CAD/CAM System B-Ship+
Version 5.0

Module Nesting
Forming nesting maps and setting
parts cut route in graphical editor

User manual

BSHIP.00004.005-2022

Sheets 67

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ANNOTATION

The document is a reference manual for work with the module **Nesting** of the **B-Ship+** system. The manual includes description of menu, commands, user interface, themes of interaction with other modules of the system.

Document is designed for specialists who run **B-Ship+** system for the design and technological preparation of the ship hull production and have practical experience of using BricsCAD graphical system. **B-Ship+** is informationally compatible with the systems **Ritm-Ship** (AutoCAD), **R-Ship+** (AutoCAD), **N-Ship+** (nanoCAD).

Recommended operating systems are: Windows 8.1, Windows 10.

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CONTENTS

1   GENERAL INFORMATION

Module **Nesting** is targeted for creation in graphical editor DWG files of sheet nesting maps, for setting route of cutting out parts in maps and for generation of numerical control (NC) programs for cutting, marking and labeling for machines with CNC in required format and code.

For shortness everywhere in the document **B-Ship+** will be named **B-Ship**.

2   TERMS AND AGREEMENTS

This manual uses the following agreements for fonts:

Italic – names of folders, files and file extensions, explanatory text to graphical editor requests;

Bold – names of modules and system components, menus, menu items, buttons and keys, commands in dialog with editor;

ALL CAPITAL – names of layers, commands of editor and named objects.

Editor messages are emphasized with *italic*.

3   ABBREVIATIONS

CAD — computer aided design

JNG — joint nesting group (list of parts and sheets of the same grade and thickness inside one launch)

NC — numerical control program (CNC)

TNC — technologic norming card

FPD – form of printed document (equivalent to TNC)

4   MODULE DESIGNATION

Module **Nesting** is designed for automatic or interactive nesting of sheet parts on standard plates or usable scraps, setting route (path) for manufacturing parts and for preparation of NC programs of cutting, marking and labeling in required format and code with machines with program control, defining usable scraps, output of reference info and documents (including TNCs, or FPDs).

Module assures cutting of the types: heat, laser, plasma, water (to be discussed with customer in the agreement). Interactive nesting variant can be used not only for flat plates, but for panels too.

Automatic nesting variant provides automatic nesting (placement inside flat sheet) by evristic algorithm. In this variant part contours are simplified, parts are united into complexes (minimal bounding rectamgles), sorting complexes by set factor, selection of nesting case, exploding complexes, calculation of script file (*.scr) for creation of nesting maps and for saving them in the current order DB. Automatic variant can consider technologic demands to narrow long parts (place along plate edge) and placing parts inside holes. Placement of very small

parts in holes is forbidden. While nesting there are defined usable scraps and saved in the table otxod.dbf for future handling. On end of nesting progtam usually says:

NESTED PARTS,

NO. OF NESTING MAPS,

LEFT UNNESTED.

Module **Nesting** uses graphical editor as environment bot for automatic and interacive nesting process. Part involved in nesting must be described beforehand: geometry by modules **Part** or **Mdet**, textual attributes in DB by module **Bdata**.

All the work is run inside opders (order is a portion of project). For example: BS103_1, EN103_1. Main DB tables filled by **Nesting** are: *kr_list.dbf, det_zak.dbf, g_svmrsc.dbf, spr_gsr.dbf, otxod.dbf*.

For each nesting map a DWG file is created. It is saved in subfolder *Karty* inside current order folder. DWG name is identic to map name in database. The main map attributes saved in DB are: list of parts, material grade, thickness, dimensions, cut length etc. Attributes can be viewed with command **BDATA > TABLES > Sheet nesting maps**.

5   MODULE MENU

B-Ship system has pull-down (popup) menus, one per each module. Ribbon is not used. To load all the pull-down menus at once user must **click B-Ship+ button** at the right end of the status line.

Module **Nesting** has its own pull-down menu (dr. 1), its name consists of NESTING and two symbol suffix denoting current interface language: en (English), ru (Russian), etc. But for universality everywhere in the document **NESTING** name is used instead of **NESTINGen**, **NESTINGru**.

Note. Menu **NESTING** resides in the folder *BSHIP\Sys\BRv<nn>* as files bship_nesting_en.mnu and bship_nesting_en.cui and is a partial menu, being added to the main BricsCAD menu default.cui (*<nn>* is BricsCAD version number, e.g. 19, 20). Therefore menu **NESTING must never be loaded as a main menu**! In case of this error user will lose access to graphical editor commands.

Menu **NESTING** as partial menu can be loaded with command MENULOAD from key-board or from menu **BDATA > MENULOAD**. MENULOAD opens dialog box **Customization Groups** (dr. 2).

This window is used for loading and unloading partial menus, one by one. **B-Ship** partial menus are named in such a way: BSHIP_BDATA_EN (module **Bdata**), BSHIP_MODEL_EN (module **Model**), BSHIP_STRUCTURE_EN (module **Structure**), BSHIP_NESTING_EN (module **Nesting**), etc.
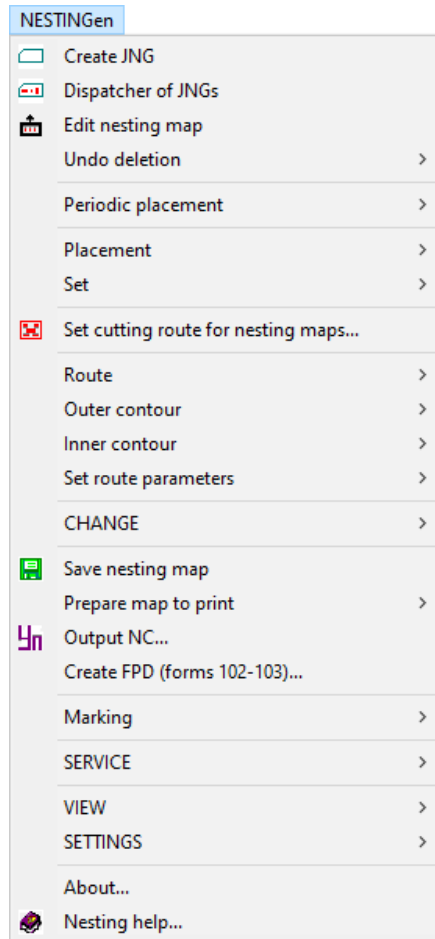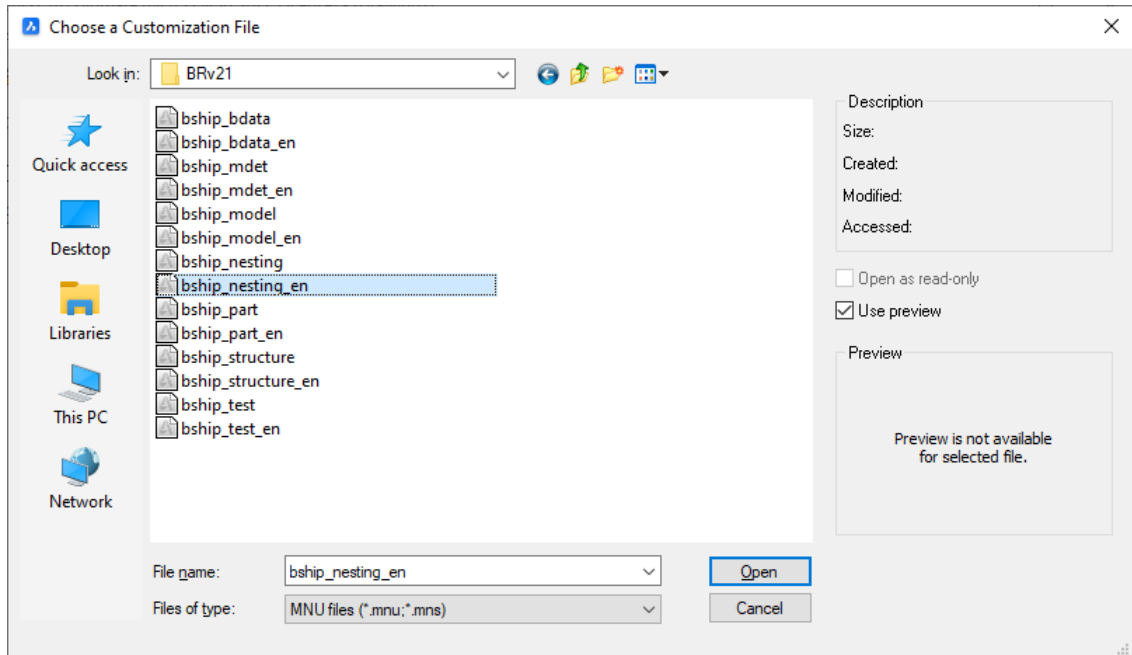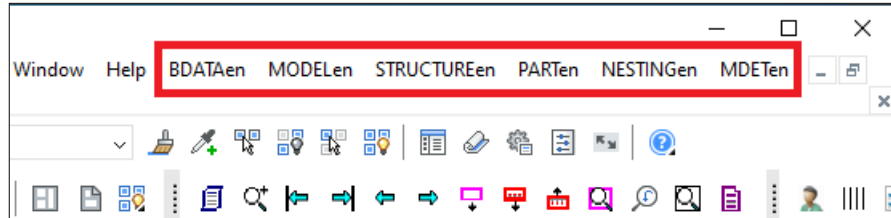
Drawing 1. Menu **NESTING**
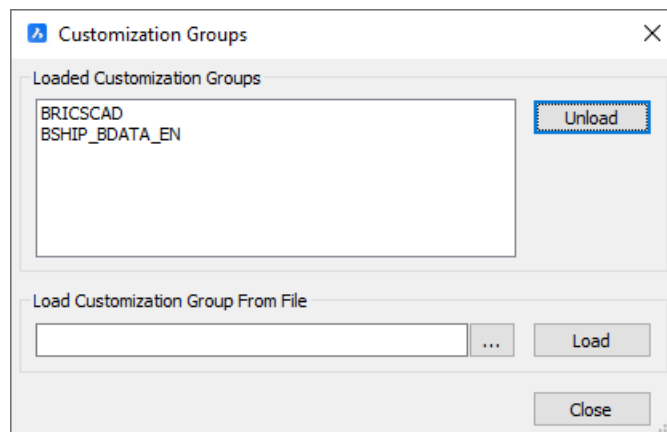
Drawing 2. Window **Customization Groups**

If BSHIP_NESTING_EN is missing in the list **Loaded Customization Groups** then it is necessary to load it. Click button [...]. Window **Choose a Customization File** opens. Set **Files of type** to **MNU files** and go to folder *BSHIP\Sys\BRv<nn>* (dr. 3).

Drawing 3. Window **Choose a Customization File (*.mnu)**

For BricsCAD v21 it must be folder *BSHIP\Sys\BRv21* (for BricsCAD v20 it should be *BRv20*). There are all the MNU files of **B-Ship**. For module **Nesting** select bship_nesting.mnu and press button **Open**. If there will be request on overwriting then approve it. Editor will create file bship_nesting.cui and load **NESTING** into menu bar (dr. 4).
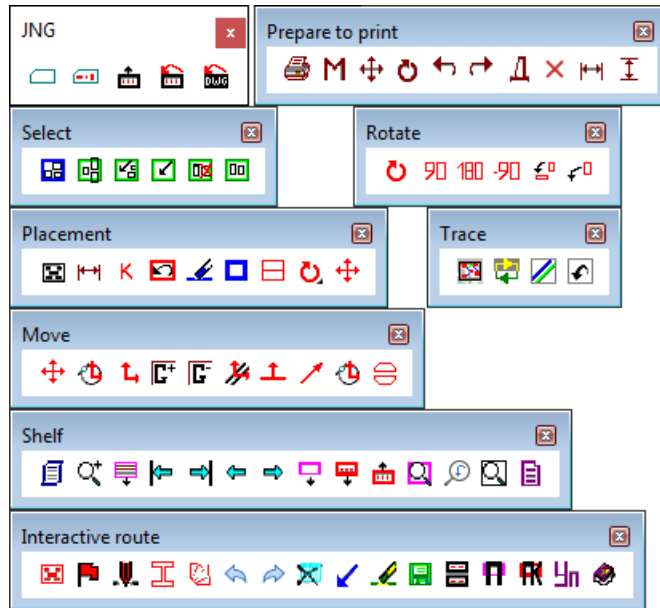

Drawing 4. Loaded partial menus

User has access to **B-Ship** commands from menu **NESTING** or from toolbars.

6   TOOLBARS

Module **Nesting** has toolbars (dr. 5).

Drawing 5. Toolbars

7   NESTING PARAMETERS

Sheet nesting procedure needs many parameters to get result that will be comfortable for workshop. They are minimal distance between parts, minimal distance between parts and sheet edges, kerf halfwidth, pierce value (outer and inner), format and code of NC program generated for cutting equipment, inscriptions included into nesting maps.

The above mentioned parameters are entered in corresponding windows: creation of new JNG, settings to send existing JNG to nesting, setting cut data, etc.

8   JOINT NESTING GROUPS

Before nesting it is obligatory to define joint nesting group (JNG) that is a list of parts of the same thickness and of the same material grade to be nested together. While automatic nesting JNG parts are included by program one by one, while interactive nesting user selects parts himself one by one. **JNG must exist before nesting.**

New joint nesting group

Before creating JNG user must activate required order (with the help of module **Bdata**). Next in module **Nesting** user must sequentially select: draws (specifications), material grade, thickness, raw sheets (usable scraps can be included too), unnested parts. It is done with with menu command **NESTING > Create JNG** (see dr. 1) or with button ▭ of toolbar **JNG**. Command opens dialog box **Create joint nesting group (JNG)** (dr. 6).
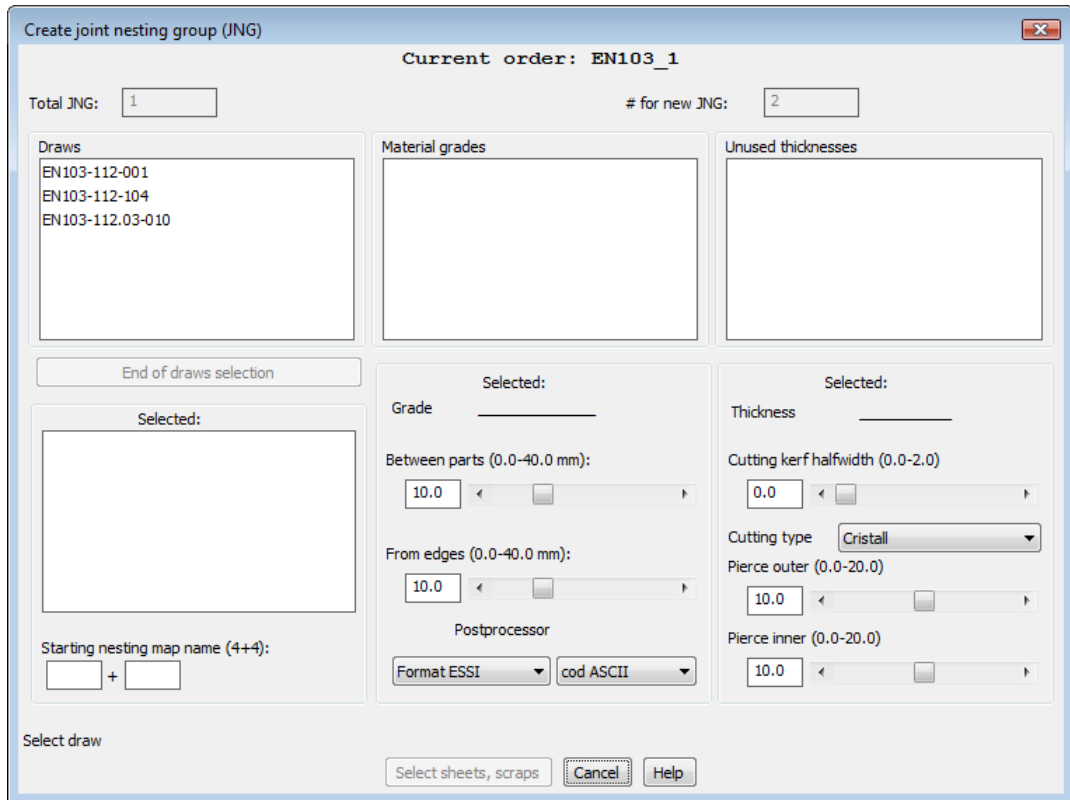
Drawing 6. Window **Create joint nesting group (JNG)**

This windows serves for running four actions:

1. From list **Draws** select one or more draws.

2. From list **Material grades** select grade.

3. From list **Unused thicknesses** select thickness (only one is allowed).

4. Fill in parameters: **Starting nesting map name**, distance **Between parts**, part distances in plate **From edges**, **Cutting kerf halfwidth**, **Cuttoing type** (**Cristall**, **Guillotine** or **Manual cutter**), value **Pierce outer**, value **Pierce inner**, format and code of **Postprocessor**. Input values are verified for unallowed symbols and for bounding limits. While entering numbers customer can use sliders (single click on icons ◄ and ► means number increment at 0.1 mm).

At the beginning info line in the lower side of the window shows message **Select draw** (see dr. 6).

Using list **Draws** it is necessary to select draws which parts will be included into JNG to be created. Draws are selected one by one, with left-click on corresponding element of the list. Every clicked draw is being copied to the lower list **Selected**. If draw is selected by mistake then it can be returned back by left-click in the lower list.

During selection process info line shows current messge like: **Selected 2 draws.** (dr. 7).

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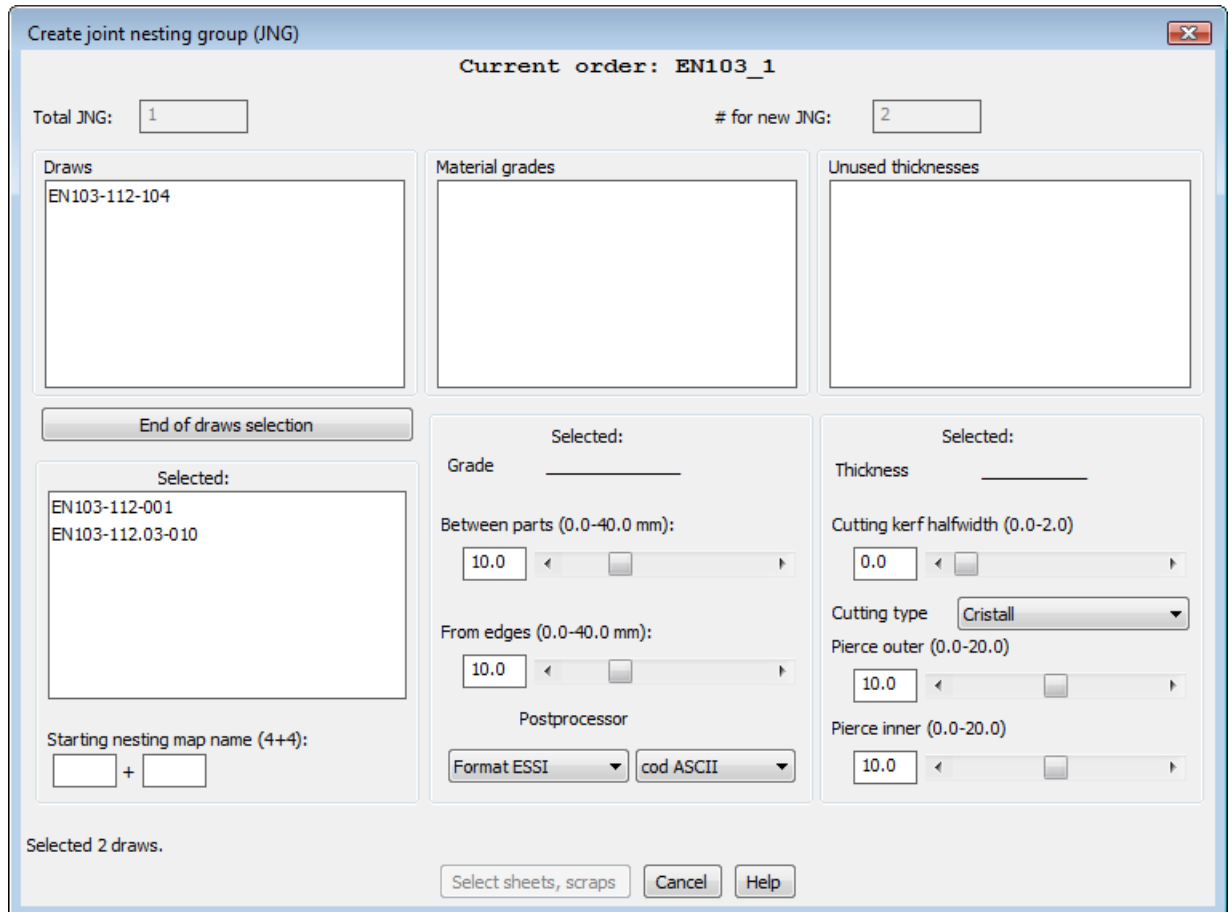
Drawing 7. Selection of draws

