# MEPtrix
# user guide

MAXCAD MEPtrix

# MEPtrix is an industry standard 3D HVAC fabrication drafting software add-on for AutoCAD.

The software automates the modelling process for air-conditioning ductwork with AutoCAD. It bridges the gap between design and detail by applying BIM (Building Information Modelling) structures to ductwork to identify issues before they become 'real world' problems.

MEPtrix offers significant savings in time and money due to its ease of use and ability to produce detailed 2D and 3D drawings of air-conditioning systems far more quickly than any product currently on the market.

Its highly detailed 2D drawings are professional in presentation, easy to read and unambiguous to avoid costly errors and on-site mismatches during fabrication and installation.

Unlike other CAD packages on the market, MEPtrix requires minimal training as it has been built with AutoCAD in mind; experienced AutoCAD users can be drawing ductwork in two hours and producing drawings in two days.

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# MEPtrix



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*Softbiz*
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*Allied Drafting Services*

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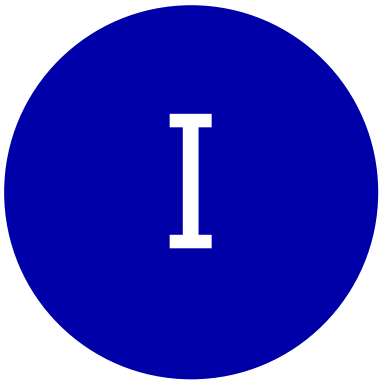
# Introduction



# 1 Introduction

The topics in this section provide some basic information about MEPtrix, what it is for and what you can do with it.

## How to get started

See Getting help for details on using the help system and how to get more help if you need it.

Study this Introduction chapter and the Getting started sections to familiarise yourself with the application.

## 1.1 About MEPtrix

MEPtrix is an industry standard 3D HVAC fabrication drafting software add-on for AutoCAD.

The software automates the modelling process for air-conditioning ductwork within AutoCAD. It bridges the gap between design and detail by applying BIM (Building Information Modelling) structures to ductwork to identify issues before they become 'real world' problems.

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Unlike other CAD packages on the market, MEPtrix requires minimal training as it has been built with AutoCAD in mind; experienced AutoCAD users can be drawing ductwork in two hours and producing drawings in two days.

## 1.2 Getting started

MEPtrix is integrated with CadTracker, an innovative drawing and document control solution.

Please familiarise yourself with the following chapters in the CadTracker manual before proceeding:

- Getting started
- Explorer
- Project
- Job
- Drawing
- Model
- AutoCAD
- Generic data

## 1.3 Getting help

This help file is the best way to get started. It will provide all the information you need to learn and use MEPtrix.

Before contacting support, please search for the information here.

## Displaying the help

The quickest way to display the help is to press F1. If context-sensitive help is available it will be displayed automatically.

## Contacting MaxCAD support

Support is available from the team at:

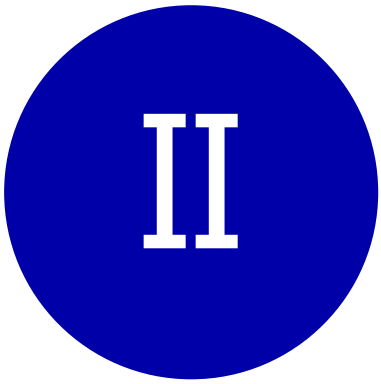
www.maxcad.com.au/contact-us

## Print the user guide

The MEPtrix PDF user guide is included in the MEPtrix installation folder, or you can download it from:

www.maxcad.com.au/meptrix

# Settings



# 2 Settings

## 2.1 Configuration

**MXS_3DConfig**

The MaxCAD MEPtrix Configuration window is the launch pad for many settings.

### 2.1.1 Mechanical components

#### 2.1.1.1 Frame damper sizes

Rectangular frame dampers are manufactured in *C* or *H* types with standard channel sizes. These sizes are displayed in a list in the frame damper property window.

**Type**
The type, *C* or *H*, defines the profile of the channel used to make the damper.

**Channel depth**
The depth of the *C* or *H* channel.

**Toe width**
The width of the toe of the *C* or *H* channel.

#### 2.1.1.2 Materials

Materials are used by the following:
- Service types
- Standard cushion heads

**Name**
The name of the material.

**Density (kg/m$^3$)**
The density of the material in kilograms per cubic metre.

#### 2.1.1.3 Rectangular fabrication standards

Each project is set up with a rectangular fabrication standard. Each new job, model or mechanical component inherits the fabrication standard of its parent at the time of creation, but it may override it at any time.

The rectangular fabrication standard property window has the following tabs:
- Fabrication standard
- Cut lengths
- Joint types
- Seam allowances
- Stock

#### 2.1.1.3.1 Fabrication standard

**Name**
The name of the fabrication standard. This is typically the company name of the fabricator.

## Shoe

**Minimum length**
The minimum allowable shoe length.

**Default length**
The default length for new shoes.

## Straight allowance

**Radius bend**
The default straight value for new radius bends.

**Transition**
The default straight value for new transitions.

## Mitred bend

**Minimum throat**
The minimum allowable throat value for mitred bends.

**Default throat**
The default throat value for new mitred bends.

**Throat label style**
Mitred bends in 2D layouts can be labelled using one of the following styles:
- *Combined throats in one label*
- *Separate lengths along outside edges*
- *Separate throats along inside edges*

## Radius bend

**Minimum radius**
The minimum recommended radius for radius bends.

NOTE Entering a radius less than the minimum is permissible, but will produce a warning.

**Radius multiplier**
The default radius for a radius bend is the product of the width relevant to the radius and the radius multiplier. The calculated radius may be overridden.

Examples:
```
radius = width × radius multiplier
   250 =   500 × 0.50
   600 =   800 × 0.75
```

NOTE The radius for rectangular radius bends is measured to the inside edge of the duct.

## Frame damper

**Default size**
The default size for new frame dampers.

## Spigot

**Default length**
The default length for new spigots.

## Straight duct

**Additional fabrication allowance**
This option increases the standard or custom cut lengths for straight duct by the specified value, to allow for gaskets or fabrication tolerance.

Dimensions on 2D layouts automatically subtract this value.

For example, a duct length of 1405mm including 5mm of additional fabrication allowance will be dimensioned as 1400mm.

### 2.1.1.3.2 Cut lengths

Fabricators usually have a list of preferred cut lengths for rectangular straight duct. These cut lengths, combined with the selected joints and step ins, determine the standard lengths available for a straight duct. The preferred order of cut lengths is generally largest to smallest.

For example, assume a fabricator has the following cut lengths:

CUT LENGTHS
1500
1200
900
600

Let's assume an operator has selected two different joint types or sizes for a straight duct, with the following fold allowance and fold back values:

| JOINT | FOLD ALLOWANCE | FOLD BACK | TOTAL |
|---|---|---|---|
| 1 | 40 | 12 | 52 |
| 2 | 50 | 12 | 62 |
| TOTAL | | | 114 |

The finished length of the straight duct will be 114mm less than the cut length, as follows:

STANDARD STRAIGHT LENGTHS
1386
1086
786
486

With the selected joint types, these are the standard lengths that will be listed in the straight duct property window. If different joint types or sizes are selected, the list of standard straight lengths is automatically

updated.

If a 50mm step in is selected for one of the joints, the standard straight lengths will be reduced by a further 50mm, as follows:

| STANDARD STRAIGHT LENGTHS |
| --- |
| 1336 |
| 1036 |
| 736 |
| 436 |

#### 2.1.1.3.3 Joint types

Fabricators have a list of joint types and sizes depending on the type of flanging machine or knock on flanges they use. If multiple joint types are supported, the fabricator usually specifies a default joint type for duct up to a certain size.

NOTE *(Raw edge)* joints are implicitly added to all fabrication standards.

**Joint type**
Select the standard rectangular joint type for this joint type.

**Name**
The name or code of the joint type. Sometimes fabricators use different names for the same types of joints. For example, integrated machine rolled flanges are commonly called *TDC* or *TDF* flanges.

NOTE *TDC* is a registered trademark of Lockformer; *TDF* is a registered trademark of Engel Industries.

**This is a default joint type**
Select this check box if this joint type is preferred for ducts up to a certain size.

**Maximum duct size (width or depth)**
This value is required if this is a default joint type.

For example, let's assume a fabricator uses the following joint types:

| JOINT TYPE | NAME | ALLOWABLE DUCT SIZES |
| --- | --- | --- |
| DS - Drive slide | DS | 0-300 |
| IMRF - Integrated machine rolled flange | TDF | 300-2000 |
| RIMRF - Reinforced integrated machine rolled flange | RIMRF | 2000+ |

Each joint type should be selected as a default joint type, and the following maximum duct sizes would be entered:

| JOINT TYPE | NAME | MAXIMUM DUCT SIZE |
| --- | --- | --- |
| DS - Drive slide | DS | 299 |
| IMRF - Integrated machine rolled flange | TDF | 1999 |
| RIMRF - Reinforced integrated machine rolled flange | RIMRF | 10000 |

**Sizes**
Fabricators may not use all of the available sizes for a particular joint type. Add or remove sizes as required.

#### 2.1.1.3.4 Seam allowances

Rectangular straight duct may be constructed from one or more sections of material. (See Stock for more information.) Each section must be joined, usually by applying a male and female seam and closing the seam together, e.g. Pittsburgh seam. Seams usually consume some of the available width, so MEPtrix allows for the seam when calculating how a duct of a particular size will be constructed, which in turn determines the standard lengths that are available.

#### 2.1.1.3.5 Stock

MEPtrix uses a fabricator's stock settings to determine the available standard lengths for straight duct.

