MIT
Design Standards

BIM and CAD Drawing Standards

T03 Thematic Folder

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Department of Facilities

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1. INTRODUCTION

These guidelines are issued to promote the development of electronic drawings and models suitable for use in the MIT Department of Facilities CAD and BIM environment. Consistency and compatibility with existing MIT documents can only be achieved when these standards are strictly adhered to. Electronic drawings produced and submitted in accordance with these standards have significantly greater value to the Institute. Architects, Engineers and Contractors delivering documentation to MIT must ensure these standards are reviewed, understood and followed by those people responsible for preparing electronic drawings and models.

Each of the following sections contains the most essential criteria for developing electronic drawings and models for use in the MIT CAD and BIM environment.

1.1 Renovations and Space Change Projects Requirements

For typical Renovation and Space Change projects, the Designer is responsible for submitting a complete set of construction documents (CDs) to MIT prior to the beginning of construction. During construction, the Contractors are responsible for submitting complete As-Built documentation to the project team as described in their contracts in electronic format and Designers are responsible for submitting the record documents to MIT based on this As-Built documentation. Construction Documents and Record Documents submitted to MIT need to adhere the criteria outlined in this document.

Designers that are not familiar with MIT's CAD requirements should meet jointly with the MIT Project Manager and representatives from MIT's Facility Information Systems (FIS) to discuss specific project requirements *prior to the development of any CAD documentation*. The MIT Project Manager should also take this opportunity to relay the project scope to FIS so MIT can furnish Designer with existing drawings that will benefit the design team.

Milestone Deliverables:

1. For typical Renovation and Space Change projects, the following documentation shall be delivered to MIT at the following project milestones:

   Design: When the project is in the end of design phase, the Designer shall submit a complete set of Design Documents (100% DD) in electronic format to MIT. These documents will be archived as a record of the project and will also be used for initial room numbering purposes. Please refer to the MIT Space Accounting Guidelines for information about the room numbering process.

Construction: When the project enters the construction phase, the Designer shall submit a complete set of 100% Construction Documents (100% CD) in electronic format to MIT. These files will be archived as a record of the project and will be used for room numbering verification. Please refer to the MIT Space Accounting Guidelines for information about updating room numbers during the construction process.

Completion: When the project has been completed, the Contractors shall submit a complete set of As-Built (AB) Documents to the project team as described in their contracts (electronic format). Designers are to submit the Record Drawings based on these As-Builts and need to meet the format requirements outlined in this document.

1.2 Capital Projects Requirements

For typical Capital Projects, the Designer is responsible for submitting a complete set of construction documents (CDs) to MIT prior to the beginning of construction. During construction, the Contractors are responsible for submitting complete As-Built documentation to the project team as described in their contracts (electronic format only) and Designers are responsible for submitting the record documents to MIT based on this As-Built documentation. Construction Documents and Record Documents submitted to MIT need to meet the criteria outlined in this document.

Recognizing the diverse nature of capital projects, Designers shall meet jointly with the MIT Project Manager and representatives of Facility Information Systems (FIS) to discuss specific electronic requirements for the project in the early stages of project startup. All Designers should also take this opportunity to relay the project scope to FIS so MIT can furnish the Designer with existing drawings that will benefit the design team. Please request any additional documents through the Project Manager.

Milestone Deliverables:

For typical Capital Projects, the following documentation shall be delivered to MIT at the following project milestones:

Design: When the project is in the end of design phase, the Designer shall submit a complete set of Design Documents (100% DD) in electronic and hard copy format to MIT. At the completion of the project, these documents will be archived as a record of the project and will also be used for initial room numbering purposes. Please refer to the MIT Space Accounting Guidelines for information about the room numbering process.

Construction: When the project enters the construction phase, the Designer shall submit a complete set of 100% Construction Documents (100% CD) in electronic and hard copy format to MIT. At the completion of the project, these files will be archived as a record of the project and will be used for room numbering verification. Please refer to the MIT Space Accounting Guidelines for information about updating room numbers during the construction process.

Completion: When the project has been completed, the Contractors shall submit a complete set of As-Built (AB) Documents to the project team as described in their contracts (typically in electronic and hardcopy formats). Where applicable, Designers are to submit the Record Drawings based on these As-Builts and need to meet the format requirements outlined in this document.

2. CAD DRAWING PRODUCTION

2.1 File Format and Setup

Electronic File Format:

Construction and Record Document project drawings must be submitted in the file formats listed below; other formats are not acceptable without the prior consent of MIT's Facility Information Systems (FIS). Please coordinate with FIS by e mailing FIS-request@mit.edu.

a) AutoCAD®– DWG format only
b) Revit®– RVT format only
c) Adobe® PDF
d) TIF 6.0

Scale, Units, and Tolerances:

1. All CAD drawing models shall be drafted at full scale in architectural units, such that one drawing unit equals one inch. Tolerances for CD's are implicit within professional service contracts.

Fonts and Text Styles:

1. Drawings created using non-standard AutoCAD® fonts, linetypes, and hatch patterns can result in content discrepancies in the delivered drawing set. To ensure the integrity of the drawing set and minimize potential problems:

    a. Only native AutoCAD® fonts, linetypes and hatch patterns are to be used. These are standard support features installed as part of a standard AutoCAD® installation.
    b. Custom fonts, linetypes and hatch patterns, including those provided by 3rd party

software, shall not be used.

c. Only these TrueType fonts shall be used: Arial, Courier New, Times New Roman.
d. Postscript fonts are not to be used.

Blocks:

1. MIT is currently not imposing the use of any particular block definitions or block libraries. However, MIT requires that the following general rules be employed when handling block entities:

   a. All blocks and entities within a block must be created on layer 0.
   b. Drawing entities translated into blocks from non-AutoCAD® systems must revert to layer 0 when exploded.
   c. File translation from other systems which result in wall blocks within the DWG file are unacceptable.

Object Enablers

Drawings created using standard AutoCAD® Object Enablers are not acceptable without the prior consent of MIT's Facility Information Systems (FIS).

2.2 Title Blocks

Each CAD file submitted to MIT shall have only one title block. If using paper space, the title block shall be placed with its lower left hand corner point inserted at a coordinate location of (0,0,0). Depending on the purpose of the drawing or facility documentation, the drawing's title block shall contain certain essential information that MIT needs to store and retrieve each drawing in its library.

Required Title Block Information:

1. Original issue date - this date should not change once the drawing has been issued.
2. Sheet number.
3. Title - description of drawing and location information. Location information should include all building, floor and room numbers as applicable.
4. Revision history - as applicable.
5. Drawing phase – for instance, drawings submitted as As-Builts or Record Design should clearly be marked as such.
6. MIT Project number
7. A/E/C – Consultant responsible for producing the drawings should be clearly identified.

Required Sheet Information:

1. Drawing title - indicating the drawing content, e.g. floor plan, section, detail, etc.
2. Sheet identification – must follow the Sheet Naming Convention in Section 4 of this document
3. Date of drawing - date of final revision of the record drawing
4. Drawing Scale - representing the intended plot scale of the drawing with title block
5. North Arrow showing orientation of drawing (when applicable)

Use of External Reference Files (XREFs):

1. MIT **will not** accept the submission of any CAD drawing deliverable which contains unbound references to external source drawing files. All externally referenced data sources that were used during the CAD drawing production phase should be inserted and retained as a block within a single drawing file, including the title block, upon project completion and prior to drawing delivery to MIT. Layers contained in XREF's inserted as blocks should conform to MIT guidelines. The resulting self-contained drawing file is an acceptable deliverable to MIT.

