quality and safety standards are indeed steps in the right direction to gain cognizance of the integrity and reliability of our builders and contractors in the international market. Thus far the construction sector's contribution to GDP has been relatively small even though it has registered a double-digit growth for quite some time now. In comparison with the construction sector of Japan and Korea, we realize that this contribution is only about one-third of what they contribute to their respective country's GDP. The move to upgrade quality and safety standards and to gain strong footings in the international market will eventually improve this sector's contribution to the national economy.

COLLECTION OF LEVY BY C.I.D.B.

To carry out C.I.D.B.'s function and to achieve its mission for the improvement, development, expansion and betterment of the construction industry, C.I.D.B. needs fund to carry out its activities and programs. Hence C.I.D.B. collects levy at 0.25% from all construction contracts **exceeding** five hundred thousand ringgit (RM500,000.00) under the ambit of Part VIII of the Construction Industry Development Board Malaysia Act 1994 (Act 520). Under the Construction Industry (Collection of Levy) Regulation 1996, all registered contractors who execute any contract on any construction work or commence construction work, having a contract sum of above five hundred thousand

ringgit shall submit a notification in Form CIDB L1/96 not later than 14 days after the date of execution of the said contract/works or not more than 14 days before the commencement of the said construction work, whichever date is earlier. The Form CIDB L1/96 can be obtained from C.I.D.B. office.

C.I.D.B. STRUCTURE



FUNCTIONS OF THE BOARD

The functions of the Board as laid down in sub-section 4(1) of the Act are as follows:

- To promote and stimulate the development, improvement and expansion of the construction industry;
- To advise and make recommendations to the Federal and State Government on matters affecting or connected with the construction industry;
- To promote, stimulate and undertake research into any matter relating to the construction industry;
- To promote, stimulate and assist in the export of services relating to the construction industry;
- To provide consultancy and advisory services with respect to the construction industry;
- To promote quality assurance in the construction industry;
- To encourage the standardization and improvement of construction techniques and materials;
- To initiate and maintain a construction industry information system;
- To provide, promote, review and co-ordinate training programme organized by public and private construction training centres for skilled construction workers and construction site supervisors;
- To accredit and certify skilled construction workers and construction site supervisors.

KEY PROGRAMMES

Quality Development

- Registration of contractors
- Accreditation of skilled workers and site supervisors
- Quality assessment system and awards

- Construction industry resource centre
- Standards writing for the construction industry.

Improving Productivity

- Research and Development
- Technology promotion
- Design support centre
- National Construction Exhibition centre
- Accident-free programmes.

Manpower Development

- Skill and Supervisory training
- Construction training centre
- Manpower policies and planning.

Improving Business Environment

- Export of construction services
- Construction economy research.

In summary, the advent of C.I.D.B. is primarily to help develop the construction sector to a new frontier which has the capacity and capability to offer quality products and services competitively. The Board is committed to develop skill standards, technology of construction, and quality and standards of materials. Above all, C.I.D.B. is committed to upgrade safety standards on construction sites and to embark on programmes to develop contractors and builders to be committed to quality and safety in construction.

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Registration requirements and procedures by C.I.D.B.

INTRODUCTION

(a) With effect from 20th July 1995, it is mandatory for all contractors whether local or foreign to register with Construction Industry Development Board Malaysia (C.I.D.B.) before they undertake to execute and complete any construction works in Malaysia except those given exemption under section 40(1) of the Construction Industry Development Board Malaysia Act 1994. Any person who undertakes to carry out and complete any construction works without being registered as a registered contractor with C.I.D.B. shall be guilty of an offence under the C.I.D.B. Act and shall, on conviction, be liable to a fine not exceeding fifty thousand ringgit. Contractors are given twelve (12) months grace period to register with C.I.D.B. Nevertheless, contractors are advised to apply early for registration as the C.I.D.B. shall not be responsible for delay in processing applications for registration received later than six (6) months before expiry of the twelve-month grace period.

(b) C.I.D.B. has established the Registration and Levy Unit to register contractors. Contractors to be registered with the C.I.D.B. must show that they have the relevant experience, financial, technical and management capability.

(c) The Registration of Contractors (Construction Industry) Regulations 1995 specify the registration requisites. Contractors applying for registration are advised to read the Registration Requirements and Procedures carefully before submitting the prescribed application forms. Local or locally incorporated applicants shall refer to Terms of Registration and Registration for Local or Locally Incorporated Applicants. For purposes of registration with the C.I.D.B., locally incorporated applicants shall be foreign companies which are locally incorporated with minimum 30% local equity.

Foreign applicants shall refer to Terms of Registration and Registration for Foreign Applicants.

Terms of registration

1. SCOPE OF REGISTRATION

There are three Registration Categories, namely

(1) Civil Engineering Construction,

(2) Building Construction, and

(3) Mechanical and Electrical

which are further classified into various specialization groups (See Appendices A-1 and A-2).

There are seven grades for each of the categories (See Appendix A-1).

2. APPLICATION DETAILS

2.1 Application Procedure

Application forms are available at C.I.D.B., Level 19, Menara Dato' Onn, PWTC, 45 Jalan Tun Ismail, 50480 Kuala Lumpur. All applications shall be submitted in the prescribed application forms available on payment of RM5.00 per form. It is the applicants' responsibility to ensure completeness of the submissions and to ensure that necessary supporting documents are submitted. Incomplete or uncompiled submissions will be returned. Processing will commence only after the submissions are found to be in order.

2.2 Processing Fees

All applications shall be accompanied by payment of the appropriate processing fees. The amount of fees to be paid is shown in Appendix B.

Processing fees can be in the form of cash or postal order or money order or company's cheque made payable to Construction Industry Development Board Malaysia. All fees paid are not refundable. C.I.D.B. may change the fees without giving any prior notice.

2.3 Submission of Application Forms

Application shall be made by a director or by a person authorized to do so by the firm or a sole proprietor or a partner as the case may be.

Application forms accompanied by the appropriate processing fees shall be submitted to:

Registration and Levy Unit
Construction Industry Development Board
Level 19
Menara Dato' Onn, PWTC
Jalan Tun Ismail
50480 KUALA LUMPUR.

Applicants are encouraged to submit applications in person to ensure that their submissions are complete.

Processing will be based only on available information submitted by applicants. Applicants are encouraged to forward references directly from clients/consultants of the projects which the firms have undertaken. References should be submitted together with the application forms in envelopes marked ''Strictly Confidential''.

In the course of processing the applications, C.I.D.B. might deem it necessary to obtain references from the applicants' bankers or the clients/professional consultants who supervised the works of the applicants. Any service charge imposed by the bankers or professional consultants on the enquiry made, shall be borne by the applicants.

3. REGISTRATION REQUISITES

Applicants must comply with the registration requisites before they can be considered for registration. Registration requisites are as stated below.

3.1 Status with the Registrar of Businesses or Registrar of Companies

(a) Applicants have to be registered with the Registrar of Businesses or Companies before they can be considered for registration with the C.I.D.B.

3.2 Experience and Performance

(a) Applicants are expected generally to have executed engineering and construction works similar to those categories and specialization which they wish to be registered in.

(b) Experience of the firm shall be in terms of:

(i) The average annual value of work executed by the applicant during the past three (3) years should be at least equal to the capacity of the registration grade applied for.

and

Have successfully completed during the last three years at least one project of a similar category of value exceeding 75% of the capacity of the registration grade applied for.

or

(ii) Experience of key technical personnel, if the applicant has no previous experience.

Appendices C-1 and C-2 illustrate the registration requisites.

(c) All main contracts or nominated sub-contracts executed by the applicants will be considered, provided they are supported by necessary contractual documents.

(d) Sub-contracts awarded directly by another contractor may only be considered if the scope and value of projects are clearly described and accompanied with the necessary contractual documents. The contract value of sub-contract work taken into consideration will depend on the extent of involvement of the applicant in a particular project.

(e) In addition to the requirements on aggregate project value, applicants must have a consistently good performance record. Those with poor performance history may be refused registration.

(f) Key technical personnel shall be the principal of the firm, or a full-time employee not associated professionally or employment-wise with any other party, having a professional or technical qualification and have been involved or employed in a managerial/supervisory capacity in construction contracting not less than five years prior to the application.

3.3 Financial Capacity

(a) Applicants should satisfy C.I.D.B. that they have sufficient financial resources to meet the financial commitments which would normally arise.

(b) Financial capacity of an applicant registered with the Registrar of Companies shall be evaluated in terms of net worth based on the latest audited financial statements* OR for new companies (less than two years), the paid-up capital of the companies. For applicants registered with the Registrar of Businesses, whether sole proprietorship or partnership, financial capacity shall be evaluated in terms of net capital worth which shall be derived from either one or all of the following:

(i) Average balance of the last three months bank account statements@ of the applicant.

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* Audited financial statements to be submitted shall be for the last financial year or if not available for the year prior to the said period.

@ Bank Account statements from the same bank/financial institution to be submitted shall be for the last three months before date of application of the applicant.

(ii) Fixed deposit (including fixed deposit of each partner). Fixed deposit considered shall not be charged to any bank or financial institution.

(iii) Amount of overdraft facilities enjoyed by the applicant.

(c) The minimum financial requirement in terms of net worth/paid-up capital or net capital worth is set at 5% of the capacity of the registration grade applied for except for Grade G7.

3.4 Personnel Resources

(a) Applicants should satisfy C.I.D.B. that they have the necessary full-time personnel resources in Malaysia to undertake the work corresponding to the registration grade and category applied for.

(b) Evaluation on personnel resources shall be made as follows:

(i) The numbers of full-time employees employed.

(ii) Experience shall be in terms of aggregate number of years in which the employees in their present as well as previous employment have been involved in construction works similar to the category in which the applicants wish to be registered in.

(c) Personnel resources shall be grouped into three (3) groups, i.e. Group A, B and C as follows:

Group A – Degree holder in construction-related fields.

Group B – Diploma holder in construction-related fields or other degree holder with experience in construction works.

Group C – Others who are involved in technical activities on site with experience in construction works and accepted by the C.I.D.B.

The minimum personnel resources requirements are laid out in Appendix C-2. Relevant EPF contribution statements, pay sheets, etc. should be attached with submissions.

3.5 Additional Requirements

(a) Applicants applying for specialization in piling works must possess the relevant plant and equipment.

(b) Applicants applying for electrical category must possess valid Electrical Contractor's Licence or the relevant licence issued by Department of Electricity & Gas Supply.

(c) Applicants applying for specialization in plumbing works must employ a full-time employee with a valid Plumber Licence issued by the relevant authorities.

(d) Generally, applicants applying for registration must comply to the requirements of any written law or rules affecting the activities that the applicants propose to engage in by virtue of the registration.

4. CATEGORIES, SPECIALIZATION AND GRADES OF REGISTRATION

4.1 Qualified applicants shall be registered in the appropriate grades, appropriate categories and appropriate specialization and will be issued the relevant registration certificates. Please refer to Appendices A-1 and A-2, for grades, categories and specialization.

5. TERMS AND CONDITIONS OF CERTIFICATION

(a) Certificate issued is non-transferable.

(b) Certificate is valid during the period for which it was issued provided it has not been cancelled or suspended or revoked by C.I.D.B.

(c) A contractor shall apply for renewal of registration within 60 days before the expiry date of registration.

(d) No contractor can submit any tender, or enter into any construction contract after the certificate has expired and before the same is renewed. Otherwise, the contractor shall be deemed to be operating without a certificate and shall be guilty of an offence under the Act.

(e) No contractor can undertake/implement any construction project which is not within the scope of his registered grade and category, otherwise he shall be liable to appropriate disciplinary action.

Any registered contractor who is awarded a project which is valued more than his registered grade shall apply for approval from the Board before executing the project.

(f) A contractor's registration is subject to review at any time to ascertain his eligibility to the present grade and category of registration.

(g) A contractor shall submit information regarding any new construction works or contract(s) within one month of award. Failure to submit the said information will tantamount to the contractor contravening the terms and conditions of registration.

(h) A contractor must submit to the C.I.D.B. any information that may be required from time to time.

(i) The contractor shall display the Certificate of Registration issued by the Board or a certified true copy of the certificate, by the Board at the place of business.

(j) The contractor shall display his registration number on the signboard at each construction site.

(k) A contractor must observe and abide by the provisions of Section VI of the Act, and any other orders or instructions which the C.I.D.B. may issue from time to time pursuant to its power and duties under the Act.

(l) The certificate issued shall be in the name of the qualified applicant, whether a sole proprietorship, partnership, company or corporation.

(m) In any revision of a contractor's registration which necessitates a change in any of the information on the certificate, the certificate previously issued to him shall be returned to C.I.D.B. for endorsement thereon.

(n) Registration Certificate is the property of the C.I.D.B. and must be surrendered to C.I.D.B. within fourteen (14) days after notice has been sent whenever the registered contractor's registration is cancelled or suspended or revoked for any reason.

6. REGISTRATION AND RELATED FEES

Registration and other related and incidental services shall be subject to payment of fees as shown in Appendix B. The appropriate fees to be paid can be in the form of postal order or money order or company's cheque or bank draft or banker's cheque made payable to Construction Industry Development Board Malaysia. All fees paid are not refundable. C.I.D.B. is empowered to increase or decrease the amount of any of the fees, to delete any thereof or to institute any new fees, whenever deemed necessary by C.I.D.B. subject to the approval of the Minister of Works.

Registration for local or locally incorporated applicants

1. APPLICATION DETAILS

(a) New Registration

New local firms or companies or locally incorporated companies and local firms or companies currently engaged in construction activities but are not registered with any recognized registration agency shall apply for registration using Form C.I.D.B. R1/95.

(b) Registration for contractors currently registered with any recognized registration agency

Contractors currently having valid registration with PKK/ Pukonsa/Department of Electricity & Gas Supply/Sarawak PWD/Sarawak DID/Sarawak SEDC or SESCO shall apply for registration using Form C.I.D.B. R1A/95.

Contractors under this category will be granted automatic registration if their registration with the relevant authorities are still valid and they submit their applications within the twelve-month grace period. Applications submitted after the expiry of this period shall be treated as applications for new registration.

(c) Processing Fees

All applications shall be accompanied by payment of RM50.00 processing fees.

2. PROCESSING TIME

Under normal circumstances, if the submissions are complete and in order, applicants will be informed of the outcome within one week after the Registration Committee takes a decision or not later than three months from date of submission of applications.

3. CERTIFICATES OF REGISTRATIONS

Qualified local construction firms or companies or locally incorporated companies shall be registered with C.I.D.B. and shall be issued Certificates of Registration which authorize the firms to undertake and complete construction works within the scope of their grades and categories as long as the certificates are still valid.

3.1 Validity of Registration

(a) Certificates of Registration shall be valid for three (3) years, unless cancelled or suspended or revoked earlier by C.I.D.B.

(b) Certificates of Registration issued to contractors currently registered with PKK/Pukonsa/Department of Electricity & Gas Supply/Sarawak PWD/Sarawak DID/Sarawak SEDC or SESCO, shall only be valid for *two (2) years.*

4. REGISTRATION FEES

Upon approval and notification by the C.I.D.B., the qualified applicants shall pay the appropriate registration fees as stated below before issuance of the Certificates of Registration.

Grade	*Fees*
Grade G7	RM1,400.00 per annum
Grade G6	RM1,000.00 per annum
Grade G5	RM 700.00 per annum
Grade G4	RM 350.00 per annum
Grade G3	RM 150.00 per annum
Grade G2	RM 80.00 per annum
Grade G1	RM 20.00 per annum

5. RENEWAL, UPGRADING, ADDITIONAL CATEGORY/SPECIALIZATION AND CHANGES IN PARTICULARS

5.1 Renewal

Application for renewal of registration shall be made using Form C.I.D.B. R4/95 within sixty (60) days before the expiry of the validity period of registration.

Applications shall be accompanied by RM30.00 processing fees.

If applications for renewal of registration are received by the C.I.D.B. less than thirty days before expiry of validity of registration, the applicants shall pay an additional RM200.00 as fees for late renewal to be paid, upon notification together with payment of renewal fees.

C.I.D.B. reserves the right to review the registration status of the contractor. C.I.D.B. may downgrade the registration of the contractors who fail to fulfill the registration requisites.

If submissions are complete, applicants will be informed of the outcome within one (1) week after the Registration Committee makes a decision or not later than three (3) months from date of submission of applications.

Upon approval and notification by C.I.D.B., the contractors shall pay the prescribed fees which amounts to 50% of the registration fees for the respective grades before issuance of Certificates.

Upon renewal, registration shall be valid for three (3) years.

5.2 Upgrading

Contractors may only apply for upgrading after they have been registered by C.I.D.B. for more than one (1) year at the current grade and category using C.I.D.B. R4/95.

Applications shall be accompanied by RM30.00 processing fees.

If submissions are complete, applicants will be informed of the outcome within one (1) week after the Registration Committee makes a decision.

Upon approval and notification by C.I.D.B., the applicants shall pay the prescribed fees which amounts to the difference in registration fees between the new grade and former grade, before issuance of certificates.

5.3 Additional Category/Specialization

Contractors may only apply for additional category/categories or specialization using Form C.I.D.B. R4/95 after they have been registered by C.I.D.B. for more than one (1) year at the current category/categories and specialization.

Applications shall be accompanied by RM30.00 processing fees.

If submissions are complete, applicants will be informed of the outcome within one (1) week after the Registration Committee makes a decision.

Upon approval and notification by C.I.D.B., the applicants shall pay the prescribed fees of RM100.00 before issuance of certificates.

5.4 Changes in Particulars

Submission for changes in particulars shall be made using Form C.I.D.B. R4/95. Contractors shall inform the C.I.D.B. whenever there are any changes in the name, capital, experience and/or qualifications, employment, ownership, the board of directors or management of the firm or company within thirty days of the change.

Failure of any contractor to inform C.I.D.B. of any change can result in the suspension or cancellation of his registration.

Submissions shall be accompanied by RM30.00 processing fees.

If changes in particulars involve issuance of new certificates then, upon notification by C.I.D.B., the applicants shall pay the prescribed fees of RM100.00 before issuance of the new certificates.

6. RE-ISSUANCE OF CERTIFICATES

A copy of the statutory declaration declaring loss/damage of the original certificate and payment of RM100.00 shall be submitted before re-issuance of a copy of the certificate as replacement for a lost/damaged certificate.

7. COPIES OF CERTIFICATES

Contractors who require copies of the registration certificates for purposes of displaying at their places of business may apply to the C.I.D.B. for copies at a cost of RM20.00 per copy.

8. CANCELLATION OR SUSPENSION OR REVOCATION OF CERTIFICATES OF REGISTRATION

(a) C.I.D.B. may upon its own motion or upon verified complaint of any person, cancel or suspend or revoke the registration of any contractor who commit any of the acts listed in (b).

(b) Any of the following shall be sufficient cause for cancelling or suspending or revoking a contractor's registration:

(i) the holder of the Certificate has been adjudicated a bankrupt; or

(ii) a winding-up petition in relation to the holder is presented; or

(iii) the holder of the Certificate contravenes or fails to comply with any provisions of the Act or these regulations; or

(iv) the holder of the Certificate has obtained the Certificate by making or causing to be made any false or fraudulent

declaration, certification or representation either in writing or otherwise; or

(v) the holder of the Certificate has abandoned any construction works undertaken; or

(vi) the holder of the Certificate is found guilty by the Court or by the Board of Enquiries established under any written law to be negligent in connection with any construction works undertaken; or

(vii) the holder of the Certificate contravenes, or fails to perform, or assists in the contravention of any terms, conditions or restrictions imposed by the Board.

(c) The registration of any contractor shall be automatically cancelled in the following cases:

(i) when his registration with the Registrar of Businesses has expired, unless the contractor submits a copy of the renewed Certificate of Business Registration within one month after the expiry of his Certificate of Businesses Registration.

(ii) for contractors whose registration with Department of Electricity & Gas Supply has expired, unless the contractors submit a copy of the renewed certificate within two weeks after the expiry of the Certificate of Registration.

(iii) on the death of a contractor operating as a sole proprietor, unless his heir or executor applies for permission to C.I.D.B. within one month after the death, in which case, with C.I.D.B.'s approval the registration may be continued until the existing construction works or engagement is completed.

(iv) on the death or disassociation of a partner in the case of a contractor operating as a partnership, unless the surviving or remaining partner applies for permission to C.I.D.B. within one month after the death or disassociation in which case with C.I.D.B.'s approval, the contractor's registration may continue until he completes his existing works or until the expiration of his registration period whichever is earlier.

(d) Before C.I.D.B. cancels or suspends or revokes the registration of any contractor, C.I.D.B. shall:

(i) send to such contractor by post a notice in writing of the complaint against him; and

(ii) afford such contractor an opportunity of giving an explanation in writing,

except in cases stipulated under (c) above.

(e) A contractor whose registration has been cancelled or suspended or revoked is not allowed to participate in any future tender or to proceed with any construction works.

(f) The Board may, in some cases allow the contractor whose registration has been cancelled to complete his existing construction works.

9. REGISTRATION CHART

Appendix D illustrates the registration procedures for local or locally incorporated firms/companies.

Registration for foreign applicants

1. APPLICATION DETAILS

(a) Provisional Registration

Foreign companies who wish to participate in tenders for construction works in Malaysia, whether on invitation by the prospective clients or through advertisements shall apply for provisional registration using Form C.I.D.B. R2/95. Companies who wish to participate in tenders as joint ventures or consortiums shall apply for provisional registration separately and individually. Foreign companies issued provisional registration shall participate only in the tenders for which provisional registration was granted.

(b) Registration

Foreign companies who are awarded construction projects in Malaysia shall be registered with the Registrar of Companies before they apply for registration using Form C.I.D.B. R3/95.

They shall be allowed to construct and complete only the specific project they are registered for. Application shall be made for each construction project awarded.

(c) Processing Fees

All applications for provisional registration shall be accompanied by payment of RM50.00 processing fees.

All applications for registration shall be accompanied by RM50.00 processing fees as well as the appropriate registration fees.

2. PROCESSING TIME

If the submissions are complete and in order, applicants will be informed of the outcome within one (1) week from the date of submission of applications.

3. CERTIFICATES OF REGISTRATION

3.1 Certificates issued by C.I.D.B. are as follows:

(a) Certificate of Provisional Registration

Certificate issued to foreign contractors before they tender for specific projects.

(b) Certificates of Registration

Certificates issued to foreign contractors which authorize the certificate holders to execute and complete construction works for specific projects.

3.2 Validity of Registration

(a) Provisional Registration is valid till the closing date or extended closing date of the specific tender.

(b) Certificate of Registration is valid for the period of construction for the specific construction project.

If for any reasons the date of completion of the project is extended, the Contractor shall apply to the Board within 14 days before the expiry of the validity of the Certificate of Registration to extend the validity of the Certificate. The application shall be substantiated with documentary evidence.

4. REGISTRATION AND RELATED FEES

(a) Registration Fees

Upon approval and notification by the C.I.D.B., the qualified applicant shall pay RM500.00 fee before issuance of a certificate of provisional registration.

An applicant applying for registration shall submit the registration fee together with the processing fee. The fee payable is RM5,000.00. If RM500.00 has been paid for a certificate of provisional registration, the fee payable is RM4,500.00.

5. RE-ISSUANCE OF CERTIFICATES

A copy of the statutory declaration declaring loss/damage of the original certificate and payment of RM100.00 shall be made before re-issuance of new certificates as replacements for lost/damaged certificates.

6. COPIES OF CERTIFICATES

Contractors who require copies of the registration certificates for purposes of displaying at their places of business may apply to the C.I.D.B. for copies at a cost of RM20.00 per copy.

7. CANCELLATION OR SUSPENSION OR REVOCATION OF CERTIFICATES OF REGISTRATION

(a) C.I.D.B. may upon its own motion or upon verified complaint of any person, cancel or suspend or revoke the registration of any contractor who commit any of the acts listed in (b).

(b) Any of the following shall be sufficient cause for cancelling or suspending or revoking a contractor's registration:

(i) the holder of the Certificate has been adjudicated a bankrupt; or

(ii) a winding-up petition in relation to the holder is presented; or

(iii) the holder of the Certificate contravenes or fails to comply with any provisions of the Act or these regulations; or

(iv) the holder of the Certificate has obtained the Certificate by making or causing to be made any false or fraudulent declaration, certification or representation either in writing, or otherwise; or

(v) the holder of the Certificate has abandoned any construction works undertaken; or

(vi) the holder of the Certificate is found guilty by the Court to be negligent in connection with any construction works undertaken; or

(vii) the holder of the Certificate contravenes, or fails to perform, or assists in the contravention of any terms, conditions or restrictions imposed by the Board.