**Type**
Select *Coil* or *Sheet*.

**Size**
Enter the width for coil stock, or the width and length for sheet stock.

**Straight length may be along stock**
Some fabricators using coil stock allow straight duct lengths to be cut length-wise from the coil, which allows longer duct to be constructed. Other fabricators only allow straight lengths to be cut across the width of the coil, so the width is the limiting factor when calculating the standard straight lengths.

NOTE With sheet stock, this check box cannot be cleared.

**Straights may be constructed as**
Select the shapes that the fabricator is capable of constructing:
- *Full wrap*
- *L shape*
- *U shape*
- *Sides*

**Preferred lengths**
Sometimes fabricators using coil stock have a different list of preferred lengths when cutting straight lengths along stock.

| OPTION | DESCRIPTION |
|---|---|
| *Standard cut lengths* | Use the same cut lengths regardless of the construction method. |
| *Custom cut lengths* | Add the appropriate cut lengths to the list. |
| *Custom finished lengths* | Add the appropriate finished lengths to the list. Finished lengths are not affected by the joint sizes selected, i.e. the fold allowance and fold back values are not subtracted from the finished lengths. |

### 2.1.1.4 Rectangular joint types

The rectangular joint types list defines all the types and sizes that are available to be selected as fabrication standard joint types.

**Code**
The code or abbreviation of the joint type.

**Name**
The name of the joint type.

**Style**

The drawing style of the joint type. The styles available are in accordance with Australian Standard AS 4254-2002:

| NAME | CODE | EXAMPLE |
|---|---|---|
| Angle reinforced drive slide | ARDC | |
| Angle reinforced standing seam | ARSS | |
| Angle reinforced streamline joint | ARSTJ | |
| Angle reinforced welded flange | ARWF | |
| Companion angle flange | AF | |
| Drive slide | DS | |
| Integrated machine rolled flange | IMRF | TDC (Lockformer), TDF (Engel Industries) |
| Integrated standing flange | SF | |
| Reinforced integrated machine rolled flange | RIMRF | |
| Slip on proprietary flange | SPF | |
| Standing capped flange | SCF | Ductmate, Mez |
| Standing drive slide | SDS | |
| Standing seam | SS | |
| Streamline joint | STJ | |
| Welded flange | WF | |

In Australia, DS and IMRF are the most common joint types.

**Sizes**
Enter the sizes available for this joint type.

### 2.1.1.5 Round fabrication standards

Each project is set up with a round fabrication standard. Each new job, model or mechanical component inherits the fabrication standard of its parent at the time of creation, but it may override it at any time.

The round fabrication standard property window has the following tabs:
- Fabrication standard
- Finished lengths
- Joint types

#### 2.1.1.5.1 Fabrication standard

**Name**
The name of the fabrication standard. This is typically the company name of the fabricator.

## Shoe

**Minimum length**
The minimum allowable shoe length.

**Default length**
The default length for new shoes.

## Straight allowance

**Radius bend**
The default straight value for new radius bends.

**Transition**
The default straight value for new transitions.

## Mitred bend

**Minimum throat**
The minimum allowable throat value for mitred bends.

**Default throat**
The default throat value for new mitred bends.

**Throat label style**
Mitred bends in 2D layouts can be labelled using one of the following styles:
- *Combined throats in one label*
- *Separate lengths along outside edges*
- *Separate throats along inside edges*

## Radius bend

**Minimum radius**
The minimum recommended radius for radius bends.

NOTE Entering a radius less than the minimum is permissible, but will produce a warning.

**Radius multiplier**
The default radius for a radius bend is the product of the width relevant to the radius and the radius multiplier. The calculated radius may be overridden.

Examples:
```
radius = width × radius multiplier
   250 =   500 × 0.5
   750 =   500 × 1.5
```

NOTE The radius for round radius bends is measured to the centre-line of the duct.

### 2.1.1.5.2 Finished lengths

Fabricators usually have a list of preferred finished lengths for round straight duct. Finished lengths are not affected by a duct's joint sizes. The preferred order of finished lengths is generally largest to smallest.

### 2.1.1.5.3 Joint types

Fabricators have a list of joint types and sizes depending on the type of flanging machine or sleeve joints they use. If multiple joint types are supported, the fabricator usually specifies a default joint type for duct up to a certain size.

NOTE *(Raw edge)* joints are implicitly added to all fabrication standards.

**Joint type**

Select the standard round joint type for this joint type.

**Name**
The name or code of the joint type. Sometimes fabricators use different names for the same types of joints.

**This is a default joint type**
Select this check box if this joint type is preferred for ducts up to a certain size.

**Maximum duct size (width or depth)**
This value is required if this is a default joint type.

For example, let's assume a fabricator uses the following joint types:

| JOINT TYPE | NAME | ALLOWABLE DUCT SIZES |
|---|---|---|
| IBSJ - Internal beaded sleeve joint | IBSJ | 0-1500 |
| FJ - Flange joint | FJ | 1501+ |

Each joint type should be selected as a default joint type, and the following maximum duct sizes would be entered:

| JOINT TYPE | NAME | MAXIMUM DUCT SIZE |
|---|---|---|
| IBSJ - Internal beaded sleeve joint | IBSJ | 1500 |
| FJ - Flange joint | FJ | 10000 |

**Sizes**
Fabricators may not use all of the available sizes for a particular joint type. Add or remove sizes as required.

### 2.1.1.6 Round joint types

The round joint types list defines all the types and sizes that are available to be selected as fabrication standard joint types.

**Code**
The code or abbreviation of the joint type.

**Name**
The name of the joint type.

**Style**
The drawing style of the joint type. The styles available are:

| NAME | CODE |
|---|---|
| Internal beaded sleeve joint | IBSJ |
| Flange joint | FJ |

**Sizes**
Enter the sizes available for this joint type.

### 2.1.1.7 Flex connection types

Flex connections can be made with different flex types, such as *Fire rated* and *Leaded acoustic*.

## 2.1.2 Duct insulation

### 2.1.2.1 Insulation facings

Duct insulation facings are used by duct insulation types.

### 2.1.2.2 Insulation types

**Name**
The name of the insulation type.

**Facing**
The insulation facing that this type uses.

**Unit mass (kg/m$^3$)**
The mass of the insulation in kilograms per cubic metre.

**Suitable for kitchen exhaust**
**Suitable for smoke exhaust**
Only certain insulation types meet the required standards and fire ratings to be used for kitchen and/or smoke exhaust ductwork.

**Location**
Specifies how the insulation type may be used:
- *Internal only*
- *External only*
- *Internal or external*

**Sizes**
Enter the available thicknesses for this insulation type.

### 2.1.2.3 Insulation hatch configurations

Insulation may be configured to use hatch patterns in 2D layouts. Each project can be configured to use a hatch configuration. Hatch patterns can be set up for internal insulation, external insulation, or combinations of internal and external insulation.

**Name**
The name of the configuration.

**Internal / external insulation**
The insulation type(s) for this hatch pattern.

**Pattern**
The AutoCAD hatch pattern to be used for the selected insulation.

**Background colour**
The background colour to be used behind the hatch pattern, or *(None)*.

## 2.1.3 Flex

#### 2.1.3.1 Default flex groups

Default flex groups can be copied to a project's list of flex templates. If you regularly work on projects with particular fabricators or engineers, you may wish to set up a flex group for each. This will help you configure new projects more easily and consistently.

**Maximum quantity (L/s)**
The maximum air quantity allowable for this flex template.

**Diameter**
The default flex diameter for the given air quantity.

#### 2.1.3.2 Flex diameters

Unlike other types of duct, flexible duct sizes are limited to a set of common diameters. The most common diameters are included by default.

NOTE If you have flexes in your MEPtrix database using an existing diameter, this diameter can not be deleted.

### 2.1.4 Pipe

#### 2.1.4.1 Materials

Pipe materials are used by pipe fabrication standards.

**Name**
The name of the material.

**Density (kg/m$^3$)**
The density of the material in kilograms per cubic metre.

#### 2.1.4.2 Fabrication standards

**Fabrication standard**
The name of the fabrication standard.

**Pipe material**
The material of the pipe in this fabrication standard.

##### 2.1.4.2.1 Size

**Nominal bore**
The nominal bore of the pipe.

**Outside diameter**
The actual size of the outside diameter of the pipe.

**Wall thickness**
The thickness of the pipe.

**Short radius**
If pipe at this size is available as a short radius bend, select this option and enter a value.

**Long radius**
The radius of long radius bends.

**Cap height**
The height of end caps for pipe at this size.

**Straight tee centre to end**
The distance from the centre to each opening for straight tees.

#### 2.1.4.2.2 Reducers

**Nominal bore**
The nominal bore of the reducer size.

**Reducing tee centre to end**
The distance from the centre to the reducing opening for reducing tees.

**Reducer height**
The height of the reducer.

#### 2.1.4.2.3 Flanges

**Flange standard**
The name of the flange standard.

**Outside diameter**
The outside diameter of the flange.

**Bore diameter**
The diameter of the slip-on bore.

**Thickness**
The thickness of the flange.

## Flange types

**Raised face**
Enter the diameter and length for raised face flanges.

**Bossed**
If bossed flanges are available at this nominal bore, select this option and enter a diameter and length.

**Weld neck**
If weld neck flanges are available at this nominal bore, select this option and enter a large diameter, small diameter, and length.

## Bolts

**Pitch circle diameter**
The diameter of the bolts' pitch circle.

**Number of bolts**
The number of bolts used by the flange.

**Bolt size**
The size of the bolts used by the flange.

## 2.1.5 Pipe insulation

### 2.1.5.1 Insulation facings

Pipe insulation facings are used by pipe insulation types.

