Hull Manufacturing

Curved Plates

User Guide

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Curved Plates i

1 Generation of Jig Pillars

1.1 General

This module calculates information about Jig pillars for curved shell panels. See the figure below.

The pillars are located in the nodes of a fixed mesh i.e. their positions are predefined and their **heights** are calculated.

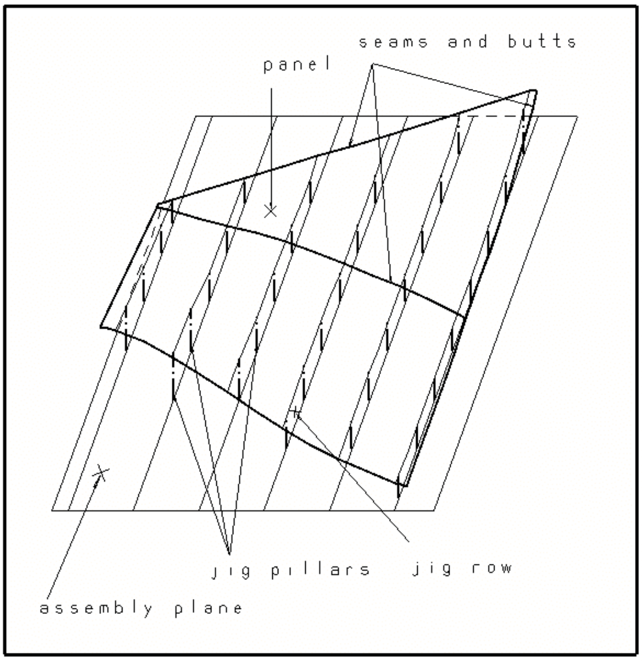


Figure 1:1. Overview.

Basic data for the calculations are normally curved panels stored in the data bank. It is, however, also possible to build up the curved panel by reference to its bounding seams.

The main results of the system are drawings and sketches of the curved panels supplied with jig information, listings of the calculated jig and a jig object, stored in the data bank.

Imperial units may be used. For information about imperial units, see *Basic Features and Concepts / Basic Features / Imperial Units* .

1.2 Environment Program

1.2.1 Set-Up in Job Launcher

The name of the executable of this module is sf824d. It communicates via an input file and resulting files. The program is normally activated through the Job Launcher (JL) where the following set-up is required:

Name recognised by JL: **JIG Pillars**

AVEVA Marine env. var.	JL set-up and explanation
SB_INPUT1	Input file to be set up with extension .dat in JL
SB_OUTPUT1	Output file with run-time information. To be set up in JL as first output file with extension .log
SB_OUTPUT2	Output file showing information about the positioning of the JIG pillars. To be set-up in JL as second output file with extension .lst

1.3 Control Information

AVEVA Marine environment variables:

SB_HREF The name of the hull reference object is fetched from this variable

SB_YARD The name of the yard to occur in listings.

IP's for this program can be given in an ordinary ASCII file with the fixed name **jigpillar.ip**, residing on the directory assigned to the environment variable SB_SHIP.

The following list shows all possible default parameters.

```
[AUTOMATIC_ASSEMBLY_PLANE, <ass_plane_def>,]
[CURVENET,]
[DIST_BETWEEN_JIG_ROWS, <distance>,]
[DIST_FIRST_PILLAR, <distance>,]
[DIST_TO_FIRST_JIG_ROW, <distance>,]
[ENGLISH,]
[FIGBELOW,]
[FRENCH,]
[GERMAN,]
[JIGRADIUS, <radius>,]
[MEASURES,]
[MIN_HEIGHT, <height>,]
[NOPILLHEIGHT,]
[NOSEAMPILLHEIGHT,]
[PILLARCLOSE,]
```

```
[PILLARDISTANCE, <distance>,]
[PILLARID,]
[SCALEU, <u_scale>,]
[SCALEV, <v_scale>,]
[SEAMFRTABLE,]
[SEAMPILLARS,]
[SWEDISH,]
[TEXTHEIGHT, <text_height>,]
[TRUE_SURFACE,]
```

Explanation of the parameters:

AUTOMATIC_ASSEMBLY_PLANE, <ass_plane_def>,
By this ip the method for calculating the assembly plane can be affected. <ass_plane_def> must be set to either CORNER or MIDPOINT. If set to CORNER, the assembly plane will be calculated so that the corner points of the panel will be as horizontal as possible. If set to MIDPOINT, the assembly plane will be calculated so that the mid-points of the boundary seams of the panel are as horizontal as possible. If the ip is not given, CORNER is assumed.

CURVENET,
If this ip is entered, then jigcurves will be created along the lines 1, 2, 3 ... etc. as well as along the rows A, B, C ... etc.. All curves are stored in the jig object.

DIST_BETWEEN_JIG_ROWS, <dist_between>,
If this ip is given, <dist_between> defines the distance between the different jig rows. If the ip is not given, 1000 mm is assumed.

DIST_FIRST_PILLAR, <dist_first_pillar>,
If this ip is given, <dist_first_pillar> defines the distance from the x-axis to the first jig pillar within the different jig rows. If the ip is not given, 250 mm is assumed. The distance between the different jig pillars in a row is defined by the ip PILLARDISTANCE, see below.

DIST_TO_FIRST_JIG_ROW, <dist_to_first>,
If this ip is given, <dist_to_first> defines the distance to the first jig row from the y-axis. If the ip is missing, 250 mm is assumed. See also Input below.

ENGLISH,
If this ip is given, the resulting list and sketches are in English. If no language ip is given, English will be used.

FIGBELOW,
If this ip is given, the pillar heights are drawn below the cross mark indicating a pillar instead of to the right.

FRENCH,
If this ip is given the output is in French.

GERMAN,
If this ip is given the output is in German.

JIGRADIUS, <radius>,
<radius> denotes the jig pillar top radius. This will affect the calculated height the pillar.

MEASURES,

If this ip is given, the distances between the panel corners and the closest jig pillars are output in the jig plan sketch.

MIN_HEIGHT, <height>,

If this ip is given, <height> defines the minimum distance between the assembly plane and the panel. If the ip is not given, 1000 mm is assumed.

NOPILLHEIGHT,

If this ip is given, the jig pillar heights will not be drawn in the jig plan sketch.

NOSEAMPILLHEIGHT,

If this ip is given, the jig pillar heights at seams will not be drawn in the jig pillar sketch.

PILLARCLOSE,

If this ip is given together with the ip SEAMFRTABLE, tables are created for each frame intersecting the panel. The tables contain the pillars that are closest to the intersection points between the frame and the seams.

PILLARDISTANCE, <distance>,

<distance> denotes the distance between the jig pillars within each row. If the ip is not given, then <distance> will be set to 1000 mm by the program.

PILLARID,

If this ip is given, the jig pillar identifications are drawn.

SCALEU, <u_scale>,

If this ip is given, <u_scale> is a factor for the u-values in the jig row drawings. All coordinates, arrow heights and positioning of texts will be multiplied by the factor. If the ip is missing, the value 1.0 is assumed.

SCALEV, <v_scale>,

Same as SCALEU above but for the v-values. However, the text height will not be affected.

SEAMFRTABLE,

If this ip is given, a table with information about intersections between frames and seams is output.

SEAMPILLARS,

This ip tells the program to calculate jig pillars in the intersection points between the jig rows and the seams.

SWEDISH,

If this ip is given output will be in Swedish.

TEXTHEIGHT, <text_height>,

This ip defines, the text height in the jig plan sketch. If not given, the text height will be 2.5 mm.

TRUE_SURFACE,

If this ip is given, the jig calculation takes into account the actual plate thickness of a curved panel when creating the JIG row curves. Input to the program must be an existing curved panel.

The following ip´s have been added for a certain customer.

```
[INCDIST, <distance>,]
[LIMITANGLE_A, <min.angle>, <max.angle>,]
```

```
[LIMITANGLE_B, <min.angle>, <max.angle>,]
[LIMITANGLE_C, <min.angle>, <max.angle>,]
[REFERENCEROW, <row_number>,]
[TRANSANGLE, <angle>,]
[TRANSVERSEDIST, <distance>,]
```

The meaning of these parameters are:

INCDIST, <distance>,

This ip is valid only when a certain seam has been selected to be as horizontal as possible. Points on that seam are calculated at the horizontal length <distance> from its two end points. Tangents of the seam are evaluated in the two calculated points and the curved panel will then be tilted around the y-axis to become as parallel as possible to the assembly plane. The default value for <distance> is 1000 mm.

LIMITANGLE_A, <min.angle>, <max.angle>,

LIMITANGLE_B, <min.angle>, <max.angle>,

LIMITANGLE_C, <min.angle>, <max.angle>,

By these three ip's, different tilting case conditions may be defined. <min.angle> is the limit angle for the first end-point of the seam for the "cases" A, B and C, respectively. <max.angle> is the limit angle of the second end point for the cases.

Default values.

Case A:	0, 3
Case B:	-1,3
Case C:	-1, 4
Case D:	No special tilting

The program will try to tilt the curved panel, so that the calculated tangents (see above) both are within the angle interval (relative to the workshop floor). First try is made with case A, then B and C. If none of the conditions A-C can be fulfilled, then the "normal" tilting will be accepted (Case D).

E.g. to be accepted as a case A, the panel will be tilted so that the tangent in the first point is horizontal and the tangent in the second point rises less than 3 degrees relative to the floor.

The resulting case is printed (with angles for A, B and C) in the list file.

REFERENCEROW, <row_number>,

The panel will be positioned so that the selected seam is positioned between the jig pillar rows (parallel to the x-axis) with order number <row_number> and <row_number> +1.

TRANSANGLE, <angle>,

<angle> defines the maximum allowable transverse inclination at the ends of the selected seam. The transverse inclinations are checked at the intersection point between the seam and jig row A and between the seam and the last jig row. If necessary, the tilting is adjusted to be within the given angle tolerance. If the condition cannot be fulfilled, then no adjustment will take place. The default value of <angle> is 12 degrees.

`TRANSVERSEDIST, <distance>,`

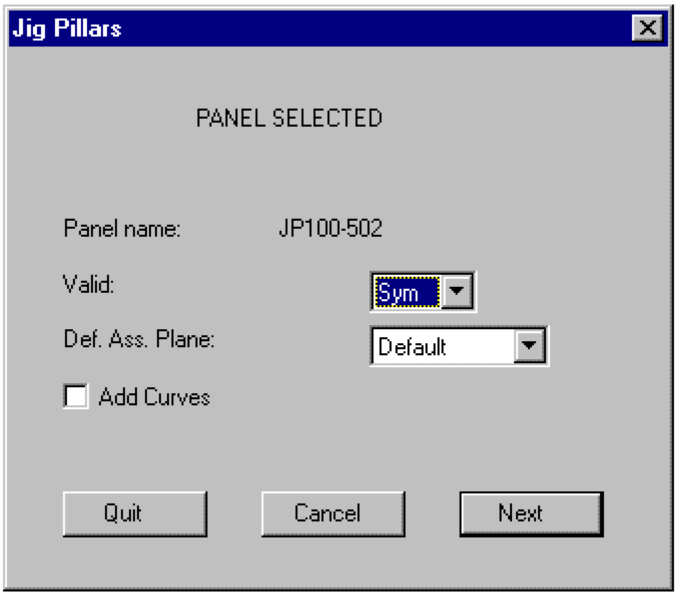
Points are calculated on jig row A at the horizontal length <distance> in both directions from the intersection point with the selected seam. The angles between lines through these points and the intersection point and the horizontal plane are calculated, and these are the angles checked against the TRANSANGLE condition above. Default value for <distance> is 500 mm.

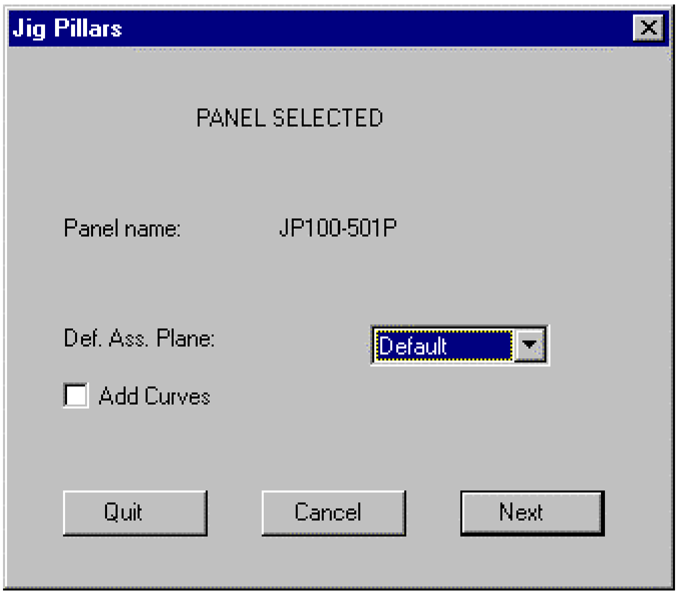
1.4 Input

Input to this module is based on the general selection tool. Input is normally generated automatically when activating the jig module through any of the interactive hull applications via a production program interface. This interface and the selection possibilities are described in *Manufacturing, General About the Production Program Interface.*

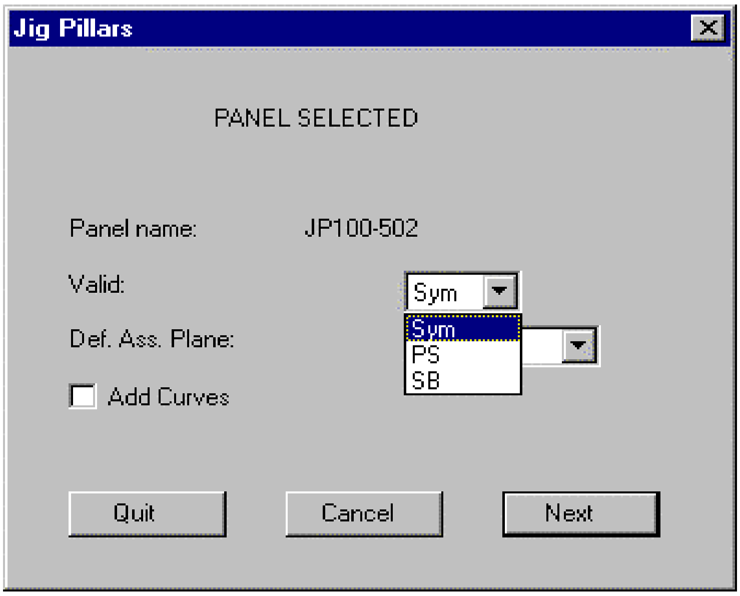
If a curved panel has been selected (if many, only the first one will be taken care of), jig pillar information will be calculated for that panel. If no curved panel has been selected, the user is guided to build up a curved panel by picking its bounding seams.

In case of an existing panel, one of the following two forms will be displayed:



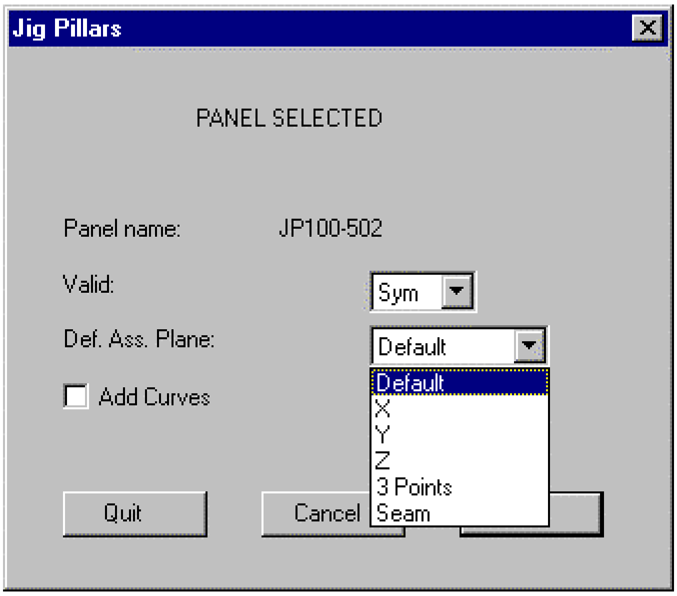


The difference is the Valid field that will be displayed only for symmetrical curved panels, i.e. panels with one portside and one starboard image. The contents of the Valid field are shown below:



If *Sym* is chosen, the jig pillars are calculated on the portside of the ship and the resulting jig object will get the suffix "-JIG". *PS* means that the calculation is performed on the portside image of the curved panel and *SB* means that the calculation is performed on the starboard image of the curved panel. The suffix will be "-JIGP" and "-JIGS", respectively.

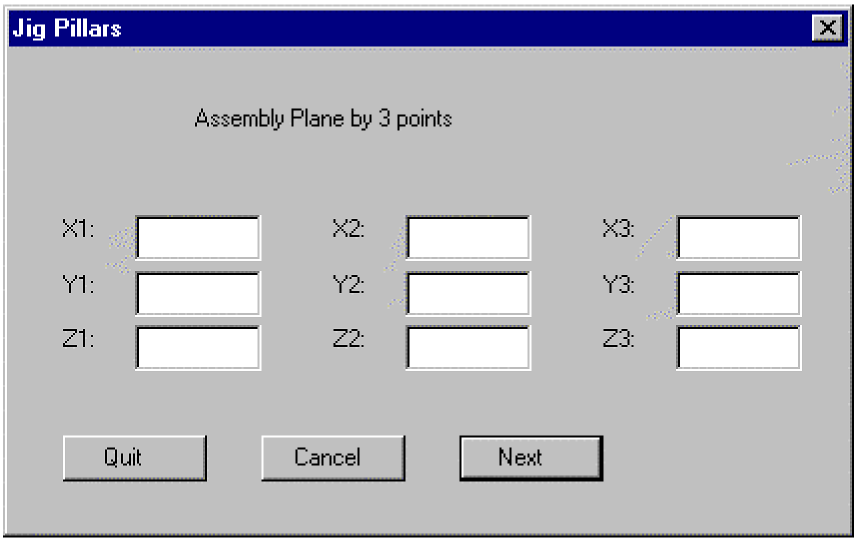
The Def. Ass. Plane enables the user to control the way of defining the assembly plane.



Default means that the assembly plane is calculated as defined by the ip AUTOMATIC_ASSEMBLY_PLANE, i.e. either by the corner points of the panel or by the midpoints of the boundary seams.

X means that the assembly plane will be parallel to a frame plane, *Y* that the assembly plane will be parallel to a buttock plane and *Z* that the assembly plane will be parallel to a waterline plane.

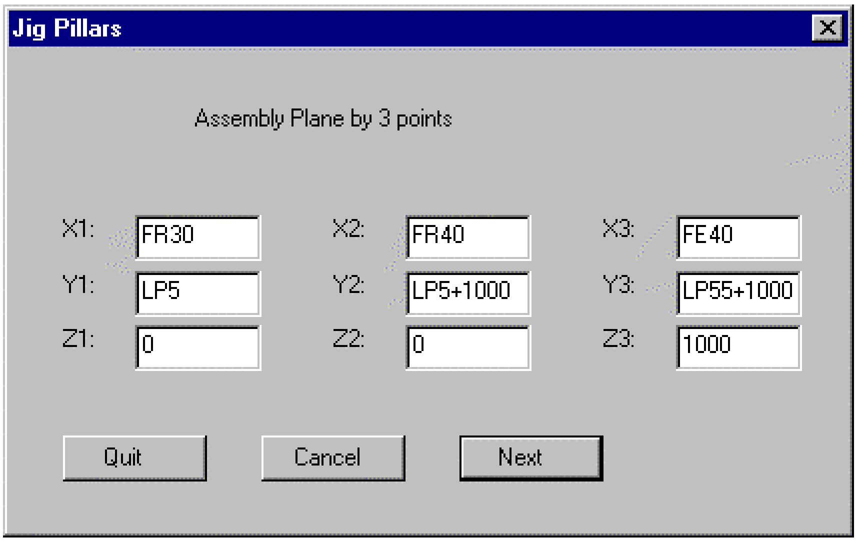
3 Points requires the user to give three points that define the assembly plane together. The points must not be co-linear. By selecting 3 Points followed by **Next** or **Return**, the following form will be displayed.



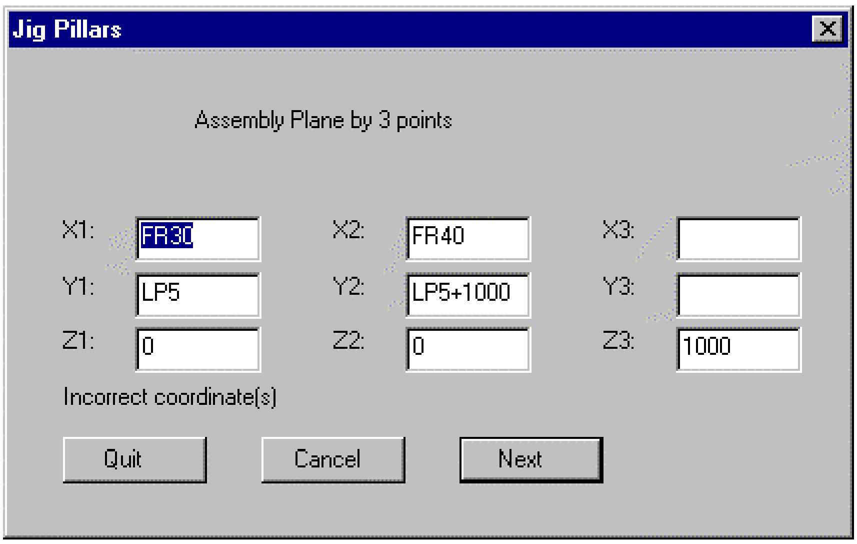
In the X-fields frame terms are accepted as well as LP-terms in the Y- and Z-fields. By filling in the different coordinate fields followed by **Next** or **Return**, the program controls the validity of the given terms. If a term is given incorrect, an error message is issued and the form is displayed with the correct terms displayed while the incorrect fields are empty.

Example:

The form is filled in by the user as shown below:



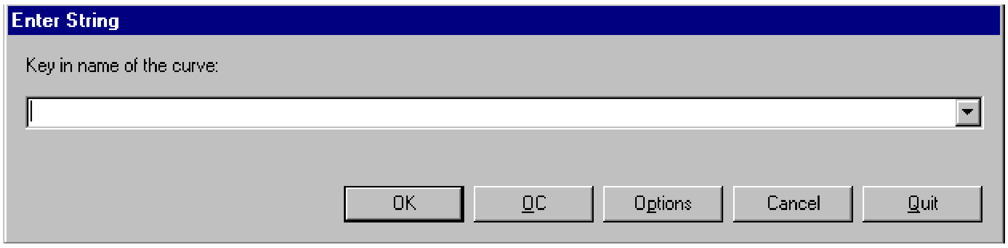
The input form will then be returned with the following contents.



The fields for X3 and Y3 are blank because of incorrectly given terms, (FE instead of FR for the X-value and an invalid long position reference). When valid terms have been given for these two fields, followed by Next or Return, the program proceeds.

If the user selects Seam in the assembly plane definition field, the program outputs the following message to the user: "Indicate seam for assembly plane decision". The user can either indicate an existing seam in a current drawing or, by choosing Options, key in the total name of the seam manually, see picture below.

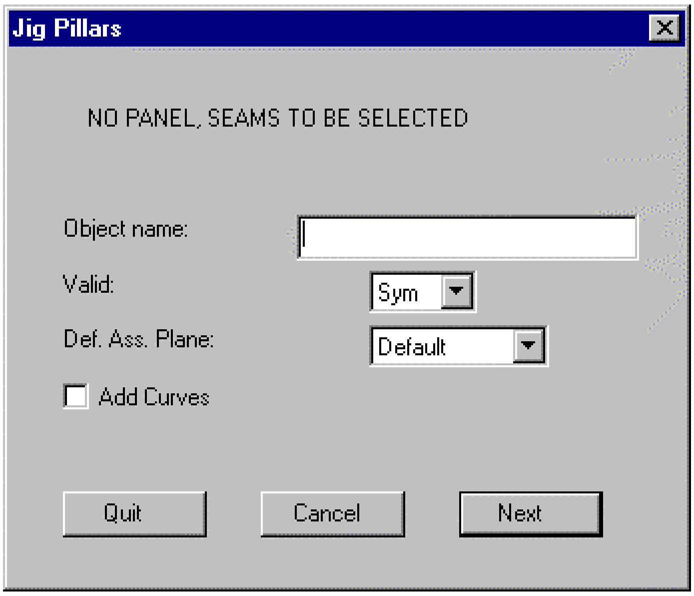
.



In this case the curved panel is tilted the same way as in the Default option and then tilted in a way so that the referenced seam becomes as horizontal as possible. This is a very specific feature normally used for two-plates panels only.

