

# Litio 2.0

Sheet metal for **ZwCAD**

Version 2.0 for **ZwCAD** - User guide

## Index

|   |    |
|---|----|
| Index .....   | 2  |
| Quick-start Guide .....   | 3  |
| Introduction .....  | 4  |
| General features .....  | 4  |
| System requirements .....   | 5  |
| Standards .....   | 5  |
| Disclaimer and contact information .....  | 5  |
| Agreement Highlights .....  | 6  |
| Program limitations for unsuscribed users .....                                     | 6  |
| Subscription [license purchase] .....   | 6  |
| Installation and Use .....  | 7  |
| Solution: Program crash after a SETTINGS change .....                               | 7  |
| Solution: imperial vs. metric units .....   | 8  |
| Dialog boxes .....  | 9  |
| Greeting box .....  | 9  |
| Language change .....   | 9  |
| Category selection .....  | 10 |
| Pattern selection .....   | 11 |
| Settings .....  | 12 |
| Parameters: Input boxes .....   | 14 |
| Input boxes .....   | 15 |
| Customized transitions – by picking two 3D Polylines .....                          | 20 |
| 3D trim with plane .....  | 22 |
| Custimized 2D profiles [2D profiles created by picking a 2D polylines] .....        | 22 |
| Curve [polyline] extraction from existing 3D objects .....                          | 22 |
| Customized branches and leaders - 3D trim of 3d object with another 3D object ..... | 23 |
| Unfolder of existing 3D objects .....   | 23 |
| Patterns available .....  | 24 |
| Entities drawn for each pattern .....   | 33 |
| Patterns not available in TRIAL mode .....  | 33 |
| Appload .....   | 34 |

## [Quick-start Guide](#)

**Litio 2.0** (also mentioned elsewhere as THE PROGRAM) is a sheet metal add-on for ZWCAD that calculates and draws the flat sheet development of ducts, rectangle-to-round transitions, cylinders, cones, pipe intersections, connections, Ys, elbows, etc. It is easy to use.

It is ideal for hoppers, cyclones, dust extraction, ducts, conveying systems, silos, piping, HVAC, etc.

**Litio 2.0** runs within **ZWCAD** as an add-on, plugin program.

At the moment of the creation of this manual it works in:

- **ZWCAD 2018 onwards** (ZWCAD 2018 and newer). Windows versions ONLY.



**Warning:** Litio2 was not tested with earlier ZWCAD versions. Please check **Litio2** compatibility with your CAD system (feel free to run the TRIAL mode).

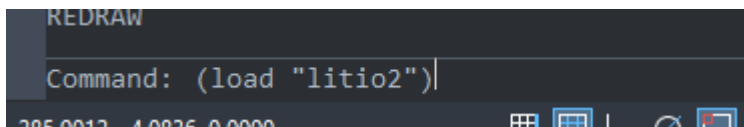
THE PROGRAM can be manually installed by placing **ALL** of the **Litio2** files in the "SUPPORT" directory of **ZWCAD**.



**Note** [advanced users]: Other directories can also be used, provided they are in your CAD's **support files** search path.

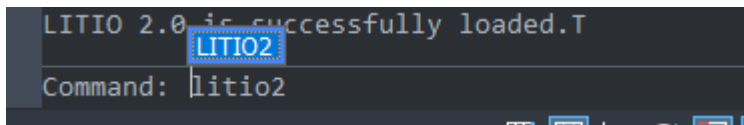
To run **Litio 2.0**, you first need to load it into your current drawing session. For this type the following in your CAD's command prompt:

(load "LITIO2")↵



Then, to run THE PROGRAM just type:

LITIO2↵



For more information check the following:

- [System requirements](#), page 5
- [Greeting box](#), page 9
- Program [General features](#), page 4
- [Installation and Use](#), page 7
- [Dialog boxes](#), page 9
- [Settings](#), page 12.
- [Language change](#), page 9.
- [Program limitations for unsubscribed users](#), page 6
- [Solution: Program crash after a SETTINGS change](#), page 7
- [Solution: imperial vs. metric units](#), page 8

## Introduction

**Litio 2.0** is a sheet metal add-on that calculates and draws the flat sheet development of ducts, rectangle-to-round transitions, cylinders, cones, pipe intersections, connections, Ys, elbows, etc. It is easy to use.

It is ideal for hoppers, cyclones, dust extraction, ducts, conveying systems, silos, piping, HVAC, etc.

It is compatible with **ZWCAD**. It works within **ZWCAD** starting with 2018.



**Warning:** Check LITIO2 compatibility with your CAD system by yourself and make sure it works undisturbedly. LITIO2 is SHAREWARE, t.i., you can test a TRIAL version of THE PROGRAM before placing your purchase to get the full-working version. Do not place any license purchase if you are not sure LITIO is good for you.



**Warning:** Future compatibility of LITIO software with your current or future CAD system depends on your CAD system provider's compatibility policies.



**Note:** LITIO [Spanish for Lithium] is the lightest (easiest) metal. Thus, with the name LITIO we mean a light, easy to use sheet metal program for ZWCAD.

## General features

- **Thickness:** 3D objects are drawn with thickness. (You are able to see the kind of bevel preparation you will need to weld the 3D parts together).
- **Special patterns:** oblique transitions; triple Ys [trifurcations]; helixes; "S" pipes; conical bends; bends with various cross sections; more branch patterns; intersecting patterns\*; free transitions\*; etc.
- You can select **inside/middle/outside** dimensions on both ends of transformations independently.
- You can **3Dtrim** (intersect) two 3D objects to get, for example, a conical branch on a square to round transition (or any other combination).\*
- You can select **inside/middle/outside contact** on bend or Y [bifurcation] pieces.
- **Customized transitions with LITIO2 3D developable ruled surfaces generator engine:** you can create your own transitions, just by clicking on any two entities located in your CAD's 3D model space, and which define both ends of the transition.\*
- 3D to 2D **unfolder** engine (you can even unfold your own 3D meshes [N=2], just by clicking on them).\*
- **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 dialog **messages:** these messages give you much more information.
- **Added Languages:** Dialogs, warning messages, and dialog messages in different **languages** (availability of languages will be increased in the future.).
- Allowance for **grooved seams** (for thin metal sheet) is made automatically.
- Input dimensions that can be either positive or negative, have a "+" symbol drawn in dialog image to show positive direction (E.g., dt X).
- **2D profiles**, both pre-set (dialog) profiles or **customized** (picking a 2D polyline).

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

## System requirements

THE PROGRAM runs within **ZWCAD**. See page 3 or page 4 for more details.



**Note:** There are versions available for other **CAD** platforms. Please visit our website at [LITIO.si](http://LITIO.si).

## Standards

To calculate unfolded development lengths, LITIO 2.0 follows the criteria set forth in the following standards:

- **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

## Disclaimer and contact information

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 6 to see agreement highlights and our website for the complete End User License Agreement.

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Visit LITIO web page at:

<http://www.litio.si/>

e-mail:

[info@litio.si](mailto:info@litio.si)

[litio3d@yahoo.com.ar](mailto:litio3d@yahoo.com.ar)

Visit LITIO web page for updated info.

## Agreement Highlights

Downloading of the software (any version) is deemed as your acceptance of all terms and conditions of the user agreement (available on our website LITIO.si) and as follows:

- You shall agree to all terms.
- This software is copyrighted. You shall not sell, lend, forward, modify, crack, etc. the software.
- TRIAL is limited to a 60-day term. After that you shall erase all files of THE PROGRAM from your computer, or purchase a subscription license(s).
- You are encouraged to publish positive reviews on professional and industry blogs, and on your professional social media profiles, and placing back links to our website. This software is Shareware and we very much appreciate your help in promoting our software.
- We reserve the right to modify THE PROGRAM and/or the information without notice.
- THE PROGRAM is provided AS IS and you use it at your own risk.

## Program limitations for unsubscribed users

The TRIAL mode of LITIO 2.0 has the following limitations:

- TRIAL version 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 the TRIAL mode. LITIO 2.0 will draw virtual objects [TRIAL mode displays a message in this case]. See page 33 [[Patterns not available in TRIAL mode](#)].



**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, text insertions for bending radiuses and/or angles are omitted.

## Subscription [license purchase]

Please visit our web page at [www.litio.si](http://www.litio.si) for price, updated registration information, and multiple-user pricing.

## Installation and Use

THE PROGRAM can be manually installed by placing **ALL** of the LITIO2 files (litio2.slb, litio2.dcl, litio2.zelx, and litio2.cfg) in the "SUPPORT" directory of ZwcAD.

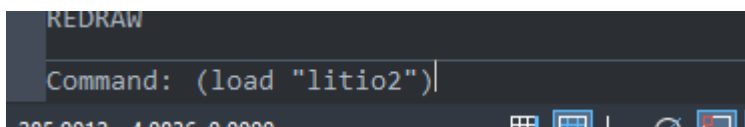
 **Warning:** THE PROGRAM could not run or not run properly if one or more of the files mentioned is/are missing. Do not place the .zip file in the support folder; unzip it. Do not place the files in a folder in the support folder, but directly in the support folder.

To run the LITIO2, you need to load THE PROGRAM in the current drawing session. After loading it, you need to call it.

THE PROGRAM is loaded by typing the following in ZwcAD's command prompt:

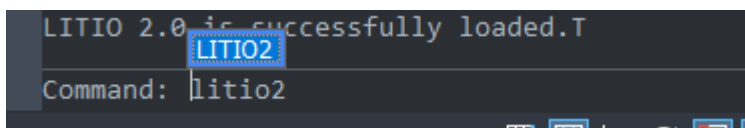
**(load "LITIO2")↵**

(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 34 to load THE PROGRAM using the APPLOAD command.

## Solution: Program crash after a SETTINGS change

If LITIO2 crashes after trying to save your LITIO2 SETTINGS changes, this may be because you do not have the permissions to modify files in the SUPPORT folder (or any other folder where you located LITIO2 files).