### 2.1.5.2 Insulation types

**Name**
The name of the insulation type.

**Facing**
The insulation facing that this type uses.

**Unit mass (kg/m$^3$)**
The mass of the insulation in kilograms per cubic metre.

**Sizes**
Enter the available thicknesses for this insulation type.

## 2.1.6 Generic data

### 2.1.6.1 Generic class label shapes

2D layout label shapes can be configured for each generic class that has been set up in CadTracker.

**Label shape**
Labels may be drawn with the following border styles:
- *(Text only)*
- *Hexagon*
- *Octagon*
- *Rectangle*
- *Rounded rectangle*

**Text height**
The height of the text, in drawing units.

**Line thickness**
The thickness of the label's border.

## 2.1.7 Fabricators

### 2.1.7.1 Access panel fabricators

**Fabricator name**
The name of the access panel fabricator.

## Catalogue items

**Type**
The type of access panel, e.g. *(Default)* or *Fire rated*.

**Catalogue number**
The catalogue number or a unique description of the access panel.

**Size**
The access panel's width and depth.

### 2.1.7.2 Cushion head fabricators

**Fabricator name**
The name of the cushion head fabricator.

## Standard cushion heads

**Name**
The name of the standard cushion head.

**Duct material**
The material from which the cushion head is made.

**Spigot margin above with insulation**
The distance from the top of the spigot to the top of the cushion head. The margin can be a fixed value, or a multiple of the insulation thickness.

**Spigot margin above without insulation**
The distance from the top of the spigot to the top of the cushion head.

**Spigot margin below with insulation**
The distance from the bottom of the spigot to the bottom of the cushion head. The margin can be a fixed value, or a multiple of the insulation thickness.

**Spigot margin below without insulation**
The distance from the bottom of the spigot to the bottom of the cushion head.

**Step in**
The distance that the cushion head opening shrinks by on each side. Cushion heads with internal insulation will often have a step in, which can be a fixed value, or a multiple of the insulation thickness.

**Step length**
How far the cushion head extends past the step in.

**Spigot default length**
The default length of spigots using this cushion head. Each spigot may override the default length.

### 2.1.7.3 Grille fabricators

**Name**
The name of the grille fabricator.

#### 2.1.7.3.1 Grille series

**Face profile**
Grille faces must be rectangular or circular.

**Neck profile**
Grille necks must be rectangular or circular.

**Grille type**
Each grille must be one of the following types:
- *Circular adjustable diffuser*
- *Door grille*
- *Double deflection*
- *Egg crate*
- *Eyelash diffuser*
- *Full chevron*
- *Half chevron*
- *Jet diffuser*
- *Linear bar grille*
- *Linear slot diffuser*
- *Louvred ceiling diffuser*
- *Non-louvred ceiling diffuser*
- *Paltech diffuser*
- *Perforated*
- *Swirl ceiling diffuser*
- *VAV diffuser*
- *Weatherproof louvre*
- *Wire mesh*

**Frame type**
Each grille type has its own list of allowable frame types, which includes at least one of the following types:
- *(Standard)*
- *Bevel*
- *Channel*
- *Fixed core*
- *Flange*
- *Flush frame (plaster)*
- *Hinged core*
- *Lay-in (T-bar)*
- *Removable core*
- *Swirl*

**Catalogue number**
The catalogue number or a unique description of the grille series.

## Manual, fixed and relative sizes

The geometry for grille sizes can be defined using the following options:
- *(Manual value for each grille size)*
- *Fixed value for all grille sizes*
- *Relative to nominal neck size*
- *Relative to face size*

## Sizes

**Nominal neck size**

The nominal width and depth of the grille's neck.

**Face size**
The width and depth of the grille's face.

**Penetration size**
The width and depth of the grille's penetration size.

**Actual neck size**
The actual width and depth of the grille's neck.

**Total depth**
The total depth of the grille.

**Frame depth**
The depth of the grille's frame.

**Neck depth**
The depth of the grille's neck.

### 2.1.7.4 Heater fabricators

**Name**
The name of the heater fabricator.

#### 2.1.7.4.1 Heater series

**Name**
The name of the heater series.

**Construction**
The material from which the heater elements are constructed:
- *(Not specified)*
- *Mild steel*
- *Nickel plated*
- *Stainless steel*

**Type**
The heater element type:
- *Finned*
- *Unfinned general purpose*
- *Unfinned low temperature*

**Sheath watts density (kW/m$^2$)**
The amount of heating produced by the sheath per square metre.

**Maximum temperature (°C)**
The maximum permissible temperature of the element when operating.

**Minimum air velocity (m/s)**
The minimum recommended air velocity through the face area of the duct.

## Element sizes

**Form**

The shape of the element:
- *Straight length*
- *U form*
- *W form*
- *Triple U form*

**Catalogue number**
The catalogue number or a unique description of the element.

**Wattage (W)**
The amount of heating produced by the element.

**Reach (mm)**
The maximum reach of the heat zone of the element.

**Mass (kg)**
The mass of the element.

### 2.1.8 AutoCAD

#### 2.1.8.1 Layer configurations

## 2.2 Project configuration

**MXS_3DEditProject**

### 2.2.1 Configuration

**Layer configuration**
The layer configuration for this project.

#### Duct fabrication standards

**Rectangular**
The default fabrication standard for new rectangular duct in this project. Jobs, models and individual components may override the default fabrication standard.

**Round**
The default fabrication standard for new round duct in this project. Jobs, models and individual components may override the default fabrication standard.

#### Insulation hatch configurations

**Duct**
The insulation hatch configuration to use for duct.

## 2.2.2 Duct service types

Duct service types are used by duct systems.

**Name**
The name of the service type. For smaller projects, this is often the same as the service class.

**Pressure class (Pa)**
The pressure class, in pascals, of the service type. 500 Pa static pressure is by far the most common classification used in Australia.

IMPORTANT
According to Australian Standard AS 4254-2002, the pressure class determines:
- The minimum duct metal thickness
- The minimum reinforcement (J) rating
- The maximum spacing between joints or intermediate reinforcement

With this in mind, it's very important to configure the project's service types with the correct pressure classes. Failing to do so could lead to costly fabrication errors.

**Service class**
The service class of the service type.

**Duct material**
The material for ducts in this service type.

## 2.2.3 Flex templates

Flex templates determine the default flex diameter for a given air quantity. Flexible ducts will default to the appropriate diameter based on the air supplied by the connected spigot.

**Maximum quantity (L/s)**
The maximum air quantity allowable for this flex template.

**Diameter**
The default flex diameter for the given air quantity.

TIP Click **Copy from default flex group** to copy a set of flex templates into the current project from the default flex groups.

## 2.2.4 Lineal sizes

Lineal sizes are used to produce lineal size summaries in duct reports for both rectangular and round duct.

A lineal size summary reports statistics about duct types that fall within a lineal size category.

The duct types included in the summary are:
- Straight
- Bend
- Transition
- Shoe
- 2-way

For each duct type, the summary displays:
- Number of items
- Total length (m)

- Average length (m)

A summary is produced for each lineal size in the project, and also displays:
- Total number of ducts
- Total length of all ducts
- Average length of all ducts

**Rectangular lineal size is**
- *Full wrap*
- *L shape*

For rectangular duct, you can specify whether the lineal size of sheet metal should be calculated using full wrap or L shape construction.

**Maximum lineal size**
The maximum lineal size of the duct for this category.

**Name**
The name of the lineal size category.

# 2.3 Job configuration

**MXS_3DEditJob**

## Duct fabrication standards

Sometimes different fabricators may be engaged to complete different areas or levels within a building. The rectangular and round fabrication standards configured in the project may be overridden by a job. The selected fabrication standard will be the new default for models within this job. Each model and individual mechanical component may also override the default fabrication standard.

**Base UCS**
The base user coordinate system helps to determine the default orientation for mechanical components.

## Implied up angle

The implied up angle is used to determine the orientation of the width and depth of a mechanical component's opening.

**Duct**
For bends, the implied up angle determines the direction of a bend. For transitions, the implied up angle determines the orientation of the alignment point. The default value is *180*.

**Grille**
For grilles, the implied up angle determines the location of cushion head spigots. The default value is *90*.

**Up transition angle**
The up transition angle is the tolerance for the implied up angle. The default value is *5*.

# 2.4 Model configuration

**MXS_3DEditModel**

## Duct fabrication standards

Sometimes different fabricators may be engaged to complete different areas or levels within a building. The rectangular and round fabrication standards configured in the project and job may be overridden by a model. The selected fabrication standard will be the new default for mechanical components within this model. Each mechanical component may also override the default fabrication standard.

**Simple model mode**
Simple model mode produces less complex versions of 3D entities. Mechanical components and pipes are not hollowed out, which can improve performance on large models or older computers.

**Show ghost images when creating or editing duct**
With this option enabled, the edit with ghost preview command is used by default.

**Show opening disconnected halo**
Draws a shape around an opening to indicate that a component is not connected.

## Flex duct

**2D and 3D resolution**
Flex resolution values greater than 0 mean flexes will be approximated by segmenting the flex. Lower values produce more segments, which results in a more accurate approximation of the flex. The default value is *15*.