The given seam must be an *internal seam* of the curved panel.

If no curved panel has been selected, the following form is displayed to assist in building up a curved panel by references to its bounding seams.



The user should enter the name of the panel to be created. The name of the resulting jig object will be this name followed by "-JIG" (or "-JIGP" or "-JIGS" depending on the validity choice). When pressing the **Next** or **Return** button, the message "Indicate seam to define the panel part (must be given counter-clockwise)" appears. The user can either indicate existing seams in a current drawing or, by choosing **Options**, manually key in the total name of the seams (as described above). These seams should form the outer counter of the panel.

There is also a check button marked **Add Curves**. Normally, this button should only be used for non-panel input to indicate inner seams of the panel. If activated, the user will be prompted by the message "Indicate additional seam". The user can either indicate an existing seam in a current drawing or, by choosing **Options**, manually key in the total name of the seam. The definition of inner seams is completed by Operation Complete or **Return**. For existing curved panels this option is normally not used because the inner seams defined in the panel are automatically included in the jig object.

The next step is to define the seam that will be the base for the positioning of the jig rows. The message "Indicate seam parallel to y-axis" appears and the seam is picked as described above, either by indicating an existing seam in a current drawing or, by choosing Options and keying in the total name of the seam.

The plane of each jig row will be calculated in the following way:

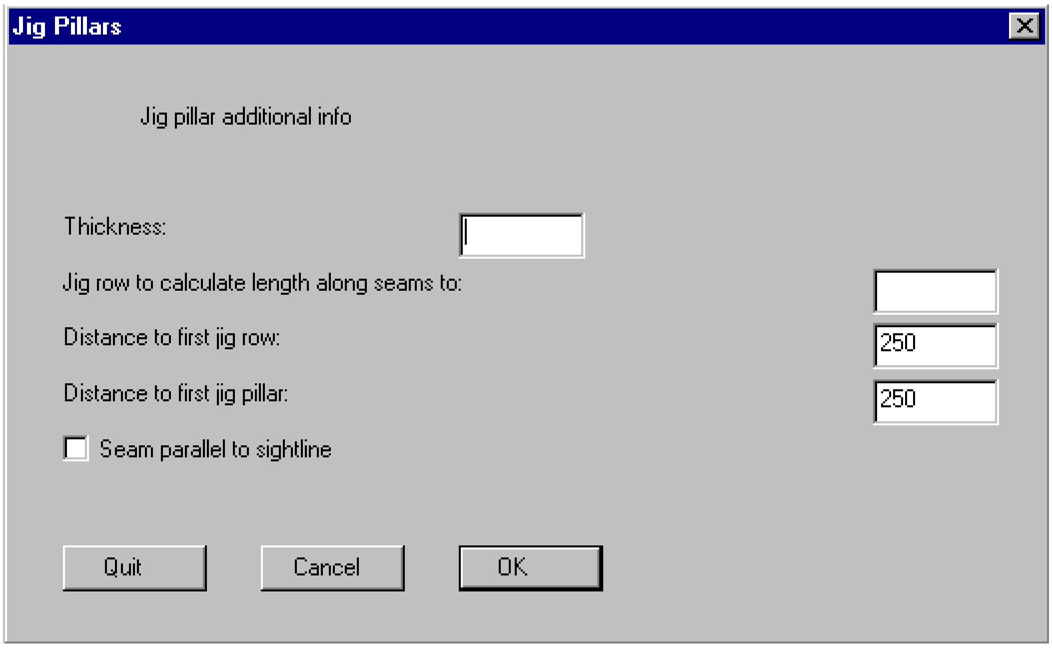
- It is perpendicular to the assembly plane
- It is parallel to the intersection line between the assembly plane and a frame plane (if the selected seam is a butt) or a waterline plane (if the selected seam is a longitudinal seam).
- It touches the selected seam in its utmost point.

The intersection between this plane and the assembly plane defines the "direction line" (= the y-axis). The position of the jig rows are measured from this line as controlled by the ip's DIST_TO_FIRST_JIG_ROW and DIST_BETWEEN_JIG_ROWS.

The next step is to define the seam from which contour lengths along the inner seams to a certain jig row will be calculated. The message "Indicate seam from which distances will be calculated" will be issued and the seam is selected as described for other seam selections (normally the same seam that is used to position the jig, see above).

The final step is to define a thickness of the plate and the designation (A to Z) of the jig row to which contour lengths along inner seams should be calculated (the distances will be measured from the seam defined prior to this step).

Furthermore, the distance to the first jig row and the distance to the first pillar within each jig row will be possible to change (the default values given via the ip file jigpillar.ip are given in the form). The following form will occur on the screen:



The thickness is an average thickness of the plate that will be used if the ip TRUE_SURFACE has not been given. For built-up objects the given thickness will always be used.

Quit will terminate the current jig pillar session, **Cancel** will go back one step in the definition process and **OK** will continue the process.

If the check button marked **Seam parallel to sightline** has been activated, the user will be prompted the message "Indicate seam to be parallel to the sightline". The seam is selected as described for other seam selection and the assembly plane will be rotated around the normal of the plane so that the selected seam will be parallel to the sightline. The seam must be an inner seam to the panel (or an added curve, see above).

On selecting **OK**, an input scheme is created and the file is assigned to the program via the logical variable SB_INPUT1. The layout and contents of the file are explained in the following paragraph.

1.5 Input Language of Jig Pillar Module

1.5.1 General

This appendix describes the input language of the jig pillar module (program sf824d) in case the logical name SB_INPUT1 has been defined. The input is based on the TIL input format.

1.5.2 Statement Types

The input language contains the following different statement types:

`PANEL`	The `PANEL` statement picks an existing curved panel for which jig pillars should be calculated.
`PANEL_NAME`	The `PANEL_NAME` statement defines the name of a panel to be established for which jig pillars should be calculated. The panel must be defined by references to its bounding seams.
`SEAM`	The `SEAM` statement defines the boundary seams of the panel created in a `PANEL_NAME` statement.
`VALID`	The `VALID` statement defines a specific portside or starboard image of a symmetric curved panel.
`ADD_SEAM`	The `ADD_SEAM` statement defines (extra) inner seams to be included in the panel.
`ASSEMBLY_PLANE`	The `ASSEMBLY_PLANE` statement defines the way the assembly plane should be calculated.
`JIG_PLANE_POSITION`	The `JIG_PLANE_POSITION` statement defines how the JIG rows should be oriented and the final position of the assembly plane.

1.5.3 Scheme Layout

The different statement types may occur in an arbitrary order in the input file. One, and only one, of either the `PANEL` or `PANEL_NAME` statements should be given. In case of a `PANEL_NAME` statement, there must be additional `SEAM` statements. The `VALID`, `ADD_SEAM` and `ASSEMBLY_PLANE` statements are optional but `JIG_PLANE_POSITION` must be given.

1.5.4 Statement Syntax

Below, the complete syntax of each statement type is described.

- **PANEL Statement**

```
PANEL, '<name of curved panel>';
```

`<name of curved panel>` is the name of an existing curved panel for which jig pillars should be calculated.

- **PANEL_NAME Statement**

```
PANEL_NAME, '<name of curved object>';
```

`<name of curved object>` is an arbitrary name of a panel that will be established by the program. When its boundaries have been defined by the `SEAM` statements, it will be used in the same way as an existing curved panel selected by a `PANEL` statement.

- **SEAM Statement**

```
SEAM, <boundary number> / NAME = '<seam name>';
```

`<boundary number>` is a number in the range 1 to 12 and denotes the order number of the boundary of the panel to be created. The seams must be given in clockwise order (looking outwards from the inside of the surface).

`<seam name>` is the name of the seam for the given boundary `<boundary number>`.

- **VALID Statement**

```
VALID        ( /PS | /SB );
```

This statement enables the user to select if the calculation should be performed on the portside (PS) or starboard (SB) side only.

- **ASSEMBLY_PLANE Statement**

```
                  /X
                  /Y
                  /Z
ASSEMBLY_PLANE    /POINTS   =    '<coord_x1>',  '<coord_y1>',
{                 (              '<coord_z1>',  };
                                 '<coord_x2>',  '<coord_y2>',
                                 '<coord_z2>',
                                 '<coord_x3>',  '<coord_y3>',
                                 '<coord_z3>')
                  /SEAM   =   '<seam name>'
```

This statement is optional and may be used to define the location of the assembly plane. If not given, the assembly plane will be calculated automatically by minimising the height of the corners (or edge midpoints) relative to the workshop floor.

X denotes that the normal vector of the assembly plane should be parallel to the x-axis, Y denotes that the normal vector of the assembly plane should be parallel to the y-axis. Z denotes that the normal vector of the assembly plane should be parallel to the z-axis.

POINTS is used to define the assembly plane via three different points. The points must not be co-linear. Frame terms are accepted as x-coordinates, e.g. FR23-600, and references to longitudinal positions are accepted as y- and z-coordinates, e.g. LP5+200.

SEAM means that the panel will be tilted automatically at first (as if this statement had not been given!). The panel will then be tilted so that the seam will become as parallel as possible to the assembly plane. This is a very specific case and is normally used for two-plates panels only.

1.5.5 ADD_SEAM Statement

```
ADD_SEAM, '<seam name>';
```

`<seam name>` is a name of a seam in the shell that will be included as inner seams in the jig object (Normally only given together with the `PANEL_NAME` statement). For ordinary panels the inner seams are already part of the generated panel.

1.5.6 JIG_PLANE_POSITION Statement

```
JIG_PLANE_POSITION     / SEAM = '<seam name>'
                       / THICKNESS = <thickness>
                       / DIST_FROM_SEAM = '<seam name2>'
                       / DIST_TO_ROW = '<row>'
                       [/ SEAM_PARALLEL_SIGHTLINE = <seam name3>]
                       / DISTANCE_FIRST_ROW = <distance to first row>
                       / DISTANCE_FIRST_PILLAR = <distance to first pillar>;
```

`<seam name>`

is the name of the seam "parallel" to which the jig rows are set.

`<thickness>`

is the mean thickness of the plates in the jig object.

`<seam name2>`

is the name of the seam from which contour lengths along inner seams to the denoted jig row will be calculated.

`<row>`

is the name of the jig row to which contour lengths along inner seams (from `<seam_name 2>`) should be calculated, e.g. A.

`<seam name3>`

is the name of the seam to be parallel to the sightline.

`<distance to first row>`

is the distance from the direction line to the first jig row.

`<distance to first pillar>`

is the distance within each jig row to the first jig pillar.

1.6 Result

1.6.1 General

The resulting information consists of:

- Jig object stored in the data bank. An existing panel will be updated as well.
- Lists.
- Drawings.

Further details are given below.

The positions of the jig rows are calculated as follows:

1. Intersect the assembly plane with a frame or waterline plane (depending on the selected direction seam).
2. Calculate a plane parallel to the intersection line defined by the `JIG_PLANE_POSITION` statement and perpendicular to the assembly plane. The plane should touch the utmost point of the given seam.
3. The intersection line between this plane and the assembly plane is defined as the *direction line* (=y-axis of the jig coordinate system).
4. Calculate a new plane perpendicular both to the assembly plane and the direction line (y-axis).
5. Let this plane touch the curved panel so that its intersection with the assembly plane, defined as the *sight line*, forms a coordinate system together with the direction line. Make the sight line the x-axis. Make the direction line the y-axis, and place the curved panel in the first quadrant.

The jig rows are parallel to the direction line (y-axis).

The jig row closest to the direction line (= the y-axis) is jig row A, the next one B, etcetera.

The first jig row will be positioned at the distance given by the ip `DIST_TO_FIRST_JIG_ROW` from the y-axis. The first jig pillar in a jig row will be positioned according to the ip `DIST_FIRST_PILLAR`. The jig pillars of a jig row will have the standard partition as given by the ip `PILLARDISTANCE`. The partition between the jig rows is given by the ip `DIST_BETWEEN_JIG_ROWS`. The minimum jig pillar height is given by the ip `MINPILLARHEIGHT`.

The jig pillars in a jig row are numbered 1, 2, 3, ... etc., according to the order in which they appear in from the sight line (= the x-axis). The name of a pillar is a combination of the jig row name and the order of the pillar within the row. For example, the third pillar in row B gets the name B3.

1.6.2 Data Bank

A jig object will be established with a name formed by adding -JIG (or -JIGP or -JIGS, depending on the VALID statement) to the name of the curved panel. The object will first contain a preliminary assembly plane (in attribute 207), passing through the lowest point of the curved panel and information about inner seams of the panel.

The jig object will be supplied with information about the jig rows and the position of the jig pillars. The assembly plane will get its final position from the distance between the plane and the lowest point of the curved panel, given in by the ip `MIN_HEIGHT`.

1.6.3 Listing

Examples of listings are given in *Example of Lists in Chapter Bending Templates for Shell Plates*.

The heading of every page contains:

- The name of the yard.
- The program name.
- The running date and time.
- The page number.
- The name of the jig object.

The listing consists of:

- The position of the jig pillars in the jig rows.
- The height over the assembly plane for the end points of the jig curves.
- The distance from the direction line/ sight line to the jig rows.
- The position of the corners of the curved panel.
- Contour length along seams from a given boundary seam to a given JIG row.
- The angles between the assembly plane and the frame and waterline planes.
- Errors and other messages.

The different lists are explained below. See also the listing in *Flexible Templates*.

1. Pillar heights and positions

The table Position And Height of JIG Pillars contains positions of the jig pillars. The columns have the following contents.

Jig No
: The numbers of the jig pillars in the order of increasing distances from the x-axis.

Jigrow<jr>
: <jr> denotes the jig row designation, A, B, ...

Dist
: Distances to the jig pillars from the y-axis. Distances to pillars under seams are surrounded by asterisks.

Height/ang
: Heights of jig pillars and inclination angles of the jig curve at the denoted jig pillar.

The following three formats are possible:

- <height>
- <height>/<v>
- <height>/<v1> /<v2>

<height> is the height of the jig pillar. If the corresponding distance is surrounded by asterisks, it denotes the height at a seam.

<v> occurs only for jig pillars at seams and denotes the inclination angle of the jig curve in the direction of the y-axis line and relative to the workshop floor.

If there is a knuckle at the seam, the inclination angles before and after the seam are output as <v1> and <v2>, respectively.

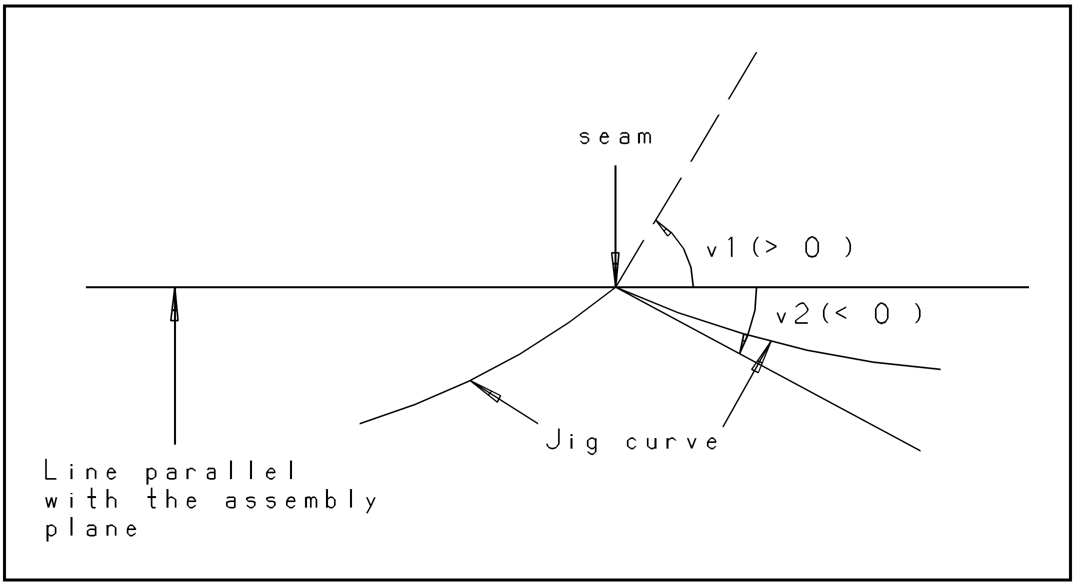


Figure 1:2. Angles for pillar at a seam.

A maximum of 5 jig rows can be listed in the same table. If there are more than 5 jig rows, the table must be repeated the required number of times.

2. Sum up table

The total number of jig pillars is listed in a table with the heading Summary Table of JIG Pillars.

3. JIG row positions

The distances from the y-axis to the jig rows are given in tables with the heading Distance from the Direction Line to the Jig Rows. Each jig row is identified by its name (A, B, ...).

4. Heights at the edges

Height of Edges for the Jig Rows is the heading of the table, containing the height above the assembly plane of the end points of the jig curves. Its format is described below.

Edge1	The height over the assembly plane of the end of the jig curve closest to the x-axis.
Edge2	The height of the jig curve at the other end.

5. Distance from the sight line to the JIG row edges.

Distance from the Sight Line to the Edges of the Jigrows is the heading of the table containing the distances from the x-axis to the intersection points between the jig row and the edges of the panel. Its format is described below.

Edge1	The distance from the x-axis to the closest edge.
Edge2	The distance from the x-axis to the distant edge.

6. Corner positions and heights

The Corners of the Panel is the heading of a table containing the positions of the corners of the curved panel. The table should be interpreted as follows:

Corn No	The order number of the corners of the curved panel (see also the drawing example in *Normal Bending Templates*).
Dist From Direction Line	The distance from the direction line to the denoted corner (= the x-coordinate).
Dist From Sight Line	The distance from the sight line to the denoted corner (= the y-coordinate).
Height	The height over the assembly plane to the denoted corner (= the z-coordinate).

7. Distance from lowest seam to first and last JIG row.

The intersection points are calculated between the lowest seam and the first and last jig rows, respectively. The distances are calculated from the leftmost and rightmost edges, respectively, to these points along the inner seams.

8. Distance to the lowest seam

Distance to the Lowest Seam <*seamno*>*:* is the heading of a table, containing three rows. The heading of the first row is Along Jig Row: and it contains the jig row designations A, B, and so on. The heading of the second row is From Pillar: and contains the order number of the jig pillar from where the distance is calculated along the jig curve. This pillar is selected as the closest pillar on the side of the seam against the x-axis. The third line has the heading Distance: and contains the calculated distance.

9. Distance along seams from an edge to a jig row

Contour Length from Seam Number <Seam> to Jig Row <Jr> along Seam No. is the heading of the table to list contour lengths. <seam> and <jr> are given in the JIG_PLANE_POSITION statement by the keywords DIST_FROM_SEAM and DIST_TO_ROW. <seam> is the number of an edge seam, from which contour lengths are calculated, <jr> is the jig row to which they are calculated.

Seam No	The order numbers of inner seams along which the contour length is calculated.
Length	Contour length as described above.

If there are no inner seams from the boundary seam <seam> to the jig row <jr>, the list does not appear.

10. Table for erection of webs and platforms

Next follows a table with the angles between the assembly plane and frame/waterline planes.

Angle between frame plane and assembly plane

= <v11> (<v12>) Degrees <v13> (<v14>) Grads

Angle between waterline plane and assembly plane

= (v21> (<v22>) Degrees <v23> (<v24>) Grads

The angles are calculated on the aft or bottom (forward or top) side of the planes

<v11>	Angle between a frame plane and the assembly plane, given at the aft side of the frame plane. The unit is degrees.
<v12>	As <v11> but at the fore side of the frame plane. <v12> = 180 - <v11>.
<v13>	The same as <v11>, but the unit is grads. 1 grad = 0.9 degrees.
<v14>	The same as <v12>, but the unit is grads. <v14> = 200 - <v13>.
<v21>	Angle between a waterline plane and the assembly plane given at the bottom side of the waterline plane. The unit is degrees.
<v22>	As <v21>, but at the top side of the waterline plane. <v22> = 180 - <v21>.
<v23>, <v24>	The same as <13> and <14> but for <v21> and <v22>.

The last line explains what the angles are valid for (as explained above).

11. Messages

The final information on the list consists of errors and other messages listed, under the heading Messages.

1.6.4 Drawings

The program generates different kinds of drawings and sketches.

The drawings are automatically generated and will be stored on the databank assigned to SBH_PINJIG_DWG.

If this data bank is not assigned the software will try to store on the data bank assigned to SBH_RECEIPT. If so this data bank is not assigned, the standard drawing data bank (SB_PDB) will be used.

The first drawing supposes that a drawing form TB_JIGPILLAR should exist in the standard data bank, SBD_STD.

There is a standard method to tailor automatic drawings by so called "$-values", which are set in drawing forms. Some of these are replaced by texts, extracted from the information inserted into the drawing, others may be used to locate pictures. This technique is used also in the forms for jig sketches.

The list below shows the available $-texts and the corresponding variable to replace the $-text.

$1001	Name of the user that runs the program, given by SBB_USER_SIGNATURE.
$1002	Telephone number to the user that runs the program, given by SBB_USER_TELEPHONE.
$1006	The drawing scale.
$1007	Name of the drawing, i.e. JPIL_<job_number>_1(2).
$1008	Name of the jig object.
$1998	Indication of the lower left corner of the rectangular area for insertion of the jig plan sketch.
$1999	Indication of the upper right corner of the same area.

The $-texts 1998 and 1999 must be given while the others are optional.

The resulting sketch is a projection of the panel on the assembly plane and it is located in the first quadrant of the local coordinate system where the x-axis is the "sight line" and the y-axis the "direction line". Furthermore, the drawing contains:

- The name of the JIG object.
- The boundary seams with their numbers.
- Inner seams with their numbers.
- Orientation information about those of the edges, not located close to the coordinate axes.

Optional values are:

Top	-	top
Bot	-	bottom
Fore	-	fore
Aft	-	aft
PS	-	portside
SB	-	starboard

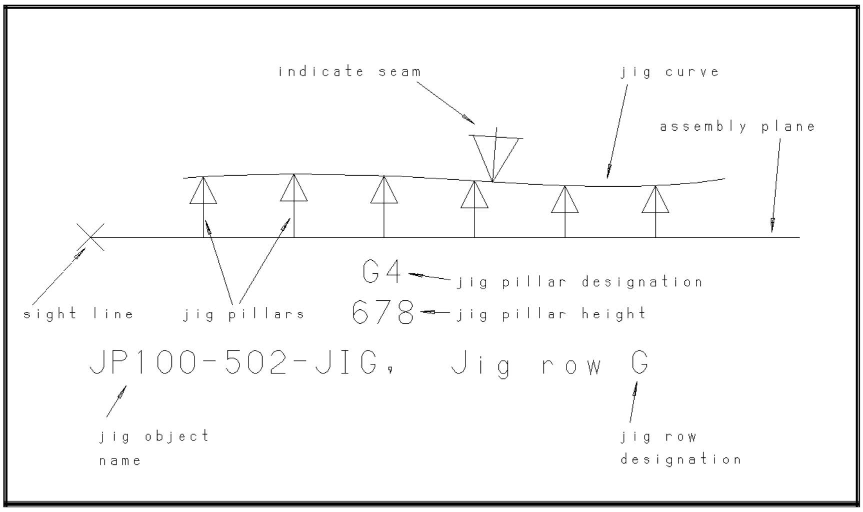
- The x-axis is identified by Sightline (X) and the y-axis by Directionline (Y).
- The corners of the panel are identified by their numbers surrounded by a circle.
- The jig row designations A, B, … are drawn below the x-axis.
- The jig pillar numbers are drawn to the left of the y-axis.
- Every calculated jig pillar will be marked on the drawing by a cross, X.
- The height of the jig pillars is by default drawn to the right of the jig pillar cross. The position may be placed below the cross in case the ip FIGBELOW has been given (except for the first jig pillar in each jig row where the height is drawn above the cross).

For an example of a resulting drawing, see *Normal Bending Templates*.

The second drawing will be named JPIL_<job_number>_2(2). It contains side views of all the jig rows in a plane perpendicular to the assembly plane and parallel to the y-axis.

Each side view contains:

- The name of the jig object and the designation of the jig row preceded by the name jig row.
- The assembly plane and a cross mark for the sight line (x-axis).
- The jig curve, that is the intersection curve between the panel and the plane of the jig row.
- The jig pillars marked by arrows. For every fourth jig pillar its designation and height will be drawn.
- The inner seams that intersect the jig curve.



