CAD/CAM System N-Ship+
Version 5.0

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

User manual

NSHIP.00004.005-2025

Sheets 117

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ANNOTATION

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

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

Recommended operating systems are: Windows 8.1, Windows 10.

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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 **N-Ship+** will be named **N-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 of the same grade and thickness/profile 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 euristic algorithm. In this variant part contours are simplified, parts are united into complexes (minimal bounding rectangles), 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 project_port 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.

Similar component is included for automatic nesting of profile (beam) parts.

Module **Nesting** uses graphical editor as environment both for automatic and interacive nesting processes. Results of nesting calculations are saved in DWG files, DBF tables of DB and documents in the format of MS Excel.

This manual includes short description of work for creating joint nesting groups (JNG), nesting parts and actions in graphical editor, with explanation of commands and menu items of module **Nesting**.

Parts involved in nesting must be described beforehand: geometry by modules **Part** or **Mdet**, textual attributes in DB by module **Bdata**. Materials (sheets, profile billets with gabarit sizes) are to be defined in the module **Bdata**.

All the work is run inside project_ports (portions of project). For example: EN103_33, where EN103 is a project name, 33 is a number of project portion. Files of project_port reside in a folder with the same name as project_port (*EN103*).

Note. Shipyard order name is referenced in the system as order, vessel or alias name.

DB tables of the project_port are: alb_details.dbf, alboms.dbf, det_zak.dbf, draws.dbf, g_svmrsc.dbf, gabcentr.dbf, ids.dbf, klsmater.dbf, kr_list.dbf, modeli.dbf, parrezki.dbf, sign_par_object.dbf, specp.dbf, spr_gsr.dbf, teh_oper.bdf, users.dbf, vid_mat.dbf. In creation new project_port procedure they are filled with default data. Main tables that are filled and modi-fied by module **Nesting** are: kr_list.dbf, det_zak.dbf, g_svmrsc.dbf, spr_gsr.dbf. Table of sheet scraps otxod.dbf and table of profile scraps otxodpr.dbf are formed outside project_ports.

For testing and learning needs the **N-Ship** installer provides sample project_ports EN103_33, BS103_1, BBBBB_2 with materials, parts (in subfolder Dwg) and nesting maps (in subfolder Karty).

5   Module menu

N-Ship system has pull-down (dropdown) menus, one per each module. Ribbon is not used.

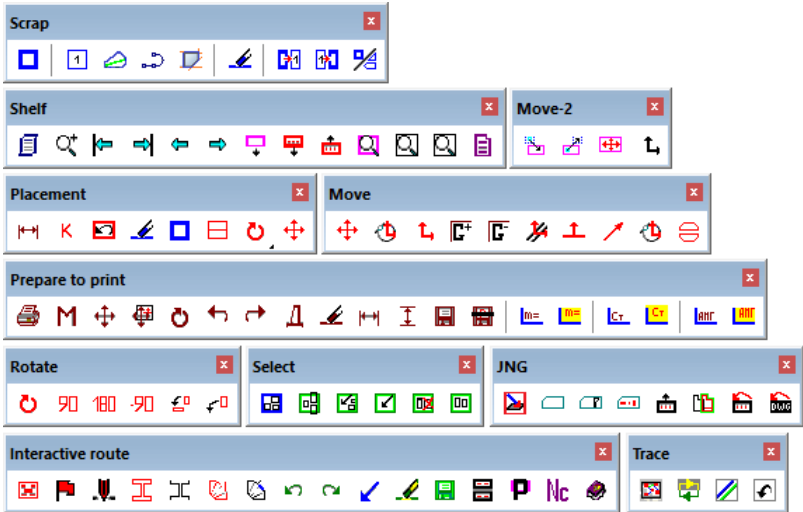Module **Nesting** has its own pull-down menu, its name consists of NESTING and two symbol suffix denoting current interface language: en (English), ru (Russian), etc. But for uni-versality everywhere in the document **NESTING** name is used instead of **NESTINGen** (dr. 1), **NESTINGru**.
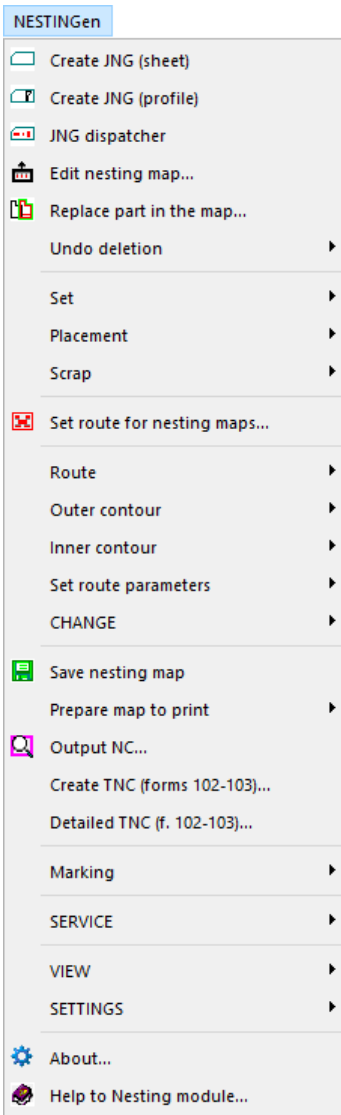
Drawing 1. Menu **NESTING**

6   Toolbars

Module **Nesting** has toolbars (dr. 2).

Drawing 2. 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, cut tool type, kerf halfwidth, pierce value (outer and inner), format and code of NC program generated for equipment, as well as inscriptions included into nesting maps.

The above mentioned parameters are entered in corresponding dialogs: 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. During automatic nesting JNG parts are included by program, while in interactive nesting user himself selects parts one by one. Profile nesting is automatic. **JNG must exist before nesting.**

8.1. Create joint nesting group for sheets

Before creating JNG user must activate required project_port (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 menu command **NESTING > Create JNG (sheet)** (see dr. 1) or with button ⬜ of toolbar **JNG** (dr. 3).

Drawing 3. Toolbar **JNG**

The command opens dialog box **Create joint nesting group (JNG) for sheet** (dr. 4).

This windows serves for running the following six actions:

1. Select **Cutting type** (default type (cut tool) is taken from the previous JNG, first 52, denoting Kristall machine).

2. From the list **Draws** select one or more draws.

Further sequence of actions for selecting parts depends on selection mode. Two modes are applicable: **a**. First material grade, then thickness or **b**. first thickness, then material grade.

If mode is grade > thickness, then steps are:

3. From list **Material grades** select one grade.

4. From list **Thicknesses** select one thickness.

Drawing 4. Window **Create joint nesting group (JNG) for sheet**

If mode is thickness > grade, then steps are:

3. From list **Thicknesses** select one thickness.

4. From list **Material grades** select one grade.

Completing actions are the same for both modes:

5. Fill in **Starting nesting map name (4+4)**. Input data are verified for presence of forbidden symbols and for matching boundaries.

6. With button **Check** run verification of parts availability for chosen grade, thickness, cutting type and existence of part geometry DWG files (parts without geometry are excluded).

At the beginning info line in the lower side of the window shows prompt **Select draw**. **Draws** list shows names of the draws in the current project_port, e.g. **[11] BS103-112-001**. In square brackets there is a launch number for the draw.

At initial moment list **Draws** includes all the draws of project_port, for all the launches. To the left from **Draws** there is **Launches** list containing numbers of the launches in the project_port therefore checkbox **All Inc.** is set at the beginning. List **Launches** is designed as filter for draw names by launches. If user marks any launch then list **Draws** will display draws only of this launch (dr. 5). Setting checkbox **All Inc.** works as selection of draws for all the launches.

Drawing 5. Filtration of draws by launch

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

With the button **Entire launch** one can select all the draws of the marked launch. Button **Entire Project_port** selects all the draws of all the launches of the current project_port.

To remove an item from **Selected draws** user should click on this draw and it will move up (to unseleted draws). Button **Clear selection** clears list of selection.

To finish draw selection click button **SELECTION DONE**. Program will analyze selected draws and shows reference message with summary data for positions, parts, materials and thicknesses for marked cutting type (dr. 6).

Similar text for each selected draw will appear in the command line. User must pay attention to number of parts available for new nesting.