**Drawing style**
Flexes with insulation can be drawn two ways:
- *Airway size, ignoring insulation*
- *True size, including insulation, if specified*

## Labels

**Number text height**
The height of number labels in 2D layouts, in drawing units.

**Number has balloon**
Number labels in 2D may be drawn with or without an ovalised balloon.

**Length style**
Length labels in 2D may be drawn with the following styles:

| STYLE | EXAMPLE |
|---|---|
| Italics, no suffix | *2300* |
| Standard, L suffix | 2300L |

## Default section volume boundary

To create a new section layout in 2D, the start and end points are picked. A default section volume boundary is created based on the following values. Each section layout may use a custom boundary, if necessary.

**Additional length for each end**
The distance before the first picked point, and after the second picked point, to create the default boundary. The default value is *1000*.

**Width**
The width of the default boundary. The default value is *100*.

# Mechanical components

# 3 Mechanical components

## 3.1 Fabrication standards

Each mechanical component in a project must have rectangular and/or round fabrication standard specified. New components default to the fabrication standard selected in the model's configuration.

**Override fabrication standard**
Click or to override the rectangular or round fabrication standard, respectively, and select a fabrication standard from the list.

## 3.2 Systems and services

**MXS_3DDuctSystems**

Each mechanical component in a project must be assigned to a duct system and service.

**Code**
Codes are usually indicative of the system's primary piece of equipment.

**Comment (optional)**
Comments are often used to record a system's location within a building, or to help distinguish between old and new systems. Comments can help operators search for and select the correct system.

### Services

**Service type**
The duct service type of the service.

**Code**
The service code, which is often an abbreviation of the service class.

The following default codes are set automatically when the service type is selected:

| CODE | SERVICE CLASS |
|---|---|
| GEX | General exhaust |
| KEX | Kitchen exhaust |
| OTH | Other |
| OA | Outside air |
| RA | Return air |
| SEX | Smoke exhaust |
| SA | Supply air |
| TEX | Toilet exhaust |

**Comment (optional)**
Service comments are usually not required, but can help operators select the correct service within a system.

## 3.3 Insulation

Some mechanical components can have internal and/or external insulation applied.

The insulation drop-down list presents insulation sizes on the left, and insulation types on the right. Click the desired insulation thickness, and then click an insulation type.

TIP Double-click an insulation size to automatically select the first available insulation type, which is typically *(Not specified)*.

## 3.4 Number

Mechanical components may optionally be numbered.

Numbers are separated into five parts:

| PART | DESCRIPTION |
|---|---|
| Prefix | The prefix is often used to group components together by system, service or component type, e.g. *S.* or *OA-* |
| Major | The major number must be all digits, all lower case letters, or all upper case letters. |
| Separator | The separator cannot contain numbers or letters. Separators are usually a dot or a dash. |
| Minor | The minor number must be all digits, all lower case letters, or all upper case letters. |
| Suffix | The number suffix is rarely needed, but is sometimes used to indicate the duct's insulation or system. |

Separating numbers into parts allows for more flexible numbering options when using the number mechanical components command or when editing numbers and comments.

## 3.5 Duct

### 3.5.1 Straight

**MXS_3DDuctStraight**

**Fabrication standards**

**System and service**

**Internal and external insulation**

**Number**

**Profile**
Straight ducts may be rectangular, circular, or flat oval.

**Size**
The width and depth of the duct.

**Step in**

**Type**

**Joint**

**Length**
The length of the straight duct.

**Free length**

**Standard lengths**
Standard lengths are calculated based on the selected fabrication standard's cut lengths, combined with the selected joints and step ins. Double-click to select a standard length.

**Single blade damper**

**Comments**

**Height markers**

**Workflow status**

**View log**

**Heater banks**

**Access panels**

## 3.5.2 Bend

**MXS_3DDuctBend**

**Fabrication standards**

**System and service**

**Internal and external nsulation**

**Number**

**Profile**
Bends may be rectangular, circular, or flat oval.

**Bend type**
Bends may be radius, mitred, or lobster back. Only bends with a non-rectangular profile may be lobster back.

**Joint 1 size**
The width and depth of the bend's first opening.

**Joint 2 size**
The width and depth of the bend's second opening.

**Straight**
For radius or lobster back bends, the straight is the distance that extends past the curved part of the bend.

NOTE Each fabrication standard defines a default straight allowance for radius bends.

**Throat**
For mitred bends, the throat is the distance from the inside corner to the opening.

NOTE Each fabrication standard defines a default throat for mitred bends.

**Free length**

**Step in**

**Type**

**Joint**

**Radius**
The radius of the bend. The radius is pre-filled based on the minimum radius and radius multiplier values specified by the selected fabrication standard. The radius may be overridden, and reset by clicking **Use calculated radius**.

**Angle**
The angle of the bend.

**Segments**
Lobster back bends are fabricated with three or more segments.

**Flat back**
Rectangular 90° radius bends may optionally be specified with a flat back.

**Splitter**
Rectangular radius bends may optionally be specified with splitters. The radii and number of splitters are automatically calculated based on the curve ratio of the bend (inside radius ÷ outside radius). There can be up to three splitters.

**Turning vanes**
Mitred bends may optionally be specified with the following types of turning vanes:
- *Single*
- *Double*
- *Special*

NOTE
Splitters and turning vanes divide the duct into sub-sections, and can help reduce turbulence, noise, static pressure loss, and energy loss.

**Direction**
Duct bends must bend up, down, left or right.

**Single blade damper**

**Comments**

**Height markers**

**Workflow status**

**View log**

**Access panels**

## 3.5.3 Split radius bends

**MXS_3DDuctBendSplit**

This command splits rectangular, non-transforming radius bend ducts into two or more pieces.

## 3.5.4 Transition

**MXS_3DDuctTransition**

**Fabrication standards**

**System and service**

**Internal and external insulation**

**Number**

**Joint 1 profile**
**Joint 2 profile**
Transition openings may be rectangular, circular, or flat oval.

**Joint 1 size**
**Joint 2 size**
The width and depth of the transition's opening.

**Straight**
The distance that extends past the transitioning part of the duct.

NOTE Each fabrication standard defines a default straight allowance for transitions.

**Step in**

**Type**

**Joint**

**Length**
The length of the transition.

**Airflow direction**
A positive airflow direction means the air is travelling from the first opening to the second opening.

IMPORTANT
Transition labels in 2D layouts are generated according to the specified airflow direction. An incorrect airflow direction could result in costly fabrication mistakes.

**Alignment point**

The transition's second opening can be aligned relative to nine different points on the first opening:

- *Flat on top & flat on left*
- *Flat on top*
- *Flat on top & flat on right*
- *Flat on left*
- *Centred*
- *Flat on right*
- *Flat on bottom & flat on left*
- *Flat on bottom*
- *Flat on bottom & flat on right*

TIP

The alignment point, horizontal offset and lateral offset may seem complicated on first acquaintance. The best approach is to imagine looking through the transition from the first opening to the second opening.

**Horizontal offset**

The horizontal distance of the second opening away from the specified alignment point. Enter a negative offset to move the second opening to the left, or a positive offset to move it to the right.

**Vertical offset**

The vertical distance of the second opening away from the specified alignment point. Enter a negative offset to move the second opening down, or a positive offset to move it up.

NOTE

When you change the alignment point, MEPtrix will automatically calculate new values for the horizontal and vertical offsets to produce an identical transition. Select the alignment point which will result in the least complicated labels in 2D layouts. Offset values of *0* are preferable whenever possible.

**Natural offset**

A natural offset transition is similar to a two bend solution. Natural offsets are only possible when the transition is offset in either the horizontal or vertical axis, but not both.

**Single blade damper**

**Comments**

**Height markers**

**Workflow status**

**View log**

**Heater banks**

**Access panels**

## 3.5.5 Split transitions

**MXS_3DDuctTransitionSplit**

This command splits transition ducts into two or more pieces.

## 3.5.6 Shoe

**MXS_3DDuctShoe**

**Fabrication standards**

**System and service**

**Internal and external insulation**

**Number**

**Size**
The width and depth of the shoe.

**Step in**

**Type**

**Joint**

**Length**
The length of the shoe.

NOTE Each fabrication standard defines a default length for shoes.

**Free length**

**Lead-in**
The length of the toe part of the shoe.

**Toe angle**
The angle between the sole of the shoe and the toe. A smaller angle produces a longer toe.

**Toe direction**
The direction in which the toe points, relative to the ankle of the shoe, i.e. the flanged joint.

**Double toe**
Two toes on opposite sides of the shoe.

**Push-pull damper**
Adds a push-pull style volume damper to the shoe.

NOTE
The damper's push-pull rod is positioned on the same side as the toe. For double toe shoes, use the toe direction to orientate the push-pull damper.

**Single blade damper**

**Comments**

**Height markers**

**Workflow status**

**View log**

**Access panels**

### 3.5.7 2-way

**MXS_3DDuct2Way**

**Fabrication standards**

**System and service**

**Internal and external insulation**

**Number**

**Bend type**
2-ways may be radius or mitred.

**Trunk size**
The width and depth of the 2-way's trunk.

**Trunk left straight**
The distance from the trunk's opening to the radius or mitre on the left branch.

**Trunk right straight**
The distance from the trunk's opening to the radius or mitre on the right branch.

**Left branch size**
The width and depth of the 2-way's left branch.

**Left branch straight**
The distance from the left branch's opening to the radius or mitre on the left branch.

**Right branch size**
The width and depth of the 2-way's right branch.

**Right branch straight**
The distance from the right branch's opening to the radius or mitre on the right branch.

**Free length**

**Step in**

**Type**

**Joint**

**Radius bend options**
Radius bend 2-ways have the following options:

| OPTION | DESCRIPTION |
|---|---|
| *(None)* | A standard radius bend 2-way. |
| *Align branches* | Lengthens the left or right branch straight to align the outside edges of the branches. |
| *Flat back* | Lengthens the left or right branch straight to align the outside edges of the branches, and replaces the branches' outside radius bends with a flat back to join the branches. This effectively produces a mitred 2-way with radius bends on the inside. |
| *Flat back with deflector* | Lengthens the left or right branch straight to align the outside edges of the branches, and adds a flat back to join the branches. |

### Left and right branch

**Radius**
The radius of the bend. The radius is pre-filled based on the minimum radius and radius multiplier values specified by the selected fabrication standard. The radius may be overridden, and reset by clicking **Use calculated radius**.