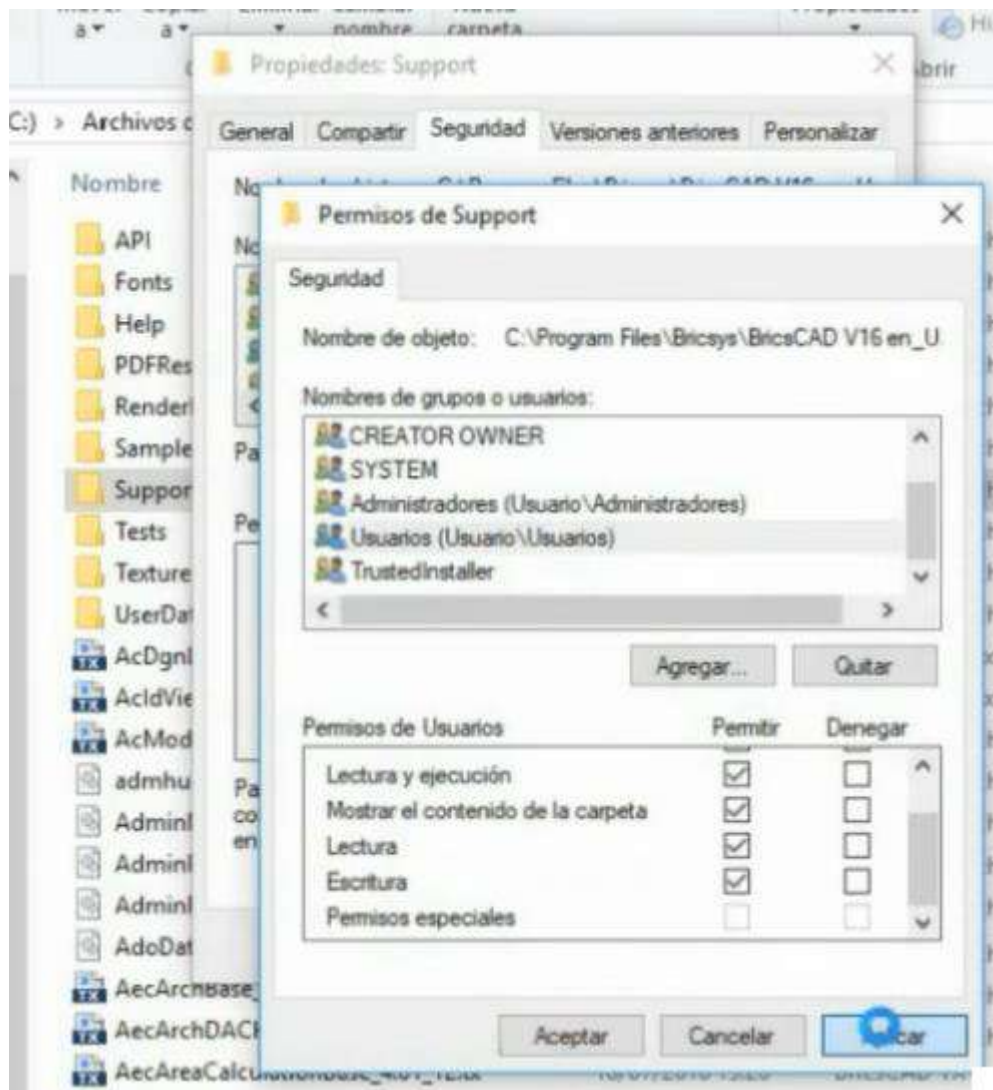
 **Warning:** In some operating systems, to run LITIO2 your user needs to have the permissions or privileges, to access or modify files in the folder where LITIO2 files are located (e.g., **SUPPORT**). LITIO2 modifies the **litio2.cfg** file when you make configuration [settings] changes.

To solve this problem, you need to get the necessary permissions or privileges, or, you need to be logged-in as an administrator. (If not, when making configuration [settings] changes, they will not have any effect, and LITIO2 will crash).

To assign the necessary permissions:

- RIGHT click the **SUPPORT** folder,
- Go to the **SECURITY** tab,
- Assign the appropriate permissions
- Press APPLY.

(check the following image).



Another solution is to place all LITIO2.\* files in a directory (folder) you have permissions to modify, and add the folder to the ZwcAD's support files search path.

### [Solution: imperial vs. metric units](#)

If LITIO2 dialog boxes show imperial units instead of metric ones (or vice versa), this is because LITIO2 uses your CAD system's configuration parameters for unit type (imperial/metric) and decimal places. Your CAD system Unit setting is adopted by LITIO.

To change your CAD system's configuration, at your CAD system command line type:

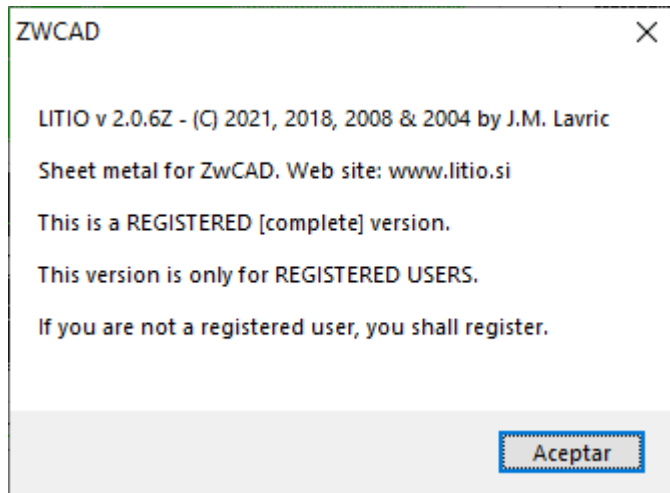
**UNITS** and enter the right value:

- **0** for imperial units, or
- **1** for metric units.



## [Dialog boxes](#)

### [Greeting box](#)



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

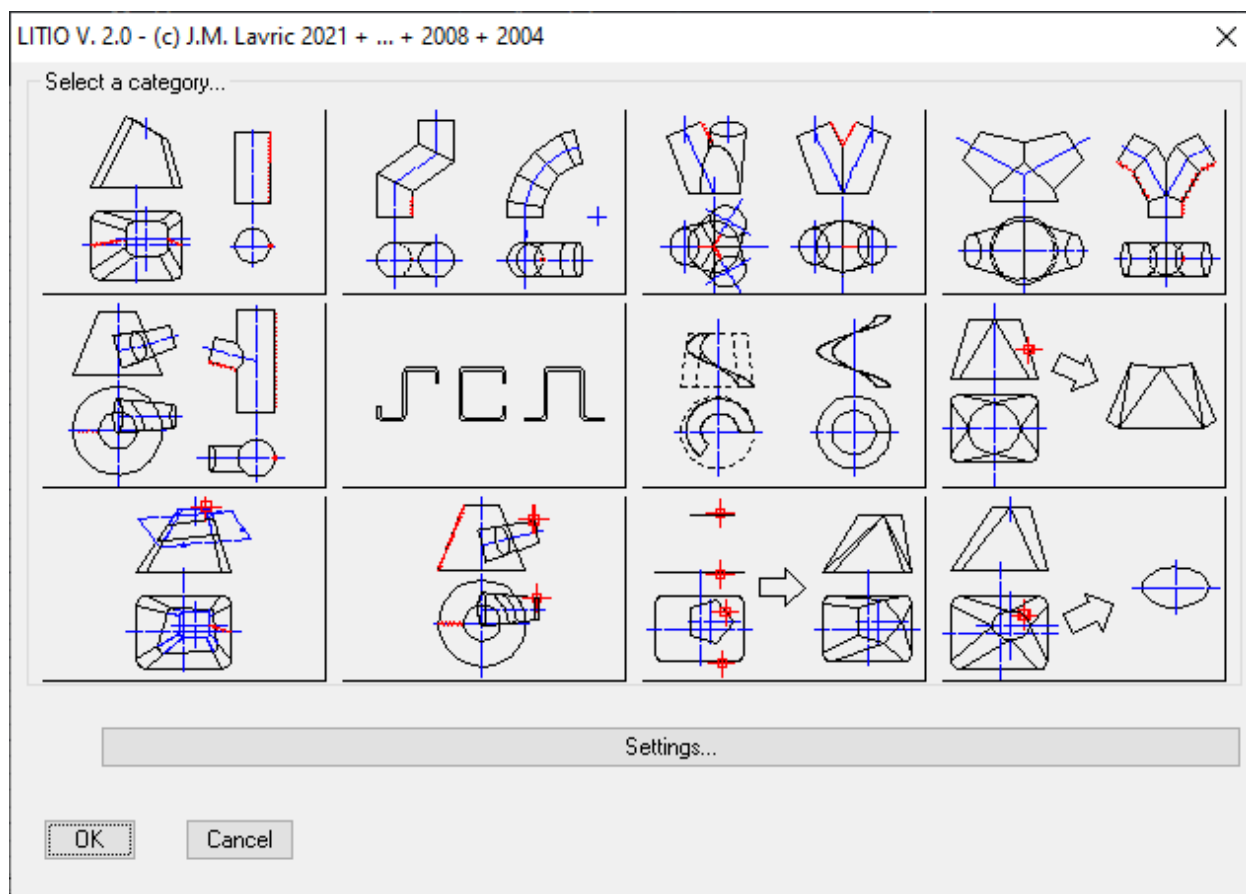
### [Language change](#)

**LITIO2** native language is English. Other languages are available.

If you have downloaded the English version, you can change the language of your dialog boxes and the program messages. For that, download the language package of your preference and make sure to add the the respective litio2.lng and the li2\*.dcl files in the SUPPORT folder of your ZwcAD.

E.g., for Spanish, add the **LITIO2.CFG** and the **LI2[ES].DCL** files; for French, add the **LITIO2.CFG** file and the **LI2[FR].DCL** file.

## Category selection



This first dialog directs THE PROGRAM to a pattern selection dialog, to a pattern dialog, or directly to an action. It shows the following options:

- [1] Transitions (see page 24).
- [2] Bends and spheres (see page 26). (\*\*\*)
- [3] Ys [bifurcations] [and triple Ys [trifurcations]] without a base piece (see page 28).
- [4] Ys [bifurcations] with a base piece (see page 29).
- [5] Customized branches and mains (see page 30).
- [6] 2D profiles (see page 31 and page 22).
- [7] Helical augers and Helixes (see page 32). (\*)
- [8] Existing 3D objects unfold (see page 23). (\*\*)
- [9] Existing 3D objects plane trimmer (see page 22). (\*\*)
- [10] Existing 3D objects intersection trimmer (see page 23). (\*\*)
- [11] Custom transitions (see page 20).
- [12] Curve [polyline] extraction from existing 3D objects (see page 22). (\*\*)

The "Settings..." button directs to the Settings (configuration) dialog (see page 12).



**Warning:** Helixes (\*) are not developable surfaces. Any development is just an approximate solution of the 3D surface.

