L i t i o 2.0

User's guide
to Version 2.0

Description

What Litio 2.0 is and does.

Litio 2.0 is a sheet metal program that calculates flat sheet development of ducts, Rectangle to round transitions, Cylinders, Cones, pipe intersections, connections, bifurcations, elbows, etc. It is easy to use. To be used for HVAC, hoppers, cyclones, dust extraction, ducts, conveying systems, silos, piping, etc.

Fast to download. Great compatibility (for AutoCAD R 200X and Mechanical Desktop 200X, being at present 2000 to 2009. It would work although you upgrade your AutoCAD version to a later one, depending on AutoDESK compatibility policy). High performance characteristics: High performance/cost ratio.

Litio [Eng.: Lithium] is the lightest (easiest) metal. Thus, with the name LITIO we mean a light, easy to use sheet metal program for AutoCAD.

What is new in v.2.0?

New version 2.0 of Litio 3D sheet metal has much more patterns, more configuration options and some very advanced features, unique to sheet metal programs of the category, and also to some high-priced sheet metal programs.

Some of these new features are:

- Thickness: 3D objects are now drawn showing thickness. (You are able to see what kind of bevel preparation you will have to weld 3D objects together).
- New patterns: oblique transitions; trifurcations; helixes; "S" pieces; conical bends; bends with various cross sections; more branch patterns; intersecting patterns*; free transitions*; etc.
- You can select in/mid/out dimensions on both ends of transformations independently.
- You can trim (intersect) two 3D objects to get, for example, a conical branch on a square to round transition (or any other combination).*
- You can select in/mid/out contact on bend or bifurcation pieces.
- New 3D developable ruled surfaces generator engine (you can create your own transitions, just by clicking on any two entities located in AutoCAD's 3D space, and which define both ends of the transition).*
- New 3D to 2D unfolder engine (you can even unfold your own 3D meshes [N=2], just by clicking on them).
- Easier way to cut 3D objects with a plane.* You also get the intersection polyline, for example, to make a cover of a tank, which was cut on an x° plane.
- Enhanced error and dialogue messages (no more messages like: "Not valid length X1."; now these messages give you much more information).
- Dialogues and error and dialogue messages in different languages (availability of certain languages. It will be increased in the future.).
- Allowance for grooved seams (for thin metal sheet) is made automatically.
- Dimensions that can be either positive or negative, have a "+" symbol drawn in dialogue image to show positive direction (E.g., dt X).
- 2D profiles, both pre-set (dialogue) profiles or free profiles (picking a 2D polyline).

* Some restrictions apply [see more in this user manual].

Hardware & Software Requirements

What you need to run Litio 2.0.

The program runs within AutoCAD (AutoCAD R 200X and/or Mechanical desktop 200X; R2000 or later). It does not work in AutoCAD LT. No need of DFX conversions. Make your developments directly in AutoCAD.

It requires:

- AutoCAD R 200X and/or Mechanical desktop 200X; R 2000 or later (at the moment this guide was issued R2000 to R2009).
- Same hardware requirements as to run AutoCAD (if you can run AutoCAD successfully, you can run the program); and
- At least 2 Mbytes available in your hard disk.

Standards

The standards LITIO uses to calculate unfolded lengths.

The unfolded length of the sheet is calculated according to German standard DIN 6935.

DIN 6935: Cold Bending of Flat Rolled Steel Products

DIN 6935 Beiblatt 1: Cold Bending of Flat Rolled Steel Products; Factors for Compensating Value v for Calculating the Flat Length

DIN 6935 Beiblatt 2: Cold bending of flat steel products; calculated compensating values

Remarks

Important facts you should know.

The information herein may be modified without previous warning.

We reserve the right to review and to improve the Program and this publication. This publication might not describe the state of the Program at the moment of its publication, and may not reflect the state of the Program in the future.

All registered trademarks are property of their owners.

See page 5 to see agreement highlights and page 33 to see the agreement.

Visit LITIO web page at:

www.litio3d.com.ar

e-mail:

litio@litio3d.com.ar

litio3d@yahoo.com.ar

Visit LITIO web page for updated contact info.

Agreement Highlights

There are some conditions you shall agree to. Downloading of DEMO is deemed as your acceptance of all terms and conditions of the user agreement (see complete text on page 33) as follows:

- You shall agree to all terms.
- This program is copyrighted. You shall not sell, lend, forward, modify, etc. the program.
- Trial is limited to a 60-day term. After that you shall erase all files of the program from your computer, or purchase a license(s).
- We can modify the program or the information without notice.
- The program is provided AS IS and you use it at your own risk.

Program limitations for unregistered users

Evaluation version [Demo] of LITIO 2.0 has the following limitations:

- DEMO is limited to OFFSET [dtX or dtY] input = 0.0 . If any of them is different to zero, LITIO 2 will draw virtual objects.
- There are also some patterns that are not available in DEMO. LITIO 2 will draw virtual objects [DEMO displays a message in this case].

Note: These virtual objects are not part of the drawing, and will disappear after a ZOOM, REGEN, REDRAW, PAN, etc.

Note: In the case these virtual objects are drawn, bending radiuses and/or angles are omitted.

Registration [license purchase]

Please visit our web pages for price, updated registration information, multiple-user pricing, and discounts for v.1.x users.

Installation

The program could not run or not run properly if one or more of the following files are missing:

- litio2.slb
- litio2.dcl
- litio2.vlx
- litio2.cfg

The program is installed by placing all these files in the "support" directory of AutoCAD.

Warning: Do not place the .zip file in the support folder; unzip it. Do not place the files in a folder in the support folder, but directly in the support folder.

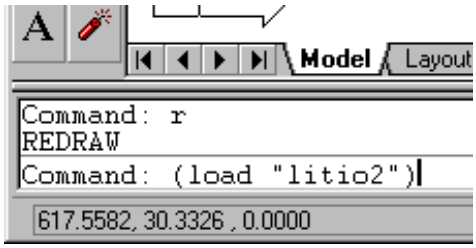
Use

First you need to load the program in the current drawing session. After loading you need to call it.

The program is loaded by typing the following in AutoCAD's command prompt:

(load "LITIO2")↵

(The parentheses and the quotation marks shall be included; the symbol "↵" of the crooked arrow means the "ENTER" key).



To start the program type:

LITIO2↵

Refer to page 32 to load the program using the APPLOAD command.

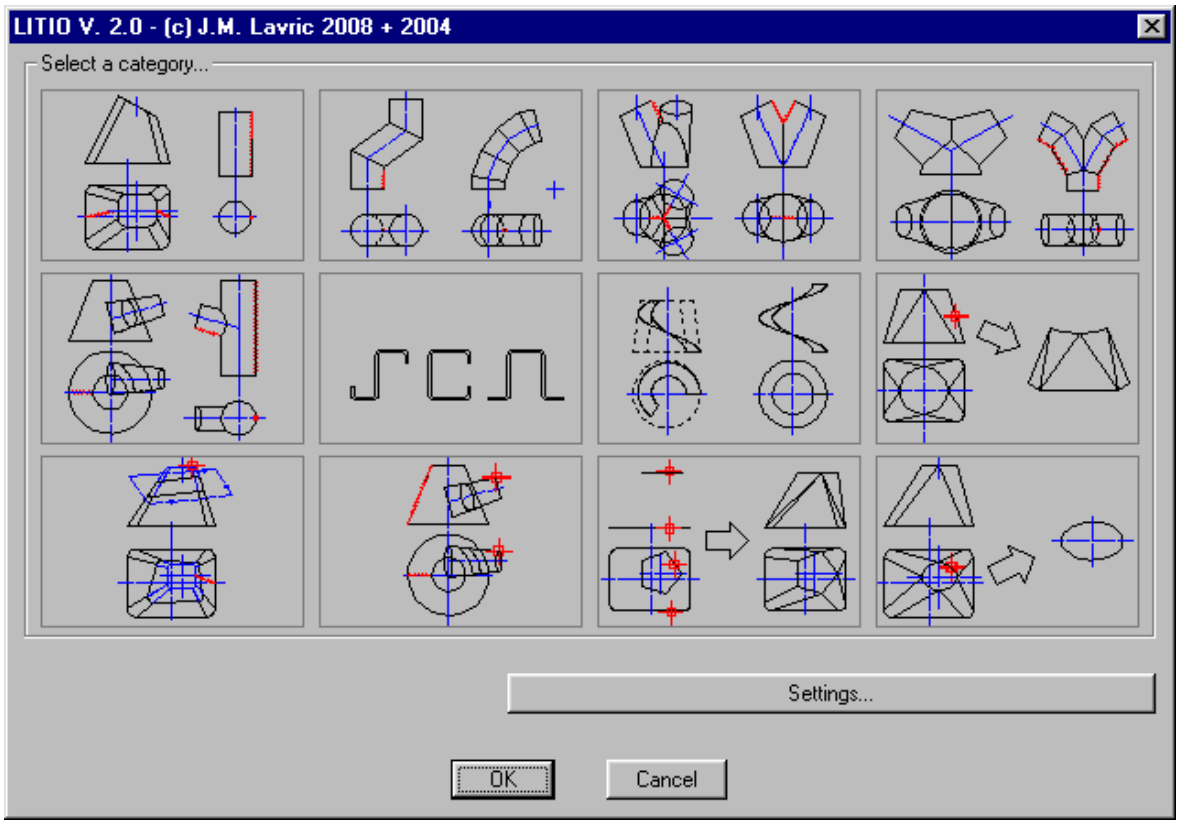
Note: Litio v.1.x and Litio v.2.0 can be placed in the same machine, installed in the same AutoCAD version, and even loaded and run in the same drawing session, without any interference among them.

Dialogue boxes

Greeting box

Registered users: Such greeting box (saying you have purchased a registered, full working version) appears only once per each drawing session, at the first run.

Category selection



This first dialogue directs the program to a pattern selection dialogue, to a pattern dialogue, or directly to an action. It shows the following options:

[1] Transitions (see page 22).

[2] Bends and spheres (see page 24).

[3] Bifurcations [and trifurcations] without a base piece (see page 26).

[4] Bifurcations with a base piece (see page 27).

[5] Branches and intersecting 3D objects (see page 28).

[6] 2D profiles (see page 29 and page 21).

[7] Helical augers and Helixes (see page 30).

[8] Existing 3D objects unfolder (see page 21).

[9] Existing 3D objects plane trimmer (see page 20).