To finish draws selection click buttn **End of draws sellection**. Program will scan psrts table for marked draws. If for these draws there are no unnested parts (for example, specification is not filled), then there will be error message (dr. 8).
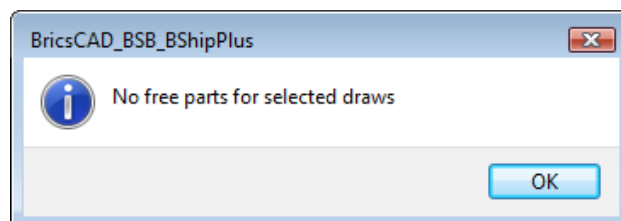

Drawing 8. Message about missing free parts

In normal case program will output grades of selected draws to list **Material grades**. Info line will show text like **Selected 2 draws. Select material grade** (dr. 9).
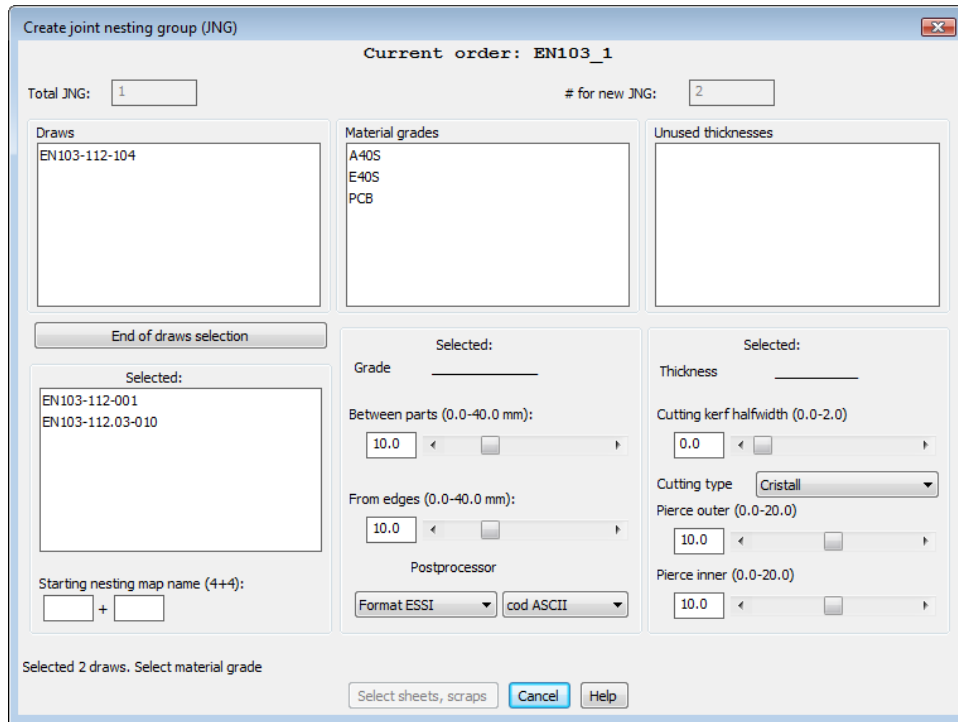
Drawing 9. Filling list of grades after draws selection

By left-click customer must select one grade for new JNG. Grade value will be copied to the field **Grade**. Program will fill the list **Unused thicknesses**, only with those thicknesses and parts that are not used in existing nesting maps and existing JNGs, for these draws and grade. Info line will show text **Material grade is selected. Select thickness** (dr. 10).
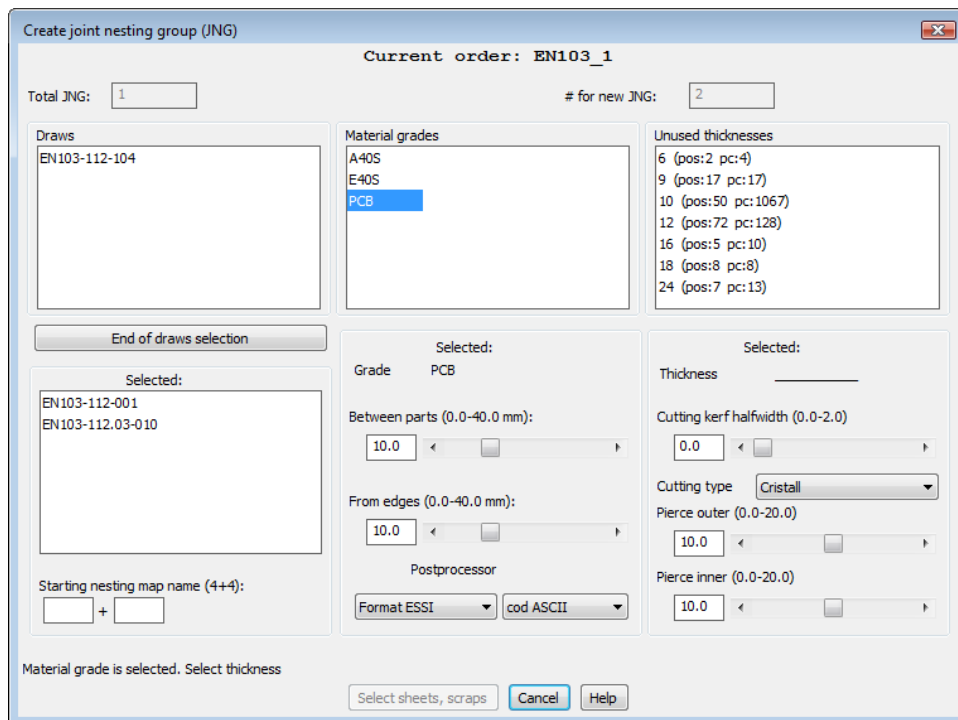
Drawing 10. Filling list of thicknesses after selection of grade

List **Unused thicknesses** includes elements in such a form:

6 (pos:2 pc:4)

9 (pos:17 pc:17)

10 (pos:46 pc:1063)

12 (pos:65 pc:112)

16 (pos:5 pc:10)

18 (pos:8 pc:8)

20 (pos:5 pc:5)

24 (pos:11 pc:12)

The first number in the line of thicknesses list is thickness itself, mm. In brackets there are shown for reference quantity of unused positions for the thickness (from table specp.dbf) and total quantity of free pieces (copies) of parts (position can have more than one number of copies). If second number in brackets (after **pc:**) is greater than the first number (after **pos:**), then it means that these parts have multiplicity more than 1.

Left-click on thickness calls filling in left lower corner parameter **Starting nesting map name (4+4)**, that is divided into two portions of 4 symbols (the first one is called nesting map prefix). Prefix is formed by thickness using one digit after decimal point (for example, **0060** corresponds to thickness 6 mm, **0125** to thickness 12,5 mm, etc.).

The second portion of starting map name is the name of the first nesting map to be created for this JNG. If for one run automatic nesting creates several maps then next maps will get names by 1 greater than the previous map. Program suggests map name after scanning names of existing nesting maps. If there are no maps with such prefix then programs issues a message in command line (on sample prefix 0060 applied for thickness 6 mm):

No occupied numbers of maps with prefix 0060.

In this case starting number will be shown as 0001.

If maps with this prefix are found then message will look like so (on sample prefix 0010):

Occupied numbers of maps with prefix 0100:

("01000002" "01000003" "01000004" "01000001")

Programs suggests number of a new map one more than the maximal existing number (for our sample it will be 01000005).

Selection of thickness in the list **Unused thicknesses** activates button **Select sheets, scraps** that was disabled before. Info line will show something like **Selected thickness 6. Check other data and go to selection of sheets, scraps** (dr. 11).
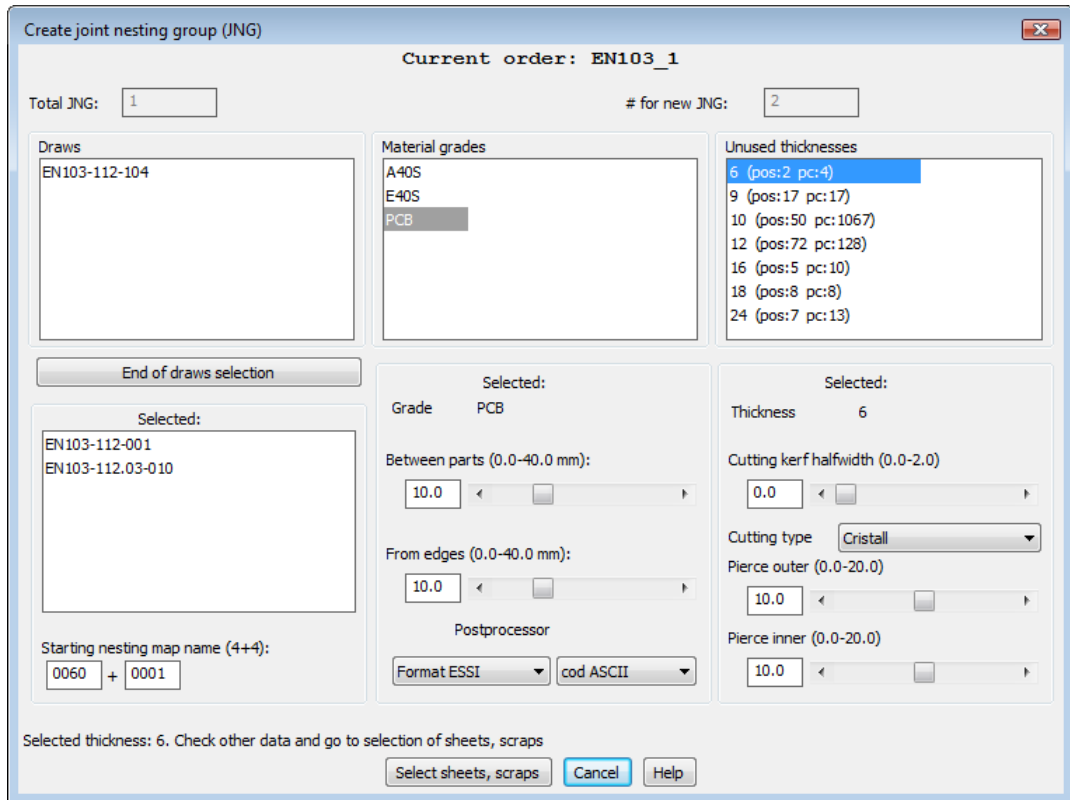
Drawing 11. Selection of thickness

If other parameters are correct (distances, kerf halfwidth, pierce values, etc.) then click button **Select sheets, scraps** going to next stage, selection of raw sheets and/or usable scraps. Click on **Cancel** stops the process with no action.

Next window is **Select sheets, scraps for JNG** (dr. 12).

Upper zone of the window reflects values from the previous stage: **JNG** (number), **Material grade**, **Thickness**. A line close down shows full name of the current scraps table. At the beginning button **Choose parts for JNG** is disabled (see dr. 12).

List **Sheets** shows those raw sheets (usually one or two, from klsmater.dbf) that are allowed by grade and thickness in module **Bdata**. Line of a sheet look like **sht 1600x6000 200 11122233**.

The line includes the following elements:

sht, type (**sht** for sheets, **scr** for scraps),

1600x6000, size of the sheet,

200, number of available sheets of required size and grade (default value is 200),

11122233, material code (up to 11 symbols), helps to select raw sheets of the same grade and thickness, but with different properties.
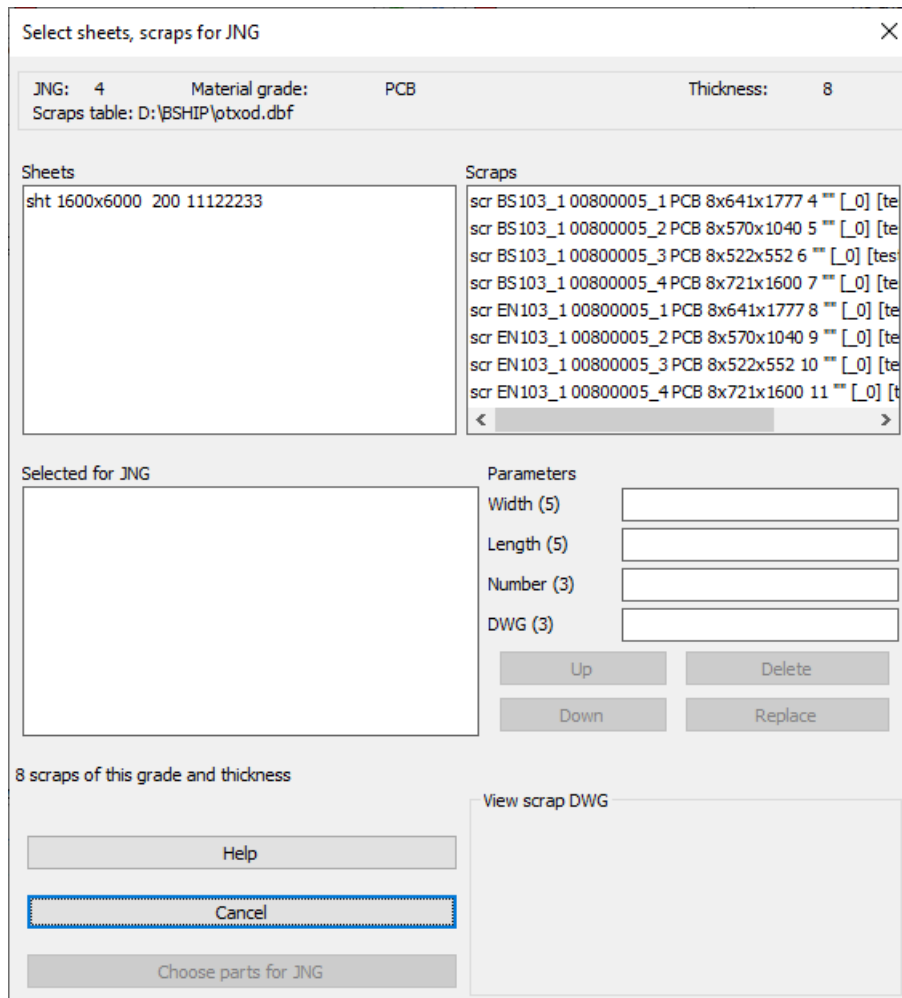
Drawing 12. Dialog **Select sheets, scraps for JNG**

List **Scraps** reflects only those free scraps that are allowed by grade and thickness. Line looks like **scr EN103_1 00600001_1 A40S 4x671x854 9321 "" [_0] [z21]**. Its components:

scr, type (**sht** for sheet, **scr** for scrap),

EN103_1, order name from which scrap has arrived,

00600001_1, scrap name (in the sample: scrap 1 in nesting map 00600001),

A40S, material grade.

4x671x854, thickness and gabarits of rectangular scrap (or size of the circumscribed rectangle for curved scrap),

9321, ID (address) of scrap in the scraps table otxod.dbf,

"", empty string for rectangular scrap or **"DWG"** for curved scrap,

[_0], number of order, to which scrap was sent for creating nesting map on it (free scrap must have [_0]),

[z21], order alias name from which scrap was taken (in some rare cases project number and portion number can be repeated in serial ship, then scraps may be selected by textual alias name of the order).

In the dialog box **Select sheets, scraps for JNG** (see dr. 12) it is necessary to select raw sheets and scraps, that will be applied for JNG to be created. Selection is made by left-click on the required line in the lists **Sheets** and **Scraps**. Selected element is copied to the list **Selected for JNG**. After the first selection button **Choose parts for JNG** is enabled (dr. 13).
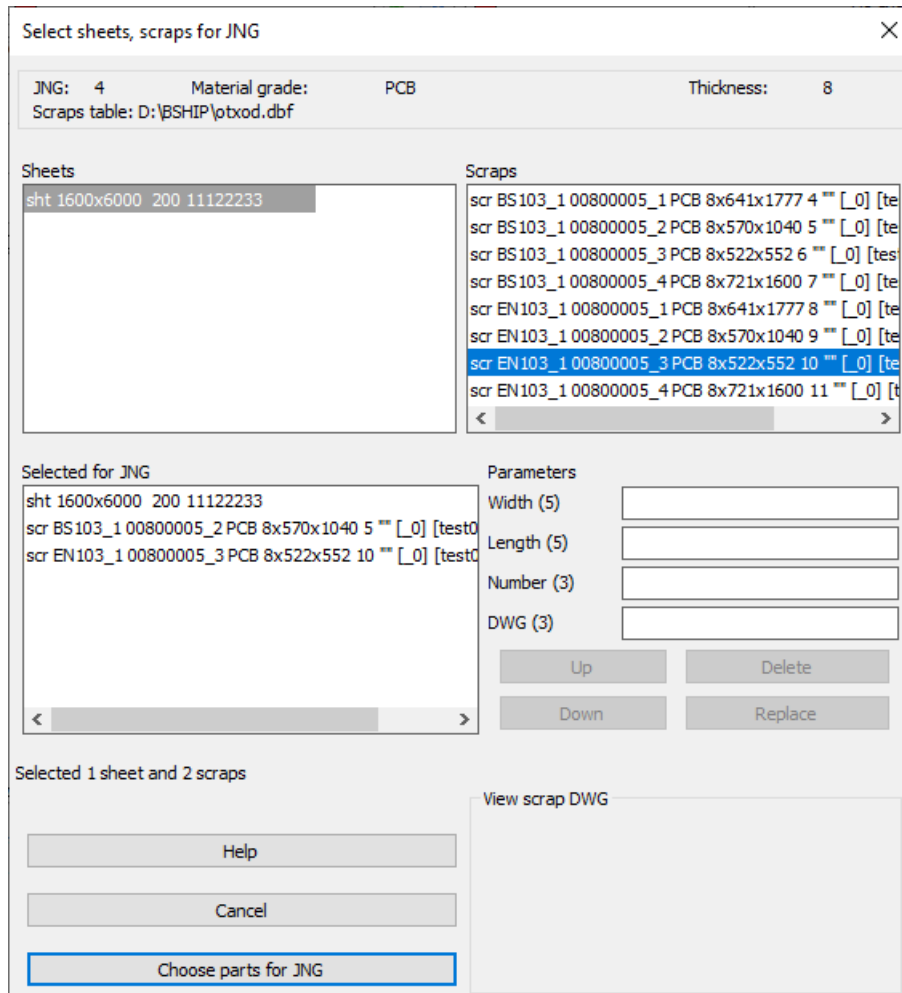
Drawing 13. Selection of sheets and scraps

In case of multiple selection sheets/scraps must be located be decreasing of priority (the most top element in the list **Selected for JNG** has the highest priority).

List of selected objects can be edited with right side buttons being enabled after left-click on element in **Selected for JNG** (dr. 14).

Sequence of the objects can be changed with buttons **Up** and **Down**, that move object to one line up or down. With button **Delete** user can remove object selected by mistake.

Selected object has the following properties: **Width (5)**, **Length (5)**, **Number (3)**, **DWG (3)**. Digits in brackets reflect maximum property symbols quantity allowed while editing. Moreover, width cannot be greater than 20000 mm, and length cannot be greater than 50000 mm. **Number** for sheets cannot exceed 200 and for scraps it must be 1 only. Field **DWG** is used only in scraps and must be empty for rectangular scrap and has value **DWG** for curved scrap.

Drawing 14. Marking object for editing

Edited values replace corresponding parameters in the elements of the list **Selected for JNG** after click on **Replace**, but not copied to DB and used only in the current nesting tas for new JNG. For example, quantity of sheets can be changed from standard 200 to 4, if workshop conditions require.

On finishing list of selected sheets and scraps user must click button **Choose parts for JNG** (see dr. 14). Button **Cancel** cancels procedure of creating new JNG.

After click on button **Choose parts for JNG** there is opened dialog box **Select parts for new JNG** (dr. 15).

