HVAC Tutorial

Overview

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PART OF HEXAGON

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Note to Student: Online Training Workflow

Each Intergraph Smart™3D Online Training session is comprised of a series of informative video clips, a short quiz, and one PDF-based tutorial viewable on any Windows or Android-OS computer/tablet. These videos are presented through a structured, learning management system, or LMS, which logs your time and monitors all videos you have watched. In our live classroom courses, you listen to an instructor's lecture and are given the chance to practice what has been relayed using your text book and the software. The recommended student workflow for our online training course is much the same.

After logging in to the LMS, you watch a video demonstration of specific topics/techniques, complete a practice tutorial and then sit a short quiz about the session to obtain credit in the system.

Please read the following information about the Intergraph Smart™3D Online Training Series.

Videos

Videos are meant to provide visual demonstrations of specific designer tasks performable in the software. They may be viewed for note-taking purposes or followed step-by-step as you explore Smart3D. You can play/pause a video by pressing the  button or Space bar on your keyboard. Pressing the  button or R on your keyboard will rewind the video to the beginning. Videos can only be viewed using the latest Flash-compliant browsers such as Internet Explorer, Firefox, Opera, or Google Chrome.

Quizzes

A Quiz will be given at the end of each session to test what you have just learned. Once you answer the question, you will be given your score.

Tutorials

Tutorials are meant to provide information and step-by-step practice for performing specific designer tasks. Although tutorials and videos are related by subject, video and tutorial content may differ in certain areas. As a guideline, try to follow the steps noted in each tutorial while using previously viewed video content as reference to your learning experience.

If you choose to follow a video task step-by-step and the same task is listed in its tutorial, note that section as followed and proceed to the next task until you finish the tutorial.

Credit for Viewing

To obtain credit for viewing a series, watch every video session from begin to end, complete its tutorial, and answer the quiz question at the end of the video. Then close the video window using the EXIT button at the top- right-hand side. You should see a check mark appear for that session in the LMS.

SESSION 1

HVAC: An Overview

Objective

By the end of this session, you will be able to:

- Identify the tasks that you can perform in the HVAC environment.

