



# **GUIDELINES FOR MECHANICAL ENGINEERING SERVICES**

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# GUIDELINES FOR MECHANICAL ENGINEERING SERVICES

## 1.0 INTRODUCTION

### 1.1 PURPOSE OF GUIDELINES

The "Guidelines for Mechanical Engineering Services" have been prepared by a sub-committee of Professional Engineers and Geoscientists of Newfoundland & Labrador (PEGNL) and have been adopted by the Council of PEGNL.

The Guidelines have been prepared to set out the standards of practice which *Members* should meet and follow in providing professional engineering services. PEGNL and its Council have a commitment to maintain the quality of the services *Members* provide to *Clients* and the public, and have published these Guidelines for that purpose.

It is anticipated that variations in the application of these Guidelines may be required. A *Member* must always exercise professional judgement in providing services. It is not intended that the Guidelines be used as a legal document or to alter contracts between *Members* and *Clients*.

However, a variation that detracts from the overall purpose of the Guidelines should never be made. The Guidelines are intended to establish minimum standards of practice which *Members* must meet to fulfil the *Member's* professional obligations, especially in regard to the primary duty to protect the public. The Council of the *PEGNL* intends that failure to meet these standards may give rise to disciplinary proceedings.

PEGNL supports the proposition that *Members* should receive fair and adequate compensation for services rendered and that this principle applies to the services provided to comply with these Guidelines. In no event will low fees be justification for services which do not meet the minimum standards set out by these Guidelines. *Members* may wish to discuss these Guidelines with their *Clients* when receiving instructions for assignments and reaching agreements regarding compensation.

## 1.2 SCOPE OF GUIDELINES

These Guidelines apply to the practice of Mechanical Engineering.

These Guidelines outline the professional services which should generally be provided by the *Mechanical Engineer of Record (MER)*. They specify tasks which should be performed by the *MER* to achieve designs which are in the best interest of the *Client* and the public and which are properly coordinated with the work of other design, fabrication and construction team participants. These Guidelines should assist in maintaining the integrity of the overall and detailed designs.

## 1.3 QUALIFICATION

Notwithstanding the purpose and scope of the Guidelines in sections 1 through 4, the decision by the *MER* not to use one or more of these Guidelines does not mean that the *MER* is legally negligent or unprofessional in the performance of professional services, if *Due Care* has been exercised.

## 2.0 DEFINITIONS

### ***Additional Services:***

Services, as set out in section 4.4, which the *MER* may provide in addition to the *Basic Services*.

### ***As-Built Drawings:***

Drawings which are prepared from measurements taken on site to depict accurately the actual size and location of existing elements.

### ***Association:***

Professional Engineers and Geoscientists Newfoundland & Labrador (PEGNL).

### ***Authority Having Jurisdiction:***

The governmental body with authority to administer and enforce the applicable codes or the local by-laws.

### ***Basic Services:***

The services provided by the *MER* as set out in section 4.3.

### ***Client:***

The party who engages the *MER* to provide professional mechanical engineering services.

### ***Commissioning:***

*Commissioning* consists of four parts:

- static tests
- operating tests
- verification reports
- demonstration of systems operation to *Owner/users*

*Commissioning* is defined as the documentation and verification necessary so that the system will function to meet design intent and tuning of the systems necessary to meet the *Owner's* operational requirements. Generally the post-commissioning phase would include monitoring through the first year of seasonal operations.

***Contract Documents:***

All documents including the engineering and architectural drawings and specifications as defined in the construction contract(s) for the project.

***Due Care:***

The level of care which would be found by reasonable and knowledgeable people to be adequate in the specific circumstances in which the term was used.

***Fabricator:***

The *Subcontractor* responsible for the supply and/or fabrication of components to satisfy a specific contract.

***Field Services:***

The services provided by the *MER* as set out in Section 4.3.5 to ascertain if the mechanical construction work is generally in accordance with the Mechanical Contract Documents.

***General Contractor:***

The contractor who has a contract with the *Owner* for the construction of all or a portion of the project.

***Maintenance Manual:***

A binder containing all the necessary technical information on mechanical systems for the *Owner* to carry out maintenance and operation of the equipment installed under the contract.

***Mechanical Engineer of Record:***

The *member* with general responsibility for the design integrity of the mechanical systems as provided by Section 3.0 of the guidelines.

***Member:***

A *Member* in good standing with *PEGNL*.

***MER:***

The *Mechanical Engineer of Record*.

**Owner:**

The person, company or other entity who controls the property under consideration and has the authority of ownership.

**Prime Consultant:**

The individual who, or firm which, is registered with the *Association* or the Newfoundland Association of Architects, and who or which has the responsibility to coordinate the design and Field Reviews of the various design professionals (such as electrical, structural, mechanical, geotechnical, architectural) for the project.

**Professional Engineer:**

The person who holds a certificate of registration to engage in the practice of engineering under the Engineers and Geoscientists Act.

**Record Drawings:**

Drawings which represent the final drawings issued and which normally incorporate such items as addenda, change orders and significant modifications made during construction. Site measurements need not be incorporated onto these drawings unless significant differences from the specified dimensions occur. Variations from the *Contract Documents* may be noted, where appropriate, with remarks or comments.

**Subcontractor:**

The person, company or other entity who contracts with the *General Contractor* to perform a specified part of the *General Contractor's* work.

**Submittal(s):**

Items required by the *Contract Documents* to be submitted such as requests for payment, progress reports, shop drawings, manufacturer's literature on equipment, schedules, etc. *Submittals* are normally used by the *MER* to aid in determining if the work and work products conform with the intent of the *Contract Documents*.