Use of External Image Files (JPGs, BMPs, PNGs, etc.):

1. MIT **will not** accept the submission of any CAD drawing deliverable which contains referenced images. All images must be imbedded as OLE objects and must not be referenced outside the DWG file. Referenced images will be discarded and therefore might cause incomplete drawings. Please be aware of this when creating your CAD files.

Model and Paper Space Usage:

1. AutoCAD® drawings created outside of MIT sometimes contain more than one drawing sheet per file. While this may facilitate the production of construction documents, it will impede the archival process and create content discrepancies. MIT requires that each CAD file submitted as a project deliverable contains only one drawing model with one title block, using either of the following setup methods. Note that some MIT clients may express a preference for one method to be used instead of another. In this case, please see your MIT client representative for specific preferences.

    a. Method #1 Model Space Only: Both the drawing model and the drawing's title block are contained in the same model space environment within a single CAD file. The paper space environment is not used. Features are drawn to 1:1 scale and title block is scaled up to appropriate sheet size.
    b. Method #2 Model Space and Paper Space Combined: Each CAD file is set up to contain only one title block in paper space which references the building model contained in model space. Title block shall be drawn at 1:1.

Summary of Best Practices:

1. General:

    a. Prior to delivery to MIT, AutoCAD® files containing multiple drawing sheets shall be broken down into separate drawings containing single sheets.
    b. AutoCAD® files delivered to MIT shall contain only one drawing and one title block per file.
    c. All AutoCAD® drawings shall be purged of empty, unused, or non-essential drawing data prior to submittal. This includes all unused layers, linetypes, blocks, fonts and entities.
    d. AutoCAD® drawings shall not contain any frozen layers. All unused entities on frozen layers shall be erased, and the empty layers purged.
    e. Place title blocks, schedules and general notes at full-scale in paper space whenever possible.
    f. Label scaled viewports with the appropriate scale in paper space.
    g. Draw all model space objects at full scale.
    h. Scale objects using paper space viewports – zoom viewports to the appropriate scale.

2. In Addition, the following practices should **not** be followed and using any of the following practices will result in the rejection of the files:

    a. Do not place or draw model-related blocks, tags and objects in paper space.
    b. Do not dimension model space objects in paper space.
    c. Do not rotate the UCS.

2.3 Layering

General: MIT has adopted the layer name and use rules recommended in the United States National CAD Standard (NCS)- for the following categories. These standards can be found at https://www.nationalcadstandard.org/ncs6/.

1. Architectural
2. Electrical
3. Mechanical
4. Plumbing
5. Structural

Where noted, MIT has supplemented the NCS with its own rules and standards, as necessary. MIT's layers listed in this guideline shall always take precedent over the NCS guidelines where applicable. For additional detail, beyond what is outlined, please refer to the National CAD Standard.

Exceptions to the NCS: MIT has not adopted the NCS for the following categories:

1. Civil
2. Landscape
3. Site
4. Surveying

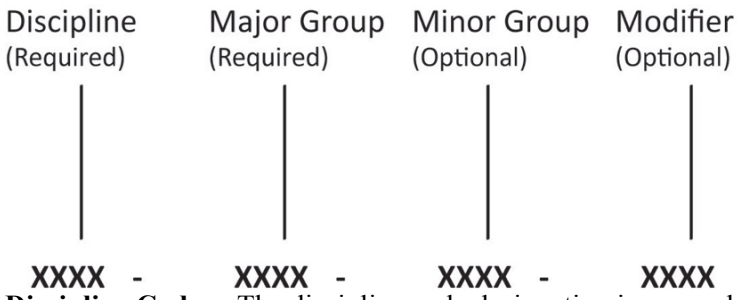
Layering for these disciplines may be found above. Layers for land surveying can be found in the MIT Design Standards Land Survey Thematic Folder.

Effective Use of CAD Layering Standards:

1. Allow users to isolate systems and drawing elements by controlling the visibility of objects - improving system performance and eliminating visual clutter.
2. Expedite the import process and maintenance requirements for each set of drawings upon import into the MIT Facilities Information Systems CAD system.
3. Facilitate the sharing of information between drawings and disciplines.
4. Allow users to control display and printing characteristics such as color, line type, line weight etc.
5. Summary of Best Practices.
6. Use only NCS and MIT standard layer names – reference the layer names provided in this document.
7. Use the minimum number of layers necessary to adequately separate entities in each drawing. The number of layers contained in each drawing will vary depending on the scope and complexity of the drawing, however drawings shall not contain extraneous, redundant, or overly detailed layer names.
8. Purge each drawing of unused layers prior to submittal. The drawing file shall contain only those layers necessary for displaying and plotting the information and drawing entities contained in each drawing. To ensure that subsequent prints made from each AutoCAD® drawing match the original, unused or unnecessary layers must be purged from the drawing prior to delivery.

Layer Name Formatting:

1. **Naming Scheme:** The NCS layer naming scheme followed by MIT is organized as a hierarchy. This structure is intuitive, easy to use and sort, and allows for expansion and customization. Layer names are defined using characters identifying disciplines, major groups, minor groups and modifiers. MIT disciplines are always identified by one character. Major groups, minor groups and modifiers are always identified by four characters and each group is separated by a hyphen and as follows:



2. **Discipline Codes:** The discipline code designation is a one character field with a designator from the table below. The Discipline designators are the same for both layer names and file names and as follows:

Discipline Designator			
A	Architectural	**M**	Mechanical
C	Civil	**P**	Plumbing
E	Electrical	**S**	Structural
L	Landscape		

3. **Major Groups:** The major group designation is a required four-character field that identifies the building system, such as doors, walls, windows, etc. Although most major groups are logically associated with specific discipline codes, it is possible to combine major group codes with any of the discipline codes.
4. **Minor Groups:** The minor group designation is an optional, four-character field for further differentiation of major groups. For example, partial height walls (A-WALL-PART) might be differentiated from full height walls (A-WALL-FULL). If necessary, the minor group field may also be defined by the user, allowing additional layers to be added to accommodate special project requirements. However, this should only be done after checking the National CAD Standard to see if any of the predefined layer names in that list would meet the special project requirements.
5. **Modifiers:** A modifier is an optional, four-character field that further subdivides the minor group whenever additional clarification is necessary. Common modifiers can delineate information categories, status or line weight elements. For example: A-WALL-FULL-TEXT OR A-WALL-FULL-DEMO.
6. **Special Modifiers:** Special modifiers are used when elements from unrelated or secondary disciplines are shown for clarity or reference on the same drawing. Drawing elements from secondary disciplines should be placed on one layer, named with the applicable special modifier. For example: The layer A-MECH in an architectural plan contains mechanical elements shown for clarity or for information only in the architectural plan. In this case, the mechanical information does not need to be separated by layer, since the drawing is primarily architectural. In similar situations, these modifiers may be used as needed with other major groups. Note that using these special

"group" modifiers does not preempt the proper application of appropriate layer names to separate drawing elements within each discipline.

7. **Egress Plans:** For layer naming and standards for evacuation route diagrams please refer to the MIT Design Standards Signage Thematic Folder.