(c) Before C.I.D.B. cancels or suspends or revokes the registration of any contractor, C.I.D.B. shall:

(i) send to such contractor by post or registered letter a notice in writing of the complaint against him; and

(ii) afford such contractor an opportunity of giving an explanation in writing.

8. REGISTRATION CHART

Appendix E illustrates the registration procedures for foreign companies.

Appendix A-1

Registration Grade/category/specialization

GRADE		→	CATEGORY	→	SPECIALIZATION*
Capacity (RM)					
G1 not exceeding	100,000.00		1. CE- CIVIL ENGINEERING CONSTRUCTION		CE01, CE02, CE03, CE04, CE05, CE06, CE07, CE08, CE09, CE10, CE11, CE12, CE13, CE14, CE15, CE16, CE17, CE18, CE19, CE20, CE21.
G2 not exceeding	200,000.00				
G3 not exceeding	1,000,000.00		2. B- BUILDING CONSTRUCTION		B01, B02, B03, B04, B05, B06, B07, B08, B09, B10, B11.
G4 not exceeding	3,000,000.00				
G5 not exceeding	5,000,000.00		3. ME- MECHANICAL AND ELECTRICAL		M01, M02, M03, M04, M05, M06, M07, M08, M09, M10, M11, M12, M13, M14, M15, E01, E02, E03, E04, E05, E06, E07, E08, E09.
G6 not exceeding	10,000,000.00				
G7 No Limit					

*Please see Appendix A-2 for description.

Appendix A-2

Registration Categories and Specialization

CATEGORY	SPECIALIZATION	DESCRIPTION
CIVIL ENGINEERING CONSTRUCTION (CE)	CE01 Road and Pavement Construction	Construction of road and road reinstatement, pavement, bus bays, open car parks and related works such as kerbs and footways.
	CE02 Bridge Construction	Construction of concrete, masonry, timber or steel bridges.
	CE03 Marine Structures	Construction of marine structures such as jetties, ports, wharves, harbours, sea and river walls.
	CE04 Water Retaining Structures	Construction of water retaining structures such as dams, reservoirs, aquaducts, treatment plants, etc. and pipe laying works.
	CE05 Tunnelling and Underpinning	Tunnelling and underpinning works.
	CE06 Irrigation and Flood Control System	Dredging in canal, river and offshore works.
	CE07 Railway Tracks	Installation of railway tracks, destressing of rails and tracks.
	CE08 Slope Protection System	Slope protection works.

CATEGORY	SPECIALIZATION	DESCRIPTION
CIVIL ENGINEERING CONSTRUCTION (CE) (Contd.)	CE09 Oil and Gas Pipe Lines	Installation, maintenance and repair of oil and gas pipe lines.
	CE10 Piling	Installation of all types of piling-sheet piles, driven precast reinforced and prestressed concrete piles, bored cast in situ piles and timber piles. Also include all other patented piling systems.
	CE11 Concrete Repairs	Reinforcement of structures by way of pressure grouting, guniting, etc.
	CE12 Soil Investigation and Stabilization	Services include sampling, investigation and testing services to determine soil classification, strength and composition. Also includes soil stabilization works such as micro piling, ground anchoring, sand drains and ground grouting.
	CE13 Signcraft Installation	Installation of an integrated sign posting system for complexes, airports, shopping centres, etc. Also includes setting up of exhibition stands and road signs.
	CE14 Landscaping	Provision of landscaping services including tree planting and turfing.
	CE15 Offshore Construction Works	Offshore construction works including related works.
	CE16 Underwater Construction Works and Maintenance	Underwater construction works and maintenance of underwater construction works.
	CE17 Airports	Terminal buildings, satellite buildings, cargo terminals, air traffic control towers, contact piers, passenger loading bridges, taxiways, runways, aprons, aircraft parking bays, baggage handling system, track transit system, etc.
	CE18 Reclamation Works	Reclamation works.
	CE19 Sewerage Works	Sewerage works and systems.

CATEGORY	SPECIALIZATION	DESCRIPTION
CIVIL ENGINEERING CONSTRUCTION (CE) (Contd.)	CE20 Water Pipe Lines	Installation, maintenance and repair of water pipe lines.
	CE21 General Civil Engineering Works	General civil engineering works, including earthworks, sub-soil drainage, etc.
BUILDING CONSTRUCTION (B)	B01 Prefabricated Buildings and Industrial Plant	Construction of buildings and industrial plant using prefabricated components and systems.
	B02 Steel Framed Buildings and Industrial Plant	Construction of steel framed buildings and industrial plant.
	B03 Restoration and Conservation	Building restoration and conservation.
	B04 General Buildings and Maintenance	General building works, including fixing partitions, roofing and general maintenance of buildings.
	B05 Piling	Installation of all types of piling-sheet pies, driven precast reinforced and prestressed concrete piles, bored cast in situ piles and timber piles. Also include all other patented piling systems.
	B06 Concrete Repairs	Reinforcement of structures by way of pressure grouting, guniting, etc.
	B07 Interior Decoration	Interior design, planning and the decoration of buildings. This includes ceiling panels, partitions, built-in fitments, raised floor works.
	B08 Waterproofing Installation	Waterproofing of basement, roofs and walls.
	B09 Landscaping	Provision of landscaping services including tree planting and turfing.
	B10 Plumbing	Installation, repairs and servicing of water and gas pipes, sanitary works, plumbing fixtures and mains.

CATEGORY	SPECIALIZATION	DESCRIPTION
BUILDING CONSTRUCTION (B) (Contd.)	B11 Signcraft Installation	Installation of an integrated sign posting system for complexes, airports, shopping centres, etc. Also includes setting up of exhibition stands.
MECHANICAL AND ELECTRICAL (ME)	M01 Air-conditioning and Ventilation System	Installation, commissioning, maintenance and repairs of air-conditioning, refrigeration, cold rooms and ventilation systems.
	M02 Fire Prevention and Protection System	Installation and maintenance of fire alarms, prevention and protection systems.
	M03 Lifts and Escalators	Installation, commissioning and maintenance of lifts, escalators, travellators and conveyor systems.
	M04 Building Automation System	Building automation, industrial and process control systems. Include installation and maintenance of micro-processors or computer based building control systems and industrial process control systems.
	M05 Workshop, Mill, Quarry System	Installation, commissioning and maintenance of workshop, mill and quarry systems such as cranes, hoist, crushing and screening plant, asphalt mixing plant, etc.
	M06 Medical Equipment	Installation, commissioning and maintenance of medical equipment such as: – Compressed air system – Hot water installation – Sterilizer and autoclave – Medical gas installation – Hydrotherapy system – Dental chair – Mortuary refrigerator etc.
	M07 Kitchen and Laundry Equipment	Installation, commissioning and maintenance of cooking and kitchen equipment, laundry equipment, etc.
	M08 Heat Recovery System	Installation, commissioning, maintenance and repair of boiler plant, heat exchangers, absorption chillers, unfired pressure vessels and hot water systems, etc.

CATEGORY	SPECIALIZATION	DESCRIPTION
MECHANICAL AND ELECTRICAL (ME) (Contd.)	M09 Compressor and Mechanical Based Generator	Installation, maintenance and repair of centrifugal compressor, reciprocating compressor, air compressor skid, rotary compressor, pipeline valves, blowers, liquid ring compressor, gas turbine generator, steam generator, diesel generator, solar photovoltaic, water turbine generator and hybrid system.
	M10 Chiller for Power Generation	Installation, maintenance and repair of gas turbine driven chiller, steam turbine driven chiller and centrifugal chiller.
	M11 Specialized Fabrication and Treatment	Erection, maintenance and repair of exhaust stocks, tanks, reactors, separators, filters, scrubbers, dehydrators, evaporators, pipings, furnaces, grit blasting and painting, hot and cold insulation, flare system, bearing and welding.
	M12 Specialized Plant	Erection, maintenance and repair of compressor station, metering station, onshore terminal station, cogeneration plant, gas processing plant, petrochemical plant, oil refinery, aviation refuelling and defuelling system, petrol station, heating ventilation and air conditioning.
	M13 Drilling Rig	Erection, maintenance and repair of offshore rig (Jack-up Tender Assisted, Drill Ship, Self Contained/Platform Rig, Semi Submersible) onshore rig, conventional workover rig and swamp barge.
	M14 Pollution Control System	Landfill technology, incinerator, oil separators.
	M15 Miscellaneous Mechanical Equipment	Installation, testing commissioning, maintenance and repair of mechanical based systems such as pumping installation, sewerage treatment plant installation, water treatment plant installation, rotary pumps, reciprocating pumps, centrifugal pumps and special purpose pumps, etc.
	E01 Sound System	Public address system, audio visual system, conference system, intercom system and MATV.

CATEGORY	SPECIALIZATION	DESCRIPTION
MECHANICAL AND ELECTRICAL (ME) (Contd.)	E02 Security, Safety and Surveillance System	Installation and maintenance of security, safety and surveillance systems (security alarm, car park security control and card access control systems, CCTV, sensor/detection system, vibration monitoring system, gas protection system, platform alarm system, aircraft warning system, fire protection system and earthing and lighting protection).
	E03 Building Automation System and Energy Generation System	Building automation, industrial and process control systems. Include installation and maintenance of micro-processors or computer based building control systems and industrial process control systems. Includes installation and maintenance of energy generation systems.
	E04 Low Voltage Installation	General wiring and control system wiring works not exceeding 1 KV. Installation and maintenance of low tension overhead lines and underground cabling not exceeding 1 KV. Also includes installation and maintenance of generating plant and equipment not exceeding 1 KV.
	E05 High Voltage Installation	Installation and maintenance of high voltage equipment and underground cabling, high tension overhead line including transmission tower exceeding 1 KV. Also includes installation and maintenance of generating plant and equipment exceeding 1 KV. Neonlights.
	E06 Specialized Lighting System	Installation and maintenance of street lighting, stadium floodlighting, traffic lighting, airfield lighting, high mast lighting installation, laser system, stage lighting, special effect lighting, navigational aid, underwater lighting, platform lighting, petro chemical plant lighting, gas processing plant lighting, oil refinery plant lighting, etc.

CATEGORY	SPECIALIZATION	DESCRIPTION
MECHANICAL AND ELECTRICAL (ME) (Contd.)	E07 Telecommunication Installation	Telephone cabling and internal ducting, radio based communication system, PABX, microwave system, multiplex and signalling, troposcatter system, satellite system, radar surveillance system, data communication equipment, remote subscriber system, vessels and navigational specialized system, etc.
	E08 External Telecommunication Works	Telecommunication cabling (underground/overhead), manholes, underground ducting/pipes
	E09 Miscellaneous Specialized	Installation, commissioning and maintenance of surgical/operating theatre table and lights, radiography equipment, radiotherapy equipment, nurse call system, electronic scoreboard, uninterruptible power supply (UPS) system, etc.

Appendix B

Fee Payable

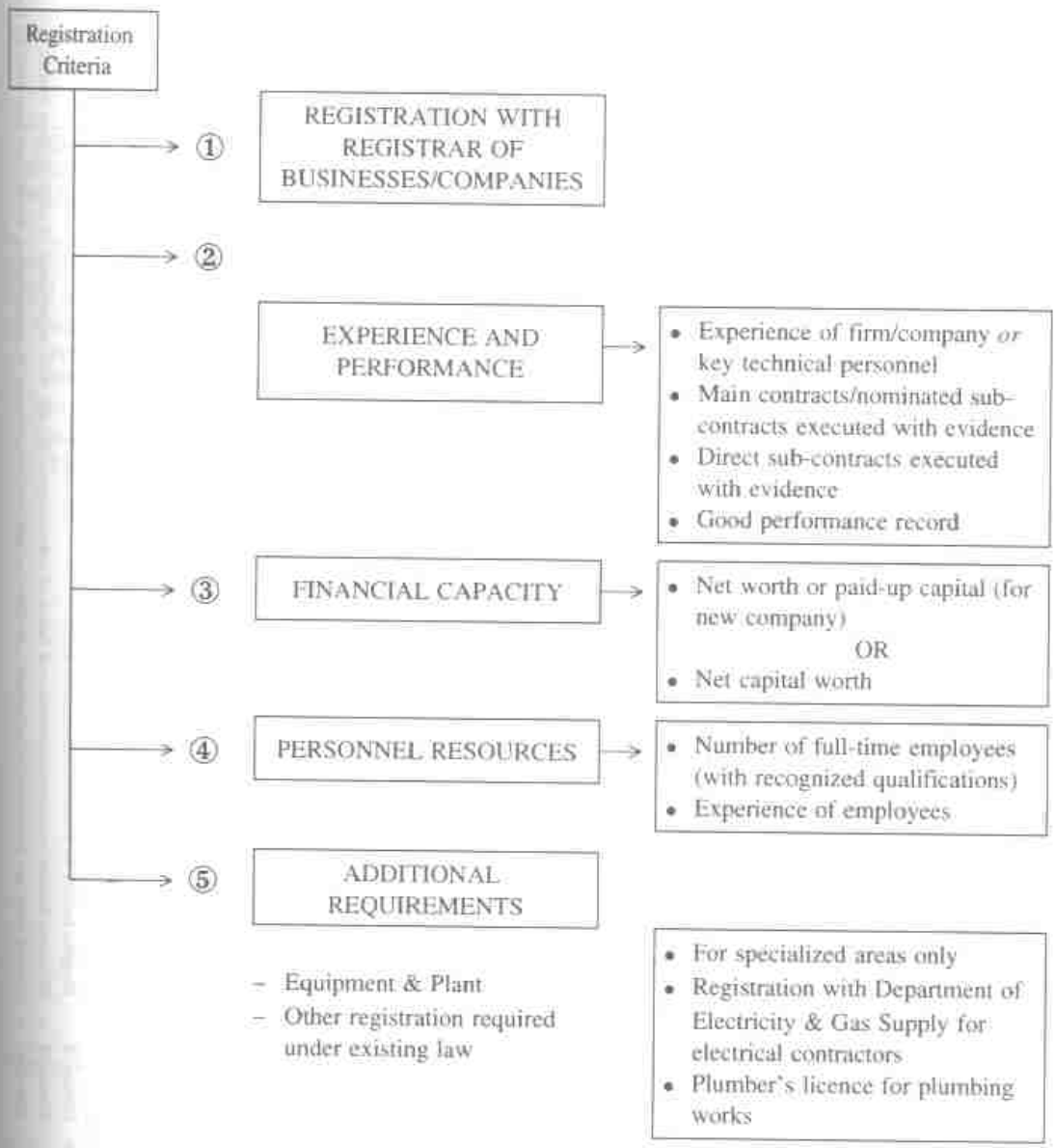
TYPE	AMOUNT	PAYMENT
1. Processing Fee	RM50.00	Submitted together with submission for: 1. application for registration form C.I.D.B. R1/95 or R1A/95 2. application for provisional registration form C.I.D.B. R2/95 or application for registration by a foreign contractor form C.I.D.B. R3/95.
	RM30.00	Submitted together with submission for: 1. application for upgrading 2. application for additional category/specialization 3. application for renewal 4. changes in particulars on form C.I.D.B. R4/95.
2. Registration Fee (a) Certificate of Registration		
Grade G7	RM1,400.00 per annum	Submitted before issuance of certificate.
Grade G6	RM1,000.00 per annum	
Grade G5	RM 700.00 per annum	
Grade G4	RM 350.00 per annum	
Grade G3	RM 150.00 per annum	
Grade G2	RM 80.00 per annum	
Grade G1	RM 20.00 per annum	
(b) Certificate of Provisional Registration	RM500.00	Submitted before issuance of certificate.
(c) Certificate of Registration for a foreign contractor	RM5,000.00*	Submitted together with application form C.I.D.B. R3/95.

TYPE	AMOUNT	PAYMENT
3. Late renewal of Registration	RM200.00	Submitted if application for renewal is received by C.I.D.B. less than 30 days before expiry of registration.
4. Re-issuance of new Certificate	RM100.00	Submitted before re-issuance of certificate to replace lost/damaged certificate.
5. Re-issuance of copy of Certificate	RM20.00	Submitted upon application.

* RM4,500 if certificate of provisional registration has been issued.

Appendix C-1

Registration Requisites



Appendix C-2

Registration Requisites

Registration Grade	Capacity (RM)	Registration Requisites			
		Experience *AND*		Paid-up Capital OR Net/Capital Worth (RM)	Minimum Personnel* Resources Requirement
		Average Annual Value of Work for 3 Years (RM)	Largest Project Value During Last 3 Years (RM)		
G1	Not exceeding 100,000.00	100,000.00	75,000.00	5,000.00	One group C with minimum 2 years' relevant experience
G2	Not exceeding 500,000.00	500,000.00	375,000.00	25,000.00	One group B with minimum 3 years' relevant experience
G3	Not exceeding 1,000,000.00	1,000,000.00	750,000.00	50,000.00	One group A with minimum 2 years' relevant experience OR two group B, one of whom must have minimum 3 years' relevant experience
G4	Not exceeding 3,000,000.00	3,000,000.00	2,250,000.00	150,000.00	One group A with minimum 5 years' relevant experience
G5	Not exceeding 5,000,000.00	5,000,000.00	3,750,000.00	250,000.00	Two group A, one of whom must have minimum 5 years' relevant experience
G6	Not exceeding 10,000,000.00	10,000,000.00	7,500,000.00	500,000.00	Two group A, one of whom must have minimum 8 years' relevant experience
G7	No Limit	15,000,000.00	11,250,000.00	750,000.00	Three group A, one of whom must have minimum 10 years' relevant experience

Note:

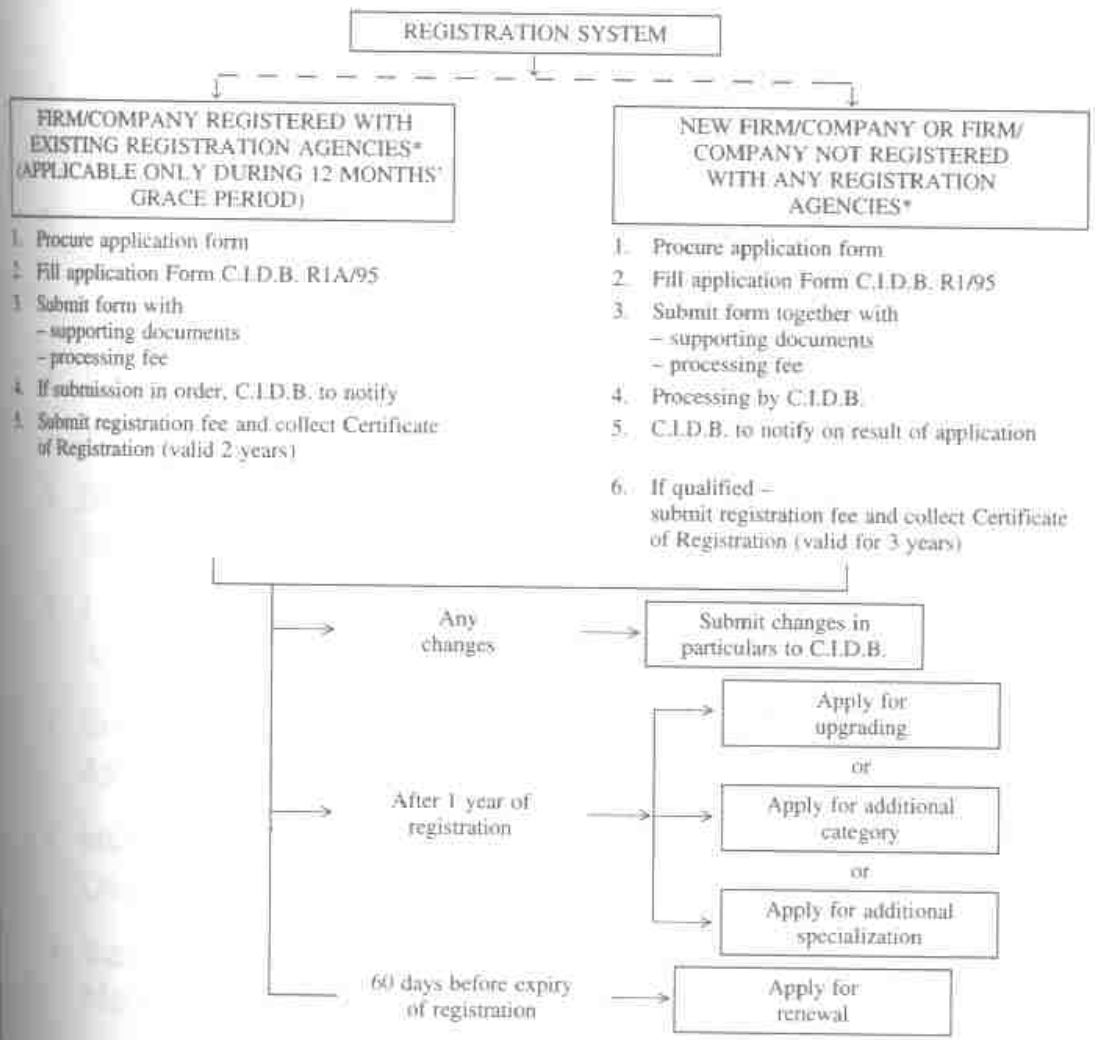
* Group A – Degree holder in construction-related fields.

Group B – Diploma holder in construction-related fields or other degree holder with experience in construction works.

Group C – Others who are involved in technical activities on site with experience in construction works and accepted by the C.I.D.B.

Appendix D

Registration procedures for local or locally incorporated firms/companies



*Registration Agencies:- PKK, PUKONSA, Electricity and Gas Supply Department, Sarawak PWD, Sarawak DID, Sarawak SEDC and SESCO.