**Angle**
Radius bend branches with no radius bend option selected may specify an angle between 1 and 90 degrees.

**Splitter**
Radius bend branches may optionally be specified with splitters. The radii and number of splitters are automatically calculated based on the curve ratio of the bend (inside radius ÷ outside radius). There can be up to three splitters.

**Turning vanes**
Mitred branches may optionally be specified with the following types of turning vanes:
- *Single*
- *Double*
- *Special*

NOTE
Splitters and turning vanes divide the duct into sub-sections, and can help reduce turbulence, noise, static pressure loss, and energy loss.

**Single blade damper**

**Comments**

**Height markers**

**Workflow status**

**View log**

**Access panels**

## 3.5.8 Frame damper

**MXS_3DDuctFrameDamper**

**Fabrication standards**

**System and service**

**External insulation**

**Number**

**Profile**
Frame dampers may be rectangular or circular.

**Size**
The width and depth of the frame damper.

NOTE Each fabrication standard defines a default size for frame dampers.

**Length**
The length of the frame damper.

**Frame damper size**
Rectangular frame dampers must be one of the configured *C* or *H* type frame damper sizes.

**Mullion width**
The width of the mullion(s). A mullion is a device used to subdivide a frame damper into multiple sections.

**Opening type 1 and 2**

## Sections

Rectangular frame dampers may optionally be divided into multiple sections. This may be necessary if the opening is larger than the maximum size of the damper.

**Design air quantity (L/s)**
The design air quantity of this section of the frame damper.

**Depth**
The depth of this section of the frame damper.

**Velocity (m/s)**
The velocity of air travelling through this section of the frame damper with the current design air quantity, width and depth.

NOTE
Entering a value for the depth will recalculate the velocity, and vice versa, according to the following formula:

Design air quantity (L/s) = Width × Depth × Velocity (m/s)

**Blade style**
Frame dampers must be one of the following blade styles:
- *Opposed blade damper (OBD)*
- *Parallel blade damper (PBD)*
- *Non-return blade damper (NRD)*

**Motor**
Frame dampers may optionally have a motor on the left or right.

**Comments**

**Height markers**

**Workflow status**

**View log**

## 3.5.9 Fire damper

**MXS_3DDuctFireDamper**

**Fabrication standards**

**System and service**

**Number**

**Profile**
Fire dampers may be rectangular or circular.

**Size**
The width and depth of the fire damper.

**Wall thickness**
The thickness of the wall, slab or ceiling in which the fire damper will be mounted.

**Style**
Fire dampers must be one of the following styles:
- *Duct to duct*
- *Grille to duct*
- *Duct to grille*

**Damper type**
Fire dampers must be one of the following types:
- *Curtain*
- *Blade*
- *Intumescent*
- *Spring-loaded curtain*

**Mounting type**
Fire dampers must be mounted as one of the following types:
- *Wall*
- *Slab*
- *Ceiling*

**Motor**
Fire dampers may optionally have a motor on the left or right.

**Access side**
Fire dampers must be accessed from either the air on or air off side.

**Airflow direction**
A positive airflow direction means the air is travelling from the first opening to the second opening.

NOTE Fire damper labels in 2D layouts are generated according to the specified airflow direction.

**Gap seals**
Fire dampers may optionally be specified with gap seals, which allow the damper to be installed with a controlled expansion gap.

### Connection 1 and 2

**Type**
Depending on the style and damper type, connections may be one of the following types:
- *Integrated flange*
- *Slip joint*
- *Starter tail*

**Length**
The length of the integrated flange, slip joint, or starter tail.

**Opening type**

**Joint**

**Comments**

**Height markers**

**Workflow status**

**View log**

## 3.5.10 Flex connection

**MXS_3DDuctFlexConnection**

**Fabrication standards**

**System and service**

**Internal and external insulation**

**Number**

**Profile**
Flex connections may be rectangular, circular, or flat oval.

**Size**
The width and depth of the flex connection.

**Type**

**Joint**

**Length**
The length of the flex connection.

**Flex type**
Flex connections must be one of the configured flex connection types.

**Comments**

**Height markers**

**Workflow status**

**View log**

## 3.5.11 Attenuator

**MXS_3DDuctAttenuator**

**Fabrication standards**

**System and service**

**Number**

**Type**
Attenuators must be one of the following types:
- *Circular, open*
- *Circular, open with impervious lining*
- *Circular, pod*
- *Circular, pod with impervious lining*
- *Circular, ultra light-weight*
- *Rectangular, straight splitters*
- *Rectangular, tapered splitters*
- *Rectangular, tapered splitters and impervious lining*

**Size**
The width and depth of the attenuator.

**Type**

**Length**
The length of the attenuator.

**Baffle orientation**
Rectangular attenuators must have vertical or horizontal baffles.

**Airflow direction**
A positive airflow direction means the air is travelling from the first opening to the second opening.

**Fabricator name**
The attenuator fabricator's name.

**Catalogue number**
The catalogue number or a unique description of the attenuator.

**Comments**

**Height markers**

**Workflow status**

**View log**

## 3.5.12 Step ins

A step in is usually required when a run of duct is changing from internal to external insulation.

**Step in**
The distance that the duct opening shrinks by on each side. This will default to the thickness of the internal insulation, if specified.

**Step length**
How far the duct extends past the step in.

## 3.5.13 Opening types and connections

By default, duct openings are automatically checked to ensure that their openings are correctly connected to another duct.

For a connection to be made, the openings must:
- Be in the same location;
- Be facing each other; and
- Have the same sizes.

When a duct opening is disconnected, a halo is drawn around the opening to alert the operator. (Opening halos may be disabled in the model configuration.)

Duct openings may be flagged as different types which are allowed to be disconnected.

**Default**
Default opening types are included in the auto-connect validation.

**Source**
Openings flagged as *Source* are usually connected to a block representing a piece of equipment. Source openings are not auto-connected.

**Terminal**
Openings flagged as *Terminal* are not auto-connected.

**Stop end**
Adds a blank end to the opening. Stop ends cannot be connected.

## 3.5.14 Joint

The opening's joint will be automatically selected from the fabrication standard's available joint types and sizes, based on the opening's size, the pressure class, and the required J-rating, in accordance with Australian Standard AS 4254-2002. Click **Edit joints** to override the selected joints.

## 3.5.15 Free length

Free length may optionally be specified for the following duct types:
- Straight
- Bend
- Shoe

Free length means the duct is fabricated oversized and will be cut to the correct length on site.

## 3.5.16 Heater banks

Straight ducts and transitions may optionally have heater banks.

**Reference number**
The reference number of the heater bank.

**Fabricator**
The fabricator of the heater elements.

**Construction**
The material from which the heater elements are constructed:
- *(Not specified)*
- *Mild steel*
- *Nickel plated*
- *Stainless steel*

**Terminal box orientation**
The terminal box can be positioned up, down, left or right.

**Terminal box position**
The terminal box can be positioned relative to the start, centre or end of the duct.

**Specified capacity (kW)**
The heating capacity specified by the engineer.

**Maximum single phase capacity (kW)**
The maximum heating capacity allowable for a single phase.

**Variable controller, e.g. SSR, SCR**
A heater bank with a variable controller can not have multiple stages, as the controller can vary the capacity on demand.

**Total capacity (kW)**
The total heating capacity of all of the stages specified for this heater bank.

### Stages

Each heater bank must be solved with one or more stages.

NOTE Heater banks with a variable controller specified can not have more than one stage.

**Calculate solutions**
MEPtrix can calculate single and three phase solutions for a heater bank.

**Specified capacity (kW)**
The heating capacity specified by the engineer for this stage.

**Total capacity (kW)**
The total heating capacity of all of the elements specified for this stage.

### Elements

Each stage can contain one or more elements.

**Quantity**
The number of units of this element.

**Phase**
Heater elements can be specified as single or three phase.

**Wattage (W)**
The amount of heating produced by the element.

**Total capacity (kW)**
The total heating capacity produced by this element (quantity × wattage ÷ 1000).

**Reach**
The maximum reach of the heat zone of the element.

**Reach %**
The reach percentage of the element across the duct with the specified terminal box orientation. Elements which do not reach across 65% of the duct's airway size will display a warning.

## 3.5.17 Access panels

Access panels may be added to the following duct types:
- Straight
- Bend
- Transition
- Shoe
- 2-way

**Select catalogue item**
Access panel values may be pre-filled by selecting an item from a fabricator's catalogue.

**Type**
The type of access panel, e.g. *(Default)* or *Fire rated*.

**Grease proof**
Grease proof access panels meet relevant standards for kitchen exhaust systems.

**Fabricator name**
The access panel fabricator's name.

**Catalogue number**
The catalogue number or a unique description of the access panel.

**Size**
The access panel's width and depth.

**Side**
The following duct types allow the access panel to positioned relative to the duct:

| TYPE | AVAILABLE SIDES |
|---|---|
| Straight | *Start* or *End* |
| Bend | *Start* or *End* |
| Transition | *Start* or *End* |
| 2-way | *Trunk*, *Left branch* or *Right branch* |

**Longitudinal offset**
The distance from the opening along the duct to the centre of the access panel.

**Lateral offset**
The distance from the centre-line across the duct to the centre of the access panel.

**Position**
The access panel can be positioned up, down, left or right.

### 3.5.18 Single blade damper

The following duct types may have single blade dampers:
- Straight
- Bend
- Shoe
- 2-way

**Type**
Single blade dampers must be *Locking quadrant* or *Motorised*.

**Side**
Straights and bends allow the single blade damper to positioned relative to the start or end of the duct.

**Offset**
The distance from the opening along the duct to the edge of the single blade damper in its open position.

**Handle location**
The handle can be located up, down, left or right.

## 3.6 Grilles

### 3.6.1 Grille

**MXS_3DDuctGrille**

**Fabrication standards**

**System and service**

**Number**

**Design air quantity (L/s)**

The design air quantity of the grille.