Before Starting this Procedure

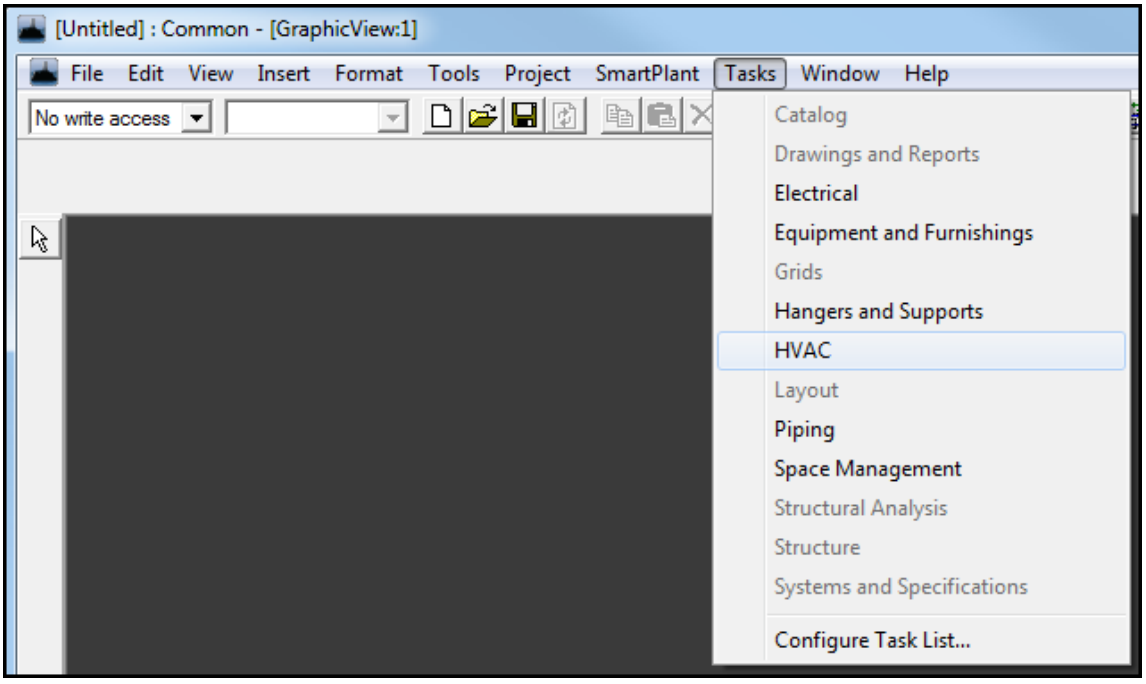
- Smart 3D Overview

Overview

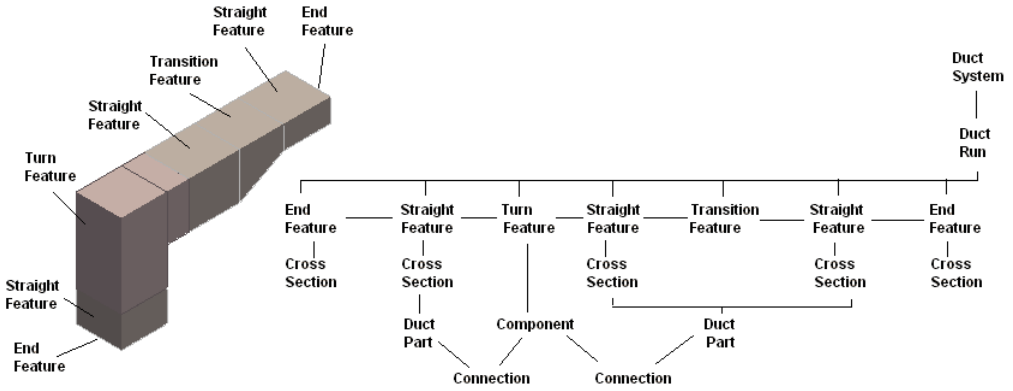
The HVAC task creates a three-dimensional (3D) representation of duct systems in your model. Placement and routing are specification driven. Smart 3D uses the specification of the selected duct run, the cross-section size of the feature path, and the active placement point to provide you with a list of valid component types as part of the modeling routine.

The HVAC task uses point-by-point route design and inserts duct components such as dampers, filters, flanges, bellmouthes, and exhaust hoods during design. The objects in the model are path features that identify the functionality that is supposed to occur at specific points along the duct path. The features identify ends, turns (changes in direction), branches, transitions, and components that are placed along the duct path.

To access the HVAC environment in Smart 3D, click **Tasks > HVAC**.



Before you start modeling, you need to become familiar with the duct feature model and all the objects that play a role in routing a duct system. The following figure shows the duct feature model and the relationships between features that represent a portion of a duct system.

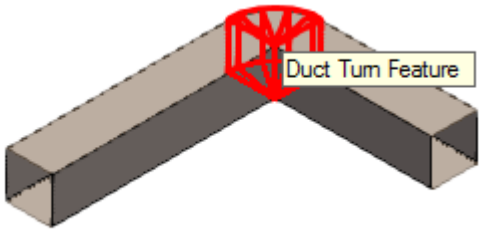


Duct systems - A duct system is a way of organizing duct runs within the system hierarchy and controlling the specifications that can be used within that system. If a duct system exists in your model, you can route duct runs and arrange the duct runs as children in the system hierarchy.

Duct Runs - A run is a collector of features and parts, and is typically a child of a duct system in the **Workspace Explorer**. It also provides the Catalog specification from which you can choose the parts. Duct run is a duct path with the same specification, material, and values of maximum recommended velocity and pressure loss.

Duct Features - A feature is a child to a run and a parent to a part. The path feature of the duct links to a cross-section that defines the shape of the duct. These cross-sections provide an outline of the shape of the duct, while the feature provides the geometry path. Ducts utilize transitions to connect different segments of the duct run that have different dimensions or shapes. Features are not displayed in the **Workspace Explorer** because of their ability to own several parts. The following are the various duct features that you can define in the HVAC environment:

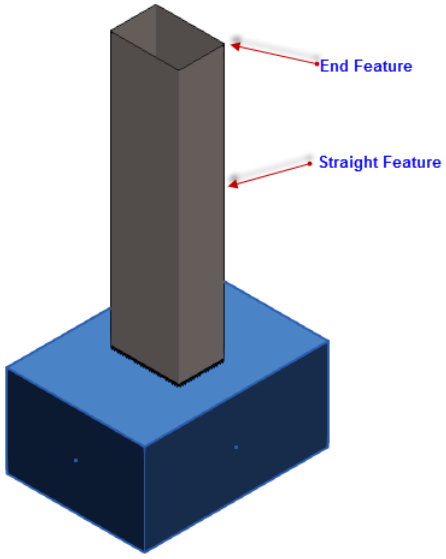
- **Turn Feature** - This feature represents a deviation in a path resulting in a turn. An example would be three data points provided by a designer. The first two data points generate a straight feature. The third data point, if not in-line with the first set, constitutes a deviation in path from the existing straight projection, as shown in the following figure. Turn features, such as elbows, miter elbows, and gooseneck elbows, change the direction of the duct.



- **End Feature** - This feature acts as a place holder for future connections to the run. It is located at the end of a run, where a port exists on a part that is managed by the run. An end feature represents either end of a physical duct run, as shown in the following figure. When

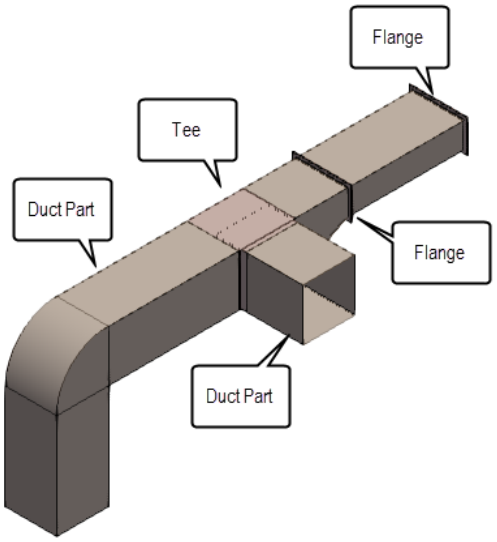
you connect an end feature to a run, Smart 3D removes and replaces it with another feature, based on the nature of the addition to the run.