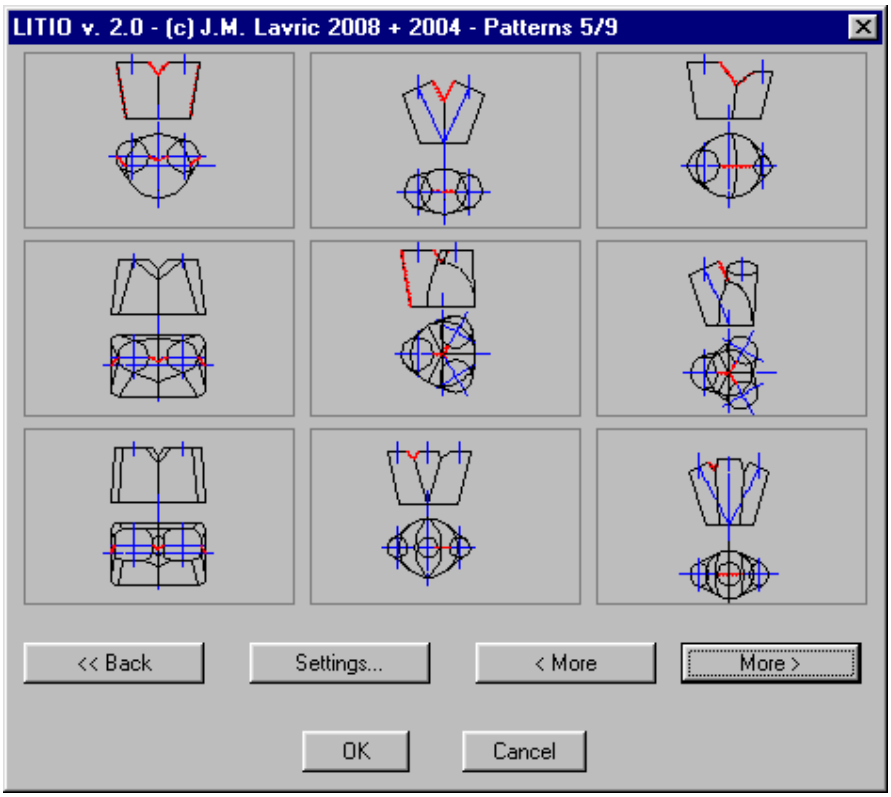
[10] Existing 3D objects intersection trimmer (see page 20).

[11] 3D developable ruled surfaces generator [free transitions] (see page 18).

[12] Curve [polyline] extraction from existing 3D objects (see page 21).

The "Settings..." button directs the program to the Settings (configuration) dialogue (see page 10).

Pattern selection

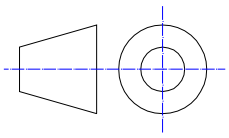


Here you select the pattern you want to generate and unfold. Pressing the "More >" or "< More" button more patterns are shown, and even other categories' patterns are shown.

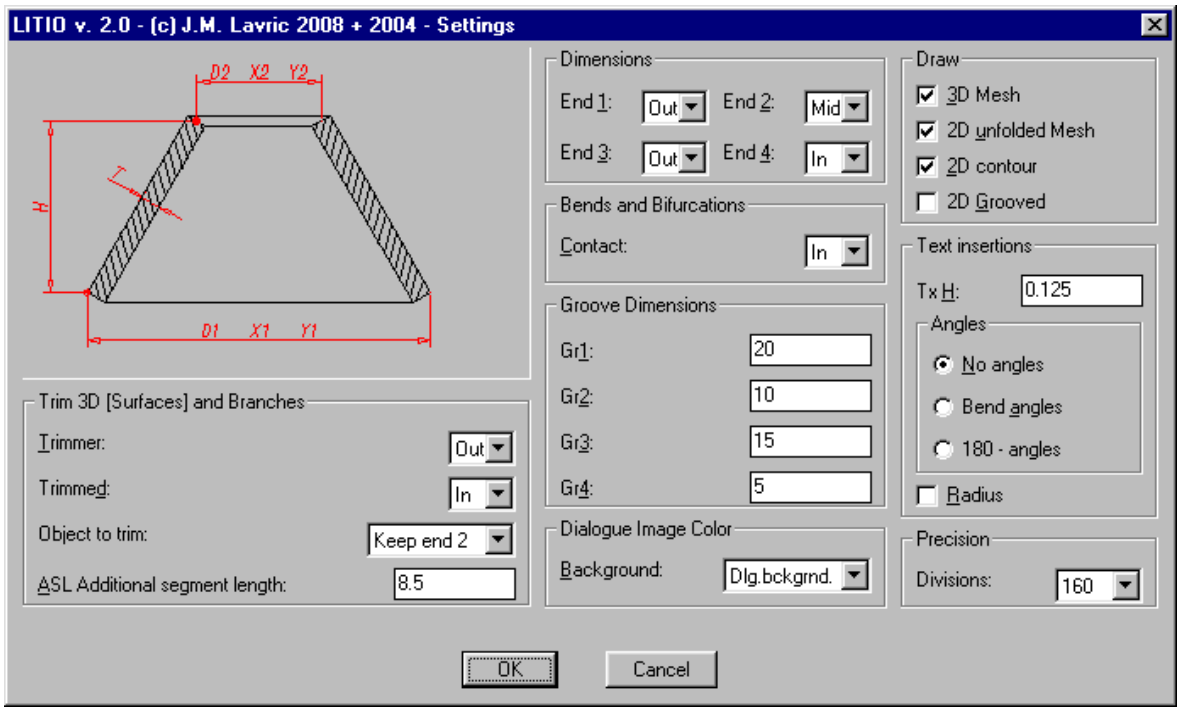
"<< Back" button goes back to category selection dialogue.

If you press the "Settings..." button, you leave this dialogue to go to the Settings dialogue.

Note: All dialogue images are in ISO-E projection.



Settings



Trim 3D [Surfaces] and Branches

Trimmer: You can choose either the out/mid/in surface of the trimmer object (either of a dialogue or an existing 3D object picked) as the trimmer surface. This is important for bevel preparation for welding. Note that, if plane trim is performed, this control is not used, since the cutting (trimming) plane has a Thickness = 0.0.

Trimmed: You can choose either the out/mid/in surface of the object to be trimmed (either of a dialogue or an existing 3D object picked) as the trimmed surface. This is important for bevel preparation for welding. This control is also used if plane trim is performed.

Object to trim: You can chose to keep end 1 or Keep end 2 (as defined in the dialogue in which the object was created; if an object was generated by picking two 3D objects, end 1 is the end of the first object picked...).

ASL Additional segment length: For and 3D object trimmed by another 3D object (either in dialogue or by picking them). Here the program ads some additional generatrixes, for the plane faces of the 3D object to be trimmed, to enhance accuracy

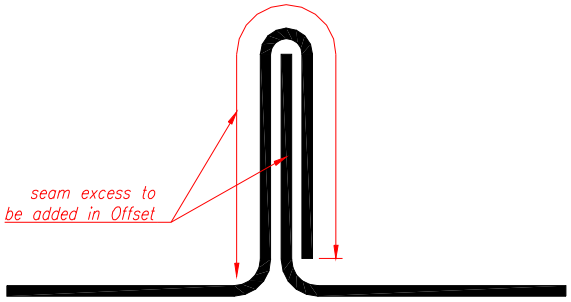
Dimensions:

You can select to use either inside, outside, or mid cross sectional dimensions, independently for ends 1, 2, 3 and/or 4. “1” applies to pipes; lower end of dialogue transitions; or first picked entity. “2” applies to upper end of dialogue transitions; or second picked entity. “3” applies to branch pipes. "4" is used for second end of a cone to be trimmed by another cone (or cylinder if D1=D2). This side is generally trimmed off.

Bends and Bifurcations

Contact: For bends and bifurcations, you can select if the parts have contact on the in/mid/out surface. This is important for bevel preparation for welding.

Groove measures: Seams can be welded or folded, depending on the sheet thickness. You can input, if they are relevant, dimensions for grove preparation allowance. This is particularly useful for very thin sheet metal tubing. (See next figure).



Dialogue Image Color: Depending on your screen background color, dialogue images are better or worse seen. Here you can select a dialogue background color to enhance dialogue image visualization, without changing your favorite screen background color.

Draw: Ticking the proper option you can select to draw or not the original 3D surface, and the unfolded sheet. The unfolded sheet can be drawn as a mesh (to help you when bending the sheet), as 2D contour (to ease cutting), or as a 2D contour with grooved seems allowance.

Note: Not all of these settings are due for all of the patterns. You may be asked for an insertion point and, if the option is unticked, it may not be drawn. And also, even though an option is unticked, it may be drawn anyway.

Text insertions: New version 2.0 helps you bending or forming your patterns. You can have, on each generatrix of the 2D mesh representation, the angle to bend that generatrix (or the 180°-angle), or the approximate bending radius for each space between generatrixes, on both ends.

Precision: You can also select the precision of the calculation of the developments. Note that the higher the precision, the slower the process, and the more powerful your computer should be. Too small precision numbers can lead to poor quality developments and to lack of accuracy. It also depends on the kinds, sizes and thickness of your patterns. We consider that a value of 128 is enough for most standard applications.

If you finish the dialogue by pressing "Cancel", none of the selected settings will become effective.

But if you finish the dialogue by pressing "OK", the selected settings will become effective for all the following patterns and they will be saved in the configuration file.