Next the program looks through parts specification table for this draw (draws) and fills in lists **Material grades** and **Thicknesses**. These lists show all available for nesting grades and thicknesses (dr. 7).
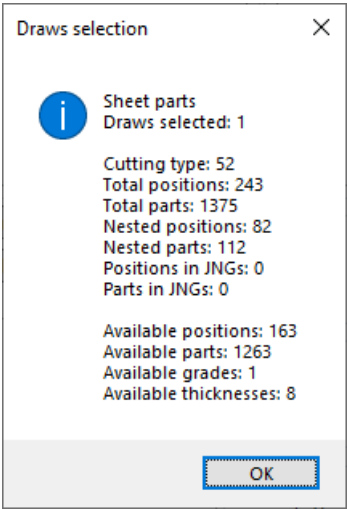
Drawing 6. Reference information on selected draws (for sheets)
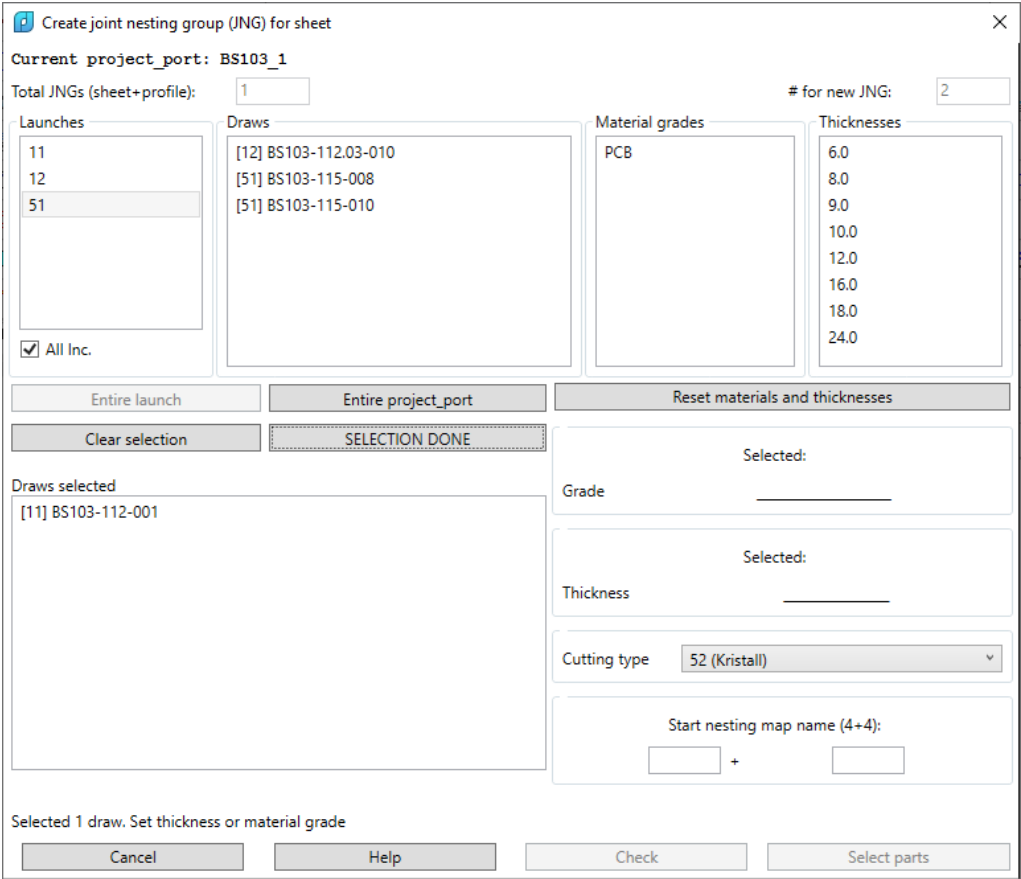
Drawing 7. Filling lists of grades and thicknesses after draws selection

In the lower zone of window info line shows text like **Selected 1 draw. Set thickness or material grade**. User must make decision: to start from material grade selection or from thickness selection.

Two modes of choosing parts for JNG are possible: from grade to thickness or from thickness to grade.

To activate the mode from material grade to thickness it is sufficient to make first click inside the list **Material grades** (mark necessary grade). After that the list **Thicknesses** will

shorten and leave thicknesses of parts to be nested only available for selected grade. Grade value will be copied to the field **(Selected:) Grade** (dr. 8).

Drawing 8. Selection started from material grade

In the info line there will appear text: **Mode from material grade to thickness. Set thickness**.

Records in the list **Thicknesses** will acquire the following view: **7 (pos:8 pc:11)**. Each record has thickness in mm, and in parentheses total number of positions available for this thickness and total number of parts for these positions.

Selection of thickness by left-click causes filling the field **(Selected:) Thickness** and parameter **Start nesting map name (4+4)** (dr. 9).

Start nesting map name is divided into two portions of 4 symbols (the first one is called prefix of nesting map name). Prefix is formed from the thickness using one digit after decimal point (e.g., 0060 corresponds to thickness 6 mm, 0125 to thickness 12.5 mm, etc.).

Program notifies in the command line what map names are already occupied with the same prefix, e.g. (for thickness 10 mm):

Occupied numbers of maps with prefix 0100:

("01000002" "01000003" "01000004" "01000005" "01000006" "01000007" "01000013" "01000001" "01000014" "01000015")

Drawing 9. Selection of thickness (mode from material grade to thickness)

The second part of the map start name is a number of the first map (without prefix) in the process of running nesting for JNG to be created. If during the process several maps are generated then name of each next map will be by 1 greater then the previous one.

Moreover selection of thickness activates button **Check** in the window. In the lower zone of window there appears message **Thickness selected. Check availability of parts with geometry and this thickness for specified cutting type.**

User must press button **Check**. It will allow to analyze if there are part positions available for including into new JNG and these positions have DWG files with geometry. Results of analysis are decored as message (dr. 10).

Drawing 10. Message **Analysis results**

If 0 positions are available then user must return to selection of cutting type or thickness.

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If number of available positions is positive then after closing window with analysis results the button **Select parts** will be activated. In the info line there will be prompt with text: **Go to parts selection** (dr. 11).

Drawing 11. Successful completion of check after selection of thickness and cutting type

If parameter values including map name are correct then click button **Select parts** going to next stage, selection of parts for new JNG (number of JNG will be by 1 greater than maximal number of existing JNGs). Click on **Cancel** stops the process with no action.

If in the work user decides to stop mode from grade to thickness then ht must press the button **Reset materials and thicknesses**. The window will return to its view as on dr. 7 (just after end of draws selection). Info line will show: **Mode reset. Set thickness or material grade**.

To start mode of choosing parts from thickness to material grade it will be sufficient to click (after draws selection) necessary line in the list **Thicknesses**. The window will move to the mode from thickness to material grade (dr. 12).

Drawing 12. Start selection from thickness

List **Material grades** will reduce and all its records will be decorated like this: **PCB (pos:49 pc:1066)**. For each grade in brackets there are total number of available positions and total number of parts for these positions. Next step is to select required material grade.

After that as in the mode from material grade to thickness user should press button **Check**. If result of check will be positive then it is nessary to click the button **Select parts** (it will become active).

If during the work user changes cutting type, then lists **Material grades** and **Thicknesses** will be cleared. User should return to draws selection and complete it with button **SELECTION DONE**.

After checking availability of parts parts and click on button **Select parts** the window **Create joint nesting group (JNG) for sheet** closes and dialog box **Select parts for new JNG** opens (dr. 13).

In the upper side of the window there are displayed **Current project_port**, number of **JNG**, **Material grade**, **Thickness**, **Cutting type**. Central zone of the window shows main tools:
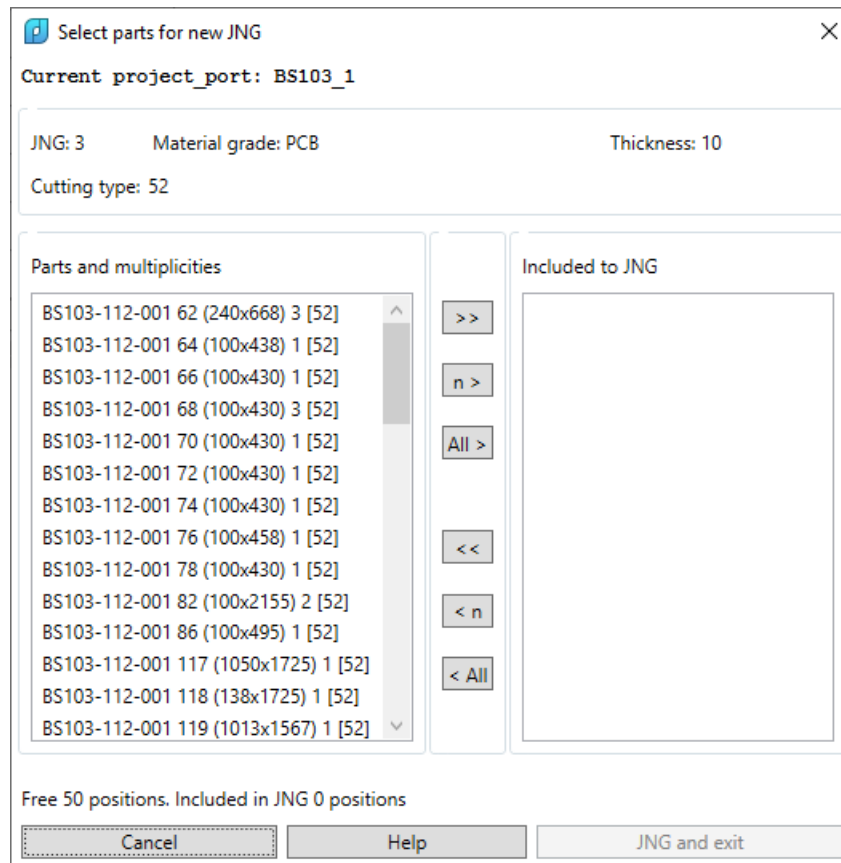
Drawing 13. Window **Select parts for new JNG**