## 3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

### 3.1 COMMON FORMS OF PROJECT ORGANIZATION

Project organizations vary according to the needs of the project and the parties. The following organizational charts are included in Appendix A:

1. *Mechanical Engineer of Record (MER)/Prime Consultants Contract*
2. *Mechanical Engineer of Record (MER)/Owner Contract*
3. *Design/Build Contract*

### 3.2 RESPONSIBILITIES OF ORGANIZATION PARTICIPANTS

#### 3.2.1 OWNER

It is not the mandate of this guideline to stipulate the responsibilities of the *Owner*, however, in order that the design and construction of the project may be carried out in a manner that meets appropriate standards of public safety and the requirements of applicable regulations, the *Owner* should:

- 3.2.1.1 Retain or cause to be retained qualified *Professional Engineers* including a *Prime Consultant* and a *MER* with responsibility for the design of the Mechanical Systems;
- 3.2.1.2 Cooperate with the *MER* to set out a written description of the scope of the *MER's* services as referred to in paragraph 3.2.3.3, and an adequate written description of the project;
- 3.2.1.3 Before the commencement of the *MER's* services, finalize or cause to be finalized a written agreement with the *MER* (directly with the *Owner* or with the *Prime Consultant* or with another appropriate party);
- 3.2.1.4 Cooperate with the *Prime Consultant* and the *MER* in establishing a realistic schedule for the provision of design services;
- 3.2.1.5 Authorize in writing any *Additional Services* that may be required beyond the scope of the *MER's* contract;
- 3.2.1.6 Ensure that all required approvals, licences and permits from the *Authorities Having Jurisdiction* are obtained prior to proceeding with construction;
- 3.2.1.7 Recognize that drawings, Specifications and other documents prepared by the *MER* are for the project and that such documents shall not be used or copied for other projects without the agreement of the *MER* and without advice from a qualified design

professional;

3.2.1.8 Recognize that, because code interpretation of the *Authority Having Jurisdiction* may differ from that of the *MER*, some changes may occur;

3.2.1.9 Recognize that, even with a well-qualified design team and with a design, meeting reasonable criteria and standards, some unforeseen changes may occur and that accordingly a reasonable contingency should be included in the *Owner's* budget.

### **3.2.2 PRIME CONSULTANT**

To enable the *MER* to perform his duties properly, the *Prime Consultant* should:

3.2.2.1 Interpret and define the needs of the *Owner* and in so doing define the *Owner's* intended functions and needs. The *Prime Consultant* should identify any special design criteria such as equipment and other requirements and should advise the *MER* accordingly;

3.2.2.2 Outline the scope of assignment to each design professional for design, preparation of *Contract Documents*, review of work during construction and contract administration;

3.2.2.3 Negotiate a fee with the *Owner* that is in accordance with the PEGNL fee schedules and seek input from each design professional before finalizing same;

3.2.2.4 Provide timely information in sufficient detail as required by the *MER* to adequately perform his/her duties;

3.2.2.5 Coordinate and review the designs, drawings and other *Contract Documents* produced by all participants of the design team;

3.2.2.6 Coordinate communication of information between the *Owner*, the contractor and the design professionals, including the *MER*, so that the work proceeds in a manner that complies with applicable codes and regulations and meets the *Owner's* needs;

3.2.2.7 Inform the *MER* of tender call results;

3.2.2.8 Provide the *MER* with one (1) complete set of *Contract Documents*.

### **3.2.3 MECHANICAL ENGINEER OF RECORD**

3.2.3.1 The *Mechanical Engineer of Record (MER)* is responsible for the integrity of the design of the Mechanical Systems shown on *Contract Documents* prepared by the *MER*.

3.2.3.2 The *MER* may rely on other *Members* to be responsible for elements of the Mechanical and Related Systems but the *MER* has the overall responsibility to see that all design is undertaken as is necessary to achieve a Mechanical System that meets acceptable engineering standards. In this event the *MER* must require the other *Members* to sign and seal the documents for such elements. These *Members* are responsible for the integrity of their design.

3.2.3.3 The *MER* together with the *Client* is responsible for setting out a written description of the scope of the *MER's* services to enable and permit the *MER* to meet the design and field review requirements of these Guidelines and applicable codes and regulations.

3.2.3.4 If the *Owner* or *Prime Consultant* fails or refuses to carry out the obligations as set out in Section 3.2.1 and 3.2.2, the *MER* should:

(a) consider giving written notice to the *Owner* advising the *Owner* of the *MER's* recommendations;

(b) consider whether the *MER* can continue with the project,

because in any event the *MER* must comply with the minimum requirements of these Guidelines.

### **3.2.4. GENERAL CONTRACTOR**

It is not the mandate of this guideline to stipulate the responsibilities of the *General Contractor*, however, the *Contract Documents* should clearly state that:

3.2.4.1 The *General Contractor* is responsible for all labour, materials, equipment, and plant required to complete the work;

3.2.4.2 The *General Contractor* is responsible for the construction methods, techniques, sequences, procedures, safety precautions and programs associated with the construction work, all as set out in the *Contract Documents*;

3.2.4.3 The *General Contractor* is responsible for coordinating the work of the *Sub-Contractors* and for checking the *Sub-Contractors'* work;

3.2.4.4 The *General Contractor* is responsible for verifying that the work is complete prior to requesting a Field Review by the *MER*;

3.2.4.5 The *General Contractor* is responsible for providing reasonable written notice to the *MER* when components are ready for Field Review;

3.2.4.6 The *MER's* Field Review does not relieve the *General Contractor* from his responsibilities to complete the work in conformance with the *Contract Documents*;

3.2.4.7 All potential *General Contractors* and *Subcontractors* submitting bids are advised to visit the site prior to the tender closing.

### 3.3 **SELECTION OF CONSULTANTS**

The recommended procedures for selecting a consultant are as described in the "Selection by Ability" booklet published by PEGNL.

## 4.0 GUIDELINES FOR PROFESSIONAL PRACTICE

The following are guidelines for services which the *MER* should consider providing as part of good practice. They may assist the *MER* in explaining mechanical engineering services to a *Client*. These guidelines deal in an advisory way with matters of practice and procedure rather than with matters of substantive engineering.

