EXPRO
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Expenditure Efficiency & Projects Authority

# National Manual of Assets and Facilities Management

## Volume 5, Chapter 21

## Control of Drawings Procedure

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## 1.0 PURPOSE

The purpose of this document is to provide guidelines and best practices in relation to the Control of Drawings Procedure. These recommendations will assist the Entity in the management of the drawings, for which they are responsible. The guidance provided, shall be applicable to the ISO Quality Management 9001 systems and requirements of the Kingdom of Saudi Arabia (KSA).

## 2.0 SCOPE

This document is applicable to Senior Managers, and those assigned with the role of drawings management in the following six Entity types:

- Healthcare
- Schools and Universities
- Office Facilities
- Municipal Facilities
- Housing Facilities
- Parks and Recreational Building Facilities

This document provides the Entity with information that enables it to:

- Understand what is meant by 'Control of Drawings' in an Asset Management and Facilities Management (FM) context.
- Understand the benefits that may accrue from implementing a written procedure.
- Ensure how implementing the Procedure informs and improves their business' decision-making about controlling drawings.
- Introduce the roles and responsibilities of the Drawing (or Document) Controller.
- Provide a rationale for implementing formal Drawing Control procedures.

The presence of a Drawing Control process is the responsibility of a Senior Document Controller within each Entity. The responsibility for following the process lies with any stakeholder that has reason to be involved, or use drawings for their intended purpose. Whilst the ongoing task of managing the process and control, storage, and retrieval, may be delegated to a competent person, the overall responsibility remains with the Entity's management.

The scope of this document does not include Drawing Standards as stipulated in CAD Standards; ISO128, BS888, BS 1192, NCS, ISO 13557.

**Note:** The Control of Drawings shares a similar understanding of the Documents Control NMA&FM Volume 13.

## 3.0 DEFINITIONS

| Term | Definitions |
|---|---|
| Asset Register (AR) | Lists all the assets owned by an Entity and specific and relevant details about each, maintainable asset. The Register may also identify the location, description, value, and age of the asset. |
| Due Diligence | Compilation, comprehensive appraisal, and validation of information of an organization that is required for assessing the accuracy, commercial integrity, financial stability, functional competence, and integrity at the appropriate stage of the agreement sourcing process |
| Entity (or Entities) | A government organization in the Kingdom of Saudi Arabia that is responsible for the delivery of government-funded Operations & Maintenance (O&M) Projects. |
| Facilities Management | An organizational function which integrates people, place, and process within the built environment, for the purpose of improving the quality of life of the people, and the productivity of the core business. |
| Industry Best Practice | In relation to any undertaking and any circumstances, the exercise of that degree of skill, diligence, prudence, and foresight which would reasonably and ordinarily be expected from a skilled and experienced operator engaged in the same type of undertaking, under the same or similar circumstances |
| Quality Management | The act of overseeing all activities and tasks that must be accomplished, to maintain a desired level of excellence. |
| **Acronyms** | |
| AR | Asset Register |
| BIM | Building Information Modelling |
| CAD | Computer-Aided Design |
| CI | Control of Information |
| DB | Distribution Board |
| IT | Information Technology |
| FM | Facilities Management |
| HSSE | Health, Safety, Security & Environment |
| KSA | Kingdom of Saudi Arabia |
| KPI | Key Performance Indicator |
| NMA&FM | National Manual of Assets and Facilities Management |
| O&M | Operations & Maintenance |
| SME | Subject Matter Expert |

## 4.0 REFERENCES

- ISO 128: Standard for the general principles of presentation in technical drawings, specifically the graphical representation of objects on technical drawings
- BS8888: British standard for technical product documentation, geometric product specification, geometric tolerance specification and engineering drawings
- BS 1192: British Standard that establishes the methodology for managing the production, distribution, and quality of construction information, including that generated by CAD systems
- ISO 13557: CAD layer standard
- NMA&FM Volume 13, Document Management.

## 5.0 RESPONSIBILITIES

**Entity Directors**

The role of an Entity Director is to:

- Determine the Entity's Policy on the Controlling of Drawings
- Endorse and ensure the implementation of the strategic direction that enables the Entity to maximize its position on the quality of controlling its drawings and documents.
- Ensure a budget is set aside for the Entity for the Controlling of Drawings, either manually and/or using software.
- Ensure that appropriate security supports its Information Technology (IT) systems throughout the Entity.

