ENGINEERING DESIGN SHOP DRAWING APPROVAL PROCEDURES

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1.0 DEFINITIONS

In these guidelines, the following terms have the following definitions and are italicized in the text:

The Engineer
An Engineer or a subordinate whose operational control and conduct is in line with a recognised Quality Management System and is directly supervised by an ECSA Registered Professional Engineer within the office of the consultant.

Final Design drawings

Design drawings signed off by a professional engineer from the office of the consultant, which reflect the original system design before the generation and submission of Shop Drawings for the building project.

Shop drawings
Drawings, diagrams, illustrations, schedules, performance charts, brochures and other data intended to illustrate details of a portion of the work which are provided to the office of the consultant for approval before procurement and/or fabrication.

Fabrication or Detail drawings
Drawings produced to provide all information necessary for shop personnel to fabricate and/or assemble items.

As-Built drawings

Design drawings of in-situ installations with as much information and detail as was supplied in the consultant's Final Design Drawings. These as-built drawings are to be signed off by a professional engineer from the office of the consultant, which reflect design changes made during the construction of the building project.

2.0 PURPOSE

Shop drawings are prepared to provide information which assists in confirmation of the intent of the design, equipment performance as specified in the tender documents (Drawings, BoQ & Technical Specification) and to provide suppliers, fabricators or manufacturers with information which assists them in making the required components.

A contractor shall prepare clearly detailed and project specific shop drawings as called for by the contract documents or as the Engineer may reasonably request. Shop drawings are prepared by fabricators, suppliers, equipment manufacturers, sub-contractors and contractors or by others retained by these parties. Shop drawings are prepared following a review of the drawings, specifications and contract documents supplied by the office of the consultant – and other project consultants as may be applicable. Shop drawings may be required to be submitted at any stage of the project and shall always be requested for any design change request to scope of installations.

3.0 RESPONSIBILITY

Administrators of the Standard Operating Procedures are responsible for monitoring the implementation of the Standards and ensuring adherence to the Standards. Any proposed changes to this Standard must be reviewed by the consultant's Quality Management Reviewer for Final approval.

4.0 PREPARATION OF SHOP DRAWINGS

4.1 Applicable Standards

Unless otherwise specified further in the tender documents, the standards below shall form part of the requirement for equipment performance and installations' benchmark.

4.1.1 Local Municipality as advised by the Engineer
4.1.2 ASIB Automatic Sprinkler Inspection Bureau (Pty) Ltd
4.1.3 SANS 10 287- Automatic Sprinkler Protection
4.1.4 SANS 10 400 Application of National Building Regulations.
4.1.5 Occupational Safety Act
4.1.6 ASIB 11th Addition Rules (latest revision)
4.1.7 SABS 10 139-1981; The prevention, automatic detection and extinguishing of fire in buildings
4.1.8 SABS 1125-1977; Room air conditioners
4.1.9 SABS 10 173-1980; The installation, testing and balancing of air-conditioning duct work
4.1.10 SABS 1238-1979; Air-conditioning ductwork.
4.1.11 SABS 1424-1987; Filters for air-conditioning and general ventilation.
4.1.12 ANSI/ASHRAE 51, ASHRAE 90.1, ASHRAE 15, ASHRAE 52.1 & EN779 (latest revision)
4.1.13 ANSI Standard 221.47
4.1.14 ARI Standard 410
4.1.15 SABS 0147-1992; Refrigerating systems including plants associated with air conditioning systems
4.1.16 NRCA Standard for Roof Curbs
4.1.17 SABS 193-1972; Fire dampers.
4.1.18 EN 12101 - Smoke and heat control systems
4.1.19 NFPA 90A for flame and smoke spread for adhesives
4.1.20 SABS 0140-1978; Identification colour marking CGA, ETLC, CSA or UL/ULC certified for prewired equipment
4.1.21 SANS 10 142 – The Wiring of Premises
4.1.22 CGA, ETLC, CSA or UL/ULC certified for prewired equipment
4.1.23 SANS 10252-2(SABS 0252-2)

4.2 Specific Requirements

4.2.1 Drawing Software

The most current version of AutoCAD is preferred to be used, whilst earlier versions are acceptable to 2007. Earlier versions tend to have compatibility issues with later versions.