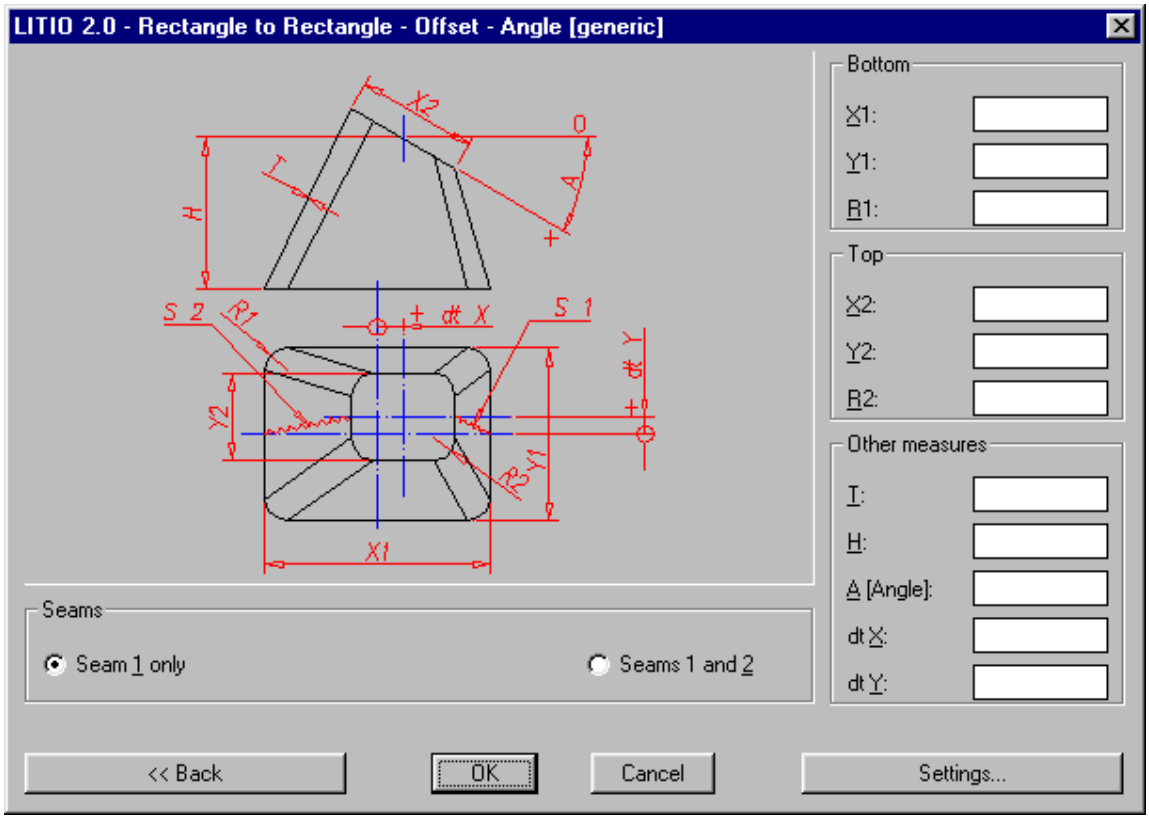
Metric Units/Imperial units: the program automatically sets the units according to the units used in the current drawing session (according to the values of MEASUREMENT and LUNITS system variables). (Refer to your AutoCAD user manual for further information on Metric and Imperial units, and on the use of MEASUREMENT and LUNITS system variables).

Parameters: Input boxes

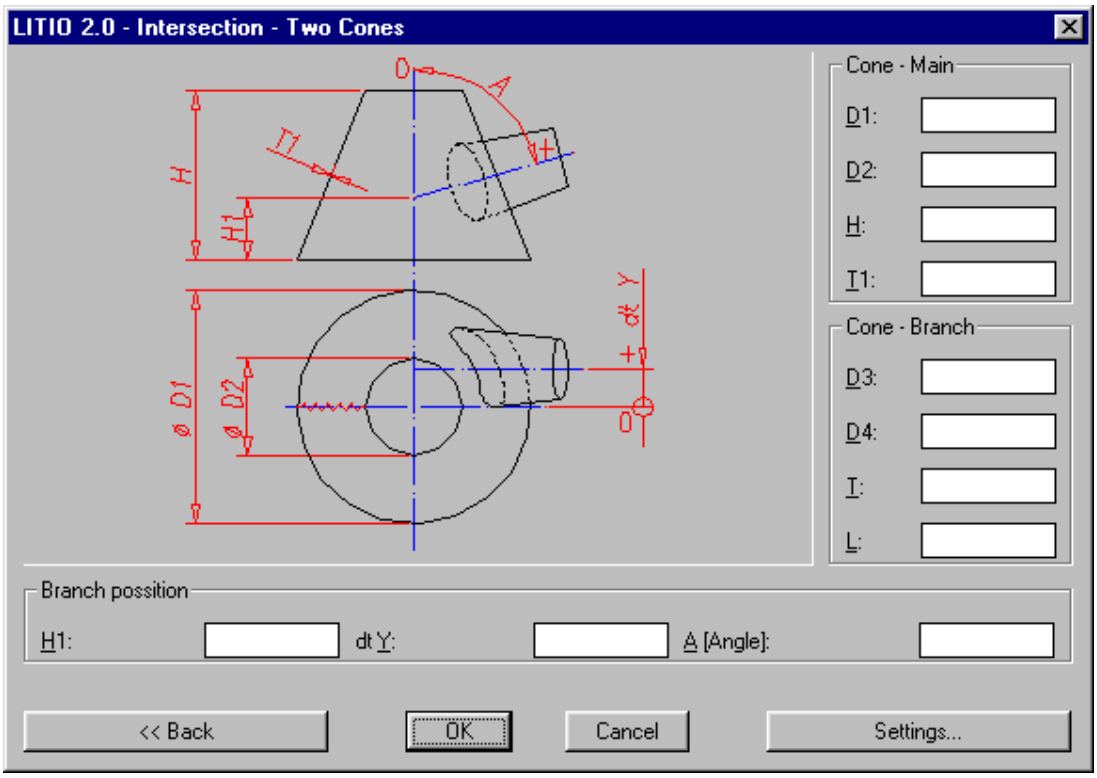
Note: A detailed explanation of all the possible dialogues is deemed not necessary. Some typical patterns are used as general examples.

See page 20 for a complete list of patterns.

Dialogue: Transition – Rectangle to rectangle – Offset - Oblique



Dialogue: Intersection - Cone with cone



Input boxes

T, T1: Input the value of the sheet metal thickness. It must be a positive value (greater than zero).

H, H1, H2: Input the value of the pattern height, or of the intersection.

D, D1, D2, D3, D4: The diameter of a circular end.

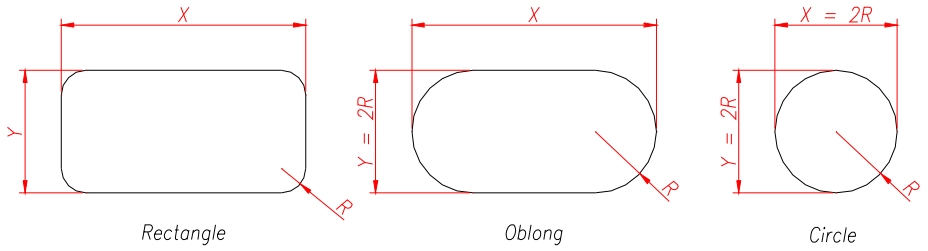
Tip: Some patterns accept circular figures on a rectangular input: If that is the case, input the value of the diameter in X and Y boxes and d/2 in the R box.

L, L1: The length of a pipe branch.

X and Y (X1, X2, X3; Y1, Y2, Y3): Length and width of rectangular end.

R (R1, R2, R3): Radius of rounded (filleted) rectangular end. It can be the radius of a bend.

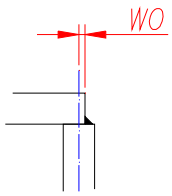
Tip: You can also have and oblong end, if you make R = X/2 or R = Y/2. If X/2 = R and Y/2 = R you have a circle.



dt X, dt Y: It refers to the offset of the upper end, relative to the lower end; or of a duct relative to the base of a cone. In this case, the centre of the upper end is at a point located at (dt x; dt y; height) relative to the lower end centre, which is at (0.0, 0.0, 0.0); or the relative position of the centre of the branch pipe end, intersecting a cone, to the base centre of that cone.

A, A1: An angular measure in degrees. It can be the angle between two intersecting pipes (either circular, conical, or of rectangular cross section). Or it can be the rotation angle of the cross sectional axis of a pipe, relative to the horizontal.

WO [weld offset]: Only for rectangular duct bend. WO = 0 means that the end of the side sheet coincides with the centre line of the thickness of the bent sheet. The figure below shows a positive WO value.

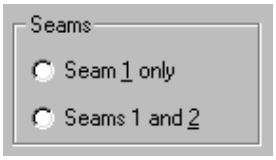


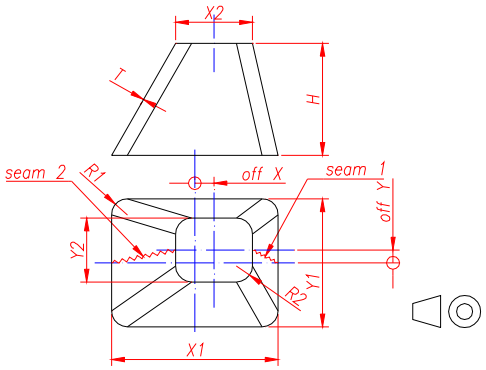
n [parts]: For duct bends of any cross section, n is the number of whole parts, in which the bend is divided (excluding the 2 halves at the ends). For conical bends, it is the amount of parts in which the bend is divided. For polygon cylinders, it is the number of sides of the polygon.

CG [cutting gap]: Only for round duct bends. CG is the distance between two consecutive parts of the bend, to allow cutting without interference. It will be equal or greater than Zero.

Other inputs:

Seam 1 only/Seams 1 and 2/Seams 1, 2 and 3: The patterns, for which this option is available, can be drawn in one piece, in two parts, or in four parts.





Existing pipe: For round pipe bends, offset pipes, branches and bifurcations. If you tick this option, the entity drawn is not a development to cut sheet metal, but a template (for example to be made of paper or a very thin sheet of metal) to wrap around an existing pipe, to mark and cut it.

After finishing the input of parameters, the program makes a first verification, to check that the input would not lead to a 3D object without interferences or geometrical incongruencies. If any of these parameters is not correct, the program asks the user to modify it.

Note: Version 2.0 is much more flexible with input parameters than v.1.3.

When this first verification (which is only preliminary and approximate) is finished, the program performs mathematical calculations, which lead to the 3D entity and the respective development.

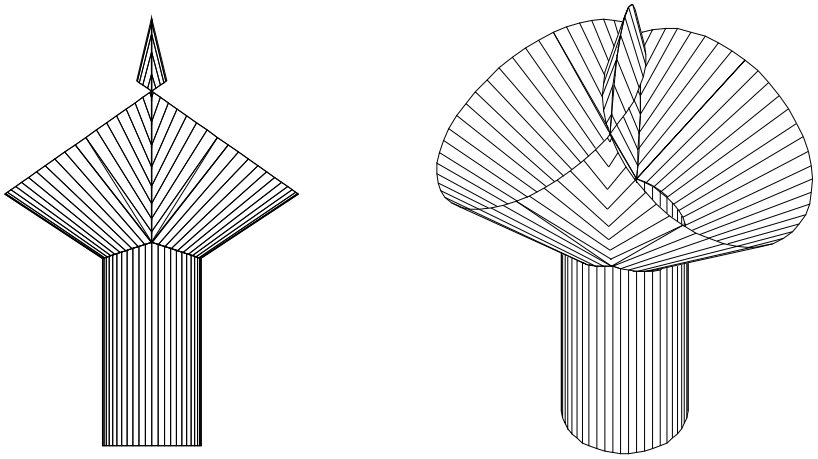
The unfolded sheet can be drawn as a mesh (to help you when bending the sheet), as 2D contour (to ease cutting), or both.