In the upper side of the window there are displayed **Current order**, number of **JNG**, **Material grade**, **Thickness**. List **To nest on sheets, scraps** reflects objects selected in the previous stage.
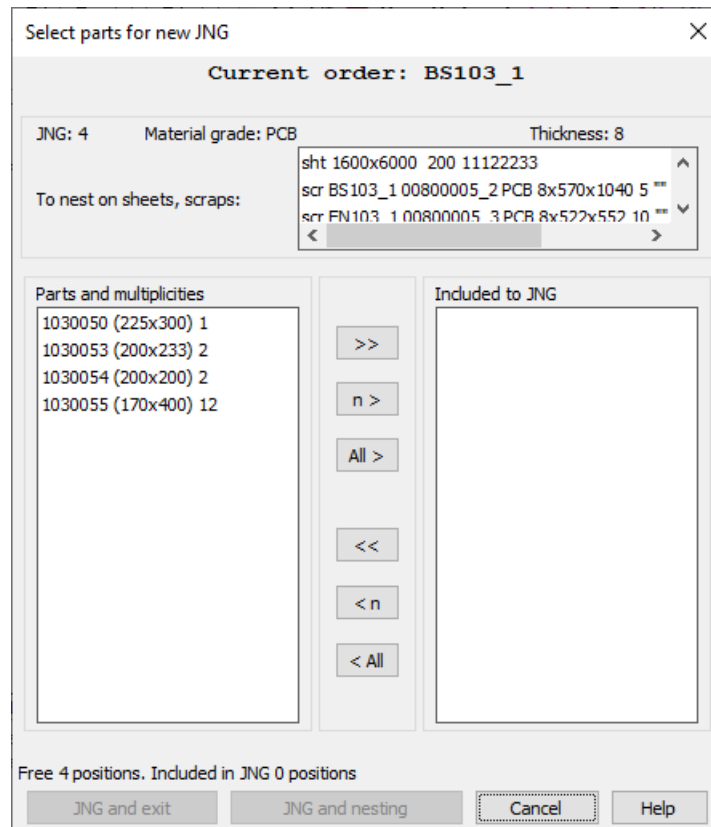
Drawing 15. Window **Select parts for new JNG**

Central zone of the window shows main tools:

– **Parts and multiplicities**, list of part positions that are free and can be included into JNG;

– **Included to JNG**, list of parts already included to JNG;

– **>>**, button for moving selected parts from the left list to the right one with maximal number of allowed copies of the position (with additional request);

– **n >**, button for moving selected parts from the left list to the right one with auxiliary request on number of copies if maximum number in the left side (multiplicity) is greater than 1;

– **All >**, button for moving all the parts to JNG;

– **<<**, button for excluding (moving from the right list to the left one) earlier included parts with maximal number of position copies (without additional request);

– **< n**, button for moving from right to left of the selected position with additional request on number of copies, if right number of copies (multiplicity) is greater than 1;

– **< All**, button for returning all the parts from right to left (clearing list **Included to JNG**).

Line of one position looks like:

1030225 (400x380) 4.

Attributes structure is as follows:

1030225, name of part DWG file (103 prefix, 0225 position no.);

(400x380), gabarits of the bounding box;

4, part multiplicity left free (maximum number of this part copies that can be included into JNG).

In the lower zone there is info line and buttons **OK**, **Cancel** and **Help**. At the beginning it reflects initial number of positions in the left and right lists, e.g.: **Free 2 positions. Included in JNG 0 positions**.

Selection of parts to include to created JNG is done with buttons of the central column (described above). If part multiplicity is greater than 1 then user will be able to specify number of copies of the position is to be moved to the right list (if multiplicity is equal to 1 then additional request is not generated). On selection of line in the left list and click on button $\boxed{\text{n >}}$ there is opened dialog box **Number of position pieces to select** (dr. 16):
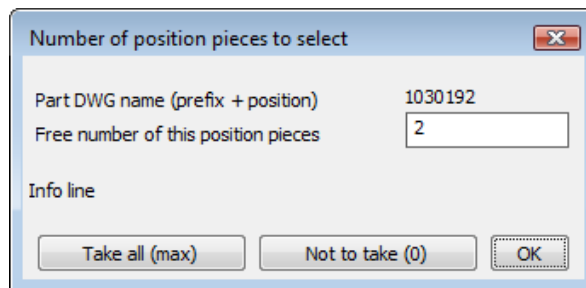
Drawing 16. Window **Number of position pieces to select**

Dialog displays **Part DWG name (prefix + position)** and **Free number of position pieces**. In the last field it is possible to reduce number of selected copies (default value is maximal value).

Click on button **OK** fixes position selection with number defined by user (for example, 1). Value 0 means rejection of moving this position. Moreover, there are two buttons, whose action does not depend on the value entered in the field **Free number of position pieces**: they are **Take all (max)** and **Not to take (0)**. All three buttons close dialog box (see dr. 16) with different action.

In case of erroneous inclusion of extra positions into JNG or extra copies user can change selection with three lower buttons in the central column on dr. 15. Sample of incomplete selection of free positions is shown on dr. 17.

Click on button **Cancel** interrupts process of creating JNG.

With button **JNG and exit** new JNG is being created, saved in DB and calculation ends without simultaneous nesting JNG.
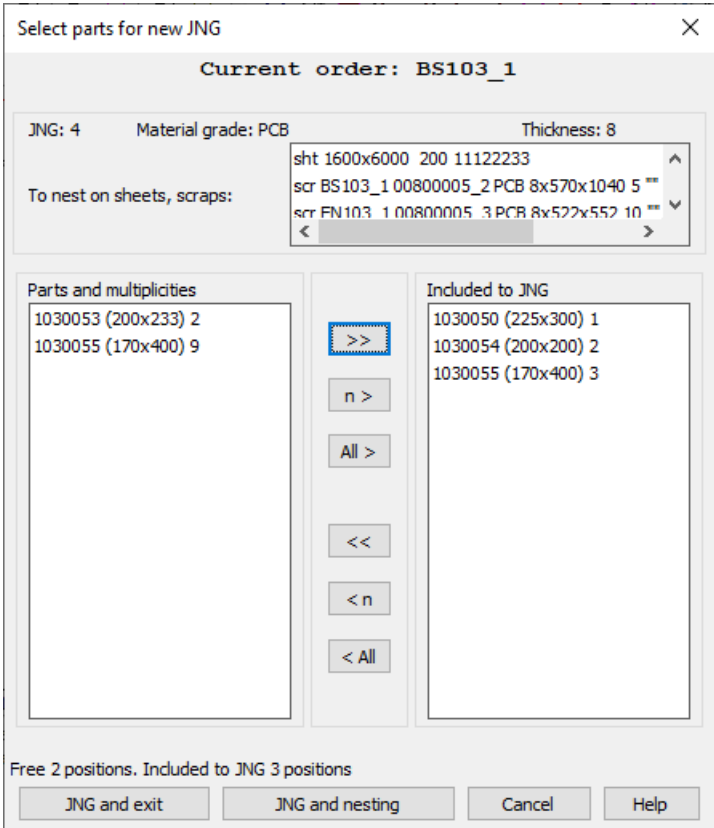
Drawing 17. Sample result of selection

With button **JNG and nesting** new JNG is being formed, saved in DB and process goes to generation of nesting task in file GSR_DET.TXT. Contents of this file is displayed in window on dr. 18.
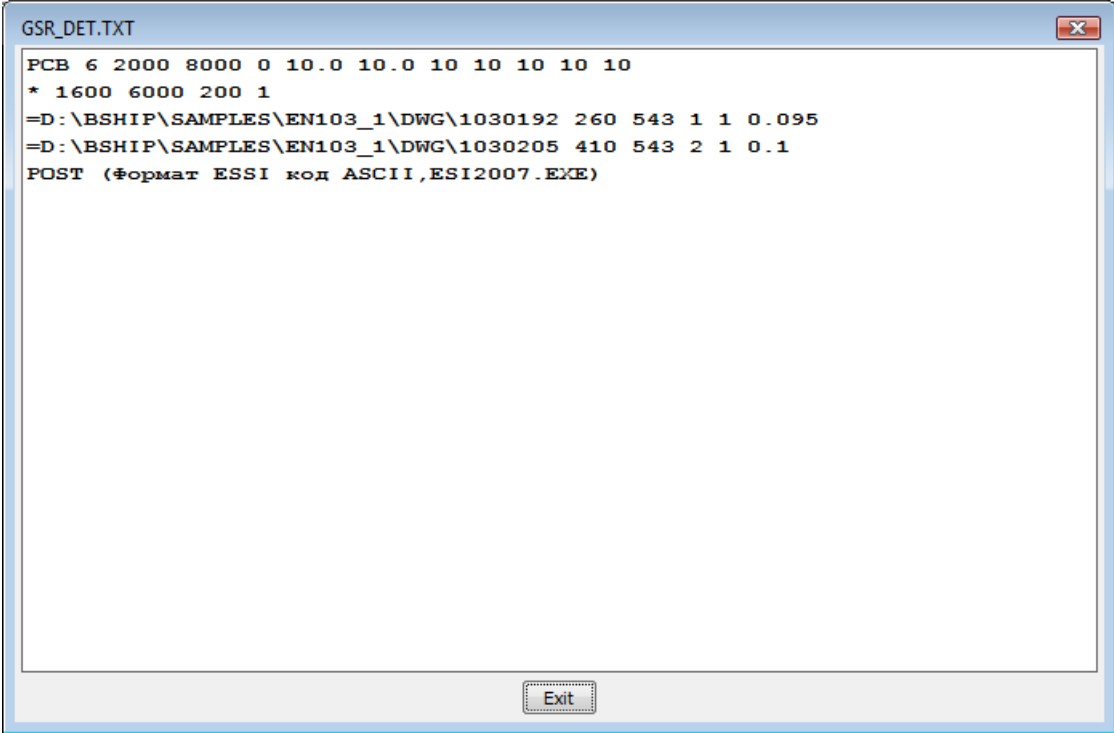
Drawing 18. Nesting task

If in the nesting task no scraps were included (only raw sheets selected), then later user will be suggested to select nesting type (dr. 19).
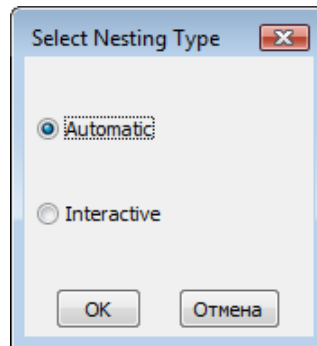
Drawing 19. Window **Select Nesting Type**

If a scrap was included then automatic nesting is impossible and program directly goes to interactive nesting.

Next by button **OK** procedure starts, calls parts contours, equidistant contours are being built. After that automatic nesting is run or program creates shelf for interactive nesting. If nesting JNG is completely done (i.e. no unnested parts of JNG left) then JNG is deleted (as completely used).

Description of nesting for both types follows hereinafter.

JNG dispatcher

Created and incompletely nested JNGs are saved in DB table spr_gsr.dbf of current order. For viewing such JNGs and for running operations on them there is command **NESTING > Dispatcher of JNGs** and button [⊡] of toolbar **ГСР**. Completely nested JNGs are removed from spr_gsr.dbf automatically.

Command **NESTING > Dispatcher of JNGs** opens dialog box **Dispatcher of joint nesting groups** (dr. 20).

At initial state of window only button **Create JNG** is enabled. It calls command **Create JNG**. Buttons **Help** and **Exit** are active too.

Box **Joint nesting groups** contains list of existing JNGs. It is displayed in the following view:

10 PCB s12 (9) 01200007.

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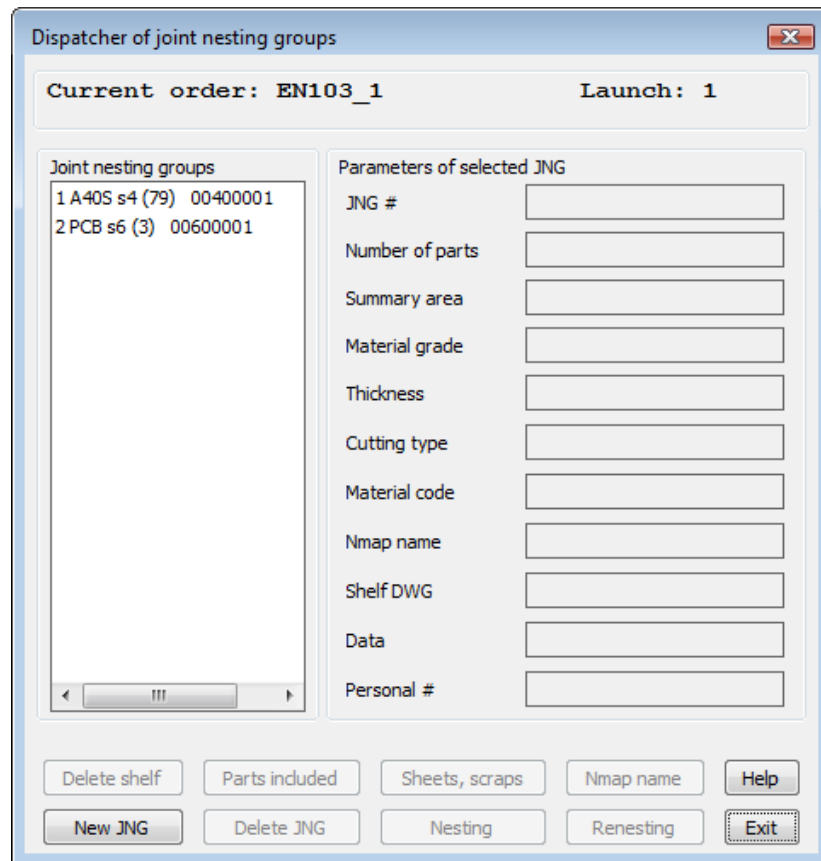
Drawing 20. Dialog box **Dispatcher of joint nesting groups**

Here:

10, JNG number,

PCB, material grade,

s12, thickness (mm),

(9), quantity of parts included to JNG,

01200007, name of the first nesting map that will be created as a result of nesting this JNG. Other maps in case of their automatic creation will get numbers with step 1 (01200008, 01200009, etc.).

If click on any element of JNGs list, then area **Parameters of selected JNG** will show its properties (dr. 21).

Button **Delete shelf**

Button **Delete shelf** is enabled only when selected JNG already has shelf DWG file (its name is POL<gsr>.DWG, where <gsr> is JNG number). Click on this button removes shelf file and clears field **Shelf DWG** (with change of database). Mesage about operation is output to info line located up from the buttons.
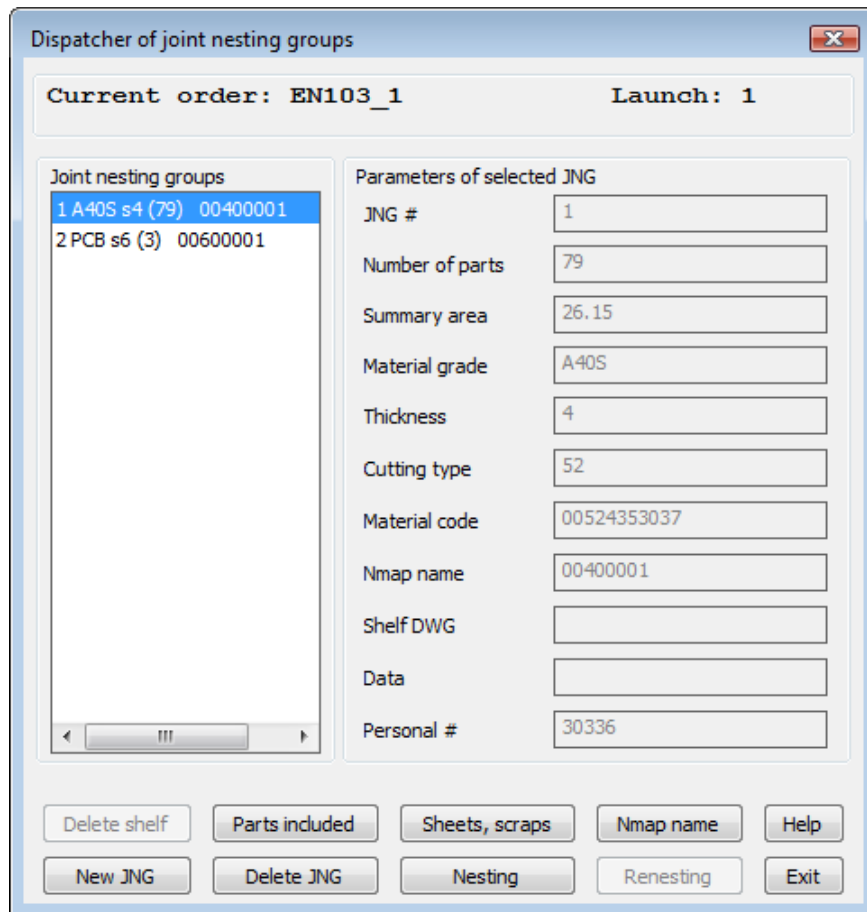
Drawing 21. Parameters of selected JNG

Button **Delete JNG**

Button **Delete JNG** is available only for those groups that do not possess shelf. Click on the button deletes selected JNG from DB.

Note. If JNG has shelf, then before deleting such JNG it is necessary to delete its shelf before. Only **next** step will be deleting JNG.

Button **Nmap name**

Button **Nmap name** serves for setting number of the start nesting map while nesting this JNG. It opens dialog box **Starting map name in JNG** (dr. 22).
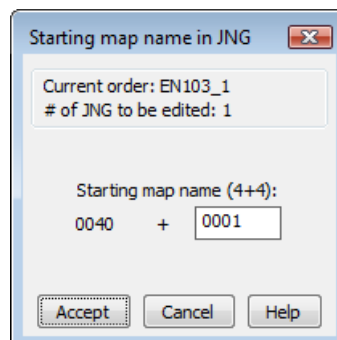
Drawing 22. Dialog **Starting map name in JNG**

This window allows user to change last 4 symbols of starting map name (map prefix

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cannot be modified). In the edit box new number is to be entered (up to 4 symbols, first zeros will be added automatically. Forming map name is checked for validness not only from the point of syntaxis but also for coincidence with existing in the table kr_list.dbf maps, as well as with starting names in other JNGs. On finding coincidence program issues a message and asks confirmation for this value (dr. 23).
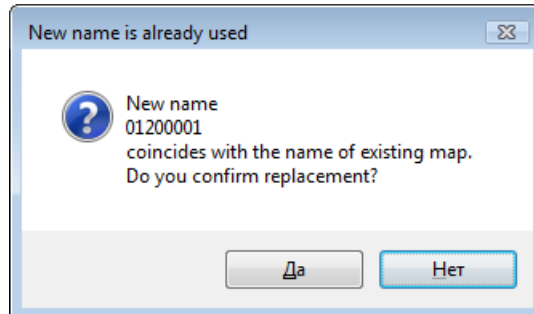
Drawing 23. Warning about coincidence with the name of existing nesting map

Button **Parts included**

Button **Parts included** in the dialog box **Dispatcher of joint nesting groups** (see dr. 21) allows to see what parts were included into selected JNG. Information is displayed in the window **JNG parts included** (dr. 24).
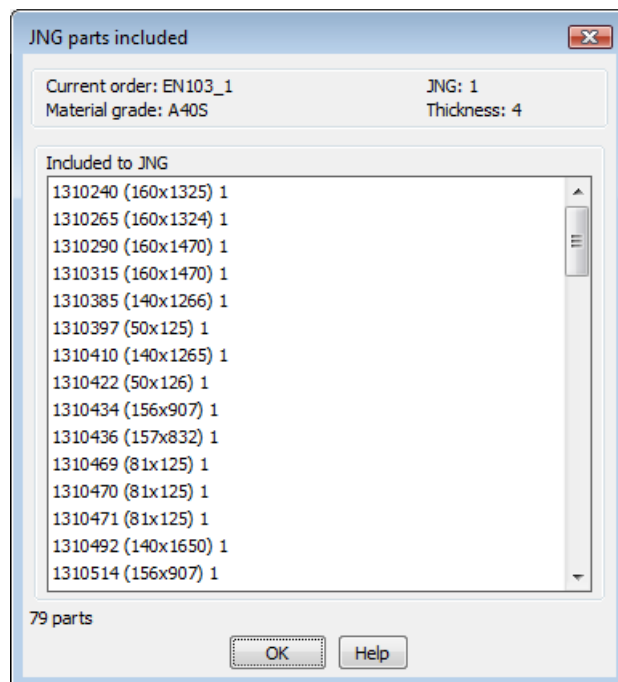
Drawing 24. List of parts included into JNG

Each line in the list **Included to JNG** corresponds to one position, e.g.: **1030227 (80x300) 4**, where

1030227, name of part DWG file (section 103, position 227);

(80x300), gabarits of the bounding box circumscribed around the part contour;

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4, multiplicity of this position (number of copies for this position included into JNG).