All drawings shall be submitted in 2010 editable .dwg and .pdf file formats.

4.2.2 Drawing Units

All drawings will conform to SI units (Systems International).

4.2.3 Language

All notes, comments and text will be in the English language (UK Standard). All instructions on a drawing shall be in the imperative tense i.e.: ducting to be insulated, 150mm high steel plinths to be provided for axial fans.

4.2.4 Information to be included on Shop Drawings

4.2.4.1 *Shop drawings* must make reference to the appropriate design drawings produced by the *Engineer* by indicating drawing number(s) and revision number(s) and the appropriate section of the specification.

4.2.4.2 *Shop drawings must include the following information:*

1. The original date of issue
2. The dates of all applicable revisions;
3. The project title;
4. Where applicable, the project address;
5. The project number;
6. Wherever applicable, the name(s) of the:
   i) Contractor(s),
   ii) Sub-contractor(s),
   iii) Supplier(s),
   iv) Manufacturer(s), and
   v) Separate detailer(s);
7. The sequence number for each *shop drawing*;
8. Identifications of all products and materials;
9. Relation to adjacent structures or materials;
10. Clearly-identified field dimensions; and
11. Applicable standards – such as a By Laws, SANS, ASHRAE, ASIB, BS, EN, etc

4.2.4.3 When the manufacturer's standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data are submitted as shop drawings, the contractor is to, where applicable:

1. Delete information which is not applicable to the project;
2. Supplement standard information where necessary to provide additional information applicable to the project;
3. Show dimensions and clearances required;
4. Show performance characteristics and capacities; and
5. Show wiring diagrams and controls.

4.2.4.4 Shop drawings provided for equipment must use the abbreviations used in the specifications from the Engineer and, where applicable, include the following:

1. Manufacturer identification;
2. Model number;
3. Installation arrangement;
4. Material sizes;
5. Construction details;
6. Dimensions;
7. Weight;
8. Operating characteristics as they relate to the use of application;
9. Operating performance curves;
10. IP Rating of equipment
11. Performance curves with clearly-indicated performance range(s);
12. Equipment efficiency;
13. Duty cycles;
14. Motor duty cycles;
15. Electrical classification;
16. Electrical data and characteristics;
17. Electrical wiring schematics & control logic;
18. Approvals;
19. Sound levels; and
20. Vibration levels if applicable.

The information above is typically available from the equipment manufacturer on request and is incumbent on the contractor to ensure this is presented to the Engineer for approval. Failure to request for approval of deviation from specification contained in BoQ and/or Technical specification, and/or Project Drawings, and/or Standards (as per Point 4.1 above), shall not absolve the contractor of the requirement to comply and the costs to remedy such shall be borne by the contractor.

4.3 Submittal of shop drawings

The Engineer may only accept Shop Drawings for review that the Contractor has reviewed and approved. Prior to submission to the Engineer, a Contractor is to review and approve all shop drawings. By this review and approval, the Contractor represents that it has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, and that it has checked and coordinated each Shop Drawing with the requirements of the work and

the contract documents. The contractor is to indicate its review and approval by including the date and the signature of a responsible person on each Shop drawing.

The Engineer may require that Shop Drawings be accompanied by a transmittal letter showing date, project title, project number, the contractor's or supplier's address, and the sequence number of each Shop Drawing submitted.

Shop Drawings can be submitted in electronic format, in the form of prints as The Engineer or the Project's Technical Specification may direct. The format in which Shop Drawings are to be submitted may be established at the start of the Project, however this document outlines the minimum standards required. Similarly the format in which Shop Drawings can be returned as having been reviewed or marked up may be established at the start of the Project. At the time of submission, the Contractor is to notify the Engineer in writing of any deviations in the Shop Drawings from the requirements of the contract documents.