– **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 (without additional request);

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

– **All >**, button for moving all the parts from the left side to list **Included 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: **BS103-112-001 192 (260x543) 2 G [52]**. Attributes structure is as follows:

BS103-112-001 — name of the draw, containing the position;

192 — position number;

(260x543) — gabarits of the bounding box;

2 — part multiplicity left free (maximum number of this part copies that can be included

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into JNG);

G — token of bended part (empty for parts that do not require bending);
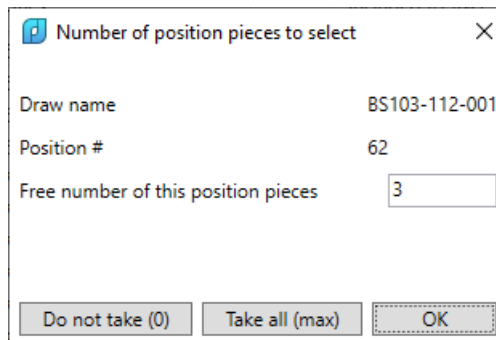
[52] — cutting type (line).

In the lower zone there is info line and buttons **Cancel**, **Help** and **JNG and exit**. At the beginning it reflects initial number of positions in the left and right lists, e.g.: **Free 50 positions. Included in JNG 0 positions**.

Selection of parts to include into JNG to be created is done with buttons of the central column (described above). If part multiplicity is greater than 1 then user will be able to specify what 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 ⬚ n > ⬚ there is opened dialog box **Number of position pieces to select** (dr. 14):

Drawing 14. Window **Number of position pieces to select**

Dialog displays **Draw name**, **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 **Do not take (0)**. All three buttons close dialog box with different actions.

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. 13. Sample of incomplete selection of free positions (62, 82) is shown on dr. 15.

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

With button **JNG and exit** new JNG is being created. Nesting of this JNG should be executed via **JNG dispatcher**.
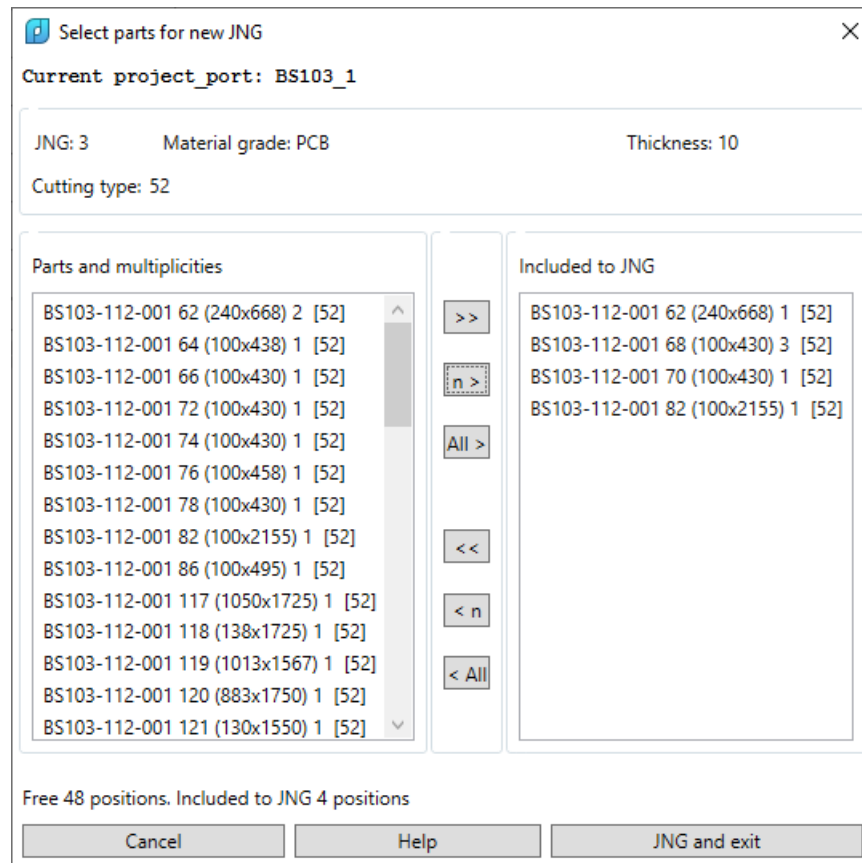
Drawing 15. Sample result of selection

8.2. Create joint nesting group for profile

To start creation of profile JNG one should use menu item **NESTING > Create JNG (profile)** or button [icon] of toolbar **JNG**. Dialog box **Create joint nesting group (JNG) for profile** (dr. 16).

This window is designed for six actions:

1. Select **Cutting type** (default type is previous or 57).

2. From the list **Draws** select one or more draws.

Further sequence of actions for selecting parts depends on selection mode. Two modes are applicable: **a**. First material grade, then profile type or **b**. first profile type, then material grade.

If mode is grade > profile type, then the following steps are:

3. From list **Material grades** select one grade.

4. From list **Profile types** select one profile type.

If mode is profile type > grade, then next actions are:

3. From list **Profile types** select one profile type.

4. From list **Material grades** select one grade.

Drawing 16. Window **Create joint nesting group (JNG) for profile**

Final actions for both modes are the same:

5. Fill in **Starting nesting map name (4+4)**. Input data are verified for presence of forbidden symbols and for matching boundaries.

6. With button **Check** run verification of parts availability for chosen grade, profile type, cutting type (line) and existence of part geometry DWG.

At the beginning info line in the lower side of the window shows prompt **Select draw**. **Draws** list shows names of the draws in the current project_port, e.g. **[12] BS103-112.03-010**. As prefix in square brackets there is a launch number for the draw.

At initial moment list **Draws** includes all the draws of project_port, for all the launches. List **Launches** is used as filter for draw names by launches. If user marks any launch then list **Draws** will display draws only of this launch. Setting checkbox **All Inc.** works as selection of draws for all the launches.

In the list **Draws** it is necessary to select draws which profile parts are to be grouped for nesting. Draws for one JNG can be selected one by one (their names will move to the lower list **Draws selected**).

With the button **Entire launch** one can select all the draws of the marked launch. Button **Entire project_port** selects all the draws of all the launches of the current project_port.

To remove an item from **Selected draws** user should click on this draw (it will move up

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to unseleted draws). Button **Clear selection** clears list of selection.

To finish draw selection click button **SELECTION DONE**. Program will analyze selected draws and shows reference message with summary data for positions, parts, materials and profile types for marked cutting type (dr. 17).
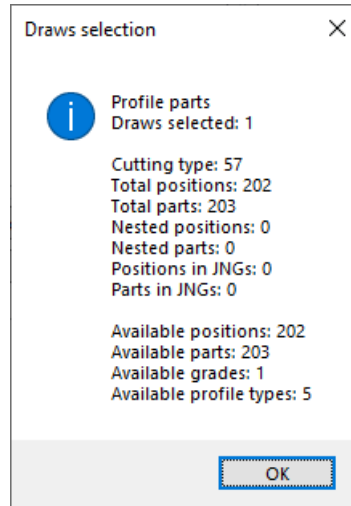

Рис. 17 Reference information on selected draws (for profile)

Similar text for each selected draw will appear in the command line. User must pay attention to number of parts available for new nesting.

Next the program looks through parts specification table for this draw (draws) and fills in lists **Material grades** and **Profile types**. These lists show all available for nesting grades and profile types (dr. 18).

In the lower zone of window info line shows text like **Selected 1 draw. Set profile type or material grade**. User must make decision: to start from material grade selection or from profile type selection.

To activate the mode from material grade to profile type it is sufficient to make first click inside the list **Material grades** (mark necessary grade). After that the list **Profile types** will shorten and leave profile types of parts to be nested only available for selected grade. Grade value will be copied to the field **(Selected:) Grade** (dr. 19).

In the info line there will appear text: **Mode from material grade to profile type. Set profile type**.