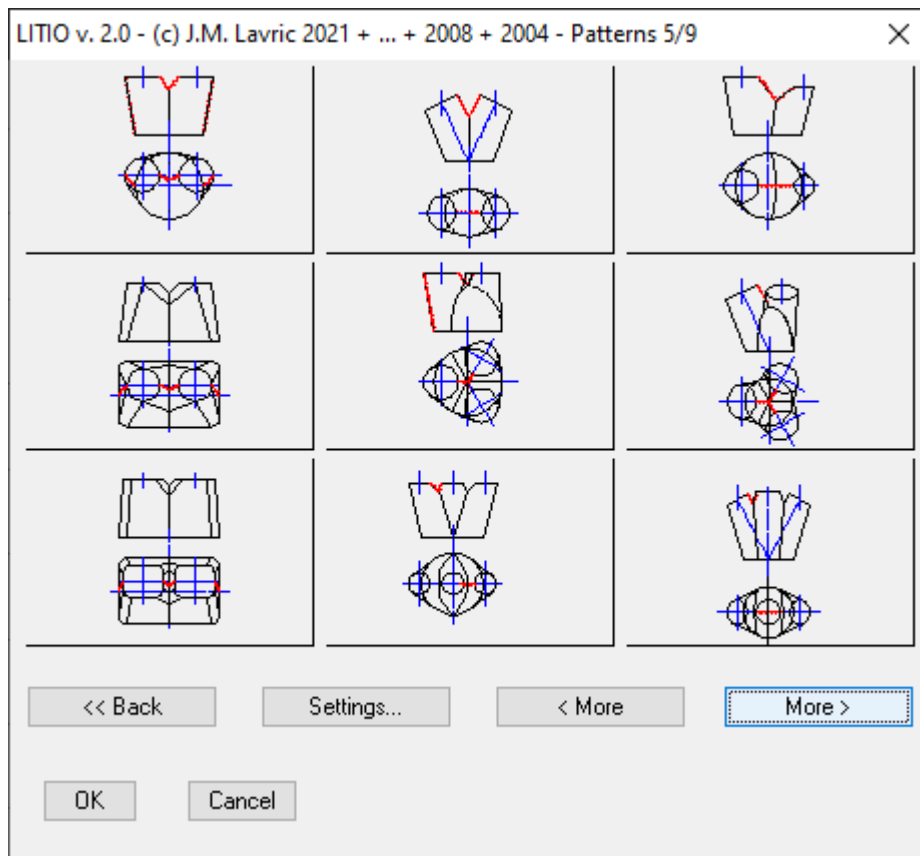


**Warning:** These features (\*\*) are not available for ZwcAD native 3D solids.



**Warning:** Spheres (\*\*\*) are not developable surfaces. Any development is just an approximate solution of the 3D surface.

## Pattern selection



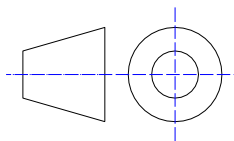
Here you select the pattern you want to generate and unfold. Pressing the **"More >"** or **"< More"** button more patterns are shown, and even other categories' patterns are shown.

**"<< Back"** button goes back to category selection dialog.

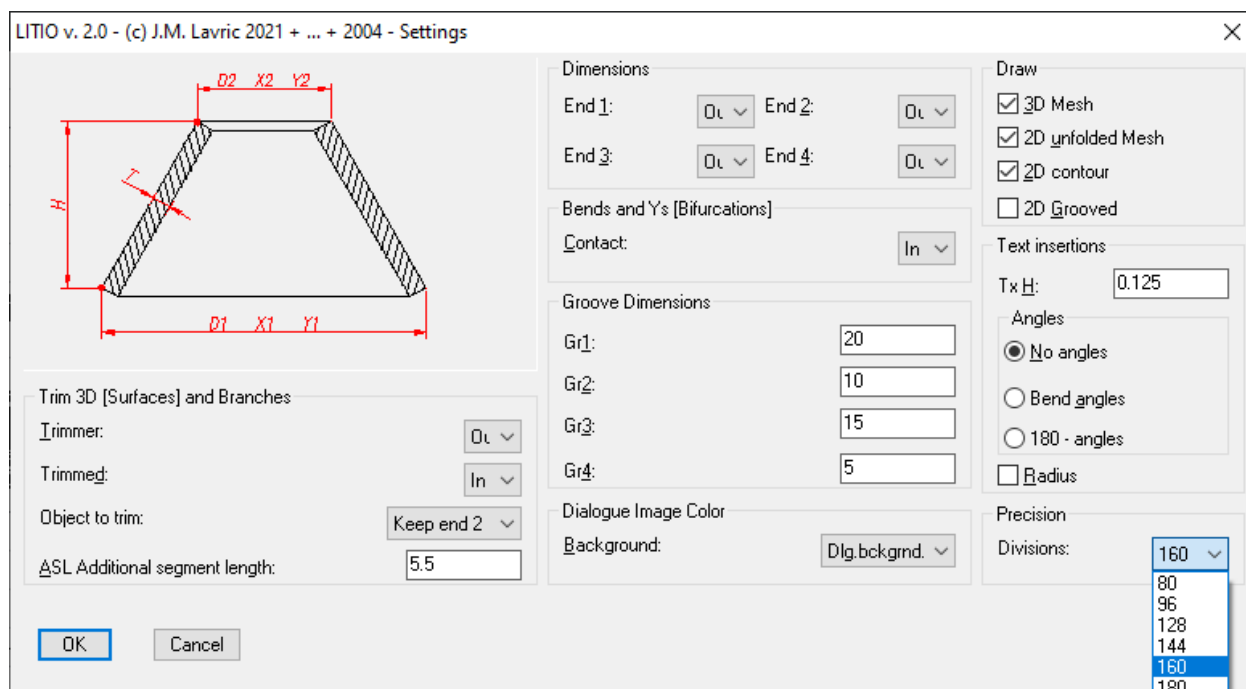
If you press the **"Settings..."** button, you leave this dialog to go to the **Settings dialog**.



**Note:** All dialog images are in ISO-E projection.



## Settings



### Trim 3D [Surfaces] and Branches



**Warning:** This feature is not available for ZwcAD native 3D solids.

**Trimmer:** You can choose either the out/mid/in surface of the trimmer object (either of a dialog 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 dialog 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 dialog 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 a 3D object trimmed by another 3D object (either in a dialog box or by picking them). Here THE PROGRAM creates some additional generatrices, for the plane faces of the 3D object to be trimmed, to enhance accuracy.

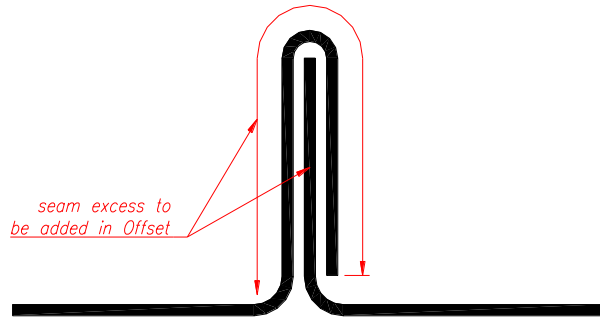
### Dimensions:

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 dialog transitions; or first picked entity. "2" applies to upper end of dialog 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 Ys [bifurcations]

**Contact:** For bends and Ys, 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 groove preparation allowance. This is particularly useful for very thin sheet metal tubing. (See next figure).



**Dialog Image Color:** Depending on your screen background color, dialog images are better or worse seen. Here you can select a dialog background color to enhance dialog 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 an allowance for grooved seams.



**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 generatrices, 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 dialog by pressing "**Cancel**", none of the selected settings will become effective.

But if you finish the dialog 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 ZwcAD user manual for further information on Metric and Imperial units, and on the use of MEASUREMENT and LUNITS system variables).



**Note:** If English units are used in the current drawing session (MEASUREMENT = 0), all inputs will be in feet and inches. If metric (MEASUREMENT = 1), inputs are in millimeters. To change from one to the other, type: **MEASUREMENT** in the command line to enter the new value (0 or 1).



**Warning:** After a Settings change, LITIO2 needs to modify the **litio2.cfg** file. If the user has not the required permissions and/or privileges to access or modify files in the SUPPORT folder (or any other folder where LITIO2 files are located), LITIO2 will **crash** and your configuration changes will not be saved.

The solution is (1) to be **logged in** as **administrator**, (2) to get the necessary **permissions or privileges**, or (3) to place all LITIO2 files in a folder you have full access, and add this folder to the ZwcAD SUPPORT **search paths** (it is recommended to place this folder at the first position of the list, to prevent any conflict).

Check also the **Warning** information on page 7, bottom.

## Parameters: Input boxes



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

See page 24 for a complete list of patterns.

## Example dialog: Transition – Rectangle to rectangle – Offset - Oblique

LITIO 2.0 - Rectangle to Rectangle - Offset - Angle [generic] ✕

**Bottom**

X1:

Y1:

B1:

**Top**

X2:

Y2:

B2:

**Other Dimensions**

I:

H:

A [Angle]:

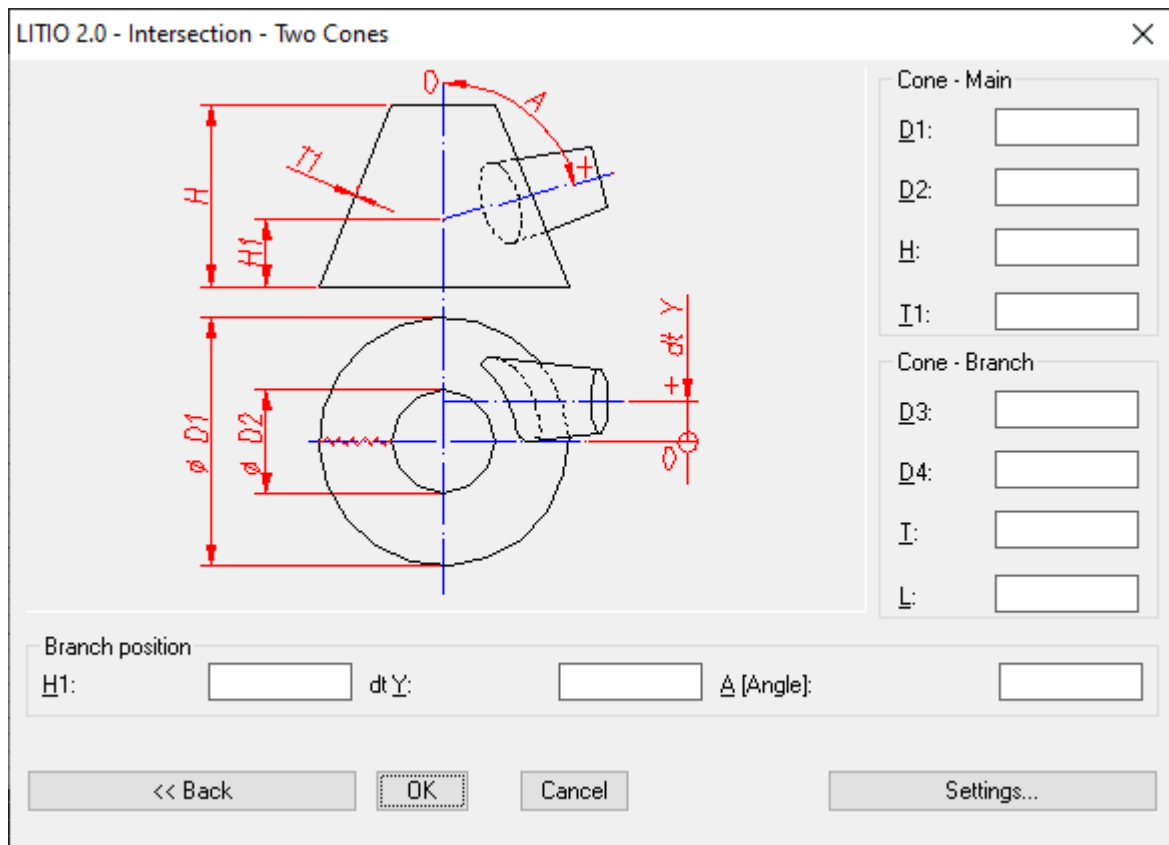
dt X:

dt Y:

**Seams**

☒ Seam 1 only ☐ Seams 1 and 2

### Example dialog: 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 although the input asks for X and Y: If it is available, input the value of the diameter in the X and Y boxes and d/2 in the R box.