Button **Sheets, scraps**

Button **Sheets, scraps** (see dr. 21) shows as reference what raw sheets and scraps are available in the moment to make nesting of selected JNG. Information is displayed in the dialog box **Sheets and scraps for JNG** (dr. 25).
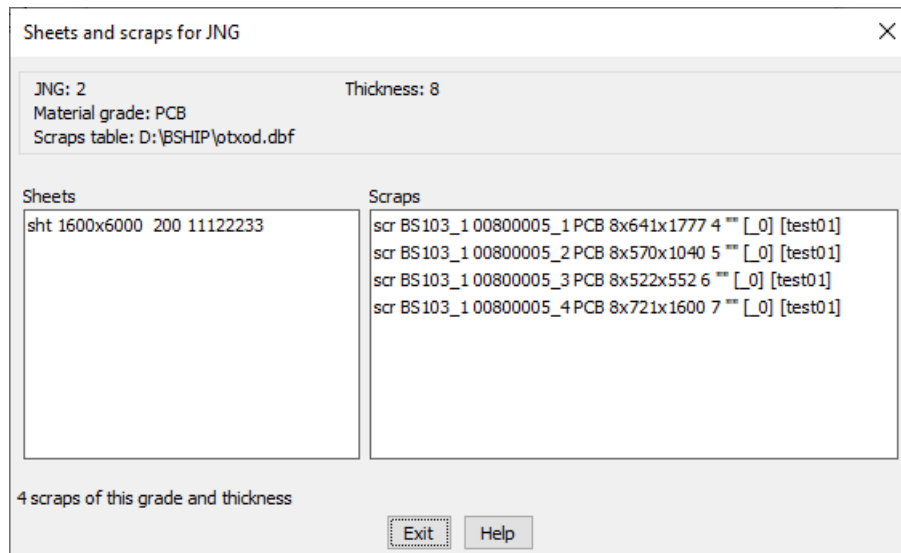
Drawing 25. Window **Sheets and scraps for JNG**

Note. This window is only for reference and show all available elements. Real sheets and scraps selection will be requested for JNG after click on button **Nesting** in dialog box **Dispatcher of joint nesting groups** (see dr. 21).

Button **Nesting**

JNG with no shelf can be sent to automatic or interactive nesting by button **Nesting** (see dr. 21). If selected JNG has shelf then button **Nesting** will be disabled (this JNG is available to **Renesting**).

After sending JNG to nesting dialog box **Select sheets, scraps for JNG** opens (dr. 26).

Similar window was discussed earlier (see dr. 13). It is necessary to make selection and edit parameters (if required) and press button **Accept**.

Next user will be sent to dialog box **JNG cutting parameters** (dr. 27).

In this window it is necessary to fill or edit values of parameters that are not saved in DB with JNG: distance **Between parts**, part distance in plate **From edges**, **Cut kerf halfwidth**, **Cutting type** (**Cristall**, **Guillotine** or **Manual cutter**), value **Pierce outer**, value **Pierce inner**, format and code of **Postprocessor**. Entered data are checked for validity (allowed symbols and limits). Horizontal sliders can be used (single click on icons ◄ and ► means change at 0.1 mm).
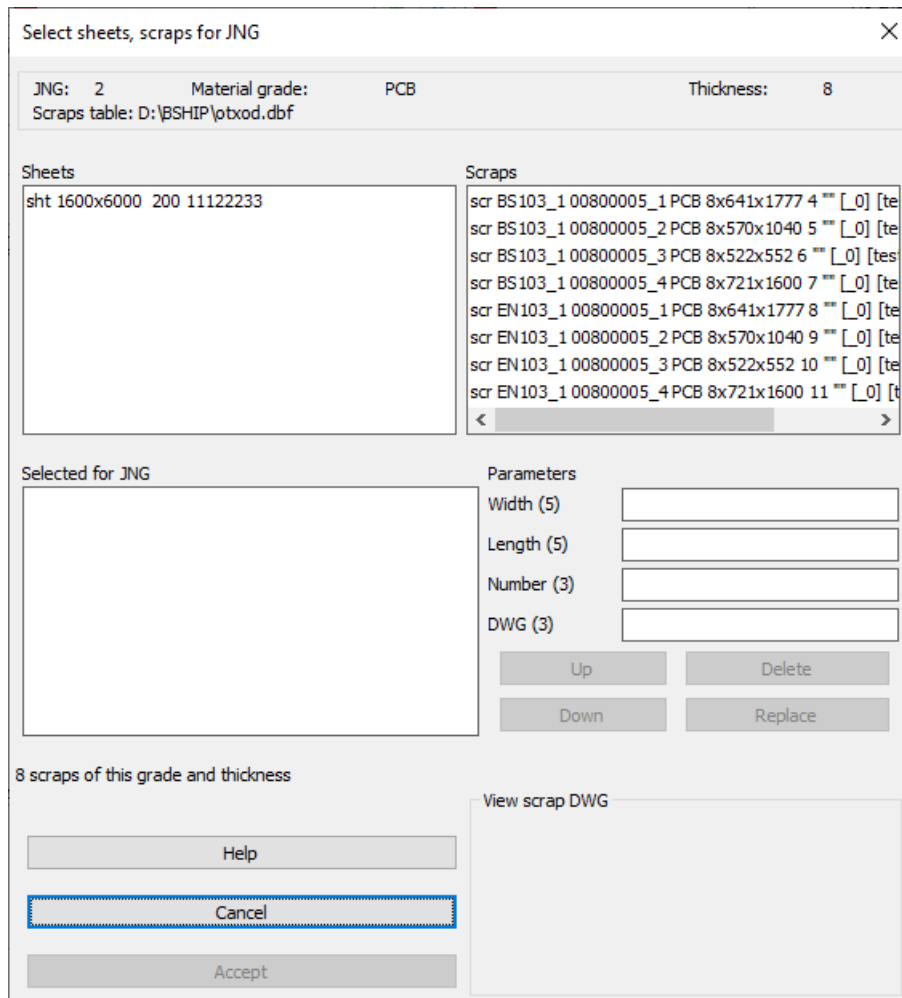
Drawing 26. Window **Select sheets, scraps for JNG**
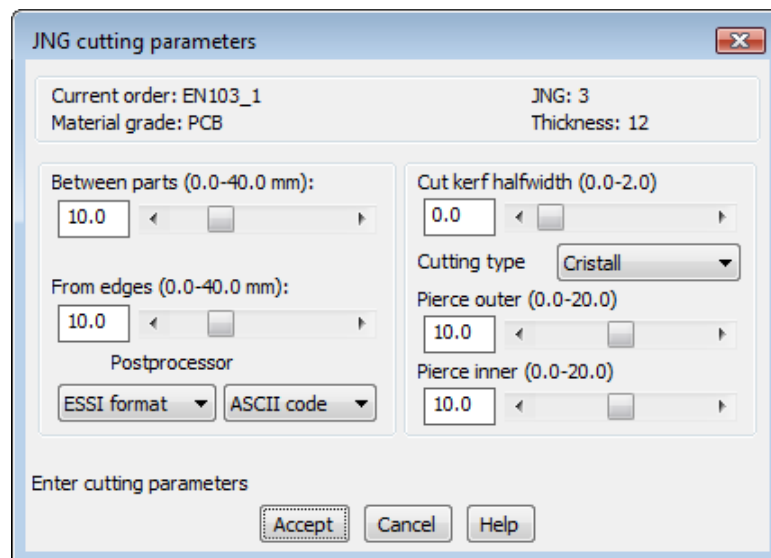
Drawing 27. Window **JNG cutting parameters**

In window **JNG cutting parameters** click on button **Accept** sends all the data to nesting program. First of all nesting task file is generated (see dr. 18), it contains list of the parts included into JNG.

Next if there were no scraps mentioned then window for selectin nesting type is opened (see dr. 19). After that nesting of required type is run.

<u>Button **Renesting**</u>

Button **Renesting** is enabled only in work on JNG with shelf. In this case the screen is divided into two viewports by horizintal line. The upper viewport is targeted for opening shelf file. Such a shelf is an additional map area for interactive nesting (adding parts from shelf to map or editing part location inside the map. Shelf is always created for interactive nesting and can be created in automatic nesting, if set checkbox **Put all the maps on shelf after autonesting** (in this mode maps are not saved automatically in DB).

<u>Button **New JNG**</u>

Click on button **New JNG** closes dialog **Dispatcher of joint nesting groups** and starts procedure of creating new JNG that was described above.

9   NESTING TYPES

Module **Nesting** supports two types of nesting sheet metal: automatic nesting for thermal and mechanical cutting, interactive nesting. Interactive type can be applied for panels (e.g. sheets with ribs).

Automatic type of nesting is allowed only for flat raw sheets (not for usable scraps). Interactive type can be applied for sheet nesting maps on raw rectangular sheets as well as on usable scraps.

Automatic nesting

Automatic variant is designed for automatic nesting (placing inside sheet) sheet parts by euristic algorithm. In this variant part contours are simplified to rectangles, that are united into complexes (rectangles of minimal area taken around parts). Then there is sorting complexes by some conditions, selecting methods for placing complexes in sheet, choosing free areas after adding next complex, deciphering parts in complexes. After that program goes to next sheet if free area exhausted, script file is generated for saving nesting maps to database of current order.

Auxiliary work settings are requested in the dialog box **Settings for nesting maps and shelf view** (dr. 28).
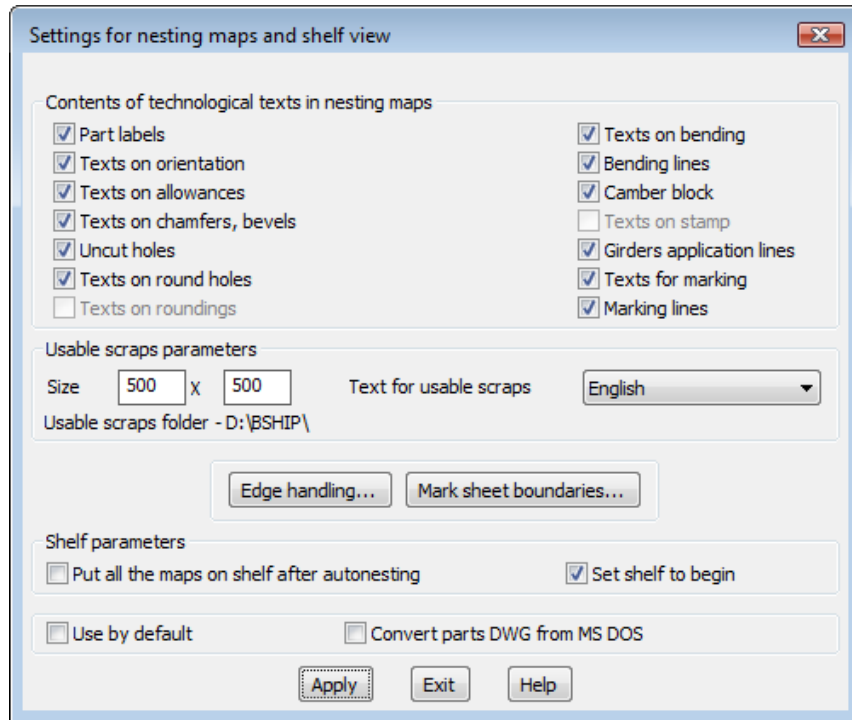
Drawing 28. Window **Settings for nesting maps and shelf view**

Automatic type for thermal cutting can take into consideration special technology demands to long narrow parts (flat bars) placement. (placing in holes is disabled). If so it can be viewed in the window **Automatic nesting options** (dr. 29).
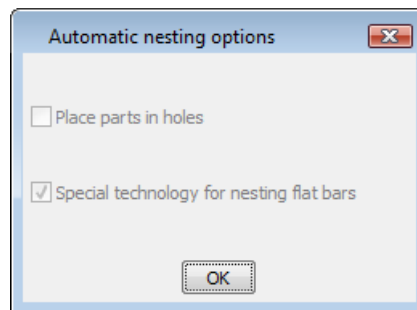
Drawing 29. Window **Automatic nesting options**

Placing parts in holes is forbidden in this version (checkbox is cleared).

Rectangular usable scraps are automatically detected in free areas and scraps data are saved in a special table of DB.

End of autonesting is signed by info window with summary data (dr. 30).
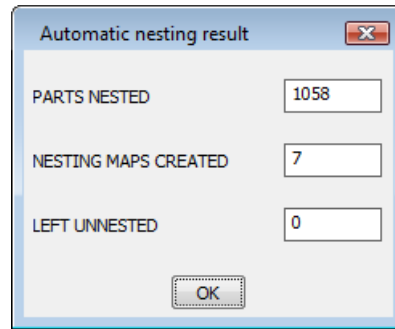
Drawing 30. Window **Automatic nesting result**

Autonesting saves created maps to DB itself, except case when maps are on shelf and not saved (see dr. 28). In such a case created maps are to be edited in interactive nesting mode and saved with menu command **NESTING > Save nesting map** or with button 🖫 of toolbar **Interactive route**.

Interactive nesting

Interactive nesting is such a mode when parts, sheets are initially placed on the so called **shelf** that is a special drawing zone (upper viewport) used as a temporary store (dr. 31). Nesting maps that need editing also can be placed on shelf.
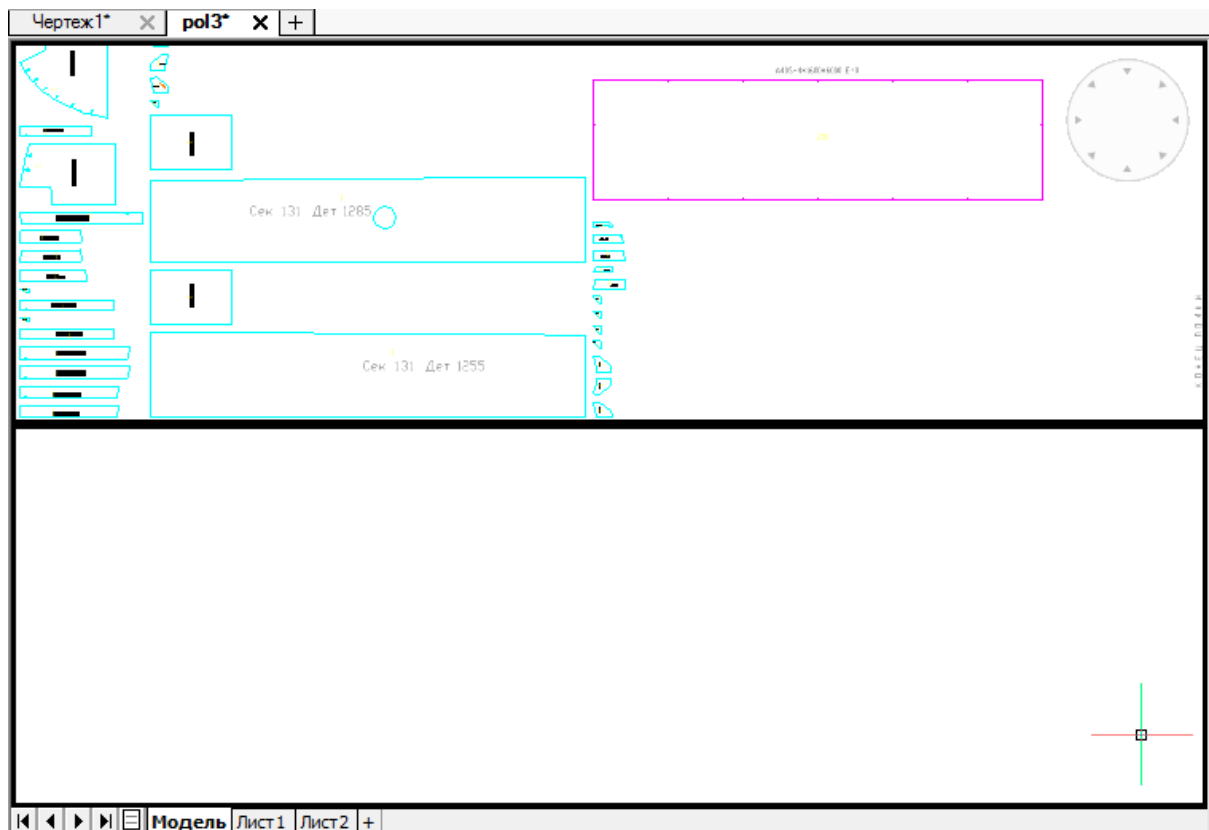
Drawing 31. Shelf with parts and sheets

The lower viewport zone is called **nesting place**. All the final results will be achieved in this zone.

Shelf drawing is a graphical image of current state of JNG. It contains available sheets and unnested parts of this JNG. During interactive nesting one copy of raw sheet is put to the nesting place from shelf. Later shelf is gradually freed from parts that are moved to nesting place (inside sheet).

Program saves non-empty shelf as DWG file in folder *Polka* of the current order. Shelf file name consists of POL prefix and JNG number (for example, POL3.dwg). If shelf is already created and saved then it is displayed in the property **Shelf DWG** in the window **Dispatcher of joint nesting groups** (see dr. 21). Non-empty property **Shelf DWG** is a sign that JNG was edited in interactive mode and this work was not finished. In such a case JNG can be taken for editing again with button **Renesting** of the window **Dispatcher of joint nesting groups**.

Note. Shelf is also a tool for interactive reediting of existing nesting map. See command **NESTING > Edit nesting map**.

Raw sheets and usable scraps on shelf are displayed in magenta, parts are displayed in cyan.

Interactive nesting is done with a group of special commands, most of them are implemented as buttons of toolbars **Shelf** and **Placement** (using submenus **Placement** and **Set** is possible too).

If nesting place is empty, the first step of work is to take sheet or usable scrap from shelf (to be moved to nesting place). This is done with menu command **Set > Sheet down** or with button ![icon] of toolbar **Shelf**. Taken sheet appears in the nesting place in the lower viewport (dr. 32). It does not disappear from the shelf because number of raw sheets is usually big (default is 200).

Next step is moving parts from the shelf, one by one. It is done with command **Placement > Move**. When command starts it suggests to select a part and after picking part it is being moved on cursor from the upper viewport to the lower one (as in usual command MOVE of BricsCAD). Moving is repeated for other parts.

Next with placement commands (move, rotate, put together, etc.) sheet is filled with parts on required place and with required angle. The main goal is to free shelf from all the parts. Placement commands are discussed herein after.

Map is saved with **NESTING > Save nesting map** or with button ![icon] of toolbar **Interactive route**. Empty shelf is deleted. Temporarily it is possible to save current state of shelf as DWG file (to continue in the next session).
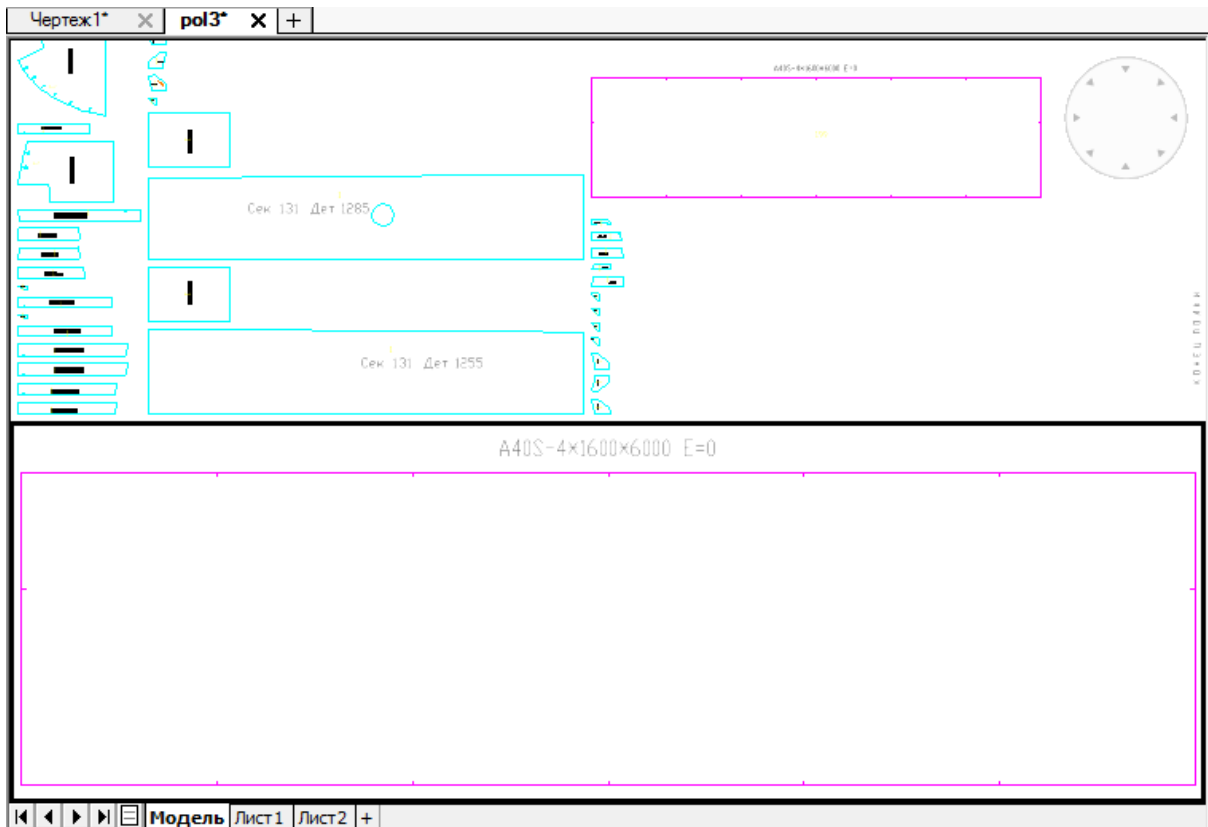
Drawing 32. Nesting place after inserting sheet

10 EDIT AND DELETE NESTING MAPS

Nesting maps may be deleted or put on shelf for editing.