Appendix E

Registration procedures for foreign companies

REGISTRATION SYSTEM

↓

COMPANY WHO WISHES TO PARTICIPATE IN TENDER

1. Procure application form
2. Fill application Form C.I.D.B. R2/95
3. Submit form with
   - copy of invitation letter or advertisement
   - supporting documents
   - processing fee
4. If submission in order, C.I.D.B. to notify applicant
5. Submit fee and collect certificate of provisional registration (valid till closing or extended closing date of tender)

↓

COMPANY ON BEING AWARDED PROJECT

1. Procure application form
2. Fill application Form C.I.D.B. R3/95
3. Submit form with
   - supporting documents
   - processing fee and registration fee
4. If submission in order, C.I.D.B. to issue Certificate of Registration (valid for period of construction)

Appendix I

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Appendix II

Sample of Inspection Form for Achitectural Works

(a) Brickwork Inspection Form ..... Figure 1

(b) Structural Steel Inspection Form ..... Figure 2

(c) Plastering Inspection Form ..... Figure 3

(d) Screeding Inspection Form ..... Figure 4

(e) Timber door and Window Inspection Form ..... Figure 5

(f) Ironmongery Inspection Form ..... Figure 6

(g) Wall Tiling Inspection Form ..... Figure 7

(h) Floor Tiling Inspection Form ..... Figure 8

(i) Vinyl Sheet Tile Inspection Form ..... Figure 9

(j) Parameter drain and Apron Inspection Form ..... Figure 10

(k) Painting Inspection Form ..... Figure 11

(l) Roofing Inspection Form ..... Figure 12

(m) Chain Link Fencing Inspection Form ..... Figure 13

(Figure 1)

BRICKWORK INSPECTION FORM

PROJECT CODE :

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE :

MATERIAL USE:

TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Cement Mortar Mix	B	A	G	Y – N	
5	Setting Out/Alignment	B	A	G	Y – N	
6	Damp Proof Course	B	A	G	Y – N	
7	Exmet/Tierod	B	A	G	Y – N	
8	Bonding	B	A	G	Y – N	
9	Verticality	B	A	G	Y – N	
10	Others	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY:

NAME:

DATE:

SUB-CONTRACTOR:

NAME:

DATE:

(Figure 2)

STRUCTURAL STEEL INSPECTION FORM

PROJECT CODE :

MATERIAL USE:

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE :

TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Welding	B	A	G	Y – N	
5	Tolerance	B	A	G	Y – N	
6	Type & Sizes	B	A	G	Y – N	
7	Setting Out/Alignment/Vertically	B	A	G	Y – N	
8	Joint	B	A	G	Y – N	
9	Test	B	A	G	Y – N	
10	Cleanliness	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY:

SUB-CONTRACTOR:

NAME:

DATE:

NAME:

DATE:

(Figure 3)

PLASTERING INSPECTION FORM

PROJECT CODE :

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE :

MATERIAL USE:

TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Cement Mortar Mix	B	A	G	Y – N	
5	Plaster Thickness	B	A	G	Y – N	
6	Surface Levelling	B	A	G	Y – N	
7	Trueness of Corner/Arises	B	A	G	Y – N	
8	Groove Line	B	A	G	Y – N	
9	Plastering Joint	B	A	G	Y – N	
10	Crack Lines After Harden	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY:

NAME:

DATE:

SUB-CONTRACTOR:

NAME:

DATE:

(Figure 4)

SCREEDING INSPECTION FORM

PROJECT CODE : MATERIAL USE:

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE : TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Cement Sand Mix	B	A	G	Y – N	
5	Screed Thickness	B	A	G	Y – N	
6	Finish Floor Level	B	A	G	Y – N	
7	Floor Finishing	B	A	G	Y – N	
8	Others	B	A	G	Y – N	
9	Screed Joints	B	A	G	Y – N	
10	Dividing Strip	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY: SUB-CONTRACTOR:

NAME: NAME:

DATE: DATE:

(Figure 5)

TIMBER DOOR AND WINDOW INSPECTION FORM

PROJECT CODE : MATERIAL USE:

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE : TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Timber Grade	B	A	G	Y – N	
5	Size	B	A	G	Y – N	
6	Priming Coat	B	A	G	Y – N	
7	Setting Out/Alignment	B	A	G	Y – N	
8	Vertically	B	A	G	Y – N	
9	Squareness	B	A	G	Y – N	
10	Fixings (Fish Tail/Firmness)	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY: SUB-CONTRACTOR:

NAME: NAME:

DATE: DATE:

(Figure 6)

IRONMONGERY INSPECTION FORM

PROJECT CODE :

MATERIAL USE:

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE :

TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Type/Model	B	A	G	Y – N	
5	Positioning	B	A	G	Y – N	
6	Functional	B	A	G	Y – N	
7	Others	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY:

SUB-CONTRACTOR:

NAME:

DATE:

NAME:

DATE:

(Figure 7)

WALL TILING INSPECTION FORM

PROJECT CODE : MATERIAL USE:

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE : TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Cement Mortar Mix	B	A	G	Y – N	
5	Type Colour	B	A	G	Y – N	
6	Setting Out/Alignment	B	A	G	Y – N	
7	Height/Level Required	B	A	G	Y – N	
8	Tile Finishing	B	A	G	Y – N	
9	Others	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY: SUB-CONTRACTOR:

NAME: NAME:

DATE: DATE:

(Figure 8)

FLOOR TILING INSPECTION FORM

PROJECT CODE :

MATERIAL USE:

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE :

TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Cement Mortar Mix	B	A	G	Y – N	
5	Type Colour	B	A	G	Y – N	
6	Setting Out/Alignment/Squareness	B	A	G	Y – N	
7	Height/Level Required	B	A	G	Y – N	
8	Tile Finishing	B	A	G	Y – N	
9	Others	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY: SUB-CONTRACTOR:

NAME: NAME:

DATE: DATE:

(Figure 9)

VINVL SHEET/TILE INSPECTION FORM

PROJECT CODE :

MATERIAL USE:

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE :

TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Cleanliness of Screeding	B	A	G	Y – N	
5	Damp Proof Glue/Adhesive	B	A	G	Y – N	
6	Type/Colour	B	A	G	Y – N	
7	Setting Out/Alignment	B	A	G	Y – N	
8	Joints	B	A	G	Y – N	
9	Skirting	B	A	G	Y – N	
10	Others	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY: SUB-CONTRACTOR:

NAME: NAME:

DATE: DATE:

(Figure 10)

PARAMETER DRAIN AND APRON INSPECTION FORM

PROJECT CODE :

MATERIAL USE:

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE :

TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Cement Mortar Mix	B	A	G	Y – N	
5	Gradient/Fall	B	A	G	Y – N	
6	Setting Out/Alignment	B	A	G	Y – N	
7	Joint	B	A	G	Y – N	
8	Levels	B	A	G	Y – N	
9	Hardcore Thickness	B	A	G	Y – N	
10	Others	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY:

SUB-CONTRACTOR:

NAME:

DATE:

NAME:

DATE:

(Figure 11)

PAINTING INSPECTION FORM

PROJECT CODE : MATERIAL USE:

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE : TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Preparing of Surface	B	A	G	Y – N	
5	Type/Colour Tone	B	A	G	Y – N	
6	Under Coat	B	A	G	Y – N	
7	Finishing Coat	B	A	G	Y – N	
8	Others	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY: SUB-CONTRACTOR:

NAME: NAME:

DATE: DATE:

(Figure 12)

ROOFING INSPECTION FORM

PROJECT CODE :

MATERIAL USE:

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE :

TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Timber Batten	B	A	G	Y – N	
5	Size	B	A	G	Y – N	
6	Joint	B	A	G	Y – N	
7	Setting Out/Alignment	B	A	G	Y – N	
8	Lapping	B	A	G	Y – N	
9	Colour	B	A	G	Y – N	
10	Fixings by Nails	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY:

SUB-CONTRACTOR:

NAME:

DATE:

NAME:

DATE:

(Figure 13)

CHAIN LINK FENCING INSPECTION FORM

PROJECT CODE : MATERIAL USE:

SUB-CONTRACTOR :

BUILDING :

LOCATION : (i) Floor (ii) Room (iii) Grid Line

DATE : TIME:

CHECKLIST :

NO	ITEMS	GRADING			ACTION BY SUB-CONTRACTOR	REMARKS
1	Compliance to relevant standard	B	A	G	Y – N	
2	Wastage	B	A	G	Y – N	
3	Clearing of Rubbish	B	A	G	Y – N	
4	Cement Mortar Mix	B	A	G	Y – N	
5	Type and Size	B	A	G	Y – N	
6	Setting Out/Alignment	B	A	G	Y – N	
7	Red Oxide	B	A	G	Y – N	
8	Welding	B	A	G	Y – N	
9	Angle of Bracing	B	A	G	Y – N	
10	Others	B	A	G	Y – N	

* PLEASE ATTACH ADDITIONAL DOCUMENT(S) FOR FURTHER CLARIFICATION, IF NECESSARY

B – BAD A – AVERAGE G – GOOD

INSPECTED BY: SUB-CONTRACTOR:

NAME: NAME:

DATE: DATE:

Appendix III

Samples of Inspection Form for Civil and Mechanical And Electrical Works

(1) Sewerage Pipe Works Inspection Form ..... Figure 1

(2) Earthwork Inspection Form ..... Figure 2

(3) Plumbing Works Inspection Form (Cold Water & Sanitary) ..... Figure 3

(4) Manhole Construction Inspection Form ..... Figure 4

(5) Piling Inspection Form ..... Figure 5

(6) Reinforced Concrete Inspection Form ..... Figure 6

(7) Approval of Work Form ..... Figure 7

(8) Request for Inspection Form (Civil Work) ..... Figure 8

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(Figure 1)

SEWERAGE PIPE WORKS INSPECTION FORM

Location: Date:

No	Items	Acceptability		Remarks
		Yes	No	
1	Material			
2	Setting Out			
3	Excavation/Level			
4	Shoring/Slopes			
5	Pipe Handling/Laying/Cutting			
6	Pipe Joints			
7	Backfilling & Compacting			

COMMENTS:

Checked By:

Sub-contractor

Name:

Date:

Main Contractor

Name:

Date:

(Figure 2)

EARTHWORK INSPECTION FORM

Location:

Date:

No	Items	Acceptability		Remarks
		Yes	No	
1	Obtain Pre-comp Plan			
2	Obtain As Built Drawing Of Earthwork Done By Others			
3	Setting Out			
4	Ensure Correctness Of TBM			
5	Excavation			
6	Backfilling			
7	Compaction			
8	Field Density Test			
9	Final Level			
10	Joint Survey With Consultant			
11	Plotting Of As-Built			

COMMENTS:

Checked By:

Sub-contractor

Name:

Date:

Main Contractor

Name:

Date:

(Figure 3)

PLUMBING WORKS (COLD WATER/SANITARY) INSPECTION FORM

Location: Date:

No	Items	Acceptability		Remarks
		Yes	No	
1	Material			
2	Clearing of Debris			
3	Setting Out/Alignment			
4	Verticality of Pipes			
5	Pipe Hangers/Brackets/Supports			
6	Pipe Joints/Connections			
7	Valves			
8	Sanitary Fittings			

COMMENTS:

Checked By:

Sub-contractor

Name:

Date:

Main Contractor

Name:

Date:

(Figure 4)

MANHOLE CONSTRUCTION INSPECTION FORM

Location:

Date:

No	Items	Acceptability		Remarks
		Yes	No	
1	Material			
2	Setting Out/Alignment			
3	Excavation/Level			
4	Shoring/Slopes			
5	Concrete Base			
6	Cement Mortar Mix			
7	Bonding			
8	Step Iron			
9	Concrete & Manhole Cover			

COMMENTS:

Checked By:

Sub-contractor

Name:

Date:

Main Contractor

Name:

Date:

(Figure 5)

PILING INSPECTION FORM

Location: Date:

No	Items	SC	MC	Remarks
		Rep	Rep	
1	Check Position Of Peg With Reference to Drawing			
2	Check Whether Piles Are Pitched Accurately As Per Drawing			
3	Check Verticality Of Piles Before Driving In			
4	Check For Welded Joints With Reference To Drawings			
5	Check For Final Set As Per Requirement			

COMMENTS:

Checked By:

Sub-contractor

Name:

Date:

Main Contractor

Name:

Date:

(Figure 6)

REINFORCED CONCRETE INSPECTION FORM

Location:

Structure:

No	Items	SC	MC	Consultant Rep		Remarks
		Rep	Rep	1st	2nd	
1	**FORMWORK**					
	– Dimension levels, verticality					
	– Adequately supported or propped					
	– Joints Tight					
	– Surface of forms acceptable					
	– All sawdust & rubbish removed					
	Date Checked					
	Initials					
2	**REINFORCEMENT**					
	– Correct grade, size, number & spacing					
	– Correct tap of anchorage length					
	– Adequate chairs, spacers, etc					
	– Cover as required					
	– No mud, oil, loose rust, etc					
	Date Checked					
	Initials					
3	**M/E OPENING AND PIPE SLEEVES**					
	– For fire protection					
	– For communication					
	– For sanitary					
	– For cold water supply					
	– For air-conditioned service					
	– Proper installation of concealed electrical pipings					
	Date Checked					
	Initials					

Approved For Concreting

For RE

_____

Signature
Date:

(Figure 7)

APPROVAL OF WORK FORM

Client:
Contractor: No:

Work to be inspected : _____

Location of Works : _____

Description of work to be inspected:

_____

_____

_____

_____

THIS WORK WILL BE READY FOR INSPECTION ON AT HRS

DATE		TIME	AM/PM	SIGNATURE (Contractor)	

COMMENTS:

_____

_____

_____

_____

WORK APPROVED: YES/NO

(If no, please state the reasons)

_____

_____

_____

_____

DATE		TIME	AM/PM	SIGNATURE (Contractor)	

To be used for concrete pours only.

To be completed by the Contractor:
Grade of concrete Pouring Rate

_____ _____ cu m/hr

(Figure 8)

REQUEST FOR INSPECTION FORM

CIVIL WORK

To: _____ Ref No: _____

_____ Date: _____

_____

Please make arrangement to inspect the following:

		Location	Date	Time
☐ Anchor Block	☐	_____	_____	_____
	☐	_____	_____	_____
	☐	_____	_____	_____
☐	☐	_____	_____	_____
	☐	_____	_____	_____
	☐	_____	_____	_____
☐	☐	_____	_____	_____
	☐	_____	_____	_____
	☐	_____	_____	_____

Remarks: _____

_____

_____

_____

Date: _____ _____

(Main Contractor's representative)

For ENGINEER's USE

Said Works: IN ORDER/NOT IN ORDER

Remarks: _____

_____

_____

_____

_____

Date: _____ _____

(Resident Engineer)

(Figure 9)

REQUEST FOR INSPECTION FORM

AIR-CONDITIONING – Starter Panel

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Phase indicating light	
2	Incoming isolators	
3	MCCB	
4	Starter	
5	Contactor indicating light	
6	Fuses Manual start/stop	
7	Current transformer	
8	Relay for fire mode	
9	Weatherproof panel	
10	Front access	
11	Push button control switches	
12	Thermal overload relays	
13	Ammeter	
14	Motor starter	
15	Wiring	
16	PVC cables	
17	Conduit installation	
18	Cable trunking and trays	
19	Protection	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 10)

REQUEST FOR INSPECTION FORM

AIR-CONDITIONING – Air Handling Unit

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Concrete plinth	
2	Fan	
3	Cooling coil	
4	Filter bank	
5	Pressed galvanized steel panel casing	
6	Neoprene gasket	
7	1" thick rigid mineral wool	
8	Insulation	
9	Access panel	
10	Condensate drain pan	
11	Threaded drain connection flush	
12	Air filters	
13	Filter cell	
14	Mixing boxes section	
15	Filter section	
16	Faced and bypass section	
17	Adhesive and fastener	
18	Perforated aluminium foil	
19	Corrosion-resistant elastomeric based	
20	Epoxy coating	
21	Bolt and nuts	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 11)

REQUEST FOR INSPECTION FORM

AIR-CONDITIONING – Pump

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Pump in parallel	
2	Balancing and vibration	
3	Pump casing	
4	Pump impeller	
5	Shaft	
6	Shaft sleeves	
7	Wear ring	
8	Bolts, nuts and fasteners	
9	Base plate and pump assemble	
10	Plinth	
11	Flexible coupling	
12	Shaft seal	
13	Bearing	
14	Electric motor	
15	Painting	
16	Drain pipe	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 12)

REQUEST FOR INSPECTION FORM

AIR-CONDITIONING – Fan

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Vibration isolater	
2	Electric motor	
3	Housing	
4	Housing support	
5	Bearing support	
6	Motor frame base	
7	Impeller	
8	Drive shaft	
9	Variable inset vanes	
10	Bearing	
11	Fan drive	
12	Belt guard	
13	Balancing	
14	Fan casing	
15	V-belt driver	
16	Axial flow	
17	Mounting	
18	Noise level	

Remark:

Location:

SSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 13)

REQUEST FOR INSPECTION FORM

AIR-CONDITIONING – Pipework

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Chilled water piping	
2	Condenser water piping	
3	Screwed fitting	
4	Flange	
5	Elbow and tees	
6	Reducers	
7	Gaskets	
8	Pipe support	
9	Pipe insulation	
10	Drain pipe	
11	Vents	
12	Welding joints	
13	Pressure test	
14	Gate valve	
15	Balancing valve	
16	Check valve	
17	Strainer	
18	Pressure gauge	
19	Thermometer gauge	
20	Orifice plate	
21	Painting	
22	Arrow indication	

Remark:

Location:

NSC Representative

MC Representative

M&E Clerk-of-Works

(Figure 14)

REQUEST FOR INSPECTION FORM

AIR-CONDITIONING – Cooling Tower

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Vibration isolator	
2	Noise attenuators	
3	Ball-float valves	
4	Concrete plinth	
5	Entering water temperature – 95 deg. F	
6	Leaving water temperature – 85 deg. F	
7	Outside wet bulb temperature – 80 deg. F	
8	Inlet and suction connection	
9	Drain	
10	Bleed-off valve	
11	Overflow	
12	Ball-float valve	
13	Suction strainer	
14	Support leg & framework	
15	FRP casing	
16	Water basin	
17	Filing	
18	Water distribution system	
19	Fan	
20	Safety guards	
21	Corrosion treated	
22	Excess panel	

Remark:

Location:

_____ _____ _____

SSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 15)

REQUEST FOR INSPECTION FORM

AIR-CONDITIONING – Chillers

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Concrete plinth	
2	Lubrication system	
3	Electric motor	
4	Water cooler	
5	Capacity control	
6	Insulation	
7	Water relief valve	
8	Purge system	
9	Refrigerant	
10	Starter	
11	Compressor	
12	Shell and tube condenser	
13	Refrigerant cobler	
14	Control panel	
15	Insulation	
16	Suction pressure gauge	
17	Discharge pressure gauge	
18	Compressor oil pressure gauge	
19	Oil pump on-off switch	
20	Low refrigerant pressure cut-off	
21	High refrigerant pressure cut-off	
22	Low cooler refrigerant temperature cut-off	
23	Cooler and condenser flow switches	
24	Low cooler refrigerant temperature cut-off	
25	Timer to control guide vane opening	
26	Manual reset safety control lock-out circuit	

Remark:

Location:

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 16)

REQUEST FOR INSPECTION FORM

AIR-CONDITIONING – Ductwork and Air Distribution

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Dimension	
2	Sheet metal	
3	Rolled steel angles	
4	Rivets	
5	Shaft tapping screw	
6	Bolts	
7	Duct hardware	
8	Corrosion protection	
9	Erection of exposed ductwork	
10	Duct construction	
11	Low & high velocity, low & medium class	
12	Duct fitting	
13	Radius elbow	
14	Square throat elbow	
15	Transition	
16	Expansion & contraction	
17	Branch take-off	
18	Taper and offset	
19	Stream liners	
20	Hand hole covers	
21	Splitter damper	
22	Hanger for duct	
23	Flexible ducting	
24	Insulated ducting	
25	Flexible connection	
26	Flashing	
27	Duct through wall	

Remark:

Location:

_____ _____ _____

SC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 17)

REQUEST FOR INSPECTION FORM

FIRE-PROTECTION – Automatic Sprinkler Installation

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Flow switches	
2	Test valve	
3	Pressure gauge	
4	Fire brigade inlet	
5	Sprinkler head	
6	Drainage pipe	
7	Range pipe	
8	Distribution pipe	
9	Welding joint	
10	Painting	
11	Arrow indication	
12	Pipe support	
13	Pump connection	
14	Vibration isolator	
15	Isolation stop valve	
16	Gate valve	
17	Butterfly valve	
18	Bolt and nuts	
19	Jockey pump	
20	Electric motor	
21	Sprinkler pump	
22	Screw joints	
23	Strainers	
24	Gasket	
25	Alarm gong	
26	Flow meter	
27	Pressure switch	

Remark:

Location:

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 18)

REQUEST FOR INSPECTION FORM

FIRE-PROTECTION – Starter Panel and Alarm Board

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Warning lamp	
2	Duplicated phase indicator	
3	Motor starter	
4	Pump selector switch	
5	Flush mounted stop-start button	
6	Auto-manual selector switch	
7	Main isolating switch fuses	
8	Voltmeter	
9	Ammeter	
10	Fuse switch unit	
11	Contactors	
12	Control switch	
13	Indicating light	
14	Auxiliary relay	
15	Terminal block	
16	Wiring	
17	Conduit	
18	Cable	
19	Earthing	
20	Cable entry	
21	Cable connection	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

_____	_____	_____
SIC Representative	MC Representative	M&E Clerk-of-Works
Date:	Date:	Date:

(Figure 19)

REQUEST FOR INSPECTION FORM

FIRE-PROTECTION – CO_2 System

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Indicating lights	
2	Valve	
3	Pipework	
4	Battery	
5	Automatic Detector	
6	Alarm bell	
7	Remote manual control	
8	Discharge nozzle	
9	Carbon dioxide control panel	
10	Carbon dioxide cylinder	
11	Painting	
12	Indication arrow	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 20)

REQUEST FOR INSPECTION FORM

FIRE-PROTECTION – Fire Alarm System

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Addressable smoke detector	
2	Addressable manual call points	
3	Bell	
4	Wiring	
5	Conduit installation	
6	24V test	
7	Height of call point and bell	
8	Alarm reset switch	
9	Fire brigade signalling transmitter	
10	Fire intercom	
11	Voltmeter	
12	Ammeter	
13	Battery test switch	
14	Audible fault alarm	
15	Audible fault isolation switch	
16	Failure or disconnection	
17	Alarm indicator	
18	Fault indicator	
19	Isolator indicator	
20	Fault test	
21	Alarm test	

Remark:

_____

_____

_____

_____

Location:

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_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 21)

REQUEST FOR INSPECTION FORM

FIRE PROTECTION – Wet Riser Installation

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Landing valves	
2	Female coupling outlet	
3	Hose cradle	
4	Hose	
5	Wet riser pump	
6	Jockey pump	
7	Handwheel	
8	Spindle	
9	Pressure relief type landing valves	
10	Pipework	
11	Painting	
12	Directional arrow indicating	
13	Pipe support	
14	Pipe sleeve	
15	Nozzle	
16	Height of landing valve	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 22)

REQUEST FOR INSPECTION FORM

FIRE PROTECTION – Hose Reel Installation

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Wall-mounted swing type	
2	Rubber hose	
3	Length of hose	
4	Hose drum	
5	Gate valve	
6	Pipe support	
7	Directional arrow indicating	
8	Nozzle	
9	Painting	
10	Making	
11	Height of drum	
12	Pressure reduction valve	
13	Pump set	
14	Screw joint	
15	Pipe sleeve	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

_____ _____ _____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 23)

REQUEST FOR INSPECTION FORM

TELEPHONE SERVICES

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Main distribution frame	
2	Cable ladders	
3	Tray riser trunking	
4	DP Boxes	
5	Terminal blocks	
6	Underfloor trunking	
7	Conduit	
8	Wiring	
9	Cabling	
10	Duct seal	
11	Cable pits	
12	Manholes	
13	Telephone sockets	
14	Fire barriers	
15	Earthing	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

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_____ _____ _____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 24)

REQUEST FOR INSPECTION FORM

MATV INSTALLATION

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Input and output impedance – 75 ohm	
2	Voltage standing wave ration (VSWR) 1.0 – 1.4 limits	
3	Wave band (30 – 300 Hz)	
4	Ghost or echo effect – 34 dB	
5	Main supply lum – 60 dB	
6	Signal to noise – 45 dB	
7	Signal level limit – 63 dB UV – 77 dB UV	
8	Lightning protection	
9	Earthed	
10	Chanelized amplifier	
11	Antenna	
12	Amplifier	
13	IF modulator	
14	IF converter	
15	Video distribution amplifier	
16	Blanking generator	
17	Coaxial cable	
18	Splitter unit	
19	Directional couplers	
20	Tap off unit	
21	Wall – recessed MATV outlet	
22	Booster amplifier	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 25)

REQUEST FOR INSPECTION FORM

ELECTRICAL – General Lighting and Power & Light Fitting

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Cables – 1.5 mm & 2.5 mm	
2	Wiring method – In conduit	
3	Conduit wiring	
4	Wiring in cable trunking	
5	Final position of outlet and lighting points	
6	Light fixture installation	
7	Light switches	
8	Power outlet	
9	Wiring for emergency lighting	
10	Final sub-circuit	
11	Fire-men switch	
12	Control wiring	
13	Segregation of circuits	
14	Underfloor trunking	
15	Photometric data	
16	Fluorescent fitting	
17	Incandescent	
18	High intensive discharge lamps	
19	Exit sign	
20	Exterior light	
21	Self-contained emergency light	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 26)

REQUEST FOR INSPECTION FORM

ELECTRICAL – General Lighting and Power & Light Fitting

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Green PVC cable	
2	Earthing conductor connecting	
3	Earthing electrodes (16 mm O)	
4	Label 'Safety Earth'	
5	Label 'Do Not Disconnect'	
6	Earthing electrodes plate (25 mm x 32 mm)	
7	Clamps	
8	Clips	
9	Saddles	
10	Staples	
11	Ohm reading	
12	Air terminal system	
13	Down conductors	
14	Conductor support	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

_____ _____ _____

SSC Representative MC Representative M&E Clerk-of-Works

Date: Date: Date:

(Figure 27)

REQUEST FOR INSPECTION FORM

ELECTRICAL – External Lighting

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Aircraft obstruction light	
2	Automatic switching	
3	Wiring	
4	Compound lighting	
5	Weatherproof nature	
6	PVC/SWC/PVC cable	
7	Anti-rust primer	
8	Building automation system control	
9	Floodlighting	
10	Security lighting	

Remark:

Location:

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 28)