**Actual air quantity (L/s)**
The actual air quantity of the grille.

**Face profile**
Grille faces must be rectangular or circular.

**Neck profile**
Grille necks must be rectangular or circular.

**Grille template**
Grilles may optionally use one of the project's grille templates.

NOTE Most grille properties are pre-filled by the selected grille template, but may be overridden by selecting the appropriate override check box.

**Grille type**
Each grille must be one of the following types:
- *Circular adjustable diffuser*
- *Door grille*
- *Double deflection*
- *Egg crate*
- *Eyelash diffuser*
- *Full chevron*
- *Half chevron*
- *Jet diffuser*
- *Linear bar grille*
- *Linear slot diffuser*
- *Louvred ceiling diffuser*
- *Non-louvred ceiling diffuser*
- *Paltech diffuser*
- *Perforated*
- *Swirl ceiling diffuser*
- *VAV diffuser*
- *Weatherproof louvre*
- *Wire mesh*

**Frame type**
Each grille type has its own list of allowable frame types, which includes at least one of the following types:
- *(Standard)*
- *Bevel*
- *Channel*
- *Fixed core*
- *Flange*
- *Flush frame (plaster)*
- *Hinged core*
- *Lay-in (T-bar)*
- *Removable core*
- *Swirl*

**Catalogue number**
The catalogue number or a unique description of the grille.

**Core pattern**
Ceiling diffusers must have one of the allowable core patterns.

Louvred and non-louvred ceiling diffuser core patterns:
- *11 - square one way blow*
- *12 - rectangular one way blow*
- *13 - rectangular one way blow*
- *21 - square two way blow*
- *22 - rectangular two way blow*
- *23 - rectangular two way blow*
- *25 - square two way blow*
- *26 - rectangular two way blow*
- *27 - rectangular two way blow*
- *31 - square three way blow*
- *32 - rectangular three way blow*
- *33 - rectangular three way blow*
- *41 - square four way blow*
- *42 - rectangular four way blow*

Swirl ceiling diffuser core patterns:
- *(Generic)*
- *Double*
- *Radial*
- *Single*

**Blank off plates**
Louvred ceiling diffusers and VAV diffusers may optionally have blank off plates.

**Mounting type**
Grilles must use one of the following mounting types:
- *(None)*
- *Duct*
- *Flush frame (plaster)*
- *Lay-in (T-bar)*
- *Wall*

**Damper type**
Grilles may optionally have one of the following damper types:
- *Butterfly damper* (circular grilles only)
- *Opposed blade damper (OBD)*
- *Stream split damper (SSD)*

**Has adaptor**
Adds a neck adaptor with the specified size.

**Nominal neck size**
The nominal width and depth of the grille's neck.

**Face size**
The width and depth of the grille's face.

**Penetration size**
The width and depth of the grille's penetration size.

**Actual neck size**
The actual width and depth of the grille's neck.

**Total depth**
The total depth of the grille.

**Frame depth**
The depth of the grille's frame.

**Neck depth**
The depth of the grille's neck.

**Cushion head**
Grilles may optionally be specified with a standard cushion head.

**Internal insulation**
Cushion heads may optionally have internal insulation.

**External insulation**
Cushion heads may optionally have external insulation.

**Connection type**
Cushion heads must have one of the following connection types:
- *Face*
- *Neck*
- *Neck adaptor (face if no adaptor)*

**Additional height**
Additional height may optionally be added to the standard cushion head height.

NOTE The cushion head height is automatically calculated to fit its spigots.

**Override step length**
Allows a non-standard step length to be specified for the cushion head.

**Comments**

**Height markers**

**Workflow status**

**View log**

### 3.6.1.1 Cushion head spigots

Each cushion head may have multiple spigots.

**Profile**
Cushion head spigots may be circular, or flat oval.

**Air quantity (L/s)**
The air quantity of this spigot. The total air quantity of all spigots must match the grille's design air quantity.

**Flex diameter**
The diameter of this spigot.

NOTE The appropriate flex diameter is pre-selected according to the air quantity and the project's flex templates.

**Size**
The width and depth of flat oval spigots.

**Length**

The length of this spigot. The length defaults to the fabrication standard's default spigot length.

## Damper

**Type**
Cushion head spigots may optionally have one of the following damper types:
- *Locking quadrant*
- *Friction blade*
- *Motorised*

**Side**
Dampers must be positioned at the start, centre or end of the spigot.

**Offset**
Dampers positioned at the start or end of the spigot may optionally be offset along the spigot away from the selected position.

**Handle location**
Locking quadrant and motorised dampers have a handle or motor, respectively, which may be positioned up, down, left or right.

## Location

**Face**
The spigot must be located on one of the following faces:
- *Top*
- *Front*
- *Back*
- *Left*
- *Right*

NOTE Cushion head faces are determined by the job configuration's implied up angle.

**Alignment**
The spigot must be aligned to the left, centre or right of the cushion head.

**Offset**
The horizontal distance of the spigot away from the specified alignment. Enter a negative offset to move the spigot to the left, or a positive offset to move it to the right.

# 3.6.2 Flex

**MXS_3DDuctFlex**

**Fabrication standards**

**System and service**

**External insulation**

**Number**

**Diameter**

The size of the flex duct. Flex duct diameters are limited to a set of common sizes.

**Number of points**
The number of points used to create the flex's centre-line path.

**Length**
The length of the flex's centre-line path.

**Opening type 1**

**Opening type 2**

**Comments**

**Height markers**

**Workflow status**

**View log**

## 3.6.3 Spigot

**MXS_3DDuctSpigot**

**Fabrication standards**

**System and service**

**Number**

**Profile**
Spigots may be circular, or flat oval.

**Air quantity (L/s)**
The air quantity of the spigot.

**Flex diameter**
Enter a size or select one of the common flex diameters.

**Size**
The width and depth of the spigot.

**Length**
The length of the spigot. The length defaults to the fabrication standard's default spigot length.

**Opening type**

### Damper

**Type**
Spigots may optionally have one of the following damper types:
- *Locking quadrant*
- *Friction blade*
- *Motorised*

**Side**
Dampers must be positioned at the start, centre or end of the spigot.

**Offset**
Dampers positioned at the start or end of the spigot may optionally be offset along the spigot away from the selected position.

**Handle location**
Locking quadrant and motorised dampers have a handle or motor, respectively, which may be positioned up, down, left or right.

**Comments**

**Height markers**

**Workflow status**

**View log**

## 3.6.4 Grille templates

**MXS_3DGrilleTemplates**

Each project has its own list of grille templates. A grille template can be used to pre-fill many properties for grilles, increasing productivity and reducing operator errors.

TIP At the start of a project, identify common grilles and create appropriate grille templates.

**Select grille**
Grille template values can be pre-filled by selecting a grille fabricator, series and size.

**Unlock values**
When a grille is selected, the values are locked, but may be unlocked and edited.

**Reset values**
Resets all values back to defaults.

**Grille properties**

# Pipe

# 4 Pipe

## 4.1 Fabrication standard

Each pipe in a project must be selected from a fabrication standard.

## 4.2 Systems and services

**MXS_3DPipeSystems**

Each pipe in a project must be assigned to a pipe system and service.

**Code**
Codes are usually indicative of the system's primary piece of equipment.

**Comment (optional)**
Comments are often used to record a system's location within a building, or to help distinguish between old and new systems. Comments can help operators search for and select the correct system.

### Services

**Service class**
The following service classes are available:

- *Chilled water flow*
- *Chilled water return*
- *Condensate drains*
- *Condensor water flow*
- *Condensor water return*
- *Heating water flow*
- *Heating water return*
- *Other*
- *Refrigerant hot gas line*
- *Refrigerant liquid line*
- *Refrigerant suction line*

## 4.3 Insulation

Pipes can have insulation applied.

The insulation drop-down list presents insulation sizes on the left, and insulation types on the right. Click the desired insulation thickness, and then click an insulation type.

TIP Double-click an insulation size to automatically select the first available insulation type, which is typically *(Not specified)*.

## 4.4 Nominal bore

Each pipe in a project has a nominal bore, selected from its fabrication standard's available sizes.

## 4.5 Straight

**MXS_3DPipeStraight**

**Fabrication standard**

**System and service**

**Insulation**

**Nominal bore**

**Joint 1 and 2**

**Length**
The actual length of the pipe.

**Centre-line length**
The centre-line length of the pipe, which may be different to the actual length if the pipe is mitred or penetrating another pipe.

**Comments**

**Height markers**

**Workflow status**

**View log**

## 4.6 Bend

**MXS_3DPipeBend**

**Fabrication standard**

**System and service**

**Insulation**

**Nominal bore**

**Joint 1 and 2**

**Short radius**
Use the short radius defined by the fabrication standard size. This may not be available for some nominal bores.