### 4.1 SOLE USE OF DOCUMENTS

The following clause should appear on all drawings and specifications:

"These design documents are prepared solely for the use of the party with whom the *MER* has entered into a contract. There are no representations of any kind made by the *MER* to any other party".

### 4.2 SCOPE OF SERVICES

Before commencement of design services, the *MER* shall meet with the *Client* to:

- 4.2.1 Determine the terms of reference and the scope of work of *Basic Services* and *Additional Services*;
- 4.2.2 Reach agreement on fees, payment schedule and professional liability insurance coverage;
- 4.2.3 Reach agreement on a contract.
- 4.2.4 For a "fast-track" project, in addition to the above, the *MER* should:
  - (a) Establish with the *Client* the terms and conditions under which preliminary or partially complete *Contract Documents* may be issued in advance and clearly define the requirements for partially complete *Contract Documents*;
  - (b) Advise the *Client* that no part of the mechanical documents can be considered complete before all *Contract Documents* including architectural, structural, mechanical and electrical drawings are completed.

### 4.3 BASIC MECHANICAL ENGINEERING SERVICES

The usual stages of the *Basic Services*, as discussed herewith, are generally organized in an agreement according to the sequential stages of a typical project. Because of the requirements of the specific project, certain *Basic Services* activities may be required to be performed out of the normal sequence or in difference stages than indicated in the scope of services.

### 4.3.1 CONCEPTUAL OR SCHEMATIC DESIGN STAGE

In the Conceptual or Schematic Stage, the *MER* may:

- 4.3.1.1 Attend, as required, periodic meetings with the *Client* and design team to obtain the *Client's* instructions regarding the *Client's* functional, aesthetic, cost and scheduling requirements to prepare a concept design and to report on the mechanical systems considering economy, performance, capital cost, compatibility with other design elements and requirements of relevant codes and authorities;
- 4.3.1.2 If required, assist the *Prime Consultant* and/or *Owner* in:
- (a) Defining the need for any specialty consulting services which may be required for the project, e.g., acoustical, fire protection, etc;
  - (b) Developing or reviewing the project schedule including any milestone dates;
  - (c) Determining channels of communication;
  - (d) Determining drawing standards and Specifications format;
  - (e) Determining the number and timing of project team meetings during each stage of the project;
- 4.3.1.3 Establish dates by which information affecting the mechanical design will be needed from other disciplines, such as structural and electrical;
- 4.3.1.4 Conduct field reviews and review existing drawings where appropriate;
- 4.3.1.5 Establish criteria for other consultants as required. Comment on reports presented;
- 4.3.1.6 Identify mechanical design criteria, prepare preliminary calculations and establish base load requirements for HVAC, plumbing and fire protection systems, etc. In the case of building projects, determine the mode of heating in consultation with the Electrical Engineer of Record and *Client*;
- 4.3.1.7 Develop the mechanical scheme for the mechanical systems. Develop alternate schemes where appropriate. Consider materials and systems suitable to the project requirements. Consider the requirements of the other design professionals and provide the information they require;
- 4.3.1.8 Check applicable codes, standards, regulations and restrictions, insurance requirements

and other factors affecting the design of the project and establish and obtain agreement with the *Client* and/or *Prime Consultant* on the applicable codes and standards to be followed;

- 4.3.1.9 Prepare a conceptual cost estimate or cooperate appropriately with others responsible for reporting the estimate, if required;
- 4.3.1.10 Determine the allocation of suitable space for mechanical rooms and other major mechanical installations;
- 4.3.1.11 Identify equipment parameters such as weights, size, noise, vibration, and other physical characteristics that are to be considered in the mechanical design. Determine the impact of noise and vibration from the mechanical systems on the *Client's* operational requirements and recommend solutions through the use of a specialist, if necessary;
- 4.3.1.12 Establish, where appropriate, comparative information to be used in selection of mechanical systems for the project;
- 4.3.1.13 Describe the major mechanical system(s) and each significant component and material;
- 4.3.1.14 Inform the *Client* of all new construction materials or new techniques proposed for use in the project and their alternatives, including the risks, advantages and disadvantages over both the short and long term, so that the *Client* can weigh the choices and make an informed decision before the *MER* proceeds further;
- 4.3.1.15 If required, prepare a concept design report which defines the mechanical systems selected for the project and outlines the reasons involved in the selection.
- 4.3.1.16 A *Client* may assume responsibility for all or some of the foregoing Conceptual or Schematic Design Stage activities provided:
  - (a) the *MER's* ability to satisfy the requirements of the subsequent stages of these Guidelines is unimpaired;
  - (b) the responsibility for such preliminary design activities is clearly defined in writing;
  - (c) the *Client*, in writing, waives the *MER's* responsibility for such preliminary design activities and their effect on the selection of the mechanical systems.

#### 4.3.2 DESIGN DEVELOPMENT STAGE

In the Design Development Stage, when the selected scheme is developed in sufficient detail to enable commencement of the final design and construction documents by all participants of the design term, the *MER* may:

- 4.3.2.1 Attend, if required, meetings with the *Client* and design team;
- 4.3.2.2 Review results of studies by specialist consultants, such as geotechnical, fire protection, etc.;
- 4.3.2.3 Prepare preliminary mechanical analysis and design calculations for typical mechanical elements of the mechanical systems. Select appropriate equipment;
- 4.3.2.4 Prepare preliminary design drawings, as required, depending on the complexity of the design, based on information coordinated with other consultants;
- 4.3.2.5 Prepare preliminary design drawings, as required, depending on the complexity of the design, showing layouts of critical areas;
- 4.3.2.6 Prepare or edit the "outline Specifications" for mechanical items, as required;
- 4.3.2.7 Coordinate mechanical design with space and servicing criteria to meet the requirements of the other design team participants. In particular, notify the Electrical Engineer of Record of all points of interface between the two disciplines and determine as soon as possible the electrical characteristics and electrical requirements of all mechanical loads and potential conflicts between the mechanical and electrical riser locations;
- 4.3.2.8 Prepare a preliminary cost estimate or co-operate appropriately with others responsible for reporting the estimate;
- 4.3.2.9 Submit a design development report for review and approval by the *Client*.