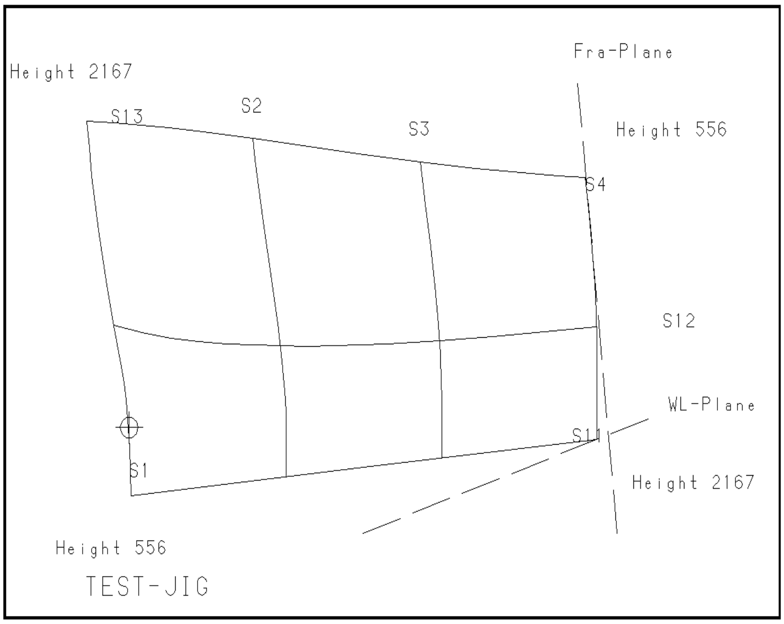
If the panel has been built up by input, i.e. via PANEL_NAME and SEAM statements, an additional sketch will be included in the second drawing. This sketch is in fact the result from the initial stage in the run. The sketch contains:

- The name of the jig object.
- The boundary seams with their numbers.
- Inner seams with their numbers.
- Heights over the assembly plane for the corners of the panel, identified by the word Height.
- Marking of the lowest point of the panel, identified by a certain symbol.
- The intersection line between the assembly plane and a frame plane (identified by Fra-Plane) and the intersection line between the assembly plane and a waterline plane (identified by WL-Plane).

The heights of the corners above the assembly plane are valid when the lowest point touches the assembly plane.

One of the intersection lines (or a line parallel to one of those on the opposite side of the panel) is then chosen as the direction line.

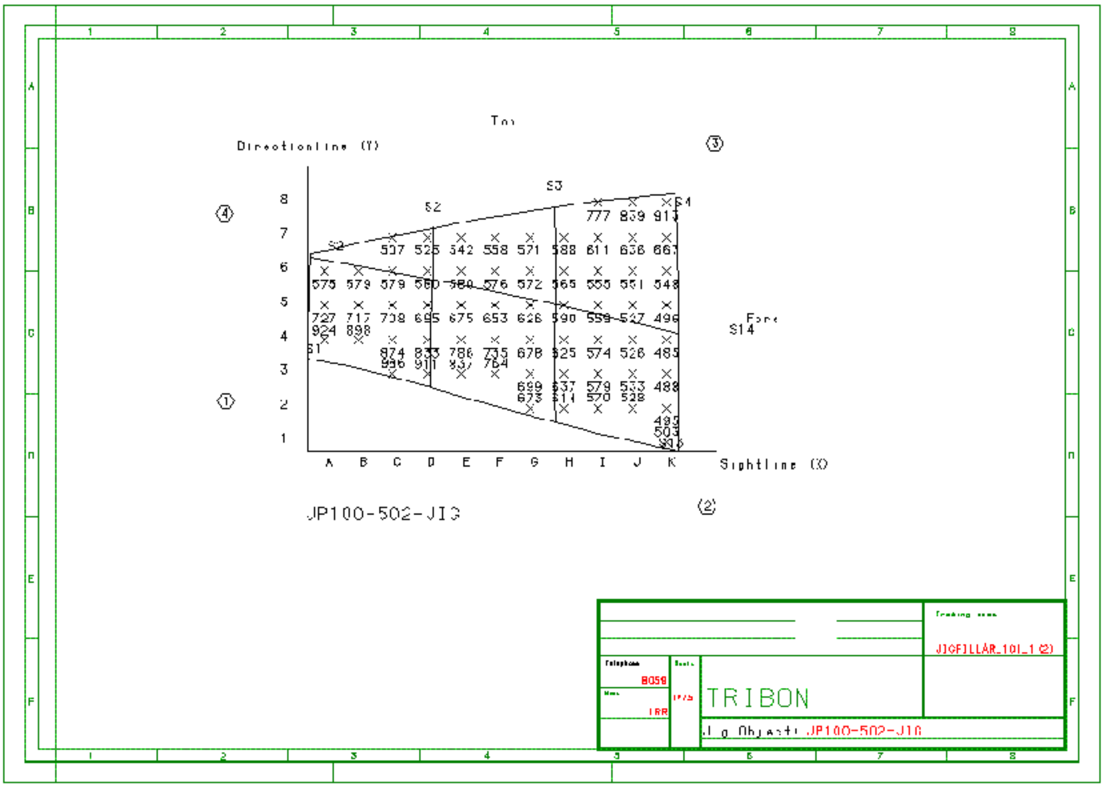
For an example of an additional sketch, please see below.



1.7 Example of an Input File for an Existing Panel

```
PANEL, 'JP100-502';
JIG_PLANE_POSITION /SEAM='JPS1'
          /THICKNESS=15.00
          /DIST_FROM_SEAM='JPS1'
          /DIST_TO_ROW='A';
```

1.8 Example of a Resulting Drawing



1.9 Example of a Resulting Listing

jigpillar_101b_n2.lst

Kockums Computer Systems AB   Jig Pillars

SF824D   Date: 99-11-17   Time: 15.51.34
Page 01

Jig Object: JP100-502-JIG

Designation:

Position and height of jig pillars

```
jigpillar_101b_n2.lst

Kockums Computer          Jig Pillars
Systems AB

SF824D                    Date: 99-11-   Time: 15.51.34
Page 01                   17

Jig Object: JP100-502-JIG

Designation:

Position and height of jig pillars
```

1.10 Example of an Input File for an Existing Panel

Example:

```
Kockums Computer Systems AB                                 Jig Pillars
SF824D                                                      Date:  99-11-18     Time: 11.44.27          Page  01

Jig Object:  JP100-502-JIG
Designation:

Position and height of jig pillars

-------------------------------------------------------------------------------------------------------------------
IJig I     Jigrow  A      I     Jigrow  B      I     Jigrow  C      I     Jigrow  D      I     Jigrow  E      IJig I
I No I  Dist  Height/AngI  Dist  Height/AngI  Dist  Height/AngI  Dist  Height/AngI  Dist  Height/AngI No I
+----+--------------------+--------------------+--------------------+--------------------+--------------------+----+
I  3 I     0 I     0      I     0 I     0      I  2250 I  986      I  2250 I  911      I  2250 I  837      I  3 I
I  4 I  3250 I  924       I  3250 I  898       I  3250 I  874      I  3250 I  833      I  3250 I  786      I  4 I
I  5 I  4250 I  727       I  4250 I  717       I  4250 I  708      I  4250 I  695      I  4250 I  675      I  5 I
I  6 I  5250 I  575       I  5250 I  579       I  5250 I  579      I  5250 I  580      I  5250 I  580      I  6 I
I  7 I     0 I     0      I     0 I     0      I  6250 I  507      I  6250 I  525      I  6250 I  542      I  7 I
-------------------------------------------------------------------------------------------------------------------

Kockums Computer Systems AB                                 Jig Pillars
SF824D                                                      Date:  99-11-18     Time: 11.44.27          Page  02

Jig Object:  JP100-502-JIG
Designation:

Position and height of jig pillars

-------------------------------------------------------------------------------------------------------------------
IJig I     Jigrow  F      I     Jigrow  G      I     Jigrow  H      I     Jigrow  I      I     Jigrow  J      IJig I
I No I  Dist  Height/AngI  Dist  Height/AngI  Dist  Height/AngI  Dist  Height/AngI  Dist  Height/AngI No I
+----+--------------------+--------------------+--------------------+--------------------+--------------------+----+
I  2 I     0 I     0      I  1250 I  673      I  1250 I  614      I  1250 I  570      I  1250 I  528      I  2 I
I  3 I  2250 I  764       I  2250 I  699      I  2250 I  637      I  2250 I  579      I  2250 I  533      I  3 I
I  4 I  3250 I  735       I  3250 I  678      I  3250 I  625      I  3250 I  574      I  3250 I  526      I  4 I
I  5 I  4250 I  653       I  4250 I  626      I  4250 I  590      I  4250 I  559      I  4250 I  527      I  5 I
I  6 I  5250 I  576       I  5250 I  572      I  5250 I  565      I  5250 I  555      I  5250 I  551      I  6 I
I  7 I  6250 I  558       I  6250 I  571      I  6250 I  588      I  6250 I  611      I  6250 I  636      I  7 I
I  8 I     0 I     0      I     0 I     0      I     0 I     0      I  7250 I  777      I  7250 I  839      I  8 I
-------------------------------------------------------------------------------------------------------------------
```

Example:

```
Kockums Computer Systems AB                          Jig Pillars
SF824D                                               Date:  99-11-18     Time: 11.44.27          Page  03

Jig Object:  JP100-502-JIG
Designation:

Position and height of jig pillars

----------------------------------------------------------------------------------------------------------
IJig I    Jigrow  K     I                  I                  I                  I                  IJig I
I No I  Dist  Height/AngI                  I                  I                  I                  I No I
!----!------------------!------------------!------------------!------------------!------------------!----!
I  1 I   250 I  503     I     0 I    0     I     0 I    0     I     0 I    0     I     0 I    0     I  1 I
I  2 I  1250 I  495     I     0 I    0     I     0 I    0     I     0 I    0     I     0 I    0     I  2 I
I  3 I  2250 I  488     I     0 I    0     I     0 I    0     I     0 I    0     I     0 I    0     I  3 I
I  4 I  3250 I  485     I     0 I    0     I     0 I    0     I     0 I    0     I     0 I    0     I  4 I
I  5 I  4250 I  496     I     0 I    0     I     0 I    0     I     0 I    0     I     0 I    0     I  5 I
I  6 I  5250 I  548     I     0 I    0     I     0 I    0     I     0 I    0     I     0 I    0     I  6 I
I  7 I  6250 I  667     I     0 I    0     I     0 I    0     I     0 I    0     I     0 I    0     I  7 I
I  8 I  7250 I  913     I     0 I    0     I     0 I    0     I     0 I    0     I     0 I    0     I  8 I
----------------------------------------------------------------------------------------------------------


Kockums Computer Systems AB                          Jig Pillars
SF824D                                               Date:  99-11-18     Time: 11.44.27          Page  04

Jig Object:  JP100-502-JIG
Designation:

Summary table of jig pillars

Total number of jig pillars:  60
```

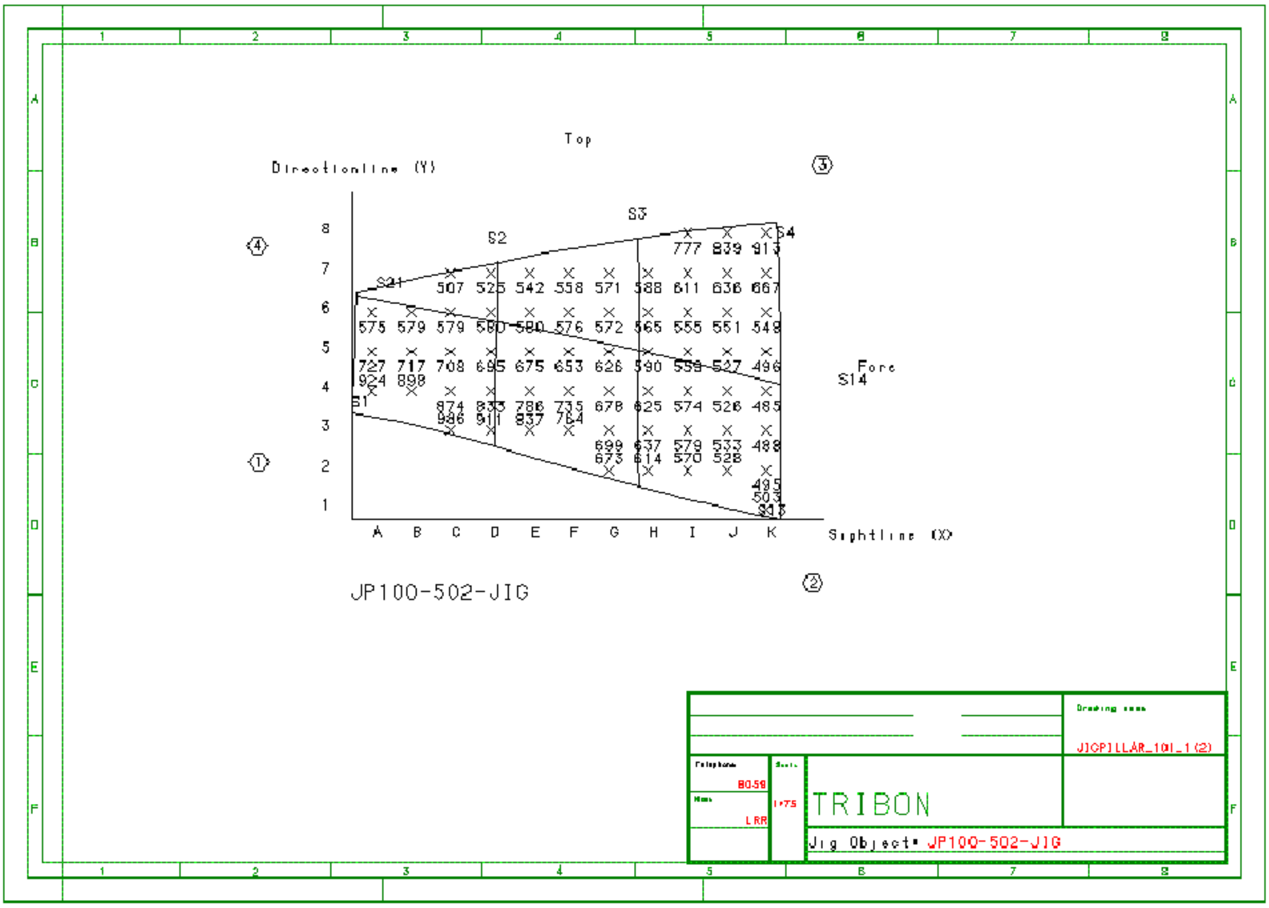
Example:

```
Kockums Computer Systems AB                                Jig Pillars
SF824D                                                     Date:  99-11-18      Time: 11.44.27           Page  05

Jig Object:  JP100-502-JIG
Designation:


Distance from the direction line to the jig rows

                 A     B     C     D     E     F     G     H     I     J     K

               500  1500  2500  3500  4500  5500  6500  7500  8500  9500 10500


Height of edges for the jig rows

                 A     B     C     D     E     F     G     H     I     J     K

Edge1         1060  1038   989   915   827   739   658   593   546   514   506
Edge2          504   500   507   524   552   593   645   711   795   898  1021


Distance from the sight line to the edges of the jig rows

                 A     B     C     D     E     F     G     H     I     J     K

Edge1         2619  2396  2149  1877  1591  1306  1026   763   515   281    70
Edge2         5836  6061  6275  6478  6670  6850  7017  7171  7307  7423  7520

Kockums Computer Systems AB                                Jig Pillars
SF824D                                                     Date:  99-11-18      Time: 11.44.27           Page  06

Jig Object:  JP100-502-JIG
Designation:

The corners of the panel

Corn  Dist from directionline  Dist from sightline  Height
 No            (X)                      (Y)           (Z)

  1              0                     2713          1038
  2          10861                       -1           494
  3          10744                     7541          1038
  4            118                     5747           494
```

Example:

```
Kockums Computer Systems AB                              Jig Pillars
SF824D                                                   Date:  99-11-18     Time: 11.44.27          Page  07

Jig Object:  JP100-502-JIG
Designation:


Distance from the intersection point between the lowest seam 14 and
the left edge to jig row  A    =   384 mm
the right edge to jig row  K    =   368 mm
measured perpendicular to the jig rows


Distances to the lowest seam 14:

Along jig row:    A    B    C    D    E    F    G    H    I    J    K

From pillar  :    6    6    5    5    5    5    5    4    4    4    4

Distance     :  344  168  991  803  609  409  201  977  746  507  268
Kockums Computer Systems AB                              Jig Pillars
SF824D                                                   Date:  99-11-18     Time: 11.44.27          Page  08

Jig Object:  JP100-502-JIG
Designation:


Contour length from seam number  1
to jigrow A along seam No

Seam  No   Length

      14      390


Angle between frame plane and assembly plane     =   77.790 (   102.210) Degrees    86.433 (  113.566) Grads

Angle between waterline plane and assembly plane =   45.177 (   134.823) Degrees    50.196 (  149.803) Grads

The angles are calculated on the aft or bottom (stem or top) side of the planes
Kockums Computer Systems AB                              Jig Pillars
SF824D                                                   Date:  99-11-18     Time: 11.44.27          Page  09

Jig Object:  JP100-502-JIG
Designation:


Messages
********

Jig object stored on DB
```

1.11 Example of a Resulting Drawing



Jig No	Jigrow A Dist	Jigrow A Height/Ang	Jigrow B Dist	Jigrow B Height/Ang	Jigrow C Dist	Jigrow C Height/Ang	Jigrow D Dist	Jigrow D Height/Ang	Jigrow E Dist	Jigrow E Height/Ang	Jig No
3	0	0	0	0	2250	986	2250	911	2250	837	3
4	3250	924	3250	898	3250	874	3250	833	3250	786	4
5	4250	727	4250	717	4250	708	4250	695	4250	675	5
6	5250	575	5250	579	5250	579	5250	580	5250	580	6
7	0	0	0	0	6250	507	6250	525	6250	542	7

1.11.1 Example of an Input File for an Existing Panel

```
PANEL, 'JP100-502';

JIG_PLANE_POSITION /SEAM='JPS1'

            /THICKNESS=15.00
            /DIST_FROM_SEAM='JPS1'
            /DIST_TO_ROW='A';
```

2 Plate Jigs

2.1 General

This module generates curved jigs which, when placed on the workshop floor, provide the necessary curved space surface, to which the curved shell plates will fit. The jigs are calculated, so that they will be vertically located on the floor, and so that the panel will be as horizontal as possible (see *Figure 2:1.: Overview.*) or placed according to the definition of the assembly plane via input.

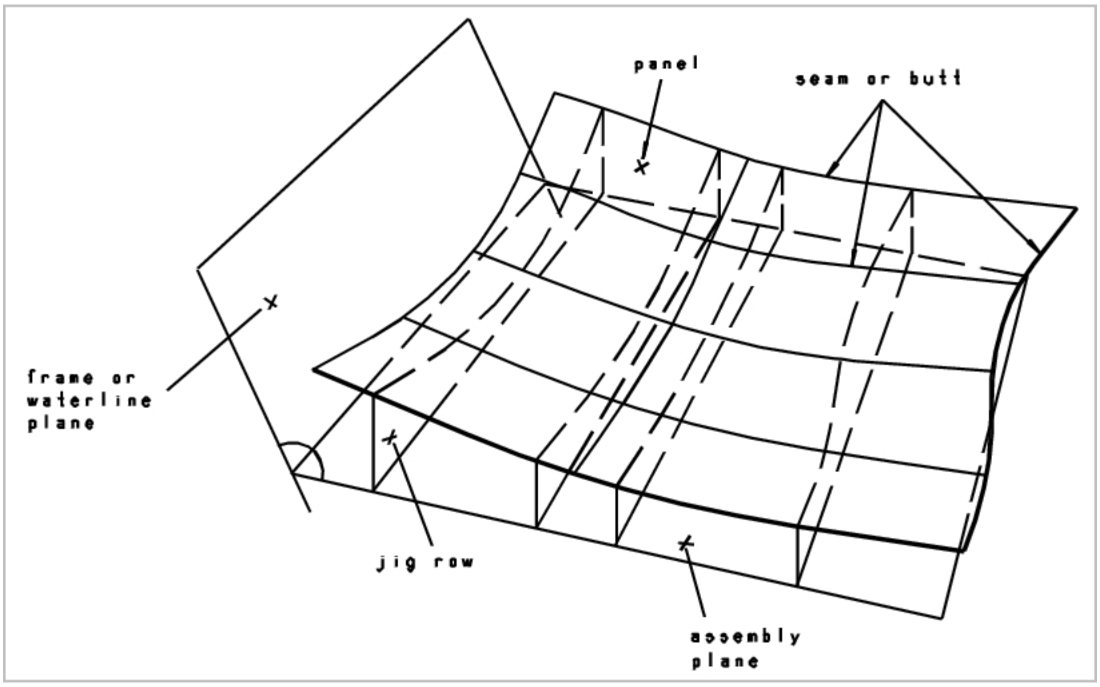


Figure 2:1. Overview.

Each jig row is named by adding a minus sign and a letter to the name of the panel, starting with A at the aft or bottom side of the panel. Each jig is named by adding a digit to the jig row name, starting with 1 at the bottom or stem side of the panel.

Each jig is calculated according to *Figure 2:2.: Side view of plate jig.* One is placed under each seam or butt apart from the first and last. The breadths of the jigs are given in the figure. The height of a jig is defined by the assembly plane and the contour of the panel, unless the height B or C or both are more than 1500 mm. In those cases the jig is cut off as sketched in the rightmost jig, where the vertical edges are 700 mm.

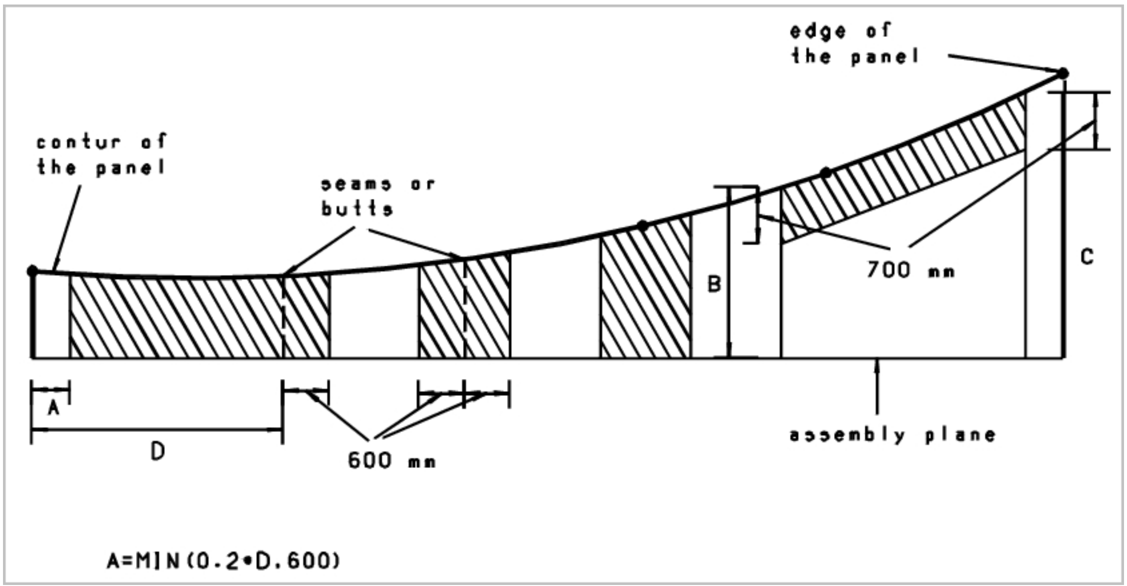


Figure 2:2. Side view of plate jig.

In each jig there is a circular cutout for the seam or the butt. The default radius is 75 mm and the central point lies on the seam or the butt. However, the radius may be changed by means of the ip CUTOUTRADIUS. Vertically below the seam or the butt there is a triangular mark for correct placing of the shell plates. See *Figure 2:3.: Circular cutout for seam*.