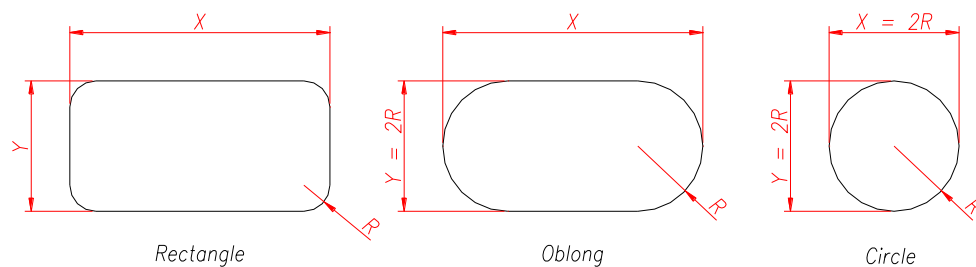
**L, L1:** The length of a pipe branch.

**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.



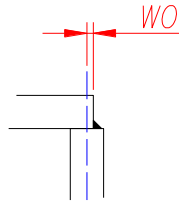
**Tip:** You can also have an oblong end, if you make  $R = X/2$  or  $R = Y/2$ . If  $X/2 = R$  and  $Y/2 = R$  you have a circle.



**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 center of the upper end is at a point located at (dt x; dt y; height) relative to the lower end center, which is at (0.0, 0.0, 0.0); or the relative position of the center of a branch pipe end, intersecting a cone, to the base center 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 center line of the thickness of the bent sheet. The figure below shows a positive WO value.

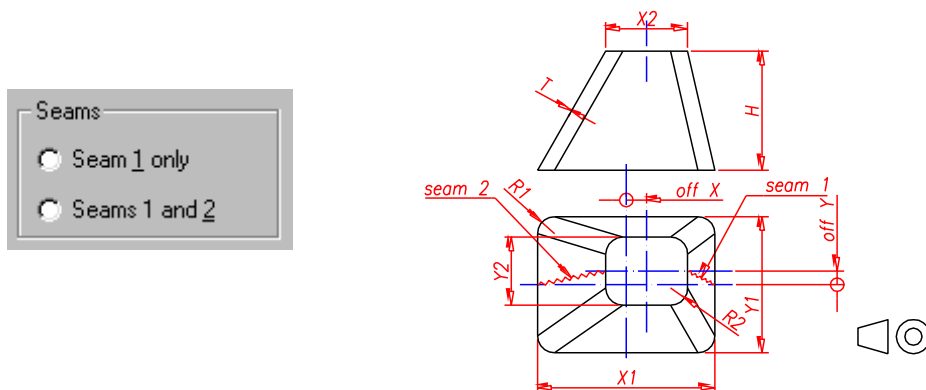


**n [parts]:** For duct bends of any cross section, **n** is the number of whole parts, in which the bend is divided (excluding the 2 halves at the ends). For conical bends, it is the amount of parts in which the bend is divided. For polygon cylinders, it is the number of sides of the polygon.

**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 Ys. 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 parameter input, THE PROGRAM makes a first verification, to check that the input would not lead to a 3D object with interferences or geometrical incongruences. If any of these parameters is not correct, THE PROGRAM asks the user to modify it.

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.



**Note:** For branches, trimmer 3D objects, etc., the 3D representation of the main has not an actual hole, but only the 2D development has.

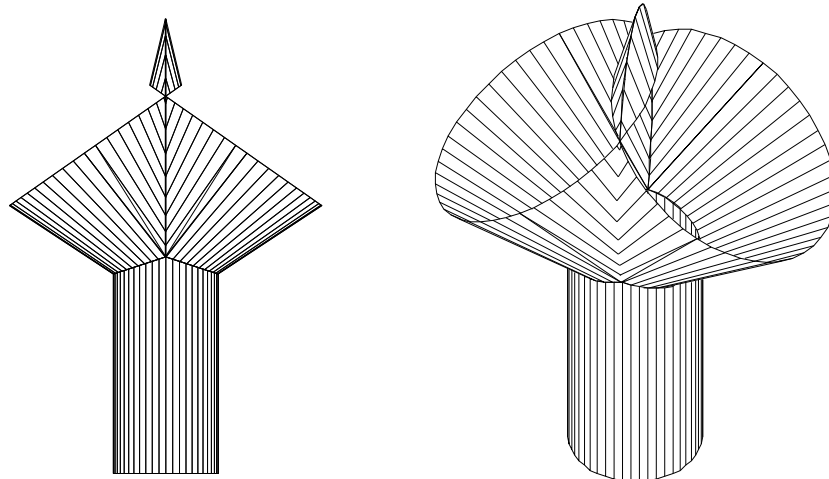
Afterwards, you can use the 2D developments for CAM cutting (plasma, laser, etc.) or manual cutting, by plotting them 1 to 1 (1 d.u. = 1 mm or 1 d.u. = 1 inch) to get paper templates, and using them to mark the sheet and then cut it.

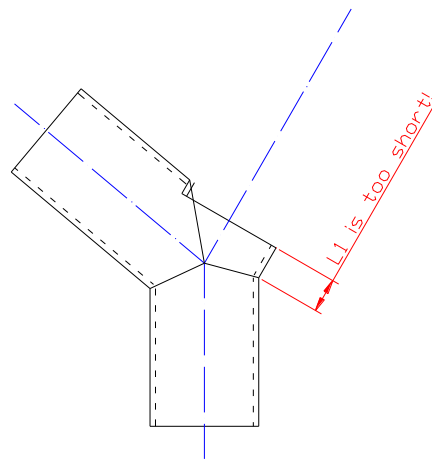
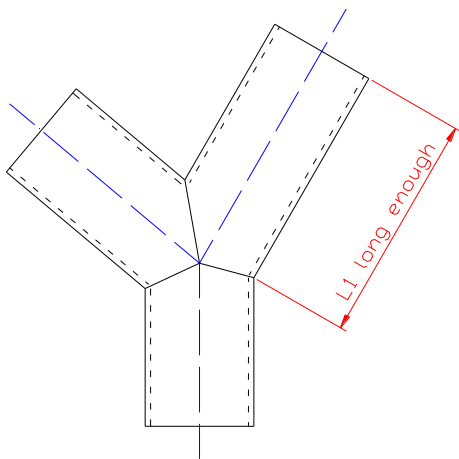
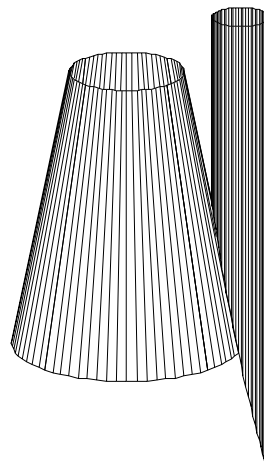
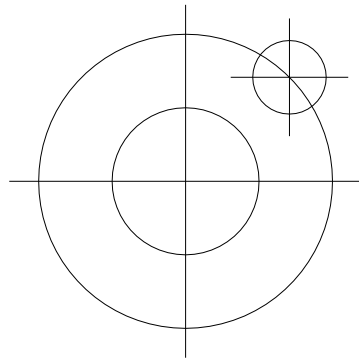
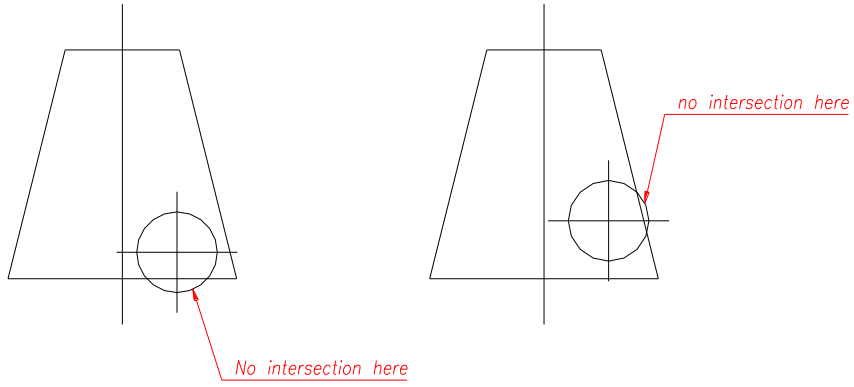


**Note:** The 3D entity version 2.0 draws, is an entity with 'thickness' (a 3D Mesh;  $M = 4$ ). All dimensions are according the input parameters.

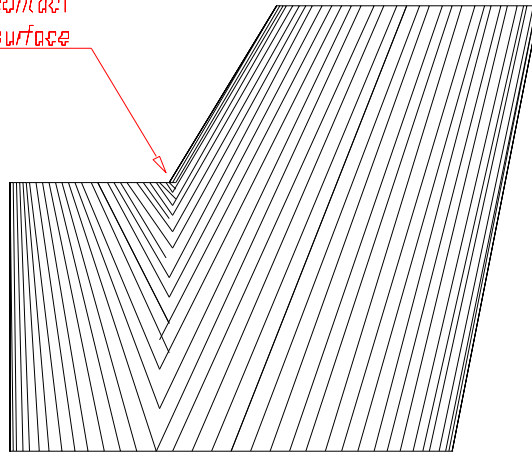
During the development calculation, THE PROGRAM may realize that the pattern is geometrically impossible, that is, that the pattern cannot actually be made. In that case THE PROGRAM warns the user about this.

See the following Figures for patterns, that are geometrically impossible.