#### 4.3.3 CONTRACT DOCUMENT STAGE

##### 4.3.3.1 General:

- (a) Design the mechanical systems;
- (b) Determine and specify in the *Contract Documents* which mechanical elements are to be designed by other *Members*;

- (c) Attend periodic coordination meetings, as required;
- (d) Coordinate with the *Authority Having Jurisdiction*, as required;
- (e) Establish testing and inspection requirements;
- (f) Comply with fire resistance requirements as determined by the *Prime Consultant* or other *Members*;
- (g) Seal documents per Engineers and Geoscientists Act.

#### 4.3.3.2 Mechanical Calculations

The *MER* must prepare mechanical calculations to support all mechanical designs. The mechanical calculations should be prepared legibly and presentably and filed by the *MER* for record purposes. Hard copy of input and output of any computer analysis should be included as well as description of the software used.

In general, mechanical calculations include but are not limited to:

- (a) Design criteria:
  - Discussion and description of design basis including assumptions;
  - Codes or standards used with edition dates;
  - List of mechanical design parameters and provisions that exceed or vary from code and standard requirements as requested by the *Client* or otherwise used by the *MER*;
- (b) Location diagrams for mechanical elements;
- (c) Computer analysis and design results, if applicable;
- (d) Special studies and analysis where required by Code;
- (e) For critical design elements and where required by Code, work done by an engineer with limited experience shall be checked by an independent qualified engineer, not necessarily from a separate company;
- (f) The names of the mechanical design engineer(s) and design check engineer;
- (g) Table of contents for, or index to, the mechanical calculations.

#### 4.3.3.3 Mechanical Drawings

Prepare contract drawings. In the case of buildings, these drawings should be made, where possible, to the same scale as that of the building layout drawings and should define the work:

- (a) Where scale of drawings or complexity of work make drawing difficult to be read and interpreted, separate drawings should be provided for such areas of the work as:
  - plumbing drainage
  - heating, ventilating and air conditioning
  - fire protection
  - process piping and equipment
  - other special systems as necessary;
- (b) Schematics and diagrams should be provided as required for all major systems with notes to describe the function of control, flow and operation;
- (c) Plot plans and/or site plans showing water supply, gas supply, sanitary and drainage arrangements and connections to public utility services as required, complete with invert elevations, should be included;
- (d) Symbol lists and typical details should be included, where required, for all equipment, accessories, piping and duct systems;
- (e) Floor plan layouts for all piping and duct systems should be provided. Complete duct and pipe sizing should be shown on these documents. Sizes, types, locations and capacities of all supply and exhaust air terminals together with type and location of valves should be shown;
- (f) To avoid conflicts, supplementary details should be provided for boiler, equipment and fan rooms and congested areas;
- (g) Piping and duct work can be shown in single line except where necessary to show arrangements and clearance for piping or duct work in ceiling spaces, shafts, header trenches, pipe chases and for tight or close-coupled equipment. This piping and duct work should be shown in double-line detail with appropriate valves, fittings and accessories;
- (h) Schedules should be included to provide capacities and details of performance of fans, air-handling units, pumps, etc.;
- (i) All drawings as well as details, elevations and sections should be properly cross-referenced.

#### 4.3.3.4 *Specifications*

- (a) Prepare Specifications using a format suitable for inclusion with the *Contract Documents*;
- (b) The Specifications should include information on:
  - standards, codes, by-laws governing work;
  - *Submittals* required;
  - quality control requirements;
  - materials;
  - workmanship and fabrication;
  - tolerances;
  - information for temporary works and erection information, where necessary, to ensure the intent and integrity of the design;
  - construction inspection and testing;
  - notification by the contractor before significant segments of the work are begun;
  - warranties;
  - performance criteria for design and detailing by other *Members*;
- (c) Where appropriate, the Specifications may be abbreviated and become part of the drawings;
- (d) The Specifications generally set out that the *MER's* review of *Submittals* and inspection of work as well as any testing by independent agencies reporting to the *Client* are undertaken to inform the *Client* of the quality of the contractor's performance and that this review and testing are not for the benefit of the contractor. The contractor must provide his own independent quality control program.

#### 4.3.4 **TENDERING STAGE**

- 4.3.4.1 Assist in the preparation of pre-qualification documents, if required;
- 4.3.4.2 Assist in reviewing bidder's qualifications, if required;
- 4.3.4.3 Assist the *Client* in obtaining required approvals, licences and permits;
- 4.3.4.4 Provide assistance to the *Client* in answering queries raised by the bidding contractors and issue mechanical addenda and clarification of mechanical documents, as required;
- 4.3.4.5 Assist in analysis and evaluation of tenders submitted, as required;

4.3.4.6 Assist in the preparation of the contract, if required.

#### 4.3.5 **CONSTRUCTION STAGE**

It is essential that *Field Services* be provided for all systems for which the *MER* is responsible to ascertain whether or not the work is generally in accordance with the mechanical Contract Documents.

It is preferable that the *Field Services* be provided by the *MER*; however, where practical the *MER* may delegate these duties to others.

*Field Services* by the *MER* should not be construed to relieve the contractor of the contractor's responsibility for completing the project in accordance with the *Contract Documents*, controlling the progress, providing safe working conditions, and correcting any deviations from the project requirements.

Some items reviewed by the *MER* may also require review by other members of the design team or by testing and inspection agencies. Such work may include proprietary products and mechanical elements designed by others.