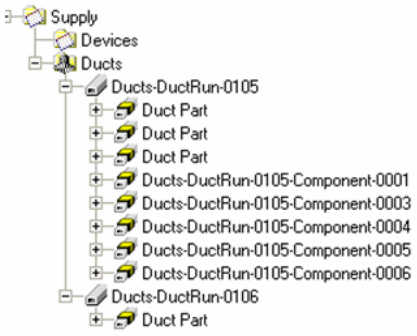
- **Straight Feature** - The path of this feature describes a straight line. This feature is defined by two linear data points. Basic geometric principles dictate that two points define a line, thus the straight section of a duct run is a straight feature, as shown in the following figure.



- **Split Feature** - This feature represents a break and a joint in the duct. It divides a duct along a straight section into two straight features to connect the ends of the two ducts at the cut location. Examples include butt welding, coupling, flange set, and joint sleeve.
- **Branch Feature** - This feature represents junctions whose path is defined by branching components, such as tees, wyes and crosses. The third port of a branch feature always (by rule) constitutes a new run, independent of the header connections.
- **Along Leg Feature** - This feature represents in-line components such as dampers or filters where port 1, the origin, and port 2 are collinear.
- **Transition Feature** - The path of this feature is defined by a transition between cross-sections or sizes or other defining constraints that result in the first port of the part being fundamentally different from the second port. The result is a feature that must close the gap between these parts. The transition feature modifies the cross-section of a duct run. It allows you to change a duct to all possible combinations.

Duct Parts - A part is a physical component that comprises of a feature and is generally selected by the software. The following figure shows some examples of duct parts that represent a portion of a duct system. The highlighted portion of the figure shows a section of the **Workspace Explorer** containing the hierarchy of duct parts.





Connections - A connection is an object that connects two parts, for example, a flange and a duct part. Currently this object does not generate any connection parts.

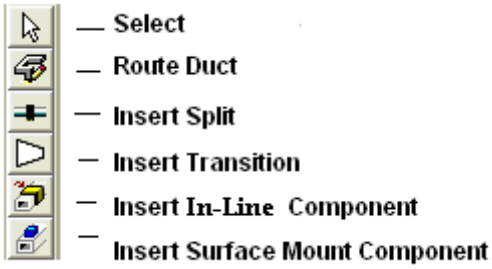
Equipment - Equipment can have one or more HVAC nozzles through which you make the connections to the duct systems. Using the Equipment task, you can model HVAC equipment such as fans, chillers, and air handling units directly in the model or place them from the Catalog if they are available in your project.

HVAC Nozzles - An HVAC nozzle is the connect point between duct parts and equipments. It contains definition of the connection like flow direction, duct cross-section, and size.

You will now learn about the common tasks that can be performed in this environment.

Common Tasks in the HVAC Environment

When you are in the HVAC environment, you can perform the following tasks by using commands available on the vertical toolbar.



Create and route a duct run - You can create a new duct run and a branch from a duct run, extend an existing duct run, and route a duct run to or from nozzles and features. You can perform this task by using **Route Duct** on the vertical toolbar.

Insert features - You can insert features to create more intricate duct routes that divide, branch, and change cross-sections. **Insert Split** on the vertical toolbar divides the duct into sections. You can use any split feature defined in the reference data, such as a flange or a butt weld, to divide the duct run into sections. **Insert Transition** creates duct transitions. The transition feature can only be inserted on an existing end feature or HVAC port.

Insert in-line and surface-mounted components - You can insert in-line components that are not placed automatically during routing. While adding in-line components, Smart 3D automatically splits a duct and adds necessary transitions. **Insert In-line Component** adds inline components, reducing components, and other components to a duct run. You can add these components either during the routing of a duct run or after you have routed the duct run. You can also add surface-mounted components at a specified location. **Insert Surface Mount Component** inserts a surface-mounted component on the surface of a section of the duct.

Perform partial calculations - You can use the **Flow Calculator** to estimate the flow rate, air velocity, pressure loss, and duct sizes on duct straight sections. You can access the **Flow Calculator** by clicking **Tools > Flow Calculator** in the HVAC environment. It is important to note that this calculator is not an analysis program. The calculations are based on straight sections with no loss coefficients available for fittings and use the Equal Friction Design Method.

The HVAC tasks help you to create HVAC objects and edit their properties. When you select an object, such as a feature or a duct run, the software displays the appropriate ribbon with commands that allow you to edit that object. For example, if you select a duct run for modification, the software provides access to commands to change the parent system, the run name, the specification assigned to that run, and properties such as duct thickness.