REQUEST FOR INSPECTION FORM

ELECTRICAL – Standby Diesel Generator

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Temperature	
2	Humidity	
3	Atmosphere	
4	Atmospheric pressure	
5	Engine – four stroke	
6	Engine speed	
7	Alternator	
8	Power distribution	
9	Voltage regulation	
10	Power factor	
11	Nominal frequency	
12	Synchronous operated speed	
13	Starting system	
14	Cooling system	
15	Exhaust system	
16	Fuel system	
17	Anti-vibration mounting	
18	Auto main failure	
19	Generator control board	
20	Off button	
21	Manual – button	
22	Automatically start	
23	High jacket water temperature	
24	Engine overspeed	
25	Alternator output	
26	Engine fail to start	
27	Low fuel level	
28	Earthing	
29	First aid chart	

Remark:

_____

_____

Location:

_____

_____

_____ _____ _____

RSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 29)

REQUEST FOR INSPECTION FORM

SOUND AND PUBLIC ADDRESS SYSTEM

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Antenna	
2	Centre control console	
3	Power amplifier	
4	Mixer pre-amplifier	
5	Input/master modules	
6	AM/FM radio tuners	
7	Wall-mounted box speakers	
8	Ceiling speakers	
9	Volume control unit	
10	Equipment rack	
11	PVC cable	
12	Conduit	
13	Steel cable trunking	
14	Fire-men microphones	
15	Speaker zone selection panel	
16	Battery	
17	Interlock push button selection switch	
18	Monitor speaker	
19	Horn speaker	
20	Compact Disc player	
21	24VDC test	
22	50 Hz test	
23	Impedance – 8 ohms	
24	Sound pressure level – 96 db/1 n/1 m	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 30)

REQUEST FOR INSPECTION FORM

ELECTRICAL – Distribution Board and Meter Panel

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Cold rolled commercial bright mild steel	
2	Rust or scale	
3	Angle frame	
4	Concealed type	
5	Baked powder paint	
6	Busbar and cable ducts	
7	Circuit breakers	
8	HRC Fuses	
9	On-load isolator	
10	Balancing of load	
11	Labels	
12	Earth leakage circuit breakers (ELCB)	
13	Control relay (24)	
14	Terminal block	
15	Magnet coil	
16	Vacuum impregnated contactor	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

_____ _____ _____

MC Representative MC Representative M&E Clerk-of-Works

Date: Date: Date:

(Figure 31)

REQUEST FOR INSPECTION FORM

ELECTRICAL – Main Switch Board

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Mounting – Angle iron support	
2	Busbar and secondary	
3	Cable arrangement	
4	Air-circuit breaker	
5	Bus coupler	
6	Mechanical and electrical interlock	
7	Moulded case circuit breakers (MCCB)	
8	Automatic changeover contactor and no-volt sensors	
9	Protection relay	
10	Current transformer	
11	Indication lamps	
12	Anti-condensation heaters	
13	Metering panel	
14	Power factor correction capacitors	
15	Earthing	
16	Labels and drawings	
17	Test certificate	
18	Signages	
19	Tools	
20	Danger sign	
21	First aid chart	
22	Rubber mat	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 32)

REQUEST FOR INSPECTION FORM

ELECTRICAL – Distribution Transformers

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Three core cast resin type	
2	Voltage ratios	
3	Winding arrangement – DYII	
4	Efficiency and losses	
5	Transformer impedance	
6	Temperature sensor	
7	Alarm and trip sensor	
8	Transformer casing	
9	Transformer terminals	
10	Earthing terminals	
11	Temperature rating – 170 degree C	
12	Manufacturer name	
13	Serial no	
14	Rating in KVA	
15	Volt at 0 on load	
16	Normal tapping	
17	Number of phases	
18	Frequency	
19	Vector group symbol	
20	Total mass in kg	
21	Year of manufacturing	

Remark:

Location:

_____ Representative
Date:

_____ MC Representative
Date:

_____ M&E Clerk-of-Works
Date:

(Figure 33)

REQUEST FOR INSPECTION FORM

ELECTRICAL – High Voltage Switchgears

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Vacuum circuit breaker	
2	Voltage transformer	
3	Current transformer	
4	Instruments	
5	Cable entry	
6	Switchgear arrangement	
7	Secondary wiring	
8	Time lap fuses	
9	Test link	
10	Battery and charger	
11	Load break switchgear	
12	Danger signs	
13	Label	
14	Function of relay	
15	Phase colour of current and voltage	
16	Characteristic curve	
17	Rated current/voltage of relay coils	
18	Current and voltage transformer ratio	
19	Voltage of tripping current	
20	Cable termination	
21	Bolt and nuts	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 34)

REQUEST FOR INSPECTION FORM

COLD WATER – Electrical Work

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Main isolating switch fuse	
2	MCCB	
3	Pump selector switches	
4	Auto manual selector switch	
5	Flush mounted stop-start button	
6	Indicating light for trip and run	
7	Indicating light for pump on auto and pump manual	
8	Ammeter	
9	Buzzer	
10	Fuse switch	
11	Thermal overload relay	
12	Terminal block	
13	Isolating switches	
14	Motor starters	
15	Wiring	
16	Cable	
17	Conduit	
18	Earthing	
19	BAS monitoring	
20	Bolt and nuts	
21	Labels	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 35)

REQUEST FOR INSPECTION FORM

SANITARY DRAINAGE INSTALLATION

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Trap cover	
2	Water test	
3	Smoke test	
4	Grease traps	
5	Damage transit	
6	Gradient	
7	Waste pipe	
8	Vent pipe	
9	UPVC fitting	
10	Pipe joints	
11	Pipe supports	
12	Pipe hangers	
13	Gasket seal	
14	Tee point	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 36)

REQUEST FOR INSPECTION FORM

WATER TANK STRUCTURE

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Concrete plinth	
2	Dimension	
3	Inlet	
4	Outlet	
5	Overflow	
6	Manhole opening	
7	Gasket	
8	Bolting	
9	Non-toxic epoxy resin coating	
10	Water level indicator device	
11	Vent	
12	Ball float valves	
13	Warning pipe	
14	Internal support	
15	T-gasket	
16	Flat gasket	
17	Drain pipe	
18	Valve	
19	Stainless steel step	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Represeniative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 37)

REQUEST FOR INSPECTION FORM

COLD WATER SUPPLY SYSTEM – Pipework

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Pipe material	
2	Size pipework	
3	Pipe support	
4	Pipe hangers	
5	Anchors	
6	Grading	
7	Painting	
8	Arrow indication	
9	Sleeve	
10	Joint	
11	Fitting	
12	Pressure reducing valves	
13	Pipe insulation	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

(Figure 38)

REQUEST FOR INSPECTION FORM

COLD WATER SUPPLY SYSTEM – Water Elevating Pump/Booster Pumpset

To: _____ Ref No: _____

Attn: _____ Date: _____

Please make arrangement to inspect as follows:

Item	Description	
1	Flange connection	
2	Pump plinth	
3	Casing	
4	Dynamically balance	
5	Mild steel section base	
6	Vibration element/Neoprene	
7	Meter speed	
8	Switch	
9	Discharge header	
10	Gate valve	
11	Check valve	
12	Pressure switch	
13	Pressure gauge	
14	Flow regulator	

Remark:

_____

_____

_____

_____

Location:

_____

_____

_____

_____

NSC Representative
Date:

MC Representative
Date:

M&E Clerk-of-Works
Date:

Appendix IV

Sample of Document Control Forms

(a) Drawing Submittal ..... Figure 1

(b) Request for Information ..... Figure 2

(c) Drawing Transmittal ..... Figure 3

(d) Document Transmittal ..... Figure 4

(e) Requisition for Printing of Documents ..... Figure 5

(f) Requisition for Printing of Drawing ..... Figure 6

(g) Drawing Received Record ..... Figure 7

(Figure 1)

Client :
Contractor :

DRAWING SUBMITTAL

SIGNED: CONTRACTOR:	Date:	Ref No.:
Type of Drawings submitted:		
DRG. NO.:	DRAWING TITLE:	
COMMENTS ON DRAWINGS:		
APPROVAL STAMP:	DISAPPROVED BECAUSE:	
SIGNED (S.O.)	DATE:	

Distribution: ❑ RE ❑ ❑

(Figure 2)

Client :
Contractor :

REQUEST FOR INFORMATION (RFI)

SIGNED: CONTRACTOR	Date:	Ref No.:
Question from Contractor		
	Date Answer Required:	
Answer from S.O.		
SIGNED		DATE:

Distribution: ❑ RE ❑ ❑

(Figure 3)

DRAWING TRANSMITTAL

Project/Tender Title: _____

_____

Date: _____

Issued By: _____

To : _____

_____

We forward herewith the following drawings:

☐ For Construction ☐ For your action

☐ For your approval ☐ As requested

☐ For your information ☐ Others: _____

DRAWING NO.	SIZE	NO. OF SET REQUIRED

Total Cost: RM

Kindly acknowledge receipt

_____

Signature:

Name:

Date:

(Figure 4)

DOCUMENT TRANSMITTAL

Project/Tender Title: _____	Date: _____
_____	Issued By: _____

To : _____

_____

We forward herewith the following drawings:

☐	For Construction	☐	For your action
☐	For your approval	☐	As requested
☐	For your information	☐	Others: _____

NO. OF ORIGINAL COPIES	SIZE	NO. OF SET REQUIRED

Total Cost: RM

FOR INFORMATION

Kindly acknowledge receipt

_____

Signature:

Name:

Date:

(Figure 5)

REQUISITION FOR PRINTING OF DOCUMENTS

To :

Date :

From :

Project/Tender Title: _____

_____

NO. OF ORIGINAL COPIES	SIZE	NO. OF SET REQUIRED

Time and date required to be ready:

.....

Requested by:

.....

_____

Comments by Printing Dept: _____

_____

.....

Signature:

Date:

(Figure 6)

REQUISITION FOR PRINTING OF DOCUMENTS

To : Date :

From :

Project/Tender Title: _____

_____

DRAWING NO.	SIZE	NO. OF SET REQUIRED

Time and date required to be ready: Signature:

....

_____

Comments by Printing Dept: _____

_____

.....

Signature:

Date:

Appendix IV

Date

(Figure 7)

DRAWING RECEIVED RECORD

Date	Drawing No	Description	Received From	Received By

Appendix V

Samples of Internal Audit Report Forms

(a) Corrective Action Request Form ..... Figure 1

(b) Attendance Register ..... Figure 2

(c) Audit Checklist ..... Figure 3

(d) Internal Audit Report ..... Figure 4

(e) Audit Notes ..... Figure 5

(f) Corrective Action Request Register ..... Figure 6

(g) Audit Report Status Log ..... Figure 7

(h) Audit Schedule ..... Figure 8

FOR

DEPART

BASIS O

AUDITO

NON-CO

SIGNED*

* Signature

CORREC

DATE CO

SIGNED

ACTION

DATE AC

SIGNED

FOLLOW-

PROPOSE
FOLLOW-

DATE CA

(Figure 1)

FORM 'CAR'		CAR NO.
	CORRECTIVE ACTION REQUEST	Date: Audit No.
DEPARTMENT AUDITED AND ADDRESS		
BASIS OF AUDIT		
AUDITOR:	DEPARTMENT REPRESENTATIVE:	CLAUSE:
NON-CONFORMANCE SIGNED* ..... SIGNED ..... Dept. Representative Auditor * Signature indicates understanding not concurrence Major Minor		
CORRECTIVE ACTION DATE CORRECTIVE ACTION TO BE COMPLETED: SIGNED ..... DATE: Dept. Representative		
ACTION TO BE TAKEN TO PREVENT RECURRENCE DATE ACTION TO PREVENT RECURRENCE TO BE COMPLETED: SIGNED ..... DATE: Dept. Representative		
FOLLOW-UP AND CLOSE OUT PROPOSED FOLLOW-UP DATE: FOLLOW-UP DETAILS DATE CAR CLOSE OUT SIGNED ..... Auditor		

(Figure 2)

ATTENDANCE REGISTER

COMPANY:

OFFICE/SITE: DATE:

NAME/POSITION (Please print)	Entry (Please initial)	Exit	REMARKS

(Figure 3)

AUDIT CHECKLIST

Audit No: Date: SUBJECT:

Clause	Requirements	Results	Comments
			AUDITEE(S)
FOUND IN ORDER Non-Conformance	Major = 1 Minor = 2		

(Figure 4)

INTERNAL AUDIT REPORT

AUDIT REPORT NO. Date: Page of

Department/s Audited:

Department Contacts:

Scope of Audit:

Previous Audit Details:

Details of Audit:

Corrective Action Requests Issued:

Signature: _____ Date: _____
Auditor

Signature: _____ Date: _____
Quality Assurance Manager

(Figure 5)

AUDIT NOTES page of

Auditee: Audit Date:

File Ref:

Department/Auditee:

REFERENCE	OBSERVATION	REMARKS

(Figure 6)

CORRECTIVE ACTION REQUEST REGISTER

CAR No.	Date Issued	Issued to	Audit Report No.	Agreed CAR Completion Date	Close Out Date	Auditor's Signature

(Figure 7)

(Figure 7)

AUDIT REPORT STATUS LOG

Audit Report No.	Audit Type	Audit Team Leader	Audit Date	Department audited	Procedures/Criteria audited	Date of Audit Report	CARs Issued

(Figure 8)

AUDIT SCHEDULE

ACTIVITY OR AREA TO BE AUDITED	YEAR													
	MONTH													
	WEEK END													

Issued: ..... Date: ..... Approved: ..... Date: .....

Quality Assurance Manager — Head of Project Management

Review dates: ....

(a) D

(b) Si

(c) Te

(d) Li

(e) Pr

(f) Pc

Appendix VI

Samples of Pre Tender Review Forms

(a) Decision To Tender ..... Figure 1

(b) Site Visit Report ..... Figure 2

(c) Tender Proforma ..... Figure 3

(d) List Of Sub-Contractors And Suppliers ..... Figure 4

(e) Preliminary Items ..... Figure 5

(f) Post Tender Review/Analysis ..... Figure 6

(Figure 1)

DECISION TO TENDER

Project Opportunity Particulars

1. Project Name : .....
2. Scope of Works : .....
3. Invitation/Advert/Other : .....
4. Client : .....
5. Architect : .....
6. Engineer : .....
7. BQ/Lump Sum : .....
8. Tender Dep (RM) : .....
9. Date of Tender : .....
10. Others : .....

Company's Capability

1. Experience : .....
2. Technical Capability : .....
3. Financial Capability : .....
4. Manpower Resource : .....
5. Plant Resource : .....
6. Others : .....

Tender Department Capacity to prepare tender:

.....

.....

.....

Prepared By: Tendering Manager _____ Date _____

☐ Yes Please Proceed to Tender (Form T2)/PQ

☐ No KIV

Remarks

.....

.....

.....

Approved by General Manager _____ Date _____

(Figure 2)

SITE VISIT REPORT

Items	Description	Remarks/Comments
1.	Proximity of Surrounding Buildings Drains, etc	
2.	Condition of Terrain & Contours	
3.	Surface Soil Condition	
4.	Access to Site	
5.	Earth Surplus due to Bore Piling	
6.	Obtain Soil Report if Possible Enquire about Water Table Level	
7.	Look out for Existing Services, e.g. junction boxes, telephone line, manhole	
8.	Identify TBM on Culverts & Kerbs	
9.	Any Remarks	

Prepared By: _____

(Figure 3)

TENDER PROFORMA

1. TENDER JOB:	
2. LOCATION:	
3. LOCATION, TIME & DATE OF SUBMISSION:	
4. CLIENT: CONTACT PERSON: TEL/FAX:	
5. CONSULTANT/Q.S.: CONTACT PERSON: TEL/FAX:	
6. SCOPE OF WORKS:	
7. SITE CONDITIONS:	
8. FIXED COMPLETION PERIOD: TENDER SUM:	
9. TENDERER'S OWN COMPLETION PERIOD: TENDER SUM:	
10. TENDER BOND FOR EARNEST MONEY: MAKE PAYABLE TO:	
11. TENDER VALIDITY PERIOD:	
12. CONDITIONS OF CONTRACT: (a) TYPE OF CONTRACT:	

(Figure 3 Contd.)

TENDER PROFORMA

(b) DEFECT LIABILITY PERIOD:	
(c) L.A.D. AMOUNT:	
(d) PERIOD OF INTERIM CERTIFICATE:	
(e) PERIOD OF HONOURING OF CERTIFICATE:	
(f) PERCENTAGE OF CERTIFIED VALUE RETAINED:	
(g) LIMIT OF RETENTION:	
(h) ONEROUS CONDITIONS OR ALTERATION TO STANDARD FORM:	
13. INSURANCES: (a) CAR POLICY (b) WORKMEN'S COMPENSATION, SOCSO, ETC. (c) OTHERS	
14. P.C. ITEMS & PROVISIONAL SUMS:	
15. NAME OF OTHER TENDERERS:	
16. OTHERS:	

PREPARED BY:

DATE:

(Figure 4)

LIST OF SUB–CONTRACTORS AND SUPPLIERS

ITEM	TRADE	BQ REF.	SUBCON/ SUPPLIER	TEL. NO.	FAX. NO.	PERSON-IN-CHARGE	DATE ISSUE	DATE RETURN	REMARKS

(Figure 5)

PRELIMINARY ITEMS

(Figure 5)

PRELIMINARY ITEMS

Project: _____

Tender Ref: _____

S/N	Description	Computation	RM	RM (Adj)
1.	Setting Out			
2.	Document Fee/Tender Deposit			
3.	Security Deposit/Performance Bond			
4.	Insurances			
5.	Site Management			
6.	Hoarding			
7.	Sign Board			
8.	Temporary Access/Roads			
9.	License Fee/Factory Permits			
10.	Contractor Site Office			
11.	Consultant Site Office			
12.	Other Site Accommodation			
13.	Temporary Toilet			
14.	Water Supply			

(Figure 5 Contd.)

PRELIMINARY ITEMS

Project: _____

Tender Ref: _____

S/N	Description	Computation	RM	RM (Adj)
15.	Power Supply			
16.	Temporary Lighting			
17.	Water Supply			
18.	Power Supply			
19.	Temporary Lighting			
20.	Telephone & Fax			
21.	Canteen Facilities			
22.	Washing Bay			
23.	Scaffolding			
24.	Watching & Security			
25.	Plant & Equipment			
26.	Progress Photographs			
27.	Protection			
28.	Regular of Debris			

(Figure 5 Contd.)

PRELIMINARY ITEMS

Appendix VI

(Figure 5 Contd.)

PRELIMINARY ITEMS

Project: _____

Tender Ref: _____

S/N	Description	Computation	RM	RM (Adj)
29.	Anti Mosquito Measure			
30.	Lunches for Supervisors			
31.	As Built Drawings			
32.	Temporary Site Drainage			
33.	Overtime			
34.	Cleaning Up on Completion			
35.	Diesel/Petrol Supply			
36.	Adjustments			
37.	Walkie Talkie, Pager			
38.	1 no. vehicle			
39.	Registered Surveyor			
40.	Attendance on NSC			

(Figure 6)

POST TENDER REVIEW/ANALYSIS

Project: _____

Tender Result

Tenderers	Tender Sum (RM)	Remarks
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		
21.		
22.		
23.		

Analysis (Based on Main Offer)

Tender	Lowest/Next Tender
Difference	% Difference

Remark/Possible reasons for the difference in tender price

_____

_____

_____

_____

_____

Appendix VII

Samples of Post Tender Review Form

(a) Materials or Equipment Submittal..... Figure 1

(b) Progress Payment Register ..... Figure 2

(c) Daywork Record ..... Figure 3

(d) Request For Site Overtime Works ..... Figure 4

(e) Summary Of Daywork Sheet..... Figure 5

(f) Manpower Schedule ..... Figure 6

(g) Plant & Machinery Schedule..... Figure 7

(h) Summary Of Workdone..... Figure 8

(i) Material On Site Record Sheet..... Figure 9

(j) Summary Of Variation Order..... Figure 10

(k) Daily Report..... Figure 11

(Figure 1)

Client:
Contractor:

MATERIALS OR EQUIPMENT SUBMITTAL

No:

ITEM COVERED BY THIS SUBMITTAL:	*Date*	*Signed by Contractor*
FULL DESCRIPTION OF ITEM FOR WHICH APPROVAL IS SOUGHT: SPECIFICATION VOLUME AND CLAUSE REFERENCE: ATTACHED ARE: MANUFACTURER'S DRAWINGS: MANUFACTURER'S LITERATURE: SAMPLE: OTHER:		
COMMENTS ON MATERIALS OR EQUIPMENT SUBMITTED:		
APPROVAL STAMP:	DISAPPROVED BECAUSE	
SIGNED BY S.O.	*DATE:*	

Distribution: MDP ❑ SABA ❑ RE ❑

(Figure 2)

PROGRESS PAYMENT REGISTER

No.	Claim		S.O. Certificate		Payment Received	
	Date	Amount	Date	Amount	Date	Amount
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						

(Figure 3)

DAYWORK RECORD SHEET NO: _____ DATE: _____

ENGINEER'S INSTRUCTION NO: _____

Location of Work _____

Description of Work _____

(A) LABOUR					TOTAL AMOUNT ($)
ITEM	TRADE	TOTAL HOUR	RATE ($)	AMOUNT ($)	
			Sub-Total		

(B) PLANT					
ITEM	TRADE	TOTAL HOUR	RATE ($)	AMOUNT ($)	
			Sub-Total		

(C) MATERIALS					
ITEM	TRADE	TOTAL HOUR	RATE ($)	AMOUNT ($)	
			Sub-Total		
			% Overhead		
				OTHER CHARGES	
				TOTAL	

Representative Name	*Signature*	*Date*

Engineer's Representative Name	*Signature*	*Date*

(FIGURE 4)

Ref :
Date :

Resident Engineer

Dear Sir,

Request For Site Overtime Works

May permission please be granted for us to carry on with our overtime works on _____ for the purpose completing the undermentioned construction works due to unavoidable circumstances and beside that we would also like to inform you that the RE/Clerk-of-Works _____ of the above project will be required to attend and supervise the said works during the duration of the overtime is in progress:

Description Of Works	Duration of Overtime Required (hrs)

Your cooperation to the above will be much appreciated.

Thank you.

Yours faithfully

Authorized Signature

For RESIDENT ENGINEER use

Request for the above is hereby approved.