Edit nesting maps

For editing existing nesting map(s) user must put them on shelf. It is done with command **NESTING > Edit nesting map** or button [icon] of toolbar **JNG**. Command opens dialog box (dr. 33).

Central listbox shows names (NM) of all the existing nesting maps of the current order. One map or more may be selected. Names of selected maps are copied to the lower list. In case of bad selection any element of the lower list can be removed by double-click on it.

Button **Exit** closes window with no action. To go to editing click on button **Correction**. After click on button **Correction** dialog box closes and graphical editor opens shelf file with specific name POL9999.dwg reserved for editing case. Selected maps will be shown on shelf (upper viewport), nesting place (lower viewport) will be empty (dr. 34).

It is necessary to take map one by one to nesting place, edit and save new variants to DB. Map edit operations are discussed in par. 11.
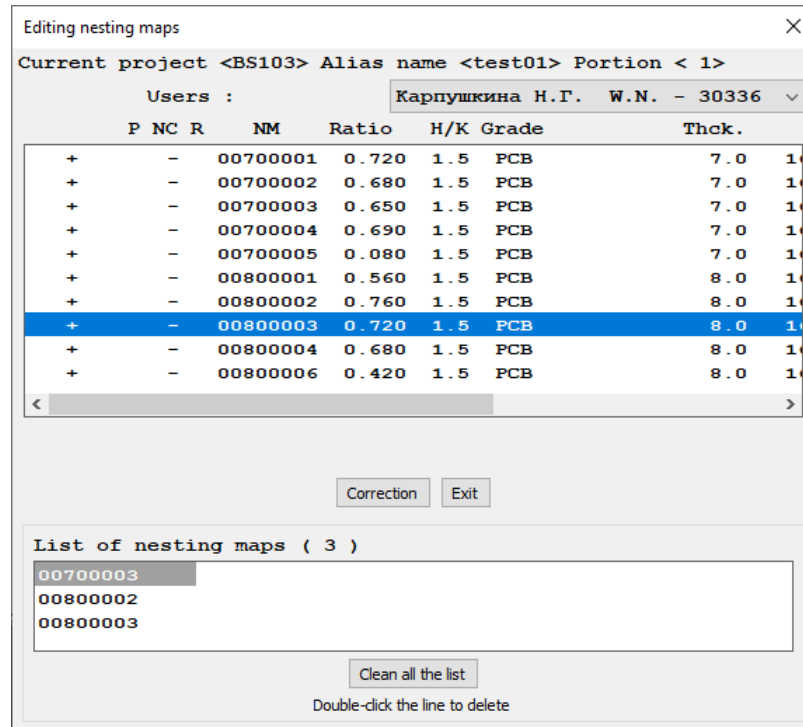
Drawing 33. Window **Editing nesting maps**
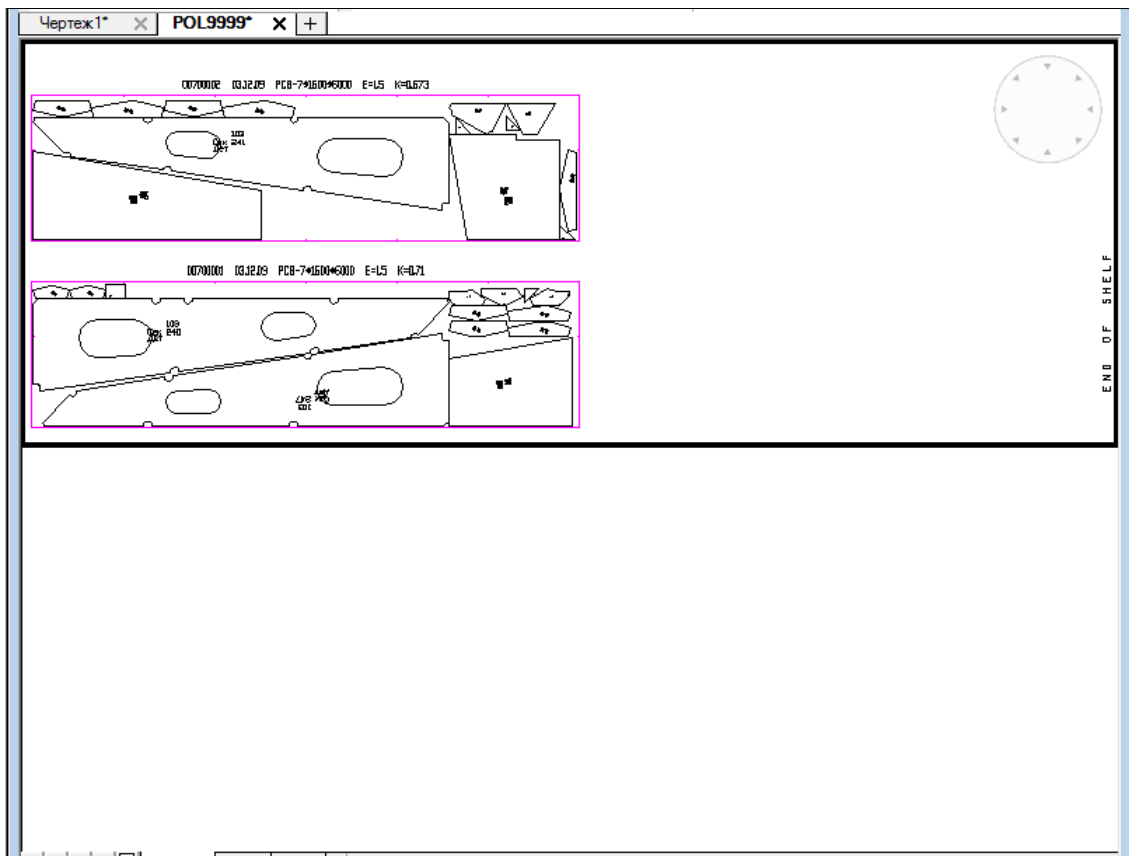
Drawing 34. Shelf with nesting maps to edit

Delete or rename nesting maps

It is recommended to delete and to rename nesting maps in module Bdata (menu command **BDATA > TABLES > Sheet nesting maps**). Similar opportunity is inserted in menu **NESTING**.

These operations are done with menu command **NESTING > SERVICE > Delete/rename maps** (dr. 35).
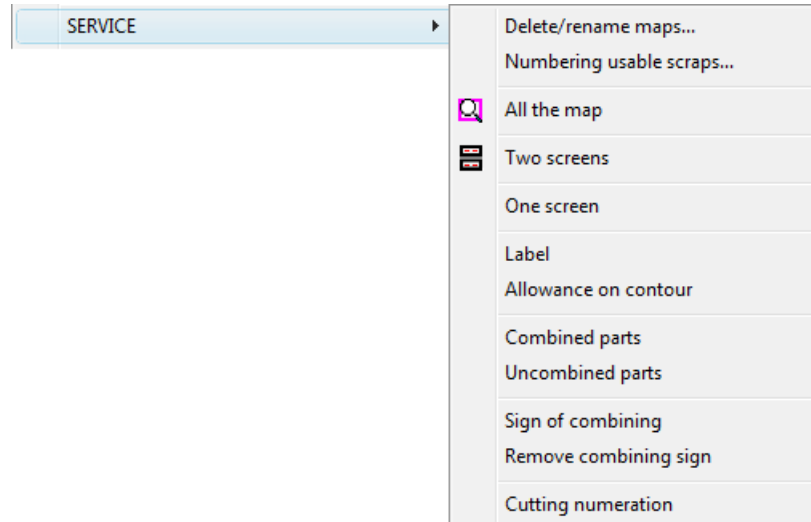
Drawing 35. Submenu **SERVICE**

Command opens dialog box **Delete/Rename nesting maps** (dr. 36).
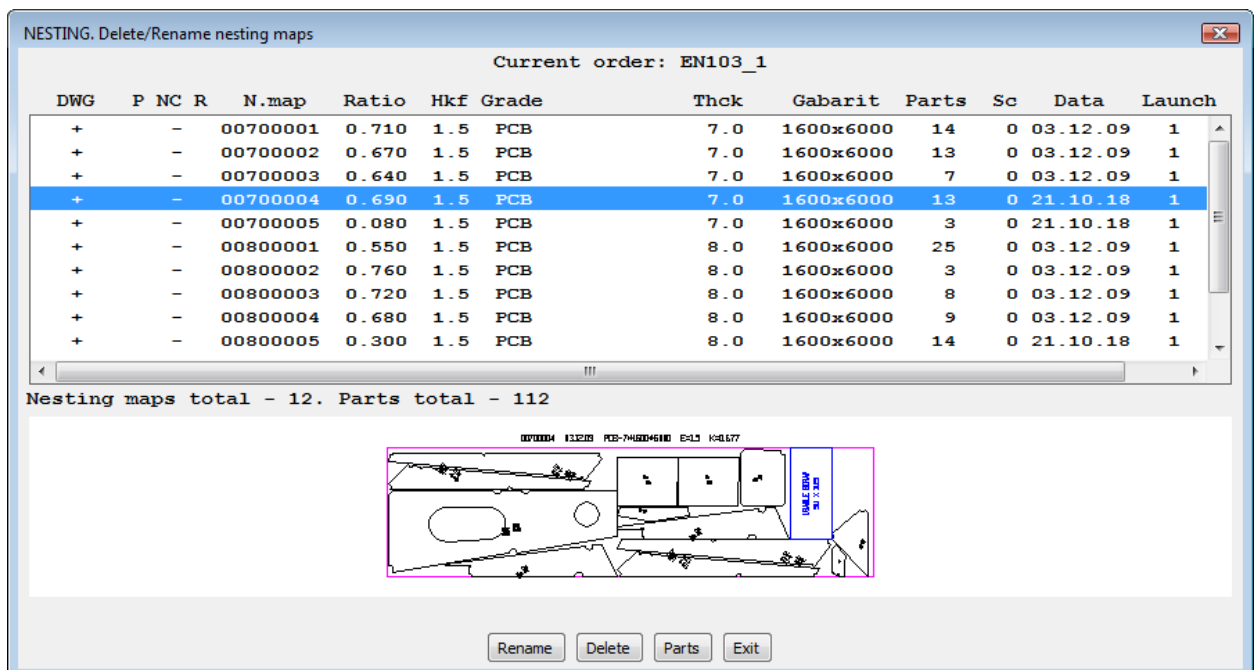
Drawing 36. Window **Delete/Rename nesting maps**

It is necessary to mark the map to de deleted or renamed. If user wishes to delete map then he must click on button **Delete**. Program asks for confirmation of operation (dr. 37).
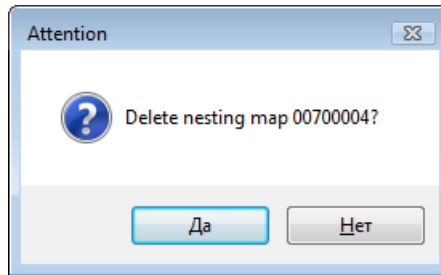
Drawing 37. Confirmation request

Button **Rename** serves for renaming operation. New map name is requested (it must not coincide with names of other maps inside current order, dr. 38).
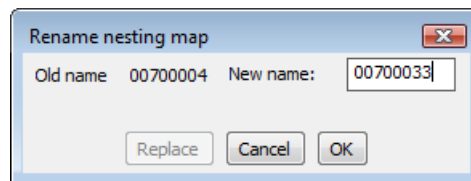
Drawing 38. Window **Rename nesting map**

Button **Parts** shows list of parts included into nesting map, with bounding boxes (gabarits) dimensions (dr. 39).

Drawing 39. List of parts from selected map

Button **Exit** closes window **Delete/Rename nesting maps** (see dr. 36) with no action. Deleting and renaming is possible only for one map at one operation.

Restore deleted nesting maps

There are two cases when nesting maps are deleted:

- command of deleting nesting map (in **Nesting** and **Bdata** modules);

- command of putting map on shelf for editing (in **Nesting** module).

Both commands before deletion create backup copies of files to be changed (in *Dbf* folder of current order and in scraps folder). Names of files being changed are kr_list.dbf, kr_list.cdx, det_zak.dbf, otxod.dbf, otxod.cdx. Names of backup files are kr_list_saved.dbf, kr_list_saved.cdx, det_zak_saved.dbf, otxod_saved.dbf, otxod_saved.cdx. Moreover, delete command before deletion creates backup copy of DWG file with nesting map geometry, e.g. for

file 00700005.dwg a copy named 00700005_saved.dwg is created (in *Karty* folder of current order).

Existence of backup copies enables restoration immediately after deleting nesting map by mistake.

Note 1. Restoration from backup copies has meaning only right away after the action of map (maps) deletion. If after deletion user runs operations except deletion (for example, renaming other map) then restoration from earlier backup copy will lead to **loss of later operation results**. In complex cases user may repeat renaming or try make changes by DBF editor of module **Bdata**.

Note 2. If after the first deletion user makes second deletion then backup files will be rewritten and first deletion **cannot be cancelled**.

Submenu **NESTING > Undo deletion** (dr. 40) is intended for restoration of nesting maps just deleted in the previous operation.
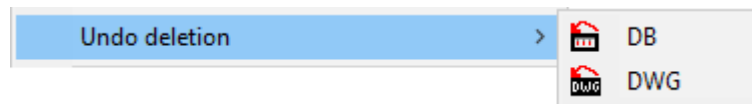
Drawing 40. Submenu **Undo deletion**

Submenu has two items: **DB** and **DWG**. They correspond to buttons and of the toolbar **JNG** (see dr. 5).

Command **Undo deletion > DB** is aimed for restoration of previous state of database table files, fixed before just deleted nesting map (maps). Command opens dialog box **Restoring DB tables after removing nesting map** (dr. 41).
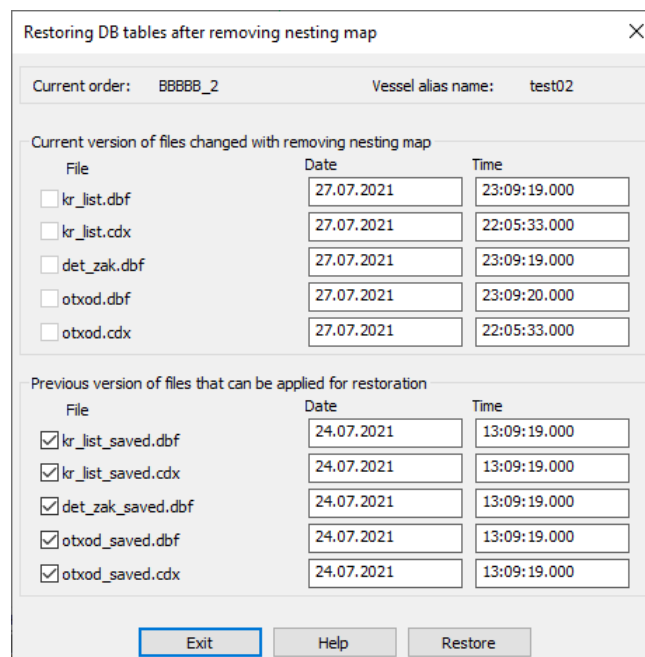
Drawing 41. Window **Restoring DB tables after removing nesting map**

Under dialog title there are current order name and its alias name. In the upper part there are shown five files to be replaced while restore operation, and lower part contain reserve five files with previous state of table files. All the files are appended with date and time information of their last modification. If backup copies in the *Dbf* folder of current order are not found then missing file have **no** instead of date.

In normal situation all the copy files exist and their names must be checked. In some rare cases user can clear unnecessary checkboxes.

To run operation press button **Restore**. The command will run copying and send messages to command line in such a form:

File   D:\BSHIP\SAMPLES\BBBBB_2\DBF\kr_list_saved.dbf   copied   to D:\BSHIP\SAMPLES\BBBBB_2\DBF\kr_list.dbf.

File   D:\BSHIP\SAMPLES\BBBBB_2\DBF\kr_list_saved.cdx   copied   to D:\BSHIP\SAMPLES\BBBBB_2\DBF\kr_list.cdx.

File   D:\BSHIP\SAMPLES\BBBBB_2\DBF\det_zak_saved.dbf   copied   to D:\BSHIP\SAMPLES\BBBBB_2\DBF\det_zak.dbf.

File D:\BSHIP\otxod_saved.dbf copied to D:\BSHIP\otxod.dbf.

File D:\BSHIP\otxod_saved.cdx copied to D:\BSHIP\otxod.cdx.

Restored 5 files.

After restoration backup copies (*_saved.*) are deleted.

Recovery of DB tables will not restore nesting maps DWG files. For this operation there is used a command **Undo deletion > DWG**. Command opens dialog box **Restore DWG and SLD files for deleted nesting maps** (dr. 42).
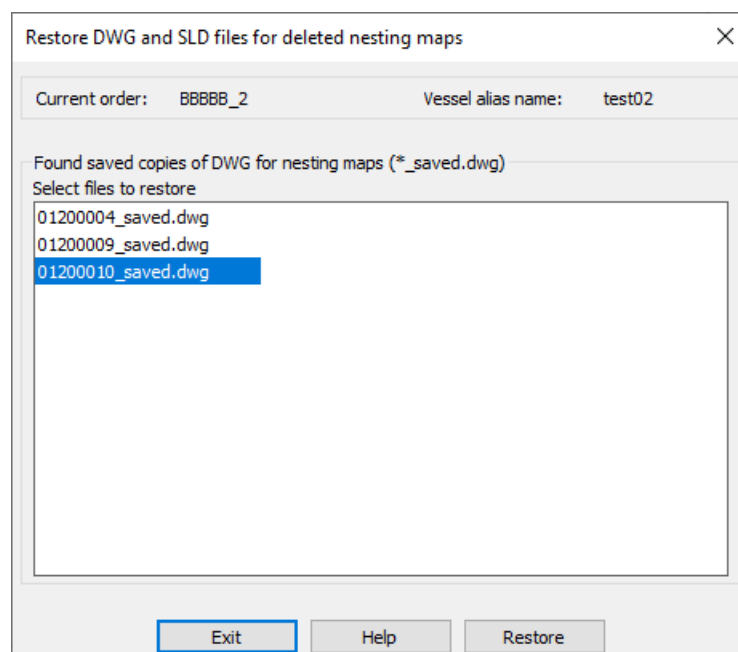
Drawing 42. Window **Restore DWG and SLD files for deleted nesting maps**

In the listbox user must select names of the DWG files to be restored from backup copies. Pressing Ctrl and Shift keys one can mark several files. Next button **Restore** is enabled, after clicking it DWG and SLD files of selected nested maps will be restored and applied backup copies will be removed.

Here are sample restoration messages:

File   D:\BSHIP\SAMPLES\BBBBB_2\KARTY\01200010_saved.dwg   copied   to D:\BSHIP\SAMPLES\BBBBB_2\KARTY\01200010.dwg.

Removed file D:\BSHIP\SAMPLES\BBBBB_2\KARTY\01200010_saved.dwg.

File   D:\BSHIP\SAMPLES\BBBBB_2\KARTY\01200010_saved.sld   copied   to D:\BSHIP\SAMPLES\BBBBB_2\KARTY\01200010.sld.

Removed file D:\BSHIP\SAMPLES\BBBBB_2\KARTY\01200010_saved.sld.

Restored 1 DWG file and 1 SLD file.

11 WORK WITH PARTS PLACEMENT

Interactive editing nesting maps admits actions on changing placement of parts and scraps. Placement commands are used in interactive map creation process too.

Here the case of nesting map presence on shelf (see dr. 34) is discussed.