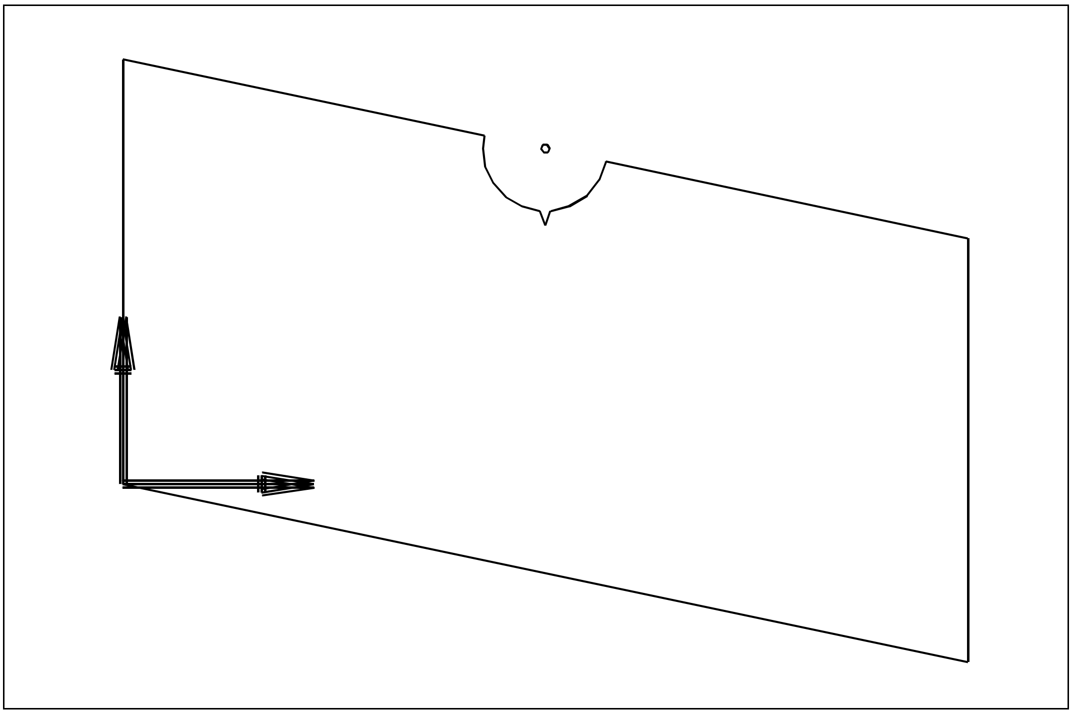


Figure 2:3. Circular cutout for seam

The jigs are stored with their local origins of coordinates oriented as in the figure.

The calculated jigs are stored on SB_PLDB. For fabrication of the jigs this program prints a list of the jig heights, see example in *Listing* .

For the jig placing on the workshop floor the module prints the necessary coordinates and distances. It also produces a drafting for this purpose, see example in *Drawings* .

For the shell plate placing another list is produced. This information is also stored in the attribute 206 (JIG) in the panel object.

The transformation vector giving the orientation of the assembly plane in the xyz-system will be stored in the attribute 206 in the panel object.

The panel object is rewritten on SB_OGDB.

2.2 Set-up of Program

2.2.1 Set-up in Job Launcher

The name of the executable of this program is sf821d. It communicates via an input file and resulting files. The program is normally activated through the Job Launcher (JL) where the following set-up is required:

Name recognised by JL: **Plate Jigs:**

AVEVA Marine logical	JL Set-up and Explanation
SB_INPUT1	Input file to be set-up with extension `.dat` in JL
SB_OUTPUT1	Output file with run-time information. To be set-up in JL as first output file with extension `.log`.
SB_OUTPUT2	Output file with production information. To be set-up in JL as second output file with extension `.lst`.

2.3 Control Information

AVEVA Marine environment:

SB_HREF The name of the hull reference object is fetched from this variable.

SB_YARD The name of the yard to occur in listings.

IP's for this program can be given in an ordinary ASCII file with the fixed name **platejigs.ip**, residing on the directory assigned to the environment variable SB_SHIP.

The following list shows all possible default parameters.

```
[ANGLEALONG, <angle_a>,]
[ANGLECROSS, <angle_c>,]
[CUTOUTRADIUS, <radius>,]
[ENGLISH,]
[FORGET,]
[FRENCH,]
```

```
[JIGINFO_DELTA, <dist>,]
[MAXJIGHEIGHT, <max_height>,]
[MINJIGHEIGHT, <min_height>,]
[SWEDISH,]
```

The order of the ip's is irrelevant.

ANGLEALONG, <angle_a>,

ANGLECROSS, <angle_c>,

These ip's are used for calculations of intervals along seams for automatic welding. The ip's specify angles (in degrees) between the assembly plane and the tangents on the seams giving the boundary conditions for the intervals. This means that these angles must not be exceeded in any part of an interval.

`<angle_a>`	denotes the angle between the assembly plane and a tangent along the seam.
`<angle_c>`	denotes the angle between the assembly plane and a tangent of the ship surface in a plane perpendicular to the seam.
`<angle_a>`	and `<angle_c>` will be set to 8 and 13 degrees, respectively, if the ip's are not given.

CUTOUTRADIUS, <radius>,

By this ip it is possible to change the cutout radius, see *Figure 2:3.: Circular cutout for seam*, from the default value 75 mm to the value <radius>.

ENGLISH,

If this ip is given, the text on the resulting listings will be in English. This is the default language.

FORGET,

If this ip has been given, the surface elements will be obliterated from the work area if read from the data bank.

FRENCH,

If this ip is given, the text on the resulting listings will be in French.

JIGINFO_DELTA, <dist>,

This ip is used when calculating information for checking of curved panels on jigs in production. This ip specifies successive distances along reference lines in the assembly plane, where checking measures between these lines and the corresponding boundary seams are to be calculated. See *Figure 2:4.: Definition of DIST1.* below.

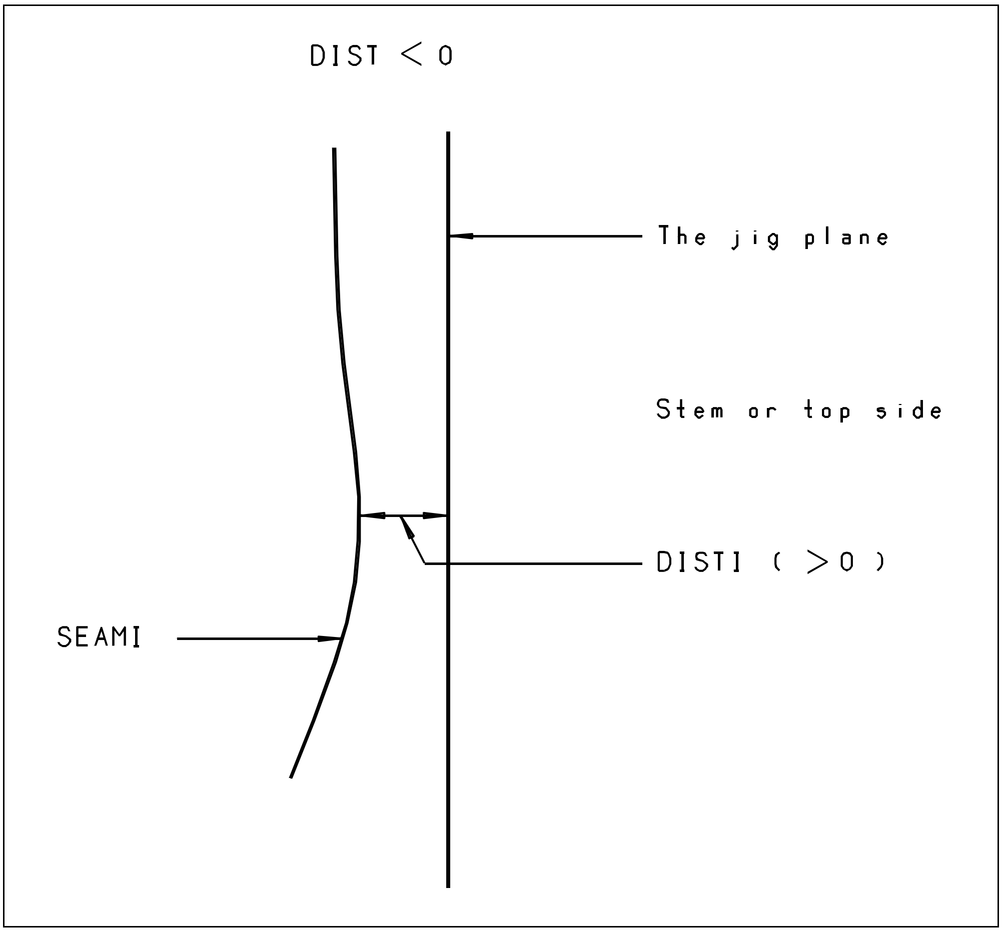


Figure 2:4. Definition of DIST1.

MAXJIGHEIGHT, <max_height>,

If this ip does not exist, <max_height> will be set to 1500 mm. If a jig part is higher than <max_height>, it will be cut off as shown in *Figure 2:2.: Side view of plate jig.*

MINJIGHEIGHT, <min_height>,

If this ip does not exist, <min_height> will be set to 1000 mm. The distance between the floor and the panel will be se <min_height> mm, see *Figure 2:2.: Side view of plate jig.*

SWEDISH,

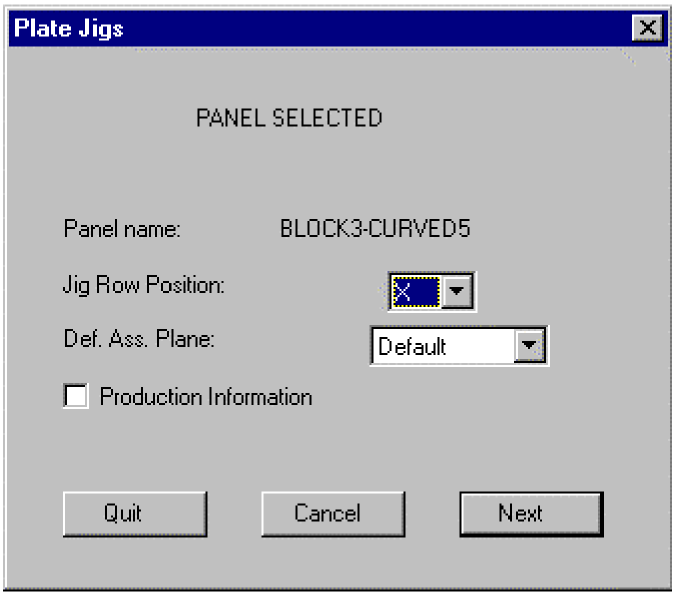
If this ip is given, the text on the resulting listings will be in Swedish.

2.4 Input

Input to the program is based on the general selection tool and this input is normally generated automatically when activating this function through any of the interactive hull applications via a production program interface. This interface and the selection possibilities are described in *Manufacturing, General About the Production Program Interface*.

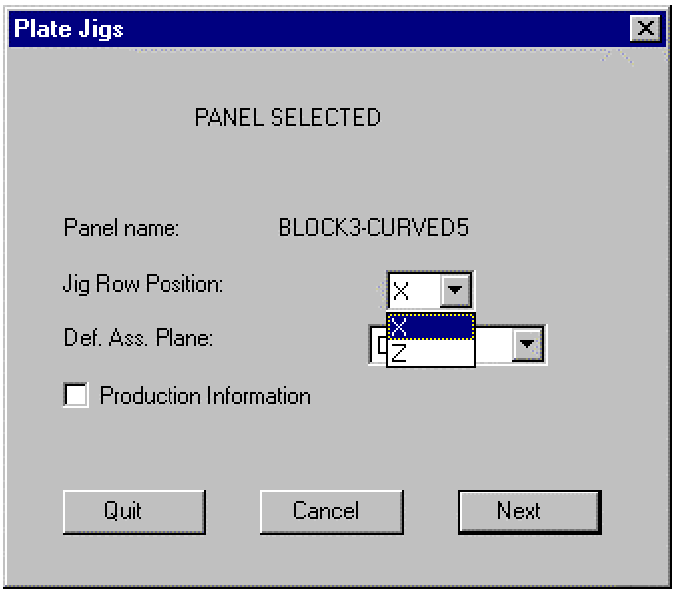
If a curved panel has been selected (if many, only the first one will be taken care of), this will be the one that the program will create plate jigs for. If no curved panel has been selected, a return to the Production interface form will be performed.

In case of a selected curved panel, the following form will be displayed:



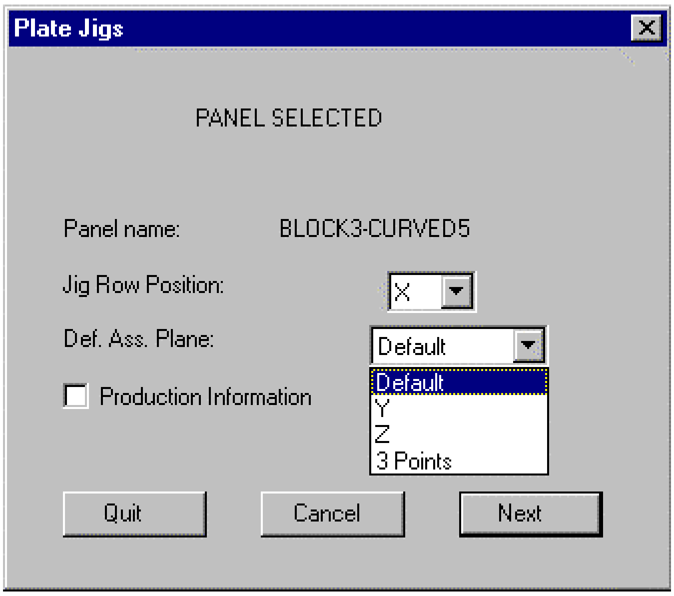
The name of the selected panel will be given at Panel name.

The Jig Row Position field gives the user the possibility to define the position of the plane of the plate jigs.



X means that the intersection line between the plate jig plane and the assembly plane is to be parallel to a frame plane. Z means that the intersection line is to be parallel to a waterline plane.

The Def. Ass. Plane field gives the user the possibility to control the way of defining the assembly plane.

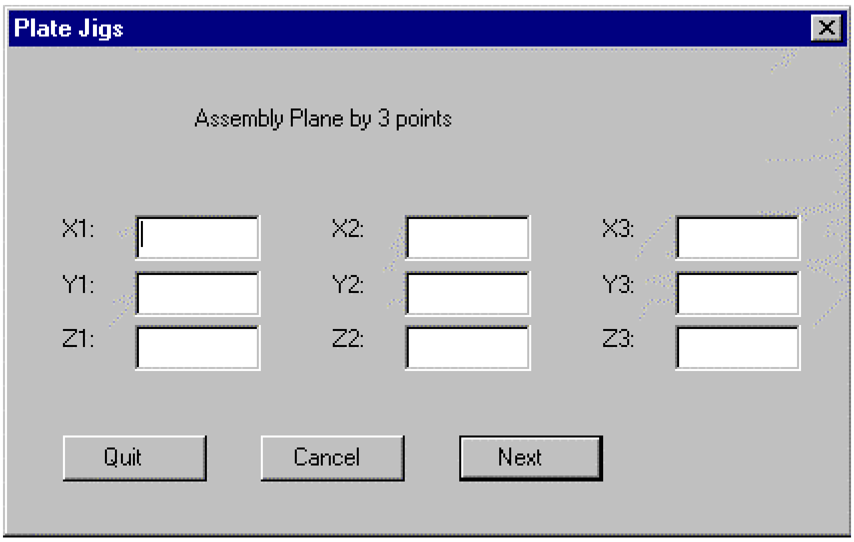


Default means that the assembly plane will be calculated so that the corner points of the panel will be as horizontal as possible.

Y means that the assembly plane will be parallel to a vertical plane.

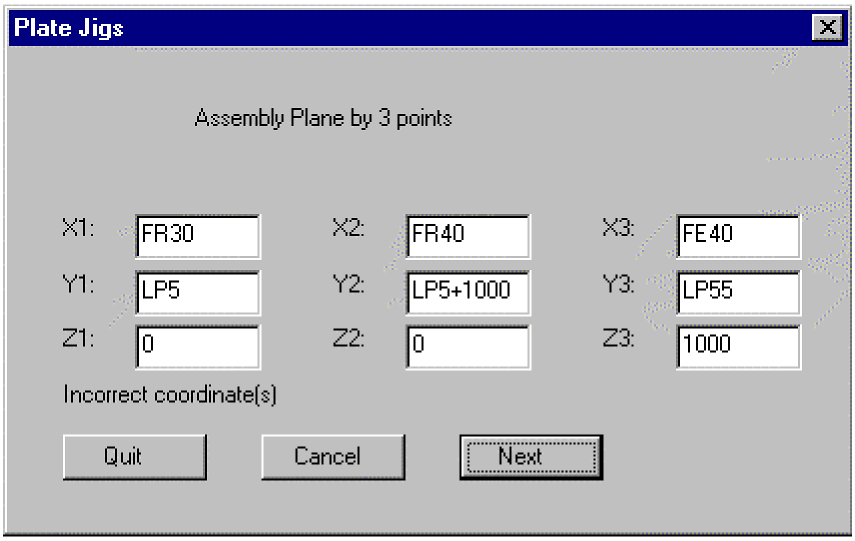
Z means that the assembly plane will be parallel to a waterline plane.

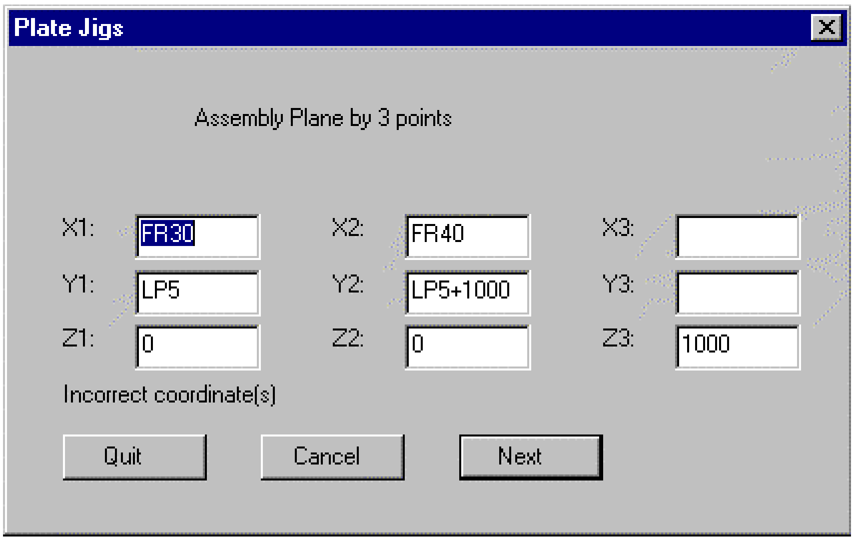
3 Points means that the user has to give three points that together defines the assembly plane. The points must not be co-linear. By selecting 3 Points followed by Next or Return, the following form will be displayed.



In the X-fields frame expressions (frame terms) might be used as well as LP-terms for the Y- and Z-fields. By filling in the different coordinate fields followed by Next or Return, the program controls the validity of the given terms and in case incorrectly given a message about it will be given and the form will be displayed with the correct given terms displayed in the form while the incorrect ones are empty.

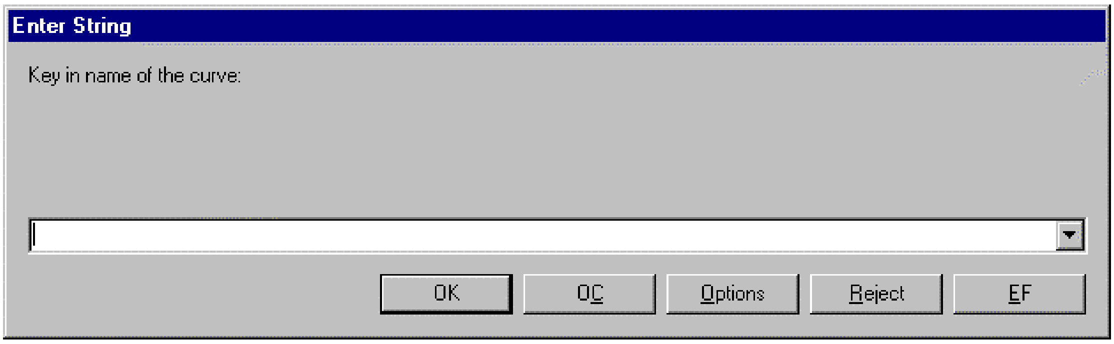
Example:



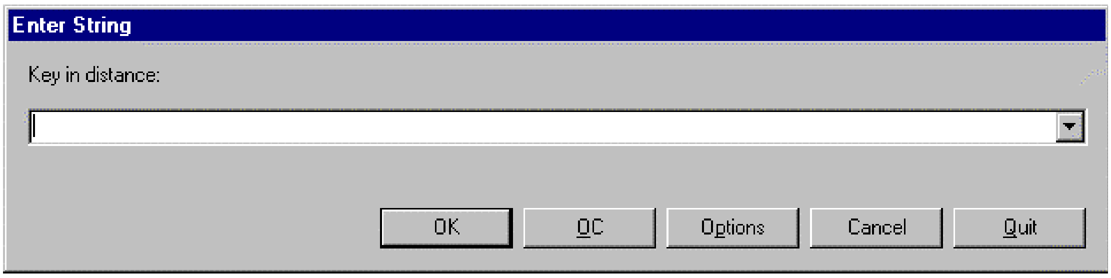


The fields for X3 and Y3 are blanks because of incorrectly given terms, FE instead of FR for the X-value and an invalid long position reference. By giving valid terms also for these two, followed by Next or Return, the program proceeds.

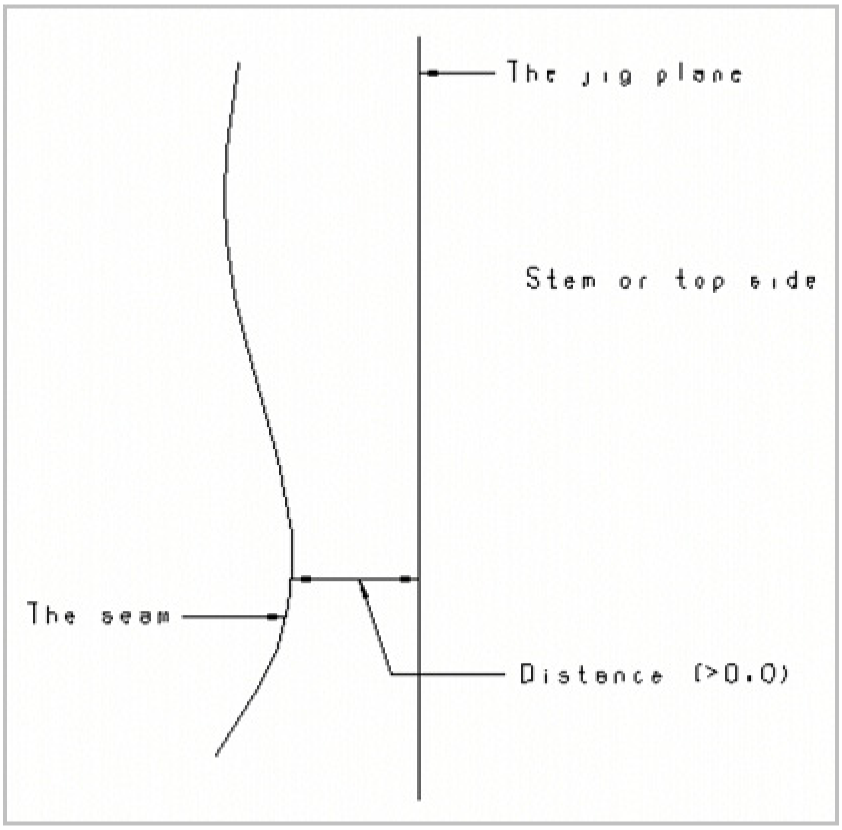
Next step is to indicate the seam from which contour lengths along seams to the nearest jig row are to be calculated. The following message will be given to the user: "Indicate seam from which distances will be calculated". The user may either indicate an existing seam in a current drawing or, by choosing Options, manually key in the total name of the seam, see picture below.



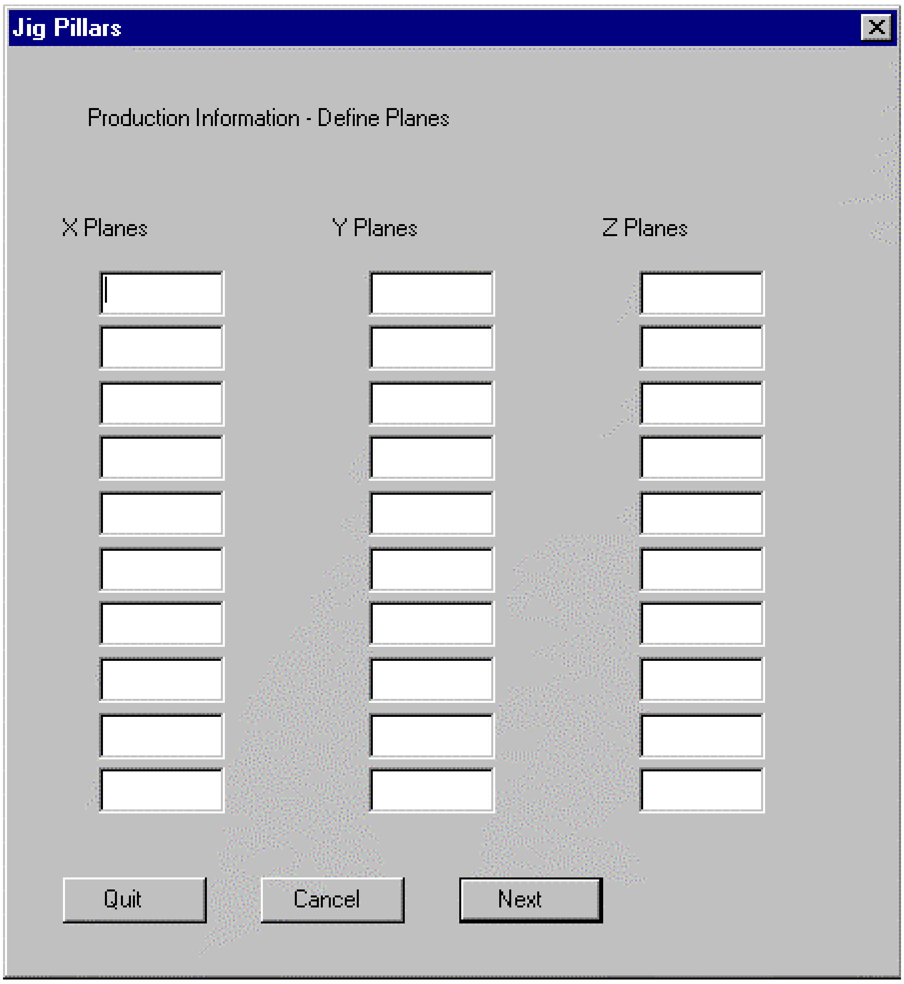
Now it is time to define the different jig planes. The planes are defined by existing seams and a distance to these seams. The following message will be given to the user: "Indicate seam for the jig row position". As for the previous step, the user may either indicate an existing seam in a current drawing or, by choosing Options, manually key in the total name of the seam. The distance has to be manually keyed in a form shown below.