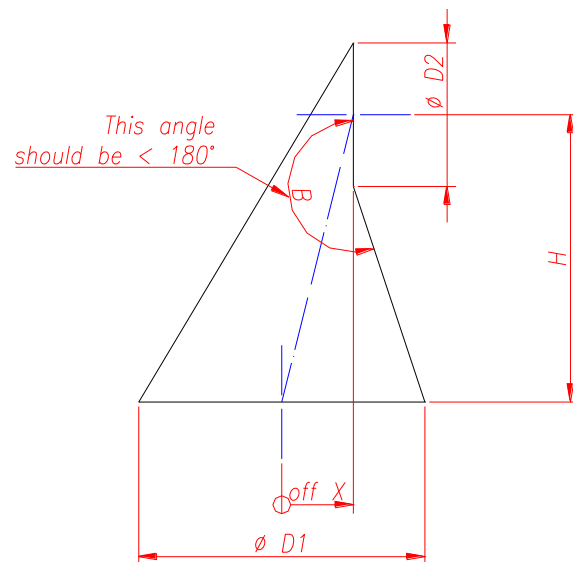




The circle of D1 or D2  
should not contact  
the other cone's surface



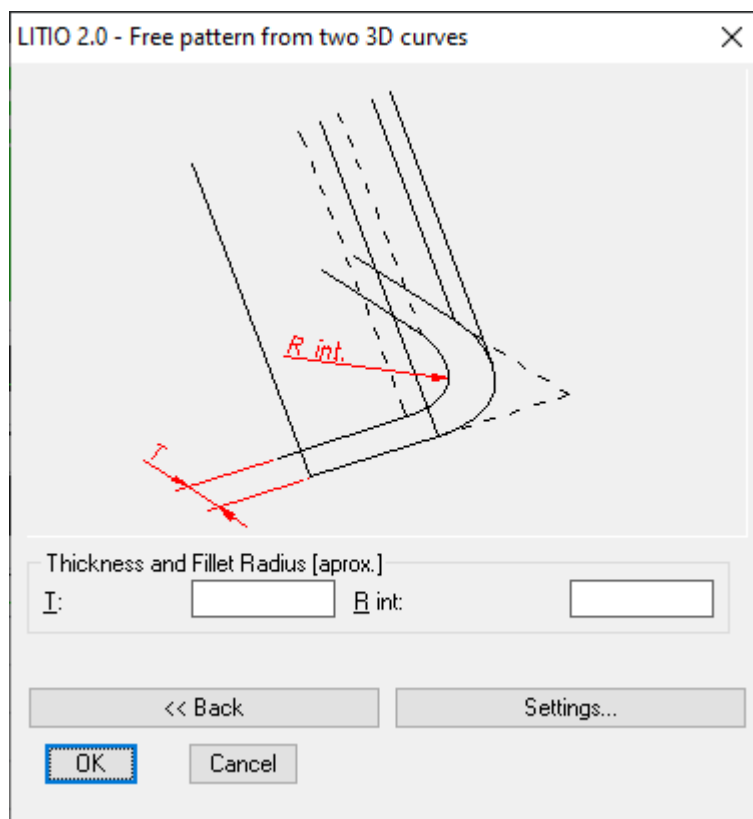
Round to Round Y [bifurcation] – Non symmetrical



Offset Cone - Unparallel

Rectangle to Round – Offset - Unparallel

## Customized transitions – by picking two 3D Polylines



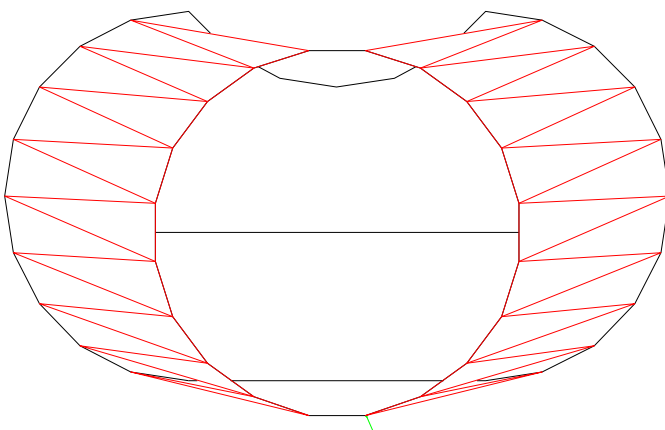
With this 3D developable ruled surfaces generator engine, you can create a customized transition by just clicking on two entities (2D and 3D polylines; or circles; or patterns created by Litio 2.0) located in your CAD's 3D space. These two entities being the ends of the transition.



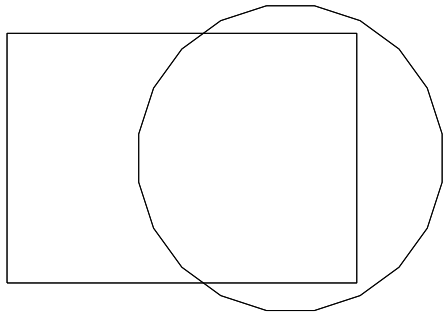
**Note:** The following entities are not accepted: arcs [convert arcs to polylines using the PEDIT command] nor ellipses [use ellipse pattern of LITIO 2.0].

Some restrictions apply:

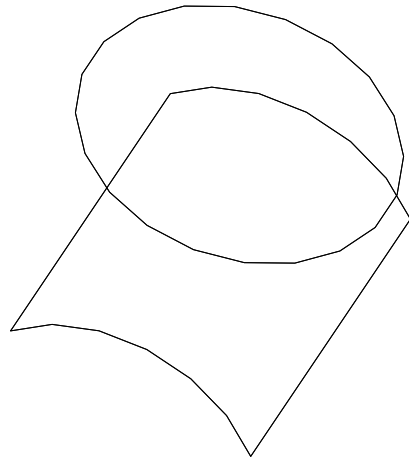
- Resulting object shall not have a concavity. See figure.



**Not valid:** Curve has a concavity.



It seems OK in plane view...  
*plane view*



...but looking well, it shows a concavity.  
*oblique view*

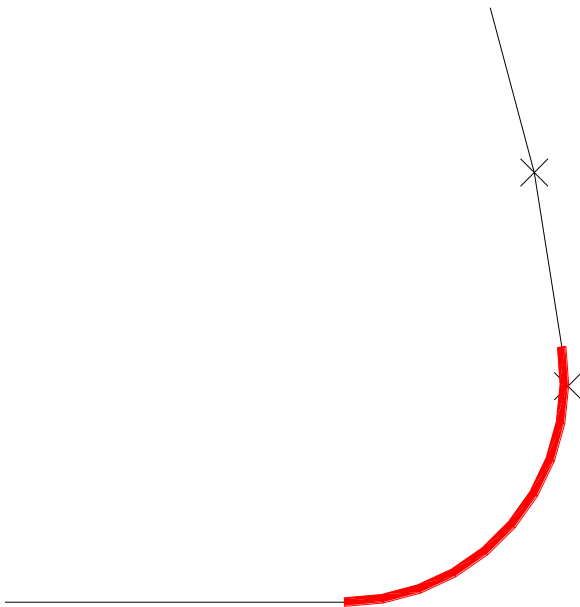


**Warning:** If a picked object has too many points (was created with a high precision number, or it was the result of a 3D trim, the new 3D object might not be able to be generated).

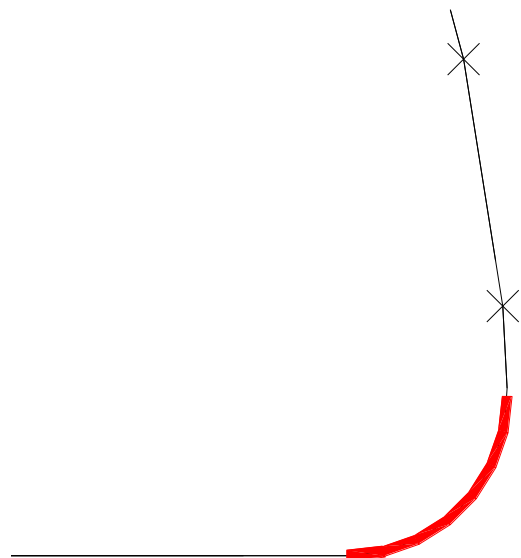
After selecting both entities, point extraction is performed. THE PROGRAM converts the arc segments in a set of points of linear segments, according to the selected precision number. THE PROGRAM then fillets all sharp angles. You are asked for the inner fillet radius and for the object thickness. Note 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 filleted 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.



**Tip:** Sometimes LITIO2 may say, an object is not possible (due to the reasons detailed herein); pick the 2 objects in the inverse order, for a try. For a more agile result, try filleting the polylines **BEFORE** starting this tool.



**Note:** The radius is not the actual bending radius, but a fillet radius; for a different bending radius, create the generatrix curve accordingly.

### 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.

The plane may cut ALL object generatrices or one of both ends. The cutting plane shall not cut both ends. If so, THE PROGRAM will exit 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  $x^\circ$  angle).



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



**Warning:** This feature is not available for ZWCAD **native 3D solids**.



**Warning:** Do not mirror nor 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.

### Customized 2D profiles [2D profiles created by picking a 2D polylines]

Some 2D profiles are provided with dialog boxes (see page 31). 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 (END 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 the 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** using this tool], or the radius is not big enough for the sheet-metal Thickness.

### 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.



**Warning:** This feature is not available for ZWCAD **native 3D solids**.



**Tip:** This feature can be used in association with the “Free pattern from two 3D curves” feature as shown on page 20.

## Customized branches and leaders - 3D trim of 3d object with another 3D object

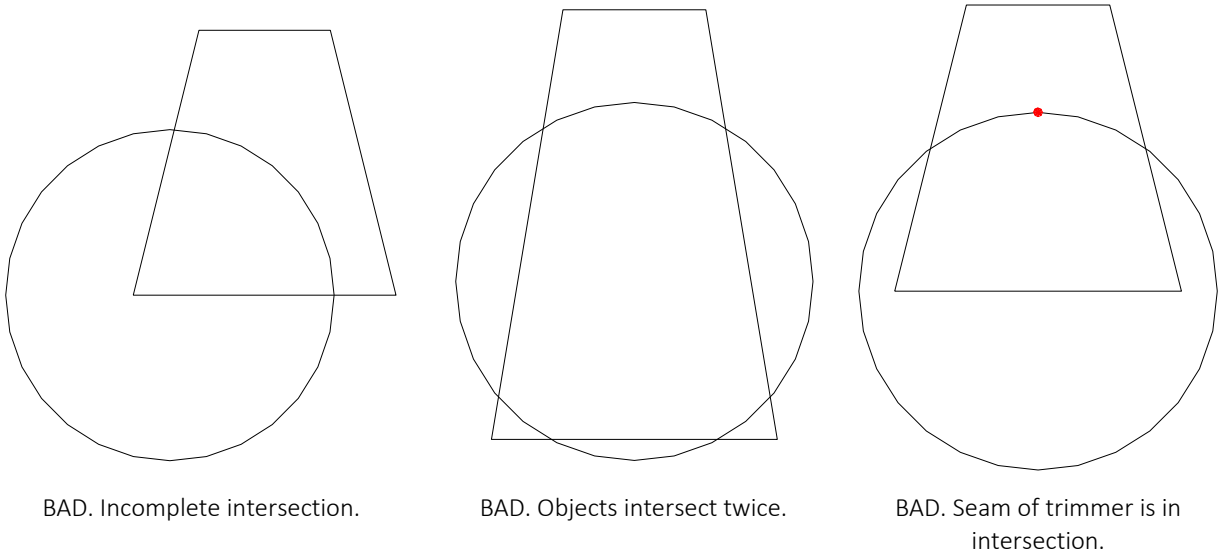


**Note:** This applies also to branch dialogs and intersection dialogs.

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

The following restrictions apply:

- Trimmer object shall completely intersect trimmed object (all generatrices 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.



*Example: Cone intersected by a cylinder (lateral view)*

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:** This feature is not available for ZWCAD native 3D solids.



**Warning:** Do **not MIRROR** nor **3D MIRROR** any 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 another 3D object.

## Unfolder of existing 3D objects

Just pick an object you have already created with LITIO2 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).



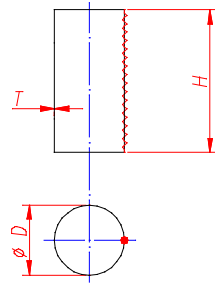
**Warning:** In general surfaces generated with **RULESURF** are not developable. Their development might not be actually possible. We recommend using the free transition generator engine (see page 20). See also FAQs page in our website for more information about non developable ruled surfaces.