Get map from shelf for edit

To start editing map it is necessary to get it from shelf (to send it to nesting place). This is done with command **NESTING > Set > Get map from shelf** or with button 🖳 of toolbar **Shelf** (see dr. 5). Nesting map on shelf is selected by click on sheet boundary (in magenta color). As a result of selection map moves to the lower viewport (dr. 43).
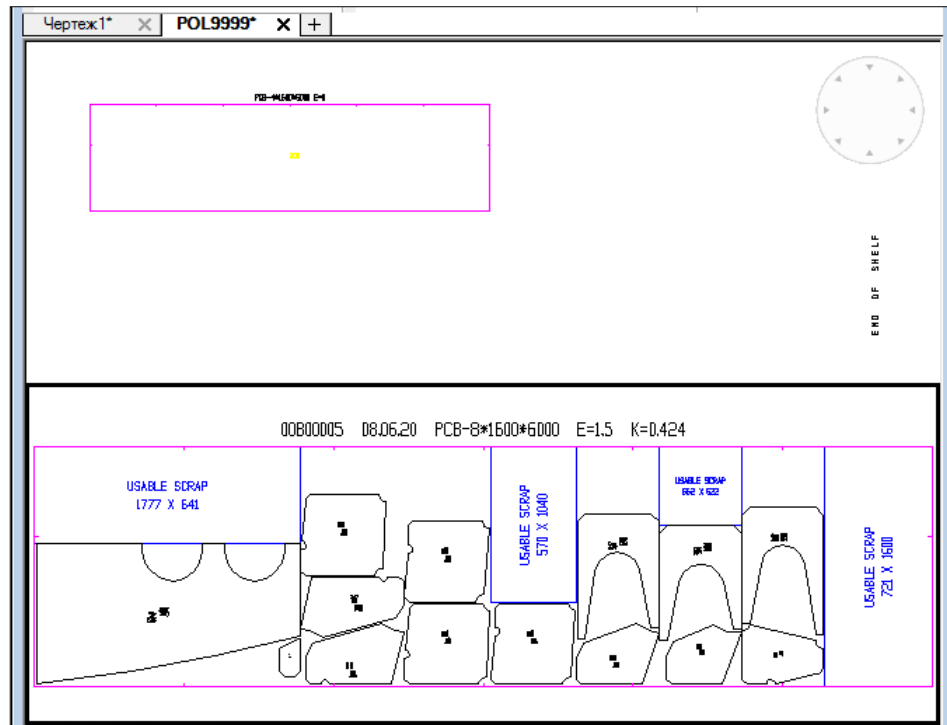
Drawing 43. Getting map from shelf

Periodic placement of parts

Commands of periodic placement are collected in submenu **NESTING > Periodic placement** (dr. 44).
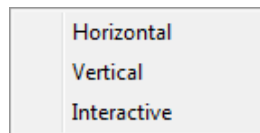
Drawing 44. Submenu **Periodic placement**

This type of placement has sense only if there are multiple copies of the same parts on shelf.

Submenu **Periodic placement** consists of three items (see dr. 44). All the three commands place group of parts up to exhausting parts group multiplicity or filling free area. Command **Horizontal** fills free area from left to right and then goes down. Command **Vertical** places in free area from botton to top and then goes right. Command **Interactive** implements opportunity of insertion point selecting for each parts complex. Before using periodic placement commands it is necessary with move, rotate and combine operations to create required position of part or parts group (on nesting map or on shelf), taking in mind that multiplicity of complex (group) is equal to minimal multiplicity of parts included in group. Next any periodic placement command requests:

Select parts:

Specify part or parts group.

If parts multiplicity is equal to 1 then there will be a message:

Single group selected, periodic placement is impossible !

If click on **Horizontal** or **Vertical**, then requests follow:

First corner of free area:

Second corner:

Command **Interactive** repeats placement requests with number of times that is equal to multiplicity of selected complex. Command running can be interrupted by key **Esc** in reply to request on placing complex. After placement multiplicity of parts on shelf is changed to a new number of unused copies. If multiplicity becomes equal to zero then part is deleted from shelf.

Move commands

Move commands are included into submenu **NESTING > Placement** (dr. 45) and in toolbar **Move** (see dr. 5).
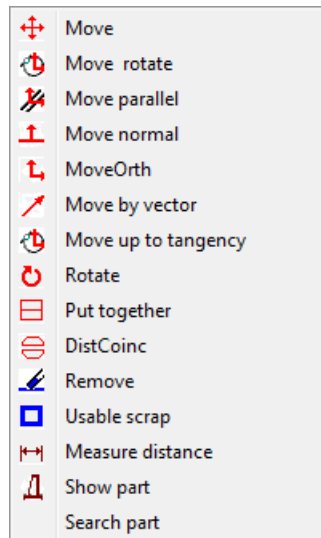
Drawing 45. Submenu **Placement**

Getting free parts from shelf or parts located inside map on shelf down to nesting place is done with commands **Move**, **Move rotate**, **Put together** of submenu **Placement**. All these comands may be also applied for moving parts inside map or on shelf. Commands **MoveOrth**, **Move by vector**, **Move parallel**, **Move normal**, **Move up to tangency** of submenu **Placement** may be used for moving parts only inside map or inside shelf.

Command **Move**

Command moves parts inside shelf, inside map or from shelf to map. Can be run with menu item **Move** (see dr. 45) or with button ⊕. Command requests:

Select parts: Select objects:

Select required parts. For multiple selection apply graphical editor method (window, crossing window, etc.).

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Moving is executed by center of the first selected part and applied to all the group. After left-click for destination point new position is fixed. If part is taken from shelf then its multiplicity on shelf decreases by one. If multiplicity becomes zero then part image is removed from shelf.

Command **Move rotate**

Command moves objects with rotation, inside shelf, inside map or from shelf to map. It can also be called with button . Command requests:

Select parts: Select objects:

Select parts by any method. After first movement there is a request for rotation. For angle input buttons of toolbar **Rotate** (dr. 46) can be used.
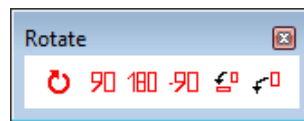
Drawing 46. Toolbar **Rotate**

Objects can be rotated either for fixed angle values -90° (button), 90° (button) or 180° (button), or for arbitrary angle, or up to parallelity of picked edges (button). User can change rotation center (initially it is center of part). This can be done with button (pick new rotation center point). The center in future will be first base point for moving parts. If right-click then inclination angle will not be changed and program will go to next movement. End of command is pressing key **Esc** in answer to parts placement request.

Parts are fixed in the last position.

Command **MoveOrth**

Command of orthogonal move runs move along axis OX or OY. It can be also called with button . Command requests:

NEAREST osnap IS ON. DIST BTW PARTS = 10 mm

Select PART to move:

Here NEAR osnap is set on. Next:

Select stationary PART:

Pick point on the second part. Moving is done along OX or OY axis, depending on axis with greater coordinate increment. Dist is taking into account. Moving displacement is decreased by value of Dist is being defined by menu item **Dist**, from submenu **NESTING > Set** (dr. 47).
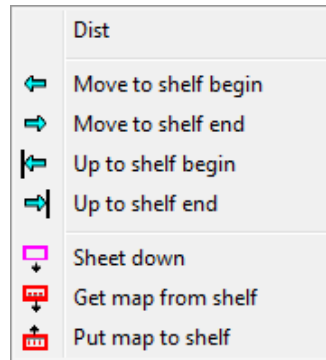
Drawing 47. Submenu **Set**

Command <u>**Move by vector**</u>

Command realizes moving of parts along specified vector. It can also be called by button ![icon]. After selection of parts there is a request:

Pick vector start point:

Here NEARest osnap is set on. Specify point. Next:

Pick vector end point:

Specify second point of displacement vector. Dist is taking into account. Moving displacement vector is decreased by length value of Dist that is defined by menu item **Dist**, from submenu **NESTING > Set** (see dr. 47).

Command <u>**Move parallel**</u>

Command realizes moving of parts parallel to specified straight part edge. It can also be called by button ![icon]. After selection of parts there is a request:

Select straight edge of the part to be moved:

Here NEAR osnap is set on. Specify sheet edge or straight edge of a part. Next:

Enter distance:

It is necessary to specify distance by number or by two points. Next there is a request for specifying move direction (as there can be two directions):

Enter move direction:

Specify second point to the side that clarifies move direction, preferably on the same edge. As a result parts group will be moved along specified edge, on given distance and required direction.

Command <u>**Move normal**</u>

Command moves parts along vector that is perpendicular to specified edge. It is also called by button ![icon]. After selection of parts there is a request:

Select straight edge normal to which the part is to be moved:

Specify sheet edge or straight edge of part. Next request:

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Enter distance:

Specify distance by number or by two points. Next there is a request for specifying move direction (as there can be two directions):

Enter move direction:

Specify second point to the side that clarifies move direction, preferably on the same edge. As a result parts group will be moved normally to specified edge, on given distance and required direction.

Command **Move up to tangency**

Command moves selected objects up to tangency with sheet or specified part. It can be called by button [⟳]. After selecting parts there is a request:

Select stationary part:

It is necessary to select unmovable part or sheet edge up to tangency with which selected parts must be moved. Next request:

Select movable part:

Specify part (from selected group) that must become closest to stationary part, after moving. Next request:

Enter move direction:

Pick point to specify desired move direction with the help of movable part. Selected parts will be moved in specified direction, on distance equal to minimal distance between vertices and edges of movable and stationary parts, minus **Dist** from submenu **Set** (see dr. 47).

Combine with distance

Command realizes combining of the first part edge with specified edge of another part up to **Dist** of submenu **Set** (see dr. 47). Use submenu item **Placement > DistCoinc** or button [⊜]. A request follows:

Select straight edge of the part to be moved:

Select straight edge of the part (on shelf or in nesting map) that is to be moved. Next:

Pick combining point on movable part:

User must pick **corner** point (vertex) of selected straight edge. There will be rotating relative this point, up to achieving parallelity of selected edges. Next:

Select straight edge on unmovable part:

Specify straight edge of the part to which the previous part will be moved. Next request:

Pick combining point on unmovable part:

It is necessary to pick corner point of selected straight edge on unmovable part. To this point movable part will be attracted. As a result of command work selected part will be moved,

by specified point, to the point on unmovable part, with rotation of the first part up to parallelity of selected edges. Distance between parts must become equal to **Dist** value from submenu **Set** (see dr. 47).

Combine parts

Allows combining (putting together) two parts along straight edges that allows common cut for combined edges. Command is implemented as submenu item **NESTING > Placement > Put together** (see dr. 45) and as button of toolbar **Placement**. A request follows:

Select straight edge of the part to be moved:

It is necessary to select straight edge of the part (on shelf or in map) that must be moved. Selection of edge means selection of part for operation. Next request:

Pick combining point on movable part:

Pick corner (vertex) of selected straight edge. Next:

Select straight edge on unmovable part:

User must select straight edge of the second part for combining (alignment). The first part will be moved to the second one and specified edges will be aligned. Next request:

Pick combining point on unmovable part:

It is necessary to pick corner point (vertex) on onmovable part. This point will become alignment base point. As a result of command work selected part will be moved, by specified point, to the point on unmovable part, with rotation of the first part up to coincidence of selected edges. Combined parts will get combining flag. This flag allows highlighting these parts by submenu item **NESTING > SERVICE > Combined parts** (see dr. 35) and identify them in setting cutting route for creating single combined cut for both straight combined edges. To remove combining flag click on submenu item **NESTING > SERVICE > Remove combining sign**.

Rotate parts

Is used for rotation of parts group. Implemented as command **NESTING > Placement > Rotate** (see dr. 45) and as button of toolbars **Placement** and **Rotate** (see dr. 46). Command dialog:

Select parts: Select objects:

Next request after parts selection:

Angle ? [90/180/-90]<any angle>:

A group of parts can be rotated either on fixed angle –90° (button), 90° (button) or 180° (button) or up to parallelity of specified edges (button).

User can change rotation center (initially it is center of part). This can be done with but-

ton ![icon](pick new rotation center point). End of command is pressing key **Esc** in answer to parts selection request.

Measure distance

To measure distance between parts or between part and sheet edge use command **NESTING > Placement > Measure distance** (see dr. 45) or click button ![icon] of toolbar **Placement** (see dr. 5). After command start pick point on the first straight edge (NEARest osnap is active) and then pick on other edge (PERpendicular osnap is activated). Second point is automatically modified with PER osnap function. Result is output in command line.

Display or hide part labels

Command **NESTING > SERVICE > Label** (see dr. 35) hides part labels if they are visible. If labels are hidden then this command restores label visibility.

Identify part

If part image is very small and its label is small too, then command **NESTING > Placement > Show part** (see dr. 45) outputs part data to command line: draw, position, section. Command requests:

Select part:

If select part in map on nesting place then draw, position and section will be displayed. If select part on shelf then there will be also added multiplicity text (quantity). End of command is **Esc** (not **Enter**).

Create rectangular usable scrap

For manual creation of rectangular usable scrap inside map located on nesting place use command **NESTING > Placement > Usable scrap** (see dr. 45). Command requests two points that will become two diagonal points of rectangle:

Select first corner of usable scrap:

Pick first corner point.

Second corner:

After second point program creates blue rectangle of new usable scrap. Scrap is converted to block having attributes. One of them is scrap dimensions (dr. 48). First one is a horizontal size, second one is a vertical size.
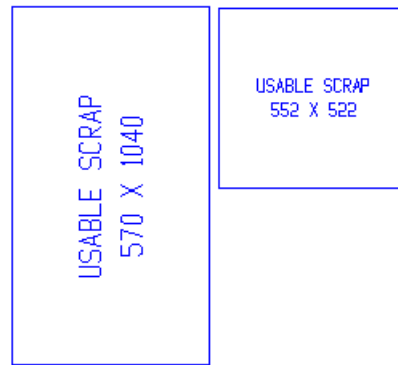
Drawing 48. Sample usable scraps

If save this nesting map then its usable scraps will be saved too (in the table otxod.dbf).

Remove usable scrap

Command **NESTING > Placement > Remove** or button ⊿ of toolbar **Placement** removes usable scrap from nesting map.

Search part

To find part in big nesting map use command **NESTING > Placement > Search part** (see dr. 45). Command requests:

Enter part name:

Enter name of part DWG file (e.g. 1030221). Program will highlight all the blocks with such name.

12 INTERACTIVE SETTING OF PARTS CUTTING ROUTE

Route is a sequence of cutting parts in finished nesting part. Parts are numbered in this sequence starting with 1. Setting route must always precede creation of NC program for cutting. Route can have additional parameters specifying cutting procedure (pierces, bridges, end point, etc.).

Note. Setting route operation does not require opening shelf drawing.

Set route mode

First it is necessary to select nesting map for which cutting route will be defined. Use menu command **NESTING > Set cutting route for nesting maps** or button 🎛 of toolbar **Interactive route**.

Command opens dialog box **Generation of cutting route for nesting map** (dr. 49). Select map and click on button **Route**.
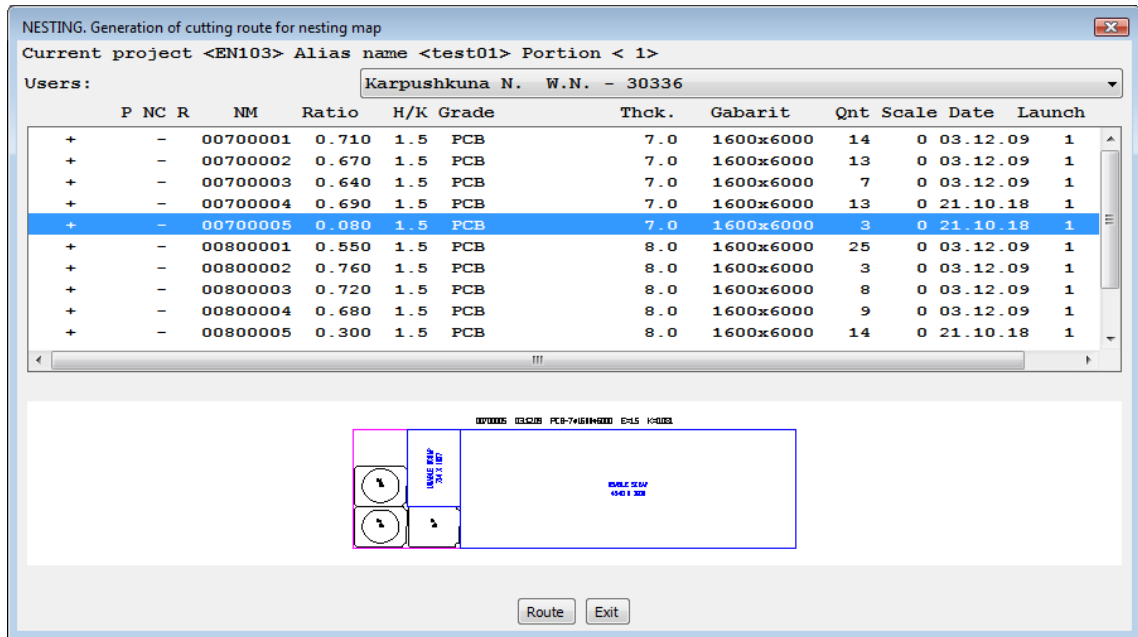
Drawing 49. Window **Generation of cutting route for nesting map**

DWG file of nesting map is being loaded into editor, and parts get red color (dr. 50).
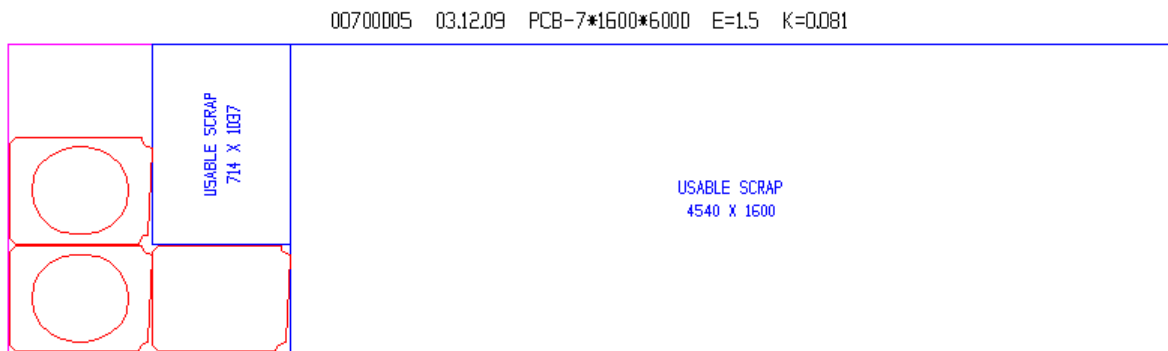
Drawing 50. Map before generation of route

Next step is activating route mode (for initializing specific program variables). It is done with command **InterRoute** of submenu **NESTING > Route** (dr. 51) or with button ![button] of toolbar **Interactive route**.
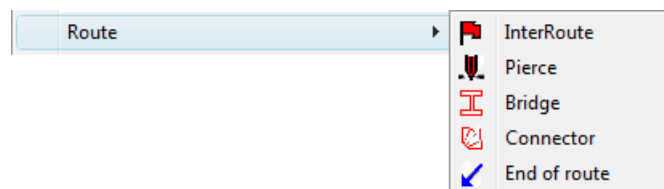
Drawing 51. Submenu **Route**

Pierce

Route defines path for movement of cutting instrument (cutter). Cutter must be switched on or off from time to time. Approaching to part and leaving part is ruled by pierce parameters, can include inlet or outlet.

To set pierce point on part contour use command **NESTING > Route > Pierce** (dr. 51) or button of toolbar **Interactive route**. Next request in command line:

Pick pierce point

If pick point on part contour, then this point will be transformed using current pierce type for the contour (types are different for outer and inner). A segment will be added on distance defined by current pierce settings.

If pierce type is "arbitrary", then user will be suggested to pick auxiliar point definin direction of straight segment as inlet. Contour cutting path will be generated in accordance with round direction: if round is CCW (counterclockwise) then contour will get green color, if round is CLW (clockwise) then color will be yellow. And passage (segement) will be added from start route point to start point of pierce. If it is without cutting (jump) then color of passage will be blue, if it is with cutting then passage line will be green. Start point of next passage will be end point of cutted contour path. If contour is open then message will be shown and cut path will be drawn from the first contour point to the last contour point.

If pick point on common segement of combined parts then pierce point will be nearest point of common segement. Cutting path will be generated on common segment extension independing of current pierce type (except "arbitrary" type; user will be suggested to pick point defining direction of inlet segment). Next, in accordance with current rule of curring combined parts, there will be selected the part to be cut first and generated cut path for these two parts. Path end in any case will in the end point of common segment opposite to start point of common segement. common segment will be drawn in cyan color.