_____

Signature & Co Stamp
Date:

(Figure 5)

SUMMARY OF DAYWORK SHEET

Sub-Contractor: ______________________________

Date	Description	Daywork	Instruction	Amount ($)	Remark
	TOTAL				

(Figure 6)

MANPOWER SCHEDULE

Month: _____

Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Project Manager																															
Project Engineer																															
Q.A/Safety Officer																															
Architectural Co-ordinator																															
M&E Co-ordinator																															
Quantity Surveyor																															
Bdg. Surveyor/Supervisor																															
Site Supervisor																															
Material Controller																															
General Clerk																															
Operators																															
Signal Man																															
Security Guard																															
Carpenter																															
Bar Bender																															
Mason																															
Door Frame Installer																															
Bricklayer																															
Plasterer																															
Tiler																															
Glazier																															
Painter																															
Joiner/Ironmonger																															
Ceiling																															
Spray Tiler																															
General Worker																															
Total Carried Forward	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(Figure 7)

PLANT & MACHINERY SCHEDULE

Month: _____

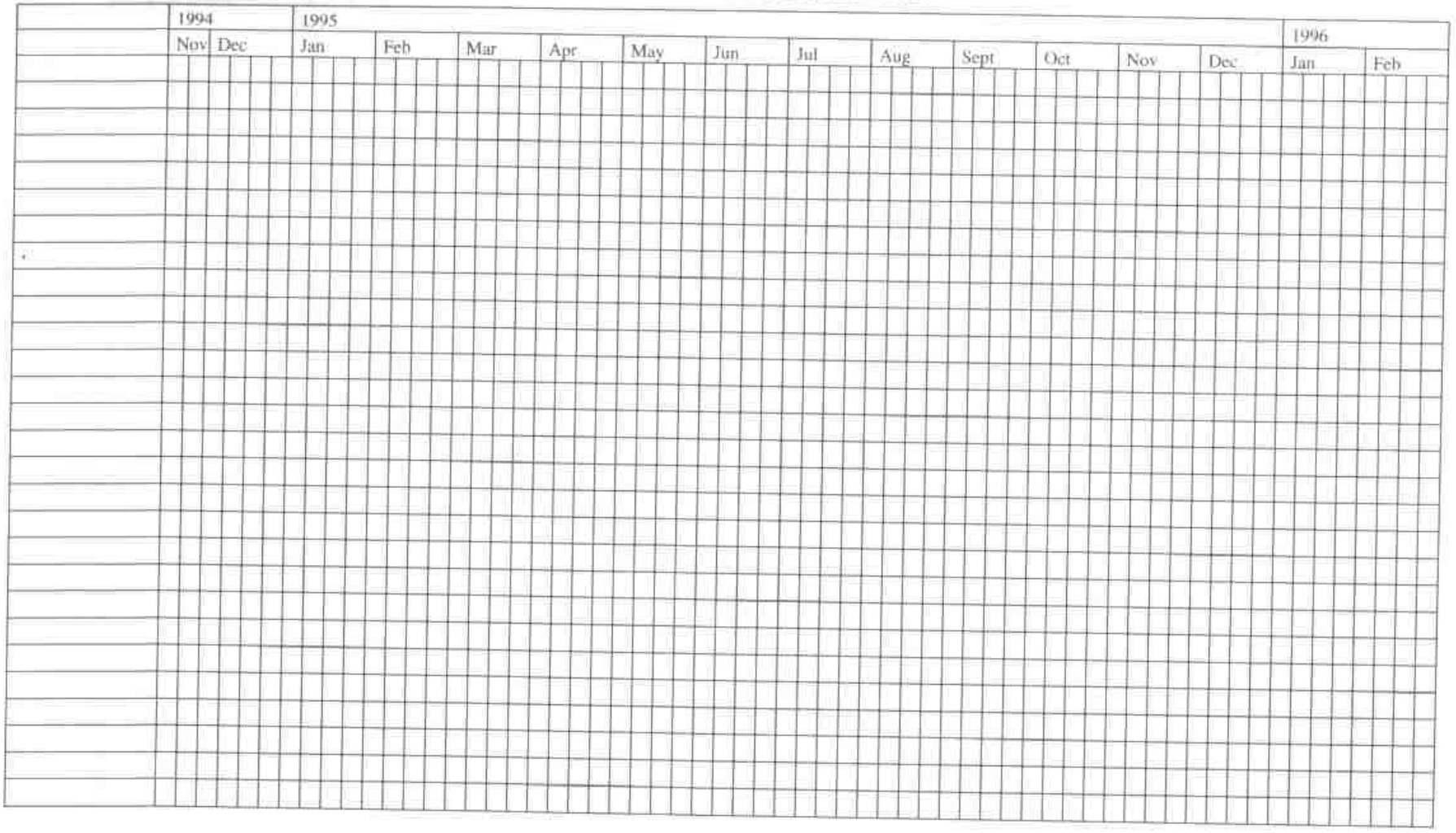
Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Backhoe																															
Barbending & Cutting Machine																															
Breaker																															
Compactor																															
Compressor																															
Concrete Mixer																															
Concrete Pump																															
Genset																															
Lorry																															
Material Hoist																															
Mobile Crane																															
Mobile Mixer																															
Oxy Cutter																															
Passenger Hoist																															
Roller																															
Tower Crane																															
Walkie Talkie																															
Water Jet																															
Water Pump																															
Welding Machine																															

(Figure 8)

SUMMARY OF WORKDONE

(Figure 8)

SUMMARY OF WORKDONE



(Figure 9)

MATERIAL ON SITE RECORD SHEETS:

PAGE:

ITEM	DESCRIPTION	UNIT	PREVIOUS ACCUM. TOTAL	THIS PERIOD	TOTAL TODATE

(Figure 10)

SUMMARY OF VARIATION ORDER

Ref No	Description	Addition	Omission	Effect	Remark
CONTRACT SUM:					
REVISED CONTRACT SUM					

(Figure 11)

DAILY REPORT

Date: _____ Day: _____ Weather: _____

A. SUPERVISORY STAFF		B. LABOUR FORCE		C. MACHINERY			
1. Site Agent		1. Carpenter		1. Mobile Crane		10. Breaker	
2. Quantity Surveyor		2. Bar Bender		2. Concrete Mixer		11. Barbending Machine	
3. Q.A/Safety Officer		3. Mason		3. Backhoe		12. Rebar Cutter	
4. M&E Co-ordinator		4. M&E Workers		4. Lorry		13. Water Jet	
5. Site Supervisor		5. Operator		5. Roller		14. Vibration Poker	
6. General Clerk		6. Security Guard		6. Paver		15. Welding Set	
		7. General Workers		7. Compactor		16. Oxy Cutter	
				8. Air Compressor		17. Elec. Drill	
				9. Genset		18. Oxy Cutter	
						19. Elec. Drill	

ACTIVITIES

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Material Received: _____

_____

Drawing Received: _____

_____

Engineer Instructions: _____

_____

Visitor: _____

_____

Prepared By	Check By	Check By
_____	_____	_____
Site Supervisor	Site Agent	Resident Engineer
Date:	Date:	Date:

Appendix VIII

PROJECT QUALITY PLAN

FOR

PROPOSED EXTENSION
XYZ HOTEL

CONTROLLED COPY NO.

ABC BUILDER

Project:

Document No.

Quality Assurance

Date:

PROJECT QUALITY PLAN

FOR

PROPOSED EXTENSION XYZ HOTEL.

CONTROLLED COPY NO.

				Signature/Date
Issue No.		Prepared by	Site Quality Co-ordinator Site Agent Project Manager	
Issue Date		Checked by Approved by Endorsed by	General Manager Senior Q.A. Manager Managing Director	
	REVISION DESCRIPTION			

ABC BUILDER

Project:

Document No.

Quality Assurance

Date:

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6.	Contractual Parties Particulars	297
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ABC BUILDER

Project:

Document No.

Quality Assurance

Date:

1. GENERAL

This project quality plan is prepared in accordance with Clause 4.2 of the Quality Manual.

The plan shall comprise the followings:

1. Quality Manual
2. Work Procedure
3. Contract Document

2. QUALITY OBJECTIVE

The project shall be constructed in accordance with the following documents:

1. Conditions of Contract & Specification
2. Construction Drawings

Copies of the above documents are kept in the Site Office. The Project Manager is responsible for keeping them up-to-date, and in good condition. He shall control the receipt and issue of drawings and specification.

3. CONTRACT INFORMATION

The contract information for this project is as per **Appendix A**.

4. PROJECT DESCRIPTION

XYZ Development Sdn Bhd under the flapship of CDE Berhad is spending millions of ringgit to upgrade the existing XYZ Hotel which was built in 1981. The upgrading includes a XXth storey Hotel Block extension (phase-I) renovation and extension to the existing podium block (phase-II), renovation of existing guestrooms in the X-storey tower, the renovation and extension to the existing Rampaisari Banquet Hall (phase-IV).

The work for phase-I comprises one level of basement, a tower block which consists of 14 levels to accommodate 361 guestrooms, a podium block which consists of three levels for administration and management, public areas, restaurant, services and car park.

Under this contract, ABC Builder is undertaking the superstructure works which comprise the podium and tower block with a total contract sum of RM1 m. The new extension is expected to complete in 1996.

5. PROJECT LOCATION

The site of the proposed Work is located as shown on the Site Plan (refer to **Appendix B**).

6. CONTRACTUAL PARTIES PARTICULARS

The particulars of the following parties are contained in **Appendix C**.

7. ALLOCATION OF RESPONSIBILITIES

1. Organization.
   The structure of the site organization is as shown in **Appendix D**.
2. Duties.
   The responsibilities of each staff are listed in **Appendix E**.

8. PROJECT SCHEDULE

The project schedule comprises a master work schedule as shown in **Appendix F**.

9. INSPECTION, TESTING AND AUDITS

A. Inspection And Testing

The inspection and test plans are as given in **Appendix G**. The Site Quality Co-ordinator, in consultation with the Project Manager, shall compile all quality records.

B. Audit

An independent Quality Co-ordinator shall audit the implementation of this Project Quality Plan.

Audit reports shall be distributed to the following people:

(i) Project Manager

(ii) Quality Assurance Manager

10. TESTING AND MEASURING EQUIPMENT

The master list of equipment used in this project is as given in **Appendix H**.

11. AMENDMENT TO PROJECT QUALITY PLAN

Review of this Project Quality Plan shall be discussed periodically. It shall be re-issued when significant changes occur.

APPENDIX A

ABC BUILDER

Project:

Document No.

Quality Assurance

(Appendix A)
Date:

CONTRACT INFORMATION

Contract Title	:	The Proposed Extension XXth Storey XYZ Hotel
Contract Sum	:	RM 1 M
Date of Possession	:	August 1994
Date of Completion	:	Section A – Jan 1996 Section B – April 1996
Contract Period	:	Section A – 72 Weeks Section B – 85 Weeks
Liquidated & Ascertained Damages	:	
Workmen's Compensation Policy No.	:	
Contract Works Insurance Policy No.		
Sum of Performance Bond	:	
Banker	:	M Bank
Guarantee No.	:	

APPENDIX B

ABC BUILDER

Project:

Document No.

Quality
Assurance

(Appendix B)
Date:

SITE LOCATION PLAN

APPENDIX C

ABC BUILDER

Project:

Document No.

Quality Assurance

(Appendix C)
Date:

CONTRACTUAL PARTIES PARTICULARS

A. CLIENT

Name :

Address :

PROJECT MANAGER

Name :

Representative

Name : :
:

Telephone :

Fax :

ABC BUILDER

Project:

Document No.

Quality Assurance

(Appendix C)
Date:

B. HOTEL OPERATOR

Name :

Representative

Name :

Telephone :

Fax :

CONSULTANTS

ARCHITECT

Name of Company :

Address :

Representative

Name :

Telephone :

Fax :

ABC BUILDER

Project:

Document No.

Quality Assurance (Appendix C) Date:

C & C ENGINEER

Name :

Address :

Representative

Name :

Telephone :

Fax :

M & E ENGINEER

Name :

Address :

Representative

Name :

Telephone :

Fax :

ABC BUILDER

Project:

Document No.

Quality Assurance

(Appendix C)
Date:

QUANTITY SURVEYOR

Name :

:

Representative

Name :

Telephone :

Fax :

ABC BUILDER

Project:

Document No.

Quality Assurance

(Appendix C)
Date:

INTERIOR DESIGNER

Name :

Address :

Representative

Name :

Telephone :

Fax :

ABC BUILDER

Project:

Document No.

Quality Assurance

(Appendix C)
Date:

KITCHEN SPECIALIST

Name :

Address :

Representatives

Name :

Telephone :

Fax :

LAUNDRY SPECIALIST

Name :

Address :

Representatives

Name :

Telephone :

Fax :

ABC BUILDER

Project:

Document No.

Quality Assurance

(Appendix C)
Date:

LANDSCAPE DESIGNER

Name :

Address :

Representatives

Name :

Telephone :

Fax :

LIGHTING DESIGNER

Name :

Address :

Representatives

Name :

Telephone :

Fax :

ABC BUILDER

Project:

Document No.

Quality Assurance

(Appendix C)
Date:

ACOUSTIC & AUDIO-VISUAL SPECIALIST/STAGE DESIGNER

Name :

Address :

Representative

Name :

Telephone :

Fax :

RESIDENT STAFF

Name :

Address :

Representative

Name :

Telephone :

Fax :

ABC'S PROJECT TEAM

The particulars of the project team members are kept by the Site Secretary.

ABC BUILDER

Project:

Document No.

Quality Assurance

(Appendix C)
Date:

SUB-CONTRACTORS

COMPANY	TRADE	REPRESENTATIVE	CONTACT NO.
L Const. (M) Sdn Bhd	Carpenter, Bar Bender & Concretor		
R Electric (M) Sdn Bhd	Site Temporary Electric Supply		
U Gemilang	License Surveyor		
Kejuruteraan J	Tower Crane		
L Enterprise	Lorry & Backhoe		
PD Distribution Sdn Bhd	Plant Bar		
SP Sdn Bhd	Floor Hardener		
QCM Laboratory Sdn Bhd	Concrete Cube Test		
TW Piling & Construction Sdn Bhd	Timber Piling (Tower Crane Foundation)		
U Guard Sdn Bhd	Security Guard		

ABC BUILDER

Project:

Document No.

Quality Assurance

(Appendix C)
Date:

NOMINATED SUB-CONTRACTORS

COMPANY	TRADE	REPRESENTATIVE	CONTACT NO.
Sykt Pembinaan NM Sdn Bhd	Plumbing & water rect. Hot/Cold Plumbing & Sanitary Services		
UG Sdn Bhd	Air Con & Mechanical Ventilation Services		

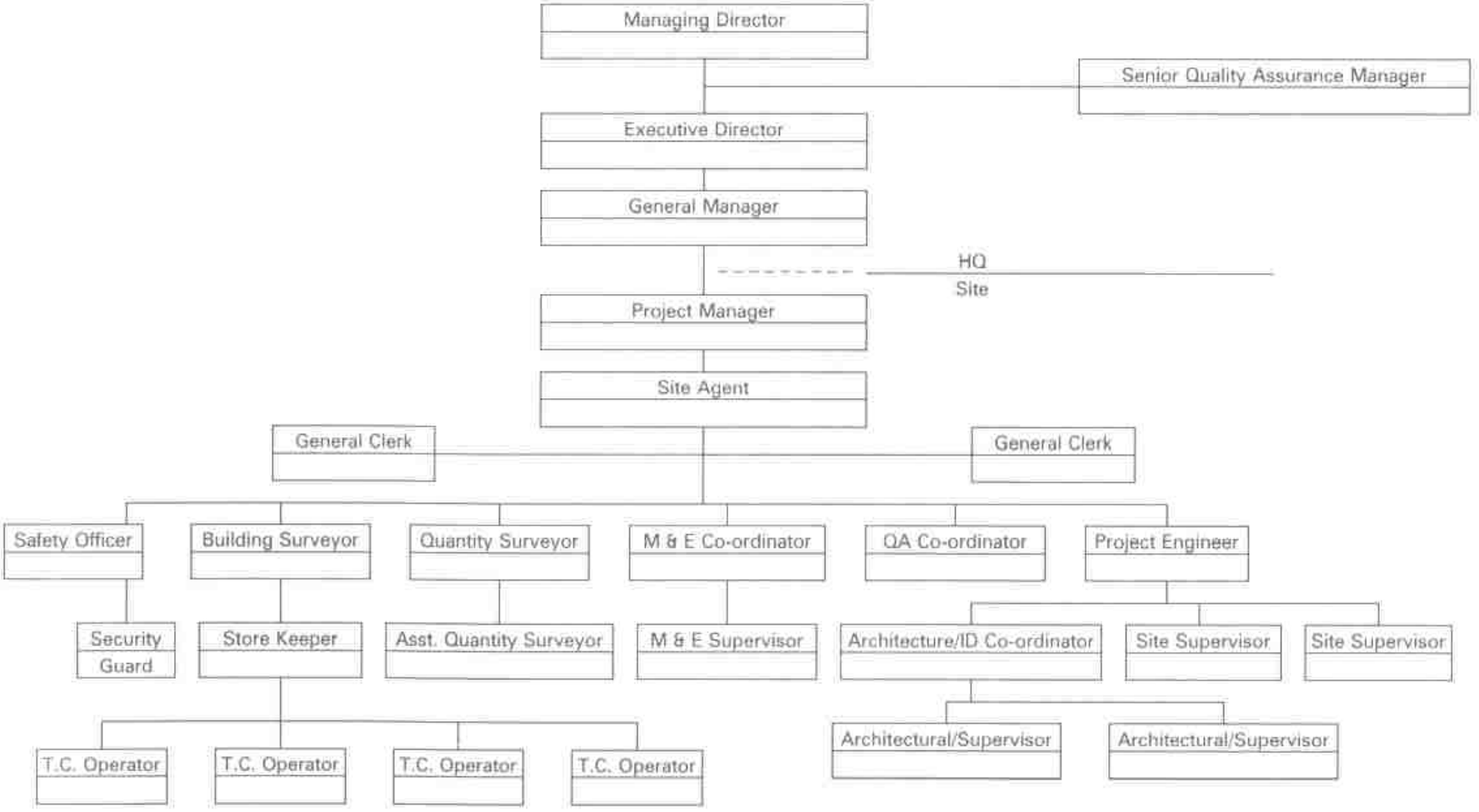
APPENDIX D

THE XYZ EXTENSION 17TH STOREY HOTEL SITE ORGANIZATION CHART

ABC BUILDER

ABC BUILDER

THE XYZ EXTENSION 17TH STOREY HOTEL SITE ORGANIZATION CHART



APPENDIX E

ABC BUILDER

Project:

Document No.

Quality Assurance

(Appendix E)
Date:

PROJECT MANAGER

(a) Reports to Project Co-ordinator.

(b) Overall planning, co-ordinating site activities, site management and budgeting.

(c) Leads a team of Engineers, Quantity Surveyors, Surveyor, Site Quality Co-ordinator and Supervisors.

(d) Liaises with client, consultants and local authorities.

(e) Attends all client/consultant meetings.

(f) Co-ordinates NSC meeting.

SITE AGENT

(a) Reports to Project Manager.

(b) Plans and co-ordinates site activities with site staff.

(c) Monitors work progress and quality control.

(d) Liaises with client, consultants and local authorities.

(e) Attends all client and consultants meetings.

(f) Liaises with sub-contractors.

(g) Implementation of safety measures.

(h) Liaises with nominated sub-contractors.

PROJECT ENGINEER

(a) Reports to Project Manager.

(b) Checks discrepancies between structure and architecture drawings and issue RFI.

(c) Counter-checks alignment and levels by surveyor.

(d) Checks structural drawings for discrepancies.

(e) Liaises with R.E./Consultant Engineer/C.O.W. on technical matter.

(f) Arranges site inspection with R.E./C.O.W.

(g) Monitors of work progress and quality control.

QUANTITY SURVEYOR

(a) Reports to Project Manager.

(b) Evaluates and prepares progress payment to sub-contractors.

(c) Prepares progress payment claim and variation orders.

(d) Prepares progress report, materials schedule and cashflow.

(e) Updates cashflow and monitor project budget and payment to sub-contractors.

(f) Verifies materials requisition.

(g) Reviews quotations submitted by sub-contractors.

(h) Attends fortnightly progress meetings.

SITE SUPERVISOR

(a) Prepares Daily Report.

(b) Liaises with R.E./C.O.W. on technical matters.

(c) Checks drawings discrepancies between architecture and structure and issue RFI.

(d) Counter-checks alignments/levels by surveyor.

(e) Monitors work progress and quality control.

(f) Plans ahead on construction materials ordering, hiring/buying machineries equipment and tools for site use.

(g) Records daywork (including sub-contractors' daywork).

(h) Plans ahead and informs R.E. of the commencement of daywork.

(i) Records dayworks and submits to R.E. for certification at the end of the day.

(j) Site Safety Committee member/supervisor.

ASSISTANT QUANTITY SURVEYOR

(a) Assists in preparation of final measurement including updating measurement with variations from time to time.

(b) Co-ordinates with site engineer and supervisors for relevant details required for final measurement.

(c) Assists in checking valuation of progress payment for sub-contractor.

(d) Assists in preparation of the proposed valuation for variation order.

(e) Assists in monitoring material as required for the up-to-date work progress.

(f) Assists in reviewing the record keeping for final measurement purposes.

BUILDING SURVEYOR

(a) Set out alignments and levels for structural/architectural works.

(b) Ensures temporary reference points are available for checking.

(c) Checks against architectural and structural drawing detail dimensions, alignments and levels.

(d) In-charge of RB's labours wages.

(e) Test cube records and reports/testing.

(f) Checks and compares architectural and structural drawings for discrepancies, issues RFI.

(g) Puts in RFI records any out-of-alignment structural works.

(h) Ensures all structural works cast to the required level alignments.

(i) Ensures all architectural works are correctly set out.

(j) Liaises with R.E., R.A. and C.O.W. on technical problems.

(k) Checks and verifies survey works with R.E., R.A./C.O.W.

(l) Prepares progress photograph.

(m) All architectural and ID works.

(n) Drawing records and control.

ARCHITECTURAL & ID CO-ORDINATOR

(a) Checks & compares architectural and structural drawings for discrepancies, issues RFI.

(b) Checks specification and ensures architectural requirements are met.

(c) Counter-checks alignments and levels by surveyor.

(d) Liaises with R.E., R.A. & C.O.W. on technical problems.

(e) Supervises structural works.

(f) Monitors Structural/Architectural/ID work progress and quality control.

(g) Prepares Architectural Daily Report.

(h) Prepares checklist for architectural works.

(i) Prepares checklist for ID works.

(j) Prepares schedule for architectural scope of work.

(k) All architectural work/ID works.

(l) Submission materials for approval.

(m) Site Safety Committee members/supervisor.

ARCHITECTURAL SUPERVISOR

(a) Checks specification and ensures architectural requirements are met.

(b) Counter-checks alignments and levels by surveyor.

(c) Monitors Structural/Architectural/ID work progress and quality control.

(d) All architectural work/ID works.

(e) Site Safety Committee member/supervisor.

SITE QUALITY CO-ORDINATOR

(a) The Site Quality Co-ordinator shall represent the Quality Assurance Manager at review meetings who shall direct any quality system queries for action.

(b) The Site Quality Co-ordinator shall assist the Project Manager in preparing the Project Quality Plans.

(c) The Site Quality Co-ordinator shall be responsible to prepare distribution list for controlled document, eg. Project Quality Plan.

(d) The Site Quality Co-ordinator shall report directly to the Quality Assurance Manager when encounter any site non-conformance.

(e) The Site Quality Co-ordinator shall scrutinize all check points found in the inspection and test plan.

(f) The Site Quality Co-ordinator shall attend the Friday meeting at Head Office conducted by the Q.A. Manager.

(g) The Site Quality Co-ordinator shall liaise with the Internal Auditor when auditing is required on site.

(h) The Site Quality Co-ordinator shall ensure the quality system is maintained on site.

GENERAL CLERK

(a) General site administration work.

(b) Records in/out correspondences.

(c) Records in/out documents.

(d) Prepares vouchers for petty cash claims.

(e) Petty cash control and claims.

(f) Prepares general workers' salary.

(g) Prepares Reports – fortnightly.

(h) Buys refreshment supplement for site office/meeting.

(i) Arranges food and drinks for fortnightly meeting.

MATERIAL CONTROLLER/STOREKEEPER

(a) Requisition of materials and prepares ROM.

(b) Controls/Checks quantity and quality of material delivered.

(c) Ensures adequate inventories and stocks.

(d) Prepares daily and monthly record for materials received on site.

(e) Plant and machinery record and services.

(f) Inventory control.

(g) Prepares GRN (with D/O attach).

(h) Prepares Material Reconciliation report.

(i) Prepares stock control card for material.

(j) Prepares good issue note.

(k) Prepares transfer note for material transfer out from the site.

(l) Liaises with Purchasing Department.

M & E CO-ORDINATOR

(a) Co-ordinates all M&E works and submission.

(b) Prepares M&E fortnightly progress report.

(c) Prepares M&E daily report.

(d) Attends M&E co-ordination meeting (Every Friday).

(e) Quality Control.

(f) All M&E correspondences and prepares minutes of M&E co-ordination meeting.

(g) Arranges for inspection with M&E, R.E. and C.O.W.

(h) Arranges for testing and commissioning and the handling over of all M&E services.

SAFETY OFFICER

(a) Advises Project Manager on safety construction regulations, health and safety at work, codes of practices relevant to safety matters.

(b) Recommends improvements to the existing safety system.

(c) Anticipates potential risk and hazards at site and recommends relevant safety procedures.

(d) Ensures all plants and tools operate according to the safety regulations laid down by the local authorities.

(e) Makes sure all workers on site observe the regulations concerning health, welfare and first aid facilities.

(f) Determines the cause of any accident or near accident and recommends means of prevention.

(g) Reports and records all accidents on site.