Layer Name Modifiers:

Modifier	Description	Example
Information		
-IDEN	Identification, Callouts, Tags	A-WALL-IDEN
-NPLT	Reference (non-plot) Information	A-XREF-NPLT
-REVC	Revision clouds and notes	A-FLOR-REVC
-SYMB	Drafting symbols	A-FLOR-SYMB
-TEXT	General notes and specifications	A-FLOR-TEXT
-PATT	Hatching patterns and poché	A-FLOR-PATT
-DIMS	Dimension lines and dimensions	A-FLOR-DIMS
-3DIM	Three-dimensional elements	A-FLOR-3DIM
Status	Entities without status modifiers are assumed to be new.	
-EXST	Existing elements to remain	A-WALL-EXST
-DEMO	Existing elements to remove	A-WALL-DEMO
-PROP	Proposed or future elements	M-CWTR-PROP
-APPX	Approximate locations	C-STRM-APPX
Line Weight		
-FINE	Fine line weight elements	A-DETL-FINE
-LITE	Light line weight elements	A-DETL-LITE
-MEDM	Normal line weight elements	A-DETL-MEDM
-HEVY	Heavy line weight elements	A-DETL-HEVY
-SCRN	Screened or shaded elements	A-DETL-SCRN
Special		
-ARCH	Architectural elements shown for clarity	M-ARCH
-CIVI	Civil engineering elements shown for clarity	A-CIVI
-ELEC	Electrical elements shown for clarity	P-ELEC
-FIRE	Fire protection elements shown for clarity	E-FIRE
-SITE	Landscaping or site elements shown for clarity	A-SITE
-MECH	Mechanical elements shown for clarity	A-MECH
-PLUM	Plumbing elements shown for clarity	M-PLUM
-STRU	Structural elements shown for clarity	E-STRU

Attributes (Colors, Linetypes, Pens, etc.):

1. **General:** Many of the layers found in the Standard Layer Listing (Section 2.3.6) have

been assigned specific attribute values by MIT according to the following categories: color, pen weight, and linetype. All attributes shall be defined on layer 0 (zero). Attributes that have not been pre-defined by MIT may be assigned at the discretion of the user.

2. **Colors:** Specific colors must be used for the layers and annotation layers most often used to assist space documentation. The color assignment of these layers can be found in the Standard Layer Listing. Entity colors shall be defined by layer, not by entity. Layer colors shall fall in the range of color numbers 1-15. All other layers may have their colors assigned at the discretion of the client.

    a. As a general rule for all projects, drawing entities should assume the color property of the layer on which they reside. This means that the color of individual entities should be assigned 'by layer' as opposed to 'by entity.' Entities which have been translated from other systems may fail to meet this requirement.

3. **Linetypes:** The default linetype of each layer is typically CONTINUOUS unless otherwise specified in the Standard Layer Listing.
4. **Pen Weight:** The following chart shows pen weight assignments which should maximize the printed clarity of drawings conforming to the color assignments of MIT's core layers. Other pen weights may be assigned at the discretion of the client.

Pen #	Color	Weight
1	red	0.010"
2	yellow	0.015"
3	green	0.010"
4	cyan	0.020"
5	blue	0.005"
6	magenta	0.010"
7	white	0.015"
8	gray	0.005"
9	light gray	0.001"
15	brown	0.001"

Layer Usage Exceptions:

1. For most MIT Renovation and Space Change projects (small to medium size projects), the MIT CAD layering standard should suffice as is. In certain cases the layering standards may require modification to accommodate special project requirements. For example, large MIT capital projects or facilities drawings developed for special projects often present unique circumstances, requiring special considerations for CAD requirements.
2. Modifications to or deviations from the layering standards as published in this document

must be pre-approved by a member of MIT's Facility Information Systems (FIS). Any special CAD requirements should be addressed at a joint meeting between the parties involved, prior to the development of CAD drawings for the project; otherwise the standards and guidelines in this document apply. Any changes need to be documented and submitted to FIS for approval.

Standard Layer Listing:

The following layer list is an example of commonly used NCS layer names along with additional **MIT specific layer names (marked with a * in the left hand column)**. Where MIT specific layer names differ from NCS, MIT layer names shall be used. For additional detail, beyond what is outlined herein, please refer to the National CAD Standard for guidance.

A copy of the National CAD Standard may be obtained from https://www.nationalcadstandard.org/ncs6/.

	Name	Description	Color	Linetype
	Architectural			
	A-AREA	Area Boundary Lines and Calculations	4-cyan	Continuous
	A-AREA-IDEN	Room Numbers and Identification, Area Calculations	7-white	Continuous
*	A-AREA-PATT	Area Hatching	8-gray	Continuous
	A-CLNG	Ceiling Information	1-red	Continuous
*	A-CLNG-EXST	Existing Ceiling	1-red	Continuous
	A-CLNG-OPNG	Overhead Skylights	6-magenta	Hidden
	A-CLNG-GRID	Ceiling Grid	3-green	Continuous
*	A-CLNG-SOFF	Ceiling Soffits	2-yellow	Continuous
*	A-CLNG-OVHD	Overhead Overhangs	6-magenta	Hidden
*	A-CLNG-PATT	Ceiling Hatching/Patterns	8-gray	Continuous
	A-CLNG-TEXT	Ceiling Plan Text	7-white	Continuous
	A-CLNG-DIMS	Ceiling Plan Dimensions	1/7-red/white	Continuous
	A-CLNG-SYMB	Ceiling Symbols (Section, Detail & Elevation Marks)	4-cyan	Continuous
*	A-CLNG-MECH	Ceiling Plan Mechanical Elements	4-cyan	Continuous
*	A-CLNG-ELEC	Ceiling Plan Electrical Elements	4-cyan	Continuous
	A-DOOR	Doors	2-yellow	Continuous
*	A-DOOR-DEMO	Demolished Doors	1-red	Dashed
*	A-DOOR-EXST	Existing Doors	1-red	Continuous
	A-DOOR-IDEN	Door Identification	2-yellow	Continuous
	A-EQPM	Equipment	6-magenta	Continuous

	A-EQPM-IDEN	Equipment Identification	2-yellow	Continuous
	A-FLOR	Floor Information – Finishes		Continuous
	A-FLOR-EVTR	Elevators	2-yellow	Continuous
*	A-FLOR-EVTR-EXST	Existing Elevators	1-red	
	A-FLOR-STRS	Stairs and Ladders	2-yellow	Continuous
*	A-FLOR-STRS-EXST	Existing Stairs and Ladders	1-red	
	A-FLOR-CSWK	Casework, Cabinets, Counters	6-magenta	Continuous
	A-FLOR-OVHD	Overhead Skylights and Overhangs		Continuous
*	A-FLOR-SILL	Door Sills	5-blue	Continuous
*	A-FLOR-PATT	Floor Hatching/Patterns	5-blue	Continuous
*	A-FLOR-TEXT-DEMO	Demolition Plan Text	7-white	Continuous
	A-FLOR-TEXT	Floor Plan Text	7-white	Continuous
	A-FLOR-DIMS	Floor Plan Dimensions (Lines/Text)	1/7-red/white	Continuous
	A-FLOR-SYMB	Floor Symbols (Section, Detail, & Elevation Marks)	4-cyan	Continuous
*	A-FLOR-MECH	Floor Plan Mechanical Elements	9-light gray	Continuous
*	A-FLOR-ELEC	Floor Plan Electrical Elements	9-light gray	Continuous
	A-FURN	Furniture Layouts	5-blue	Continuous
	A-FURN-IDEN	Furniture Identification	2-yellow	Continuous
	A-GLAZ	Windows	2-yellow	Continuous
*	A-GLAZ-DEMO	Demolished Windows	1-red	Dashed
*	A-GLAZ-EXST	Existing Windows	1-red	Continuous
*	A-GLAZ-SILL-EXST	Existing Window Sill	1-red	Continuous
	A-GLAZ-SILL	New Window Sill	2-yellow	Continuous
	A-GLAZ-PRHT	Partial Height Windows and Glazed Partitions	1-red	Continuous
	A-GLAZ-IDEN	Window Identification	2-yellow	Continuous
	A-WALL	Full Height Walls	4-cyan	Continuous
*	A-WALL-DEMO	Demolished Walls	1-red	Dashed
*	A-WALL-EXST	Existing Walls	1-red	Continuous
	A-WALL-PRHT	Partial Height Walls	2-yellow	Continuous
	A-WALL-MOVE	Moveable Wall Partitions	2-yellow	Continuous
	A-WALL-HEAD	Door and Window Headers	15-brown	Continuous
	A-WALL-JAMB	Door and Window Jambs	2-yellow	Continuous
	A-WALL-PATT	Wall Hatching/ Poché	8-gray	Continuous
	A-WALL-CNTR	Wall Centerlines	5-blue	Continuous
	A-WALL-IDEN	Wall Identification	2-yellow	Continuous
*	A-WALL-SHFT	Service Shafts (hidden lines)	5-blue	Hidden
*	A-WALL-MATL	Wall Panels or Surface Materials	5-blue	Continuous