The definition of jig planes is repeated until Operation complete or Return is chosen. The seams and the distances define the jig planes in the following way. If the distance is equal to 0.0, the distance from the jig plane to the starting point of the seam is equal to that to the end point (apart from the sign). If the distance > 0.0, then the jig plane is positioned at the stem or the top side of the seam and with its shortest distance from the seam equal to the distance. A negative distance means that the jig plane should be positioned at the stern or bottom side of the seam and with its shortest distance from the seam equal to the negative given distance. See the figure below.



In the first form there is a field named Production Information. If this has been asked for, an additional form will be displayed. The user will then be able to define principal planes to be used for calculation of checking information. It will be possible to define up to 10 different planes in each of the 3 principal directions. The form looks like this.



As for the 3 points definition, frame terms might be used for the X planes and LP-terms for the Y and Z planes. By clicking Next or Return, the positions filled in will be checked upon its validity and any incorrectly given position will be blanked and the form will be displayed again. This will be repeated until all given fields are correctly given.

Quit will terminate the current Plate Jigs session, Cancel will return one step in the definition process and Next or OK will continue the process.

When Next has been given, an input scheme will be created and the file will be assigned to the program via the logical variable SB_INPUT1. The contents of the file will be explained in the following chapter.

2.5 Input Language to Program SF821D

2.5.1 General

This paragraph describes the input language to the program SF821D in case the environment variable SB_INPUT1 has been defined. Input should be in the general TIL input format.

2.5.2 Statement Types

The input language contains the following different statement types:

`PANEL`	The PANEL statement defines an existing curved panel for which plate jigs are to be calculated.
`JIG_ROW_POSITION`	The JIG_ROW_POSITION statement defines the main position of the jig planes, i.e. frame or waterline plane.
`ASSEMBLY_PLANE`	The ASSEMBLY_PLANE statement defines the way the assembly plane is to be calculated.
`DISTANCES`	The DISTANCES statement defines the seam from which contour lengths to the nearest jig row are to be calculated.
`SEAM`	The SEAM statement defines the real position of a jig plane.
`PROD_INFO`	The PROD_INFO statement defines the position of a principal plane to be used for calculation of production information.

2.5.3 Scheme Syntax

The different statement types may occur in an arbitrary order in the input file. One, and only one, of the PANEL, JIG_ROW_POSITION and DISTANCES statements must be given. The ASSEMBLY_PLANE and PROD_INFO statements may be missing but the SEAM statement must be given, one for every jig plane.

2.5.4 Statement Syntax

Below, the complete syntax of each statement type is described.

- **PANEL Statement**

```
PANEL, '<name of curved panel>';
```

<name of curved panel> is the name of an existing curved panel for which plate jigs are to be calculated.

- **JIG_ROW_POSITION Statemant**

```
JIG_ROW_POSITION,     ( /x | /z );
```

This statement defines the main direction of the jig rows to be calculated.

`X`
denotes that the intersection line between the jig row plane and the assembly plane is to be parallel to a frame plane.

`Z`
denotes that the intersection line between the jig row plane and the assembly plane is to be parallel to a waterline plane.

- **ASSEMBLY_PLANE Statement**

```
                       /Y
                       /Z
ASSEMBLY_PLANE{/POINTS= ('<coord_x1>','<coord_y1>', '<coord_z1>'};
                         '<coord_x2>','<coord_y2>','<coord_z2>',
                         '<coord_x3>','<coord_y3>','<coord_z3>')
```

This statement makes it possible for the user to define the location of the assembly plane.

Y
denotes that the normal vector of the assembly plane should be parallel to the y- axis.

Z
denotes that the normal vector of the assembly plane should be parallel to the z-axis.

POINTS is used to define the assembly plane via three different points. The points must not be co-linear. Frame terms may be given for the x-coordinates, e.g. FR23-600, and references to longitudinal positions may be given for the y- and z-coordinates, e.g. LP5+200.

- **DISTANCES Statement**

```
DISTANCES / SEAM = '<seam name>';
```

<seam name> is the name of a seam in the shell from which the contour lengths to the nearest jig row are to be calculated.

- **SEAM Statement**

```
SEAM / NAME = '<seam name>'
     / DIST = <distance>;
```

This statement defines a final position of a jig row plane.

`<seam name>` is a name of a seam in the shell that together with `<distance>` will define the position of a jig row. If `<distance>` = 0.0, the distance from the starting point of the seam is equal to the distance to the end point (apart from the sign). If `<distance>` > 0.0, then the jig plane will be positioned at the stem or top side of the seam and with its shortest distance to the seam equal to `<distance>`. A negative value of <distance> means that the jig plane will be positioned on the stern or bottom side of the seam and with its shortest distance to the negative given distance.

See *Figure 2:4.: Definition of DIST1.* above.

- **PROD_INFO Statement**

```
                   /XP = <x-position>
PROD_INFO =  {     /YP = <y-position>          };
                   /ZP = <z-position>
```

This statement defines a principal plane for which certain checking information will be calculated.

2.6 Result

2.6.1 General

The resulting information consists of:

- Plate Jig objects stored in the data bank. The corresponding panel will be updated as well.
- Lists.
- Drawings.

Further details are given below.

2.6.2 Data Bank

The name of a plate jig object will be built up in a special way, where the first part is the panel name and the second part a combination of the jig row position and the order number of the plate jig within the row. The first jig row will be named A, the second B and so on.

Example:

The third plate jig within the second jig row will get the name <panel>-B3.

2.6.3 Listing

Examples of listings are given in appendix *Example of Lists in Chapter Bending Templates for Shell Plates* .

The heading of every page contains:

- The name of the yard.
- The program name.
- The running date and time.
- The page number.
- The name of the panel.

The listing consists of:

- Height of the jigs above the assembly plane.
- Position of the corners of the panel.
- Distance to the jig rows.
- Distance from the sight line.
- The angles between the assembly plane and the frame and waterline planes.
- Contour lengths along seams from a given boundary seam to the first jig row.

and, in case production information has been requested, also:

- Distances from reference lines between the corners of the panel.
- Angles between reference lines.
- Information about the lowest plate.
- Measures along seams for welding.

The different lists are explained below.

1. Height of the jigs above the assembly plane.

   The table lists, for every plate jig, the height of the two edges and to the centre of the cutout.
2. Position of the corners of the panel.

   The table lists the different panel corner numbers, the distances from the first jig row A, the distances from the sight line and the heights above the assembly plane.
3. Distance to the jig rows.

   The distances to the different jig rows, accumulated values with the first jig row as base, will be listed.
4. Distance from the sight line.

   Distances from the s8ight line to the marked side of the different jigs (= edge 1 of the jig).
5. The angles between the assembly plane and the frame and waterline planes.

   The angle between a frame plane and the assembly plane, as well as the angle between a waterline plane and the assembly plane, will be listed.
6. Contour lengths along seams from a given boundary seam to the first jig row.

   The table lists the distance along seams from a denoted seam to the first jig row. An explanation of the sign of the distance is given as well.

2.6.4 Drawings

The program generates different kind of resulting drawings.

The drawings are automatically generated and will be stored on the data bank assigned to SBH_PLJIG_DWG.

If this data bank is not assigned the software will try to store on the data bank assigned to SBH_RECEIPT. If so this data bank is not assigned, the standard drawing data bank (SB_PDB) will be used.

The base for the first drawing is an existing drawing form TB_PLATEJIGS that must be stored on the standard data bank, SBD_STD. There are some predefined rules that might be defined in the form and the program will then automatically add different kind of information when the drawing is created.

The rules are defined by a number preceded by a $ sign. The position of this $-text defines the position in the drawing form. The texts to be placed automatically will get the same text height and rotation angle as the corresponding $-text.

Below, a list of the available $-texts and the corresponding variable to be put in the form is given.

$1001 - Name of the user that runs the program, given by SBB_USER_SIGNATURE.

$1002 - Telephone number to the user that runs the program, given by SBB_USER_TELEPHONE.

$1006 - The drawing scale.

$1007 - Name of the drawing, i.e. PJIG_<job_number>_1(2).

$1008 - Name of the jig object.

$1998 - Indication of the lower left corner of the rectangular area for insertion of the resulting sketch.

1999- - Indication of the upper right corner of the rectangular area for insertion of the resulting sketch.

The $-texts 1998 and 1999 must be given while the rest are optional.

The resulting sketch is a projection of the panel on the assembly plane with all the calculated plate jigs projected and identified and it is oriented in a local coordinate system where the y-axis is located along the first jig row and the origin in the starting point of the first jig plate. Furthermore, the drawing contains:

- The corner points of the panel.
- The size of the circumscribed rectangle.
- Direction information about two of the edges. Possible identifications are:

```
Top   -   top
Bot   -   bottom
Fore  -   fore
Aft   -   aft
PS    -   portside
SB    -   starboard
```

For an example of a resulting drawing, see below.

- **Example of Result**

Link to example file: platejigs1_PC229_74.txt

- **Example of Resulting Jig Placing**

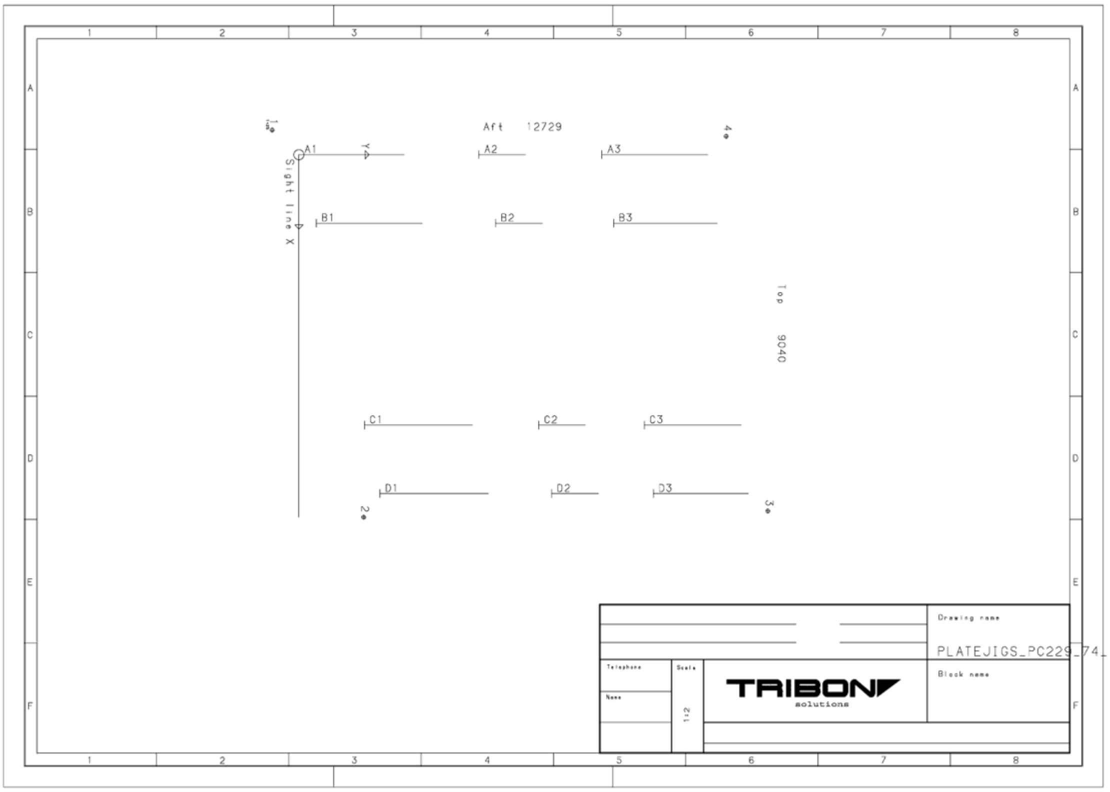


Figure 2:5. Jig placing on workshop floor.

The second drawing will get the name PJIG_<job_number>_2(2). It contains the side view of all the plate jigs.

3 Interactive Jig Pillars

3.1 Input Data

The purpose of this application is to calculate information about jig pillars for curved panels knuckled panels or plane panels.

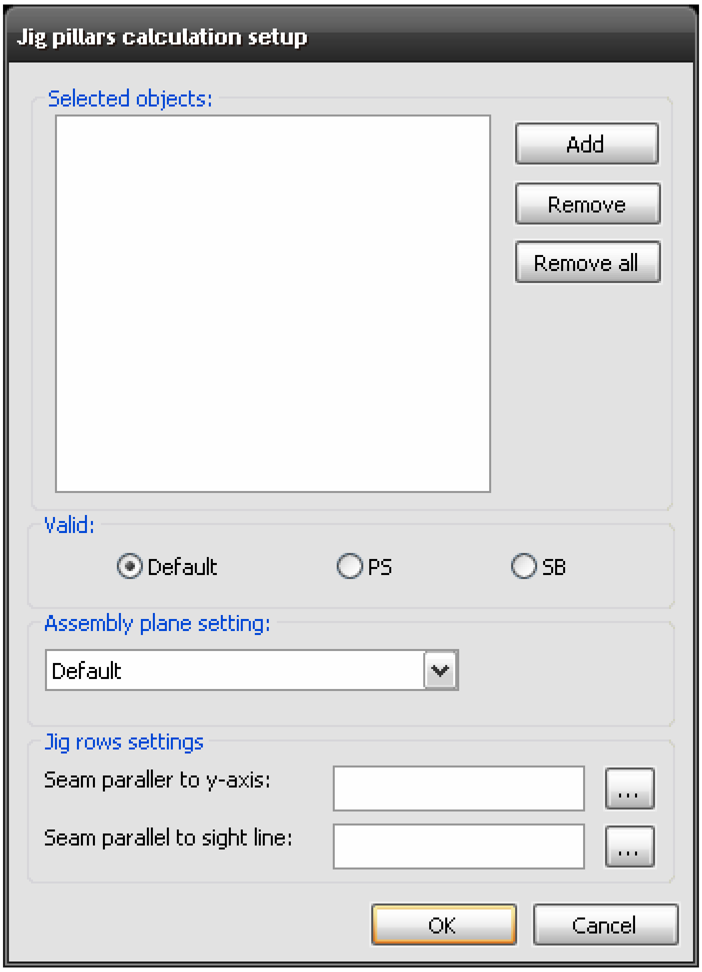


Figure 3:1. User input

The firs step of the operation is to select panels for which the calculation will be done.

User can select a number of knuckled panels or planar panels welded together at a knuckle or one curved panel (if more panels are selected only the first one will be considered).

For symmetrical panels user can select for which side the calculation should be made.

If *Default* is chosen, the jig pillars are calculated on the portside of the ship and the resulting jig object will get the suffix "-JIG". PS means that the calculation is performed on the portside image of the panel and SB means that the calculation is performed on the starboard of the panel. The suffix will be "-JIGP" and "-JIGS", respectively.

Next step is to select how the assembly plane should be calculated. If the Default is chosen the predefine setting is used (this will be described in the next paragraph of this document.

Other available options are:

- The assembly plane should be parallel to the plane X, Y or Z.
- The assembly plane defined by three points (coordinates input by the user)
- If the seam option is selected the panel(s) is tilted the same way as in the Default option and then tilted in a way so that the referenced seam becomes as horizontal as possible. If this option is selected user is prompted to select another seam after pressing the OK button.

Before calculation can start user must select seam seam that will be the base for the positioning of the jig rows - **seam parallel to y-axis**. This seam can be given via name entered directly to the text box or user can select it from the current drawing

The plane of each jig row will be calculated in the following way:

- It is perpendicular to the assembly plane
- It is parallel to the intersection line between the assembly plane and a frame plane (if the selected seam is a butt) or a waterline plane (if the selected seam is a longitudinal seam).
- It touches the selected seam in its utmost point.

The intersection between this plane and the assembly plane defines the "direction line" (= the y-axis). The position of the jig rows are measured from this line.

If **seam parallel to sightline** has been entered, the assembly plane will be rotated around the normal of the plane so that the selected seam will be parallel to the sightline. The seam must be an inner seam to the panel.

After accepting the choices by pressing Ok, the calculations are proceeding. Current drawing is closed and the result together with the input objects are presented on the form previously setup by the user.

3.2 Preferences

This entry in the Interactive Jig Pillars menu represents the settings that are used for creating an object representing the data about jig pillars.

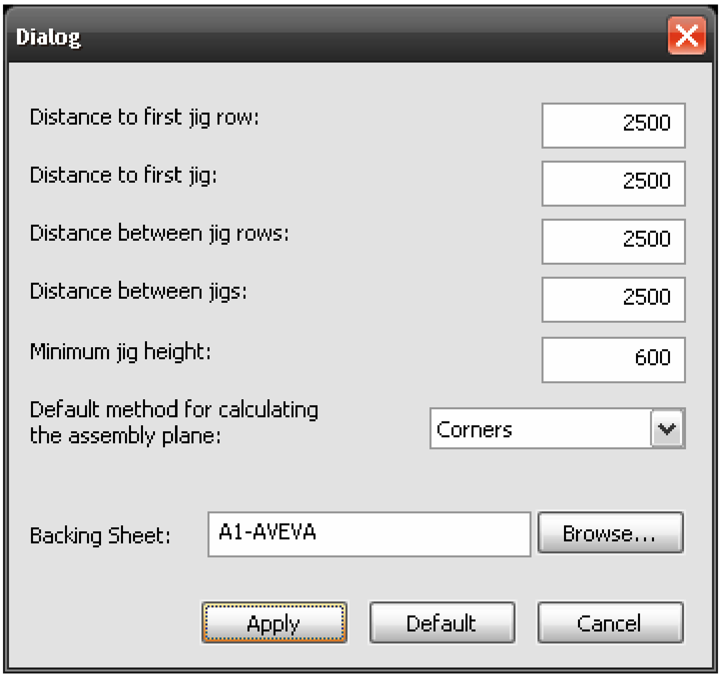


Figure 2.1 Preferences

Here user can setup default values for calculating jig pillars positions.

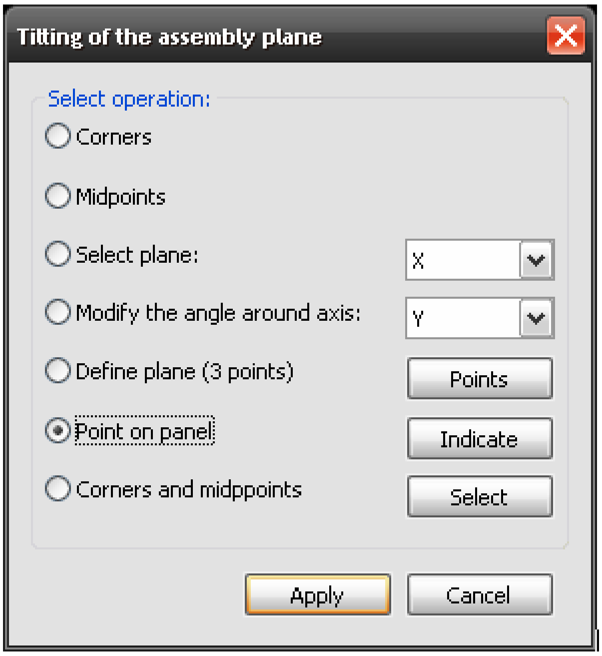
Also a method that is used by default by the procedure can be setup here. The following choices are available:

- **Corners** - the normal of the average plane through all corners of the panel should be perpendicular to the workshop floor
- **Midpoints** - the normal of the average plane trough all midpoints of the panel should be perpendicular to the workshop floor

Another setting is a backing sheet used for presentation of calculation result. The backing sheet must have at least one model view otherwise no result will be displayed.

3.3 Tilting

This tool is designed to allow user to modify already created object.



First user selects operation that should be performed on the jig pillars object.

The three choices represent the standard definitions of the assembly plane used when the object is created.

The rest of them work as follows:

- Modify angle around any of the main axes - user can rotate the assembly plane.
- Define plane (3 points) - user can setup the assembly plane by entering coordinates of three points that belong to that plane.
- Point on panel - Indicate any point on the panel and use the surface normal in this point so that the normal will be perpendicular to the assembly plane.
- Corners and midpoints - User can select any number of the corner and midpoints of the panel or an intersection point to calculate an average plane to be parallel to the assembly plane.

3.4 Save

Saves the resulting object in database.

4 Bending Templates for Shell Plates

4.1 General

When forming curved shell plates it is common to use different kinds of templates to control and check the forming process. AVEVA Marine has a facility that can develop several different types of templates and produce output in several different formats.

Templates can be generated for plates, developed by the module for developing shell plates. Templates may further be developed both as "inner" and "outer" templates depending on the curvature of the plate.

Traditionally, bending templates were often physical templates made e.g. of wooden board. Nowadays these physical templates have often been replaced by different kinds of reusable templates that can be set up to fit any plate.

However, the template module in the bottom still *always* creates the information required for physical templates. These templates are stored as a special kind of "plate part" in the plate data bank. The contents of such a part are a template contour and miscellaneous additional information that may be used to position the template correctly and to perform different alignment checks.

In a second step the information in these "physical" templates may be processed in different ways by this module to extract and output the information required to set up different types of adjustable templates. It also follows that some of the information that is relevant for physical templates may be irrelevant for other types of templates even if this information is always there.

4.2 Contents of a Template

A template as stored in the plate data bank consists of the following types of information (see the figure below).

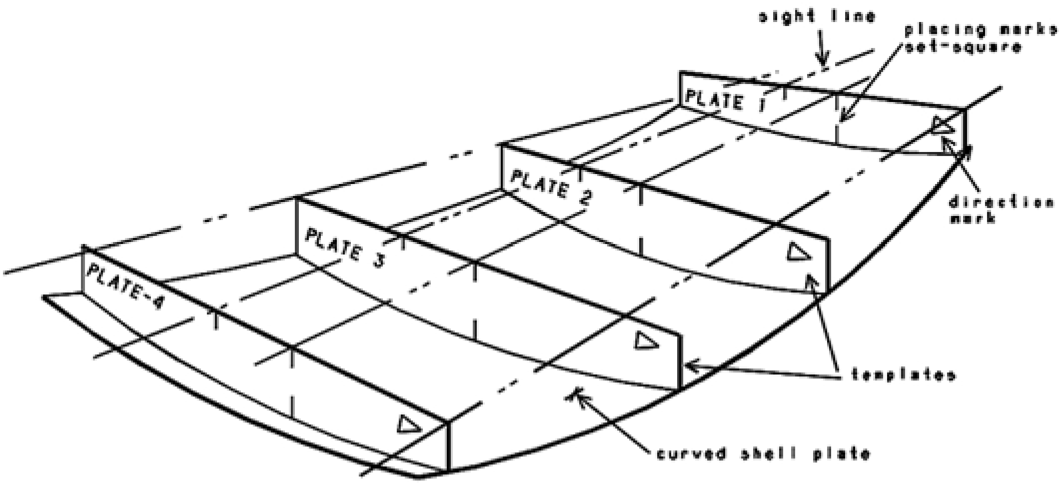


Figure 4:1. Example of bending templates.