**Facility Manager**

The role of a Facility Manager is to:

- Execute the Procedure, in line with Entity Policy
- Advise the Entity Director on the best strategy that fits within the Facility either manually and/or with the purchase of software.
- Ensure that procedures are developed for operational excellence.
- Endorse training of its operational staff on managing and controlling drawings.
- Develop and implement quality control systems and procedures to maintain the integrity and usability of the its department's 'Control of Drawing' process.
- Ensure appropriate auditing of its drawing control systems, and that they are compliant with ISO 9001 International standards.
- Manage staff resources to ensure the quality of drawing control is maintained.

**Health, Safety and Environment Manager**

The role of a HSE Manager is to:

- Ensure that the requirements of all Health, Safety and Environmental legislation and regulations, are appropriately followed in all Control of Drawing activities.
- Ensure that all activities conform to the requirements of the Entity's Safety Management System.
- Record incident and accident information, and provide reports to the Entity's management.
- Manage internal and external audits to ensure best practices are being maintained.

**Document Controller**

The role of a Document Controller is to:

- Ensure that drawings and documents are collected and stored, as per the Entity's procedure.
- Create, monitor and maintain drawing documents to ISO 9001 International Standards.
- Ensure that all drawings have the appropriate recorded information.
- Archive all obsolete drawings.
- Prepare all drawings and documents for all internal and external audits.
- Maintain a clear and simple library system, that is reflective of the Entity's procedure.

**Operations Manager**

The role of the Operations Manager is to:

- Collaborate with the Facilities Manager and Document Controller, to ensure that their Department Control of Drawings' requirements are understood and communicated.
- Ensure all new drawings are sent to the Document Controller for processing.
- Assist the Document Controller with maintaining the Control of Drawings.

- Promote the Entity's Control of Drawings Procedure.
- Manage its contractors to ensure the Control of Drawings Procedure is being followed.

**Contractors**

The role of a contractor is to:

- The role of a contractor may be classified as an external Project Manager, Project Engineer, Civil Engineer or MEP Manager.
- Follow the Control of Drawings Procedure as per the Entity's recommendations.
- Inform the Document Controller of any deficiencies in the process, or the drawings.

## 6.0 PROCESS

Each drawing shall be treated with the same due diligence as any other critical asset, i.e. just as with the asset it describes, the drawing shall have a lifecycle plan associated with it, and therefore a duty of care shall exist to manage that life-cycle. A drawing's life-cycle, is the lifecycle of a drawing from its design phase to its 'As Built' Drawing phase.

The benefits of implementing a written procedure for the Control of Drawings are:

- Costs savings influenced by technical staff repairing and/or locating equipment.
- Equipment working online has a positive impact on potential operational Key Performance Indicators (KPI's).
- Implementing a document control system to reduce storage space.
- Better Collaboration.
- Quick emergency and disaster recovery.
- Assists designers and builders with refurbishments or minor, new works

The following are examples of risks associated with a poor drawing control processes:

- Misfiled or misplaced drawings.
- Incorrect revision of controlled drawings.
- Parts and materials ordered against incorrect revisions of drawings.
- Unauthorized release of sensitive drawings, due to insecure facilities.
- Misdiagnoses of faults, due to wrong or inaccurate drawings.
- Safety hazards to personnel and equipment.

Further information on the roles of personnel and procedures are further described below.

### 6.1 Document Controller

A Document Controller has the responsibility of maintaining and controlling drawings. For Control of Drawings to be effective, there must be a governance procedure. A high-level configuration of a typical Document Control system can be found in Figure 1.

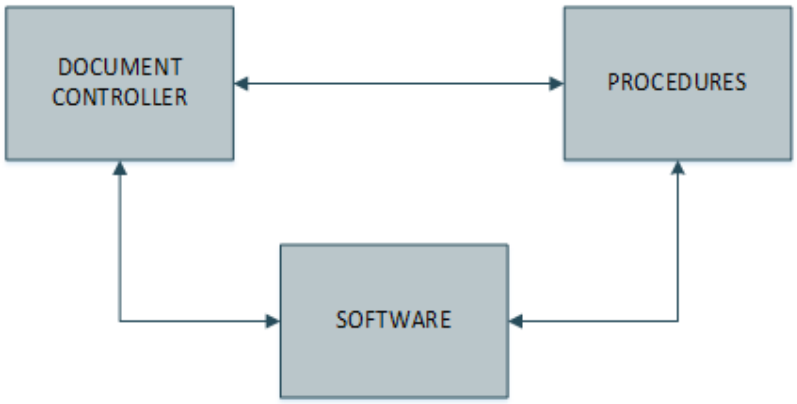


**Figure 1: Document Controller Position**

Simply creating drawings and recording data is insufficient; to be useful, drawings and data must be stored in a fashion where their easily accessible, safe, reviewed, approved, published, and maintained. In other words, drawings and data require a robust document control process, and a designated and responsible owner of that process.