##### 4.3.5.1 General Services During Construction

General Services should include, but not necessarily be limited to, the following and may vary depending on the complexity of the job:

- (a) Attend construction meetings, if required;
- (b) Confirm communication channels and procedures;
- (c) Assist in confirming, reporting and scheduling procedures for testing and inspections;
- (d) Assist in confirming procedures for shop drawings and other *Submittals*;
- (e) Confirm that the qualifications of manufacturers meet the Specifications;
- (f) Advise the contractor and the *Prime Consultant* on the interpretation of the mechanical drawings and Specifications and issue supplementary details and instructions during the construction period as required;
- (g) If requested, advise the *Client* on the validity of charges for additions to or deletions from the contract and on the issue of change orders;
- (h) Assist *Client* in the development of an acceptable format and price

breakdown structure to facilitate certification of construction progress payments;

- (i) Review and comment on, if requested by the *Client*, the contractor's applications for progress payments. Estimate, if required, completed work and materials on site for payment according to the terms of the construction contract;
- (j) Review reports from the testing and inspection agencies to determine if the agency has verified compliance of the reported item of work with the mechanical Contract Documents. Initiate any necessary action;
- (k) Conduct substantial performance field reviews of the mechanical components of the project, note deficiencies and inspect completed corrections;
- (l) Attend the start-up of the mechanical systems and respond as required to any design-related operational difficulties. Arrange and perform field review when the contractor has applied for substantial completion of the project; prepare a list of deficiencies (workmanship, completeness and function) and, when these have been rectified, issue the final report.

#### 4.3.5.2 Review of *Submittals*

*Submittals* should be reviewed for general compliance with the mechanical Contract Documents and does not include checking dimensions or quantities or the review of the contractor's safety measures or methods of construction.

The *MER* shall:

- (a) Confirm that the *Submittals* have been reviewed by the *General Contractor* and relevant *Subcontractors* before review by the *MER*;
- (b) Review the shop drawings and other *Submittals* for general conformance with the *Contract Documents* and the intent of the design;
- (c) When required by the *Contract Documents*, confirm that the shop drawings bear the signature and professional seal of the other *Members* responsible for the design of specialty systems. Responsibility for the detail design remains with the other *Members* whose seal and signature appear on the drawings;

- (d) Review *Record Drawings* prepared and submitted by the contractor on white prints or mylar copies to reflect "Record" condition of the project as turned over to the *Client*. The *Client* shall be advised that these drawings are prepared by the contractor and have been reviewed only for general conformity to the drawing standards and the intent of the design and that the *MER* cannot accept responsibility for their accuracy;
- (e) Arrange for the contractor to submit and review operating and *Maintenance Manuals* for the equipment/systems supplied on this project. The data submitted should include manufacturer's recommendations for maintenance of each piece of equipment and other such information which will enable the *Client* to assume operation of the systems.
- (f) The following is the recommended stamp affixed to all *Submittals* signed and dated by the *MER*:

<b>ABC ENGINEERING LIMITED</b>	
<p>Shop Drawing review is solely for purpose of determining adherence to general design concept. Contractor shall remain responsible for any detail design inherent in the shop drawings and for all errors and omissions. Contractor shall remain responsible for confirmation and correlation of all dimensions for fabricated components at the job site.</p>	
REVIEWED ( )	
REVIEWED & MODIFIED ( )	
REVISE & RESUBMIT ( )	
Date Returned	Shop Drawing No.
Reviewed by	Job No.

#### 4.3.5.3 Field Review

The *MER* should:

- (a) Visit the site at intervals appropriate to the stage of construction to observe the quality and the progress of the construction of those elements designed by the *MER*. At the discretion of the *MER*, components which have been designed by other *Members* should be inspected by those other *Members* at the appropriate stage of construction and reported in writing to the *MER*;
- (b) Prepare site visit reports outlining observations and deficiencies in the work and bring them to the attention of the contractor's site representative;
- (c) Distribute site visit reports to the *Prime Consultant* and other parties such as the *General Contractor* and *Owner*, as required. Where the *Owner* directly retains the services of the *MER*, it is recommended that the *Owner* also be sent copies of the reports;
- (d) Conduct a final project review and advise the *Client* of all observed defects or deficiencies whether or not they have been previously reported. Include in this report any action recommended for correction or resolution of these defects or deficiencies.
- (e) Conduct warranty inspection, if required.

## 4.4 ADDITIONAL MECHANICAL ENGINEERING SERVICES

In addition to the *Basic Services*, the *MER* may provide the following *Additional Services*, if the *MER* and the *Client* reach appropriate mutual agreements. They are generally not considered intrinsic parts of the basic mechanical design services, as discussed in section 4.3, and are not part of the minimum services which the *MER* should provide under these Guidelines.

Examples of *Additional Services* are:

- 4.4.1 Design work resulting from changes to the project as originally described and agreed to under the contract between the *MER* and *Client*, such as changes in scope, complexity, diversity or magnitude of the project;
- 4.4.2 Preparation of alternate mechanical designs and related documentation after selection of the mechanical system made during the conceptual and schematic design stage;
- 4.4.3 Review, design and documentation of alternate systems, if requested by the *Prime Consultant*, the *Client* or the contractor, for tendering to obtain competitive bids for items such as proprietary products;
- 4.4.4 Work connected with the preparation of documents for tendering segregated contracts, pre-tendered contracts, phased or fast-track construction;
- 4.4.5 Review of alternate designs or products after completion of the *Contract Documents*;
- 4.4.6 Work resulting from changes necessary because of construction cost over-run which is outside the control of the *MER*;
- 4.4.7 Translation of *Contract Documents* into a second language, conversion to other units, special preparation of drawings for reduction;
- 4.4.8 Investigation, analysis and/or studies to determine the user requirements of a special nature and subsequently the mechanical system design criteria for materials and performance;
- 4.4.9 Analysis of long range plans as defined by the *Prime Consultant* and attendant preliminary sketches and reports (master planning);
- 4.4.10 Preparation of alternative system designs and attendant documentation when required by the *Prime Consultant* or *Client* either for review or for competitive tender prices;