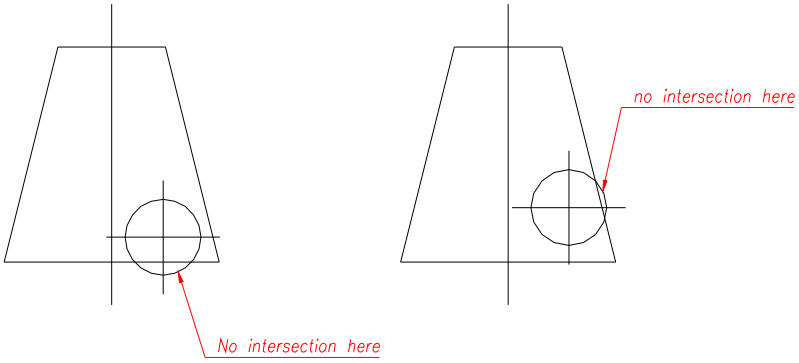
Afterwards, you can use the 2D developments for CAM cutting (plasma, laser, etc.) or manual cutting, by plotting them 1 to 1 (1 d.u. = 1 mm or 1 d.u. = 1 inch), and using them to mark sheet and cut.

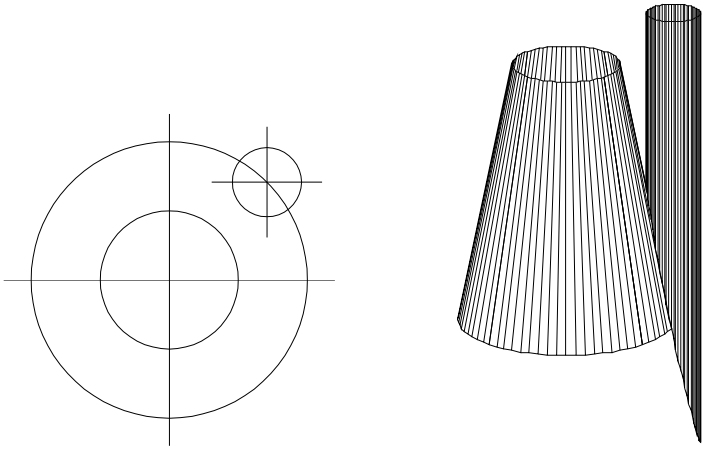
Note: The 3D entity version 2.0 draws, is an entity with thickness. All dimensions are according the input parameters.

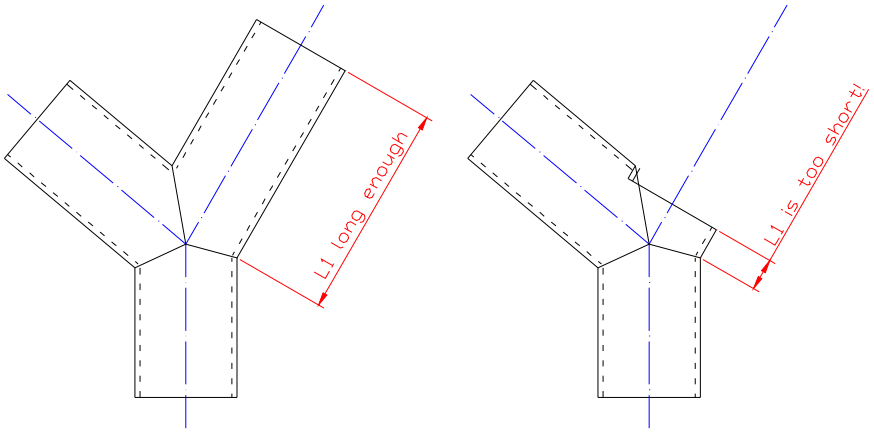
During the development calculation, the program may realize that the pattern is geometrically impossible, that is, that the pattern cannot actually be made. In that case the program warns the user about this.

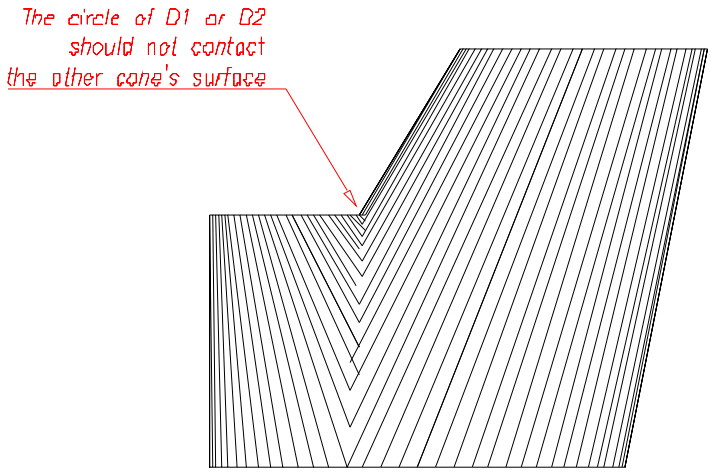
See Figures below for patterns that are geometrically impossible.



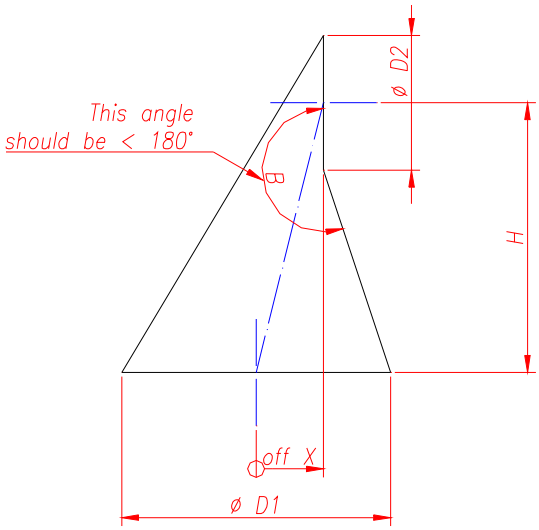

no intersection here
No intersection here




L1 long enough
L1 is too short!



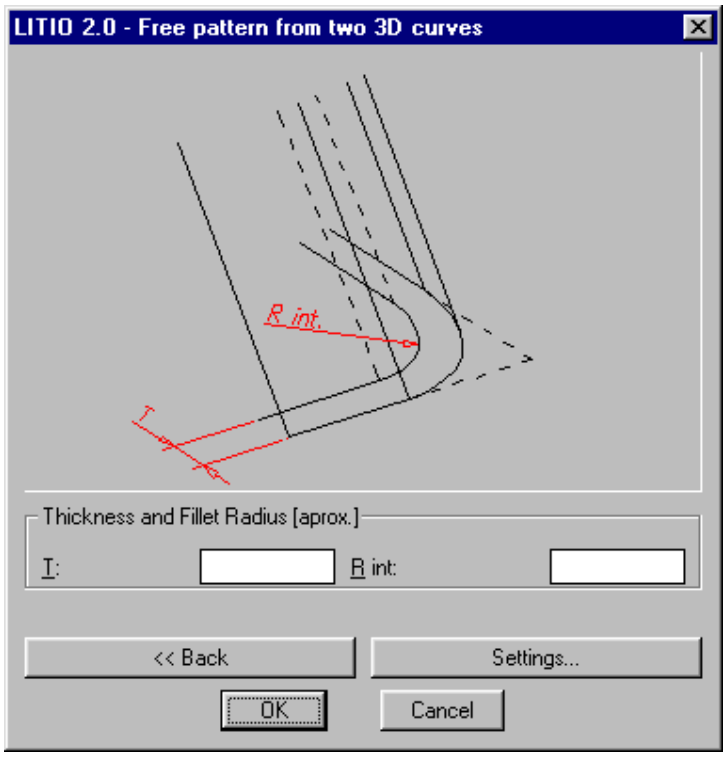
Round to Round Bifurcation – Non symmetrical



Offset Cone - Unparallel

Rectangle to Round – Offset - Unparallel

Free pattern from two 3D curves

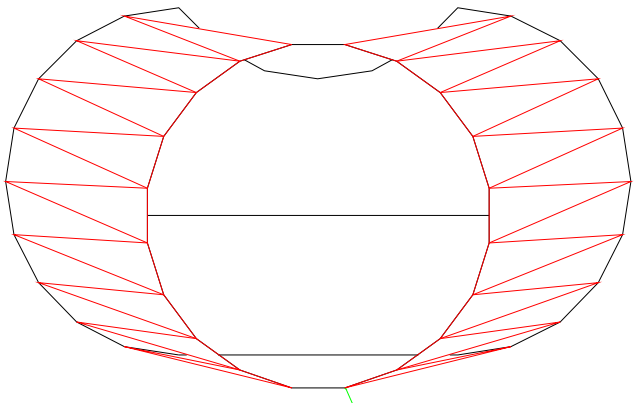


New v.2.0 has a new feature, a 3D developable ruled surfaces generator engine. You can create a transition just by clicking on two entities (3D meshes created by Litio 2.0; 2D and 3D polylines; or circles) located in AutoCAD's 3D space. These two entities being the ends of the transition.

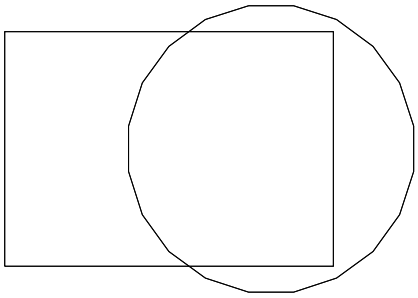
Note: The following entities are not accepted: arcs [convert arcs to polylines using the PEDIT command] nor ellipses [use ellipse pattern of LITIO 2.0].

Some restrictions apply:

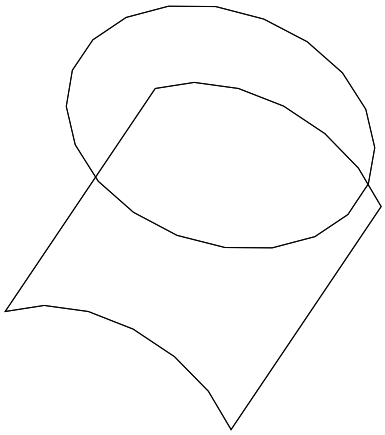
- Resulting object cannot have a concavity. See figure.



Curve has a concavity.



It seems OK in plane view.