APPENDIX F

MASTER WORK PROGRAMME

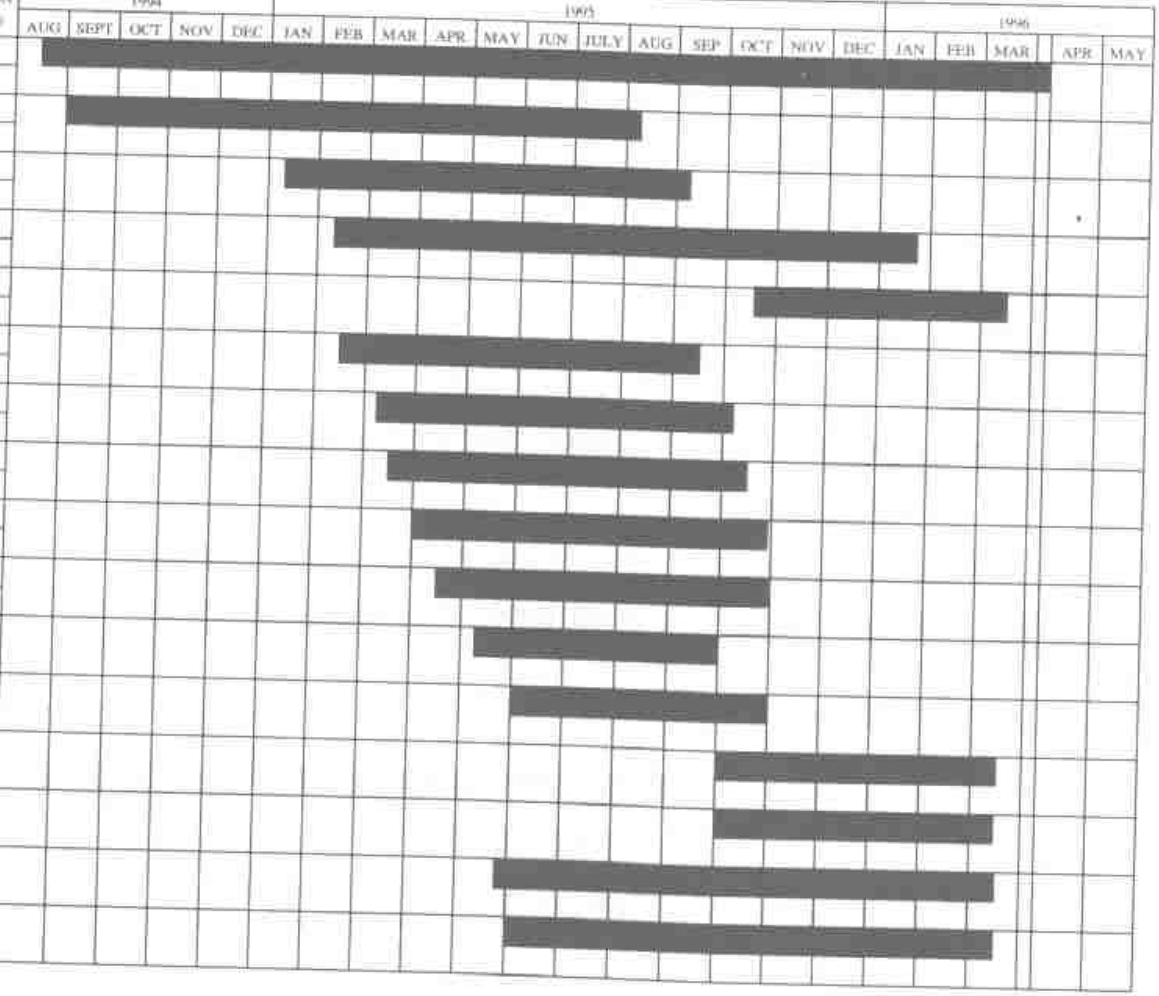
Proposed 17 Storeys Hotel for XYZ Hotel Development Sdn. Bhd.
WORK PROGRAMME

NO	DESCRIPTION OF WORK	B. START	B. FINISH	DURATION	1994	1995

Proposed 17 Storeys Hotel for XYZ Hotel Development Sdn. Bhd.

WORK PROGRAMME

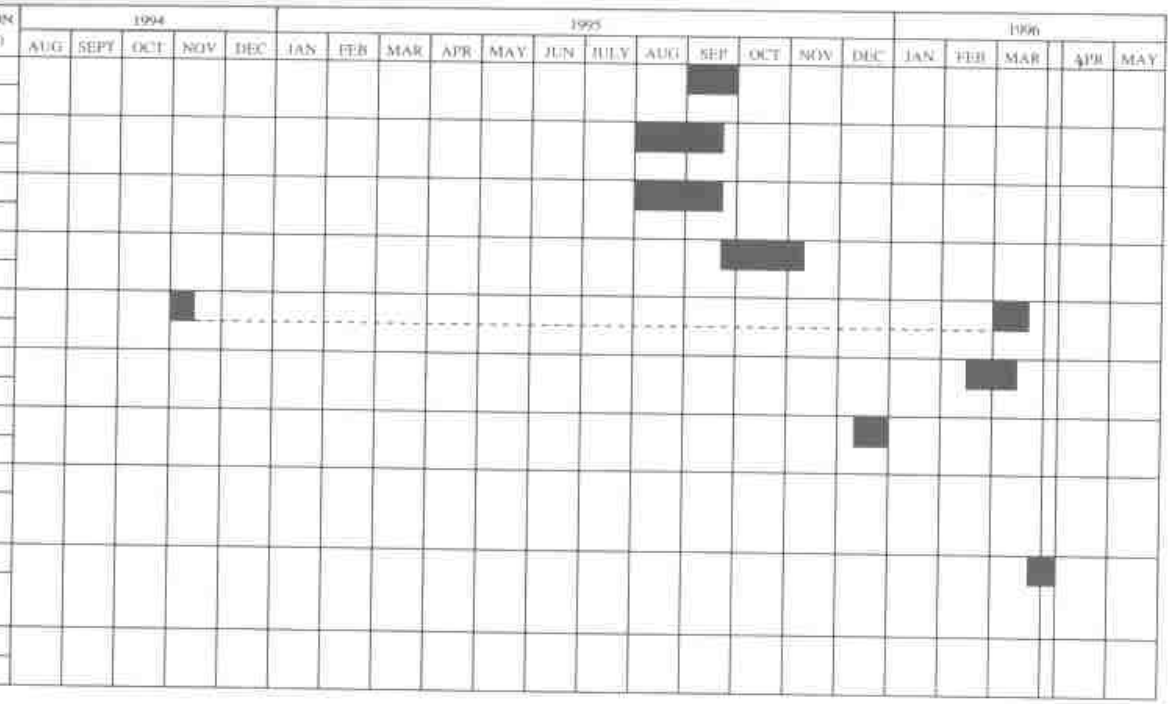
NO ALARM	DESCRIPTION OF WORK	B. START / A. START	B. FINISH / A. FINISH	DURATION (WEEKS)
A0010 –	PRELIMINARIES	19-4-94 / 19-4-94	2-4-96	85
A1000 – A1095	R.C. SUPERSTRUCTURE LGF—ROOF LEVEL	2-9-94 / 2-9-94	1-4-95	48
D0000 – D0290	INT. & EXT. BRICKWORK INCL. DOOR & WINDOW FRAME	10-1-95	4-9-95	34
A0400 – D0555	INT. & EXT. PLASTERING	10-2-95	27-1-96	49
D0360 – D0565	SPRAY TILES	16-10-95	15-3-96	22
D0600 – D0680	WALL FINISHES	20-2-95	16-9-95	30
D0600 – D0690	FLOOR FINISHES	4-3-95	8-10-95	31
B1000 – B1090	CEILING FINISHES	23-3-95	15-10-95	30
B1200 – B1290	DOOR/WINDOW IRONMONGERIES	4-4-95	30-10-95	30
B1600 – B1690	PAINTING & DECORATION	14-4-95	1-11-95	29
M1805 –	ID – PUBLIC AREA @ LGFGF & MZF	2-5-95	2-10-95	22
B1810 –	ID – CHINESE RESTAURANT	2-6-95	2-11-95	22
B1835 –	ID – PKG1 – GUESTROOM & CORR. (WALL COVERING)	1-10-95	15-3-96	22
B1840 –	ID – PKG2 – GUESTROOM & CORR. (CARPET)	1-10-95	10-3-96	22
B1825 –	ID – PKG3 – GUESTROOM & CORR. (CEILING)	24-5-95	8-3-96	40
B1830 –	PKG4 – GUESTROOM & CORR (MILLWORK)	30-5-95	15-3-96	40



NO ALARM	DESCRIPTION OF WORK	B. START	B. FINISH	DURATION (WEEKS)
		A. START	A. FINISH	
B1830 –	ID – GUESTROOM & CORR (MILLWORK (P.C. SUM)	30-5-95	16-3-96	40
M1000	SANITARY FITTINGS INSTALLATION	9-5-95	6-8-95	13
M3000 –	HOT/COLD WATER PLUMBING & SANITARY SERVICES	19-8-94	14-2-96	75
M0100 –	ELECTRICAL: TEL. PA. MATV. SEC SYSTEM & BEDSIDE PANEL	16-9-94	19-3-96	76
M0290 –	AIR-CON & VENTILATION SERVICES	15-11-94	24-3-96	67
M0300 –	FIRE PROTECTION SERVICES & LPG PIPING	15-11-94	24-3-96	67
M1200 –	LIFT SERVICES	4-8-95	15-1-96	23
M0400 –	BAS	5-11-94	24-3-96	67
M0400	STEAM BOILERS & PIPING	2-5-95	30-7-95	13
M1050 –	LIGHTNING	5-3-96	26-3-96	3
M5000 –	GONDOLA	19-11-95	17-1-96	5
M3000 –	LINEN CHUTE	11-8-95	24-8-95	2
M6000 –	LAUNDRY EQUIPMENT	1-11-95	28-11-95	4
M7000 –	KITCHEN EQUIPMENT	1-11-95	28-11-95	4
B3000 –	SURFACE WATER DRAINAGE	15-7-95	28-8-95	6
B3000 –	FOUL DRAINAGE & SEWERAGE	15-7-95	28-8-95	6

NO ALARM	DESCRIPTION OF WORK	B. START	B. FINISH	DURATION (WEEKS)
		A. START	A. FINISH	
B3005 –	SEWERAGE TREATMENT PLANT	29-8-95	27-9-95	4

NO ALARM	DESCRIPTION OF WORK	B. START / A. START	B. FINISH / A. FINISH	DURATION (WEEKS)
B3005 –	SEWERAGE TREATMENT PLANT	29-8-95	27-9-95	4
B3010 –	WATER RETICULATION	1-8-95	25-9-95	6
B3015 –	BWIC WITH INB S/STATION	1-8-95	25-9-95	6
B3100 –	ROADWORK	28-9-95	11-11-95	4
B3020 –	GENERAL SITE WORKS	1-11-94	19-3-94	1
B3500 –	LANDSCAPING – HARD & SOFT	20-2-94	20-3-94	4
Y1000 –	SECTIONAL CLEARING & CLEANING	12-12-95	1-1-94	3
Y1003 –	SECTIONAL HANDING OVER (LOWER GD.FL. – MEZZ.FL.)	2-1-96	1-2-94	-
Z1000 –	CLEARING & CLEANING FINAL CLEARING & CLEANING	27-3-96	1-4-96	1
Z1005 –	COMPLETE & HANDOVER	2-4-96	2-4-96	



APPENDIX G

DOCUMENT NO:
PAGE:
DATE:

ABC BUILDER
XYZ PROJECT

ABC BUILDER
XYZ PROJECT
INSPECTION AND TEST PLAN

DOCUMENT NO:
PAGE:
DATE:
REVISION:

TRADE: SUB STRUCTURE AND SUPER STRUCTURE WORKS (R.C.)			LEGEND: ○ checked by * confirmed by # approved by							
			CONTRACTOR				CONSULTANT			
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
1.	Setting out.	Surveyor shall carry out site setting out works by referring to the control points set up in accordance with the contract drawings. As specified in the contract document.		○	*				#	
2.	Check formwork.	(a) Formwork must be oiled before erection. (b) Ensure correct dimension and check verticality of columns and alignments of beams and levels and evenness of slab formwork. (c) Seal all gaps and holes. (d) Old formwork which has deteriorated must be replaced. (e) Ensure formworks are well supported, secure and clean. (f) As specified in the contract document.	○	○	*				#	
3.	Check reinforcement.	Ensure correct size, length, number and position of bars and mesh as per drawing. As specified in the contract document.	○	○	*				#	
4.	Check cover to reinforcement.	According to structural drawings. Ensure sufficient spacer used. As specified in the contract document.	○	○	*				#	

ABC BUILDER
XYZ PROJECT
INSPECTION AND TEST PLAN

DOCUMENT NO:
PAGE:
DATE:
REVISION:

TRADE: SUB STRUCTURE AND SUPER STRUCTURE WORKS (R.C.)

LEGEND: ○ checked by
* confirmed by
# approved by

ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
5.	Check all M&E Services before concreting.	Ensure Rain Water Down Pipes are installed and protected.								
		Ensure M&E services box-out or pipe sleeves (penetration through beams or slabs) are provided.	○	○	*			*	#	
		As specified in the contract document.		○	*				#	
6.	Check concreting level	Marking on the sides of the formwork must be checked with a dumpy level.		○	*				#	
		Ensure sufficient marking for concreting levels.								
		As specified in the contract document.								
7.	Check concrete used.	(a) Refer to BQ specification for concrete grades used.								
		(b) Do slump test to check workability.								
		(c) Make test cubes for strength test at 7th & 28th days.		○	*				#	
		As specified in the contract document.								

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TRADE: SUB STRUCTURE AND SUPER STRUCTURE WORKS (R.C.)

LEGEND: ○ checked by
* confirmed by
# approved by

ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
8.	Check concrete source.	For ready-mixed concrete: (a) Obtain design mix for the grades specified. (b) Do trial mixes. (c) Carry out concrete cube test at 7th & 28th days. As specified in the contract document.		○	*				#	
9.	Ensure concrete is agitated (spin concrete drum) before discharged from truck and before poured in place.	Time limit between batching and placement is 2 hours with agitator and 1/2 hour without agitator. As specified in the contract document.	○	○	*				#	
10.	Ensure concrete is properly vibrated once it is poured in place.	Ensure there are at least 2 vibrators, 1 on standby during concreting. As specified in the contract document.	○	○	*				#	
11.	Ensure proper curing is done.	For at least 3 consecutive days. As specified in the contract document.	○	○	*				#	
12.	Dismantling of formwork.	As specified in the contract document.	○	○	*				#	

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TRADE: ROAD WORK

LEGEND: ○ checked by
* confirmed by
\# approved by

ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
1.	Approve of material and design mix.	As specified in the contract document.			○	*			#	#
2.	Setting out level and alignment.	As specified in the contract document.	○	○	*				#	
3.	Excavation/backfilling to formation on level.	As specified in the contract document. Backfilling to be carried to in layer and compacted to required density. Conduct field density test. Testing result to be filled in standard form.	○	○	*				#	
4.	Laying of sub base.	In accordance to the specification. Ensure thickness as per drawing. Compaction as required prior to subsequent laying. As specified in the contract document.	○	○	*				#	
5.	Laying on road base.	In accordance to the specification. Ensure thickness as per drawing. Compaction as required prior to subsequent laying. As specified in the contract document.	○	○	*				#	

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TRADE: ROAD WORK			LEGEND: ○ checked by * confirmed by # approved by							
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
6.	Spray prime coat.	As specified in the contract document. To spray evenly at the specified rate of spraying. Ensure the surface is dry, clean and free of loose material.	○	○	*				#	
7.	Laying of asphaltic binder course.	In accordance to the specification and refer to work instruction as specified in the contract document.	○	○	*				#	
8.	Core test to be carried out.	As specified in the contract document.	○	○	*				#	

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TRADE: DOOR, WINDOW AND IRONMONGERY

LEGEND: ○ checked by
* confirmed by
# approved by

ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
1.	Submits sample/shop drawing for approval.	As required in the specification.			○	○	*			#
2.	Material delivered to site.	Provide protection to the delivered material. As specified in the contract document.		○	*		#			
3.	Contractor to measure opening provided at site for windows and doors.	To check prior to fabrication and any deviation to the specified size to be reported to S.O.		○	○		*			#
4.	Fix sub frame in position.	To fix sub frame before plastering, check alignment with level before bolting in place. As specified in the contract document.	○	○	*		#			
5.	Fix frame in position.	Check defect on the frame, if any, rectify or reject.	○	○	*		#			
6.	Install door/window panel.	As specified in the contract document.	○	○	*		#			
7.	Install ironmongery.	As specified in the contract document.	○	○	*		#			

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TRADE: TILING WORKS (WALL/FLOOR)

LEGEND: ○ checked by
* confirmed by
\# approved by

ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
1.	Send sample for approval.	Within 1 month from commencement of work. Ensure that only approved materials are used at site. As specified in the contract document.			○	○	*			#
2.	Check surface appearance of tiles when tiles are delivered to site.	Colour tone, crack, wasp, crazing and bubble to be rejected. As specified in the contract document.	○	○	*		#			
3.	Check dimension of tiles.	As per drawing. Tolerance for width and length +/– 1%, for thickness +/– 10%. As specified in the contract document.	○	○	*		#			
4.	Soak tiles before laying.	To be soaked overnight. As specified in the contract document.	○	○	*		#			
5.	Check the bonding mortar thickness and ensure enough mortar is applied before laying.	As stated in the specification. As specified in the contract document.	○	○	*		#			

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TRADE: TILING WORKS (WALL/FLOOR)			LEGEND: ○ checked by * confirmed by # approved by							
			CONTRACTOR				CONSULTANT			
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
6.	Lay tiles to fall.	(a) Gradient of floor tiles to floor trap as per detail drawings. Tolerance +/– 3 mm. (b) For wall tiles, to get vertical alignment, tolerance +/– 3 mm. As specified in the contract document.	○ ○	○ ○	* *		# #			
7.	Check the size of joints between tiles.	Ensure size of joint is consistent, check detail drawings for joint sizes. As specified in the contract document.	○	○	*		#			
8.	Check pointing.	For wall tiles to be white cement and for floor tiles to be original cement. As specified in the contract document.	○	○	*		#			
9.	Check evenness of tiles.	Use 1.2 m long ruler to place on the tile surface and measure the gap. Tolerance for gap should be less than 3 mm. As specified in the contract document.		○	*		#			
10.	Detail procedure.	As specified in the contract document.		○	*		#			

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TRADE: PLASTERING WORKS			LEGEND: ○ checked by * confirmed by # approved by							
			CONTRACTOR				CONSULTANT			
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
1.	Preparation for plastering.	At least 3 days after the completion of brickwall. As specified in the contract document.	○	○	*		#			
2.	Clean surface.	The surface shall be cleaned and wetted before plastering. As specified in the contract document.	○	○	*		#			
3.	Plaster mix.	1 part of cement to 6 parts of sand, by volume. As specified in the contract document.	○	○	*		#			
4.	Alignment.	Set out alignments on brickwall surface before commencement of plastering works.	○	○	*		#			
5.	Apply the first coat.	Averaging 10 mm thick applied to the area having greater deviation from the intended finish surface. As specified in the contract document.	○	○	*		#			

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TRADE: PLASTERING WORKS			LEGEND: ○ checked by * confirmed by # approved by							
			CONTRACTOR				CONSULTANT			
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
6.	Apply finishing coat.	Averaging 10 mm applied over the whole area to finish the plane and shape. Steel trowel on internal surface and wood float on external plaster. As specified in the contract document.	○	○	*		#			
7.	Plastering joint.	Vertical or Horizontal plastering joint shall be straight.	○	○	*		#			
		As specified in the contract document.	○	○	*		#			
8.	Reinforcement between r.c. & brickwork interface.	At the interface between r.c. structures and brickworks, reinforcement in the form of exmet or Hi-rib shall be provided to prevent cracking due to differential shrinkage.		○	*		#			
				○	*		#			

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TRADE: COMMON BRICKWALL

LEGEND: ○ checked by
* confirmed by
# approved by

ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
1.	Send samples of all the materials to be used for approval.	Only approved materials will be allowed to be used. As specified in the contract document.			○	*				#
2.	Check cracks, chipped bricks, shape and dimension of brick.	According to approved sample. As specified in the contract document.		○	*		#			
3.	Check positions of brick wall.	To set out brickwall positions according to drawings. Any remedial work to r.c. structure to be carried out prior to brick laying. As specified in the contract document.	○	○	*		#			
4.	Check verticality of brickwall.	Ensure bricks are laid vertically by using a plumb or spirit level. As specified in the contract document.	○	○	*		#			
5.	Check dowel bars and stiffeners.	Ensure dowel bars are installed at r.c. wall/columns face adjoining brickwall. Stiffeners shall be installed in accordance with drawings.	○	○	*		#			
6.	Wet the bricks before laying.	All bricks must be thoroughly wet. As specified in the contract document.	○	○	*		#			
7.	Wet & clean r.c. surface.	Ensure surface are freed from grease/dirt before laying. As specified in the contract document.	○	○	*		#			

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TRADE: COMMON BRICKWALL			LEGEND: ○ checked by * confirmed by # approved by							
			CONTRACTOR				CONSULTANT			
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
8.	Mix mortar thoroughly before water is added.	1 : 3 cement mortar. As specified in the contract document.	○	○	*		#			
9.	Install damp proof course.	Comply to B.S. 6398 and specification. As specified in the contract document.	○	○	*		#			
10.	Brick Joints.	Maintain joints evenly. Joint to be raked out to a depth of 13 mm to receive plastering. No straight joints are allowed. As specified in the contract document.	○	○	*		#			
11.	Ensure to use exmet reinforcement.	64 mm wide × 22 gauge 'exmet' reinforcement at every fourth course, for all half brickwalls and partitions. As specified in the contract document.	○	○	*		#			

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TRADE: FLOOR HARDENER (CAR PARK FLOOR)

LEGEND: ○ checked by
* confirmed by
# approved by

ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
1.	Sample submission.	Submit samples for approval. As specified in the contract document.			○	*			#	
2.	Material.	Non-metallic floor hardener shall be Sika 'Chapdur Premix' as specified in BQ. As specified in the contract document.			○	*			#	#
3.	Strength & Durability.	(a) Compressive strength of over 80 N/mm^2 @ 28 days. (b) Tensile strength of 10 N/mm^2 @ 28 days. (c) Wear rating to be below 6 $cm^2/50\ cm^2$. (d) Hardness of aggregates to be not less than Moh Scale. As specified in the contract document.			○ ○	* *			# #	# #
4.	Dosage and application.	To use at the rate of 4 kg/m^2 laid monolithically to freshly floated, level concrete all done in accordance with the manufacturer's specification. As specified in the contract document.		○	○	*		#	#	
5.	Mixing.	1 : 2, i.e. 1 part of Portland cement to 2 parts of floor hardener aggregates by weight. As specified in the contract document.		○	○	*			#	#

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TRADE: FLOOR HARDENER (CAR PARK FLOOR)			LEGEND: ○ checked by * confirmed by # approved by							
			CONTRACTOR				CONSULTANT			
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
6.	Protection.	The finished floor shall not be used for 24 to 48 hours for foot traffic. Light traffic after 7 days. Normal traffic after 28 days. As specified in the contract document.		○	○	*			#	#
7.	Curing.	Apply 1 coat of curing compound approved as directed by the manufacturer's specification. Additional curing with water or wet gunny sacks may be necessary. As specified in the contract document.		○	○					#
8.	Warranty Period.	Upon completion, Contractor shall provide a 10-year warranty for its performance. As specified in the contract document.			○	*			#	

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TRADE: SCREEDING

LEGEND: ○ checked by
* confirmed by
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ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
1.	Check cement and sand mixed ratio.	Mixing shall be one (1) part of cement to mix with three (3) parts of sand in volume (1 : 3). As specified in the contract document.	○	○	*					#
2.	Check screeding for various floor finishes.	(i) 40 mm thick to receive ceramic tiles (wood trowel). (ii) 40 mm thick to receive homogeneous tiles (wood trowel). (iii) 40 mm thick to receive marble tiles (wood trowel). (iv) 40 mm thick to receive quarry tiles (wood trowel). (v) 40 mm thick to receive vinyl tiles (steel trowel). (vi) 40 mm thick to receive carpet (steel trowel). (vii) 25 mm thick as base screed to waterproofing system (wood trowel). (viii) 18 mm thick paving (steel trowel) As specified in the contract document.	○	○	*					#