1. A closed template contour. The upper part of the template is straight and should lie in the same plane (the *sight plane*) for all the templates of the plate. The width of the template should fit exactly to the width of the plate.
2. A direction mark (a small triangle) at the right end of the template. It is intended for checking against a corresponding mark on the plate (or a sketch of the plate) to make sure that the template is turned correctly when used.
3. A *sight line mark* (a small tick) perpendicular to the upper edge of the template. When the plate is correctly shaped the sight line marks of all templates should lie in line with each other.
4. Two matching *set-square marks* (ticks) at the lower and upper edges of the template. They are supposed to be used in the following way. Some types of templates are supposed to be mounted perpendicular to the plate. They are positioned with the aid of a right angle tool (see the picture below). However, since the plate is curved and may be twisted it is necessary to specify where along the template this tool should be placed. This position is indicated by the set-square marks. (Similarly they may be used to define where the angle against the plate should be measured for other types of templates).

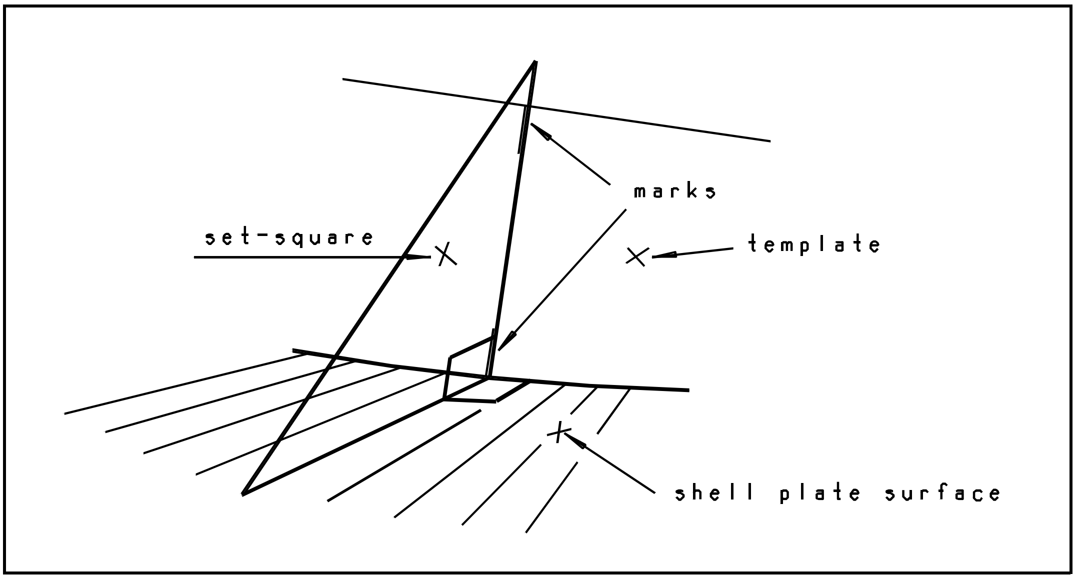


Figure 4:2. Templates are by default perpendicular to shell plate surface.

Additionally, each template is supplied with a transformation matrix so that it is correctly positioned in space. Therefore, the templates may be displayed in 3D views together with its plate.

(The vocabulary used above may be slightly different for certain types of templates. Details will be found together with the description of them.)

4.3 Supported Types of Templates

A short survey will be given below of the different types of templates that may be developed by the template module. For one and the same type of template the desired output may be different, e.g. information to create a physical template or set-up information for adjustable templates. Some of the template types below can only be used as adjustable templates.

For a typical output for adjustable templates, see *Example of Lists*.

4.3.1 Standard Templates

The standard templates have the following special features:

- They should always be mounted at a right angle to the plate surface (see the figure below).

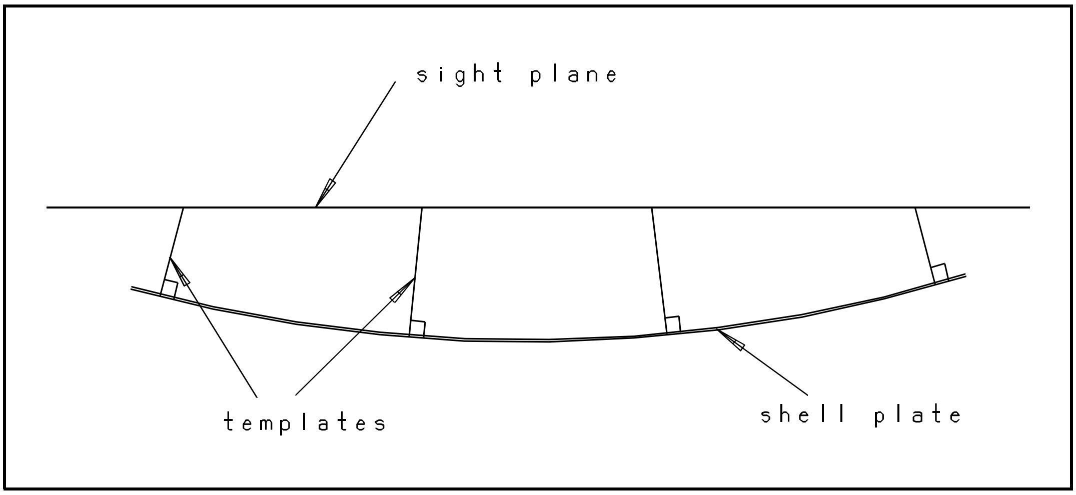


Figure 4:3. Standard templates are set perpendicular to shell plate surface.

- They are distributed in an optimal way over the surface of the plate (optimised distance between them and also optimised orientation, e.g. like a fan if the plate is not close to rectangular).

The advantage of this type of templates are:

- The number of templates is automatically optimised.
- The templates are independent of the orientation of the plate.
- The templates are not sensible to minor inaccuracies in their placing/tilting.

A disadvantage may be that their position must be specified, either by separate marking traces or by measurements in the plate sketch.

4.3.2 Standard Frame Templates

Frame templates are always positioned in the position of frames. Optionally, templates may be set a certain distance from the short edges (butts) of plate provided they are positioned in frame planes.

The advantage of this type of template is that they are located at frames (which are normally marked on the plate anyhow) and thus there is no need for additional information for their positioning.

Disadvantages are:

- They are poor for controlling the shape of the plate when the angle becomes narrow between the template (frame) plane and the plate surface.
- Separate and individual tilting information must be supplied (and kept record of) for each individual template.
- They are not spread over the surface of the plate in an optimal way. Some of the templates may have to be sorted away.

4.3.3 Normal Templates

The "normal" type of templates are closer to the standard templates than the frame templates:

- They are all parallel to each other.

- The plane of the templates is defined by a template close to the middle of the plate. This template is placed at right angle to the plate surface in the same sense as the standard templates.
- The remaining templates are set parallel to the middle template at distances that are optimised with regard to the size of the plate.

Advantages:

- The templates are reasonably perpendicular to the plate independent of its location.
- The number of templates is automatically optimised.

Disadvantages:

- The templates require separate positioning information.
- Not all templates are at right angle to the plate.
- The template may poorly cover non-rectangular plates.

For further details, see *Normal Bending Templates.*

4.3.4 Special Frame Templates (Flexible Templates)

The "special" frame templates occur in two variants that have in common that they are located at frame positions. Templates of the first type are true frame templates: they are located in the frame plane. The second type are located at frames only at the edges of the plate but are all normal to a "base plane" of the plate.

If the short edges of the plate are not close to the frame plane additional templates may be set parallel to the short edges of the plate a certain distance.

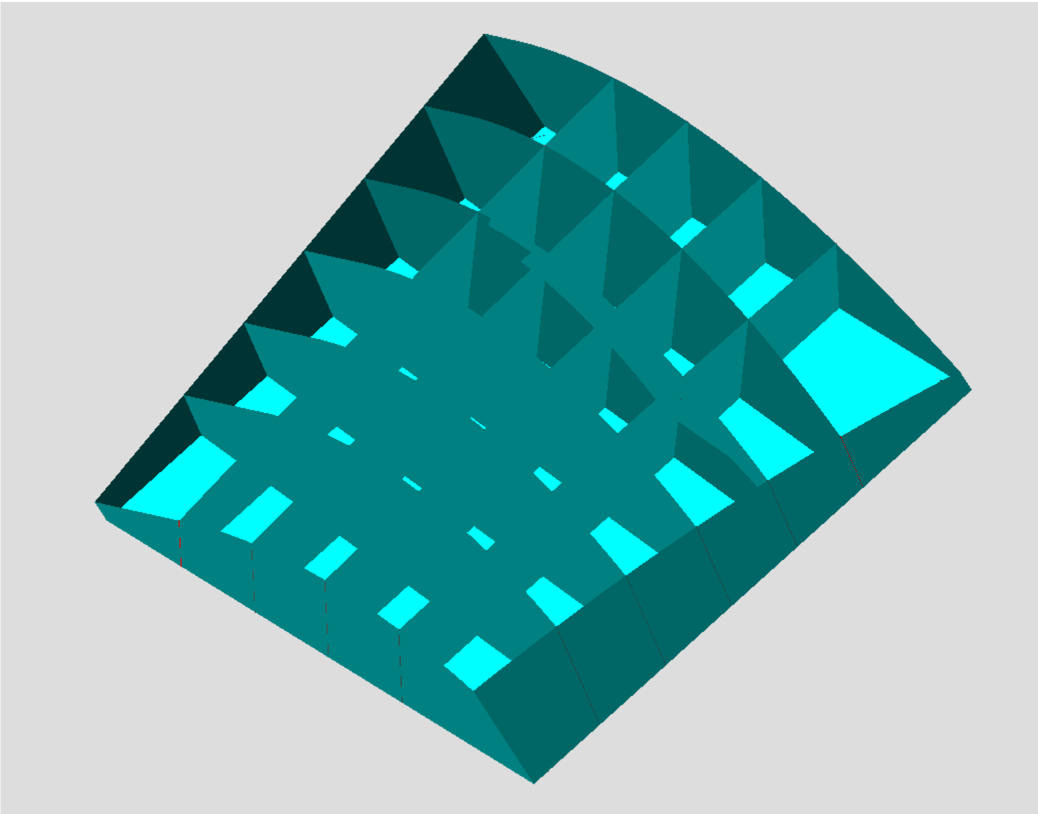
For further details, see *Flexible Templates.*

4.3.5 Cross Templates

These cross templates are modeled in two different main directions, the main direction of the v-axis of the base plane (templates also referred to as inner templates) and the main direction of the u-axis of the base plane (templates also referred to as cross templates). Both inner and cross templates are always perpendicular to the base plane. All inner templates are modeled in parallel planes at a constant distance and this is also valid for cross templates. Inner templates are always set perpendicular to cross templates. The positions of the templates, inner as well as cross templates, are calculated automatically.

In addition, special edge templates will be modeled at the plate edges, provided that the plate edge is lying in a plane. The number of edge templates will be at most four, regardless of if the number of plate edges exceeds four. The inner and cross templates are in general not at right angle with the plate surface, but the angle can to some extent be controlled by the choice of base plane.

Below is shown an example of inner, cross and edge templates and a base plane part.



4.4 Running Environment

4.4.1 Set-up for Job Launcher

This module is normally supposed to be run via the Production Program Interface (PPI) . PPI assists in selecting the plates for which templates should be calculated, starts the execution via the Job Launcher (JL) and presents the result for inspection.

Communication between this module (program name is sf820d) takes place via an input file and result files and drawings.

Name recognised by JL: **Bending Templates**

AVEVA Marine env. variable	Use by JL
SB_INPUT1	Input file to be set up with extension .dat in JL
SB_OUTPUT1	Output file with input interpretation result. To bet set-up in JL as second output file with extension .log
SB_OUTPUT2	Output file with result list. To be set-up in JL as third output file with extension .lst

4.4.2 Control Information

Default parameters ("ip:s") of this module are defined via an ordinary ASCII file with the fixed name **bendtempl.ip,** residing on the directory assigned to the environment variable `SB_SHIP`.

This program has the following default parameters:

Note: The default parameters must be set up exactly as specified below, i.e. always followed by a comma(,).

```
[ENGLISH,]
[GERMAN,]
[DISTTOEDGE, <dist 1>,]
[MAXDISTTOTEMPLATE, <dist 2>,]
[MINHEIGHTOFTEMPLATE, <height>,]
[NO_EXC,]
[NO_EDGE_LENGTHS,]
[PINS, [<dist>,]]
[HDW,]
[DAL,]
[SIGHTLINEMARK, <dist_fact>,]
[FRAMETEMPLATES, [PERP, [Y, | Z,]]]
[EDGE_TEMPLATE, [<distance>,]]
[MIN_TEMPLATES,<minimum number of templates>,]
[AUTO_TEMPL_SIDE,{INSIDE|OUTSIDE|CONCAVE|CONVEX},]
[NORMAL_TEMPLATES,]
[FLEXIBLE_TEMPLATES,]
[EDGE_SEAM_TEMPLATES,]
[ONLY_SIMPLE_SKETCH,]
```

In addition to the ip:s listed here it is also possible to use the ip:s controlling the layout of output drawings from the Production Program Interface.

The result of the different ip´s is described below (or in appendices, referred to)

ENGLISH
If the ip is given the text in the resulting drawing will be in English.

GERMAN
If the ip is given the text in the resulting drawing will be in German.
Default language is English.

DISTTOEDGE, <dist1>
This parameter controls the distance between the first template and the corresponding edge of the plate. If missing it is set to 100 mm. Valid also for the last template (Valid in this sense only for standard templates).

MAXDISTTOTEMPLATE, <dist2>
Maximum allowable distance between two adjacent templates (valid for standard templates).
If the ip is missing the distance is set to 3500 mm.

MINHEIGHTOFTEMPLATE, <height>

Minimum allowable height of a template (valid for standard templates).
If the ip is missing the height is set to 250 mm.

NO_EXC

If the ip is given, the text for excess, if any, is suppressed in the plate sketch.

NO_EDGE_LENGTHS

If the ip is given measurements to the templates along edges are suppressed in the plate sketch.

PINS, [<dist>]

If the ip is given, the program will calculate and list heights for adjustable pin templates. If `<dist>` is given, the distance between the pins will be set to this value. Default value is 200 mm, except when ip HDW is given. In that case the default value is 500 mm. When ip DAL is given the default value is 250 mm.

HDW

Together with the ip PINS this ip will cause the program to calculate and list pin templates according to HDW standards.

DAL

Together with the ip PINS this ip will cause the program to calculate and list pin templates according to DAL standards.

[SIGHTLINEMARK, <dist_fact>,]

This ip gives the user the possibility to define the position of the sight line mark on the first template. The mark will be placed `<dist_fact>` multiplied by the width of the template from the left edge of this first template. This may be necessary if the plate has an abnormal shape. Then the standard procedure may place some sight line marks outside the other templates.
`<dist_fact>` must be given in the interval 0-1. Other values will be replaced by the default value 0.25.

FRAMETEMPLATES, [PERP, [Y, | Z,]]

The templates will be calculated with their planes perpendicular to the X-axis at frame positions.
The addition PERP will cause the sight plane to be "parallel" to the X-axis, i.e. it will not intersect the X-axis. The sight plane and the template planes will thus be perpendicular to each other. This will cause the templates to be larger than if the plane is placed as close as possible to the plate (valid only for frame templates).
The additions Y and Z are mutually exclusive. They state, that the sight plane should be a plane perpendicular to the Y-axis, respective the Z-axis. The sight plane and the template planes will be perpendicular to each other. Additionally all the planes are perpendicular to a major axis (X, Y or Z). This will cause the templates to be still larger.

EDGE_TEMPLATE, [<distance>]

This word requests, that templates are created at the two seams, that intersect the base line. They are created if, and only if, the seams are X sections. The value of `<distance>` determines, that any frame template closer to the edge templates than `<distance>` will not be created. A warning about skipped frame templates will be printed in the log if any of the "regular" frame templates have been skipped. The default value for `<distance>` is 200 mm (valid only for frame templates).

MIN_TEMPLATES,<minimum number of templates>

Minimum allowable number of templates for each plate.

If the ip is missing the minimum number is set to 3.

AUTO_TEMPL_SIDE,{INSIDE|OUTSIDE|CONCAVE|CONVEX}
One of the options must be entered if the ip is given.
The side of the curved plate on which the templates shall be located when automatic side calculation is requested in the interactive input.

INSIDE	means inside of the ship (towards CL).
OUTSIDE	means outside of the ship.
CONCAVE	means the concave side of the curved plate (the templates will be convex).
CONVEX	means the convex side of the curved plate (the templates will be concave).

If the ip is missing the default choice will be INSIDE.

The meaning of the remaining ip´s is described elsewhere in the documentation.

NORMAL_TEMPLATES, see *Normal Bending Templates.*

FLEXIBLE_TEMPLATES, see *Flexible Templates*.

EDGE_SEAM_TEMPLATES, see *Flexible Templates*.

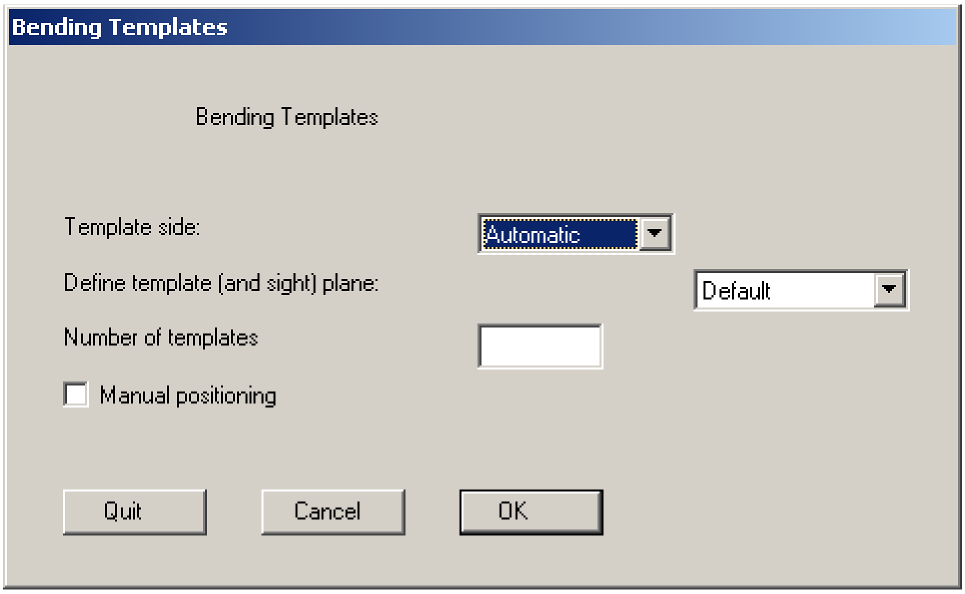
ONLY_SIMPLE_SKETCH, see *Drawings* for an explanation.

OFFSET_TRACE_CURVES, [<dist>], see *Flexible Templates*.

4.5 Input

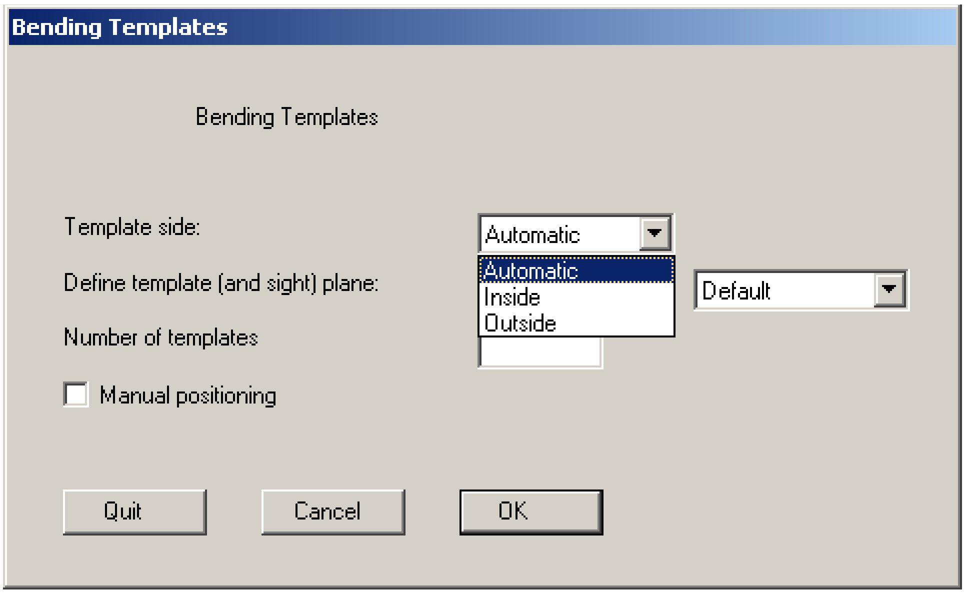
Input to the program is created via the general selection tool of the Production Program Interface (PPI). Via the PPI both individual plates and all plates of selected panels may be extracted for template calculation.

The following form will be displayed:



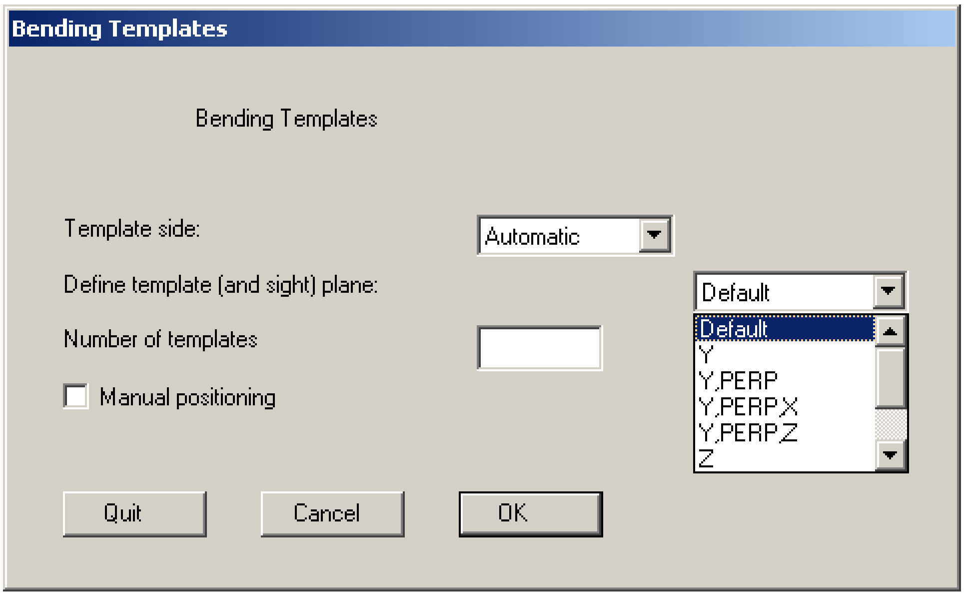
The default side choice is automatic. In this case the side is chosen in the following order.

1. from the plate object attribute 501.
2. from the AUTO_TEMPL_SIDE in the default file.



Inside means inside the shell and outside means outside the shell independently of the plate curvature. However, if the curved plate attribute 501 exists, then the side determined in this attribute will be chosen.

The templates are normally positioned automatically on the selected plates. The orientation and position of the templates may also be controlled by the default file (FRAMETEMPLATES, etc.) and by defining the template plane according to the form below.



Y means that the templates will be calculated with their planes perpendicular to the Y-axis.

The addition PERP will cause the sight plane to be "parallel" to the Y-axis, i.e. it will not intersect the Y-axis. The sight plane and the template planes will thus be perpendicular to each other. This will cause the templates to be larger than if the sight plane is placed as close as possible to the curved plate. (It may be necessary to increase the MINHEIGHTOFTEMPLATE in the default file.)

The additions X or Z state that the sight plane should be a plane perpendicular to the X- or Z- axis, respectively. The sight plane and the template planes will be perpendicular to each other. Additionally all the planes are perpendicular to a principal plane (X, Y or Z). This will cause the templates to be even larger. Z means that the templates will be calculated with their planes perpendicular to the Z-axis.

The addition PERP will cause the sight plane to be "parallel" to the Z-axis, i.e. it will not intersect the Z-axis. The sight plane and the template planes will thus be perpendicular to each other. This will cause the templates to be larger than if the sight plane is placed as close as possible to the curved plate. (It may be necessary to increase the MINHEIGHTOFTEMPLATE in the default file.)