*	A-ELEV-FINE	Elevation Linework – Fine	5-blue	Continuous
*	A-ELEV-LITE	Elevation Linework – Light	1-red	Continuous
*	A-ELEV-MEDM	Elevation Linework – Medium	2-yellow	Continuous
*	A-ELEV-HEVY	Elevation Linework – Heavy	4-cyan	Continuous
*	A-ELEV-TEXT	Elevation Text	7-white	Continuous
*	A-ELEV-DIMS	Elevation Dimensions	1/7-red/white	Continuous
*	A-ELEV-SYMB	Elevation Symbols	4-cyan	Continuous
*	A-SECT-FINE	Section Linework – Fine	5-blue	Continuous
*	A-SECT-LITE	Section Linework – Light	1-red	Continuous
*	A-SECT-MEDM	Section Linework – Medium	2-yellow	Continuous
*	A-SECT-HEVY	Section Linework – Heavy	4-cyan	Continuous
*	A-SECT-TEXT	Section Text	7-white	Continuous
*	A-SECT-DIMS	Section Dimensions	1/7-red/white	Continuous
*	A-DETL-FINE	Detail Linework – Fine	5-blue	Continuous
*	A-DETL-LITE	Detail Linework – Light	1-red	Continuous
*	A-DETL-MEDM	Detail Linework – Medium	2-yellow	Continuous
*	A-DETL-HEVY	Detail Linework – Heavy	4-cyan	Continuous
*	A-DETL-TEXT	Detail Text	7-white	Continuous
*	A-DETL-DIMS	Detail Dimensions	1/7-red/white	Continuous
*	A-SCHD-LITE	Schedule Linework – Light	1-white	Continuous
*	A-SCHD-HEVY	Schedule Linework – Heavy	4-cyan	Continuous
*	A-SCHD-TEXT	Schedule Text	7-white	Continuous
*	A-XREF	External References		Continuous
*	A-MTCH	Match Lines (Polylines)	6-magenta	Continuous
*	A-VIEW	Paper Space Viewports		Continuous
*	A-TEXT	General Notes and Specifications	7-white	Continuous
*	A-SHBD	Sheet Border and Title Block (Polylines)	6-magenta	Continuous
*	A-REVC	Revision Clouds (Polylines)	6-magenta	Continuous
	Civil and Site			
	C-BLDG	MIT Building Footprints		
*	C-BLDG-DOCK	MIT Loading Docks		
	C- PRCH	MIT Porches		
	C-DECK	MIT Decks		
	C-BLDG-IDEN	MIT Building Identification		
*	C-BLDG-OTHR	Other Building Footprints		
	C-BLDG-OTHR-IDEN	Other Building Identification		
	C-PRKG	Parking Lots		

	C-PRKG-IDEN	Parking Lot Identification		
	C-ROAD	Paved Roads		
	C-ROAD-UPVD	Dirt Roads		
	C-DRIV	Driveways		
	C-ROAD-CURB	Curbs		
	C-ROAD-EQPM	Road Apparatus - Traffic Lights etc.		
	C-ROAD-IDEN	Road Identification		
	C- BRDG	Bridges		
	C- BRDG-IDEN	Bridge Identification		
	C-RAIL	Railroad Tracks		
	C-RAIL-EQPM	Railroad Apparatus - Crossing Gates etc.		
	C-RAIL-IDEN	Railroad Identification		
	C-STRM	Storm Drainage Lines		
*	C-STRM-EQPM	Storm Drainage Equipment		
*	C-STRM-MHOL	Storm Drainage Manholes		
	C-STRM-CBSN	Storm Drainage Catch Basins		
	C-STRM-IDEN	Storm Drainage Identification		
	C-SSWR	Sanitary Sewer Lines		
*	C-SSWR-EQPM	Sanitary Sewer Equipment		
	C-SSWR-MHOL	Sanitary Sewer Manholes		
	C-SSWR-IDEN	Sanitary Sewer Identification		
*	C-CWTR	Chilled Water Lines		
*	C-CWTR-EQPM	Chilled Water Equipment		
*	C-CWTR-MHOL	Chilled Water Manholes and Valve Boxes		
*	C-CWTR-IDEN	Chilled Water Identification		
	C-STEM	High Pressure Steam Lines		
*	C-STEM-EQPM	High Pressure Steam Equipment		
	C-STEM-MHOL	High Pressure Steam Manholes		
*	C-STEM-IDEN	High Pressure Steam Identification		
*	C-STEM-COND	High Pressure Condensate Lines		
*	C-STEM-COND-EQPM	High Pressure Condensate Equipment		
*	C-STEM-COND-MHOL	High Pressure Condensate Manholes		
*	C-STEM-COND-IDEN	High Pressure Condensate Identification		
*	C-STMP	Medium Pressure Steam Lines		
*	C-STMP-IDEN	Medium Pressure Steam Identification		
*	C-DOMW	Domestic Water Lines		
*	C-DOMW-EQPM	Domestic Water Equipment		
*	C-DOMW-MHOL	Domestic Water Manholes and Valve Boxes		
*	C-DOMW-IDEN	Domestic Water Identification		

*	C-CDSR	Condenser Water Lines		
*	C-CDSR-EQPM	Condenser Water Equipment		
*	C-CDSR-IDEN	Condenser Water Identification		
*	C-FOIL	Fuel Oil Lines		
*	C-FOIL-EQPM	Fuel Oil Equipment		
*	C-FOIL-IDEN	Fuel Oil Identification		
	C-NGAS	Natural Gas Lines		
	C-NGAS-EQPM	Natural Gas Equipment		
	C-NGAS-MHOL	Natural Gas Manholes and Valve Boxes		
	C-NGAS-IDEN	Natural Gas Identification		
	C-FIRE	Fire Protection Lines		
*	C-FIRE-EQPM	Fire Protection Equipment		
	C-FIRE-MHOL	Fire Protection Manholes and Valve Boxes		
	C-FIRE-HYDT	Fire Hydrants		
	C-FIRE-IDEN	Fire Identification		
*	C-ELEC	Electrical Distribution - Duct Banks		
*	C-ELEC-MHOL	Electrical Manholes and Hand Holes		
*	C-ELEC-EQPM	Electrical Equipment - Substations, Generators, Transformers etc.		
*	C-ELEC-LITE	Site Lighting		
*	C-ELEC-POWR	Misc Underground Power		
*	C-ELEC-FIRE	Fire Alarm Distribution		
*	C-ELEC-FIRE-IDEN	Fire Alarm Identification		
*	C-ELEC-FIRE-MHOL	Fire Alarm Manholes and Hand Holes		
*	C-ELEC-FIRE-PSTN	Fire Alarm Pull Stations		
*	C-ELEC-POLE	Utility Poles		
*	C-ELEC-IDEN	Electrical Identification		
	C-COMM	Telecomm Distribution - Duct Banks		
*	C-COMM-MHOL	Telecomm Manholes and Hand Holes		
*	C-COMM-EMER	Emergency Telephones		
	C-COMM-IDEN	Telecommunication Identification		
	C-CATV	Cable TV		
*	C-CATV-IDEN	Cable TV Identification		
	C-PROP	Property Lines		
	C-PROP-IDEN	Property Identification		
	C- ESMT	Property Easements		
	C- ESMT-IDEN	Easement Identification		
*	C-PROP-PRCL	Parcel Lines		
*	C-PROP-PRCL-IDEN	Parcel Identification		