After handling this point request will be repeated:

Pick pierce point

Here are sample settings for cutting contours:

- going to part is done with jump (no cut);

- do not improve pierce;

- if exists combined cut then it is cut first;

- outer contour round is CLW (clockwise);

- outer contour pierce is on continuation;

- outer contour round is CCW;

- inner contour pierce is by radius with outlet;

- outer contour pierce value is 6 mm;

- inner contour pierce value is 6 mm.

If it is necessary to change settings for contour round, passage or pierce type, without leaving request on picking pierce point, then submenu **NESTING > Set route parameters**

(dr. 52) can be used (see more information hereinafter).
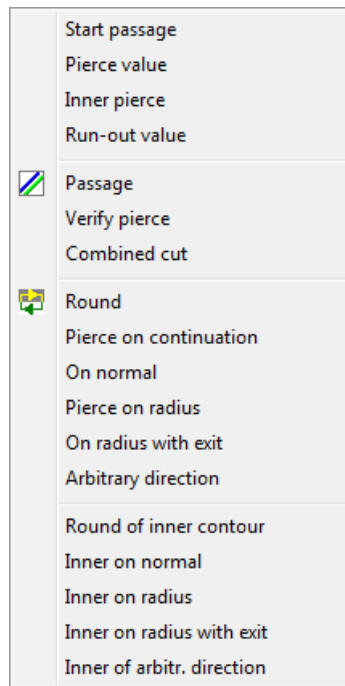
Drawing 52. Submenu **Set route parameters**

On using items **Round**, **Round of inner contour** or **Passage** there will be change of current setting to a new value (i.e. round CLW changes to CCW, jump changes to cut). After selecting one of the pierce items then current pierce type changes to this type.

On using item **Combined cut** ther can be set flag, what will be cut first: part or combined segment.

Items **Pierce value** and **Inner pierce** modify pierce value for outer and inner contours.

Request for pierce value is repeated until user presses key **Esc**.

Bridge

For uniting parts contours into one cut path use command **NESTING > Route > Bridge** (see dr. 51) or button of toolbar **Interactive route**. First part from which bridge (piece) will be created must be already cut out.

After command start there is request:

Point piece start:

Pick the start point for "bridge". Next:

Select bridge end:

After specifying second point on the contour of the part that is yet not cut there is a request:

Bridge width:

By default double value of pierce is suggested for bridge width. The last bridge width is

saved. As a result there will be a cut path going from the first point to the second one, returning to the first part contour with required width.

Current settings for outer contour

To define current parameters of route generation there is submenu **NESTING > Outer contour** (dr. 53). All these parameters are connected with cutting outer contour.
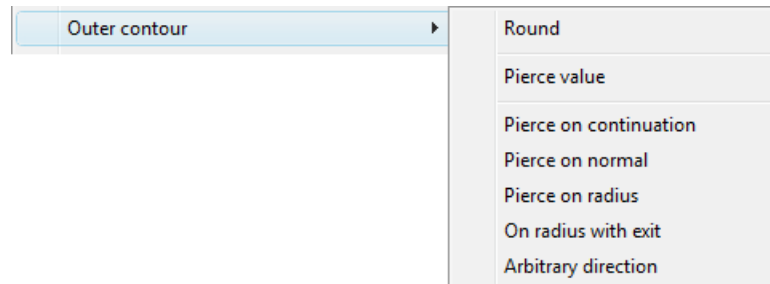
Drawing 53. Submenu **Outer contour**

Item **Round** changes round direction to an opposite one. If round is CLW then contour is yellow, if round is CCW then contour is drawn in green.

Item **Pierce value** allows changing outer contour pierce value.

The following items set various pierce types for outer contour.

Pierce on continuation sets pierce on continuation of first contour segment, automatically ENDpoint osnap is set. For all other pierce types osnap NEARest is applied.

Pierce on normal sets pierce by normal to the first segment.

Pierce on radius sets pierce type on quarter arc that is tangent in picked point.

On radius with exit differs from the previous one by symmetric exit.

If **Arbitrary direction** is used then each time there will be suggestion to pick additional point, defining direction of inlet segment. Inlet is generated along straight line.

Current settings for inner contour

Submenu **NESTING > Inner contour** (dr. 54) is designed for inner contour settings.
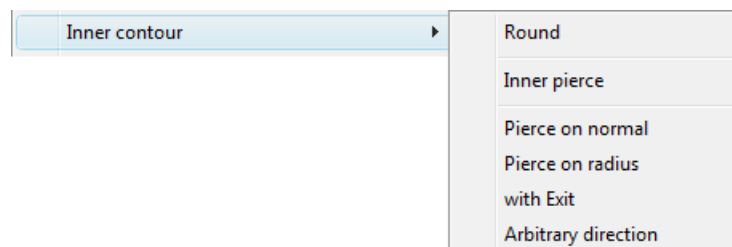
Drawing 54. Submenu **Inner contour**

Submenu items serve for inner contour settings (round, pierce).

Item **Round** changes round direction to opposite (CCW/CLW).

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Item **Inner pierce** sets pierce value for inner contours.

The following items set various pierce types for inner contours.

Pierce on normal sets pierce by normal to the first segment.

Pierce on radius sets pierce type on quarter arc that is tangent in picked point.

with Exit differs from the previous one by symmetric exit.

If **Arbitrary direction** is used then each time there will be suggestion to pick additional point, defining direction of inlet segment. Inlet is done along straight line.

Change route settings

Submenu **NESTING > Set route parameters** (see dr. 52) is used for modification of current settings inside command **Pierce**.

Item **Start passage** changes start point of passage to next cutted contour. At initial entrance in submenu the start point is (0,0). While setting pierce this point is automatically remembered in the last point of cut trajectory. In case of adding new parts to map with route, or in case of deleting route fragment, or in case of recreation of total route it is necessary to set start passage point to cut end point of the last contour, because route must be continued from this position.

Item **Pierce value** is used for setting new value of outer contour pierce.

Item **Inner pierce** allows resetting inner contours pierce value, in command line.

Item **Run-out value** sets outlet value for cutting outside part.

Item **Passage** changes passage type to opposite. Passage between contours can be with cut (in green color) or with jump (in blue color).

Item **Verify pierce** allows define pierce on part contour, in the window.

Item **Combined cut** changes cutting rule for combined parts. Status line caption **1st part** defines rule under which cut path goes from the pierce point on continuation of common segment turning to the part contour. Status line caption **1st cut** defines rule under which cut path goes along commom segment and then as set for part contour.

Item **Round** changes round direction to opposite (CCW/CLW).

The following items set various pierce types for approach to part outer contour.

Pierce on continuation sets pierce on continuation of the first contour segment, automatically ENDpoint osnap is set. For all other pierce types osnap NEARest is applied.

On normal sets pierce by normal to the first segment.

Pierce on radius sets pierce type on quarter arc that is tangent in picked point.

On radius with exit differs from the previous one by symmetric exit.

If **Arbitrary direction** is used then each time there will be suggestion to pick additional

point, defining direction of inlet segment. Inlet is generated along straight line.

Item **Round of inner contour** changes inner contour round to opposite.

The following items set various pierce types for approach to part inner contour.

Inner on normal sets pierce by normal to the first segment.

Inner on radius sets pierce type on quarter arc that is tangent in picked point.

Inner on radius with exit differs from the previous one by symmetric exit.

If **Inner of arbitr. direction** is selected then user will each time offered to pick additional point defining inlet direction. Inlet is executed along straight line.

Edit existing route

Submenu **NESTING > CHANGE** (dr. 55) is used for edit of existing route.
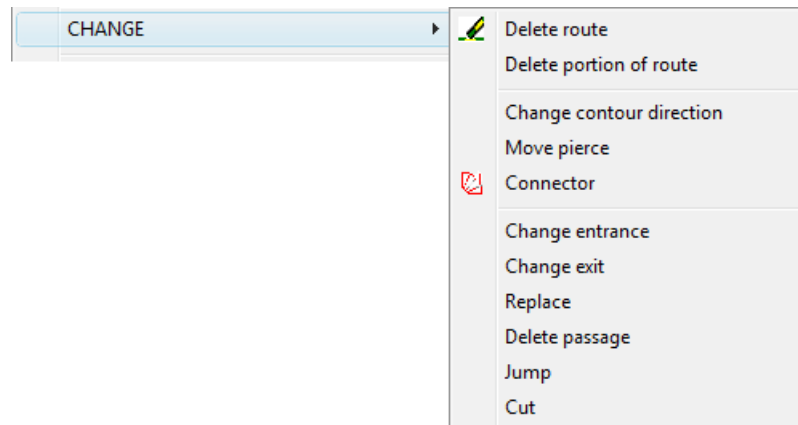
Drawing 55. Submenu **CHANGE**

Commands allow to delete all the route or its fragment, to modify route. Command **Delete route** removes all the route from nesting map. This command is recommended when map route requires too many changes, for many parts.

Command **Delete portion of route** allows delete fragment of existing route. Command requests two points defining rectangle inside which route must be removed. Rectangle is considered to be crossing window, i.e. all the segments inside window and intersecting window rectangle will be deleted.

Change cut direction

Command **CHANGE > Change contour direction** allows changes of contour round.

In this command it is sufficient to select cut contour and contour will change cutting direction, as well as inlet segment according to new direction, and move approach to pierce point to a new place.

Move pierce point

Command **CHANGE > Move pierce** allows to move pierce point to other point of con-

tour. Command requests:

Pick new pierce point:

Specify point on the same contour. Old inlet segement will be deleted and cut path will be rebuilt with new pierce. Command does not work with contours having outlets after which there were bridges to other parts. For these cases route must be removed completely and new route must be created.

Piece

If a piece (connector) is needed on cut path (or it is necessary not to cut route fragment), then user can apply command **CHANGE > Connector** or click on button [image] of toolbar **Interactive route**. After start command requests:

Point piece start:

Specify point on cutting route from which cut must be cancelled. Next:

Piece length:

Enter length or specify second point. If piece length exceeds rest segment length up to next vertex (corner), then piece length will be reduced up to corner point. If end point of piece is the lest point of cutting route then this fragment of cut will be cancelled and start of passage to next part will be moved to the piece end. Otherwise portion of cut trajectory equal to piece length (from piece start) will be deleted, and use will be suggested to pick point defining direction of inlet to the second portion of cut trajectory, and there will be added a jump segment, from connector start point to the end of auxiliary pierce.

Passages between parts

As an opportunity to edit passages between parts, or to change parts placement after setting cut route, or in other cases, there is a command **CHANGE > Change entrance**. Request:

Select line:

Select passage line so that no other lines included into selection set (other contours cuts, other passages).

Command **Change entrance** allows to move point of approaching to the part contour (inlet). This change influences only on passage segment.

Command **Change exit** moves exit point (outlet). If on screen there only one end of passage is seen then commands **Change entrance** and **Change exit** work similar.

Command **Replace** triggers between cut and jump. User must remember that with change to jump (i.e. no cutting) value of inlet segment can be unsufficient. To solve this problem it is recommended with editor STRETCH command move start of inlet (not more) to necessary

distance from part contour.

Command **Delete passage** deletes any line (passage).

Command **Jump** allows set passage with jump from one point to another. ENDpoinr osnap is automatically activated.

Command **Cut** adds passage line with cutting by specifying points. End of points is by key **Enter**.

Save map

After generation or modification of route it is necessary to save results, for future creation of NC program. It is done with command **NESTING > Save nesting map** or with button 🖫 of toolbar **Interactive route**.

While route correction or adding parts after setting route user must consider the following:

– all the route path (including jumps) must be continuous, i.e. next cut must begin after the end of previous jump or previous cut;

– first passage must begin in point (0,0);

– for every point only one line must enter and one line must exit.

If at the end of the route instrument must return to the left lower corner then this end point must be specifyed as (2,2). Otherwise if from the point (0,0) there are two passages (begin and end) then software may generate NC program in wrong round direction.

Software can issue the following message:

Path is not closed, coordinates of break point ....

This means that NC was going along route and has reached the point from which no lines are coming out but there left other unused cuts or jumps. Point with specified coordinates will be marked by red cross sign. Use ZOOMing and PANning to investigate break reason. If break point is inside of path then probably no lines come out of the point. It is possible whille editing part placement in the map with earlier set route. If break point is at the end of route then from some point two passages are coming out.

In case of successful end of the setting route process and map will be sent for saving, all the parts in map will be numerated in the sequence of cutting, nesting map title block will get total lengths cuts and jumps and pierces number. There will be message about generation of NC program and saving it in subfolder *Pl* of current order. DWG file of map with route will be saved with its name in subfolder *Karty* (it is used for storing nesting map DWGs).

Create NC

NC (NC program) is generated while saving map with route, by command **NESTING >**

Save nesting map. Moreover there is a special command **NESTING > Output NC** and button ![Yn] of toolbar **Interactive route**.

Command **Output NC** calls dialog box **Formats and codes for NC** (dr. 56).
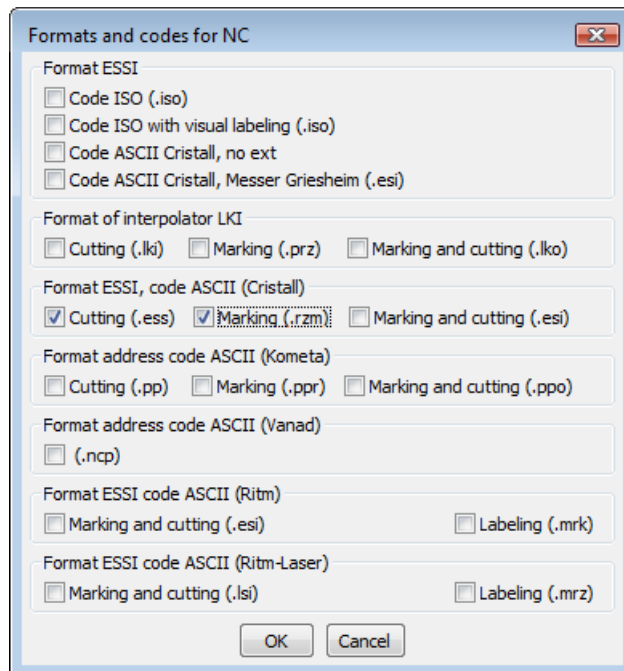
Drawing 56. Window **Formats and codes for NC**

Window displays current format and code of NC structure (from previous session). It is possible to change data or add additional formats. It will result in one or several programs, in specified codes and formats. Divided NC for cutting and marking are possible too (see dr. 56).

Then next dialog box **Building NC program** opens (dr. 57).

In this dialog user must select maps for which NCs must be generated. Only nesting maps with route (with '*' in column R) can be selected.

Button **All NC** allows output of NC for all maps (enabled only if all the maps have routes).

Button **NC** is used for going to NC calculation (for selected maps).

Button **Clean all the list** serves for clearing the lower list. Button **Exit** closes window with no action.
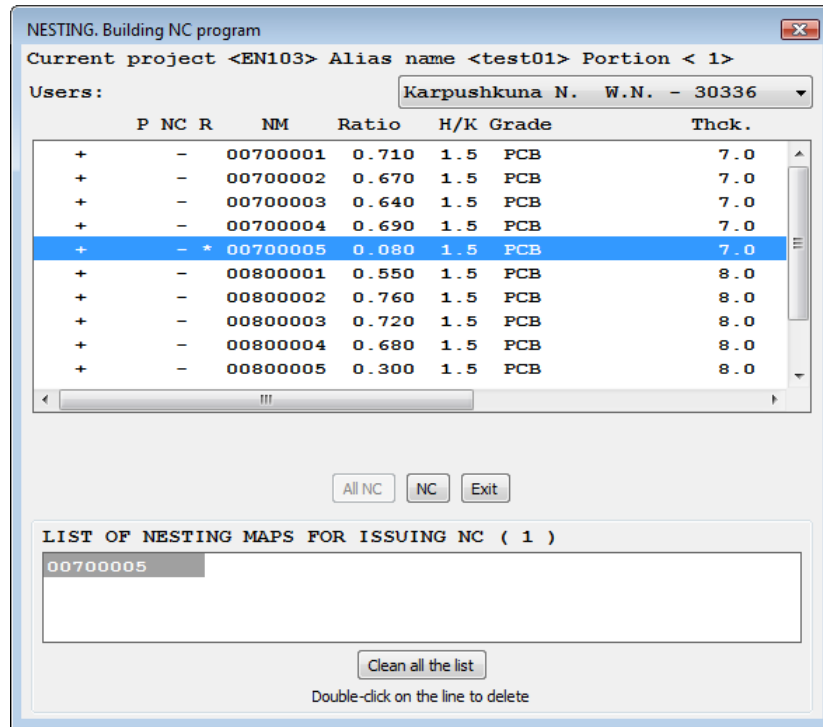
Drawing 57. Window **Building NC program**

Verify NC

For visual control of NC there is submenu **NESTING > VIEW** (dr. 58).
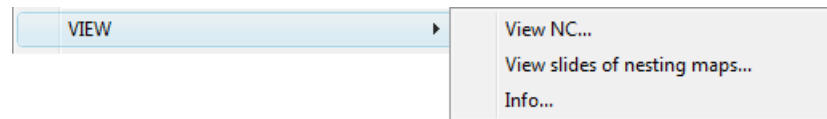
Drawing 58. Submenu **VIEW**

Command **View NC** calls dialog box **NC verification** (dr. 59). It displays all the NC files saved in subfolder *PI* of current order.
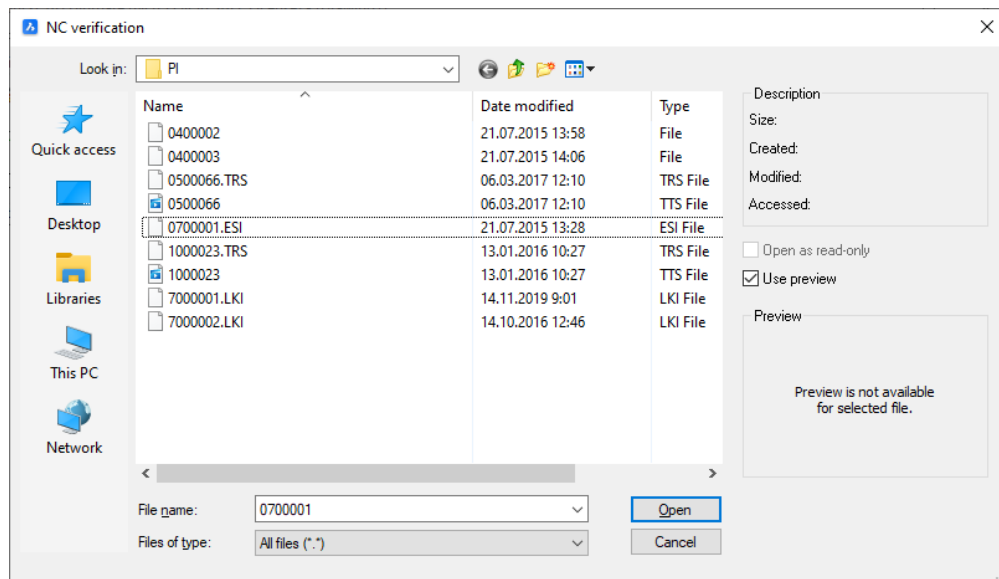
Drawing 59. Window **NC verification**

Select required file and click on button **Open**. NC will be visualized on the screen (dr. 60).
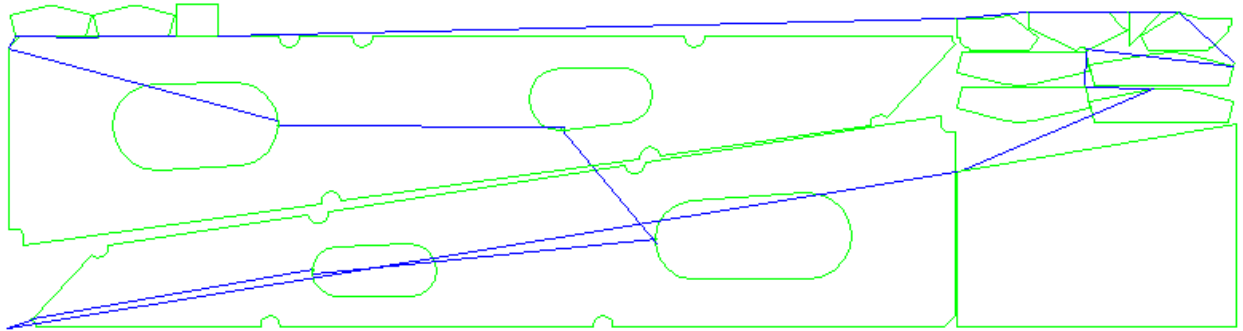
Drawing 60. Visualization of NC

13 PREPARATION OF NESTING MAPS FOR PRINT

If nesting maps are to be printed then there arises a problem that some texts are un-readable (too small). Therefore it is necessary to prepare them for comfortable print. Corresponding commands are included into submenu **NESTING > Prepare map to print** (dr. 61) and toolbar **Prepare to print**.
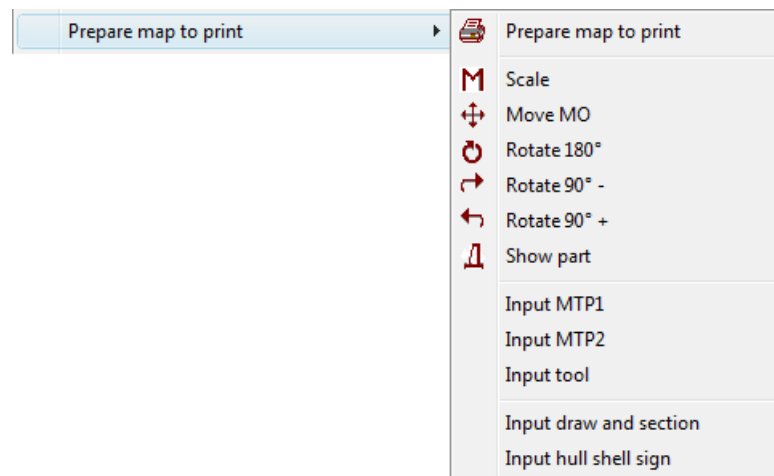
Drawing 61. Submenu **Prepare map to print**

Command **NESTING > Prepare map to print > Prepare map to print** (or) is intended to start preparation mode.