The Contractor will forward the Shop Drawings to the appropriate members of the Consulting Firm's team for review. In performing his or her review, The Engineer will only review for conformity to the design concept and for general arrangement. Unless a deviation on the Shop Drawings has been previously approved in writing by the Engineer, such a review by The Engineer does not relieve the contractor from its responsibility for any and all errors or omissions in the Shop Drawings or from its responsibility for meeting all the requirements contained in the contract documents.

The Engineer must sign the Shop Drawings and include appropriate wording to indicate the nature of the review, and that the Shop Drawings were reviewed for general conformance only to the design concept and for general arrangement.

Unless otherwise directed by The Engineer, a contractor is to make all changes to the Shop Drawings which The Engineer may require to be consistent with the contract documents and resubmit the Shop Drawings. When resubmitting the Shop Drawings, a contractor is to notify The Engineer in writing of any revisions other than those requested by The Engineer. Equipment wiring and control diagrams are also to be submitted for review by the Engineer, but the approval does not relieve the contractor of the requirement for the correct switching, control logic and associated safeties with such equipment as per Standards stipulated under section

4.3.1 Drawing Sizes

STANDARD SIZE	DIMENSIONS	
	Width (mm)	Length (mm)
A4	210	297
A3	297	420
A2	420	594
A1	594	841
A0	841	1189

Figure 1: Standard "A" Series Drawing Sizes

Long drawings, where necessary for piping, wiring/circuit diagrams, cable run diagrams, etc. shall be prepared with widths equal to the widths of "A" series sheets, as required.

4.3.2 Drawing Scales

The requirements of scale settings are as follow:

- When using model space, the design must always be full size, i.e. active scale = 1:1.

In the case of non-dimensional drawings such as diagrammatic drawings, the viewport must be scaled to suit the drawing sheet. Different vertical and horizontal scales may be chosen in order to exaggerate a profile or to clarify thin layers of a section.

PREFERRED SCALES		
1:1	1:2	1:5
1:10	1:20	1:25
1:100	1:200	1:50
1:1000	1:2000	1:500

Figure 2: Preferred Drawing Scales

4.3.3 Dimensioning

- All detailed dimensions shall be in millimeters and must be of the filled head arrow type.
- All notes must have a leader pointing at the detail referred to.
- Co-ordinates shall be stated in meters to 3 decimal places.
- Dimensioning must be done whilst in model space, and NOT in an **active** viewport. Dimensions are not to be exploded.

5.0 DESIGN CHANGE REQUESTS

A Design Change Request (DCR) is the only way to materially change the design after Shop Drawing Approval. This Standard Operating Procedure (Document No.: SOP 012) and a DCR form (Document No.: IFQ 042 - Design Change Request) is always to be e-mailed to the project team for clarity of process in design changes requested or found due to change in layouts (i.e. architectural ceiling or floor layouts and clashes with other services)

The purpose of a DCR is to give clarity on the impact the change may cause on 1) Overall installation costs, 2) Mechanical & Electrical interfaces (weight, size, power supply, etc.), 3) Get a costing for the change if any, and 4) Who is responsible the costs for the change if any. Complete DCR's are to be submitted by hard copy or e-mailed to the project Engineer (refer to project specific contact register and organogram). Cost Account holders include for Tenants (Tenant Account), Main Contractor, Subcontractor, Variation Order / Scope Creep (Addition to Subcontractor scope) and Value Engineering (Reduction to subcontractor scope).

Design approval may only be signed off by the Engineer whilst cost approval shall be signed by the following:

1. The Engineer (Mechanical, Electrical & Fire Consultant)
2. Project QS and/or Principal Agent (mostly Project Manager)
3. Tenant
4. Main Contractor

Material Changes are:

1. Change in equipment or material quantities (i.e. sprinkler heads, water mains, diffusers,
2. Relocation of units and/or clash avoidance (i.e. coordination on site)
3. Scope change (i.e. change in space usage/size/layout resulting in equipment/reticulation change in size and specification)
4. Value Engineering (i.e. equipment or material change to save costs)

Note: Alternative equipment, qualifications and omissions must be handled at Tender or shop drawing submission. These must be clearly set out by the contractor and signed off by the Engineer.