*	C-PROP-MNMT	Property Monuments		
*	C-PROP-MNMT-IDEN	Property Monument Identification		
	C-TOPO	Contour Lines and Elevations		
	C-TOPO-SPOT	Spot Elevations		
*	C-TOPO-BMRK	Benchmarks		
	C-WALL-RTWL	Retaining Wall		
	C-TOPO-IDEN	Elevation Identification		
*	C-WATR	Water Bodies - Rivers, Lakes, etc.		
*	C-WATR-IDEN	Water Body Identification		
	C-GRID-MMIT	MapMIT Grid		
*	C-GRID-MMIT-IDEN	MapMIT Grid Identification		
*	C-GRID-MSCS	Mass State Coordinate System		
*	C-GRID-MSCS-IDEN	MSCS Identification		
*	C-ELEV	Elevations		
*	C-ELEV-TEXT	Elevation Text		
*	C-SECT	Sections		
*	C-SECT-TEXT	Section Text		
*	C-DETL	Details		
*	C-DETL-TEXT	Detail Text		
*	C-LGND	Legend symbols		
*	C-LGND-TEXT	Legend text		
*	C-SCHD	Schedules		
*	C-SCHD-TEXT	Schedule Text		
*	C-TEXT	General Notes and Specifications		
*	C-XREF	External References		
*	C-VIEW	Paper Space Viewports		
*	C-SHBD	Sheet Border and Title Block		
	Electrical			
	E-FIRE	Fire Alarm Wiring and Conduit		
*	E-FIRE-DEVC	Fire Alarm Devices - Miscellaneous		
*	E-FIRE-DEVC-MANL	Fire Alarm Manual Devices - Pull Stations		
*	E-FIRE-DEVC-SGNL	Fire Alarm Signal Devices - Horns and Lights		
	E-FIRE-EQPM	Fire Alarm Equipment - Panels and Boxes		
*	E-FIRE-SCHM	Fire Alarm Schematic Diagrams		
	E-FIRE-IDEN	Fire Alarm Identification		
	E-LITE	Lighting Fixtures		
*	E-LITE-POWR	Lighting Power		
	E-LITE-SWCH	Light Switches		
	E-LITE-IDEN	Lighting Identification		

*	E-EQPM-13_8	13.8KV Equipment		
*	E-EQPM-208V	120/208V Equipment - Switches, XFMRs, Panels		
*	E-EQPM-2400	2400V Equipment		
*	E-EQPM-480V	277/480V Equipment		
*	E-POWR-13_8	13.8 KV Power Circuits		
*	E-POWR-13_8-IDEN	13.8KV Power Identification		
*	E-POWR-1LIN	One Line Power Diagrams		
*	E-POWR-208V	120/208V Power Circuits		
*	E-POWR-208V-IDEN	120/208V Power Identification		
*	E-POWR-2400	2400V Power Circuits		
*	E-POWR-2400-IDEN	2400V Power Identification		
*	E-POWR-480V	277/480V Power Circuits		
*	E-POWR-480V-IDEN	277/480V Power Identification		
	E-COMM	Communications Wiring and Conduit		
	E-COMM-EQPM	Communications Devices and Equipment		
	E-COMM-IDEN	Communications Identification		
*	E-SECR	Security Wiring, Conduit		
*	E-SECR-EQPM	Security Devices, Equipment		
*	E-SECR-IDEN	Security Identification		
	E-LITE-EMER	Emergency Lighting		
*	E-EMER-POWR	Emergency Power		
*	E-EMER-EQPM	Emergency Equipment		
*	E-EMER-IDEN	Emergency Identification		
	E-CONT	Electrical Controls		
	E-CONT-IDEN	Electrical Controls Identification		
	E-GRND	Ground System		
	E-GRND-IDEN	Ground System Identification		
*	E-ELEV	Elevations		
*	E-ELEV-TEXT	Elevation Notes		
*	E-SECT	Sections		
*	E-SECT-TEXT	Section Notes		
*	E-DETL	Details		
*	E-DETL-TEXT	Detail Notes		
*	E-SCHD	Schedule Lines		
*	E-SCHD-TEXT	Schedule Text		
*	E-LGND	Legend Symbols		
*	E-LGND-TEXT	Legend Text		
*	E-TEXT	General Notes and Specifications		
*	E-XREF	External References		

*	E-VIEW	Paper Space Viewports		
*	E-SHBD	Sheet Border and Title Block		
	Landscape			
	L-PLNT	Plants and Landscaping		
	L-PLNT-TREE	Trees and Shrubs		
	L-PLNT-GCVR	Ground Covers and Vines		
	L-PLNT-BEDS	Rock, Bark and Landscaping Beds		
	L-PLNT-TURF	Lawn Areas		
	L-PLNT-IDEN	Plant and Landscaping Identification		
	L-IRRG	Irrigation Piping		
	L-IRRG-SPKL	Irrigation Sprinklers		
	L-IRRG-IDEN	Irrigation Identification		
	L-SITE	Site Improvements		
*	L-SITE-CONC	Concrete Pads		
	L- FENC	Fencing		
	L-SITE-STEP	Steps		
*	L-SITE-SIGN	Signs		
*	L-SITE-RAMP	Handicap Ramps and Access		
	L-SITE-WALL	Walls		
	L-SITE-SWLK	Walkways		
	L-SITE-TRAL	Dirt Paths		
	L-SITE-FURN	Site Furnishings		
	L-SITE-SPRT	Athletic Fields		
	L-SITE-IDEN	Site Identification		
*	L-ELEV	Elevations		
*	L-SECT	Sections		
*	L-DETL	Details		
*	L-SCHD	Schedules		
*	L-SCHD-TEXT	Schedule Text		
*	L-LGND	Legend Symbols		
*	L-LGND-TEXT	Legend text		
*	L-TEXT	General Notes and Specifications		
*	L-XREF	External References		
*	L-VIEW	Paper Space Viewports		
*	L-SHBD	Sheet Border and Title Block		
	Mechanical			
	M-CWTR	Chilled Water Supply/Return Piping		
	M-CWTR-EQPM	Chilled Water Equipment		
*	M-CWTR-PROC	Secondary Chilled Water - Equipment Cooling		