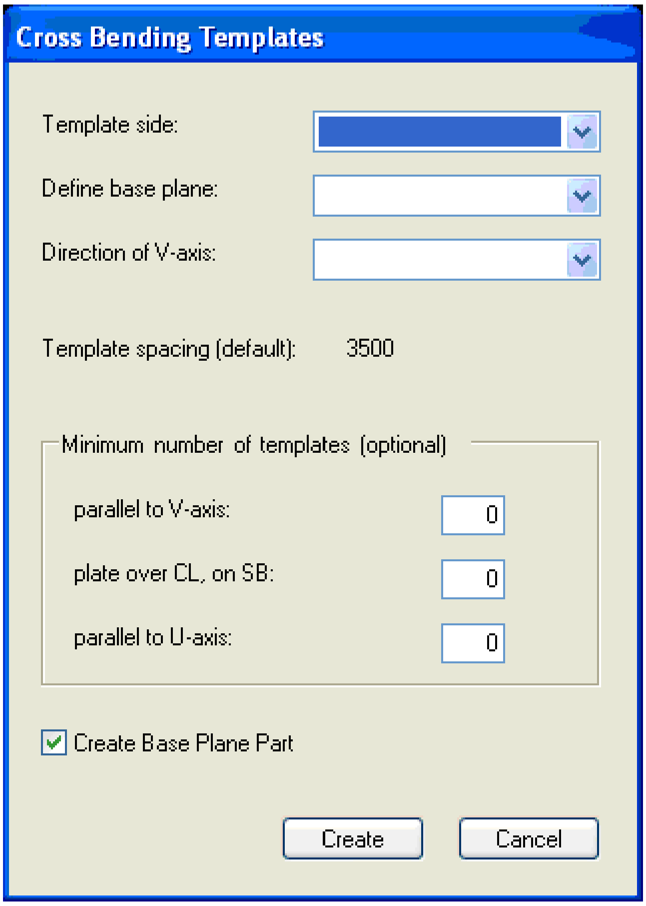
The additions X or Y state that the sight plane should be a plane perpendicular to the X- or Y- axis, respectively. The sight plane and the template planes will be perpendicular to each other. Additionally all the planes are perpendicular to a principal plane (X, Y or Z). This will cause the templates to be even larger.

The number of templates may be determined in different ways. If FRAMETEMPLATES is entered in the default file, then the number of templates is given by the number of frame positions within the plate. For other template types the number may be entered in the form above. If not entered in this form, the number will be determined by the values assigned to "MIN_TEMPLATES" or "MAXDISTTOTEMPLATE* in the default file. "MIN_TEMPLATES" will override "MAXDISTTOTEMPLATE" if both are entered. If nothing is entered, the default number of templates is 3.

If the manual positioning field is marked, the above options are overruled, and the message "Indicate Seam for manual positioning along" will appear. A seam may be picked up by pointing at it on the screen, or by selecting option (++). In the latter case a new form will appear, in which you may write the name of a convenient seam. After a seam has been chosen, another form will appear. In this form you should enter the distances to the templates along the selected seam.

Options for cross bending templates

After the plate parts have been selected using the PPI Hull selection tool, the user is presented with a dialog that asks whether to create cross bending templates or not. If the answer is YES then the following dialog for creating cross bending templates will appear.



The side of the plate for which cross templates should be created must be specified. The choices are automatic (requires keyword AUTO_TEMPL_SIDE with parameter in IP-file), inside, outside.

There are also the following choices for the base plane of the cross templates:

X, Y, Z means that the base plane will be perpendicular to the x-, y-, z-axis, respectively. "3 points" means that the base plane will be defined by three points given by the user. "Avg through corners" means that the corner points of the plate will be used to calculate the base plane, or alternatively the plate midpoints will be used instead.

The direction of the base plane v-axis, defining the orientation of its local coordinate system, has the following choices: For, Aft, PS, SB, Top and Bottom.

The number of cross templates is normally calculated through the use of control information in the IP-file, but it can optionally be set to a minimum number of templates parallel to the base plane v-axis and u-axis, respectively. If the plate is over centre line (CL), then the minimum number of templates on the other side of CL can be specified. Of course, if a too small number is set, e.g. 0, then it will have no effect on the actual number of templates being generated.

4.6 Output

4.6.1 Data Banks

- Plate Data Bank (PLDB)

  The plate objects treated are rewritten to the Plate Data Bank extended with some information about the position of the templates.

  The created templates are also stored in the Plate Data Bank. The names of the templates will be the plate name extended with a running number.

  Bending Template Drawing Data Bank (SBH_BENDTEMPL_DWG), Receipt Data Bank (SBH_RECEIPT) or Drawing Data Bank (SB_PDB).
  As explained under *Drawings* below.

4.6.2 Listings

- Receipt List

  If the ip PINS is the default file then tables of pin heights are written in the list file that normally has the name bendtempl_<job No.>.lst (the file extension may be changed by the Job Launcher). Certain options will create such a list even if this ip is not explicitly given.

- Log file

  Some information related to the treated plates will output on the log file. Error and warning messages (if any) will also be output.

4.6.3 Drawings

The template module produces a number of pictures, some of which are common to all run modes, some specific for certain run modes.

The different types of pictures are:

- A sketch of the plate with its name, the roll axes, lengths of edges, indication of the positions of the templates (optionally with contour lengths to them). The dimensions of the plate (length-breadth-thickness) are indicated below the plate. See the figure below.

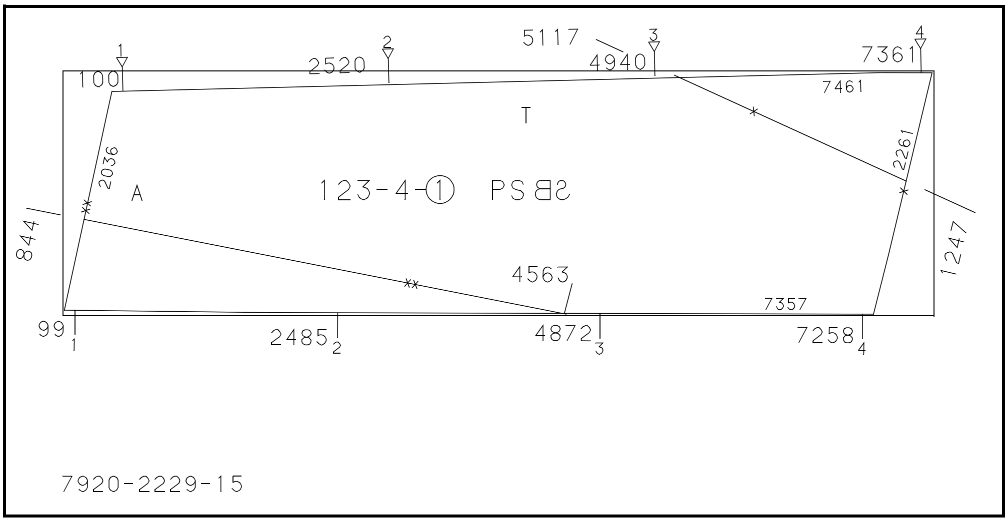


Figure 4:4. Sketch of plate with template information.

The lines marked with X and XX are the primary and secondary roll axis, respectively. Edges marked with X and XX are the basis of the roll axis with the same indication.

- Sketches of the individual templates with inscribed names. One picture is generated for each template, see the figure below.

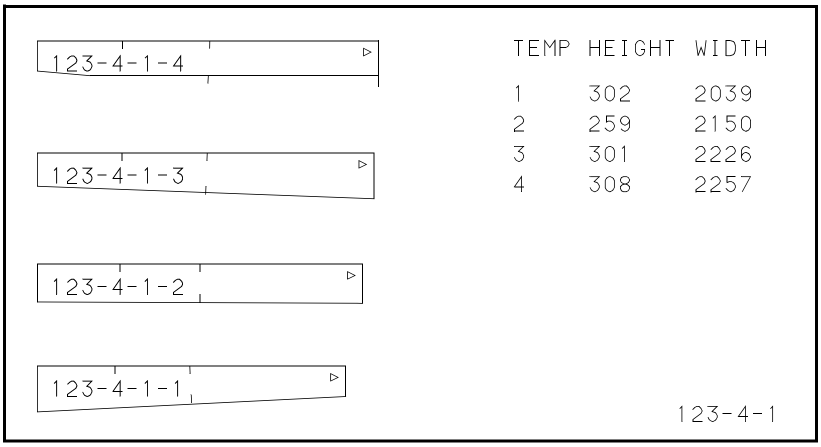


Figure 4:5. Templates and template table.

A small table containing the height and width of all templates. Such a table is included in the figure above. For frame templates this table is extended with the distances in the special figure below for set-up of the templates. (See below).

- Only for frame templates: A layout sketch for placing of templates upside down, supposing that the workshop floor coincides with the sight plane. This sketch may e.g. be used to position the templates to build a mock-up for the plate. See the figure below.

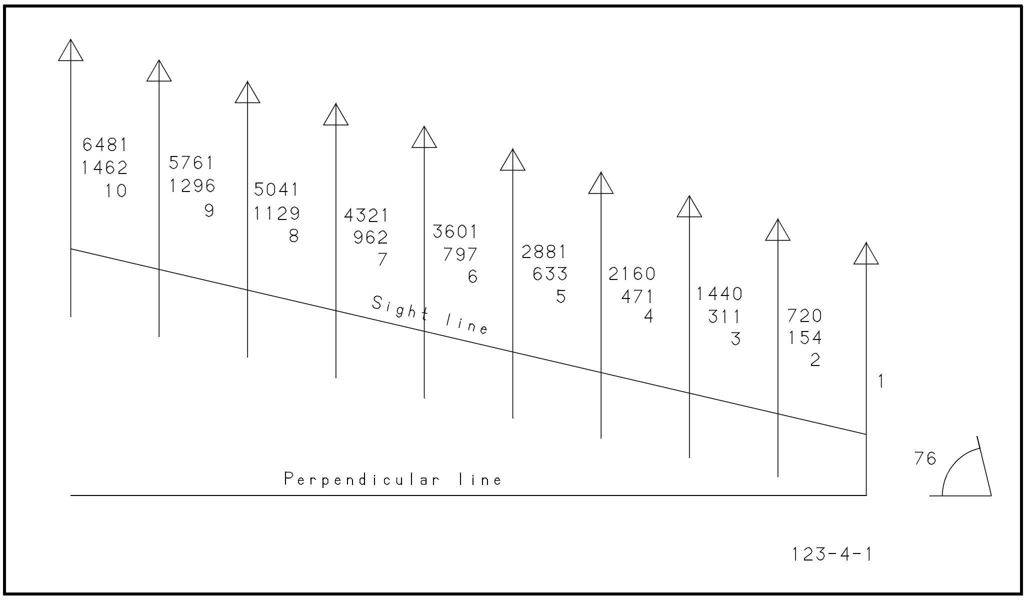


Figure 4:6. Special assembly sketch for frame templates.

In this view the templates are drawn as follows:

- A triangle at the end of direction marks of the templates.
- A "perpendicular line" that is perpendicular to all the templates and goes through the starting point of template number 1. The line is indicated by the text "Perpendicular line".
- The sight line. The line is indicated by the text "Sight line".
- An angle mark, where the bottom of it is supposed to lie in the assembly plane and the angle shown supposed to be measured on the side of template number 1 towards the other templates.
- Three rows of integer values. At the template number 1 the upper two rows are missing. The lower row shows the template number.
  The upper row shows the distance along the perpendicular line for the current template to template number 1.
  The middle row shows the distance between the start of the current template and the perpendicular line. A positive value means to the right of the perpendicular line seen from template number 1 in the direction to the other templates.

Special run modes may produce certain other figures as described together with the documentation of these run modes.

There are in principle two ways in which the pictures above may be output:

1. If no special set-up is made, the pictures will be handled according the standard routine for receipt pictures from runs via the Production Program Interface, i.e. they will be collected into a receipt drawing by name BTPL_<plate_No>_<job_No>.
2. The second option is that certain of the pictures may be output on a predefined drawing form, as described below.

In case (2) two drawings will be output:

- The formatted drawing with its contents will get the name BTPL_<plate_No>_<job_No>_1(2).

- The unformatted drawing with the remaining pictures will be output in a drawing by name BTPL_<plate_No>_<job_No>_2(2).

In the name specification above <job_No> is the job number of the current job. <plate_No> is a running number, starting in 1. If several plates are treated in the same run <plate_No> will be incremented by one for each new plate.

Conditions to get a formatted receipt drawing are:

- A drawing form with the fixed name TB_BENDTEMPL must exists on the data bank assigned to SBD_STD and it must contain certain control parameters ("$-values") as explained by the table below.
- The ip ONLY_SIMPLE_SKETCH must not have been given in the default file of the template module.

Rule number ("$ value")	**Usage (replaced by / indicating position of)**
1001	User name (fetched from SBB_USER_NAME)
1002	User telephone number (fetched from SBB_USER_TELEPHONE)
1006	Scale of drawing
1007	Drawing name
1008	Plate name
1009	Position number
1012	Block name
1998	Lower left corner of area to be reserved for plate sketch
1999	Ditto upper right corner. Rules 1998 and 1999 must be available for a formatted drawing to be created.
1996	Lower left corner of area the template table (optional)
1997	Ditto upper right corner
1994	Lower left corner of area for special frame template sketch (*Figure 4:6.: Special assembly sketch for frame templates.*) above)
1995	Ditto upper right corner
1992	Lower left corner of area for sketch "Flexible frame templates", see *Example of listing of flexible templates in Chapter Flexible Templates*
1993	Ditto upper right corner.

The picture below shows a drawing form that may be used. Note that it need not contain all possible $-values.

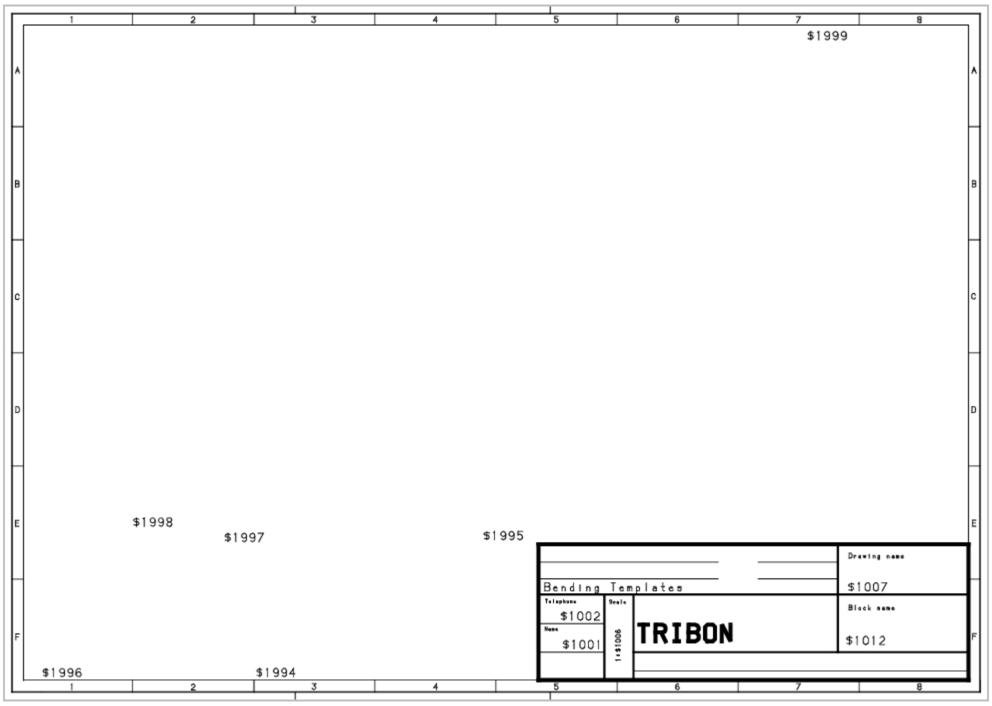
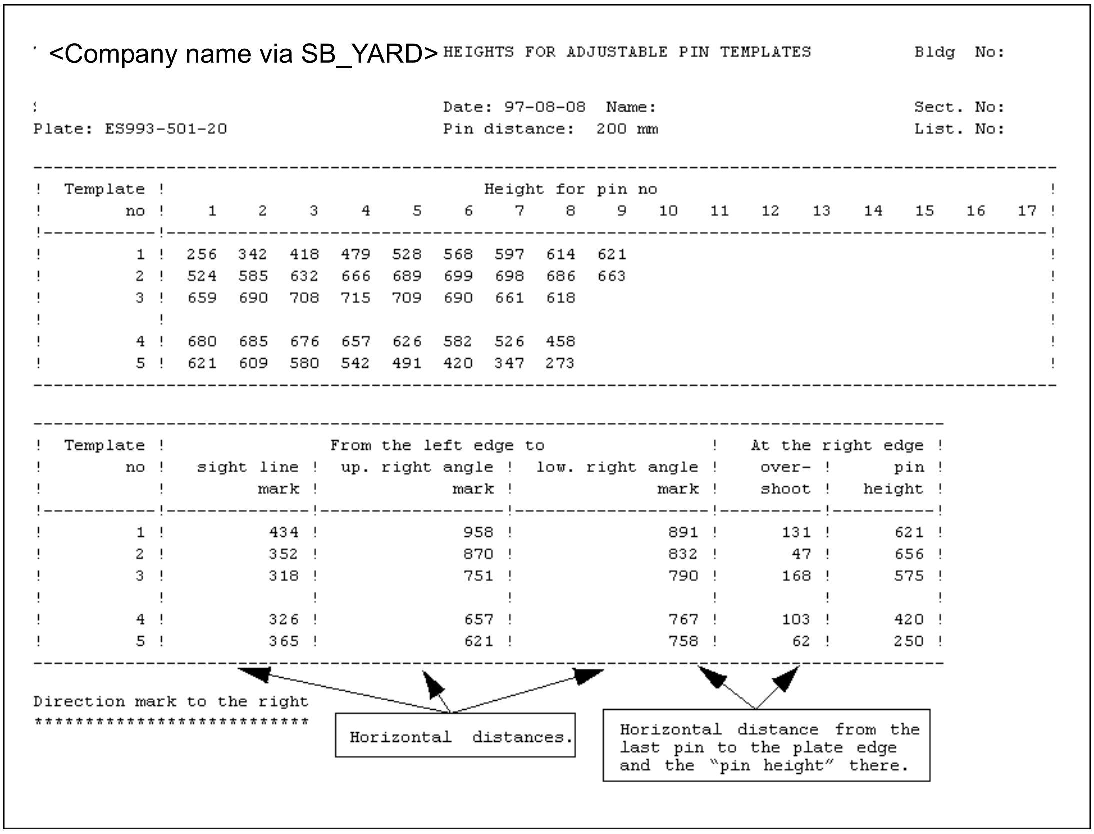


Figure 4:7. Drawing form with $-values for template drawing.

4.7 Example of Lists

The list below is an example of a standard output if the default parameter PINS has been included in the default file for a standard templates.



<Company name via SB_YARD> HEIGHTS FOR ADJUSTABLE PIN TEMPLATES   Bldg No:

Date: 97-08-08 Name: Sect. No:

Plate: ES993-501-20   Pin distance: 200 mm   List. No:

Template no	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Height for pin no																
1	256	342	418	479	528	568	597	614	621								
2	524	585	632	666	689	699	698	686	663								
3	659	690	708	715	709	690	661	618									
4	680	685	676	657	626	582	526	458									
5	621	609	580	542	491	420	347	273									

Template no	From the left edge to sight line mark	up. right angle mark	low. right angle mark	At the right edge over-shoot	pin height
1	434	958	891	131	621
2	352	870	832	47	656
3	318	751	790	168	575
4	326	657	767	103	420
5	365	621	758	62	250

Direction mark to the right
****

Figure 4:8. Example of listing of pin heights for a standard template

When producing the list the trace curve of the template has been extended so that there is one pin outside the plate at the right edge of the template. The height of a "fictitious" pin at the plate edge is listed in the rightmost column of the lower table.

The list below is the corresponding list for standard frame templates.

<Company name via SB_YARD> HEIGHTS FOR ADJUSTABLE PIN TEMPLATES BLDG NO:

Date: 97-08-08 Name: Sect. No:

Plate: Es993-501-20 Pin Distance: 200 Mm List. No:

Template No	Height For Pin No 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	250	336	413	475	524	565	593	610	617								
2	418	490	552	598	633	657	669	670	661								
3	543	600	645	677	696	703	700	685	658								
4	626	668	696	712	716	707	688	656									
5	670	695	707	709	696	672	638	589									
6	682	692	690	677	650	612	563	501									
7	667	666	651	625	588	537	472	399									
8	631	621	595	559	511	444	370	297									

Template No	From The Left Edge To Sight Line Mark	Upper Angle Mark	Lower Angle Mark	Angle Fore	At The Right Edge Over-Shoot	Pin Height
1	432	960	891	97	132	617
2	381	918	856	96	84	654
3	346	856	827	94	38	652
4	326	786	804	93	194	615
5	320	719	785	92	153	546
6	326	668	772	91	117	461
7	342	637	763	91	88	367
8	366	615	760	90	66	273

Direction Mark To The Right
****

Horizontal distances.

Horizontal distance from the last pin to the plate edge and the "pin height" there.

Angle between the plate and the template fore of the template.

Figure 4:9. Example of listing of pin heights for standard frame templates.

4.8 Errors

Some self-explanatory error messages may be output on the job log.

A1 Normal Bending Templates

A1.1 General

Standard frame templates have the disadvantage that they are relatively poor tools for controlling and checking the shape of a shell plate if the angle between the frame (template) plane and the plate surface becomes narrow. On the other hand they are quite appropriate when this angle is close to 90 degrees and have in this situation the advantage that marking information for their application on the plate normally already is available.

This appendix describes an option that allows a user to get so called "Normal templates" as an alternative to the standard frame templates. It further offers the alternatives either always to have normal templates, or to produce normal templates only if the angle between the frame plane and the plate becomes smaller than a certain angle.

The main document of the template module is applicable unless otherwise specified.

The default parameters relevant for this run mode are specified below in the paragraph *Control Information* .

A1.2 Special Features of Normal Templates

In the text below the expression "base line seams" refers to the two seams that intersect the base line, i.e. normally the two shorter edges of the plate. For the definition of the base line, please refer to the document for the shell plate development module. Normal templates are generated as described below.

- The sight plane is set so, that the distances between the plane and the opposing plate corners on the base line seams are equal. The shortest of the two distances can be set in the default file.
- The plane of the middle template is placed across the plate approximately at the middle point of the plate. The corners at the end points of the base line seams are used in order to decide this point.
- The template planes are all parallel and set at equal distances. The maximum allowed distance can be set in the default file.
- The minimum distance from the outer templates to the base line seams can be set in the default file.
- The sight line is set as close as possible to the middle points of the templates. This choice can be overridden by information in the default file.

When the module is working as described in this Appendix it may be controlled to produce two types of templates:

1. Always create Normal templates independently of angle between the frame plane and the plate.

2. Create standard frame templates normally. Normal templates should be generated only if any of the frame templates would get an angle to the plate that is smaller than 75 degrees.

A1.3 Input to the Program

As described in the main document.

A1.4 Result

The listing of the pin heights is the same for both frame templates and normal templates.

All listed measures are given in millimetres and degrees. The values are rounded to the nearest integer value.

A1.5 Control Information

The run mode described in this document is activated by the presence of the default keyword `NORMAL_TEMPLATES` (see below). The following information is relevant in the default file:

`ENGLISH,`

`DISTTOEDGE, <dist>,`

`MAXDISTTOTEMPLATE, <dist>,`

`MINHEIGHTOFTEMPLATE, <height>,`

`PINS, [<dist>,]`
For details about these words above, see the main part of the document.

`FRAMETEMPLATES,`
This word states, that the program always shall create frame templates. If this word is given, the next one - `NORMAL_TEMPLATES` - is not taken into account. Thus, giving this default will inhibit the run mode described in this document.

`NORMAL_TEMPLATES, [MANDATORY,]`
This word states, that the program is allowed to choose between frame templates and Normal Templates. The transition takes place at the angle 75 degree. If the parameter MANDATORY is given, the program is told to always create Normal templates.

A1.6 Remark

This run mode of the template module was originally implemented for Mitsui Engineering & Shipbuilding Company.

A1.7 Examples of Default Files

Example:

```
MAXDISTTOTEMPLATE,2000,
PINS, 400,
NORMAL_TEMPLATES,
```

This example tells the program to choose between frame templates and normal templates. Further:

- set the minimum distance between the outer templates and the base line seams to 100 mm.
- set the maximum distance between the templates to 2000 mm (only normal templates).
- set the height of the shortest pin to 250 mm.
- create a list of pin templates.
- set the distance between the pins in the templates to 400 mm.

Example:

```
PINS,
NORMAL_TEMPLATES,
```

This case gives a similar behaviour as in example 1 except:

- set the maximum distance between the templates to 3500 mm, (only when normal templates)
- set the distance between the pins within a template to 250 mm.

Example:

```
PINS,
NORMAL_TEMPLATES, [MANDATORY,]
```

As example 2, only that all templates will be normal templates.

Example:

```
PINS,
FRAMETEMPLATES,
NORMAL_TEMPLATES, MANDATORY
```

Since FRAMETEMPLATES is given NORMAL_TEMPLATES will be disregarded in this case.