For this reason, the responsibility for the Control of Drawings in general, shall be designated to a competent Document Controller within each Entity, the configuration of which, shall be in accordance with the NMA&FM Volume 13.

## 6.2 Drawing Control Procedure

The external Project Manager has an open work order on new works, and the Project Manager has passed on the new Drawings associated with his/her project to the Operations Manager of the Entity. Once a new Drawing has been identified for 'Document Control' from the Operations Manager, the subject matter expert (SME) is then chosen as the reviewer of the new Drawing. The SME then notifies the Document Controller either by email, or by a Document Controller software system, that they need to review a new Drawing.

### 6.2.1 Format

The Document Controller provides the SME with a Document Review Form which provides information on the new or amended system. For the Document Controller to ensure the library system is easily categorized and identified when being searched in the future, the form's format should include the following:

- Document Type
- Title
- Asset Number
- Description
- Date of Issue
- Facility
- Authorization
- Document Identification
- Revision History

All new drawings shall be verified by two SME's; for example, this may be the Operations Manager and Contractor before submitting the new proposed drawing to the Document Controller, along with a completed Document Review Form.

### 6.2.2 Controlled

Once the drawing has been reviewed and approved by the SME, the drawing is then passed to the Document Controller, either through a software system or by email. The software system is recommended

due to being safer, rather than using an email option. Information may be lost due to utilizing the emailing system, and this could be caused by simultaneous multiple drawings and document update requests. Therefore, maintaining a software system would be beneficial rather through a filling/folder document control system. It is understood that this option may not be the most feasible, if the Entity has a small Facility and/or if the Entity has minimal updates for Control Drawing requests.

**Typical Document Types**

| | |
|---|---|
| DRAW = Drawing | PROC = Procedure |
| PLAN = Plan | STND = Standard |
| MANL = Manual | FORM = Form |

### 6.2.3 Authorization

Depending on how the resources are managed, the size of the Entity and the type of request, authorization may be sufficient from the approved SME and contractor. However, the Entity should also consider security and higher potential risks within its business, when final authorization is being issued. Therefore, approvals from a contractor may not be the best choice.

### 6.2.4 Distribution of A Live Document

The Document Controller is now in possession of the new drawing and is responsible for uploading and controlling the drawing within the Entity's data system. The system should be accessible by the Operations Manager and FM. However, these rights should be 'read' only, as the Document Controller has full control of its library's data system. The Document Controller will notify all stakeholders involved, of the updated drawing version.

A typical high-level workflow process of the document control system can be found in Figure 2.

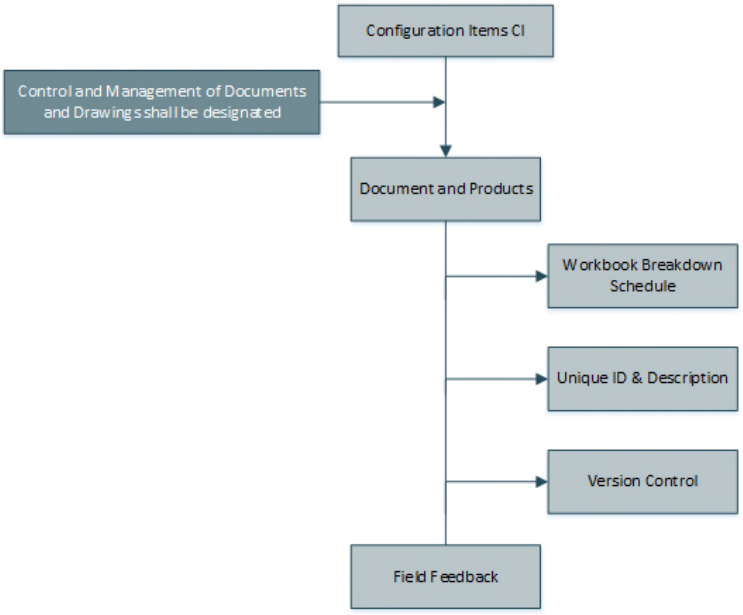


**Figure 2: High Level Document Control Process**

### 6.2.5 Periodic Review

It is recommended that an Entity initiate a periodic review of its Control of Drawings. The degree of the periodic review should be assessed by the Entity, and its risk management system. The purpose of having such a review is to ensure that the Drawings are of the latest revision, and to ensure the Control of Drawings Procedure is the most efficient way of conducting business. Finally, the Entity should be comfortable that the its Control of Drawings is aligned with its assets.