Records in the list **Profile types** will acquire the following view: **7 (pos:87 pc:96)**. Each record has profile type, and in parentheses total number of positions available for this thickness and total number of parts for these positions.

Drawing 18. End of draws selection (for profile)

Drawing 19. Selection started from material grade (profile JNG)

Selection of profile type by left-click causes filling the field **(Selected:) Profile type** and parameter **Start nesting map name (4+4)** (dr. 20).

Drawing 20. Selection of profile type (mode from material grade to profile type)

Start nesting map name is divided into two portions of 4 symbols (the first one is called prefix of nesting map name). By default prefix is formed as P000. The first symbol P (latin) is mandatory for profile maps. Program will tell in command line what map names are already occupied with the same prefix, for example:

Occupied numbers of maps with prefix P000:

("P0000002" "P0000003" "P0000005" "P0000022")

The second part of the map start name is a number of the first map (using this prefix) in the process of running nesting for JNG to be created. If during automatic nesting several maps are generated then name of each next map will be by 1 greater then the previous one.

Moreover selection in the list **Profile types** activates button **Check**. In the lower zone of window there appears message **Profile type selected. Check availability of parts with geometry and this profile for specified cutting type.**

User must press button **Check**. It will allow to analyze if there are part positions available for including into new JNG and these positions have DWG files with geometry. Results of analysis are decored as message (dr. 21).
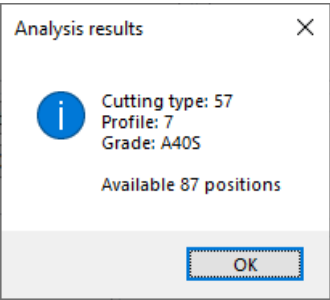
Drawing 21. Message **Analysis results** (profile)

If 0 positions are available then user must return to selection of cutting type or profile type.

If number of available positions is positive then after closing window with analysis results the button **Select parts** will be activated. In the info line there will be prompt with text: **Go to parts selection** (dr. 22).
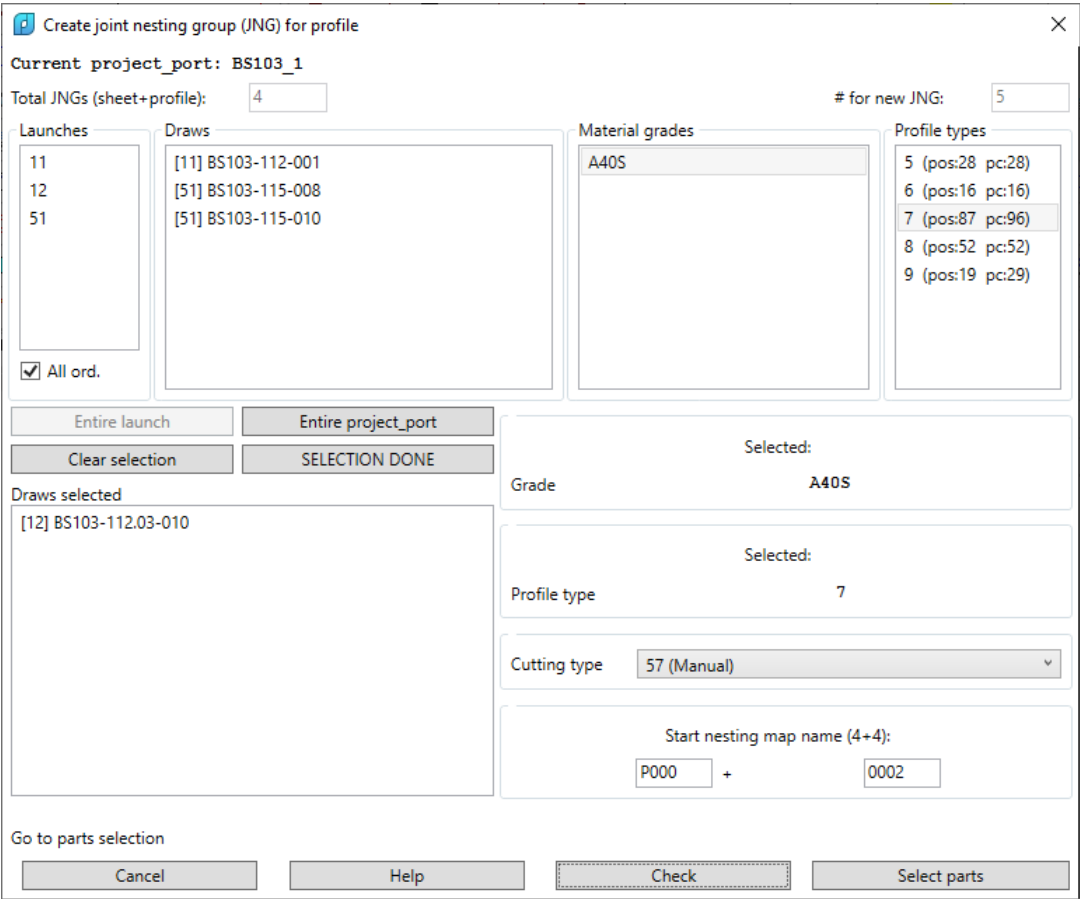
Drawing 22. Successful completion of check after selection of profile type and cutting type

If parameter values including map name are correct then click button **Select parts** going to next stage, selection of parts for new JNG (number of JNG will be by 1 greater than maximal number of existing JNGs). Click on **Cancel** stops the process with no action.

If during the work user changes cutting type, then lists **Material grades** and **Profile types** will be cleared. User should return to draws selection and complete it with button **SE-**

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LECTION DONE.

After click on button **Select parts** dialog box **Select profile parts for new JNG** opens (dr. 23).
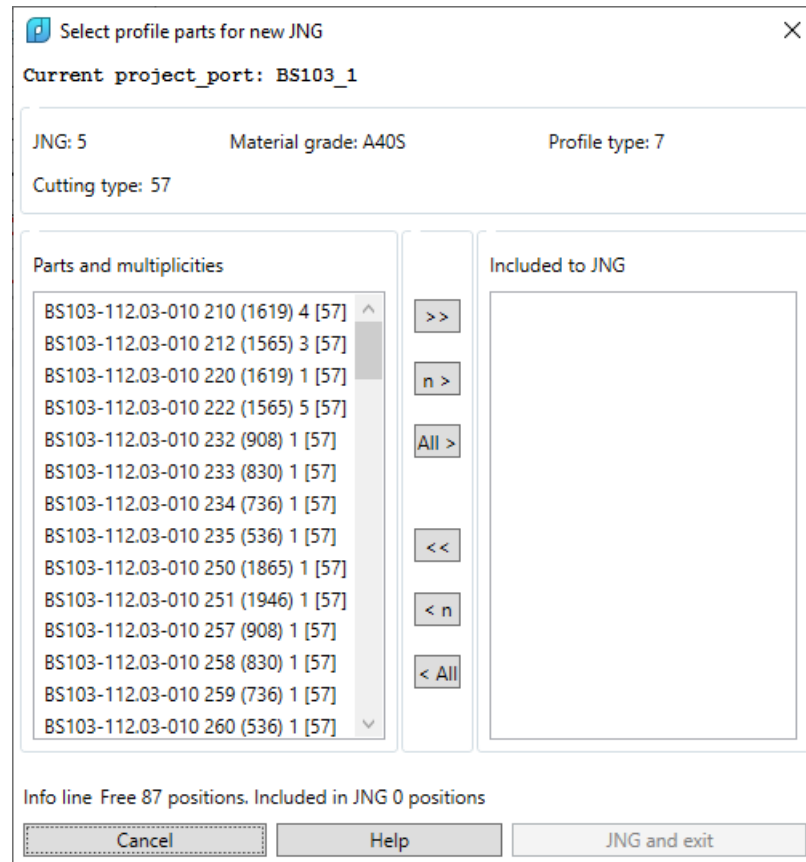
Drawing 23. Окно **Выбор профильных деталей для новой ГСР**

In the upper side of the window there are displayed **Current project_port**, number of **JNG**, **Material grade**, **Profile type**, **Cutting type**.

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 (without additional request);

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

– **All >**, button for moving all the parts from the left side to list **Included 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;

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

String of one position looks like: **BS103-112.03-010 210 (1619) 4 G [57]**. Attributes structure is as follows:

BS103-112.03-010, name of the draw, containing the position;

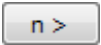**210**, position number;

(1619), part length;

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

G, token of bended part (empty for parts that do not require bending);

[57], cutting type.

In the lower zone there is info line and buttons **Cancel**, **Help** and **JNG and exit**. At the beginning it contains text reflecting initial number of positions in the left and right lists, e.g.: **Free 87 positions. Included in JNG 0 positions**.