A2 Flexible Templates

A2.1 General

This Appendix describes a special run mode of the template module that may be used to generate information for a special type of flexible templates, used in general in the Chinese shipbuilding industry. These templates are constructed of a flexible template part and a stand with a sight mark (for a schematic picture, see the picture below).

These flexible templates may be generated and used in two different ways:

1. The templates are generated in principle as standard frame templates but the output information is somewhat special.
2. The templates are generated as a special type of "normal templates" with some similarity to the Normal templates described in *Normal Bending Templates*.

The ordinary templates of both kinds may be completed with special edge seam templates. The output will for all consist of table information for the setting-up of the flexible templates.

There is no special input for these types of templates, rather they are selected by certain settings in the default file (see below).

A2.2 Definitions

The two seams that intersect the base line are here called the *base seams*. They are normally the two short edges of the plate. They are either frame sections or nearly so. For the definition of the base line, please refer to the document for the program shell plate development module.

The intersection point between the template and the sight line plane is called the *middle point* of the template.

A2.3 Flexible Frame Templates

The template module is switched into flexible frame template mode by adding the following parameters to the default file:

```
FLEXIBLE_TEMPLATES, TYPE2,
```

TYPE 2 should be considered as a value assigned to the keyword.

A2.3.1 Rules for Calculation

These special frame templates are generated as described below. The picture shows schematically how they are used and also the vocabulary used for them (which differs somewhat from the standard vocabulary).

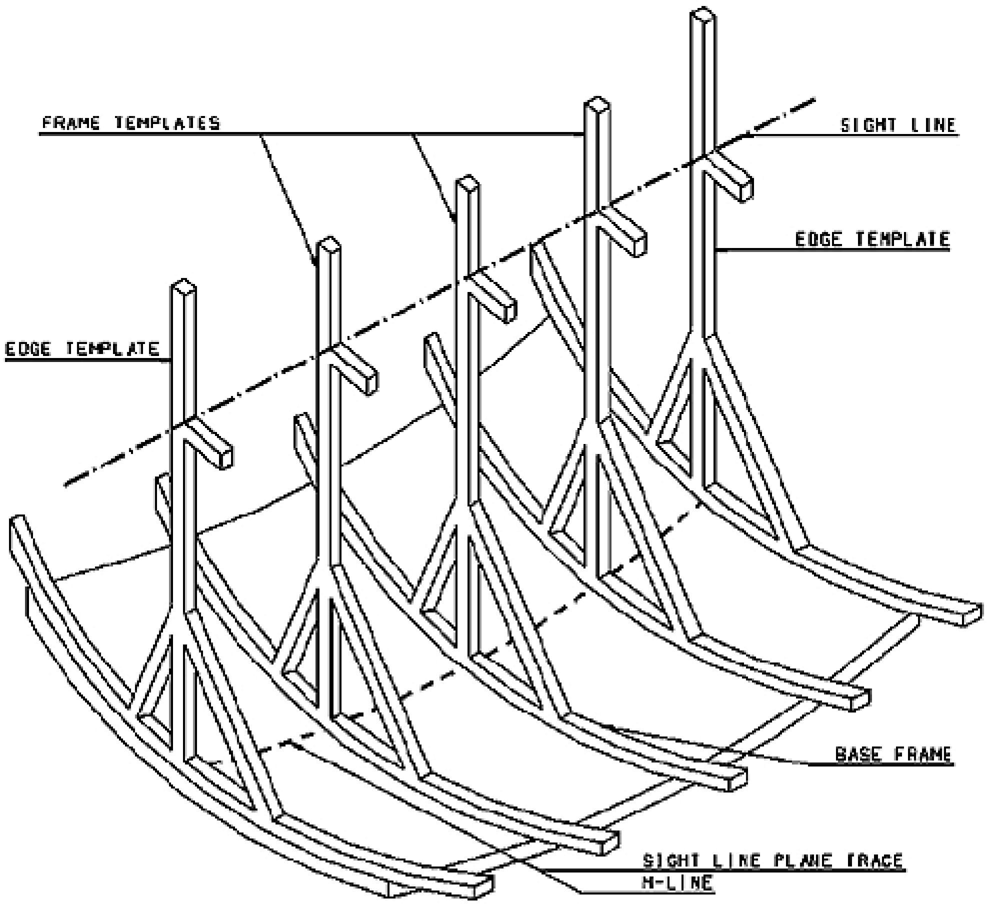


Figure A2:1. Flexible frame templates.

- The upper edges of the templates (when still treated as physical templates, cf. the main document) are located in a base plane (otherwise called the sight plane). The base plane is selected so that it is parallel to the line between the midpoints of the two next outermost template curves and so that the difference in distance to the plate corners is minimised
- A sight line plane is calculated as perpendicular to the base plane and approximately in the middle of the plate (and the template curves).
- The base plane is then moved so that the distance along the stand from the template midpoint to the base plane becomes 600 mm (for the same two templates). The line of intersection between the base plane and the sight line plane is called the sight line. The distance along all stands to this line is output in the resulting list.
- The frame closest to the middle of the plate is called the *base frame*.
- If the base seams are in frame planes templates will be generated along these seams. If the next frame template is too close, that frame template will be skipped (see *Flexible Frame Templates* and *Control Information*).
- The intersection curve between the sight line plane and the plate (M-line in the figure above) will be marked on the plate (at the same time as other marking is added).
- The angle between the template and the M-line will be calculated on the forward side.

A2.3.2 Result

- **Listing**

For an example of the special output list in this case, see below. The list starts with two headlines. The first contains the name of the plate, the date when the templates were created, and the distance between "pins" of the template. The second line contains the limiting frame sections, the base frame, the aft and fore butts, and the number of templates.

The headline for the templates contain the digits from -8 to 8. These digits denote the multiplication factor to use together with the distance given in the first headline row. This creates the distance from the middle point to the pin where to apply the listed height.

One row is printed for each template. The middle column normally contains the value 0, while the other columns contain the height (with sign) of the template in this point. The value is relative to the height of the middle point. The templates curves have been extended to reach the first "pin" outside the actual plate.

To the left in the row the frame number or frame section is printed.

To the right there are five columns. They contain the distance from the middle point to the lower and upper seams, the distance from the middle point to the sight mark, and the angle between the template and the plate measured fore of the template.

Four lines are printed at the bottom of the list. They contain the coordinates of the middle points given in the ship's coordinate system.

The last line is the distance from the base frame to the straight line between the end points of the sight line plane curve.

```
HEIGHTS FOR FLEXIBLE TEMPLATES      PLATE= ES993-501-10
DATE= 99-02-16      DISTANCE BETWEEN COLUMNS= 200

LIMITS= F20+200 -- F30+200   BASE= F25   AFT   BUTT= ESS503
FORE      BUTT= ESS13   TEMPLATES= 12
```

Example of listing of flexible templates

Link to file: Flexible_template.txt

- **Sketch**

A horizontal axis is plotted from minus eight to plus eight times the spacing of the pins. A vertical axis is plotted at the coordinate 0 showing the height to the sight mark for the base frame. The templates are transformed so, that their middle points coincide. The extreme values in the horizontal direction are also plotted. At the top of the sketch the name of the plate, the X-limits, and the names of the delimiting butts are plotted.

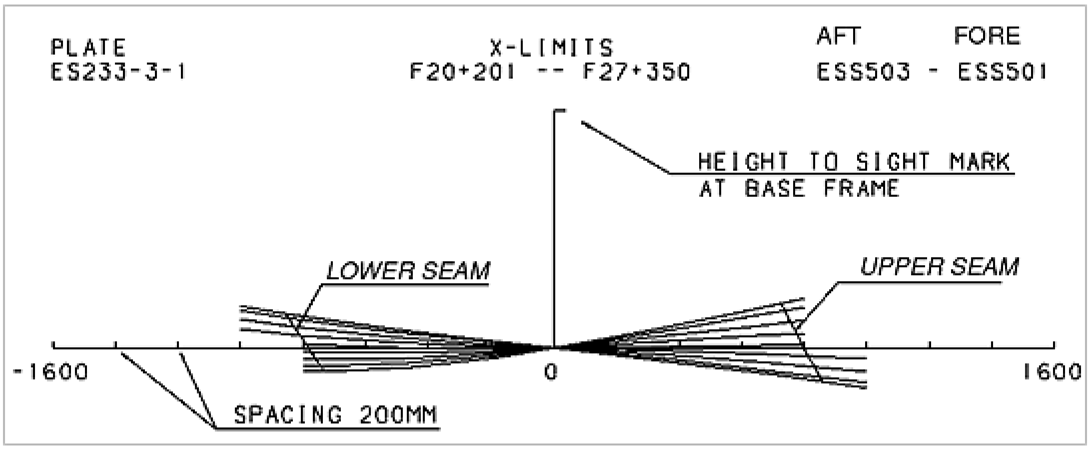


Figure A2:2. Sketch, example.

A2.4 Flexible Normal Templates

The flexible normal templates are calculated very much in the same way as the flexible frame templates (even if the base plane is calculated somewhat differently).

The template module is switched into that mode by the following information in the default file:

`NORMAL_TEMPLATES, FRAME_POSITIONS,`

`FRAME_POSITIONS` should be considered as a value assigned to the keyword.

This variant of normal templates are not lying in frame planes, rather they are all perpendicular to the base plane. Like the frame templates they are positioned by the frames but they are locked to the frame position only where the frames intersect the upper and lower seams. Thus, the template curve will not exactly coincide with the frame curve.

The output is similar. However, the base plane curve has been moved for each template so that all "pin heights" are positive in this case. The column SMAR in the example above has been removed for normal templates.

A2.5 Edge Seam Templates

Sometimes, the short edges of a plate are not located in frame plane. Since the position of the templates described in this Appendix always are decided by the frame positions a rather big plate area may be left uncovered by any template. Therefore there is an option to get additional templates parallel to the short edges of the plate. These templates are called *edge seam templates*.

The edge seam templates are requested by an ip with at most two parameters:

`EDGE_SEAM_TEMPLATES, [<angle>, [<distance>,] ]`

To get these extra templates there must be a certain deviation from 90 degrees in the angle between the short and long edges. This angle is by default 75 degrees but any value may be given by the customer (=`<angle>`).

The templates will be placed roughly parallel to the short edges of the plate between two points at a given distance from the corners. The distance is measured along the upper and lower seams. The default distance is 100 but the customer may specify any value (=<distance>).

Edge seam templates in association with normal templates will be perpendicular to the same base plane as the other templates.

For edge seam templates in combination with frame templates the planes of the edge seam templates will be perpendicular to a "base plane". This base plane is perpendicular to the sight (line) plane and contains the sight line (at height about 600 mm), i.e. is roughly "parallel" to the plate.

If the butts at the short edges (the base seams) lie in a frame plane no edge seam will be created at the respective butt.

If there should be an interference between an edge seam template and the closest templates in a frame position, the frame templates will be deleted.

A2.6 Special Features for the Flexible Templates

- The sight plane is chosen using the next outermost templates. At those two templates the distance from the sight line point to the middle point is chosen to be 600mm. After correcting the template curve for the plate thickness these two distances may differ from 600mm.
- The sight line plane is chosen so, that the middle points are as close as possible to the mid points of the templates counted between the delimiting seams.
- The frame closest to the middle of the plate is chosen as the base frame.

A2.7 Result

The result consists of listings and sketches. One listing and one sketch is given for each plate.

A2.8 Control Information

The following information is relevant in the default file:

```
MINHEIGHTOFTEMPLATE, <height>,
```

This word can be used to increase the minimum distance between the middle points and the sight marks for frame templates. The default and minimum value is 600 mm.

```
EDGE_SEAM_TEMPLATES, [<angle>, [<distance>,]]
```

Activates the calculation of edge seam templates, see above for details.

```
EDGE_TEMPLATE, <distance>,
```

This word can be used to change the minimum distance between the base seams and the closest frames. Frames, that lie closer to a base seam than <distance>, will be skipped and a warning will be printed in the log. The default value is 200mm. There is no minimum distance.

```
FLEXIBLE_TEMPLATES, [TYPE 2,] [ DISTANCE, <distance>,]
[LONGBEND,] [LENGTHS,]
```

The word `FLEXIBLE_TEMPLATES` must be given.

If TYPE 2, is entered, then the templates are lying in frame planes.

The `<distance>` denotes the spacing between the measuring points along the templates. The default value is 200mm.

- LONGBEND will add a row in the listing giving the height at the base frame template from this template's middle point to the intersection point between the template and a line between the points where the sight line plane intersects the edges.

LENGTHS will cause an extra column to be listed as an extra column in the list the lengths of the template curves.

`NORMAL_TEMPLATES, FRAME_POSITIONS,`

Activates the normal template mode, see above.

`OFFSET_TRACE_CURVES, [<offset,]`

Normally when asking for flexible templates a sketch is produced as shown in *Figure A2:2.: Sketch, example.* In this sketch the trace curves have been translated so that their intersection points with the sightline get located in (0, 0).

Using OFFSET_TRACE_CURVES means some changes to this sketch:

- The curves are offset relative to each other by <offset in the u-direction and by 2*<offset> in the v-direction.
- The frame number (or position) of the curves are added to the left of each curve.
- The projected edge curves in the *old* sketch have become obsolete and have been replaced by *tics* where ech template curve is intersects the edges.
- Likewise, the *u-axis* has become obsolete and is removed.

Default value for <offset> is 50 mm.

A3 Special Bending Templates

A3.1 General

Standard frame templates have the disadvantage that they are relatively poor tools for controlling and checking the shape of a shell plate if the angle between the frame (template) plane and the plate surface becomes narrow. On the other hand they are quite appropriate when this angle is close to 90 degrees and have in this situation the advantage that marking information for their application on the plate normally is available already.

This appendix describes an option that allows a user to get so called "Normal templates" as an alternative to the standard frame templates. It further offers the alternatives either always to have normal templates, or to produce normal templates only if the angle between the frame plane and the plate becomes smaller than a certain angle.

The main document of the template module is applicable unless otherwise specified.

The default parameters relevant for this run mode are specified below in the paragraph *Control Information* .

A3.2 Special Features for Normal Templates

In the text below the expression "base line seams" refers to the two seams that intersect the base line, i.e. normally the two shorter edges of the plate. For the definition of the base line please refer to the document for shell plate development module. Normal templates are generated as described below.

- The sight plane is set so, that the distances between the plane and the opposing plate corners on the base line seams are equal. The shortest of the two distances can be set in the default file.
- The plane of the middle template is placed across the plate approximately at the middle point of the plate. The corners at the end points of the base line seams are used in order to decide this point.
- The template planes are all parallel and set at equal distances. The maximum allowed this distance can be set in the default file.
- The minimum distance from the outer templates to the base line seams can be set in the default file.
- The sight line is set as close as possible to the middle points of the templates. This choice can be overridden by information in the default file.

When the module is working as described in this Appendix it may be controlled to produce two types of templates:

1. Always create Normal templates independently of angle between the frame plane and the plate.

2. Create standard frame templates normally. Normal templates are generated only if any of the frame templates would get an angle to the plate that is smaller than 75 degrees.

A3.3 Input to the Program

As described in the main document.

A3.4 Result

The listing of the pin heights is the same for both frame templates and normal templates.

All listed measures are given in millimetres and degrees. The values are rounded to the nearest integer value.

A3.5 Control Information

The run mode described in this document is activated by the presence of the default keyword `NORMAL_TEMPLATES` (see below). The following information is relevant in the default file:

`ENGLISH,`
This word states, that the language to use in the list of the pin heights is to be English. This word is not mandatory.

`DISTTOEDGE, <dist>,`
This word states the minimum distance between the outer templates and the base line seams. If the word is left out the distance defaults to 100 mm.

`MAXDISTTOTEMPLATE, <dist>,`
This word states the maximum distance between the templates. If the word is left out the distance defaults to 3500 mm.

`MINHEIGHTOFTEMPLATE, <height>,`
This word states the height of the shortest pin. If the word is left out the height defaults to 250 mm.

`PINS, [<dist>,]`
This word states, that the program shall create a list of the heights of the pin templates. The parameter <dist> is optional and specifies the distance between the pins. If the addition is not given, the distance will default to 250 mm.

`FRAMETEMPLATES,`
This word states, that the program always shall create frame templates. If this word is given, the next one - NORMAL_TEMPLATES - is not taken into account. Thus, giving this default will inhibit the run mode described in this document.

`NORMAL_TEMPLATES, [MANDATORY,]`
This word states, that the program is allowed to choose between frame templates and Normal Templates. The transition takes place at the angle 75 degree. If the parameter MANDATORY is given, the program is told to always create Normal Templates.

Remark

This run mode of the template module was originally implemented for Mitsui Engineering & Shipbuilding Company.

A3.6 Examples of Default Files

Example:

```
MAXDISTTOTEMPLATE,2000,
PINS, 400,
NORMAL_TEMPLATES,
```

This example tells the program to choose between frame templates and normal templates. Further:

- set the minimum distance between the outer templates and the base line seams to 100 mm.
- set the maximum distance between the templates to 2000 mm (only normal templates).
- set the height of the shortest pin to 250 mm.
- create a list of pin templates.
- set the distance between the pins in the templates to 400 mm.

Example:

```
PINS,
NORMAL_TEMPLATES,
```

This case gives a similar behaviour as in example 1 but:

- set the minimum distance between the outer templates and the base line seams to 100 mm.
- set the maximum distance between the templates to 3500 mm, (only when normal templates)
- set the height of the shortest pin to 250 mm.
- create a list of pin templates.
- set the distance between the pins within a template to 250 mm.

Example:

As example 2, only that all templates will be normal templates.

```
PINS,
NORMAL_TEMPLATES, [MANDATORY,]
```

Example:

```
PINS,
FRAMETEMPLATES,
NORMAL_TEMPLATES, MANDATORY
```

Since FRAMETEMPLATES is given NORMAL_TEMPLATES will be disregarded in this case.

A4 Cross Templates

A4.1 Input to the Program

As described in *Input in Chapter Bending Templates for Shell Plates*.

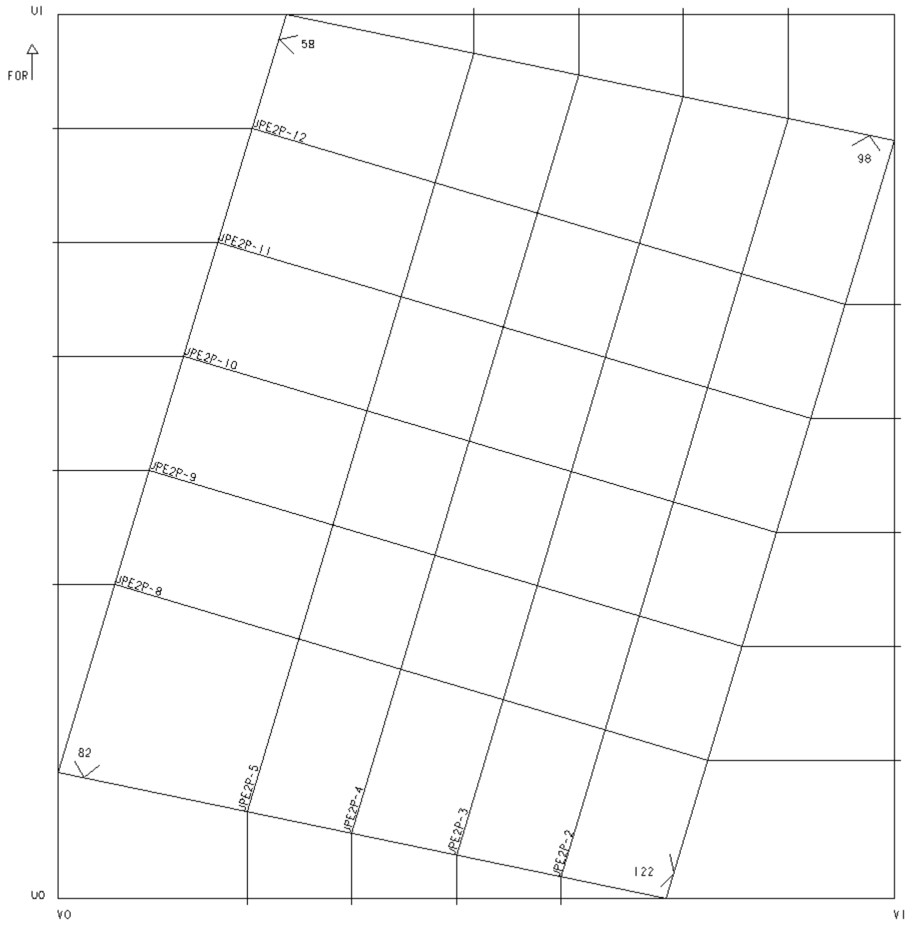
A4.2 Result

The templates will be written to the plate data bank (SB_PLDB). This includes all interior templates in the direction of the base plane v-axis and u-axis, edge templates and the base plane template. The naming of the template objects will be `<plate name>-<suffix>` where suffix is an integer running number starting with 0. The base plane template will be named `<plate name>-0` and the templates in the v-axis direction will be named `<plate name>-1 through <plate name>-N` where N is the number of templates in this direction. If there are edge templates at both ends of this direction, they are the first and last templates.

The first templates in the u-axis direction will be named starting with `<plate name>-N+1`.

A sketch showing the base plane (template) in its local uv-coordinate system with markings for all templates will be prepared by the program and stored in one of the drawing data banks. The sketch will also contain attachment angle information for edge templates. A separate list containing distances from the edges to all interior templates will also be store in a comma separated file on SB_SHIPPRINT with the extension `.csv`.

Below is an example of a sketch showing the base plane part in its local uv-coordinate system.



The corresponding csv file is then:

```
Aux. Axis,V1,U1
Distance From 0 axis,6410,6792
,JPE2P-6,JPE2P-5,JPE2P-4,JPE2P-3,JPE2P-2,JPE2P-1,Angle
U,0,1446,2249,3052,3855,4658,82
V,973,671,503,335,168,0,
,JPE2P-6,JPE2P-5,JPE2P-4,JPE2P-3,JPE2P-2,JPE2P-1,Angle
U,1751,3185,3988,4791,5594,6410,98
V,0,299,467,635,802,973,
,JPE2P-7,JPE2P-8,JPE2P-9,JPE2P-10,JPE2P-11,JPE2P-12,JPE2P-
13,Angle
U,0,434,698,961,1225,1488,1751,58
V,973,2416,3291,4167,5042,5917,6792,
,JPE2P-7,JPE2P-8,JPE2P-9,JPE2P-10,JPE2P-11,JPE2P-12,JPE2P-
13,Angle
U,1751,1433,1169,906,642,379,0,122
V,0,1059,1935,2810,3685,4560,5820,
```

A4.3 Control Information

The following IP:s are used when calculating cross bending templates:

Note: No special IP is needed in order to make bending templates of the type *cross templates*.

DISTTOEDGE, <integer value>,

The distance between the first template and the edge of the plate. This is only valid for plate edges without edge templates. If there is an edge template, the calculated spacing between templates will be used to get the distance from the edge to the first (interior) template.

MAXDISTTOTEMPLATE, <integer value>,

The maximum allowed distance (spacing) between to adjacent templates.

MINHEIGHTOFTEMPLATE, <integer value>,

The minimum allowed distance between the base plane and the plate edges. This will also affect the height of all templates.

MIN_TEMPLATES, <integer value>,

The minimum allowed number of templates including edge templates in each direction, i.e parallel to the base plane v-axis or u-axis. Using the cross template dialog instead, this number can optionally be separately set for each template direction.

AUTO_TEMPL_SIDE ,{inside | outside | concave | convex},

The side of the plate for which the templates should be created.

SPLIT_PLATEEDGE_NO, <integer value>,

In case the shell plate has three edges, one of the edges must be logically split in two parts before it can be processed by the program to make cross bending templates. Note that this IP is unique to cross templates and that the value of parameter <integer value> should be in the range 1-3 corresponding to edges with these numbers. If omitted the default is 1.

SPLIT_PLATEEDGE_RATIO, <real value>,

Unique to cross templates and optionally used together with SPLIT_PLATEEDGE_NO. This IP instructs the program where to logically split one of the edges of a shell plate with three edges. <real value> should be in the range 0.00-1.00 and if the IP is omitted the default is 0.50.

A4.4 Examples of Default Files

DISTTOEDGE, 100,

MAXDISTTOTEMPLATE, 1000,

MINHEIGHTOFTEMPLATE, 200,

MIN_TEMPLATES, 4,

This example default file will affect the result in the following way:

The distance to the first template is 100 mm if there is no edge template on that side. The number of templates in each direction is dependent on the fact that the distance between templates cannot exceed 1000 mm. The distance can actually be a lot less if a sufficient minimum number of templates are specified in the cross template dialog. If not, the minimum number is 4 in each direction. The distance between the base plane and the plate contour is at least 200 mm.