	M-CWTR-IDEN	Chilled Water Identification		
	M-CNDW	Condenser Water Supply/Return Piping		
	M-CNDW-EQPM	Condenser Water Equipment		
	M-CNDW-IDEN	Condenser Water Identification		
*	M-HWTR	Heating Hot Water Supply/Return Piping		
	M-HWTR-EQPM	Heating Hot Water Equipment		
	M-HWTR-IDEN	Heating Hot Water Identification		
	M-REFG	Refrigeration Piping		
	M-REFG-EQPM	Refrigeration Equipment		
	M-REFG-IDEN	Refrigeration Identification		
	M-STEM-HPIP	High Pressure Steam Piping		
	M-STEM-HPIP-EQPM	High Pressure Steam Equipment		
	M-STEM-HPIP-IDEN	High Pressure Identification		
	M-STEM-HPIP-COND	High Pressure Condensate Piping		
	M-STEM-HPIP-COND-IDEN	High Pressure Condensate Identification		
	M-STEM-MPIP	Medium Pressure Steam Piping		
	M-STEM-MPIP-IDEN	Medium Pressure Steam Identification		
	M-STEM-LPIP	Low Pressure Steam Piping		
	M-STEM-LPIP-IDEN	Low Pressure Steam Identification		
	M-STEM-LPIP-COND	Low Pressure Condensate Piping		
	M-STEM-LPIP-COND-IDEN	Low Pressure Condensate Identification		
	M-STEM-LPIP-PROC	Low Pressure Process Steam Piping		
	M-STEM-LPIP-PROC-IDEN	Low Pressure Process Identification		
	M-RCOV-PIPE	Heat Recovery Piping		
	M-RCOV-EQPM	Heat Recovery Equipment		
	M-RCOV-IDEN	Heat Recovery Identification		
	M-FUEL-OGEP	Fuel Oil Piping		
	M-FUEL-OGEP-IDEN	Fuel Oil Identification		
	M-HVAC-SPLY-SDFF	HVAC Supply Diffusers		
	M-HVAC-SPLY-DUCT	HVAC Supply Ductwork		
	M-HVAC-SPLY-IDEN	HVAC Supply Ductwork and Diffuser Identification		
	M-HVAC-RETN-RDFF	HVAC Return Diffusers		
	M-HVAC-RETN-DUCT	HVAC Return Ductwork		
	M-HVAC-RETN-IDEN	HVAC Return Duct and Diffuser Identification		
*	M-HVAC-EXHS-EDFF	HVAC Exhaust Diffusers		

	M-HVAC-EXHS-DUCT	HVAC Exhaust Ductwork		
	M-HVAC-EXHS-IDEN	HVAC Exhaust Duct and Diffuser Identification		
*	M-HVAC-SUPP-1LIN	HVAC Supply One-Line Ductwork		
*	M-HVAC-RETN-1LIN	HVAC Return One-Line Ductwork		
*	M-HVAC-EXHS-1LIN	HVAC Exhaust One-Line Ductwork		
	M-HVAC-EQPM	HVAC Equipment		
	M-HVAC-EQPM-IDEN	HVAC Equipment Identification		
*	M-HVAC-CONT	HVAC Controls		
*	M-HVAC-CONT-IDEN	HVAC Control Identification		
	M-CMPA	Compressed Air – Mains		
	M-CMPA-EQPM	Compressed Air Equipment		
	M-CMPA-IDEN	Compressed Air Identification		
*	M-ELEV	Elevations		
*	M-ELEV-TEXT	Elevation Notes		
*	M-SECT	Sections		
*	M-SECT-TEXT	Section Notes		
*	M-DETL	Details		
*	M-DETL-TEXT	Detail Notes		
*	M-SCHD	Schedule Lines		
*	M-SCHD-TEXT	Schedule Text		
*	M-LGND	Legend Symbols		
*	M-LGND-TEXT	Legend Text		
*	M-TEXT	General Notes and Specifications		
*	M-XREF	External References		
*	M-VIEW	Paper Space Viewports		
*	M-SHBD	Sheet Border and Title Block		
	Plumbing			
*	P-FIRE	Fire Protection Piping and Sprinkler Heads		
*	P-FIRE-EQPM	Fire Protection Equipment		
*	P-FIRE-IDEN	Fire Protection Identification		
	P-DOMW-CPIP	Domestic Cold Water Piping		
	P-DOMW-HPIP	Domestic Hot Water Piping		
*	P-DOMW-HOTR	Domestic Hot Water Return Piping		
	P-DOMW-EQPM	Domestic Water Equipment		
	P-DOMW-IDEN	Domestic Water Identification		
*	P-PROC-COLD	Process Cold Water Piping		
*	P-PROC-HOTS	Process Hot Water Piping		
*	P-PROC-HOTR	Process Hot Water Return Piping		
*	P-PROC-EQPM	Process Water Equipment		

*	P-PROC-IDEN	Process Water Identification		
*	P-RCVR	Recovered Water Piping		
*	P-RCVR-EQPM	Recovered Water Equipment		
*	P-RCVR-IDEN	Recovered Water Identification		
*	P-CMPA	Lab Air Piping		
*	P-CMPA-EQPM	Lab Air Equipment		
*	P-CMPA-IDEN	Lab Air Identification		
*	P-VACM	Vacuum Piping		
*	P-VACM-EQPM	Vacuum Equipment		
*	P-VACM-IDEN	Vacuum Identification		
*	P-CO2S	CO2 Piping		
*	P-CO2S-EQPM	C02 Equipment		
*	P-CO2S-IDEN	C02 Identification		
*	P-NIOX	NO Piping		
*	P-NIOX-EQPM	NO Equipment		
*	P-NIOX-IDEN	NO Identification		
*	P-NO2S	NO2 Piping		
*	P-NO2S-EQPM	NO2 Equipment		
*	P-NO2S-IDEN	NO2 Identification		
*	P-OXYG	Oxygen Piping		
*	P-OXYG-EQPM	Oxygen Equipment		
*	P-OXYG-IDEN	Oxygen Identification		
*	P-NGAS	Natural Gas Piping		
*	P-NGAS-EQPM	Natural Gas Equipment		
*	P-NGAS-IDEN	Natural Gas Identification		
*	P-PURE	Pure Water Piping		
*	P-PURE-EQPM	Pure Water Equipment		
*	P-PURE-IDEN	Pure Water Identification		
	P-SSWR-PIPE	Sanitary Waste Piping		
	P-SSWR-VENT	Sanitary Vent Piping		
*	P-SSWR-INDR	Indirect Waste Piping		
*	P-SSWR-LABS	Lab Waste Piping		
*	P-SSWR-LABS-VENT	Lab Vent Piping		
	P-SSWR-IDEN	Sanitary Identification		
	P-STRM-PIPE	Storm Drain Piping		
	P-STRM-IDEN	Storm Drain Identification		
*	P-FIXT	Plumbing Fixtures		
*	P-FIXT-IDEN	Plumbing Fixture Identification		
*	P-ELEV	Elevations		
*	P-ELEV-TEXT	Elevation Notes		

*	P-SECT	Sections		
*	P-SECT-TEXT	Section Notes		
*	P-DETL	Details		
*	P-DETL-TEXT	Detail Notes		
*	P-LGND	Legend Symbols		
*	P-LGND-TEXT	Legend Text		
*	P-SCHD	Schedule Lines		
*	P-SCHD-TEXT	Schedule Text		
*	P-TEXT	General Notes and Specifications		
*	P-XREF	External References		
*	P-VIEW	Paper Space Viewports		
*	P-SHBD	Sheet Border and Title Block		
	Structural			
	S-COLS	Columns		
	S-GRID	Column Grid		
	S-GRID-DIMS	Column Grid Dimensions		
	S-GRID-IDEN	Column Grid Identification		
	S-WALL	Structural or Bearing Walls		
*	S-FRAM	Framing		
	S-BEAM	Beams		
	S-DECK	Decking		
	S-FNDN	Foundation		
	S-FNDN-PILE	Foundation Piles		
	S-FNDN-PIER	Foundation Piers		
	S-FNDN-RBAR	Foundation Reinforcement		
*	S-METL	Miscellaneous Metal		
*	S-ELEV	Elevations		
*	S-ELEV-TEXT	Elevation Notes		
*	S-SECT	Sections		
*	S-SECT-TEXT	Section Notes		
*	S-DETL	Details		
*	S-DETL-TEXT	Detail Notes		
*	S-SCHD	Schedule Lines		
*	S-SCHD-TEXT	Schedule Text		
*	S-LGND	Legend symbols		
*	S-LGND-TEXT	Legend text		
*	S-TEXT	General Notes and Specifications		
*	S-XREF	External References		
*	S-VIEW	Paper Space Viewports		
*	S-SHBD	Sheet Border and Title Block		