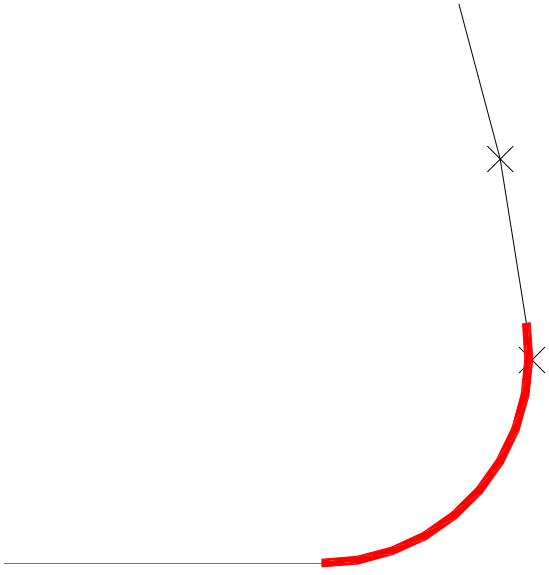


But looking well it shows a concavity.

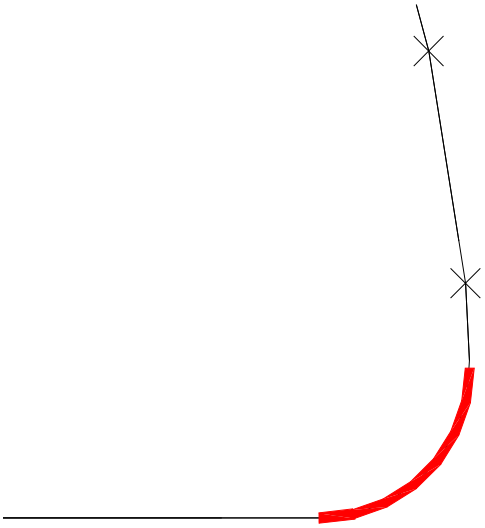
Warning: If a picked object has too many points (was created with a high precision number, or it was the result of a 3D trim, the new 3D object might not be able to be generated).

After selecting both entities, point extraction is performed. The program converts the arc segments in a set of points of linear segments, according to the selected precision number. The program then fillets all sharp angles. You are asked for the inner fillet radius and for the object thickness. Note that Dimension type selection applies also here (1: in/mid/out; 2: in/mid/out).

Warning: Object cannot be created either, if an arc segment has to be filleted, and there is interference (linear arc segment too short for fillet radius). If this happens, you should use a smaller fillet radius or a smaller precision number. Or have it fillet before.



Too many divisions or too big radius (fillet does not fit in last segment).



OK. Fillet radius fits well in last segment of curve.

Note: that the radius is not the actual bending radius, but a fillet radius.

3D trim with plane

Any 3D object (with thickness) generated by the program can be cut by a plane. First you are asked to click the object to be trimmed and then you are asked to pick three points, defining the cutting plane. Points shall not be coincident nor aligned.

Plane can cut all object generatrixes or one of both ends. The cutting plane shall not cut both ends. If so, the program exists with an error message.

You get the new 3D object (cut), its development and the cutting path (for example, to make a cover for a tank cut at an x° angle).

Note: Here the in/mid/out trimmed surface settings are due.

Warning: Do not mirror or 3D mirror 3D objects generated by Litio 2.0. Mirrored 3D objects will lead to erroneous developments if they are trimmed 3D with a plane or with other 3D object.

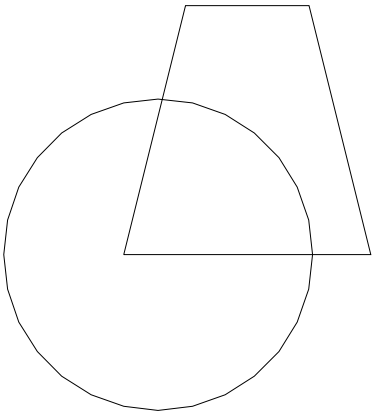
3D trim of 3d object with another 3D object

Note: This applies also to branch dialogues and intersection dialogues.

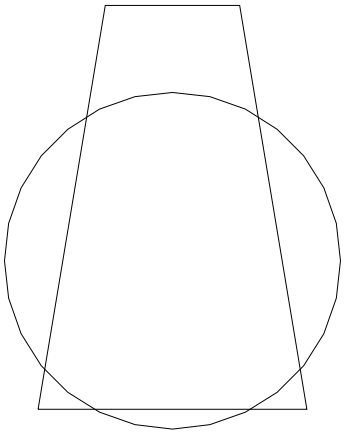
Any two 3D objects (with thickness) generated by the program can be cut by themselves. First you are asked to click the trimmer object and then you are asked to pick the trimmed object.

The following restrictions apply:

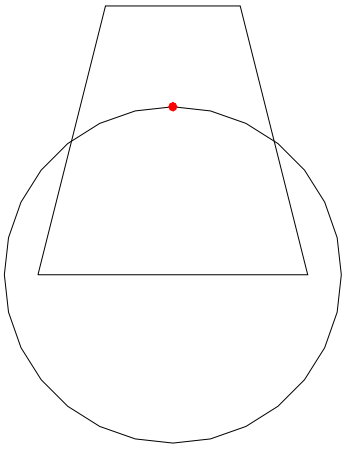
- Trimmer object shall completely intersect trimmed object (all generatrixes of the trimmed object shall be intersected by the trimmer).
- Trimmed object shall intersect trimmer only once.
- Trimmer object seam shall not be in the intersection.



BAD. Incomplete intersection.



BAD. Objects intersect twice.



BAD. Seam of trimmer is in intersection.

You get the Trimmer object development with the intersection hole, the new 3D object (cut), and its development.

Note: Here the in/mid/out trimmed and trimmer surface settings apply.

Warning: Do not mirror or 3D mirror 3D objects generated by Litio 2.0. Mirrored 3D objects will lead to erroneous developments if they are trimmed 3D with a plane or with other 3D object.

Free 2D profiles [2D profiles created from 2D polylines]

Some 2D profiles are provided with dialogue boxes (see page 29). But you can develop your own customized profiles with just some clicks!

With LITIO 2.0 you can just pick a 2D polyline, which defines the profile form [out/mid/in], to get your 2D profile in 3D space and its 2D development.

After having selected a 2D polyline, point extraction is performed. The program converts the arc segments in a set of points of linear segments, according to selected precision number. The program then fillets all sharp angles. You are asked for the inner fillet radius, the profile thickness and profile height.

Note: Dimension type selection applies also here (1: in/mid/out).

Warning: Since for some profiles it is not simple to define and out or in side, the following rule applies for ALL profiles: starting from first vertex, OUT side is defined as the one on the right of the polyline, and IN is on the left. For example, if your End 1 definition is set as OUT, the profile will be generated being the OUT side the selected polyline and the other [IN] on the left [starting from first vertex].

Warning: 2D profile cannot be created either, if the fillet radius does not fit in curve segmentation [in which case a smaller radius or less divisions should be used, or the polyline should be filleted before running the program] or the radius not big enough for Thickness.

Existing 3D objects unfolder

Just pick an object you have already created with LITIO (either v.1.x or 2.0) and LITIO 2.0 unfolds it for you. You can also pick 3D meshes (N=2) you have created (for example with RULESURF).

Warning: In the case of meshes created with RULESURF and in the case of 3D meshes created with Litio 1.x, the surface will be unfolded as if it has a Zero thickness (T=0).

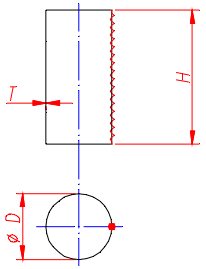
Warning: In general surfaces generated with RULESURF are not developable. Their development might not be actually possible. We recommend using the free transition generator engine (see page 18). See also FAQs page in our website for more information about non developable ruled surfaces.

Curve [polyline] extraction from existing 3D objects

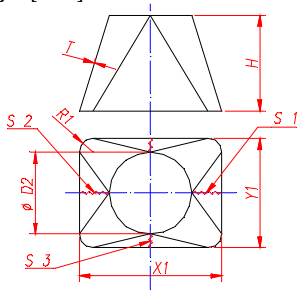
Just pick an object you have already created with LITIO 2.0 and you can get the 3D path (in the form of a 3D polyline) of any end (or intersection or contact path) for further use.

Patterns available

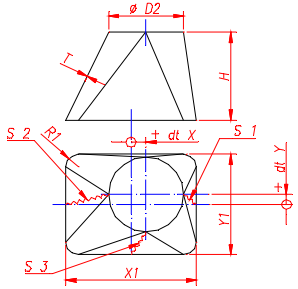
Round Cylinder



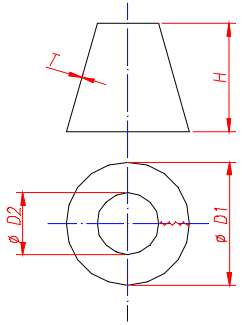
Rectangle [fillet] to round



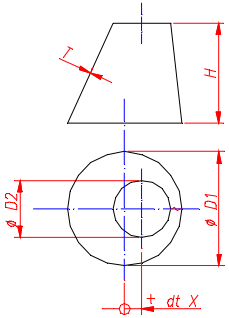
Rectangle [fillet] to round - Offset



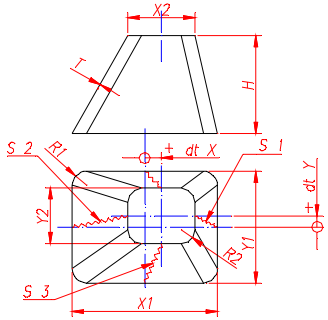
Cone



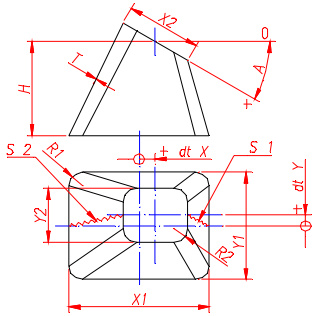
Offset Cone – Parallel



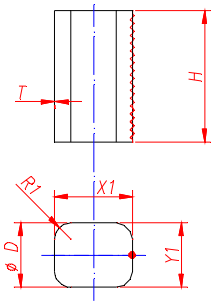
Rectangle to Rectangle - Offset - Parallel [generic]



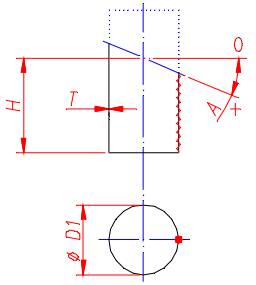
Rectangle to Rectangle - Offset - Angle [generic]



