SECTION M3 - DESIGN CONTROL

OBJECTIVE

To ensure all engineering design functions which occur during the duration of a project including environmental considerations are adequately controlled so that the Client's requirements are correctly interpreted and translated into practical design. It covers the preparation and verification of reports, calculation, drawings and other design documents.

RESPONSIBILITIES

Project Manager / Assistant Project Manager	- Overall responsible for the projects assigned to him - Responsible for design of works in accordance to relevant codes of practice. - Coordinate with the Design Assistant on their designs for production of drawings and check the drawings for accuracy. - Responsible for the arrangement of all checked and signed calculations, forms and drawings for Authority submission and follow up till approval. - To represent the Management at meetings with Clients, Architects, other Consultants, Contractors, and Authority if necessary
Project Team Member	- To assist the Project Manager in design and contract administration. - To feedback to the Project Manager on the impact of the M&E provision due to architectural and structural changes.
Checker	- The Project Manager shall assume this role or the Project Director may delegate this role to another suitable person.

PROCEDURES

1. Design and Development Planning

An overall project internal programme shall be prepared and documented in the PQP file. The overall project internal programme shall include all aspects/activities for design review and verification.

2. Organisational and Technical Interfaces

The Project Manager shall identify and record in Section 6.1 of the PQP the method of interface for Client's review and approval, interchange of design data with external design teams associated with the project and also between internal design teams within the office.

(a) Interface with Client and External Design Teams

The method of interface normally takes the form of the following:

(i) M&E Design Report
(ii) Series of pre-planned meeting at regular interval
(iii) Correspondences through telefax, letter, email and telephone.

The Project Manager shall establish the appropriate contact person from each design team for proper channeling of information and record in Section 3 of the PQP.

(b) Interface between Internal Design Teams

This is normally done through circulation of information and internal project team meeting.

3. Design Input

All design information, parameters, standard and statutory/regulatory requirements are to be established, identified and their selection reviewed for adequacy and appropriateness. The established design input shall be recorded in Section 8 of the PQP.

Design inputs may consist of the following:

3.1 Client Supplied Documents

This shall includes documents supplied by the Client and other consultant teams engaged by the Client, e.g. architectural drawings, structural drawings, specification, Client's design brief, etc.

Upon receipt of the Client supplied documents, the Project Manager/Assistant Project Manager shall review and circulate the documents for action to be taken by the respective project team members.

All ambiguity and inadequacy shall be feedback to the Client or the originator for clarification and correction.

In the event of revised or updated Client supplied documents, the Project Manager shall decide upon his/her review, whether a substantial design change with major cost and time implication to the Company will be incurred. If so, these shall be dealt with in accordance with Section M4 : Design Change Control.

3.2 Statutory Requirements and Design Standards

In general, all designs shall comply with local statutory requirements and design standards stipulated. The design standards shall consist mainly of Singapore Standards and Code of Practices, British Standards (BS), Australian Standards (AS), NFPA, IEC, etc.

The Project Director and Qualified Persons will constantly update the project team members of the latest changes or clarification from the local authorities via Memo and e-mail.

3.3 Design Guides/Handbook

Design guides or handbook prepared by other independent enquiry bodies or association may be referred to for design guidance and shall be recorded in Section 8.3 of the PQP.

3.4 Environmental Considerations

Environmental considerations can arise from the Green Mark criteria, relevant codes of practices, statutory / regulatory requirements, clients' requirements and design guides / handbook. Parameters include energy efficiency, water efficiency, site and project environmental management, indoor environmental quality and environmental protection as well as other environmental related innovations. These considerations shall form part of the design input during design phase and shall be recorded in Section 9.1 of the PQP.

Controls shall be established to ensure that its environmental requirement is addressed in the design and development process for the product or service, considering each life stage and shall be recorded in Section 9.1 & 9.6 of the PQP.

4. Design Output

All design output are to be documented and expressed in terms that can be verified and validated against design input requirements.

Design output may consist of the following:

(a) Reports
(b) Calculations
(c) Drawings
(d) Specifications

4.1 Reports

Reports classified as design output shall include the following:

(i) M&E Design Report

(ii) Cost Estimate Report

(iii) Tender Report

(iv) Technical Report

All reports shall be prepared complete with title page, revision no., etc.

All reports shall be reviewed by the Project Manager/Assistant Project Manager and approved by the Project Director including all subsequent revisions.

All reports shall be identified with a revision status starting from zero.

4.2 Calculations

All design calculations shall be carried out using appropriate methods and the calculations and results recorded.

Design calculations may be divided into two types:

(i) Manual Calculations

(ii) Computer Calculations/Output

4.2.1 Manual Calculations

Manual calculations may be carried out on the Company's standard calculation sheets and dated.

All calculations shall be legible and preferably in ink.

All calculations shall be maintained in an orderly method in the project calculation files (i.e. MC or EC File).

Amendments to established calculations shall be clearly indicated and superseded calculation sheets struck through with reference to the revised calculations indicated.

4.2.2 Computer Calculations/Output

Software used for the purpose of calculations shall be verified before use and take from the list stated in Section 8.6 of PQP.

Printouts of the software programs shall be obtained for record purposes, dated and filed in the project calculation files (i.e. EC or MC file).

Amendments to established calculations shall be clearly indicated and superseded calculations stuck through with reference to the revised calculations indicated.

4.3 Drawing

All drawings shall be prepared as stipulated under Section S8: Drawing Control.

4.4 Specifications

All specifications shall be prepared as stipulated under Section S4 : Specification Control.

5. Design Reviews

Design reviews shall be done to examine the following:

(i) Compliance to requirements of Client.

(ii) Compliance to regulatory requirements, relevant codes and standards, and office design policies.

(iii) Validity of methods, basic data and design assumptions used.

(iv) Completeness of design with due regard to coordination between various discipline (e.g. architectural, structural, mechanical, electrical, environmental etc.)

(v) Suitability of design in terms of performance characteristics and constructability.

(vi) Economical consideration

(vii) Sustainability of design in relation to resources conservation and pollution prevention

Depending on site and complexity of the project, the Project Manager shall determine and schedule the necessary design reviews.

The design review shall be chaired by the Project Manager/Assistant Project Manager and all design team members shall be involved. Where required, independent reviewers may be invited to review critical areas of design philosophy and methodology.

The design review shall be minute and the Project Manager/Assistant Project Manager shall ensure that all items review and concluded be incorporated into the final design. The Design Review Record Form may be used.

6. Design Check

The following shall be subject to design check prior to issuance for tender:

6.1 Specification

Specification shall be checked as stipulated under the Section S4: Specification Control.

6.2 Drawings

Drawings shall be checked as stipulated under the Section S8: Drawing Control.

6.3 Design Calculations

Design calculations shall only be checked where deemed necessary by the Checker.

The Checker shall request for certain design calculations to be checked when he find suspects in the specified equipment's data.

In the event of urgent release for tender, arrangement shall be made for the design check to be done after issuance. Any changes to the documents arising from the Checker's comment shall be reissued as addendum, etc.

A copy of the document incorporating all comments from the Checker shall be retained as record, and stamped with the 'Check Print' stamp bearing the date checked, name and signature of Checker.

7. Design Validation

The following shall reflect the design validations in a project:

7.1 Interim design validation

This step in design validation is deemed to have been achieved when all authorities submissions have been approved for construction to proceed.

7.2 Final design validation

This step in design validation is deemed to have been achieved when all relevant authorities inspection upon completion of project have been performed and relevant certificates have been issued.

REFERENCE

Form M3.A - Design Review Record

Standard Calculation Sheet