- 4.4.11 Travelling time outside of normal requirements;
- 4.4.12 Construction or project management services;
- 4.4.13 Value engineering (life cycle costing) analysis including schematics where required by the *Prime Consultant* or *Client*;
- 4.4.14 Preparation of designs and documentation for future implementation not included in construction contract;
- 4.4.15 Preparation of Bills of Material or Schedules of Material at any time during the project;
- 4.4.16 Resident engineering services during construction. Supply resident staff on the project to determine if the contractor is carrying out his work in accordance with the *Contract Documents*. If required by the *Prime Consultant* resident services may include the recording of all details of construction for final revision of the plans or drawings to show the work on *Record Drawings*. "Services" as described do not include the direction of persons or the selection, direction or approval of methods and equipment employed by the contractor in any phase of the construction or the placing in operation of any plant or equipment;
- 4.4.17 Preparation of drawings, Specifications and change orders and administration of contract additions and/or deletions which are initiated by the *Client* but either have not been implemented or result in a reduction in the contract price;
- 4.4.18 Certification inspections and testing of life safety systems where required by the *Authority Having Jurisdiction*;
- 4.4.19 Testing of mechanical systems requiring confirmation of conformance with Specifications;
- 4.4.20 Preparation of *Maintenance Manuals*;
- 4.4.21 Preparation of *Record Drawings*. (The *MER* does not guarantee the accuracy of information provided to him by the contractor);
- 4.4.22 Providing services after expiry of the period of one (1) year following Certification of Substantial Performance;
- 4.4.23 Complete or partial revision of design documents previously approved by the *Client* or in keeping with written instruction or drawings previously received from the *Client*;

- 4.4.24 *Commissioning* of mechanical systems including training of personnel and providing operating and maintenance assistance;
- 4.4.25 Advisory services which include: testimony; consultation and advice; appraisals; valuations; research; other services leading to specialized conclusions and recommendations;
- 4.4.26 Surveys of existing mechanical equipment which includes elaborate surveys or measurements and evaluation of existing mechanical equipment, i.e., securing of information on special existing loadings such as unusual equipment requirements or unusual construction;
- 4.4.27 Balancing of air and water/liquid systems which involves the actual detailed balancing and adjustment of air and water/liquid systems including adjustment of heating, air conditioning, ventilation systems, and piping networks as installed;
- N.B. It is customary to include in the Specifications a detailed outline of the balancing procedure and to provide an allowance in the construction contract for the services of a skilled technician who will supervise and assist the contractor in the proper balancing procedure and prepare the balancing reports for submission to the *MER*.
- 4.4.28 Computerized energy analysis involving the use of computer programs to simulate the amount of energy used. The program optimizes the effects of varying architectural features, mechanical systems and electrical systems;
- 4.4.29 Fast-track construction. To facilitate an earlier-than-normal construction start, the *Prime consultant* or project manager may request the *MER* to prepare several separate bid packages instead of the normal one. In this case, complete tender documentation necessitating extra work on the part of the *MER* is required for each bid package;
- 4.4.30 Site work elements beyond the property line;
- 4.4.31 Specific elements or systems normally designed by other *Members*;
- 4.4.32 Review of design drawings or Specifications prepared by others;
- 4.4.33 Preparation or assisting with the development of detailed cost estimates. The *MER* shall inform the *Client* of the variables inherent in the estimate and the expected degree of variation from the estimate. Where the degree of variation is critical, the *Owner* should have the estimate independently verified;
- 4.4.34 Filing application for and obtaining permits, that are normally the responsibility of

others;

- 4.4.35 Preparation of *As-Built Drawings* and/or demolition documents;
- 4.4.36 Tenant-related design services;
- 4.4.37 Design or review of the effects of the contractor's methods, procedures or construction equipment on the structure;
- 4.4.38 Work resulting from corrections or revisions required because of errors or omissions in construction by the contractor;
- 4.4.39 Work due to extended time schedules for design or construction beyond the control of the *Prime Consultant* or *MER*;
- 4.4.40 Services as an expert witness in connection with any public hearing, arbitration or court proceedings concerning the project, including attendant preparation of same;
- 4.4.41 Work resulting from damage as the result of fire, man-made disasters, or natural disasters;
- 4.4.42 Authorized overtime work requiring premium pay.

## 4.5 FABRICATION DRAWINGS AND DOCUMENTS

The *Fabricator* or manufacturer shall produce all necessary drawings and documents to represent the work covered by his contract with the contractor. These drawings and documents are prepared following a review of the drawings, Specifications and *Contract Documents* supplied by the *MER* and following the resolution of any errors or requested changes. They usually include:

### 4.5.1 Shop Drawings

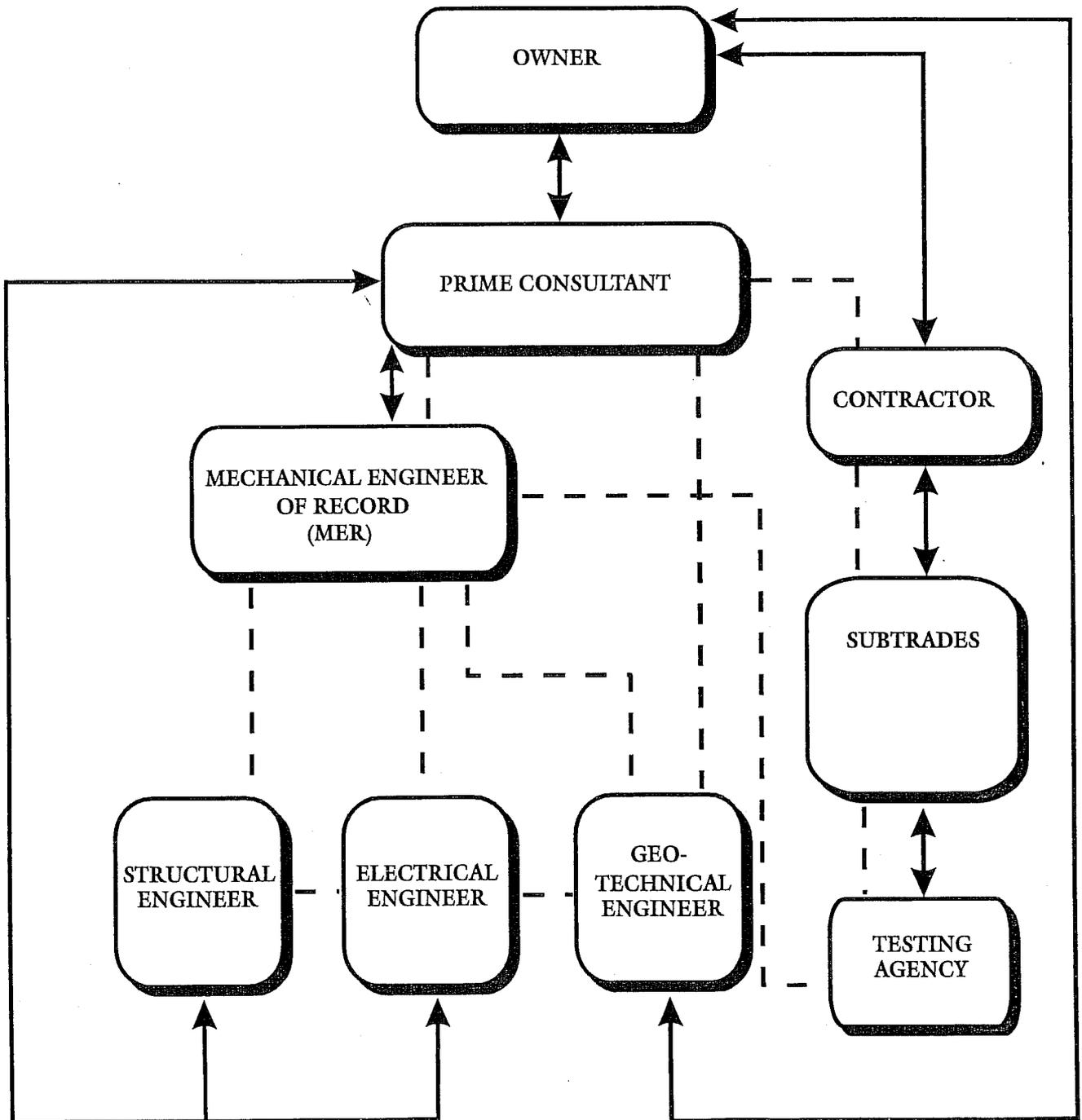
These are drawings produced by the *Fabricator* to provide all information necessary for shop personnel to fabricate and assemble the items. The drawings shall be sealed, signed and dated when incorporating design by the other *Members*.

# APPENDIX A

## COMMON ORGANIZATIONAL CHARTS

# COMMON ORGANIZATIONAL CHARTS

## 1. MECHANICAL ENGINEER OF RECORD (MER) / PRIME CONSULTANT CONTRACT



Contractual Relationship

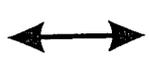
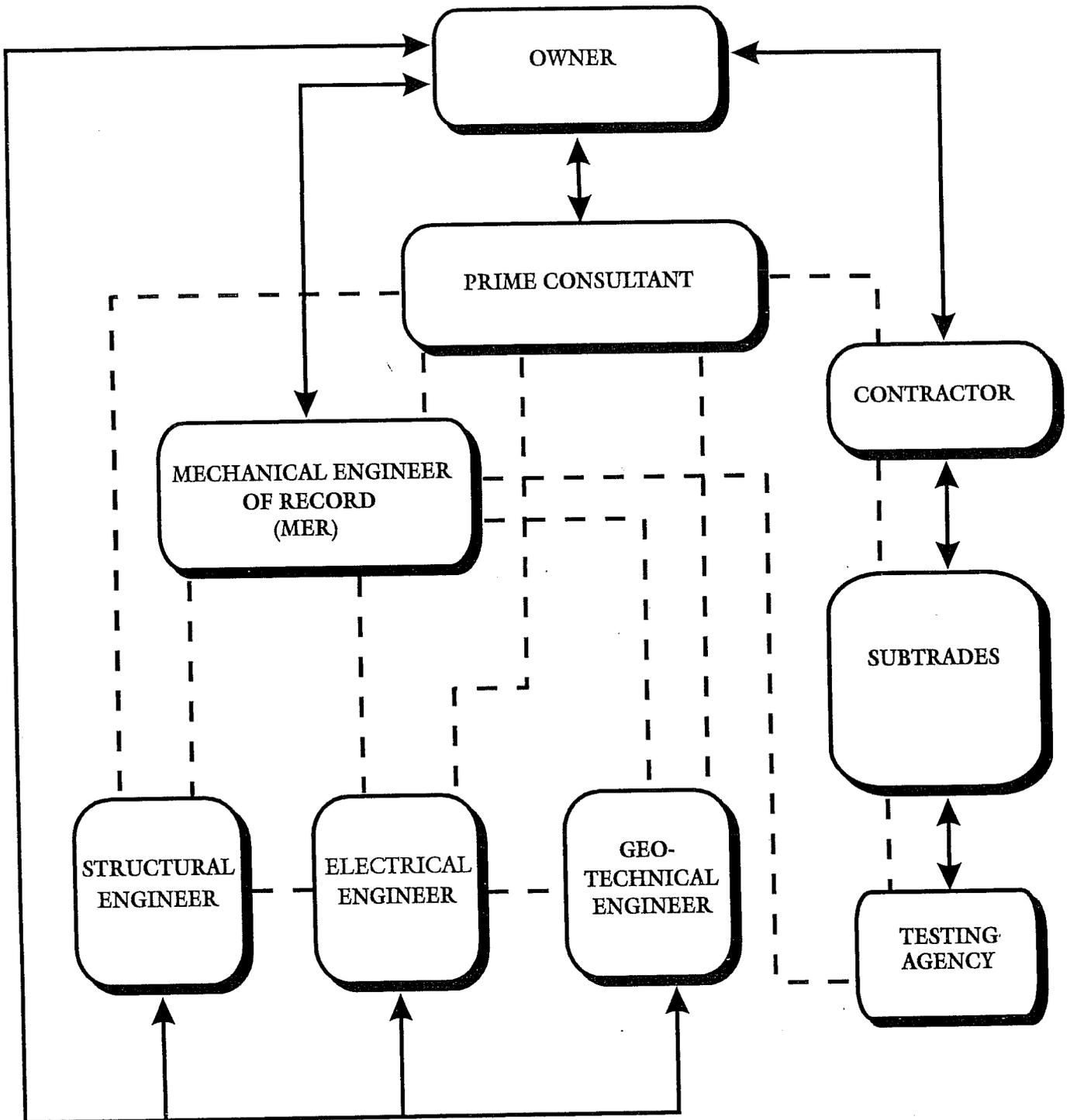