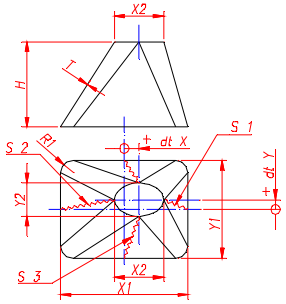
Cylinder - Fillet rectangle



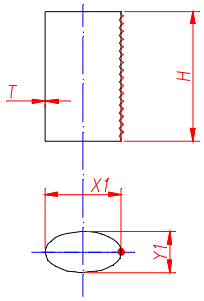
Round Cylinder - Cut once



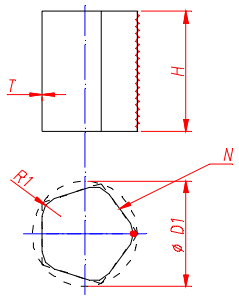
Rectangle [fillet] to Ellipse - Offset



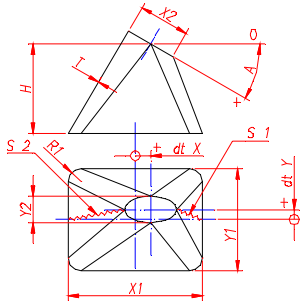
Cylinder – Ellipse



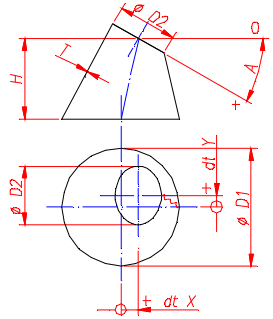
Cylinder – Polygon



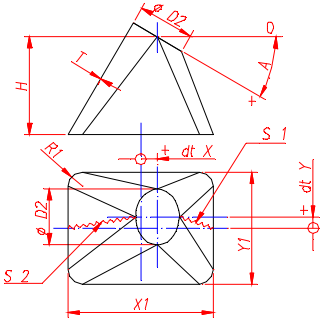
Rectangle [fillet] to Ellipse - Offset – Angle



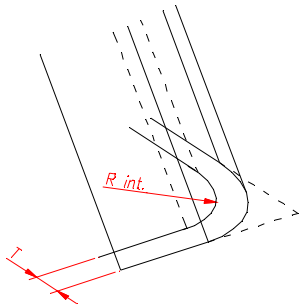
Offset Cone – Angle



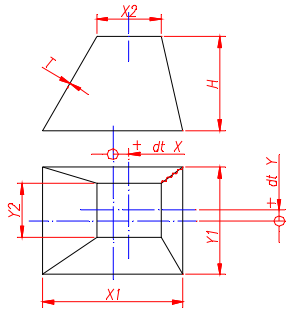
Rectangle [fillet] to round - Offset – Angle



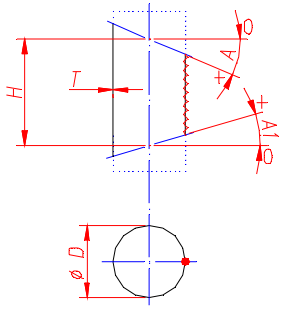
Free pattern from two 3D curves



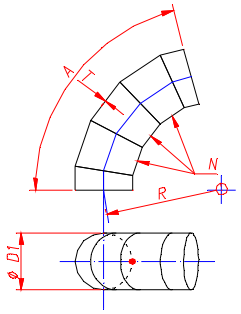
Rectangle to Rectangle - Offset [Hopper]



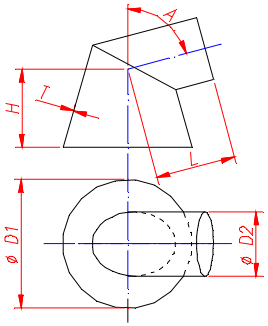
Round Cylinder - Cut twice



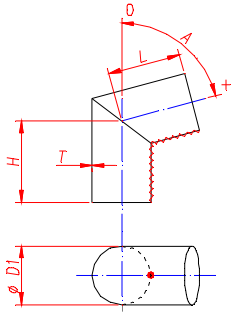
Bend - Round - N parts



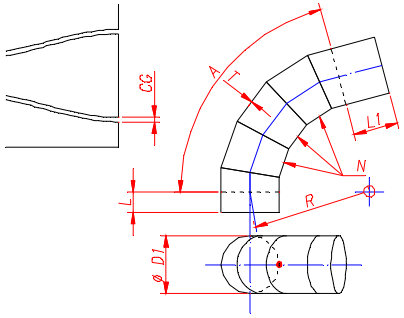
Cone to Cylinder Bend



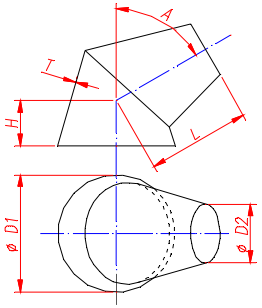
Bend - Circular Cylinder



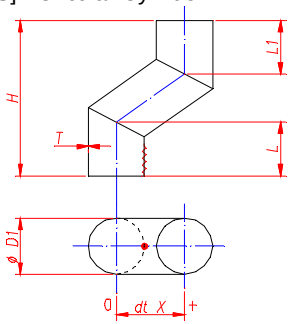
Bend - Round - N parts - Optimized



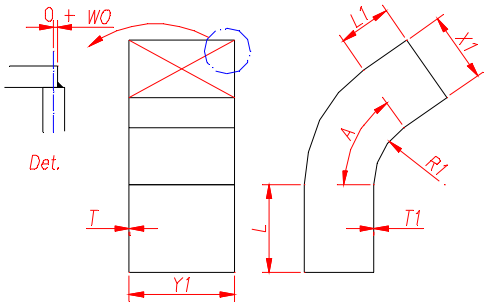
Cone to Cone Bend



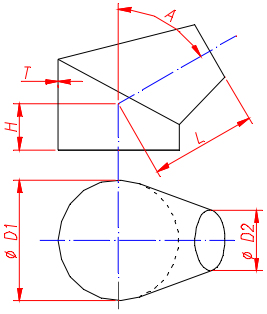
Offset Pipe [S] - Circular Cylinder



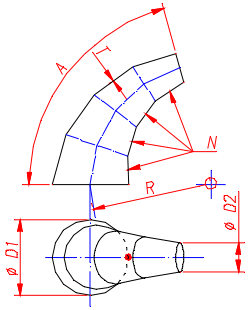
Rectangular duct – Bend



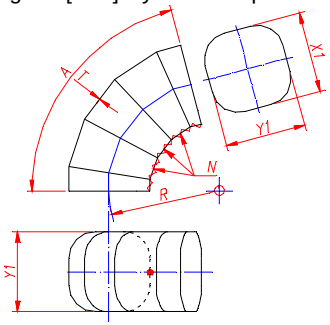
Cylinder to Cone Bend



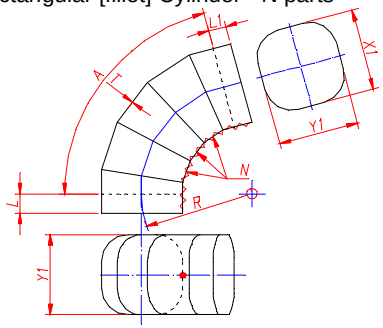
Bend - Conical - N parts



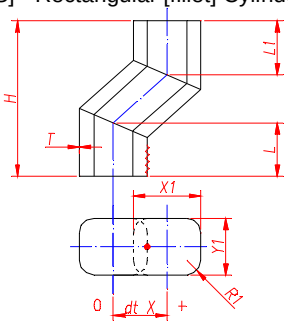
Bend - Rectangular [fillet] Cylinder - N parts



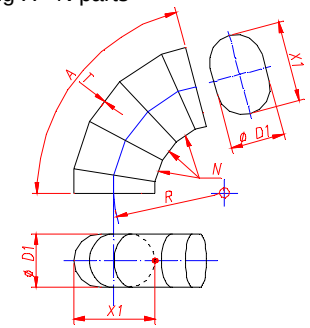
Bend - Rectangular [fillet] Cylinder - N parts



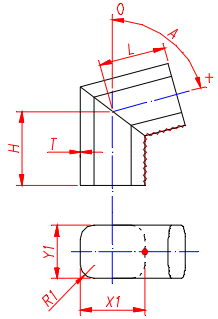
Offset Pipe [S] - Rectangular [fillet] Cylinder



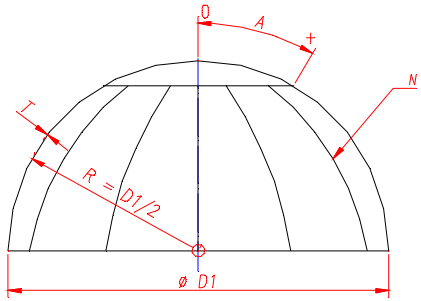
Bend - Oblong X - N parts



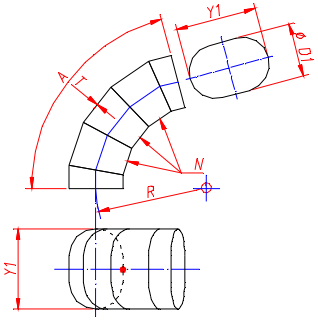
Bend - Rectangular [fillet] Cylinder



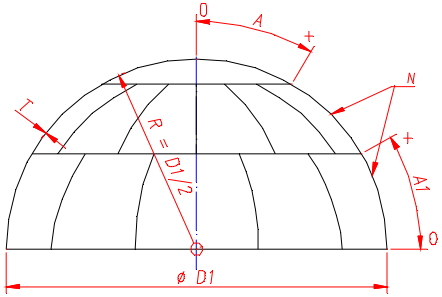
[Semi]Sphere - 1 row



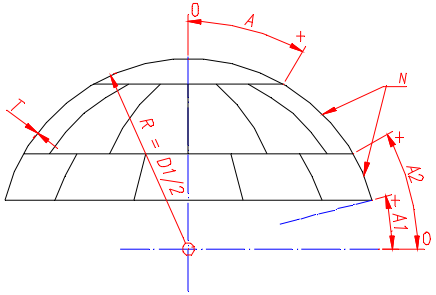
Bend - Oblong Y - N parts



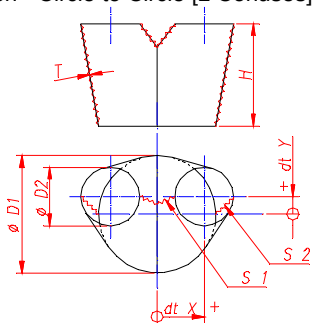
[Semi]Sphere - 2 rows



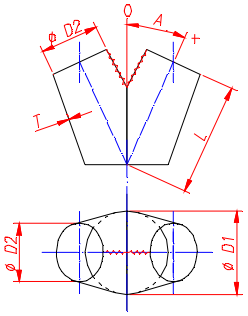
[Sector of] Sphere



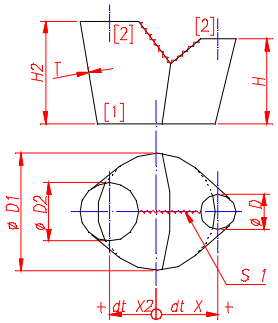
Bifurcation - Circle to Circle [2 Conuses]