Command calls dialog box for nesting map selection (dr. 62).

Select nesting map and click on button **Set map**. Map drawing will be opened on screen for preparation operations.

For setting print view use submenu command **Prepare map to print > Scale** or button . Command calls dialog box **Settings for nesting maps to be printed** (dr. 63).

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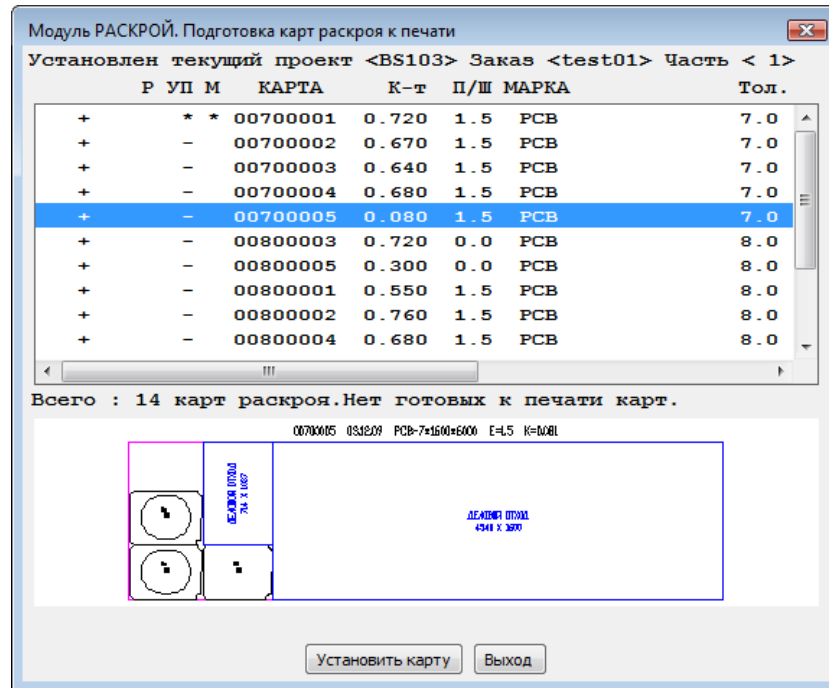
Drawing 62. Window **Prepare nesting maps to print**
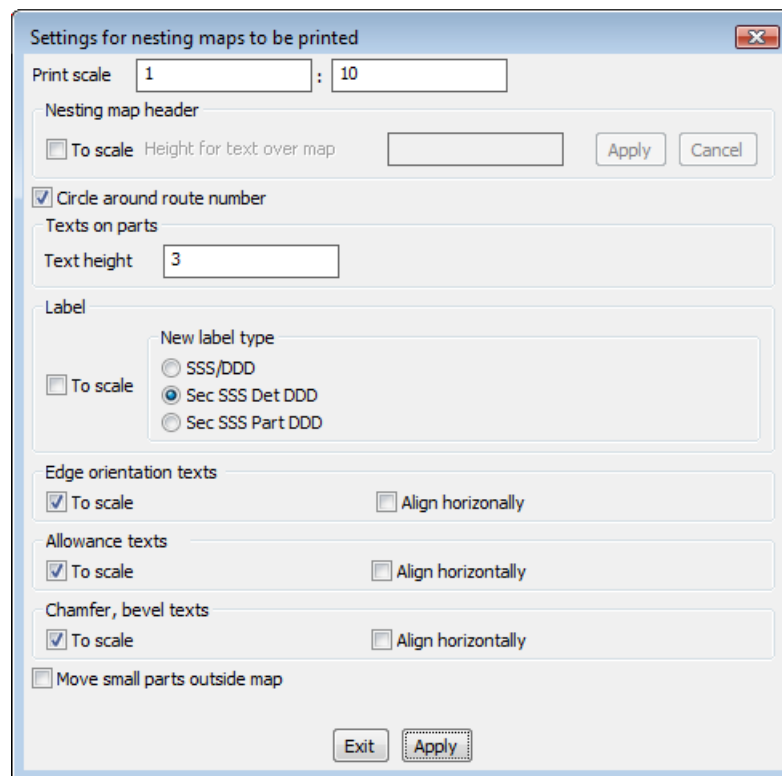
Drawing 63. Window **Settings for nesting maps to be printed**

User must set required checkboxes to modify text height and part label type.

With other commands of submenu **Prepare map to print** (see dr. 61) user can improve texts location (move out or scale), add designation of draw and section, edit texts on orientation, marking, allowances, chamfers and bevels.

14 WORK WITH USABLE SCRAPS

Usable scrap is a special object (usually with rectangular form), that can be placed in the free zone of nesting map, and later can be used for creation of the child map on it. This can bring a good economy in metal sheets. Automatic nesting creates usable scraps itself. In the interactive nesting mode customer can create scraps himself.

New nesting maps can be created either on raw sheets or on free usable scraps (see dr. 12). Map on scrap is called **child**, and map on sheet inside which this scrap was created is called **parent**.

Command **NESTING > Placement > Usable scrap** (button ▣) is used for manual creation of rectangular scrap. Command requests two diagonal points for rectangle:

Select first corner of usable scrap:

Second corner:

New usable scrap appears on the parent map. It is a block reference in blue color (dr. 64).

Drawing 64. Free usable scrap

Free scrap block includes two text objects: **USABLE SCRAP** and gabarit sizes (e.g. **1777 X 641**).

Scrap data are saved as records in DB table otxod.dbf. If free scrap was used for location of child nesting map then name of this map is also written into scrap record. In this situation if user opens parent nesting map then scraps that are not free (used for child maps) will be filled in with cyan solid hatch, or fill (dr. 65). Free scraps have no cyan fill.
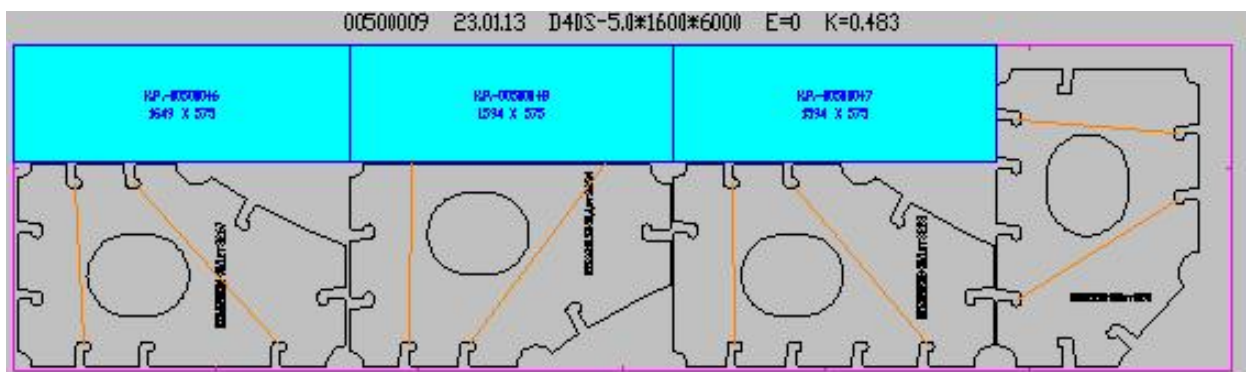
Drawing 65. Nesting map with used scraps

In used scrap the first text object is replaced by text with name of child map. For exam-

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ple: **N.M.- 00500041**, where 00500041 is a child map name, located on this scrap.

If there will be an attempt to delete used scrap then a message will be produced to delete from DB the child nesting map on the scrap.

After deletion of child map usable scrap becomes free (with no cyan solid hatch) and can be used for nesting again.

Free scrap can be deleted from parent map with command **NESTING > Placement > Remove** or with button ![icon] of toolbar **Placement**.
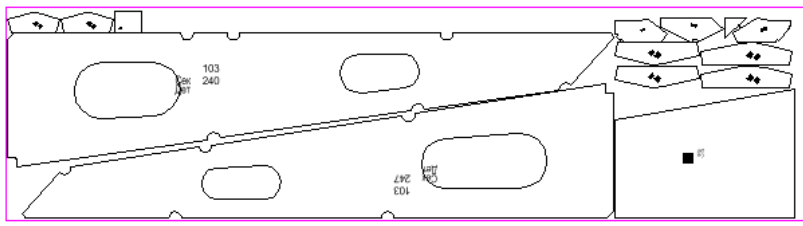
15 OUTPUT OF NESTING MAP FPDS

System generates specific workshop documents called technologic norming card (TNC), or form of printed document (FPD). TNC and FPD are equivalent terms inside **B-Ship**. Used for parts (module **Part**) and for nesting maps (module **Nesting**).

TNC (FPD) for nesting maps are created with menu command **NESTING > Create FPD (forms 102-103)**.

TNC is a DWG document of A4 format. It has first sheet (form 102) and next sheets (form 103). Contents and design of TNCs for various shipyards can differ, or even not planned (then command for TNC is disabled).

Sample form 102 is on dr. 66, sample form 103 is shown on dr. 67.

Drawing 66. Sample form 102 of nesting map TNC

Nseq	DRAW NUMBER	PART POSITIONS	NAME	Qnty	SENT
1	EN103-112-001	240	BRACKET s7 4550x1000	1	
2	EN103-112-001	247	BRACKET s7 4442x1006	1	
3	EN103-112-001	263	BRACKET s7 1345x968	1	
4	EN103-112-001	404	KNEE s7 302x345	2	
5	EN103-112-001	436	KNEE s7 522x480	2	
6	EN103-112-001	446	KNEE s7 574x498	2	
7	EN103-112-001	460	BRACKET s7 461x227	1	
8	EN103-112-001	554	KNEE s7 391x164	1	
9	EN103-112-001	555	KNEE s7 436x175	1	
10	EN103-112-001	4006	Part S7 150x150	1	
11	EN103-112-001	4007	Part S7 200x150	1	

Drawing 67. Sample form 103 of nesting map TNC

Command **NESTING > Create FPD (forms 102-103)** calls dialog box **Select map DWG file** (dr. 68). Dialog displays list of existing DWG files for nesting maps of subfolder *Karty* of the current order.
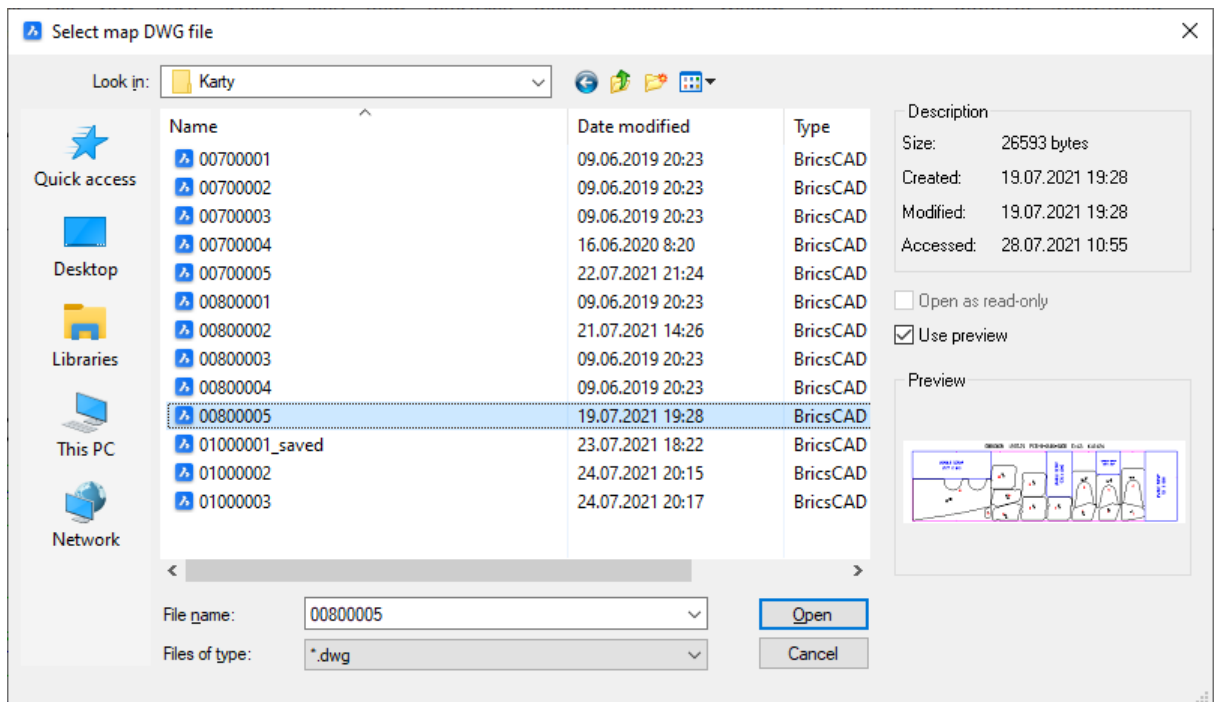
Drawing 68. Окно **Select map DWG file**

Select DWG file and click on button **Open**.

Next dialog in the command line:

Selected: "D:\\BSHIP\\Samples\\En103_33\\Karty\\00800005.dwg"

Wait... Creating form 102...

FPD was generated.

DWG files of created TNCs (FPDs) are saved in subfolder *Tnk_krt* of current order.

Note. XLS documents for nesting maps can be created with commands of submenu **BDATA > DOCUMENTS** (module **Bdata**).

16 DESCRIPTION OF TOOLBARS

Standard configuration of module **Nesting** includes 9 toolbars (see dr. 5). This section contain description of functions (commands), connected with buttons of these toolbars.

Toolbar *JNG*

Toolbar **JNG** (dr. 69) is intended for work with joint nesting maps (JNG), as well as for editing existing maps.

Drawing 69. Toolbar **JNG**

Toolbar buttons:

☐ – call window for new joint nesting group creation;

▭ – call window **Dispatcher of joint nesting groups**;

⬆ – send nesting map to shelf for editing operation;

⬆ – restore DB tables for just deleted maps;

⬆ – restore DWG files for just deleted maps.

Toolbar *Placement*

Toolbar **Placement** (dr. 70) includes most usable commands for placing parts in nesting map.

Drawing 70. Toolbar **Placement**

Toolbar buttons:

▦ – deprecated;

↤ – measure distance;

K – calculate nesting ratio;

– rotate map on 180°;

– delete free usable scrap;

– create rectangular usable scrap;

– combine parts;

– submenu of rotation commands (see toolbar **Rotate**);

– move part.

Toolbar *Shelf*

Toolbar **Shelf** (dr. 71) contains buttons for most popular commands for work with shelf or setting modes.

Drawing 71. Toolbar **Shelf**

Toolbar buttons:

– open window **Settings for nesting maps and shelf view** (see dr. 28);

– ZOOM Extents;

– decorate sheet as panel (horizontal lines acording to panel type);

– move to shelf begin;

– move to shelf end;

– move left on shelf;

– move right on shelf;

– get sheet from shelf;

– get map from shelf;

– return map from nesting place to shelf;

– ZOOM Window for all the map;

– ZOOM Previous;

– ZOOM Window.

– open window with autonesting options (see dr. 29).

Toolbar *Interactive route*

Toolbar **Interactive route** (dr. 72) includes commands for setting and editing route in nesting map.

Drawing 72. Toolbar **Interactive route**

Toolbar buttons:

– select map for setting route;

– activate mode of interactive setting route;

– set pierce;

– set bridges between parts;

– set piece;

– command **Undo**;

– command **Redo**;

– reset;

– retiurn cutter to start corner;

– delete route;

– save nesting map;

– go to two viewports mode (with shelf in the upper part);

– add project name to map header;

– add panel type to map header;

– output NC;

– call help.

Toolbar *Prepare to print*

Toolbar **Prepare to print** (dr. 73) contains commands for preparation of map to print.

Drawing 73. Toolbar **Prepare to print**

Toolbar buttons:

⊟ – select map for print preparation;

M – set map decoration;

⊕ – move text;

↻ – rotate text on 180°;

↰ – rotate text on 90° counterclockwise;

↱ – rotate text on 90°clockwise;

Д – show part attributes (draw, position, section);

✕ – delete drawing objects;

⊢⊣ – horizontal dimension;

I – vertical dimension.

Toolbar *Move*

Toolbar **Move** (dr. 74) assures access to move commands.
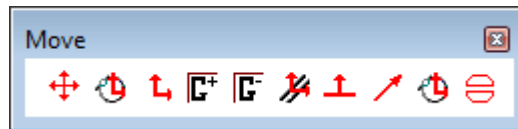
Drawing 74. Toolbar **Move**

Toolbar buttons:

⊕ – move;

⟳ – move and rotate;

⌐ – move ortho;

⊏⁺ – group objects;

⊏⁻ – ungroup;

⤫ – move parallel;

⊥ – move normally to vector;

↗ – move by vector;

⟳ – move up to tangency;

⊜ – combine parts with distance.

Toolbar *Rotate*

Toolbar **Rotate** (dr. 75) includes rotation commands.

Drawing 75. Toolbar **Rotate**

Toolbar buttons:

⟲ – rotate;

90 – number 90 (as reply to angle request, CCW);

180 – number 180 (as reply to angle request);

-90 – number –90 (as reply to angle request, CLW);

– rotate up to parallelity of edges;

– change rotation center.

Toolbar *Select*
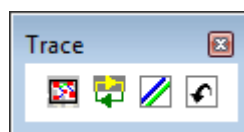
Toolbar **Select** (dr. 76) contains commands of forming selection set.
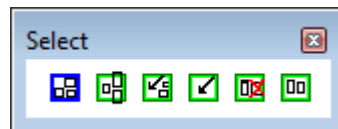
Drawing 76. Toolbar **Select**

Toolbar buttons:

– select by Window;

– select by Crossing window;

– select from previous selection set;

– cancel selection;

– activate exclude objects mode;

– activate add objects mode.

Toolbar *Trace*

Toolbar **Trace** (dr. 77) can be used in setting route.

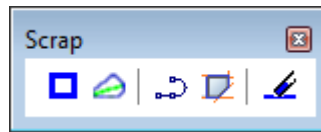Drawing 77. Toolbar **Trace**

Toolbar buttons:

– set pierce;

– change round direction;

– change approach to contour method (inlet with cut to inlet with jump or vice versa);

– undo command.

Toolbar *Scrap*

Toolbar **Scrap** (dr. 78) exists in some configurations of module **Nesting**. Used for work with scraps of new type.

Drawing 78. Toolbar **Scrap**

Toolbar buttons:

– create rectangular scrap of new type (different from scrap of old type in **NESTING > Placement > Usable scrap**); see sample on dr. 79;

– create curvilinear scrap of new type (built on basis of prepared closed 2D polyline); see sample on dr. 77;

– create polyline as contour of future curvilinear scrap (editor command POLYLINE);

– select free zone and convert it to a closed polyline for fiuture curvilinear scrap (like editor command BOUNDARY);

– delete free scrap from nesting map.

Drawing 79. Sample rectangular scrap of new type (ID=0 before saving in DB)

Drawing 80. Sample of curvilinear scrap

Note. Work with curvilinear scrap is possible only in special version of module **Nesting**, and impossible in standard version.