Selection of parts to include into JNG to be created is done with buttons of the central column (described above). If part multiplicity is greater than 1 then user will be able to specify what 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 ⟨ n > ⟩ there is opened dialog box **Number of position pieces to select**, as for sheet JNG (see dr. 14).

Window displays **Draw name**, **Position #** and **Free number of position pieces**. In the last field it is possible to reduce number of selected copies (default 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 **Do not take (0)**. All the three buttons close dialog box with corresponding actions.

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. Sample of incomplete selection of free positions (210, 222) is shown on dr. 24.

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

With button **JNG and exit** new JNG is being created. Nesting of this JNG should be executed via **JNG dispatcher**.
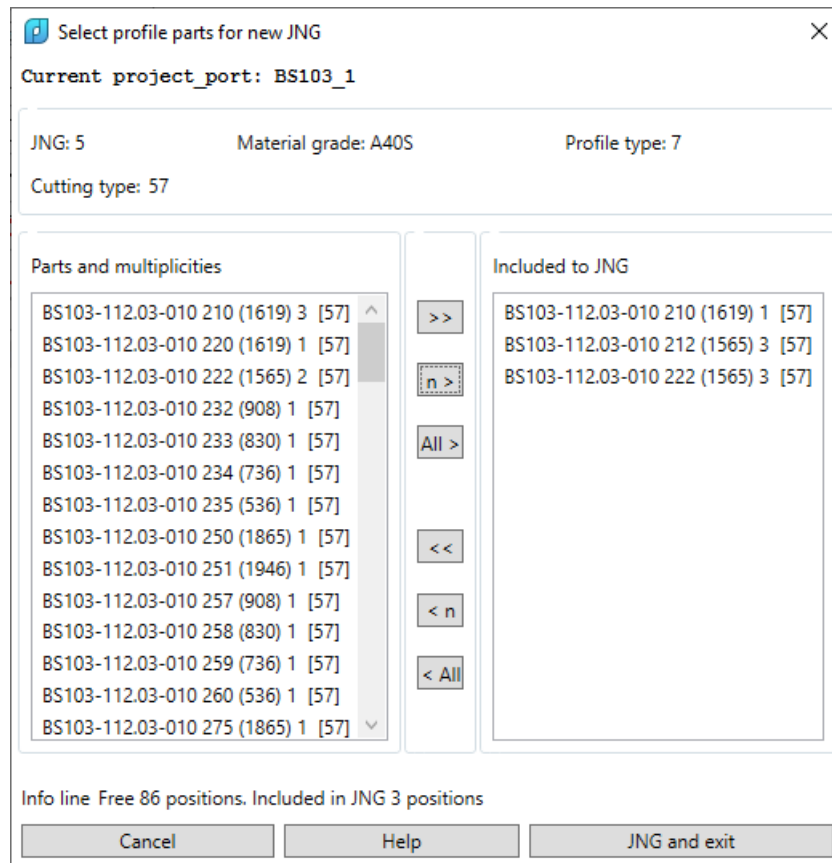
Drawing 24. Sample result of selection (parts for profile JNG)

8.3. JNG dispatcher

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

Command **NESTING > Dispatcher of JNGs** opens dialog box **Dispatcher of joint nesting groups** (dr. 25).

Box **Joint nesting groups** contains list of existing JNGs (sheet and profile) in the following form:

3 PCB s10.0 (6) 01000002

5 A40S [7] (7) P0000002

The first line corresponds to sheet JNG, the second one – to profile JNG.

Sheet JNG uses the following structure:

3, JNG number,

PCB, material grade,

s10.0, thickness (mm),

(6), quantity of parts included to JNG,

Drawing 25. Dialog box **Dispatcher of joint nesting groups**

01000002, 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 (01000003, 01000004, etc.).

For profile JNG:

5, JNG number,

A40S, material grade,

[7], profile type,

(7), quantity of parts included to JNG,

If click on any element of JNGs list, then area **Parameters of selected JNG** will show its properties. On dr. 26 there are sample data of sheet JNG (**JNG type = sheet**).

Sheet JNG may have shelf that is a DWG file with placed in itnesting maps, sheets and parts for use in operation of maps modification. File name begins with POL. If any maps are placed on the shelf then for this JNG the field **(maps on shelf)** shows map names divided by comma (e.g., **00700004,00700005**).

At the initial state of window only button **New JNG** is activated and click on it outputs message on JNG type to be created (dr. 27).

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Drawing 26. Parameters of selected JNG (sheet)

Drawing 27. Request for type of new JNG

Click on **Yes** (Да) leads to the window for creation of sheet JNG, **No** (Нет) – for creation of profile JNG.

Forth there are described functions of other buttons of the dialog box **Dispatcher of joint nesting groups**.

8.3.1. Button **Delete shelf**

Button **Delete shelf** is designed to delete connections of JNG with shelf that is a tool for editing sheet map. Operation must forst delete shelf file from subfolder *Polka* (file name is POL<gsr>.DWG where <gsr> is JNG number) and to clear the field **Shelf DWG** (with DB

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change). Besides solving the main task the program will check existence of the token of correction (shelf name) in the table kr_list.dbf for those maps that earlier could be placed on the current shelf, and nullifies it.

Depending on situation request for confirming shelf deletion can have 4 variants (dr. 28 and 29):
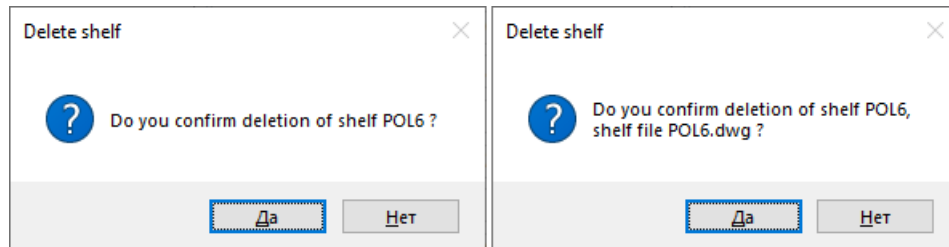
Drawing 28. Variants 1-2 of request for shelf deletion
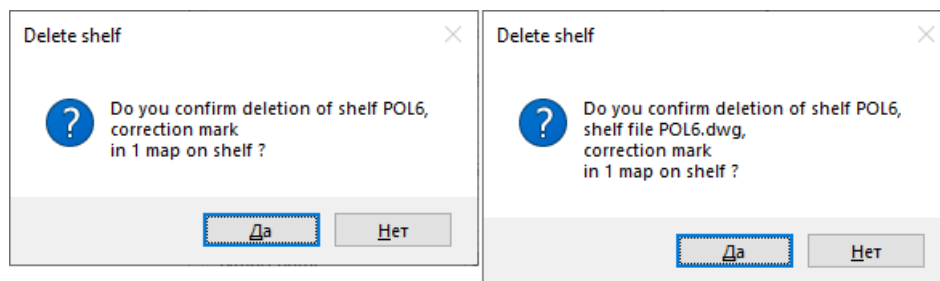
Drawing 29. Variants 3-4 of request for shelf deletion

In case of positive answer all the shelf elements will be deleted. Message about operation results is output into info line above buttons. Operation details are shown there:

Correction mark was removed from nesting map 00800007.

Deleted file C:\NSHIP\SAMPLES\BS103_1\POLKA\POL6.DWG.

Completed operation of deleting shelf POL6.

8.3.2. Button **Delete JNG**

Button **Delete JNG** is designed to delete selected JNG. If JNG has shelf then shelf and all its links are deleted too as in command **Delete shelf**. Command **Delete JNG** issues request to confirm deletion similar to variants on dr. 28, 29.