2.4 Translating CAD Files to DWG Format

Translating from other CAD Software:

MIT recognizes that many of its vendors do not use the same version of design software to produce plans for their projects. However, MIT requires that service providers who work with other file formats submit DWG formatted CAD files upon project closeout that are fully compliant with all of the standards outlined herein, and which have no significant loss of drawing entities or project data that can result from standard CAD file translation procedures.

Translating from BIM Software:

Projects using Building Information Modeling (BIM) software are still required to produce DWG and PDF/TIF formats for their projects. The use of the National CAD Standard will help facilitate the production of properly formed DWG files.

DWG File Translation Testing:

For firms translating their native CAD file format into DWG format concerned about delivering error-free CAD files to MIT upon project closeout, it is strongly recommended that thorough file translation testing be conducted before the drawing development phase of the project. This will assure early detection of file conversion issues, if any, and allow for corrective measures to be taken before the project closeout period. DXF files will not be accepted at project closeout as a substitution for DWG file deliverables.

Error Free DWG Files:

All DWG files and CAD drawing entities submitted at the end of a project must be able to be manipulated using standard AutoCAD® drafting procedures. Files with proprietary features from other AutoCAD add-ons will not be accepted. Non-compliance with this policy will result in the rejection of DWG files submitted at project closeout in addition to delayed rendering of final project payment.

3. USE OF BUILDING INFORMATION MODELING (BIM)

3.1 MIT Requirements

Many projects are utilizing Building Information Modeling (BIM) for design and construction projects at MIT. While this practice is encouraged, the 2D deliverables are still required as outlined in this guideline and as specified in MIT contracts.

3.2 BIM Execution Plan

Refer to Appendix A - BIM Execution Plan. Document is to be completed by project teams as indicated.

Projects using BIM are required to use the **MIT BIM Execution Plan** to document modeling practices. This document declares what is being modeled, the accuracy of the models, the intent of the models, and how project teams work within the models. Software platforms and procedures are also outlined and agreed upon in this document.

The **MIT BIM Execution Plan** template is available upon request to fis-request@mit.edu.

3.3 BIM Standards

There are a number of evolving standards for the use of BIM. Since no one standard can be applied to all types of MIT projects, it is recommended that modeling practices and standards be declared and agreed upon in the project's BIM Execution Plan (BEP).

Use of Industry Foundation Classes (IFC):

> Currently MIT is working on its internal BIM standards, but until the standard is complete the use of IFC and the creation of IFC compliant models is highly recommended. Information about IFC can be found at the BuildingSMART Alliance website at: http://www.nibs.org/

Other BIM Standards:

> If other BIM standard is being used for a project, for example OmniClass, it must be declared and agreed upon in the project's BIM Execution Plan before the start of the project.

3.4 BIM Models and Deliverables

Models turned over to MIT as a deliverable must meet the requirements of the agreed upon **MIT BIM Execution Plan**. Internally, MIT has standardized its BIM environment on Autodesk's BIM platform and models created for projects are expected to work within MIT's CAD/BIM environment.

Use of Revit and NavisWorks:

1. It is recommended that models are created in the most current versions of Autodesk Revit or Autodesk NavisWorks. Modeling practices are declared in the project's BIM Execution Plan and best practices for model creation include, but are not limited to:

    a. Consisted file naming convention.

b. Models must not have linked models.
c. Vertical and Horizontal Coordinates must comply with MIT's Survey Guidelines.

2. Naming conventions of models delivered to MIT should closely follow the naming conventions outlined in **File Organization and Transmittal to MIT** below.

Use of Other BIM Products:

1. It is understood that different disciplines require the use of different types of software. These software packages need to be declared in the BIM Execution Plan and their use must result in the creation of proper 2D products and with models that can be used.

BIM Deliverables:

1. Its MIT's philosophy that the use of BIM will assist in the creation accurate deliverables as outlined in this document. When models are considered as part of the deliverable and conform to the projects BIM Execution Plan, the **MIT BIM Execution Plan** itself is considered a required deliverable. .

4. ARCHIVAL FILES

The intent of requiring Archival Print Files is to receive a file of sufficient detail to recreate 100% of the information contained in the hard copy original, without creating an excessively large digital file. Every sheet in the record or construction drawings needs to have a corresponding (1:1) Archival Print File. These files must be either PDF or TIF formats and they may be produced either directly from CAD/BIM applications or from a scanned hard copy (PLT files and other print file formats will not be accepted).

Regardless of production method, the Archive Print Files must match the content of the materials being submitted at closeout. The names of these files must also be the same as the DWG files they represent, therefore multipage TIF/PDF files will not be accepted. All Archival Print Files must follow these production requirements.

4.1 PDF File Creation

Creation from DWG:

1. PDF files from DWG files must mirror the color and line thickness that were represented by the print products. To create these files, the same print settings should be used to generate the PDF files. Unless colors are used in the files, PDF files with AutoCAD layer colors instead of their line settings will not be accepted since this is not a true representation of the project documentation.

Linework and Resolution:

1. When possible, PDF files should be in vector format to provide crisp line work for drawings. Files needing to be rasterized or scanned may be produced in PDF format and should be created at a resolution of 300dpi or higher. A 24 by 36 inch original at 300dpi will result in an image 7,200 pixels by 10,800 pixels, but higher resolution can be used if 300dpi does not accurately reproduce all content in ad drawings. Do not adjust paper settings to achieve 300dpi.

BIT Depth:

1. Images encapsulated in PDF files should be created with a bit depth that is appropriate for the drawings they represent. Embedded images may be either compressed using LZW lossless compression or uncompressed. The figure below shows suggested settings for drawings with rasterized features:

Bit Depth		
Black and White	1-bit	May not be used for images created by scanning hard copy, only to be used in circumstances where there will be no loss of information.
Grayscale	8-bit	Sheets in which no color is used.
Color	8-bit or greater	Sheets in which color is used to differentiate content.

4.2 TIF File Creation

Creation from Scanning:

1. Generating TIF files by scanning the hard copy drawing are accepted. Please refer to the Bit Depth table above for appropriate resolutions and bit depths. JPG files will not be accepted in place of TIF or PDF files.

Creation from AutoCAD®:

1. Creation of TIF files directly from AutoCAD® is not recommended. PDF files are the preferred file format when producing Archival Print Files from CAD/BIM software.

Creation from Other Formats:

1. Converting to TIF from other image file formats, the format being converted from must be a lossless format like PNG or GIF. Firms should not convert from a file format that

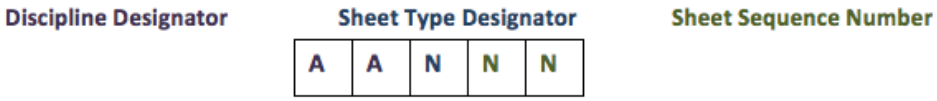
uses lossy compression, such as JPEG, due to degradation of the image. Images should not be resampled in order to increase resolution to 300dpi.