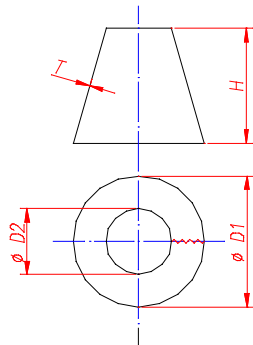
**Warning:** This feature is not available for ZWCAD native 3D solids.

## Patterns available

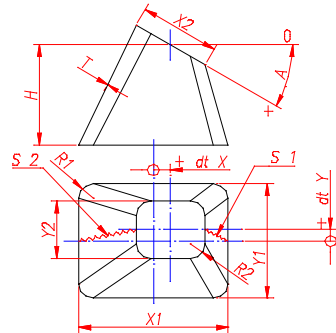
Round Cylinder



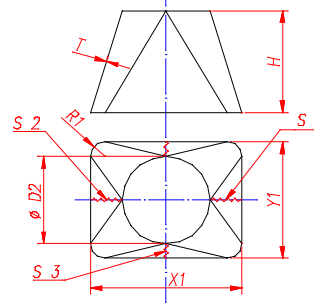
Cone



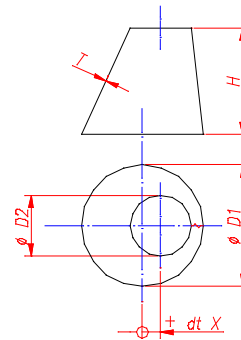
Rectangle to Rectangle - Offset - Angle [generic]



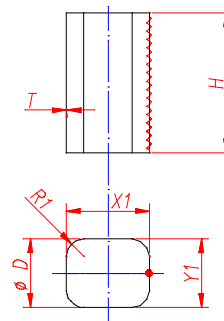
Rectangle [fillet] to round



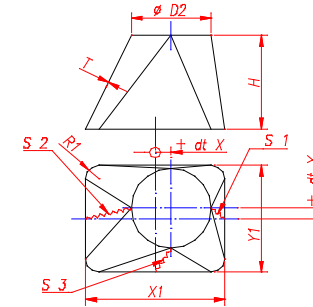
Offset Cone – Parallel



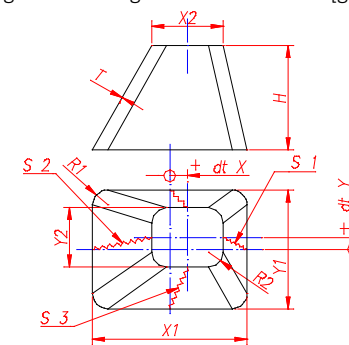
Cylinder - Fillet rectangle



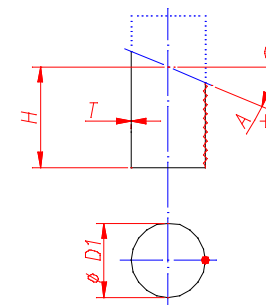
Rectangle [fillet] to round - Offset



Rectangle to Rectangle - Offset - Parallel [generic]

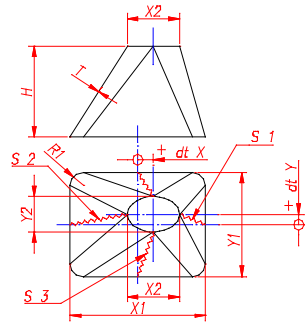


Round Cylinder - Cut once

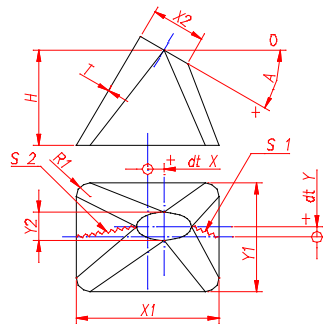




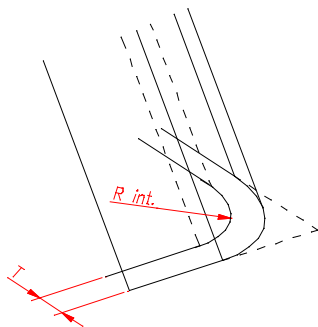
Rectangle [fillet] to Ellipse - Offset



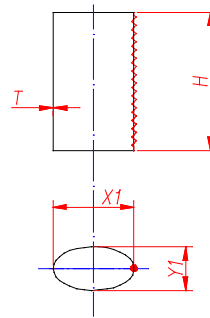
Rectangle [fillet] to Ellipse - Offset - Angle



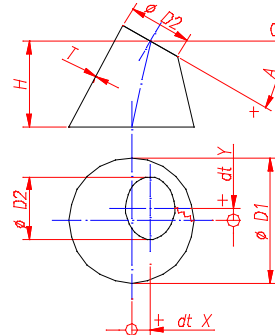
Free pattern from two 3D curves



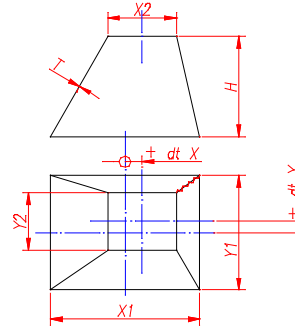
Cylinder - Ellipse



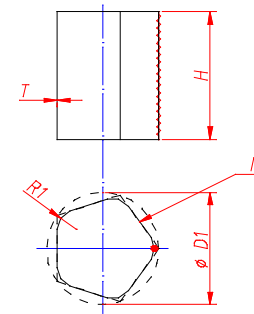
Offset Cone - Angle



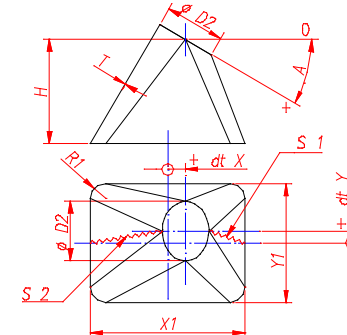
Rectangle to Rectangle - Offset [Hopper]



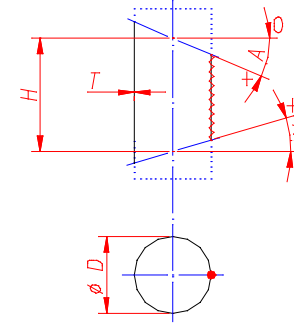
Cylinder - Polygon



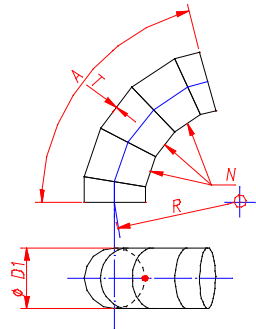
Rectangle [fillet] to round - Offset - Angle



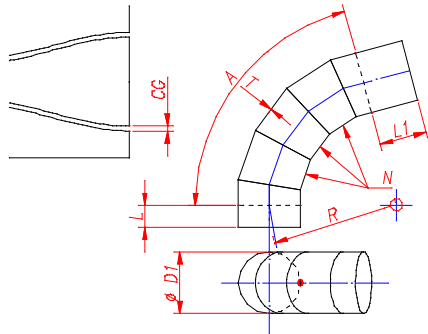
Round Cylinder - Cut twice



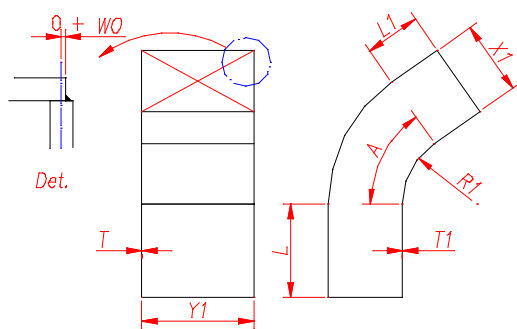
Bend - Round - N parts



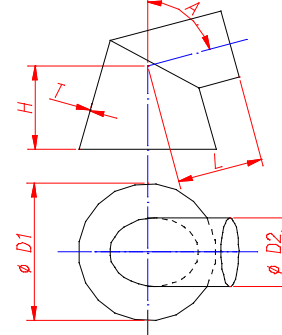
Bend - Round - N parts - Optimized



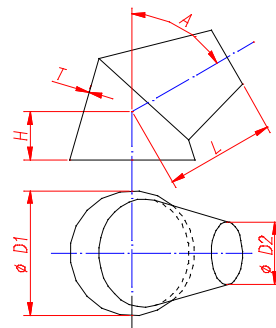
Rectangular duct - Bend



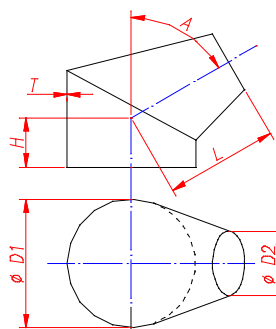
Cone to Cylinder Bend



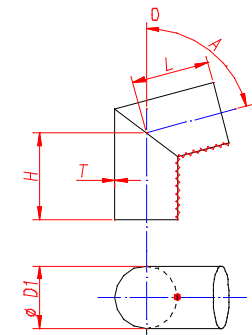
Cone to Cone Bend



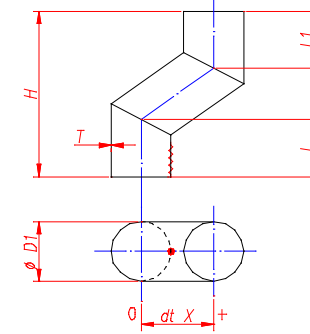
Cylinder to Cone Bend



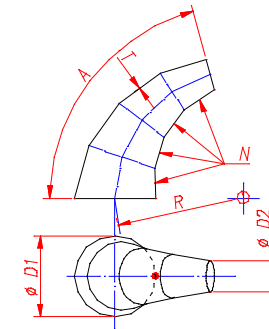
Bend - Circular Cylinder



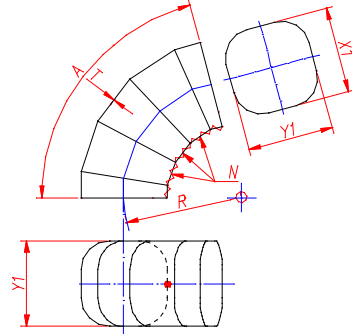
Offset Pipe [S] - Circular Cylinder



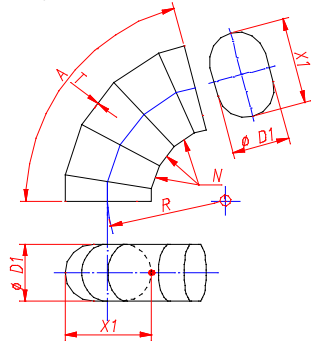
Bend - Conical - N parts



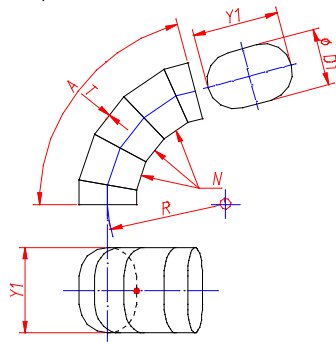
Bend - Rectangular [fillet] Cylinder - N parts