8.3.3. Button **Nmap name**

Button **Nmap name** serves for setting name of the start nesting map while automatic nesting this JNG. It opens dialog box **Starting map name in JNG** (dr. 30).
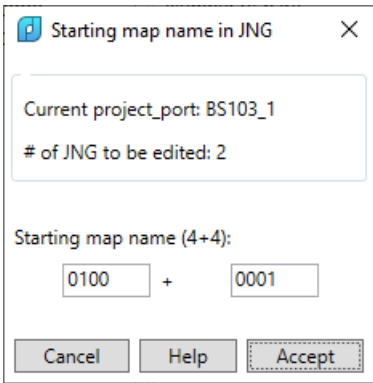
Drawing 30. Dialog **Starting map name in JNG**

In the window user may change starting map name (4+4 symbols in two fields). 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. On finding coincidence program issues a message and asks confirmation for this value (dr. 31).
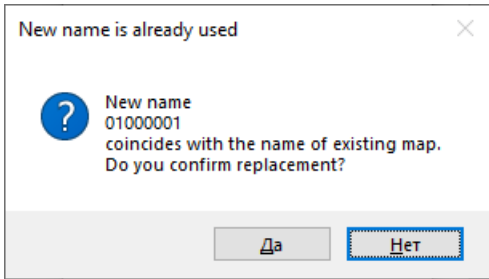

Drawing 31. Warning about coincidence with the name of existing nesting map

8.3.4. Button **Parts included**

Button **Parts included** in the dialog box **Dispatcher of joint nesting groups** allows to see what parts were included into selected JNG. Information is displayed in the window **JNG parts included** (dr. 32).
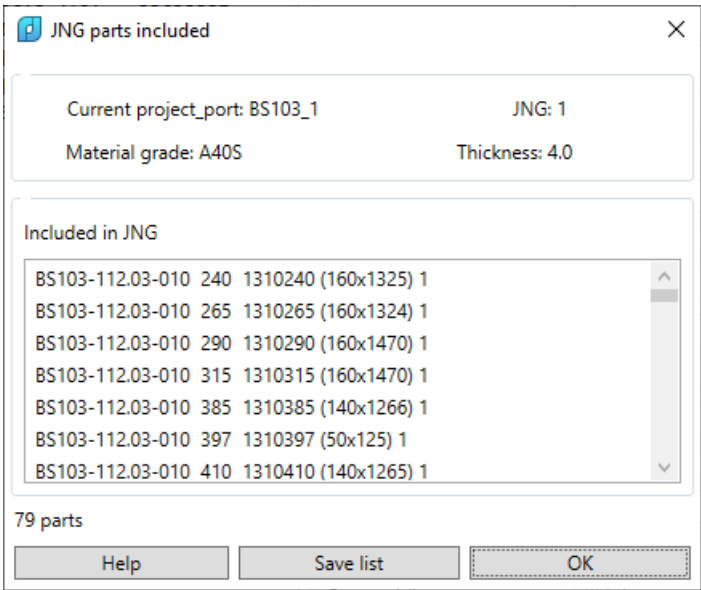
Drawing 32. List of parts included into JNG

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Each line in the list **Included in JNG** corresponds to one position, e.g.: : **BS103-112.03-10 240 1310240 (160x325) 1**, where

BS103-112.03-10, name of the draw containing part;

240, position number;

1310240, name of part DWG file (section 131, position 240);

(160x325), gabarits of the bounding box circumscribed around the part contour;

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

Note 1. For profile parts length is output in brackets instead of gabarits.

Note 2. With the button **Save list** user can save list of parts in the folder *NSHIP\Tmp*, in text file with extension txt.

8.3.5. Button **Billets**

Button **Billets** shows as reference what raw sheets and scraps or raw profiles and profile scraps are available in the moment to make nesting of selected JNG. Information for sheet JNG is displayed in the dialog box **Sheets and scraps for sheet JNG** (dr. 33) and for profile JNG – in **Billets and scraps for profile JNG** (dr. 34).
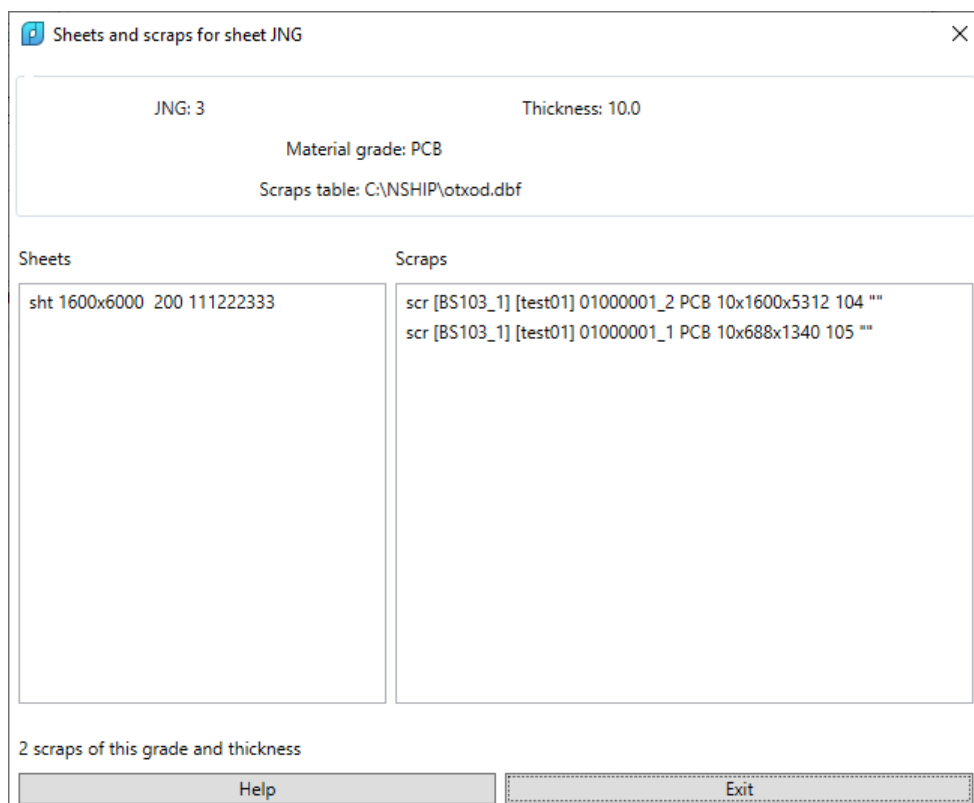
Drawing 33. Window **Sheets and scraps for sheet JNG**
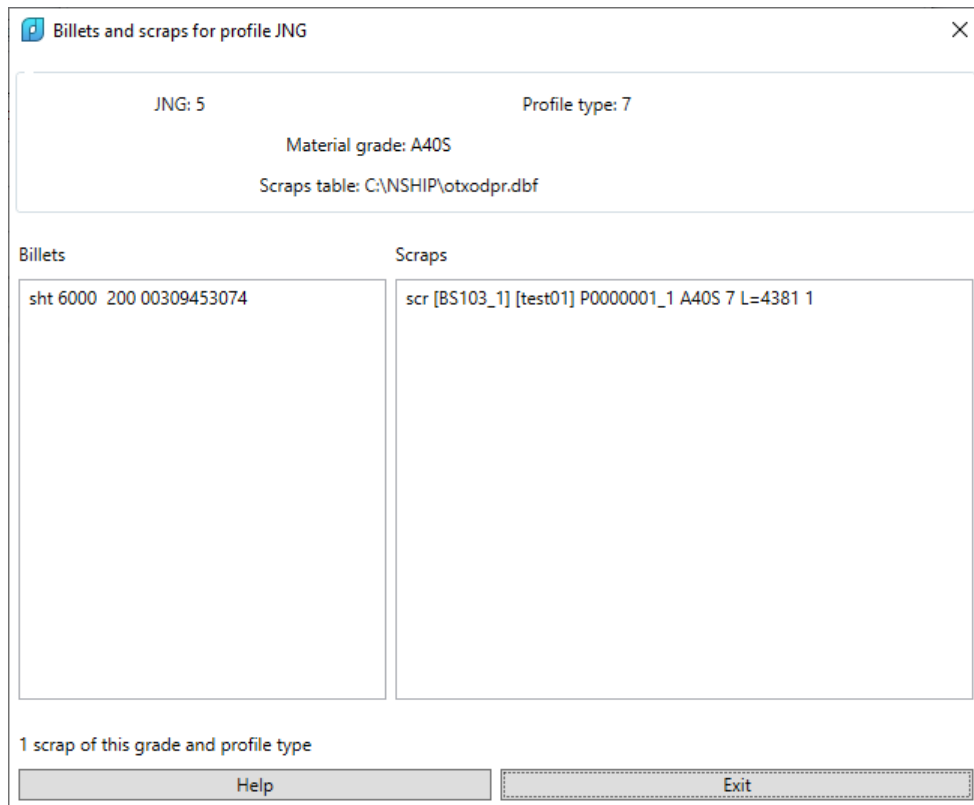
Drawing 34. Window **Billets and scraps for profile JNG**

Note 1. For scraps there are shown source project_port and order because on serial project it is necessary to differ shipyard orders (vessels, aliases) from which scrap will be taken.

Note 2. The two last windows are only for help. Real sheets, billets and scraps selection will be requested for JNG after click on button **Nesting** in dialog box **Dispatcher of joint nesting groups**.

8.3.6. Button **Nesting**

This button is used for direct nesting of sheet and profile JNGs. Sheet JNG with no shelf can be sent to automatic or interactive nesting by button **Nesting**. If selected sheet JNG has shelf then button **Nesting** will be disabled (button **Renesting** will be active). The process is discovered in the chapter **Nesting of sheet metal**.