Control of Drawings consists of attributes, and a defined, control process. Drawings, including technical documents such as specifications and procedures, will usually contain the following attributes:

- An Owning Organization, which is ultimately responsible for the Document Control.
- Document Identification by using a Document Numbering System.
- Title or Description.
- Document Revision, or other indication of a specific design iteration.
- Author(s), reviewer(s) and/or others who created the information.
- Appropriate Technical Information.

A Document Control process consists of a set of procedures for creating and maintaining the attributes of drawings.

Drawing Control processes include business rules that define:

- How to support drawing types, and the contents and format of each type.
- How to identify drawings, for example by owner, number, revision, or title.
- Person(s) responsible for creating, reviewing, and approving drawings.
- Control of access and authorities.
- Follow-up Activities.
- Copyright and Ownership.
- The conditions required to revise, replace, or cancel existing drawings.
- How to control, recall or destroy obsolete drawings.

Drawings that have a consistent set of attributes, and are controlled using a documented set of procedures, significantly reduce product costs by simplifying design, sourcing, production, customer adoption and field service.

## 6.3 Quality Control

Quality Control is important and it is common poor practice that design drawings are renamed to ‘as installed’ without actually being ‘as installed’. Additionally, maintenance technicians will likely have annotated copies that never become official versions within the Document Control system. Implementing a simple procedure that all can follow will keep the Control of Drawings at a high level.

It is equally important that obsolete or outdated Drawings are maintained in the Entity’s data base system. This is good practice to show the development over the lifecycle of the Asset. The Drawing shall be marked as outdated, and revised with a new Drawing number. This will ensure that no confusion occurs between the new and old Drawings.

Destroying of documents should only be considered and approved by the Entity’s authorized personnel, based on business, legal, and regulatory requirements.

### 6.3.1 Drawing Identification Convention

Every asset that resides in the Asset Register (AR), is identified by a standardized, common language protocol. This principle is reflected in every effective Drawing Control process, and there are differing standards, depending on the classification of subject matter contained within the drawing. These standards are covered in the references provided, and shall be deemed essential benchmarks towards establishing a Drawing Control procedure, in each Entity’s Document Control Team.

Drawings that are stored on the Entity’s data base system must comply with the Drawing Identification Convention standards. Computer Aided Drawing (CAD) is one way of developing drawings to a professional level, and can be stored electronically. It is recommended that all drawings saved on the Entity’s data base system should be from some form of aided computerized software. This ensures that the detail is read easily, change of designs (when required) are perfected, higher-quality designs are developed to scale, and can easily be shared.

A Document Controller shall ensure engineering drawings have five primary parts, before installing the drawing into its library system. This includes:

- Title Block
- Co-ordinated Grid System
- Revision Block
- Legends
- The Main Engineering Drawing

The Title Block - The drawing typically comprises of the drawing title, the drawing number, location, site name or owners name, scale, drawing size, sheet number, and approving officer. The Title Block is normally found at the bottom right hand corner of the drawing. Usually drawing identification numbers are unique, and contain the type of system, drawing and Entity's asset. The Title Block also comprises approval dates and signatures.

Co-ordinated Grid Systems – These are commonly found on electrical and instrumentation, schematic drawings. The grid system assists the technician in locating points of equipment that are illustrated by listed letters and numbers that run, similar to longitude and latitude lines on a map.

Revision Block - Is simply a place where the revision number is located. Every time a drawing is revised, the number is updated in the Revision Block. The revision includes the revision number, tile of the revision, and issue date.

Legends - Drawings can get very complicated to understand. Legends comprise symbols and lines which identify certain aspects or features of the drawings, and make it easier to read.

The Engineering Drawing – For example if the drawing may be made up of a piece of equipment, the drawing will illustrate floor plans, section views, and elevation views. Other information on the drawings may show dimensions, material types, part numbers, and assembly types.

Other than CAD, but not always available on older sites, another way to locate services and transfer building operations knowledge is through 3D Building Information Modelling (BIM). If available, the Entity should consider using BIM to illustrate an entire Facility through its 3D modelling.

BIM provides more than a 3D virtual reality illustration experience. It also provides asset information, such as the location, service history, cost, carbon impact, maintenance, spares, substitution, serial number, warranty details, specifications, and asset numbers.

Upon an application to change or implement a new Drawing through BIM, authorization must be provided by the Entity's SME. Only then can the Document Controller release the new updated BIM within its library system. The Entity should consider reviewing its BIM Drawings frequently, as this reduces the risk of the BIM Drawing becoming outdated, and therefore obsolete.