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TRADE: SCREEDING			LEGEND: ○ checked by * confirmed by # approved by							
			CONTRACTOR				CONSULTANT			
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
3.	Preparation.	Ensure concrete surface clean and free from dust and dirt before applying cement slurry. Check the required screed thickness with reference to the FFL and concrete floor level. Fix mortar level pegs at 1200 mm centres commencing 300 mm from two vertical edges. Mix cement and sand thoroughly before water is added to it. As specified in the contract document.	○	○	*		#			
4.	Tolerances.	Where screeds are laid to falls, no place should the minimum thickness be less than 13 mm. Thickness of screed shall not be less than 13 mm on any surfaces. As specified in the contract document.	○	○			*		#	
5.	Curing.	Curing is important to ensure screed gains initial strength before drying shrinkage which induces the risk of cracking. The screed should be covered with polythene sheet at least 3 days after laying. As specified in the contract document.	○	○			*		#	

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TRADE: GLAZING			LEGEND: ○ checked by * confirmed by # approved by							
			CONTRACTOR				CONSULTANT			
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
1.	Glass generally.	All glass shall be obtained from the approved manufacturers complying with the requirements of B.S. 950. They shall be free from cracks, bubbles, waves, scratches or other defects. Exposed edges shall be rubbed down with corborundum stone and finished smooth. As specified in the contract document.		○	*					#
2.	Clean sheet glass.	Ordinary glazing – weight and thickness refer to contract specification and drawings. As specified in the contract document.		○	*					#
3.	Obscure glass.	It shall be plain rolled, sand blasted and to be cut and glazed so that the direction and face of the pattern is the same throughout. For all windows and fixed glass panels for bathroom, W.C. and internal door opening. As specified in the contract document.		○	*					#
4.	Wired glass.	It shall be Georgian Wired glass and where required to be 'lined up'. It is to be cut so that the wires in adjacent panes line up horizontally and vertically. As specified in the contract document.		○	*					#

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ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
5.	Tinted glass.	Tinted glass shall be float glass with thickness and colour to be tinted as per contract specification or Architect's detail drawings. As specified in the contract document.		○	*					#
6.	Mirror.	Mirror shall be of first quality polished plate 'Pilkington' or equal and approved glass and shall be fixed with chromium-plated dome-headed screw. As specified in the contract document.		○	*					#
7.	Putty.	Putty for glazing in wood sashes shall be approved (B.S. 544) tropical putty and for glazing to metal, an approved patent mastic shall be used. Glass must be well bedded and back puttied. All putty or mastic to be carefully trimmed or cleaned off. As specified in the contract document.		○	*			#		
8.	Rebates.	All timber rebates to receive glazing shall be cleaned prime and painted with one coat of oil paint before glazing. Metal rebates to receive glazing shall be cleaned and primed before glazing. As specified in the contract document.		○	*			#		

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ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
9.	Glazing work.	All doors, windows, etc. shall be glazed as shown on drawings. All glass shall be well bedded and carefully back puttied, springged in and fixed with beads for timber rebates and pegged or secured with spring clips for metal rebates and puttied the front neatly. Care shall be taken to ensure that the putty does not appear above the sight lines. All panes for adjustable louvred windows shall be properly secured to housing clips. Refer to Section 2/80–2/83 of contract specification for detail work descriptions. Refer to shop drawings for detail illustration. As specified in the contract document.	○	○	*			#		

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TRADE: WATERPROOFING SYSTEM – FLAT ROOF			LEGEND: ○ checked by + confirmed by # approved by							
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
1.	Waterproofing System.	'Hitchins Traffiguard' waterproofing system as specified in the contract document. The system shall consist of the following: (a) A layer of 1 : 4 @ 25 mm base screed laid to falls and crossfalls. (b) A layer 50 mm thick 'AIS–TEXSA' lightweight concrete thermal insulation, and (c) Five (5) layers of Traffiguard system as follow: (i) Primer – fills hairline and minor cracks. (ii) Body coat – acrylic polymer gel for strengthening the system. (iii) Fibre glass mat – Glass fibres to reinforce the resistance to wear and tear. (iv) Second Body Coat – Further strengthen the system. (v) Topcoat – added protection and an attractive surface finish.			○	+				#

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TRADE: WATERPROOFING SYSTEM – FLAT ROOF			LEGEND: ○ checked by * confirmed by # approved by							
			CONTRACTOR				CONSULTANT			
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
2.	Application.	As specified in the contract document. (a) The concrete roof slab should be screeded to fall finished smooth to receive lightweight concrete insulation. (b) Dilute Traffiguard with water (4 : 1 in volume) and apply primer coat at coverage of 9 m^2/l. Allow to dry. (c) Apply one bodycoat over primer at a coverage of 2.5 m^2/l and while it is still wet, unroll fibreglass mat over it. (d) Immediately apply a second bodycoat over fibreglass mat at a coverage of 2.5 m^2/l ensuring that the fibreglass mat is fully immersed with Traffiguard gel. Leave till dry. (e) Apply topcoat at a coverage of 1.5 m^2/l. Refer to manufacturer's instructions and technical data.	○	○	*				#	
3.	Warranty.	On completion, the contractor shall provide a guarantee of ten (10) years against any failure or leakages due to workmanship or materials. As specified in the contract document.	○		○	*				

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TRADE: WATERPROOFING SYSTEM – FOR PLANTER BOXES, TOILET FLOORS, BATHROOMS, KITCHENS AND AREA WITH VINYL TILE FLOORS			LEGEND: ○ checked by * confirmed by # approved by							
			CONTRACTOR				CONSULTANT			
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
1.	Waterproofing System.	'Hitchin Vandex and Vandex premix cementations'. As specified in the contract document. Refer to manufacturer's instructions.			○	*				#
2.	Application.	In accordance to specification. Vandex super at 1.00 kg/m^2 applied in one slurry coat to hardened, clean concrete surface by means of masonry brush; or Dry sprinkle and travel – applied to fresh concrete when it has reached initial set. Where two (2) layers of Vandex are demanded, the second layer must be applied while the first layer is still green but sufficiently set, so that it is not drawn off while applying the second coat. As specified in the contract document.	○	○	*				#	
3.	Warranty.	On completion, the contractor shall provide a guarantee of ten (10) years against any failure or leakages due to workmanship or materials. As specified in the contract document.	○		○	*				

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TRADE: ALUMINIUM WORK			LEGEND: ○ checked by * confirmed by # approved by							
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ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
1.	Material.	All aluminium members and material unless otherwise specified must be extruded. Aluminium section shall have a minimum thickness of 1.2 mm All aluminium extruded sections unless otherwise specified shall be an approved Architectural aluminium alloy of either B6063 or KE-45 or its equivalent conforming to the requirements of B.S. 1470–1475: 1972. Hardness shall be T-5 conforming to B.S. 1474. All joints in frames, corner junctions or intersection shall be electrically welded. As specified in the contract document.	○	○	*					#
2.	Submission	(i) Submit name of aluminium company for approval.	○	○	*					#
		(ii) Submit sample of material for approval.	○	○	*					#
		(iii) Submit shop drawings for approval.	○	○	*					#
		As specified in the contract document.								

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3.	Fixing.	Fixing screws, nuts, bolts, rivets and other fastening devices shall be aluminium, stainless steel or cadmium-plated to the Architect's approval. All fixing anchors, brackets, attachment used in the erection of windows and doors shall be stainless steel, galvanised steel or zinc or zinc-coated steel and be of sufficient gauge or size to withstand any loading, and stresses. As specified in the contract document.	○	○	*					#

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			SUB CON.	SUPER-VISOR	SITE ENG.	PROJ MGR.	ARCH C.O.W.	M&E C.O.W.	R.E.	S.O.
4.	Aluminium Window.	To fix aluminium frame (i) Check type of fasteners used, i.e., straps anchor bolts, brackets, lugs, etc. according to drawings and specification. (ii) Wrap aluminium members with tapes to prevent scratches, cement mortar and paint splashes and dampness. (iii) Set plumb, square level and check alignment with surrounding work before bolting in place. Infill with cement mortar around frame. Plastering work may commence after the above is completed. As specified in the contract document. After painting, install inner panels/glazing. (i) Check dimension of inner panels. (ii) Check each inner panel members are rigidly assembled. Reject loose members. (iii) Ensure safety stopper and locking devices are securely installed. As specified in the contract document.	○ ○	○ ○	* *				# # 	

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			NSC	M&E S/VISOR	M&E COOR.	PROJ MGR.	M&E C.O.W.	M&E R.E.	R.E.	S.O.
	Noise & Vibration Control									
1.	Vibration Isolation.	Spring Vibration mountings as per contract specification.	○		*		#			
2.	Noise Control.	Noise control as per contract specification.	○		*		#			
3.	Plantroom Noise and Vibration control.	As per contract specification.	○		*		#			
4.	Wall sound insulation Wall/Panel.	Acoustic insulation wall/panel shall be as per specification contract.	○		*		#			
5.	Wall sound absorption panel.	Sound absorption panel shall be as per contract specification.	○		*		#			
	Corrosion Protection & Paintings									
1.	Contact between dissimilar metals.	Direct contact between dissimilar metals shall be as per contract specification.	○		*		#			
2.	Fastenings.	Fastenings shall be as per contract specification.	○		*		#			
3.	Welding of corrosion protection surfaces.	All welding joint shall be as per contract specification.	○		*		#			
4.	Metal surface in contact.	Surface of metal work shall be as per contract.	○		*		#			

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			NSC	M&E S/VISOR	M&E COOR.	PROJ MGR.	M&E C.O.W.	M&E R.E.	R.E.	S.O.
5.	Paints and paint material.	All paint and material shall comply to specification.	○		*		#			
6.	Painting practices.	All painting shall comply to contract specification.	○		*		#			
7.	On site painting.	As specified in the contract document.	○		*		#			
8.	Equipment and pipework identification.	All equipment, pipework and components of the installation shall be as per specification.	○		*		#			
	Ductwork and Air Distribution									
1.	Dimension.	All ductwork dimensions shall comply to specification.	○		*		#			
2.	Material.	Material shall comply to specification.	○		*		#			
3.	Duct construction.	Duct construction shall comply to specification.	○		*		#			
4.	Handhole covers.	All handhole cover shall comply to specification.	○		*		#			
5.	Splitter dampers.	As specified in the contract document.	○		*		#			
6.	Hanger for duct.	Hanger shall be fabricated to comply to contract specification.	○		*		#			
7.	Flexible Ducting.	Flexible ducting shall comply to contract specification.	○		*		#			

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8.	Balancing of air quantities.	The air quantities shall be as per contract specification.	○		*		#			
9.	Shut off and Volume control damper.	As specified in the contract document.	○		*		#			
10.	Insulation of ductwork.	As specified in the contract document.	○		*		#			
11.	Air Terminal Unit.	As specified in the contract document.	○		*		#			
	Pipework									
1.	Operating pressure in piping system.	As specified in the contract document.	○		*		#			
2.	Piping Materials.	Pipe to be as per contract specification.	○		*		#			
3.	Arrangement and Layout of Piping.	Piping layout shall comply to contract specification.	○		*		#			
4.	Connection to pump.	As specified in the contract document.	○		*		#			
5.	Pipe Support.	Steel piping shall be supported by clips, rollers or hangers. Shall comply to contract specification.	○		*		#			
6.	Piping Installation.	Piping Installation shall comply to specification.	○		*		#			

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7.	Valve, Stairnes, pressure and vacuum gauges, dial thermometer gauges, bend and condensate drain.	Supply and installation shall comply to specification.	○		*		#			
	Electrical									
1.	Power Supply.	Power supply to the installation shall be 415 volts, 3 phase four wire, 50 cycle A.C. and 240 V, 50 cycles one phase.	○		*		#			
2.	Starter panel for air-conditioning & ventilation system equipment.	Supply and installation starter panel for exhaust or ventilation fans and air-conditioning unit shall comply to contract specification.	○		*		#			
3.	MCCB, contractors, Thermal overlaid relays rotary control selector switches, push-button control switch, indicating lights, auxiliary relays terminal block, ammeter motor, wiring, PVC cables MICC, isolating switches, motor starters.	As per contract specification.	○		*		#			

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	Plant & System Controls									
1.	Chiller Plant Control.	The start-up of the chilled water pump and chiller shall be effected by the BIS. As specified in the contract document.	○		*		#			
2.	Cooling Tower Fans Control System.	The number of cooling tower fans to run are designed to match the numbers of chillers in operation as per contract specification.	○		*		#			
3.	Chilled Water make-up & Expansion Tank Alarms	As specified in the contract document.	○		*		#			
4.	Cooling Tower Make-up Tank Alarms.	As specified in the contract document.	○		*		#			
5.	Chilled Water By-pass Control.	As specified in the contract document.	○		*		#			
6.	Chilled Water Flow in AHU Cooling Coils.	As specified in the contract document.	○		*		#			
7.	Air Handling Unit Fan Control.	As specified in the contract document.	○		*		#			
8.	Control of Staircase Pressurization Fan.	As specified in the contract document.	○		*		#			

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9.	Control of Lobbies Pressurization Fan.	As specified in the contract document.	○		*		#			
10.	Control of Smoke Extract Fan.	As specified in the contract document.	○		*		#			
11.	Ventilation System Controls.	As specified in the contract document.	○		*		#			
	Fan									
1.	Fan Performances, Testing and Noise.	As specified in the contract document.	○		*		#			
2.	Centrifugal Fan.	As specified in the contract document.	○		*		#			
3.	Axial Flow Fan.	As specified in the contract document.	○		*		#			
	Pump									
1.	Performance and Testing.	As specified in the contract document.	○		*		#			
2.	Pump in parallel.	As specified in the contract document.	○		*		#			
3.	Balancing and Vibration Prevention.	As specified in the contract document.	○		*		#			
4.	Pump Components Material.	As specified in the contract document.	○		*		#			
5.	Pump Construction.	As specified in the contract document.	○		*		#			

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	Air Handling Units									
1.	Proprietary Air Handling Units.	Air handling unit to be installed in the air-conditioning system shall comply to contract specification.	○		*		#			
2.	Built-up Air Handling Unit.	Built-up air handling units are installed as per contract specification.	○		*		#			
	Chiller									
1.	Mounting of Chillers.	As specified in the contract document.	○		*		#			
2.	Centrifugal Chillers.	As specified in the contract document.	○		*		#			
3.	Water Cooler.	As specified in the contract document.	○		*		#			
4.	Water Cooled Condenser.	As specified in the contract document.	○		*		#			
5.	Water Relief Valve.	As specified in the contract document.	○		*		#			
6.	Purge System.	As specified in the contract document.	○		*		#			
7.	Refrigerant.	As specified in the contract document.	○		*		#			
8.	Instrument Panel.	As specified in the contract document.	○		*		#			

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9.	Compressor Motor Starter & Control.	As specified in the contract document.	○		*		#			
10.	Reciprocating Chiller.	As specified in the contract document.	○		*		#			
	Cooling Tower									
1.	Cooling Tower Performance.	As specified in the contract document.	○		*		#			
2.	Fibre-Glass Reinforced Polyester (FRP) Tower.	As specified in the contract document.	○		*		#			

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TRADE: ELECTRICAL H.T. & L.T. TELEPHONE, PA, MATV, BEDSIDE PANEL AND SECURITY SYSTEM

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ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			NSC	M&E S/VISOR	M&E COOR.	PROJ MGR.	M&E C.O.W.	M&E R.E.	R.E.	S.O.
	A. Electrical H.T. and L.T. System									
1.	High Voltage Switchgear.	The switchgear shall be of metal clads design, extendable, front controls, vermin and dustproof for indoor use. The panels shall be fully compartmentalised. The rating shall be 350 MVA, 11 KV 3 phase and 50 HZ. The busbar shall comply with B.S. 159 in terms of rating, connection and clearance between busbars. Other equipment or components for these H.V. switchgear must also comply to contract specification.	○		*		#			
2.	Distribution Transformers.	The details of the transformers shall be as indicated in the drawings, schedules and contract specification.	○		*		#			
3.	Main Switchboard.	Main switchboard shall either be of the cubicle type and be totally enclosed, heavy-duty, self-contained, flush–fronted and suitable for both front and back access, bottom and top cable entries and shall comply to contract specification.	○		*		#			
4.	Reticulation Mains and Submains.	The reticulation main and submains cables, busbar trunking bud duct system, installation must comply to contract specification.	○		*		#			

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5.	Distribution Board and Meter Panels.	Meter panels and distribution boards for lighting and power shall be supplied and installed as shown on the drawing and comply to contract specification.	○		*		#			
6.	General Lighting & Power Requirements.	All the general lighting & power supply to the building must comply to contract specification.	○		*		#			
7.	Light Fittings.	Light fitting shall be supplied and installed complete with lamps, diffusers, control gear, power factor correction equipment and suitably-sized connectors. The materials used and quality of finish of all light fittings shall comply with the contract specification.	○		*		#			
8.	Earthing.	All non-current carrying metal parts, including metal parts liable to transmit a potential including earth potential but not forming part of the electrical installation shall be earthed in accordance to the recommendation of the I.E.E. regulation, 15th Edition and shall comply to contract specification.	○		*		#			

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	B. Lighting Protection System									
1.	Protection of structures against lightning.	The lightning protection system for the buildings shall comply with the recommendations of the British Standard code of practice CP 326:1965 and the additional requirements as contract specifications.	○		*		#			
2.	Air Terminal System.	The air-terminal shall be an early streamer emission air terminal designed to create an early initiation of the upward connecting leader as stated in the contract specification.	○		*		#			
3.	Earthing	The earthing system shall have a maximum resistance of 5 ohm in dry weather condition as per stated in the contract specification.	○		*		#			
4.	Bonding of Structure.	All external metallic frames or structures, underground ducts and metal piping shall be effectively bonded to the lightning protection earthing system as per contract specification.	○		*		#			
5.	Conductor Support.	All supports and security devices shall be galvanised or similarly protected from corrosion and as recommended by the manufacturer as stated in the contract specification.	○		*		#			

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	C. Cable Conduits, Trays, Trunking and Ducts									
1.	Conduits.	As specified in the contract document.	○		*		#			
2.	Cable Trays.	The cable trays for main, submains, etc. must be installed according to contract specification.	○		*		#			
3.	Metal trunking.	Metal trunking shall generally be fabricated from mild steel sheet and comply to contract specification.	○		*		#			
4.	Colour Coding.	Refer to contract specification.	○		*		#			
	D. Standby Diesel Generator Installation									
1.	Standby Generator.	As specified in the contract document.	○		*		#			
2.	Atmospheric Conditions.	As specified in the contract document.	○		*		#			
3.	Engine.	As specified in the contract document.	○		*		#			
4.	Alternator.	The alternator shall be directly coupled to diesel engine through bolted flanges as per contract specification.	○		*		#			

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5.	Starting System.	The engine's electric starting system shall be provided as per contract specification.	○		*		#			
6.	Cooling System.	The engine shall be water cooled as stated in the contract specification.	○		*		#			
7.	Exhaust System.	Refer to contract specification.	○		*		#			
8.	Fuel System.	As specified in the contract document.	○		*		#			
9.	Anti-Vibration Mountings.	The whole generator set shall be provided with anti-vibration mounting arrangement giving a minimum isolation efficiency of 95%, spring type anti-vibration mountings shall be fitted with levelling and adjustment.	○		*		#			
10.	Auto Mains Failure (AMF) And Generator Control Board.	The above may be a common board fabricated from 14SWG floor standing cubicle type and installed complete with all necessary equipment for engine and alternator protection and Control as per contract specification.	○		*		#			
11.	Tools.	Tools necessary for normal maintenance by user shall be provided.	○		*		#			
12.	Spare Parts Lists.	A comprehensive spare parts list shall be provided to ensure accurate and easy ordering of parts.	○		*		#			

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13.	Danger Signs and First Aid Chart.	As specified in the contract document.	○		*		#			
14.	Earthing.	All non-current carrying metal parts shall be bonded effectively to earth as mentioned in the contract specification, Section 11.19, Page 11.9.	○		*		#			
15.	Noise Control.	Refer to contract specification.	○		*		#			
	E. External Lighting									
1.	Air Crafted Obstruction Light.	These light fittings shall be located at the highest point in the building and shall be complied with wiring and automatic switching arrangement as per contract specification.	○		*		#			
2.	Compound Lighting.	The light fitting shall be weatherproof as stated in the contract specification.	○		*		#			
3.	Floodlighting.	As specified in the contract document.	○		*		#			
4.	Security Lighting.	These fittings shall be as described in the schedule of light fittings and as per contract specification	○		*		#			

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	F. Telephone Services Installation									
1.	Telephone works.	The scope of work relevant to the proposed telephone service installation comprises the supply, delivery and installation of all necessary materials and equipment including all minor and incidental works must comply to contract specification.	○		*		#			
2.	Excavation Works.	The excavation works for telephone services must comply to requirement in contract specification.	○		*		#			
3.	Underground Ducts.	Telephone reticulation ducts and incoming ducts shall be PVC or galvanised iron ducts/pipes as indicated on the drawings and also refer to the contract specification.	○		*		#			
4.	Manholes.	Refer to contract specification.	○		*		#			
5.	Telephone Cables.	Refer to contract specification.	○		*		#			
6.	Telephone Distribution Boards.	DP boxes shall be of approved make and provided with approved terminal blocks and be lockable.	○		*		#			

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7.	Main Distribution Frame (MDF).	The MDF shall be provided with wire channels or guide leading each pair of wire for termination to facilitate easy tracing of jumper wires as stated in the contract specification.	○		*		#			
8.	Cable Installation.	The cable installation for the telephone services shall comply to the contract specification.	○		*		#			
9.	Telephone Sockets.	Telephone sockets shall be of flush-mounted type unless otherwise specified. It shall be approved by TM. All necessary fixture accessories and mounting plates shall be provided. For the underfloor system, jack-in telephone connection boxes shall be provided.	○		*		#			
10.	Conduit and Trunking Installation.	The conduit and trunking installation shall comply to the contract specification.	○		*		#			
11.	Fire barriers.	Fire barriers approved by Fire Department must be provided at every floor penetration to prevent the spread of fire through telephone riser cables.	○		*		#			

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12.	Earthing.	All cable tray and steel trunkings and conduits must be effectively earthed using earth continuity conductors, copper clad earthing electrodes must be planted at the position suitable on site to the approval of the Architect/Engineer and the earthing shall be less than 5 ohms.	○		*		#			
	G. Beside Control Panel	Colouring and shape must be an attractive design to match the room and interior audit shall be subjected to the interior designer or architect's approval, refer to contract specification.	○		*		#			
	H.Integrated Security System									
1.	Access and Alarm Control System.	The system shall provide comprehensive access/alarm monitoring of the desired areas and flexible in terms of integration and upgrading of the system, as stated in the contract specification.	○		*		#			
2.	Video Multiplexing CCTV System.	The CCTV system shall provide security management and general. Surveillance to premises/area of the building as stated in the contract specification.	○		*		#			

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3.	Video Multiplexer.	The equipment offered shall be of the latest state-of-the-art video multiplexer controller as per contract specification.	○		*		#			
4.	Fixed Lenses.	As specified in the contract document.	○		*		#			
5.	1/2" High sensitivity and High Resolution.	The camera shall be a 1/2" device high sensitivity solid state B/W camera using CCD image sensor, as per contract specification.	○		*		#			
6.	14" High Resolution Colour Monitor.	The monitor shall be a high performance industrial grade colour video monitor with a 14-inch 90-degree precision in-line picture tube as per contract specification.	○		*		#			
7.	Video Time Lapse Recorder (VTLR).	As specified in the contract document.	○		*		#			
	I. Sound & Public Address System	As specified in the contract document.	○		*		#			
1.	Central Control Console.	The central control console shall be housed in a well ventilated cabinet and comply to the contract specification.	○		*		#			
2.	Amplifier.	All the component for the amplifier must comply to the contract specification.	○		*		#			

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3.	Fireman's Handheld Microphone Paging Panel.	As specified in the contract document.	○		*		#			
4.	AM/FM Radio Tuner.	The tuner shall be capable of receiving a high quality AM/FM & VHF transmission and shall be in completely solid state as mentioned in the contract specification	○		*		#			
5.	Compact Disc Player.	The disc player shall be capable of accepting a minimum of 5 CDs at a time. The playing sequence shall be automatic and revert back to the original at the end of the sequence. Technically the CD player shall be matched with the rest of the equipment, e.g. amplifier, speakers, etc. It shall operate on 240 V AC 50 HZ.	○		*		#			
6.	Speakers.	All the speakers include ceiling loudspeaker, box speaker and horn speaker shall be comply to the contract specification.	○		*		#			
7.	Monitor Speaker.	A monitor loudspeaker shall be built into the control cabinet to monitor the outgoing programmes of all music channels as stated in the contract specification.	○		*		#			
8.	Antenna.	The antenna system shall consist of one AM/FM aerial. Refer to contract specification.	○		*		#			

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9.	Loudspeaker Volume Control Complete with Overriding Relay Unit.	As per contract specifications.	○		*		#			
10.	Equipment Rack.	The compact disc player, tuner, pre-amplifier, power amplifiers shall be rack mounted in a standard 19" rack with adequate ventilation and for easy removal from rack for servicing as stated in the contract specification.	○		*		#			
11.	Cabling.	As specified in the contract document.	○		*		#			
	J. MATV Installation	The objective and requirements for the system must refer to the contract specification.	○		*		#			
1.	Antenna.	The head end amplifiers must be as close as possible to the antenna and the specification must refer to the contract specification.	○		*		#			
2.	Amplifier.	As specified in the contract document.	○		*		#			
3.	IF MODULATOR.	As specified in the contract document.	○		*		#			
4.	IF CONVERTER.	As specified in the contract document.	○		*		#			
5.	Video Distribution Amplifier.	As specified in the contract document.	○		*		#			
6.	Blanking Generator.	As specified in the contract document.	○		*		#			

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7.	Character Generator.	As specified in the contract document.	○		*		#			
8.	Coaxial Cable.	As specified in the contract document.	○		*		#			
9.	Splitter Units/Directional Couplers/Tap Off Units.	As specified in the contract document.	○		*		#			
10.	Wall-Recessed MATV Outlet.	The outlet shall be installed at 12 to 14 inches above finished floor level. Blocking capacitors shall be provided for safety isolation. The outlet shall be able to withstand a high voltage test of 2 KV for one minute.	○		*		#			
11.	Booster Amplifier.	As specified in the contract document.	○		*		#			

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	A. Automatic Sprinkler Installation									
1.	Sprinkler Pumps.	Sprinkler pumps shall comply to the contract specification.	○		*		#			
2.	Sprinkler Pump Electric Motor.	The electric motor to be used in this project shall comply to the contract specification.	○		*		#			
3.	Jockey Pump.	The fire contractor shall supply and install jockey or make-up pumps of vertical model to the sprinkler system to maintain pressure in the system as shown on the drawings. Refer to contract specification.	○		*		#			
4.	Sprinkler Stop Control Valves.	Refer to contract specifications.	○		*		#			
5.	Pressure Gauge.	The fire contractor shall supply and install pressure gauges as per contract specification.	○		*		#			
6.	Fire Brigade Inlet.	Fire Brigade Inlet connections shall be supplied and installed as shown on the drawings to enable the Fire Brigade to pump water into the tank by use of their own equipment.								