Profile JNG can be sent to automatic nesting. This operation is discussed in the chapter **Nesting of profile metal**.
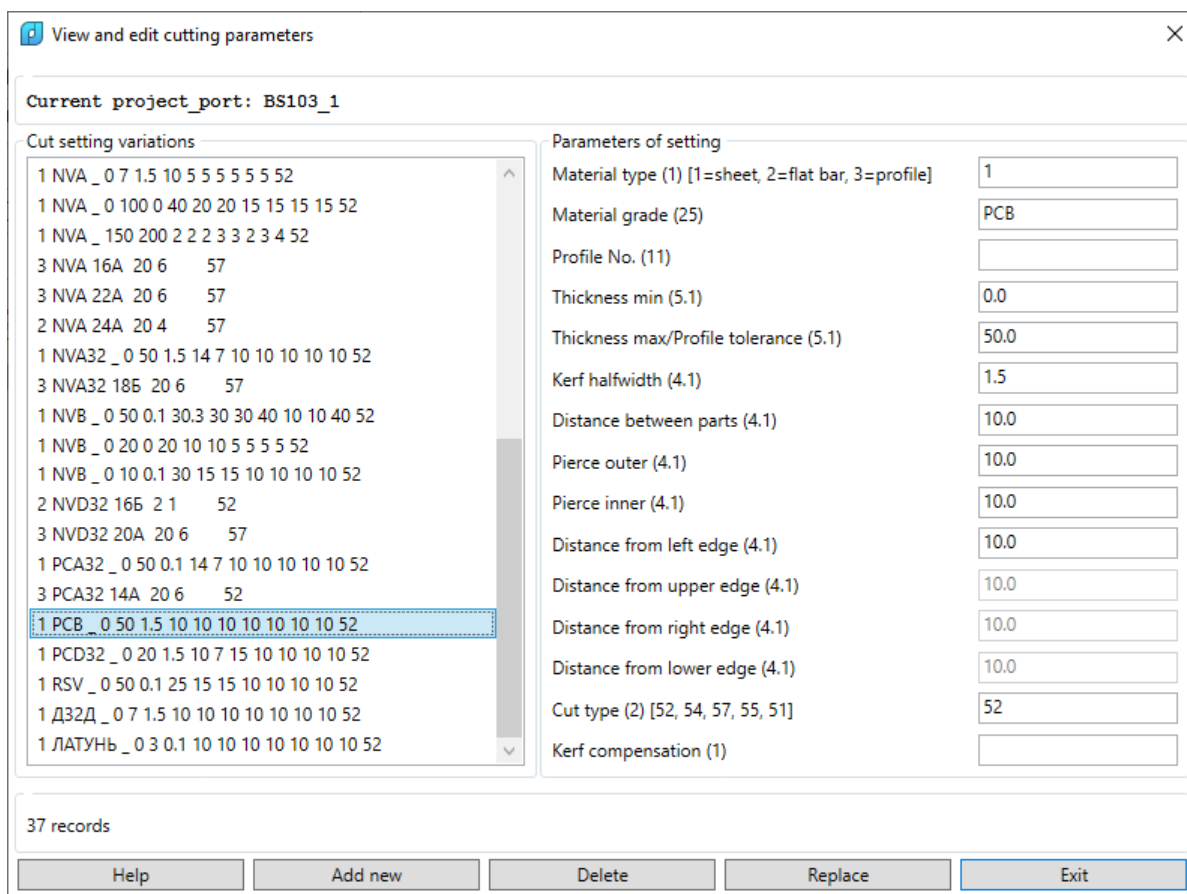
8.3.7. Button **Renesting**

Button **Renesting** is enabled only in work on sheet 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 for interactive editing (changing parts placement). 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**.

8.4. Cutting parameters

While creating JNG user should take into account cutting parameters that are stored before in the table parrezki.dbf of current project_port (portion of project). Filling and editing the table can be done either in module **Bdata** (menu command **BDATA > TABLES > AUXILIARY > Parrezki**) or in module **Nesting** (button ![icon] of toolbar **JNG**).

Command opens dialog box **View and edit cutting parameters**. Selection of line in the list **Cut setting variations** fills the right list **Parameters of setting**. On dr. 35 there is a sample setting for cutting type 52 (thermal cutting of sheet metal on machine Crystall).

Drawing 35. Dialog **View and edit cutting parameters** (sheet)

Parameters can be set for three material types, that are denoted by numbers: sheet (1), flat bar (2) and profile (3).

Five variants of cutting types are implemented: 51, 52 – thermal cutting for sheets (usually these numbers denote machines Ritm, Crystall), 54 – Sheet cutting on guillotine, 55 – manual cutting for goffer sheets, 57 – manual cutting of profiles.

In the window area **Parameters of setting** for each parameter in brackets there are given limit number of input symbols: integer number for textual and integer values (e.g., 25), real number for real numeric values (e.g. 4.1, where 4 is maximal total number of symbols, 1 is maximal number if digits after decimal point).

These parameters are: **Material type (1)**, **Material grade (25)**, **Profile No. (10)**, **Thickness min (5.1)**, **Thickness max/Profile tolerance (5.1)**, **Kerf halfwidth (4.1)**, **Distance between parts (4.1)**, **Pierce outer (4.1)**, **Pierce inner (4.1)**, **Distance from left edge (4.1)**, **Distance from upper edge (4.1)**, **Distance from right edge (4.1)**, **Distance from lower edge (4.1)**.

For sheets cutting parameters are given by thicknesses groups. As limits there are used **Thickness min** and **Thickness max**. Parameters **Distance from upper edge**, **Distance from right edge**, **Distance from lower edge** are not applied, and there values are taken from the parameter **Distance from left edge**.

On dr. 36 There is a sample variant of setting for cutting type 57 (manual cutting of profile). Only 6 parameters are to be filled.
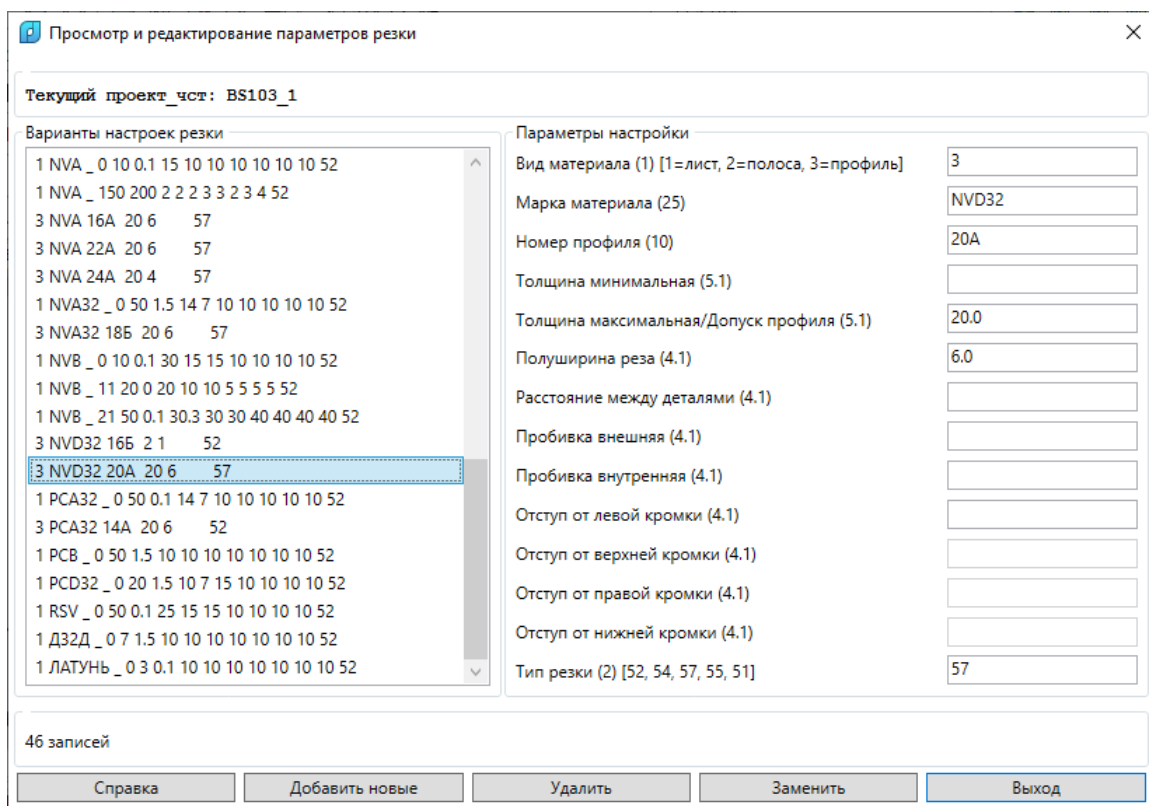
Drawing 36. Dialog **View and edit cutting parameters** (profile)

9   Nesting of sheet metal

Module **Nesting** supports two types of nesting sheet metal: automatic and interactive. Interactive type can be applied for panel metal.