**Angle**
The angle of the bend.

**Direction**
Pipe bends can bend up, down, left or right.

**Comments**

**Height markers**

**Workflow status**

**View log**

## 4.7 Reducer

**MXS_3DPipeReducer**

**Fabrication standard**

**System and service**

**Insulation**

**Nominal bore**

**Joint 1 and 2**

**Reducer nominal bore**
The nominal bore of the reducer's second joint. Each fabrication standard size has a list of reducer sizes.

**Eccentric**
Specifies an eccentric reducer.

**Direction**
Eccentric reducers can be can be anchored up, down, left or right.

**Comments**

**Height markers**

**Workflow status**

**View log**

## 4.8 Extend

**MXS_3DPipeExtend**

Extends a pipe to meet another pipe opening, or to interpenetrate a pipe.

## 4.9 Tee

**MXS_3DPipeTee**

**Fabrication standard**

**System and service**

**Insulation**

**Nominal bore**

**Joint 1, 2 and 3**

**Reducer**
Specifies a reducing tee.

**Reducer nominal bore**
The nominal bore of the tee's reducing joint. Each fabrication standard size has a list of reducer sizes.

**Direction**
Pipe tee branches can point up, down, left or right.

**Comments**

**Height markers**

**Workflow status**

**View log**

## 4.10 Mitre pipes

**MXS_3DPipeMitre**

Extends two pipes to make a mitred connection.

## 4.11 Joints

**Type**
A pipe opening must be specified as one of the following types:

| TYPE | NOTES |
|---|---|
| *(Default)* | |
| *End plate* | Only available with no flange selected. |
| *Blind flange* | Only available with a flange selected. |
| *Cap* | |
| *Penetration* | Automatically specified when a pipe is interpenetrated using the extend command. |
| *Mitred* | Automatically specified when a pipe is mitred using the mitre pipes command. |

**Flange**
Adds a flange to the joint.

**Flange standard**
The flange standard for this flange.

**Flange type**
All flanges must be one of the following flange types:
- *Plate slip-on*
- *Bossed slip-on*
- *Weld neck*

NOTE *Bossed slip-on* and/or *Weld neck* flanges may not be available for some flange standards.

**Raised face**
Adds a raised face to the flange.

# Common properties

# 5 Common properties

## 5.1 Comments

Multi-line comments may be recorded for all mechanical components and pipes. Comments can be included in schedules.

TIP Adjust the splitter if the comments box is too small.

## 5.2 Workflow status

A MEPtrix component can be specified as one of the following workflow statuses:

- *(None)*
- *Existing*
- *Approval*
- *Construction*
- *Constructed*
- *Installed*

## 5.3 View log

Each time a mechanical component or pipe is created or edited, the date, time, and the current operator code is recorded.

NOTE The current operator is set through CadTracker. See CadTracker's help for more information.

## 5.4 Stream data

Each MEPtrix component saves a copy of its property values as "stream" data inside its drawn AutoCAD block. These stream values enable the audit components command to do its work, and are also helpful when copying components between DWG files.

# Generic data

# 6 Generic data

## 6.1 Generic objects

**MXS_3DGenericObjects**

CadTracker includes a comprehensive system which allows you to define your own data structures. (See the *Generic data* chapter in the CadTracker manual for more information.)

Generic objects that have been added to the project in CadTracker can be linked to blocks or other entities in the current model. Each generic object can be linked to one entity only in the project. If an entity representing a generic object needs to be moved from one model to another, the link needs to be removed in the old model before a new link can be added to the entity in the new model.

### Tool tips

Blocks or other entities that have been linked to generic objects display comprehensive tool tips in 3D models and 2D layouts.

NOTE
Generic objects are cached to improve performance. If a generic object has been modified since it was loaded into the cache, it will need to be refreshed to display the updated data. Click  **Clear generic object cache** and the generic object will be reloaded the next time it is needed.

### Schedules

Generic objects can be scheduled even if they have not been linked to an entity in a model. However, creating schedules with linked objects affords greater flexibility as the objects may be selected by job or model, or by selecting the drawn items.

# Modify

# 7 Modify

## 7.1 Redraw

**MXS_3DRefreshDrawnComponents**

The redraw command can be used to redraw MEPtrix items, such as mechanical components, pipes, schedules, and 2D layouts.

## 7.2 Break connection

**MXS_3DBreakConnection**

## 7.3 Edit

### 7.3.1 Edit with ghost preview

**MXS_3DEditDuctGhost**

Edits a mechanical component with a ghost preview. Ducts will snap to other duct openings, and straight ducts snap to standard lengths.

### 7.3.2 Edit comments

**MXS_3DEditDuctsComments**

This command allows you to type a comment and apply it to multiple mechanical components.

### 7.3.3 Edit insulation

**MXS_3DEditDuctsInsulation**

Edits the internal and/or external insulation for multiple mechanical components.

**Maintain current airway sizes**
Increases or decreases the size of the duct to make the airway size the same after the new insulation is applied.

### 7.3.4 Edit service

**MXS_3DEditDuctsService**

This command allows you to apply a system and service to multiple mechanical components.

### 7.3.5 Edit workflow status

**MXS_3DEditDuctsWorkflowStatus**

This command allows you to apply a workflow status to multiple mechanical components.

### 7.3.6 Reset fabrication standards

**MXS_3DResetFabStd**

This command allows you to reset multiple mechanical components back to the model's default fabrication standards.

### 7.3.7 Audit MEPtrix components

**MXS_3DAuditComponents**

Sometimes you may need to work with a DWG which has different components to those recorded in the MEPtrix database. This may arise from one of the following situations:

- AutoCAD crashed
- The DWG file was lost or corrupted and needed to be restored from a backup
- The database was rolled back to an earlier backup
- The DWG was edited using a different database instance, e.g. an operator working remotely with no internet access

Before continuing work, the DWG should be audited. The audit command compares the model's drawn components to components in the database and reports mismatches and missing items.

**Database components** may be previewed in the model, added to the DWG, or deleted.

**DWG components** can be zoomed to, added to the database and redrawn, or deleted.

**Mismatched components** list the values which are different for each component. The DWG component can be zoomed to, and the operator can decide to either keep the DWG version, or keep the database version and redraw the component.

# 7.4 Number

## 7.4.1 Number mechanical components

**MXS_3DNumberMechanicalComponents**

This command allows you to add numbers sequentially to mechanical components, counting up or down.

**Last number**
Click **< Pick component** to load a number from an existing component.

**Next number**
Enter the desired prefix, major number, separator, minor number and suffix for the next component to number.

TIP
The component's system code can be automatically added to the suffix. Click **Insert keyword** > **System**. Other characters may be entered before or after the <*System*> keyword.

**Number to change**
The major or minor number can be changed. The minor number is particularly useful if you need to insert a run of duct between ducts which have already been numbered.

**Count direction**
New numbers can count up or down.

## 7.4.2 Edit numbers and comments

**MXS_3DEditNumbersAndComments**

With this command you can:
- Generate numbers sequentially
- Edit numbers
- Edit comments
- Edit workflow statuses
- Create CSV or XLSX reports

Mechanical components are grouped into the following types:
- Ducts
- Fire dampers
- Flexes
- Frame dampers
- Grilles
- Spigots

Components can be selected by:
- Project
- Job(s)
- Model(s)

- This model

TIP Select multiple rows to edit values for several components at once.

NOTE
This editor saves values directly to the database. DWG files for the components do not need to be opened. As a result, components may need to be redrawn to update the stream data or number labels.

## 7.5 Height markers

Height markers can help installers correctly position components on site.

Height marker calculations require external references to be attached and configured.

MEPtrix calculates height marker values by firing "rays" above and below a component, and measuring the distances to the configured xrefs.

### 7.5.1 External references for height calculations

**MXS_3DHeightXref**

In the **Modify** panel, click **External references**. If the button is not visible, click the arrow next to **Height marker**.

Select the external references which should be included in height calculations.

**Type**
Select the type of the external reference, as follows:

| TYPE | XREF BEHAVIOUR |
|---|---|
| *(Undefined)* | Ignored in height calculations |
| *Ceiling* | Used to calculate the distance to ceiling |
| *Floor above* | Used to calculate the distance above |
| *Floor below* | Used to calculate the distance below |

### 7.5.2 Add height marker

**MXS_3DHeightMarker**

Height markers can be added to MEPtrix components in both 3D and 2D models.

Select the component to measure, and then pick the point at which the height should be calculated, within the component's bounds. A new height marker label will be drawn at the selected point. Multiple height markers can be added to each component, if necessary.

NOTE When adding a height marker to a 2D component, MEPtrix opens the 3D model, measures the height, and then switches back to the 2D model.

## Configuring the label

In the 3D model, open the MEPtrix properties window for the component by double-clicking the component, or click **Edit** in the ribbon.

At the bottom of the window, the heights will be listed.

Each height marker label can be configured to show or hide the following values:
- Clearance above and below
- Centre-line above and below
- Relative level above and below

NOTE Ceiling distances are listed for information only; they cannot be added to height marker labels.

2D

# 8 2D

## 8.1 2D layouts

**MXS_3DLayouts**

MEPtrix can produce the following types of 2D layouts:
- Plan
- Section
- Oblique view

**Name**
The name of the layout.

NOTE
For section layouts, an auto-generated name will be suggested based on the section reference and the name of the other layout, e.g. *A - Plan*.

**3D model UCS**
The origin point, x-direction and y-direction of the layout in the 3D model. Click **< Pick model UCS** to select new coordinates.

**2D model UCS**
The origin point, x-direction and y-direction of the layout in the 2D model. Click **< Pick layout UCS** to select new coordinates.