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7.	Sprinkler Heads.	Contractor shall supply and install approved sprinkler heads as generally indicated on the drawings and as per contract specification.	○		*		#			
8.	Slope of pipes for Drainage.	The fire contractor shall install the sprinkler pipes in such a way that the system can be thoroughly drained. Refer to contract specification.	○		*		#			
9.	Electric Wiring.	The fire contractor shall provide power wiring from panel to motors and a control circuit wiring from the pressure switches in accordance with Section stated. Wiring shall be in accordance with the wiring rules, latest amendments and requirements of the TNB (LLN). Only licensed and registered electrical fire contractors shall be employed. Drawings shall be submitted to the engineer for approval before work commences.	○		*		#			
10.	Water Storage Tank.	Water storage tanks installation shall comply as per contract specifications.	○		*		#			
	B. Horse Reel Installation									
1.	Hose Reel System.	The supply, installation and testing of a fire hose reel system shall comply to specification.	○		*		#			

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2.	Rubber Hose.	The length of rubber hose on the reel shall be 100 ft as per contract specification.	○		*		#			
3.	Construction of the System.	The hose reel components shall be of adequate strength and rigidity as stated in the contract specification.	○		*		#			
4.	Hose Reel.	Refer to contract specification.	○		*		#			
5.	Finish.	All burrs and sharp edges shall be removed and waterways shall have a smooth finish. The exterior of all components shall be rounded and smooth to prevent injury during use. All threaded parts of aluminium alloy components shall be coated with molybdenum disulphide grease.	○		*		#			
6.	Colour Identification.	The sides of the reel shall be signalled red to B.S. colour No. 537.	○		*		#			
7.	Marking.	Every hose reel shall be marked for the information as stated in contract specification.	○		*		#			
8.	Installation.	The installation of the hose reel must refer according to contract specifications.	○		*		#			
9.	Pressure Reduction Valves.	As specified in the contract document.	○		*		#			

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10.	Acceptance Test.	Arrangements shall be made as soon as possible after the installation of the hose reel preferably before the building is occupied for an acceptance test to be carried out by the Fire Brigade.	○		*		#			
	C. West Riser Installation									
1.	Landing Valves.	The landing valves & specification are stated in the contract specification.	○		*		#			
2.	Hose Cradle and Hose.	Supply and install aluminium hose cradle complete with 100 ft of 2–1/2 inch diameter hose and nozzle for wet riser system. The hose cradle shall be mounted in position where wet riser landing valves are located.	○		*		#			
3.	Wet Riser Pumps.	The fire contractor shall supply, deliver and install automatic centrifugal wet riser pumps as per contract specification.	○		*		#			
4.	Wet Riser Jacking Pump.	The fire contractor shall supply and install an automatic in-line jacking pump to maintain system pressure under low flow conditions as stated in the contract specification.	○		*		#			

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	D. Fire Alarm System									
1.	Operation of Fire Indicator Board.	The operation of the fire indicator board shall be automatically instituted as the conditions of initiation occur as stated in the contract specification.	○		*		#			
2.	Fire Indicator Board.	As specified in the contract document.	○		*		#			
3.	Precautions Against Failure.	A distinct visual and audible signal shall be given on the fire indicator board as stated in the contract specifications.	○		*		#			
4.	Alarm Group or Facilities.	The switches and indicating facilities shall be provided for each alarm group or zone. Means shall be provided to enable each switch or indicator to be readily identified as stated in contract specification.	○		*		#			
5.	Battery Test Facilities.	An appropriately rated moving coil ammeter shall be fitted to each fire indicator board to indicate charger output. Refer to contract specification.	○		*		#			
6.	Lamps for Indicator Panels.	Where filament type lamp are used, they shall be either twin metal filament type with bayonet cap or two individual lamps and the voltage applied shall not exceed 80% of the rated voltage of the lamp or lamps. Lamps shall be of long life type (not less than 5000 hours life).	○		*		#			

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7.	Fire Brigade Signalling Transmitter.	The transmitter shall meet the requirements stated in the contract specification.	○		*		#			
8.	Fire Indicator Board Manual Call Points.	A manual call point shall be provided on each fire indicator board and shall be accessible and clearly visible at all times. This call point shall be of the 'break the glass' type and shall be of a type approved by the Local Fire Authority.	○		*		#			
9.	Operating Voltages.	All indicators and other circuits within the fire indicator board shall operate at 24 V, DC. The fire indicator board including all its components shall function satisfactorily at the nominal mains voltage +/– 10% when tested as item stated in the contract specification.	○		*		#			
10.	Battery Charging and Capacity.	The manufacturer of the fire indicator board shall provide information on the basis of the derivation of those combinations of battery charging equipment and batteries that meet the specifications which is stated in the contract specification.	○		*		#			
11.	System Voltage.	Refer to contract specification.	○		*		#			
12.	Protection against earth leakage currents.	Refer to contract specification.	○		*		#			

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13.	Manual Controls.	All manual controls shall be of robust construction, positive in operation and designed and positioned so that accidental operation is prevented. There shall be no control, normally accessible to the user of the equipment which permanently disconnects one or both power supplies. All manual controls shall be clearly labelled.	○		*		#			
14.	Electrical Components.	Components of assessed reliability shall comply to the contract specification.	○		*		#			
15.	Fire Indicator Board Cabinet.	The cabinet housing all fire fighting equipment shall be of sheet metal construction to the contract specification.	○		*		#			
16.	Addressable Manual Call Point and Bell.	The addressable manual call point and bell must be installed to follow the contract specification.	○		*		#			
17.	Addressable Analogue Smoke Detector.	Refer to contract specification.	○		*		#			
18.	Wiring System.	All wiring shall meet the requirement as per contract specification.	○		*		#			

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19.	Identification and marking of Indicators.	The arrangement of the indicator and circuits shall be such that the operation of any indicator shows clearly the origin of the call. All indicators and switches shall be labelled with engraved labels, white letters on block background.	○		*		#			
20.	Bas Monitoring of Fire Services System.	Nominated points of the fire system are to be monitored by a Building Automation System. A data gathering panel will be mounted adjacent to the fire control panel and wired to the BAS interface terminal strip provided in the BAS interface area of the fire control panel. The requirement of these system is stated in the contract specification.	○		*		#			
	E. Carbon Dioxide Extinguishing System									
1.	Protected Areas.	The areas to be protected with carbon dioxide extinguishing system shall be as specified in the drawings.	○		*		#			
2.	Carbon dioxide Containers.	The carbon dioxide containers shall comply to contract specification.	○		*		#			
3.	Carbon Dioxide Control Panel.	The solid state carbon dioxide control panel shall comply to contract specification.	○		*		#			

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4.	Discharge Nozzles.	Discharge nozzles shall be listed for the intended use and for discharge characteristics as stated in the contract specification.	○		*		#			
5.	Remote Manual Control.	The remote manual control shall be in the form of a hand control. This control shall be activated by means of a 'pull handle' in a 'break glass' box and shall be of a type approved by the Chief Inspector of Fire Services.	○		*		#			
6.	Automatic Detectors.	Refer to contract specification.	○		*		#			
7.	Pipework and Fittings.	The material of piping and fitting shall comply to contract specification.	○		*		#			
8.	Valves.	Refer to contract specification.	○		*		#			
9.	Indicating Lights.	The fire contractor shall supply and install all necessary wing and indicating lights to each protected area shall comply to contract specification.	○		*		#			
	F. Fire Brigade Communication System									
1.	Master Control Handset Panel.	This panel shall include red coloured, and comply to the contract specification.	○		*		#			

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2.	Zone Select Panel.	The panel shall be able to accommodate the total number of zones called for and shall contain call indication and fault indication.								
3.	Mode of Operation.	Refer to contract specification.	○		*		#			
4.	Wiring System.	Refer to contract specification.	○		*		#			
5.	Trouble Indicator Panel.	This panel shall provide both visual and audible indication of trouble within the system as stated in the contract specification.	○		*		#			
6.	Speaker and Handset Supervisory Units.	These units shall be incorporated in the system, capable of detecting open and short circuit conditions and activate the Trouble Indicator Panel/Speaker Zone Select Panel.	○		*		#			
7.	Amplifier Supervisory Unit and Module.	Refer to contract specification.	○		*		#			
8.	Tone Generator.	A tone generator of 800 HZ pulsed 0.6 sec. on, 0.4 sec. off, shall be supplied and the signal shall be activated by a fire alarm signal fed from the fire alarm panel. Failure of this unit shall be indicated in the trouble indicator panel.	○		*		#			

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9.	Standby battery and Charger.	The fire contractor shall supply, install and maintain DC Flat plate nickel cadmium battery as per contract specification.	○		*		#			
10.	Battery Test Facilities.	Refer to contract specification.	○		*		#			
	G. Pipeworks and Fittings									
1.	Requirement for pipeworks.	The fire contractor shall supply and install all pipework and fitting as stated in the contract specification.	○		*		#			
2.	Pipe Joints.	All the pipe joints must join properly and comply to the contract specification.	○		*		#			
3.	Pipe Supports.	All pipework and fitting are to be supported by mild steel hangers and brackets of approved design as stated in the contract specification.	○		*		#			
4.	Fixing of Pipe Supports.	Refer to contract specification.	○		*		#			
5.	Spacing of Pipe Supports.	Spacing of pipe supports must refer to the requirement and comply to the contract specification.	○		*		#			
6.	Location of Supports.	Refer to contract specification.	○		*		#			
7.	Fabrication.	Refer to contract specification.	○		*		#			

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8.	Provision for Expansion.	All the pipework for fire protection services must provide for expansion as stated in the contract specification.	○		*		#			
9.	Preventing Transmission of Vibration.	Flexible connections shall be provided at connections to rotating and vibrating machinery as per contract specification.	○		*		#			
10.	Pump Connections.	Full-line size pipework shall be taken right to the pump and the connections shall comply to the contract specification.	○		*		#			
11.	Pipe Anchors.	Piping shall be anchored where required to localise expansion or to prevent undue strain on piping. Anchors shall be entirely separated from hangers and shall be of forged or welded construction of approved design.	○		*		#			
12.	Expansion and Anti-Vibration Joints.	Refer to contract specification.	○		*		#			
13.	Valves, Fitting, Etc.	All valves, fitting, etc. shall be suitable for the working and test pressure of the system concerned and refer to the contract specifications.	○		*		#			

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TRADE: FIRE PROTECTION SERVICES

LEGEND: ○ checked by
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\# approved by

ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	CONTRACTOR				CONSULTANT			
			NSC	M&E S/VISOR	M&E COOR.	PROJ MGR.	M&E C.O.W.	M&E R.E.	R.E.	S.O.
	H. Electrical Works									
1.	Starter Panel.	Starter panels for all the pumps shall be located in the positions shown on the drawings and shall be fitted with alarms under the contract specification.	○		*		#			
2.	Materials and Components.	The Materials and components to be supplied and installed must comply to the contract specification.	○		*		#			
3.	Wiring.	Refer to contract specification.	○		*		#			
4.	Conduit.	Generally wiring shall be carried out in class 'B' steel screwed conduit throughout. Refer to contract specification.	○		*		#			
5.	Isolating Switches.	Refer to contract specification.	○		*		#			
6.	Motor Starters.	As stated in contract specification.	○		*		#			
7.	Earthing.	Earthing shall be carried out to the requirements of the specification and all other requirements of the supply authority. Provide suitable earth leakage protection where required by the supply authority.	○		*		#			
8.	Motors.	As per contract specification.	○		*		#			

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			CONTRACTOR				CONSULTANT			
ITEM	DESCRIPTION OF WORK	STANDARD/REQUIREMENT	NSC	M&E S/VISOR	M&E COOR.	PROJ MGR.	M&E C.O.W.	M&E R.E.	R.E.	S.O.
	A. Installation of Cold & Hot Water Supply System									
1.	Equipment and Materials Submission for Approval.	Within thirty (30) days after the official order, the sub-contractor shall submit for approval a list of manufacturer's equipment and materials proposed for the work as per contract specification.	○		*		#			
2.	Shop Drawing Submission.	The sub-contractor shall provide at his own expenses within two (2) weeks of acceptance of the tender. Refer to contract specification.	○		*		#			
3.	Connections to Water Main.	The contractor shall supply and install the incoming water mains to the fire and domestic suction tanks as per contract specification.	○		*		#			
4.	Water Storage Tanks.	The contractor shall supply, deliver and install the water storage tanks. Refer to contract specification.	○		*		#			
5.	Water Elevating Pump.	The installation works for the cold water elevating pump shall comply to contract specification.	○		*		#			
6.	Operation of Elevating Pump.	Two (2) sets of domestic water elevating pumps shall be provided as shown on the drawings and contract specification.	○		*		#			

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			NSC	M&E S/VISOR	M&E COOR.	PROJ MGR.	M&E C.O.W.	M&E R.E.	R.E.	S.O.
7.	Water Booster Pumpset.	The sub-contractor shall supply and install a proprietary made package set of water booster system from a reputable manufacturer for cold water servicing as per contract specification.	○		*		#			
8.	Hot Water Circulation Pumps.	Hot water circulation pumps shall be installed as per contract specification.	○		*		#			
9.	Hot Water Supply System.	Refer to contract specification.	○		*		#			
10.	Pressure Test for Waterpiping.	All water piping shall be pressure installation as per contract specification.	○		*		#			
	B. Sanitary Drainage Installation									
1.	Excavation for Drainage System.	The contractor shall excavate all trenches for the sanitary plumbing and drainage works as described in the contract specification.	○		*		#			
2.	Underground Drains.	The contractor shall supply and install all underground sewage and waste water drains as described in the contract specification.	○		*		#			
3.	Internal Pipework.	All soil, waste, anti-syphonage and ventilating pipes shall be installed in accordance with the requirements of contract specification.	○		*		#			

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4.	Testing for Internal Sanitary Installation.	The testing procedure of the sanitary installations must comply to contract specification.	○		*		#			
5.	Installation of Sanitary Appliances.	As specified in the contract document.	○		*		#			
6.	Grease Traps.	As specified in the contract document.	○		*		#			
7.	Manhole Covers and Frames.	As specified in the contract document.	○		*		#			
8.	Engineering Bricks.	Engineering brick shall comply with B.S. 2921 and be of Class B. Refer to contract specification.	○		*		#			
9.	Pipes to be Sound.	Refer to contract specification.	○		*		#			
10.	Sight Rains and Boning.	Refer to contract specification.	○		*		#			
11.	Installation & Laying of Pipes.	All pipes shall be laid at the depths and to the lines and levels as per contract specification.	○		*		#			
12.	Testing of Pipelines.	All site pipelines upon completion of laying shall be subjected to testing with water under head. Only sufficient backfilling of the trench but not over the joints to prevent movement of the pipes under test shall be allowed before satisfactory completion of tests detailed as per contract specification.	○		*		#			

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13.	Manhole and Valve Chambers.	All manholes shall be constructed either in engineering brickwork or in precast concrete as generally shown in the drawings and shall be made perfectly water-tight as per contract specification.	○		*		#			
14.	Brickwork.	Refer to contract specification.	○		*		#			
15.	Cement Rendering.	All surfaces to receive a finishing coat of cement rendering. Refer to contract specification.	○		*		#			
16.	Submersible Pumps.	Contractor shall supply and install two (2) submersible pumps for each pump. The required performance characteristics shall be as specified in the drawing and contract specification.	○		*		#			
	C. Pipework, Valves and Fittings	All fabrication and installation works of the piping system shall comply to contract specification.	○		*		#			
1.	Piping Material.	Contractor shall be responsible in ensuring that piping materials comply with the relevant standards or statutory authorities' requirements as per contract specification.	○		*		#			
2.	Provision for Expansion.	All the piping shall be installed sufficiently flexible to absorb the whole of its own expansion as per contract specification.	○		*		#			

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3.	Preventing Transmission of Vibration.	Flexible connections shall be provided at connections to rotating and vibrating machinery. Refer to contract specification.	○		*		#			
4.	Pump Connections.	As specified in the contract document.	○		*		#			
5.	Expansion and Anti-Vibration Joints.	As specified in the contract document.	○		*		#			
6.	Pipework.	In the installation of pipeworks, refer to contract specification.	○		*		#			
7.	Valves.	For all valves installation by contractor, refer to contract specification.	○		*		#			
8.	Strainers.	Refer to contract specification.	○		*		#			
9.	Pressure Gauges.	Gauges shall suit the various duties and services and shall comply with the requirements as per contract specification.	○		*		#			
10.	Flow Controller.	Refer to contract specification.	○		*		#			
11.	Pressure Reducing Valves.	Contractor shall ensure that the pressure in the domestic and potable water reticulation shall follow the contract specification.	○		*		#			

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			NSC	M&E S/VISOR	M&E COOR.	PROJ MGR.	M&E C.O.W.	M&E R.E.	R.E.	S.O.
12.	Pipe Insulation for Hot Water Piping.	Refer to contract specification.	○		*		#			
13.	Joints in Copper Pipe.	Joints for the copper pipe for hot water shall comply to contract specification.	○		*		#			
14.	Painting.	All pipeworks and brackets installation to be painted to comply with the requirement in the contract specification.	○		*		#			
15.	Labelling.	All pipework and equipment for the complex shall be identified with approved labels. Directional arrows shall be provided on the pipework in plantrooms and vertical risers indicating the direction of flow. Letters are to be generally 1–1/2″ (40 mm) high to suit the pipe diameter.	○		*		#			
16.	Balancing and Adjustment.	As specified in the contract document.	○		*		#			

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	D. Electrical Work for Sanitary and Plumbing Works	The sub-contractor shall carry out the complete electrical installation for equipment specified under this contract. All work being in accordance with the IEE wiring rules and the requirements of local authorities having jurisdiction over the work. The work shall include: (i) starter panels (ii) wiring to motors and controls (iii) control systems	○		*		#			
		Electrical supply cables of 415 V, 3 phase, 50 HZ shall be terminated at each starter panel by the sub-contractor even if they are not specifically indicated in the drawings.	○		*		#			
1.	Starter Panel.	The starter panel for pumps set shall be referred to contract specification.	○		*		#			
2.	Materials (Components).	The component such as fuse switch, switch fuse units, contractors' thermal overload relays, control switches, indicating lights, auxiliary relays and terminal blocks shall refer to contract specification.	○		*		#			
3.	Isolating Switches.	As specified in the contract document.	○		*		#			

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4.	Motor Starters.	All motors installed shall be provided with starters as per contract specification.	○		*		#			
5.	Moulded Case Circuit Breakers (MCCB)	MCCB shall be used according to contract specification.	○		*		#			
6.	Wiring.	As per contract specification.	○		*		#			
7.	Cable.	Cable use for motor for sanitary and plumbing services must refer to contract specification.	○		*		#			
8.	Conduits.	Generally wiring shall be carried out in class 'B' steel screwed conduit and refer to contract specification.	○		*		#			
9.	Earthing.	Refer to contract specification.	○		*		#			
10.	BAS Monitoring of Sanitary and Plumbing System.	A building automation system for the building is to be supplied under this contract as per contract specification.	○		*		#			

APPENDIX H

ABC BUILDER

Project:

Document No.

Quality Assurance

(Appendix H)
Date:

TESTING AND MEASURING EQUIPMENT

For C&S Work

1. Dial Gauges
2. Hydraulic Jack & Pump
3. Cube Crushing Machine
4. Dumpy Level
5. Theodolite
6. Measuring Tape

For M&E Work

1. Insulation Tester
2. Earth Tester
3. Illuminometer
4. ELCB Trips Tester
5. Mega Ohm Meter
6. Cable Pressure Test Equipment
7. Air-flow meter
8. Thermometer
9. Sound Level Meter
10. Water Pressure Test Equipment

Appendix IX

A Glossary of Quality Terms

Quality

Quality is the totality of characteristics of an entity that bears on its ability to satisfy stated or implied needs such as customer satisfaction and conformance to requirements. (ISO 8402:1994)

Quality Control

The operation techniques and activities that are used to fulfill requirements for quality. (ISO 8402:1994)

Quality Assurance

All the planned and systematic activities implemented within the quality system and demonstrated as needed to provide adequate confidence that an entity will fulfill requirements for quality. (ISO 8402:1994)

Quality Policy

Overall intentions and directions of an organisation with regard to quality, as formally expressed by top management.

Quality Management

All activities of the overall management function that determine the

quality policy, objectives and responsibilities, and implement them by means such as quality planning, quality control, quality assurance and quality improvement within the quality system. (ISO 8402:1994)

Quality Audit

A systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives. (ISO 8402:1994)

Compliance Audit

The documented quality management system being complied with by the company's staff.

System Audit

The documented quality management system that meets the requirements of the relevant standard.

Auditee

An Organisation to be audited.

Auditor(Quality)

A person who has the qualification and is authorized to perform Quality Audits.

Major Non-Conformance

A major non-conformance relates to the absence, or the total breakdown of a system to meet the requirements of a clause of ISO 9000. A number of minor non-conformances listed against one clause of ISO 9000 can represent a total breakdown of a system and thus be considered as a major non-conformance.

Minor Non-Conformance

A minor non-conformance relates to a single observed lapse in following one item of a company procedure.

Objective Evidence

Qualitative or quantitative information, records or statement of fact, pertaining to the quality of an item or service or to the existence and implementation of a Quality System element which is based on observation, measurement or test and which can be verified.

Project Quality Plan

A document setting out the specific quality practices, resources, sequence of activities relevant to a particular project.

Corrective Action Request Form

A form which addresses a non-conformance to a system element, work procedure, work instruction or project quality plan.

Inspection and Test Plan

A document which describes the inspections and tests to be carried out on a given item.

Management Review

A regular meeting held with senior management to check the effectiveness of the quality system.

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