Functional Interface

Note: The *Prime Consultant* shall be responsible for coordination of the subconsultants even though they are hired by the *Owner*.

# COMMON ORGANIZATIONAL CHARTS

## 2. MECHANICAL ENGINEER OF RECORD (MER) / OWNER CONTRACT



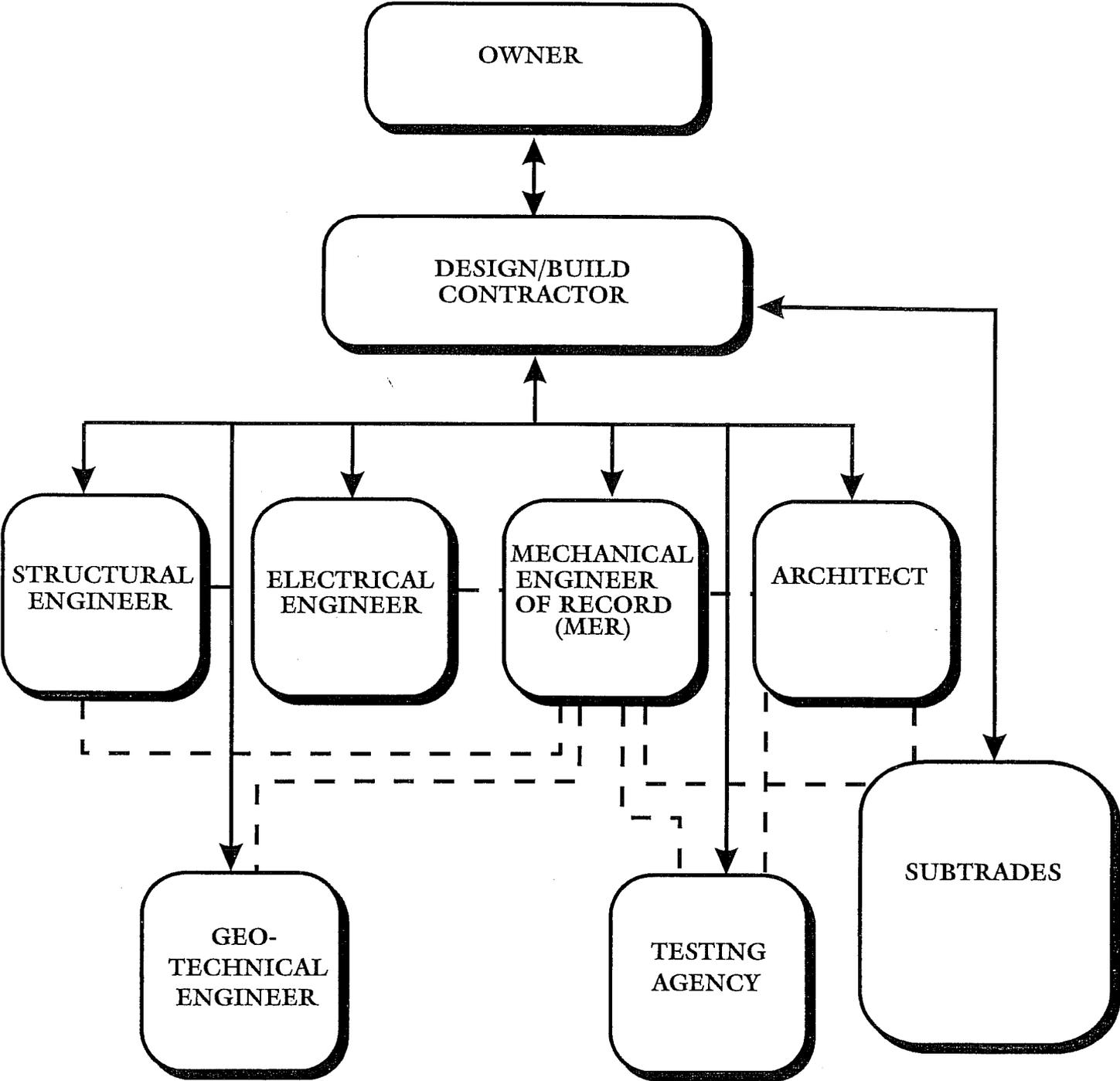
Contractual Relationship

Functional Interface

Note: The *Prime Consultant* shall be responsible for coordination of the subconsultants even though they are hired by the *Owner*.

# COMMON ORGANIZATIONAL CHARTS

## 3. DESIGN/BUILD CONTRACT



↔ Contractual Relationship  
- - - Functional Interface