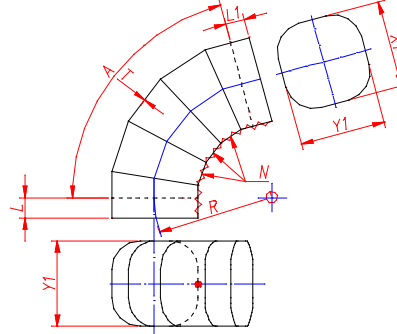
Bend - Oblong X - N parts



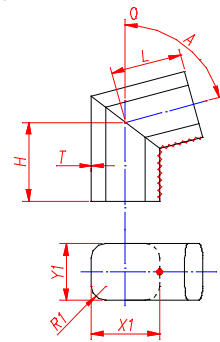
Bend - Oblong Y - N parts



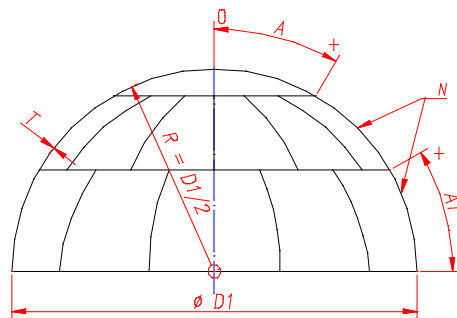
Bend - Rectangular [fillet] Cylinder - N parts



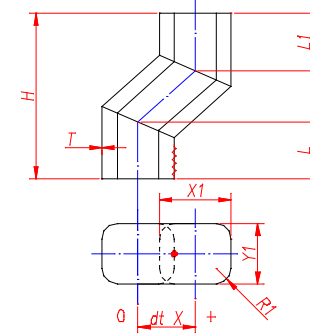
Bend - Rectangular [fillet] Cylinder



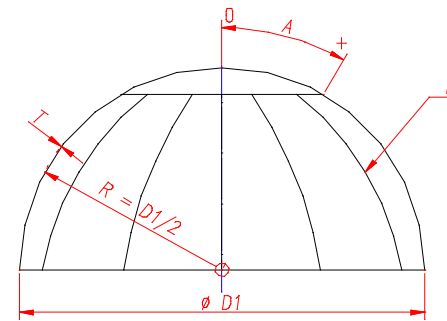
[Semi]Sphere - 2 rows



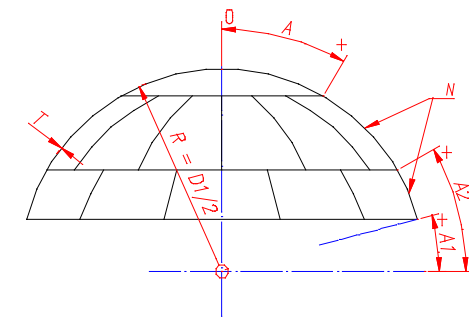
Offset Pipe [S] - Rectangular [fillet] Cylinder



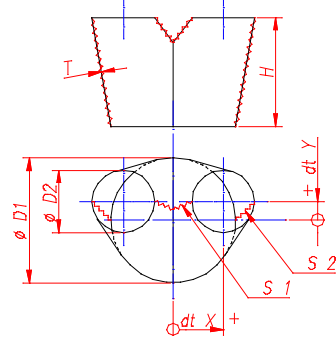
[Semi]Sphere - 1 row



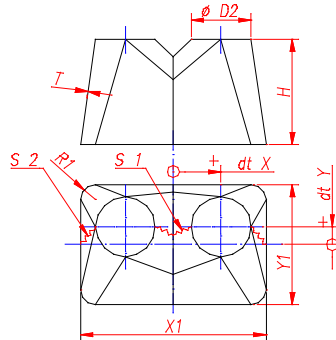
[Sector of] Sphere



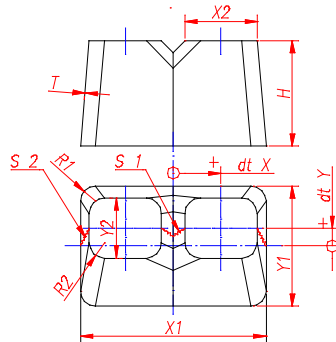
Y [bifurcation] - Circle to Circle [2 Cones]



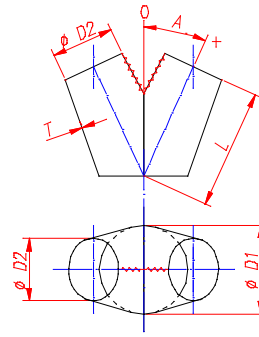
Y [bifurcation] - Fillet Rectangle to Circle



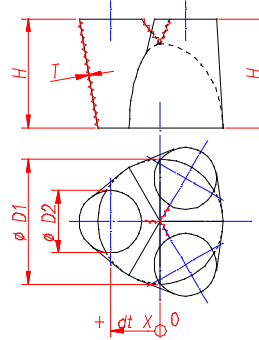
Y [bifurcation] - Fillet Rectangle to Fillet Rectangle



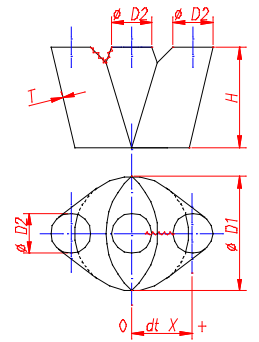
Y [bifurcation] - Circle to Circle [2 Cones] - Non parallel



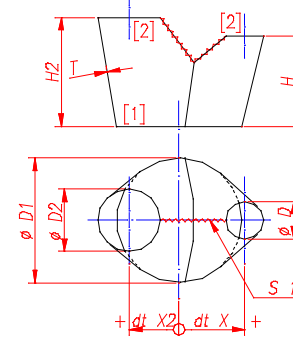
Triple Y [trifurcation] - Circle to Circle [3 Cones]



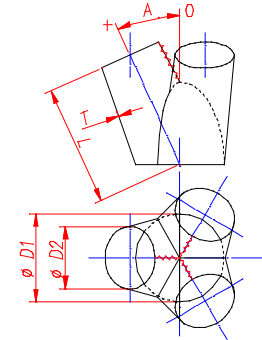
Triple Y [trifurcation] - Aligned - [3 Cones]



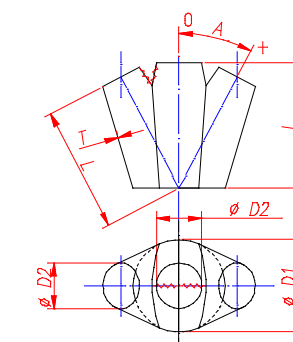
Y [bifurcation] - Circle to Circle [3 Diameters] - Non symmetric



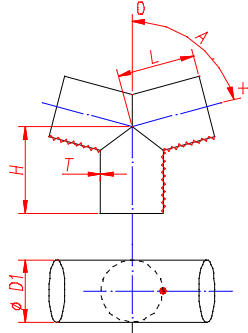
Triple Y [trifurcation] - Circle to Circle [3 Cones] - Non parallel



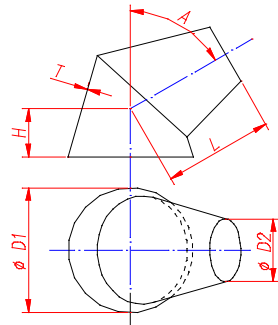
Triple Y [trifurcation] - Aligned - [3 Cones] - Non parallel



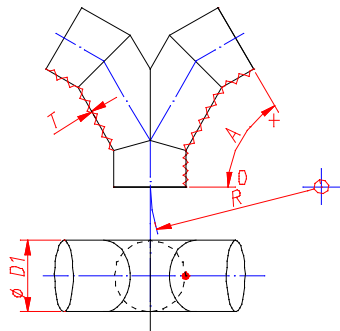
Y [bifurcation] - Circular Cylinder



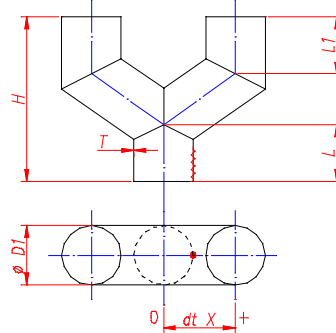
Y [bifurcation] - Circular Cylinder - Non Symmetric



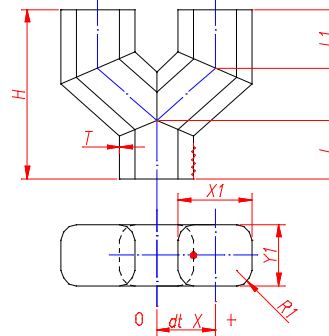
Y [bifurcation] with intermediate part - Circle



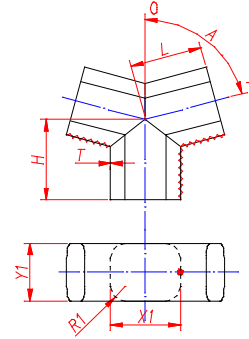
Y [bifurcation] Offset Pipe [S] - Circular Cylinder



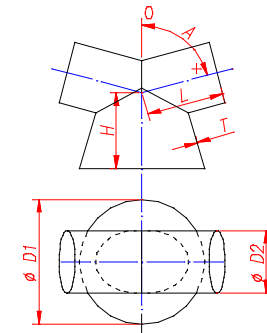
Y [bifurcation] Offset Pipe [S] - Rectangular [fillet] Cylinder



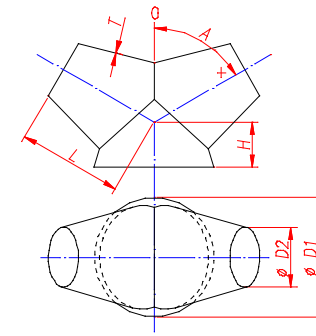
Y [bifurcation] - Rectangular [fillet] Cylinder



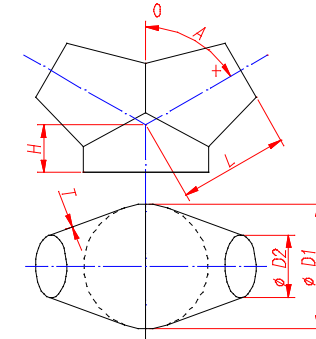
Cone to Cylinder Y [bifurcation]



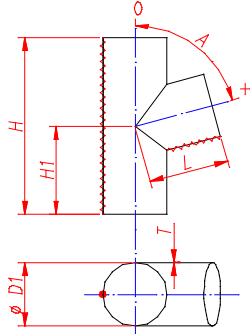
Cone to Cone Y [bifurcation]



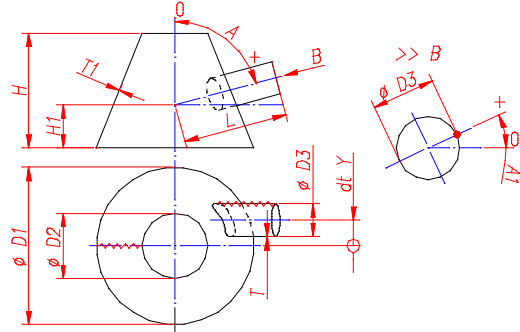
Cylinder to Cone Y [bifurcation]