5. FILE IDENTIFICATION AND NAMING CONVENTIONS

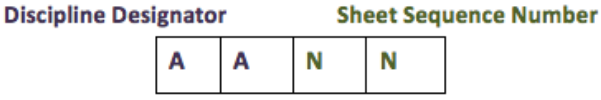
MIT requires that for each sheet submitted as a project deliverable there is a corresponding DWG and Archive Print File (PDF or TIF). The sheet and the digital files should follow the same naming convention. Each print file's name should have the same name as its source DWG file.

5.1 DWG Sheet Identification

Larger Capital Projects should use the following sheet identification format. It is a consistent format that contains five alphanumeric characters in a specific sequence conveying meaningful information to both the drawing creator and user. The sheet identifier consists of three components: the discipline designator, the sheet type designator, and the sheet sequence.



For smaller Non-Capital projects MIT allows for the sheet identifier to consist of two components: the discipline designator and the sheet sequence number, removing the sheet type designator.



Discipline Designators:

1. The discipline designator consists of one alphabetical character and a hyphen or two alphabetical characters. The codes used for the discipline designator are listed in the Layer Naming Convention. The discipline designator identifies the sheet as a member of a particular genre of drawings and is one character. For more specific genres, such as security (SC) or audio visual (AV) drawings, creators can use a two-character designator. Not all type designators are required. The standard also does not prohibit combining different types of drawings onto the same sheet. Basic discipline designators are listed below:

Discipline Designator			
A	Architectural	**M**	Mechanical
C	Civil	**P**	Plumbing
E	Electrical	**S**	Structural
L	Landscape		

Sheet Type Designators:

1. Sheet type designators consist of one numeric character. The sheet type designator refers to the type of information displayed in the drawing.

Sheet Type Designators		
0	General	symbols, legends, notes, etc.
1	Plans	horizontal views
2	Elevations	vertical views
3	Sections	sectional views, wall sections
4	Large-Scale Views	plans, elevations, stair sections, or sections that are not details
5	Details	
6	Schedules and Diagrams	
7	User Defined	
8	User Defined	
9	3D Representation	isometrics, perspectives, photographs

Sheet Sequence Numbers:

1. Sheet sequence numbers consists of two numeric characters in sequential order from 00 through 99. Example: Second floor plan - A102.

5.2 File Organization and Transmittal to MIT

In order to keep track of materials submitted to MIT, a clear catalog of information needs to accompany the materials submitted to MIT.

File Names:

1. MIT has its own file naming convention for archival purposes to make file easily identifiable to users. Though this naming convention is not required, it is good to be aware of the nomenclature used for archiving. Naming convention for MIT's archiving system is as follows:

    a. **File:** MIT_MG02_02145_A_AB_A-102.DWG

b. **Convention:** [*campus*]_[*building #*]_[*MIT project #*]_[*discipline*]_[*phase*]_[*sheet #*].[*extension*]
c. **Description:** From the MIT campus, Main Group building 2, project number 02145 and is an architectural as-built, sheet A-102.

2. Please refer to the **MIT Archiving Guidelines** for other best practices when organizing project information.

File Transmittal:

1. The content of electronic drawings must match the delivered original hard copy set exactly. To ensure the integrity of the electronic drawing set upon delivery to MIT:

    a. Ensure the drawings adhere to the guidelines presented in this document. Review the procedures for preparing drawings for submittal as detailed in the preceding paragraphs.
    b. Submit Adobe PDF's or TIF's of the sheets, with file names corresponding to names of DWG files.
    c. Submit all digital files on thumb drives or portable hard drives, to the MIT project manager. If external ftp or file transfer site is being used, please notify FIS.

APPENDIX A: BIM EXECUTION PLAN

Please use the MIT BIM Execution Plan for all project utilizing building information modeling. This template can be requested at fis-request@mit.edu.

APPENDIX B: GLOSSARY OF TERMS

The definitions below have been gathered from a variety of sources including online documents, the American Institute of Architects and MIT Staff.

As-Built Drawings:
As-built drawings are prepared by the contractor. They show, in red ink, on-site changes to the original construction documents. This set of drawings depicts the actual conditions of the completed construction "as it was built".

Basis of Design:
The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the Owner's Project Requirements. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the Owner's Project Requirements may be included.

Bid Documents:
Documents required to be submitted in response to an Invitation To Bid (ITB). These include the prescribed bid form, drawings, specifications, time lines, charts, price breakdowns, etc.

Commissioning Plan:
An overall plan, developed before or after bidding, that provides the structure, schedule and coordination planning for the commissioning process.

Construction Drawings:
Drawings that provide all the necessary information, both graphic and written, to build the project. These drawings provide specific, detailed information regarding walls, doors, furniture, equipment, lighting, outlets, and so on.

Design Drawings:
Technical drawings used to fully and clearly define requirements for engineered items so that they may conform to the design aesthetic. The purpose of such a drawing is to accurately and unambiguously capture all the geometric features of a product or a component that will allow a manufacturer to produce that component.

Final Commissioning Report:

A final summary report by the Commissioning Authority provided to the Owner, focusing on evaluating commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., are compiled in appendices and provided with the report

Functional Performance Tests (FPT):
A test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional performance testing is the dynamic testing of systems (rather than just components) under full operation. Systems are tested under various modes, such as high and low cooling/heating loads, component failures, fire alarm, power failure, etc. The systems are run through all control system's sequences of operation and components are verified to be responding as the sequences state.

O&M Manuals:
Operational and Maintenance Manuals include equipment specifications and schedules, drawings and overall information needed to maintain installed equipment.

Owner's Project Requirements:
A dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.

Pre-Functional Checklist (PFC):
A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the Commissioning Authority to the Sub-Contractors. PFCs are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, gages in place, etc.). However, some PFC items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system).

Record Drawings:
Record drawings are prepared by the architect and reflect on-site changes the contractor noted in the as-built drawings. They are often compiled as a set of on-site changes made for the owner per the owner-architect contract.

Shop Drawings:
A drawing or set of drawings produced by the contractor, supplier, manufacturer, subcontractor, or fabricator typically required for pre-fabricated components.

Sketches:
A simple, technical drawing created to isolate a particular engineering/architectural item and provide specific requirements related to that item.

Specifications:
Specific qualitative statements of particular needs to be satisfied, or essential characteristics that a customer requires (in a good, material, method, process, service, system, or work) and which a vendor must deliver. They are usually written in a manner that enables all parties to measure the degree of conformance.

Submittals:
Product data submittals, samples, and shop drawings are required primarily for the architect and engineer to verify that the correct products will be installed on the project. This process also gives the architect and sub-consultants the opportunity to select colors, patterns, and types of material that were not chosen prior to completion of the construction drawings.

Survey Drawings:
A CAD plan prepared by a licensed surveyor, which shows all essential measurements taken in the survey. Each survey drawing will be tied into the MIT control network and be submitted in NAD 83 feet.

Systems Manual:
The Systems Manual expands the scope of the traditional operating and maintenance documentation to include the additional information gathered during the Commissioning Process and to provide a systems-based organization of information. The Systems Manual is intended to be useful in the day-to-day operations of a facility.

Working Drawings:
A complete set of plans and specifications showing and describing all phases of a project, architectural, structural, mechanical, electrical, civil engineering, and landscaping systems to the degree necessary for the purposes of accurate bidding by contractors and for the use of artisans in constructing the project.

END OF DOCUMENT