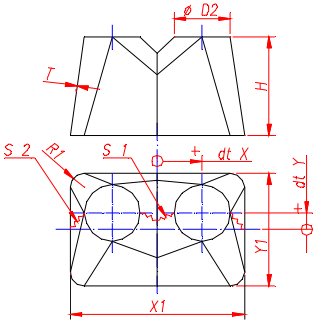
Bifurcation - Circle to Circle [2 Conuses] - Non parallel



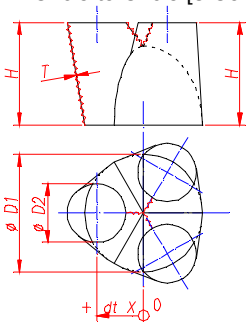
Bifurcation - Circle to Circle [3 Diameters] - Non symmetric



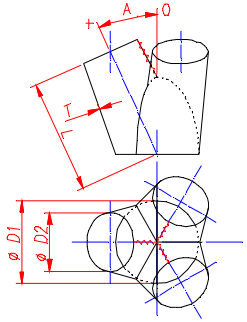
Bifurcation - Fillet Rectangle to Circle



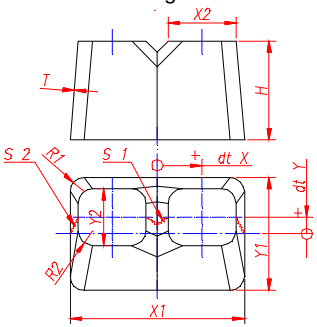
Trifurcation - Circle to Circle [3 Conuses]



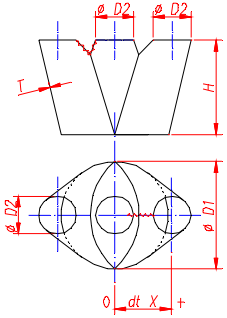
Trifurcation - Circle to Circle [3 Conuses] - Non parallel



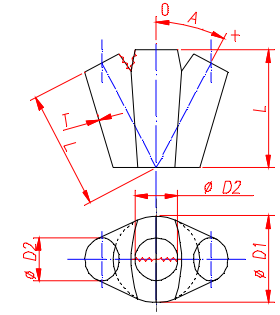
Bifurcation - Fillet Rectangle to Fillet Rectangle



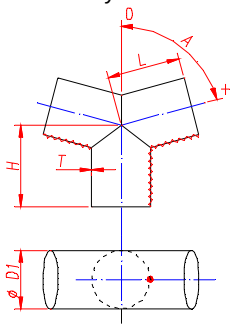
Trifurcation - Aligned - [3 Conuses]



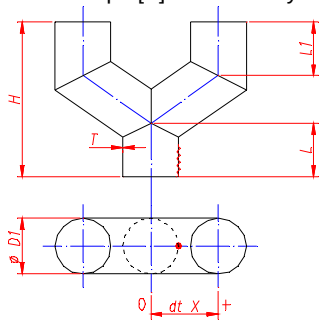
Trifurcation - Aligned - [3 Conuses] - Non parallel



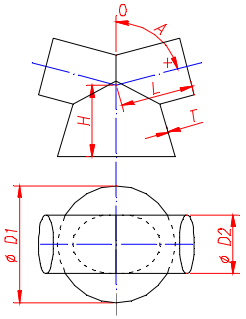
Bifurcation - Circular Cylinder



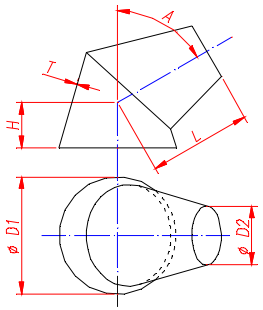
Bifurcation Offset Pipe [S] - Circular Cylinder



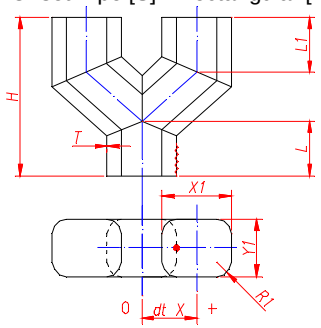
Cone to Cylinder Bifurcation



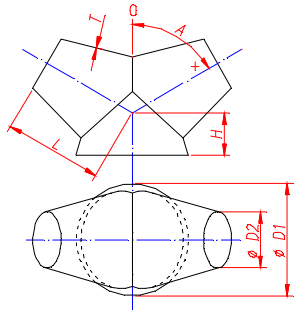
Bifurcation - Circular Cylinder - Non Symmetric



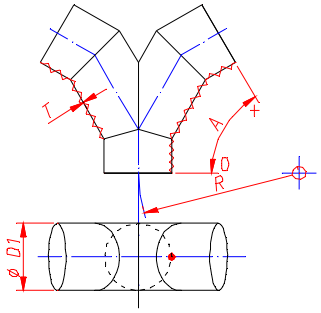
Bifurcation Offset Pipe [S] - Rectangular [fillet] Cylinder



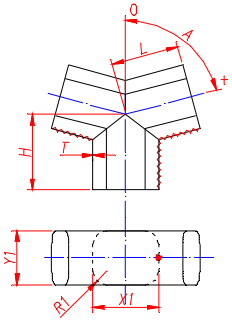
Cone to Cone Bifurcation



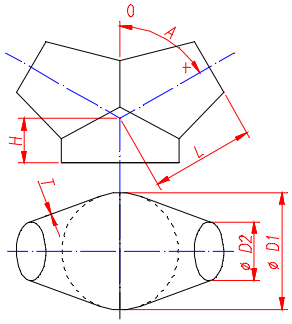
Bifurcation with intermediate part - Circle



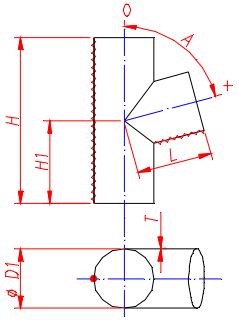
Bifurcation - Rectangular [fillet] Cylinder



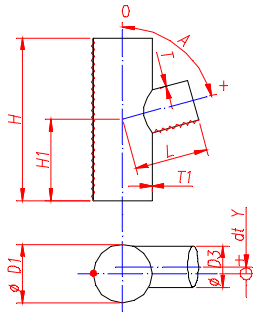
Cylinder to Cone Bifurcation



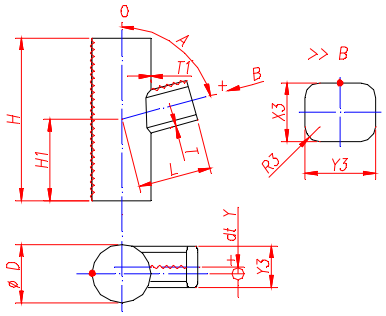
Branch - Cylinders [1 Diameter]



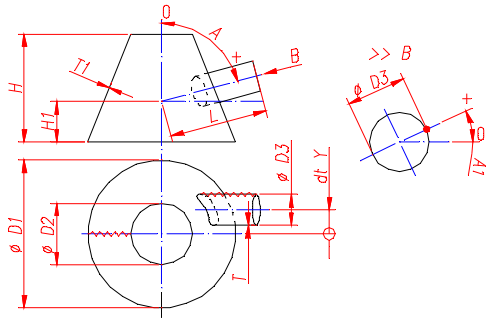
Branch - Cylinders [2 Diameters]



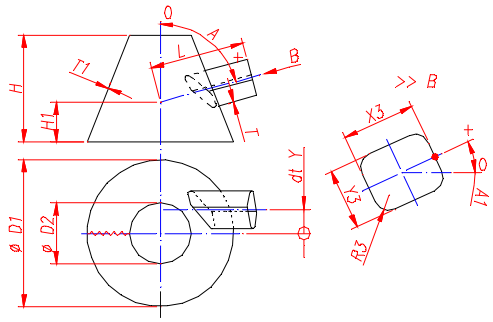
Branch - Cylinder + Rectangle [fillet]



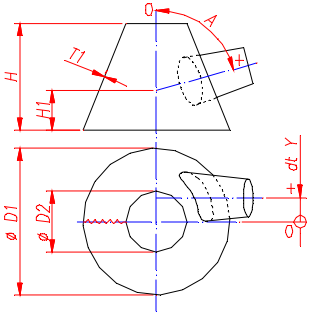
Intersection - Cone with round duct [angle]



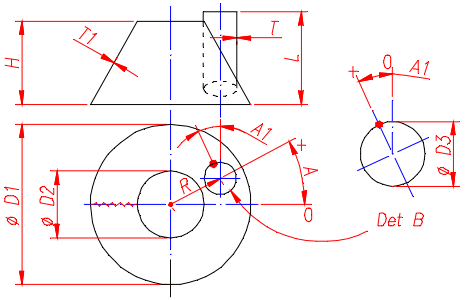
Intersection - Cone with rectangular duct [angle]



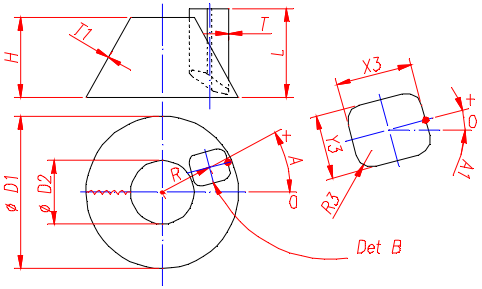
Intersection - Two Cones



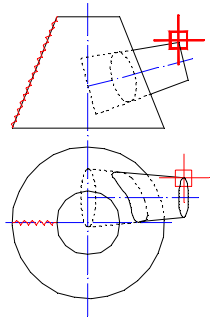
Intersection - Cone with round duct [vertical]



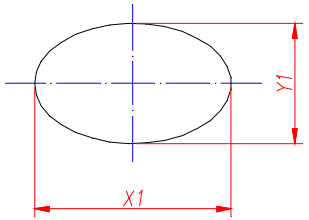
Intersection - Cone with rectangular duct [vertical]