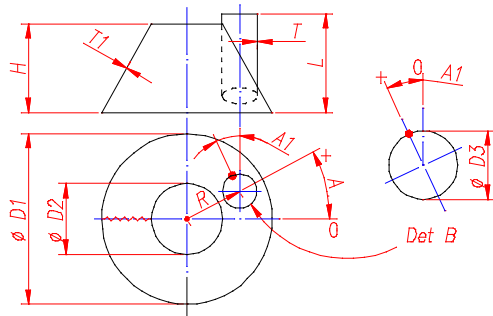
Branch - Cylinders [1 Diameter]



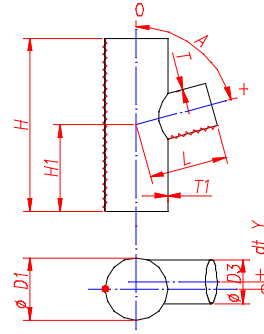
Intersection - Cone with round duct [angle]



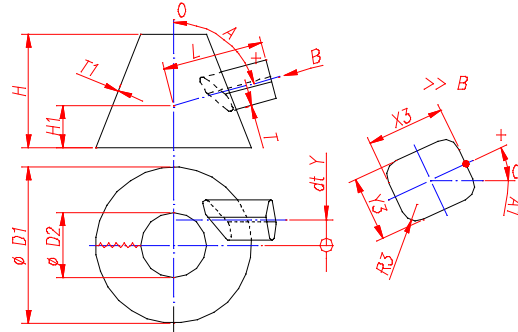
Intersection - Cone with round duct [vertical]



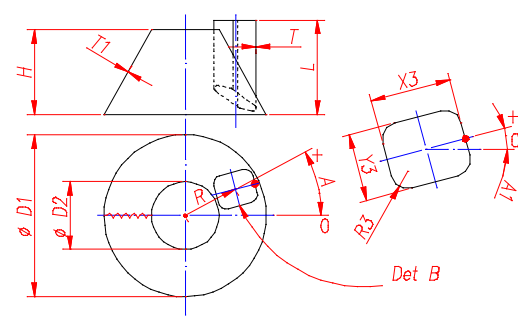
Branch - Cylinders [2 Diameters]



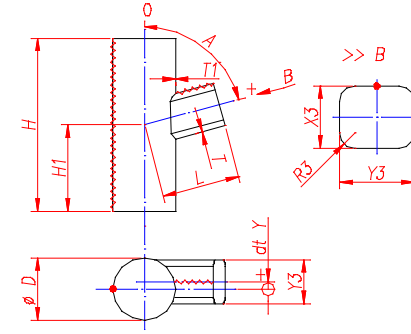
Intersection - Cone with rectangular duct [angle]



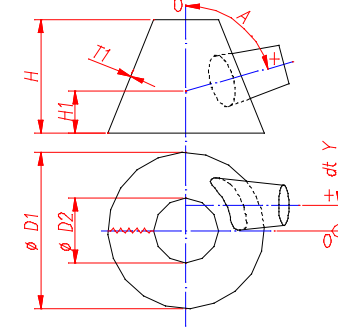
Intersection - Cone with rectangular duct [vertical]



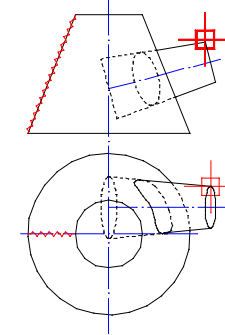
Branch - Cylinder + Rectangle [fillet]



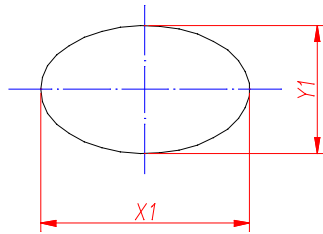
Intersection - Two Cones



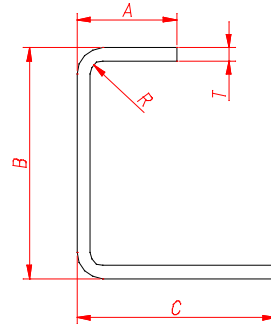
Existing 3D objects intersection trimmer



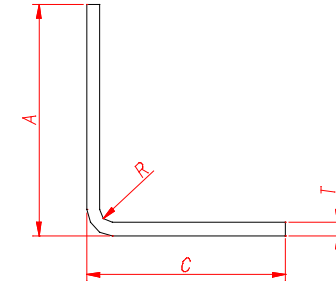
2D polyline – Ellipse



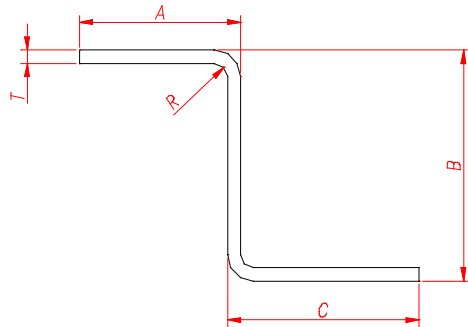
2D profiles – U



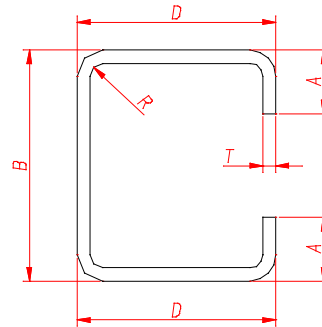
2D profiles – L



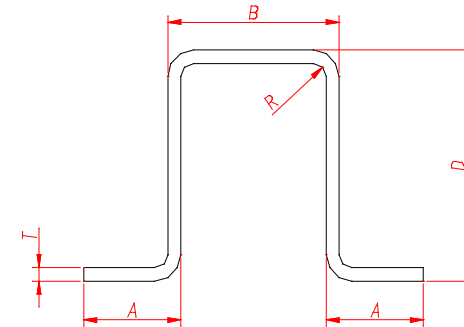
2D profiles – Z



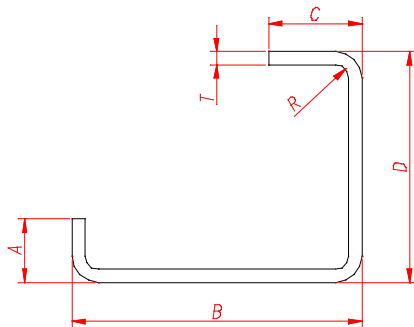
2D profiles – C



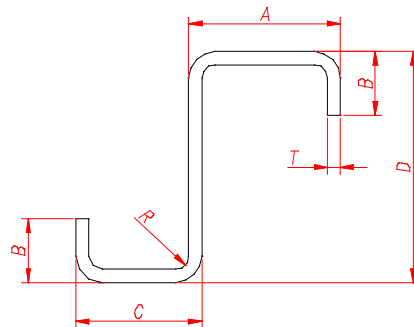
2D profiles – OMEGA



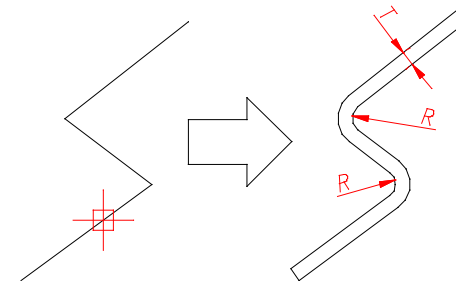
2D profiles – J



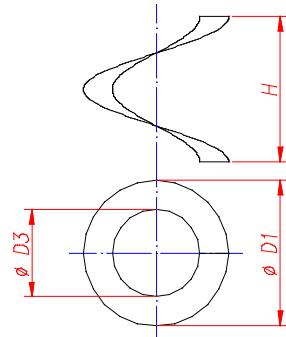
2D profiles – S



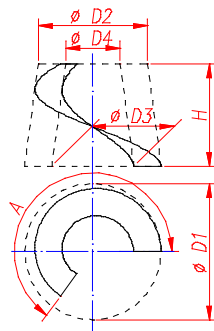
2D profiles - Free profile from 2D curve



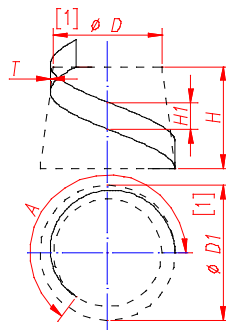
Helix - 360°



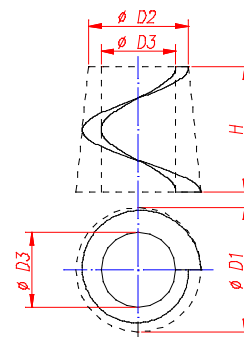
Helix - BiConical – Angle



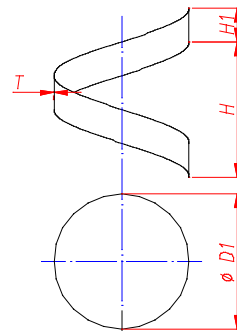
Helix Lateral - Conical – Angle



Helix - Conical - 360°

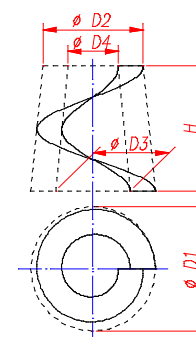


Helix Lateral - Cylinder - 360°

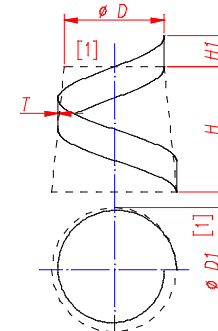


[reserved]

Helix - BiConical - 360°



Helix Lateral - Conical - 360°



[reserved]

**Warning:** Helixes are **NOT** developable surfaces. Please contact us for an enhanced version of these developments.



## Entities drawn for each pattern

After all parameter are input, THE PROGRAM draws the 3D entity, the 2D unfolded mesh, the 2D contour of the unfolded mesh, and/or the 2D contour with groove seam allowance, and/or text insertions for angles and approximate radius of the unfolded mesh, according to your LITIO2 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.**

## Patterns not available in TRIAL mode

The following patterns are drawn as virtual objects in TRIAL mode:

- Free pattern from two 3D curves
- 2D Free profile from 2D curve
- Trim 3D of 2 3D objects
- Bend - Conical - N parts
- Y [bifurcation] with intermediate part - Circle
- Y [bifurcation] - Rectangular [fillet] Cylinder
- Cone to Cylinder Y [bifurcation]
- Cone to Cone Y [bifurcation]
- Cylinder to Cone Y [bifurcation]
- Triple Y [trifurcation] - Circle to Circle [3 Cones] - Non parallel
- Triple Y [trifurcation] - Aligned - [3 Cones] - Non parallel
- Helix - Biconical - 360°
- Helix - Biconical - Angle
- Helix Lateral - Conical - 360°
- Helix Lateral - Conical - Angle



**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, text insertions for bending radiuses and/or angles are omitted.

## Appload

Additionally to the loading method explained on page 7, THE PROGRAM can also be loaded by using the APPLOAD command. Just type the following on the command line:

**\_appload**↵

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