### 6.3.2 Document Control Software

The volume, size and complexity of files created is difficult to manage. Therefore, Entities should strongly consider Control of Drawings through a software platform. There are many different types of document management software available on the market, with Aconex and eQuorum, to name a couple. The software solutions are central to configuration management, and this can be critical, e specially for Entities that have highly-sensitive Facilities, and associated equipment. Some benefits of using a document control management system are:

- Enhanced Security
- Reduced Storage Space
- Streamlined Workflows
- Audit Trails
- Version Control
- Paperless Office
- Safe Storage Location

The Entity should consider the following critical elements, for drawings stored on its data base system:

- File types must be compatible with the Entity's IT system
- Build an electronic library convention system
- Ensure a retrieval process for emergency and non-emergency situations
- Ensure to allow restricted database access
- Provide external connectivity through the intranet or local HD

The software should be user-friendly, and appropriate training shall be provided by the Entity, to enable its users to be sufficiently competent in providing an easy and efficient way of updating their Drawings.

### 6.3.3 Audits

It is the Document Controller's responsibility to initiate and monitor regular audits of Drawings and Documents. Periodic audits, internal and external, are an important part of the operation of a Facility. This ensures the Facility is maintaining its efficient reliability to safeguard its assets.

An internal audit is usually set up and managed by the HSQE manager. As per ISO 9001 standards, the standard requires recertification every 6 months by an external ISO quality management provider. This then gives the opportunity for the Entity HSQE Manager to conduct an internal audit of its Control of Drawings.

The objectives of internal audits should include, but not be limited to:

- Checking for Drawing information, including Drawing Conventions are being adhered to
- Reviewing technical Drawings to check for compliance with standards
- Filing of Drawings in physical and digital-record structures
- Correct use of processes, and non-conformances
- Ensuring that the movement of Drawings are being tracked
- Ensuring that confidential Drawings and sensitive information, are being strictly managed
- Securing and protecting Drawings from disasters such as fire or flood damage

### 6.3.4 Site Versions

Most hard copy Drawings should be stored in a secure cabinet, while soft copy Drawings in a reputable computer filing system. However, many Drawings for legal reasons, are required to be kept on site, usually for emergency use.

Some examples of this are:

- An electrical circuit drawing shall be securely stored at each electrical distribution board (DB), to describe the relevant circuit for that DB.
- Plant Room Drawings, shall be stored outside of plant rooms, for Emergency Services.
- Evacuation Drawings shall be found outside passenger lifts, muster points, main exits of office spaces, to assist during any emergency evacuations.

In these instances, the responsibility for the Control of Drawings rests upon the FM. To reduce the risk that these types of Drawings are not updated regularly, regular inspections shall be conducted (usually included with the Preventative Maintenance), to ensure Facility needs are satisfied. They should not be visible to unauthorized users, or be allowed to be photographed or copied. Any non-conformance shall be acted upon immediately.

### 6.3.5 Change Control

A detailed description on Change Control can be found in the National Manual of Assets and Facility Management Volume 5, Change Control and Configuration Management. It states that Information is an asset, and Drawings must be treated as such. If the configuration of an Asset is changed, there will be an

associated drawing that requires amendment, and as a result of that change. The Document Controller shall manage any amendments by keeping a log of drawing activities, including version control.

### 6.3.6 Change Control Failure

Change Control Failure is usually a result of insufficient document management, and auditing. The process of Change Control outlines the principles of Control of Drawings as a critical business activity, with potential legal implications. Quality and Safety may be severely at risk, if this aspect of management is overlooked or ignored.

For example, new works require the ground on a Facility to be excavated. Before such excavating can proceed, the underground services must be located on a Facility. The easiest and most efficient way, would be to locate the latest drawings within the Entity's library system to ensure no live cables are being buried within the work zone area. Additionally, using radar systems to confirm the drawings, would be sufficient for a decision to start excavating. This example highlights the importance the Control of Drawings, and for maintaining up-to-date records, within a Facility.

There are alternative ways of finding cables and services, but these come with a cost, and are not as efficient as the Control of Drawings. Other potential ways may be as follows:

- A technician physically tracing water pipes, storm water and sewerage drains, as well as electrical, telecommunications and cables.
- Using Radar systems when locating underground services.
- A technician conducting a continuity test.

Additionally, building security is a prime factor for the security of an Entity, and the protection of its overall assets contained within. Change in Control Failures may have a devastating effect on the Entity's Facility and its buildings intelligence, if security measures are not implemented on the Control of Drawings.