NOTE
It is possible to have both the 3D components and 2D layouts in the same model. However, this methodology is not considered best practice, and should only be used for testing, or for very small projects.

### Models

Layouts may be composed of 3D entities selected from multiple models.

### Labels

Labels can be switched on or off via an entity's context menu in AutoCAD. In the layout's **Labels** tab, there are also options for showing, hiding or resetting label types for selected entities.

MEPtrix uses a complex algorithm for arranging component labels automatically. A label will be placed inside its owning component if there is sufficient space, otherwise it will be placed outside the component at the preferred location based on the component's type. The default position should be acceptable for at least 90% of labels in a layout. For more complex layouts, some manual tweaking of label positions may be required. Each label which has been manually positioned remembers its new location relative to its owning component.

### Section markers

A new section created for a layout will add a section marker with left and right arrows using the default style. Section markers from other layouts may also be added manually.

Section markers can be drawn using the following styles:
- *(Default)*
- *Arrow*
- *Triangle*
- *View marker*

### Process commands

The layouts list and edit windows provide the following process commands:

| WINDOW | COMMAND | DESCRIPTION |
|---|---|---|
| List | **Process all** | Processes all entities and labels in the layout. |
| List | **Process labels** | Processes all labels in the layout. |
| List | **Process selected entities** | Processes the selected entities only, prompting for a selection if necessary. |
| Edit | **Process all with selected label types** | Processes all entities and labels using the label types selected in the **Labels** tab. |
| List and Edit | **Process all and hatch duct only** | Processes all entities and labels, and hatches duct using the insulation hatch configuration specified by the project. To improve performance, flex ducts are not included in the hatching boundary calculations. If any flex duct is overlapping hatched duct, the hatch pattern will be visible through the flex duct. |
| List and Edit | **Process all and hatch with obscuring flexes** | Processes all entities and labels, and hatches duct using the insulation hatch configuration specified by the project. Flex ducts are included in the hatch boundary calculations. |

## 8.2 Process selected entities

**MXS_3DLayoutProcessSelected**

2D layouts with several hundred mechanical components can take several minutes to process, especially if ducts are being hatched. This command allows you to process a subset of the layout.

## 8.3 Zoom to 3D component

**MXS_3DZoomTo3DComponent**

This command switches to the 3D model and zooms to the selected component(s).

## 8.4 Schedules

## 8.4.1 Edit schedules

**MXS_3DSchedules**

All schedules are owned by a project, but multiple schedules of the same type may be created to group components by job, area or model. Schedules may be drawn in any DWG; they do not have to reside in a MEPtrix model.

Schedules may be created for the following component types:

- Attenuator
- Cushion head
- Fire damper
- Flex connection
- Frame damper
- Grille
- Heater bank
- Generic object

**Template**
Each schedule must use one of the project's schedule templates.

**Title**
The text that appears at the top of the schedule.

**Select items**
Items may be added by project, job, or model, or by selecting drawn items in a 3D model. When selecting by project, job or model, items which have been included in other schedules may optionally be excluded by clicking **Unscheduled items**.

NOTE
MEPtrix displays a warning when an item which has already been included in another schedule is added to this schedule. Scheduling the same item multiple times can lead to costly fabrication or purchasing errors.

## 8.4.2 Schedule configurations

**MXS_3DScheduleConfig**

Each project has its own list of schedule configurations. There is also a list of standard schedule configurations which are automatically copied into each new project. Standard schedule configurations may be created or edited via the MEPtrix Configuration window. To edit project schedule configurations, in the **2D** panel, click  **Schedule configurations**. If the button is not visible, click the arrow next to  **Edit schedules**.

**Name**
The name of the schedule configuration.

**Null data display value**
For the sake of clarity, it is often preferable to display a value instead of leaving a schedule cell blank. Common null data display values include:

- *(None)*
- -
- --

**Text size (Title, Header, Data)**
The text size in drawing units.

**Text style (Title Header, Data)**
The name of the AutoCAD text style.

**Alignment (Title, Header)**
Titles and column headers may be aligned to the left, centre or right.

NOTE
The alignment of data is controlled by each column in schedule templates.

**Row height (Title, Header, Data)**
The minimum row height in drawing units. Data rows automatically grow to fit if their values span multiple lines.

**Second line**
The distance between the first and second line in drawing units or *(Not used)*.

**Underline title**
Adds an underline to the title text.

**Title border**
Adds a border to the title text spanning the width of the schedule.

## 8.4.3 Schedule templates

**MXS_3DScheduleTemplates**

Each project has its own list of schedule templates. There is also a list of standard schedule templates which are automatically copied into each new project. Standard schedule templates may be created or edited via the MEPtrix Configuration window. To edit project schedule templates, in the **2D** panel, click **Schedule templates**. If the button is not visible, click the arrow next to **Edit schedules**.

Schedule templates may be created for the following component types:
- Attenuator
- Cushion head
- Fire damper
- Flex connection
- Frame damper
- Grille
- Heater bank
- Generic object

**Configuration**
The schedule configuration to use with this template.

**Name**
The name of the schedule template.

**Title**
The default title for schedules using this template.

NOTE UPPER CASE titles are recommended.

**Alignment point**
When a schedule is drawn, the operator is prompted to pick a point. Relative to this point, schedules may be aligned to:
- *Top left*
- *Top right*
- *Bottom left*
- *Bottom right*

**Place column headers at bottom**
Places the column headers and title at the bottom of the schedule. “Bottom up” schedules were common in the manual drafting era, and some offices still prefer this style.

**Group common items**
With this option selected, items with identical values are tallied and collapsed into a single row. The **Quantity** column is automatically displayed when common items are grouped.

### Columns

All possible data columns for the schedule type are listed. The template's columns may be switched on or off, and arranged into the desired order.

**Header**
The column's header text.

NOTE UPPER CASE headers are recommended.

**Width**
The minimum width of the column in drawing units or *(Auto)*.

**Visible**
Shows or hides the column in drawn schedules.

**Ignore in group**
When grouping common items, some column values may be different to other items but the items are still considered the same for the purpose of grouping. For example, comments are usually ignored when checking for common items. Values that are ignored in the group can still be displayed in one cell, spanning multiple lines.

**Alignment**
Each column may be aligned to the left, centre or right.

## 8.5 Create viewport

**MXS_3DCreateViewport**

With a paper space tab activated, this command prompts the operator to select an existing 2D layout and then creates a new viewport, setting the appropriate size and scale. The boundary of the viewport is displayed as a ghost preview and the operator can pick its location.

## 8.6 Opening size label

W×D

**MXS_3DOpeningSizeLabel**

By default, most mechanical component fittings in 2D layouts do not display opening size labels, as their sizes can usually be inferred by the adjacent straight ducts. This command can be used to manually add a size label to an opening.

## 8.7 Sections

### 8.7.1 New section layout

**MXS_3DNewSectionLayout**

A new section layout can be created by completing the following steps:

1. Click **New section layout**.

2. Select an existing 2D layout when prompted.
3. Pick the left-hand point for the section plane.
4. Pick the right-hand point for the section plane.
5. Pick where to draw the new section layout.

6. In the **New Section Placeholder** window, enter a **Reference**.
7. Optionally, enter a **Comment**.
8. Click **OK**.

9. In the **New Section** window, select layout entities and sliced entities to be included in the section.
10. Click one of the layout **Process** options.

**Volume boundary**
New section layouts use the model's default section volume boundary. Click **Custom** to create a different boundary.

### 8.7.2 Section placeholders

**MXS_3DSectionPlaceholders**

Each section layout creates a section placeholder, which is a link between the section drawing(s), and the drawing(s) where the section markers are visible.

**Reference**
The section placeholder's reference, which is usually one or two characters.

SECTIONS VS VIEWS
Technically, there is little difference between a section and a view. Typically, the main differences are as

follows:

| | SECTION | VIEW |
|---|---|---|
| Reference | Letter | Number |
| Markers | Left and right markers with tails | Single view marker |

**Comment (optional)**
Section placeholders are owned by the project, and may be shared between multiple jobs, models and drawings. For larger projects, different sections may use the same reference, which can lead to confusion. Enter comments to help keep track of large lists of section placeholders.

### Section drawings

Section markers using the default style display the reference and the drawing number of the drawing in which the section layout appears. Larger sections may actually span multiple drawings, e.g. duct risers in multistorey buildings. Section marker labels will display all section drawing numbers in a vertical list, ovalising the label, if necessary.

### Section marker drawings

Section labels display the reference and the drawing number of the drawing in which the section layout appears. If the section markers appear in multiple drawings, the section label will display all drawing numbers in a vertical list, ovalising the label, if necessary.

NOTE
Drawing numbers in section markers and labels are automatically abbreviated to the digits at the end of the number. For example, *XYZ-25-101* would be displayed as *101*.

## 8.7.3 Scan for section markers

**MXS_3DSectionMarkerViewportScanner**

Keeping the section and section marker drawing lists up to date can be a tedious task. This command scans viewports for visible section markers and labels, updates the section placeholder records, and refreshes the section markers and labels to display the up-to-date drawing numbers.

## 8.7.4 Scan for section markers with XRefs

**MXS_3DSectionMarkerViewportScannerXrefs**

This is the same as the regular section marker viewport scanner, but it also scans external references for section markers and labels.

# 8.8 Auxiliary view

**MXS_3DAuxView**

This command creates or edits an auxiliary view for a single component in a 2D layout.

## 8.9 Orthographic view

**MXS_3DOrthoView**

This command creates a new orthographic view based on an existing 2D layout, including all entities in the layout.

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