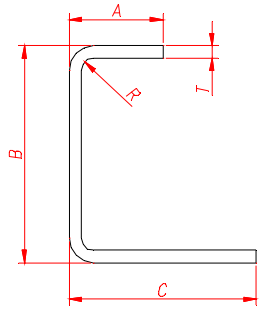
Existing 3D objects intersection trimmer



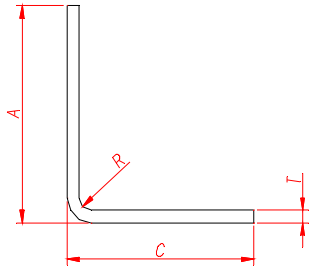
2D polyline – Ellipse



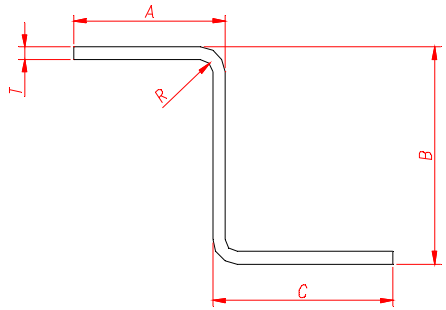
2D profiles – U



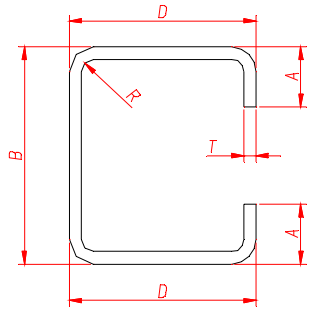
2D profiles – L



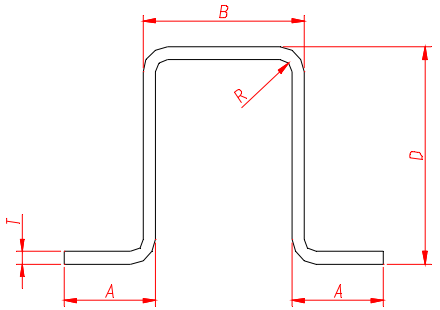
2D profiles – Z



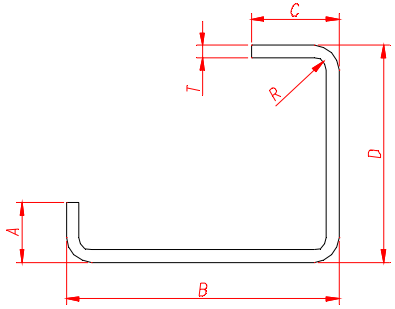
2D profiles – C



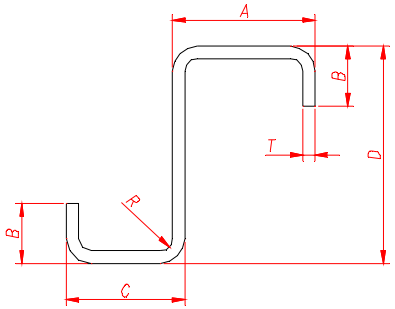
2D profiles – OMEGA



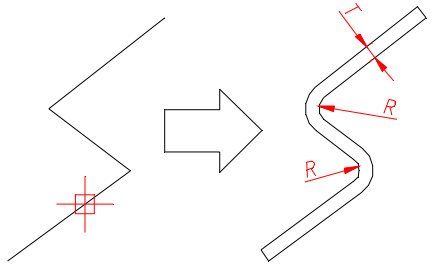
2D profiles – J



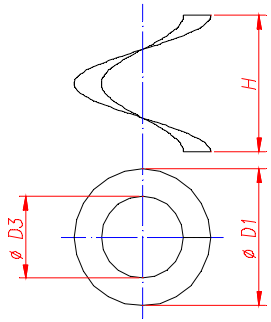
2D profiles – S



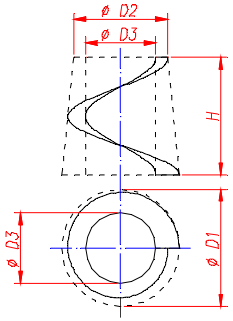
2D profiles - Free profile from 2D curve



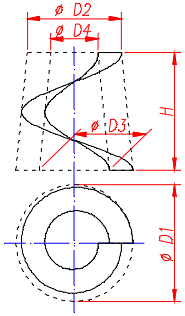
Helix - 360°



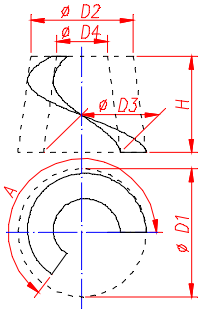
Helix - Conical - 360°



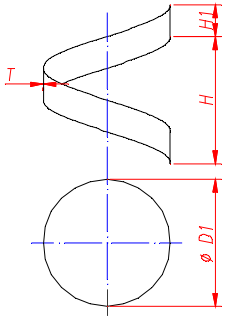
Helix - BiConical - 360°



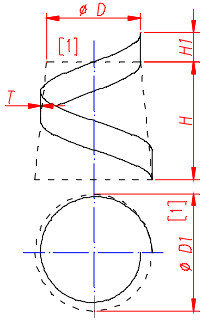
Helix - BiConical – Angle



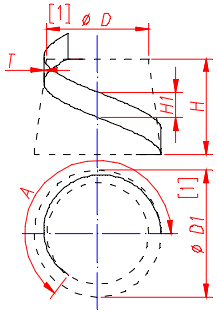
Helix Lateral - Cylinder - 360°



Helix Lateral - Conical - 360°



Helix Lateral - Conical – Angle



[reserved]

[reserved]

Entities drawn for each pattern

After parameter input, the program draws the 3D entity, the 2D unfolded mesh, a 2D contour of the unfolded mesh, and/or a 2D contour with groove seam allowance, and/or text insertions for angles and approximate radius of the unfolded mesh according to configuration settings.

Note: Not all settings are due to all of the patterns. You may be asked for an insertion point and, if the option is unticked, it may not be drawn. Also, although an option is unticked, it may be drawn anyway.

Exceptions:

Rectangle to Rectangle - Offset [Hopper]: No thickness.

Helix - 360°: No thickness.

Helix - Conical - 360°: No thickness.

Helix - Biconical - 360°: No thickness.

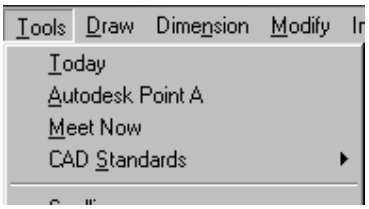
Helix - Biconical – Angle: No thickness.

Rectangular duct – Bend: No 3D.

Spheres and sectors of spheres: No 3D.

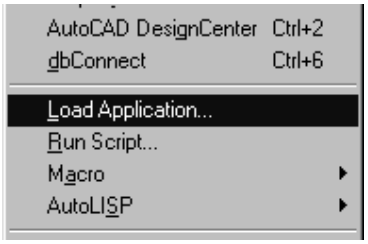
Appload

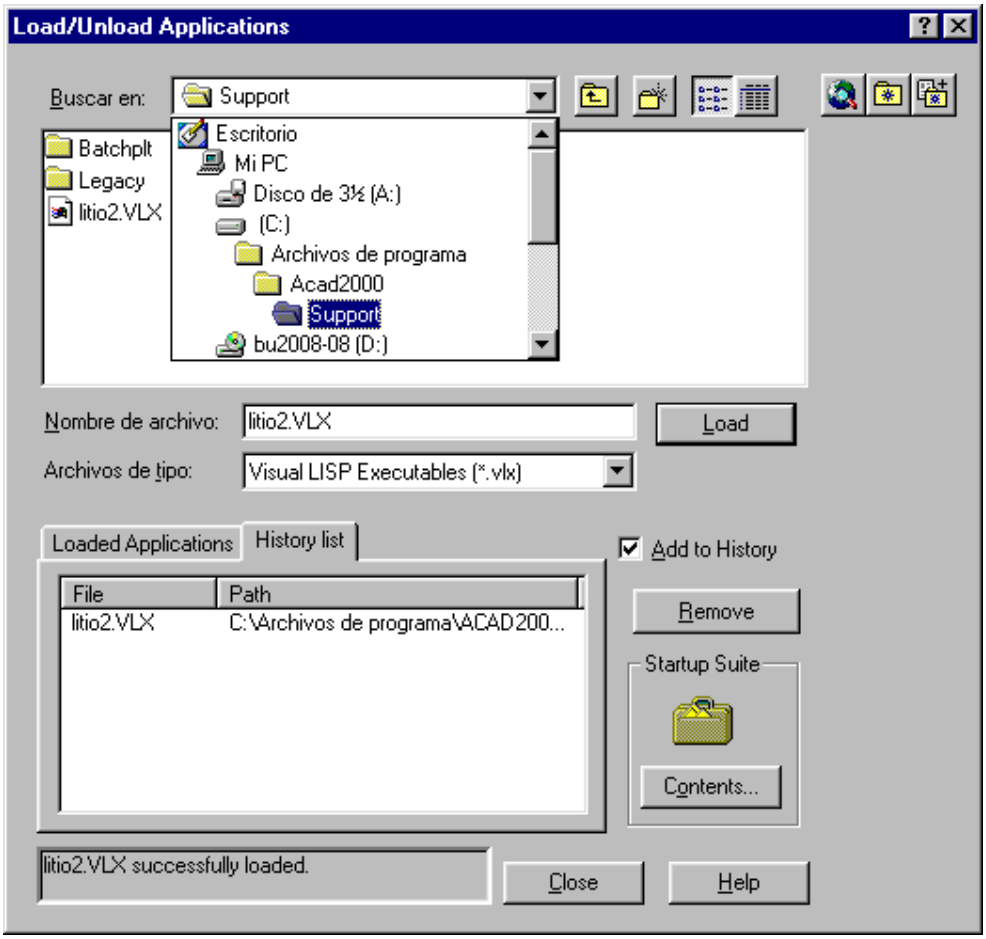
The program can also be loaded by using the APPLOAD command. Just select the *Tools*, *Load Application* menu.



Note: This menu may vary, depending on the AutoCAD version you have.

A dialogue box appears (Load/Unload Applications). Browse to find the directory where the *litio2.vlx* file is (this directory shall have been included in AutoCAD's search paths). Select the *litio2.vlx* file, and press the *load* button. A message saying "litio2.vlx file successfully loaded" should appear in the appropriate message box. Press the *close* button. You are ready to use the program in the current drawing session.





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