Automatic type of nesting is allowed only for flat raw sheets and for rectangular usable scraps. Interactive type can be applied for sheet nesting maps on raw rectangular sheets as well as on usable scraps.

9.1. Start nesting from JNG dispatcher

To start use button **Nesting** of the window **Dispatcher of joint nesting groups**.

Note. Before nesting cutting pameters must be set for required material grade and thickness.

After sending sheet JNG to nesting it is necessary to select raw sheets and scraps on which JNG parts will be placed (nested). Dialog box **Select sheets, scraps for JNG** (dr. 37) opens.

Рис. 37. Окно **Select sheets, scraps for JNG**

In the upper part of the window there are values of features read from JNG: **JNG** (number), **Material grade**, **Thickness**, **Cutting type**. Next there is a full name of current scraps table, and for reference there are shown active cutting parameters (**Cut halfwidth** etc.). At the beginning button **Accept** is disabled in the window.

List **Sheets** displays those raw plates that were given for sheet material of selected grade and thickness in module **Bdata**. Line of sheet has the following illustrative form: **sht 1600x6000 200 111222333**. Line elements are:

sht — type (sht for raw sheet, scr for scrap),

1600x6000 — sheet gabarits,

200 — number of sheets for required size and material (default is 200);

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111222333 — material code (up to 11 symbols), assists to distinguish sheets with the same size but with different material properties.

In the list **Scraps** program shows only those free scraps that fit by material grade and thickness. Sample line: **scr [BS103_1] [test01] 01000002_1 PCB 10x566x1587 23 ""**. Its components are:

scr — type (sht for raw sheet, scr for scrap),

BS103_1 — project_port that was a source for the scrap,

test01 — order (vessel) that was a source for the scrap,

01000002_1 — scrap name (in this example: scrap 1 in the map 01000002),

PCB — material grade,

10x566x1587 — thickness and dimensions of the rectangular scrap (or gabarits of the bounding rectangle around curved scrap),

23 — scrap ID (address) in the DB scraps table,

"" — empty string for rectangular scrap or **"DWG"** for curved scrap.

In the window **Select sheets, scraps for JNG** it is necessary to select raw sheets and scraps that will be used for nesting JNG. Selection is done with left mouse button click on corresponding line in the lists **Sheets** and **Scraps**. Selected object is copied to the list **Selected for JNG**. Just after the first selection button **Accept** becomes enabled (dr. 38).

Drawing 38. Selection of scrap

Objects must be located in descending order (the highest priority in nesting will have the most upper element of the list **Selected for JNG**). Nesting will be done strictly by this sequence (initially the first sheet/scrap to be nested, then the second one, etc.).

List of selected sheets/scraps can be edited with the buttons that are activated after click on any object of **Selected for JNG** (dr. 39).

Рис. 39. Selection of object for editing

Order of selected objects may be changed with buttons **Up** and **Down** that move selected line one position up or down. With the help of button **Delete** one can remove object selected by error.

Moreover for selected object there are parameters **Width (5)**, **Length (5)**, **Number (3)**, **DWG (3)**. Digits in brackets show maximal number of symbols while editing value.

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 is always equal to 1. Field **DWG** is used only for scraps and must be empty for rectangular scraps or have value **DWG** for curved scraps.

Edited values replace corresponding parameters in the list **Selected for JNG** by button **Replace**, but do not transfer to DB, and only go to nesting task for this JNG. For example, number of sheets in the JNG nesting task can be changed from 200 to 4, if it is dictated by the cur-

rent shipyard conditions. Using editor one can type raw sheet gabarits that for some reason do not exist in DB.

After end of managing list of selected sheets/scraps user should press button **Accept**. Button **Cancel** cancels prosessing JNG.

Click on button **Accept** leads program to next step of nesting operation. File GSR_DET.TXT with nesting task is created. Contents of GSR_DET.TXT is displayed in the window on dr. 40.
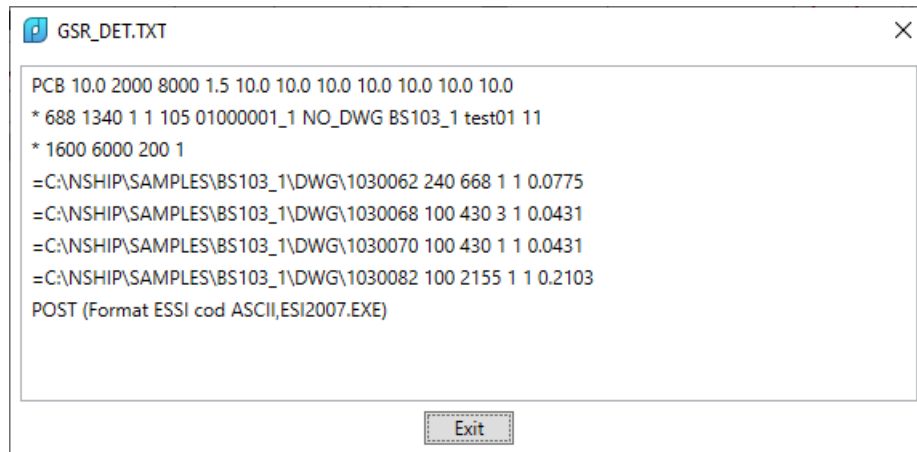
Drawing 40. Nesting task in the file GSR_DET.TXT

After closing window with GSR_DET.TXT user will be suggested to choose type of sheet nesting (dr. 41).
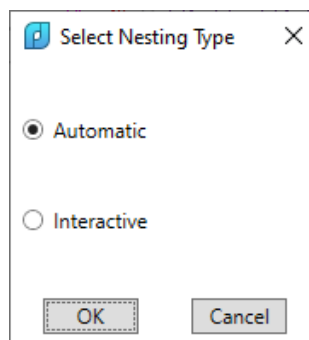
Drawing 41. Window **Select Nesting Type**

On completing choice (**Automatic** or **Interactive**) process goes to corresponding program branch.

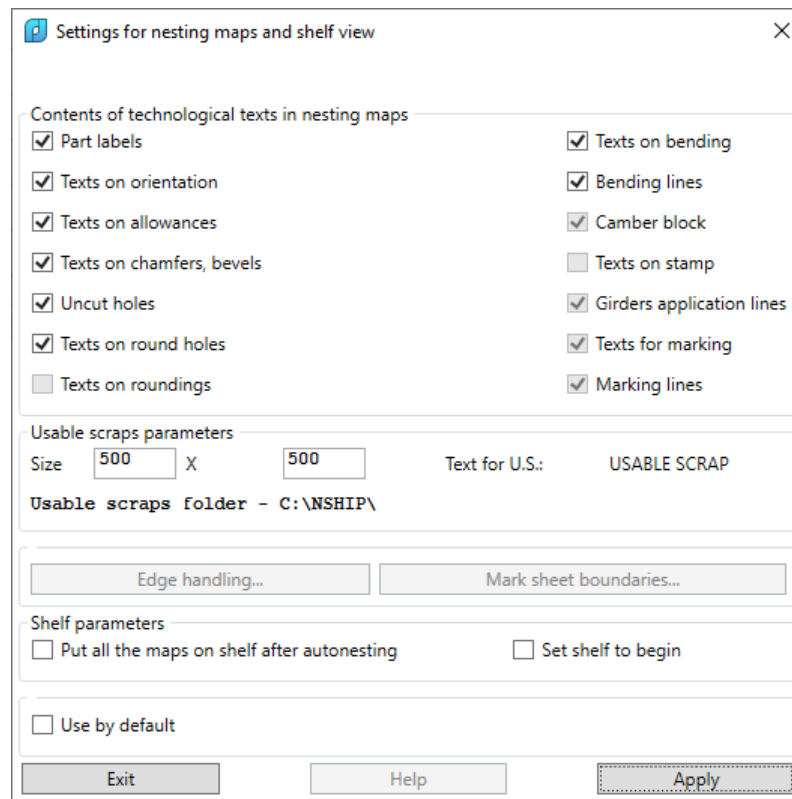### 9.2.   Automatic nesting

Automatic variant is designed for automatic nesting (placing inside sheet) sheet parts by euristic algorithm. In this variant part contours are simplified to polygons, that are united into complexes (rectangles of minimal area around group of parts). Then there is sorting complexes by some conditions, selecting methods for placing complexes in sheet, choosing free areas af-

ter adding next complex, deciphering parts in complexes. After that program goes to next sheet if free area is exhausted, script file is generated for creating and saving nesting maps to database of current project_port.

Automatic nesting works not only on standard raw sheets but on rectangular usable scraps too.

During autonest running the program requests additional settings opening dialog box **Settings for nesting maps and shelf view** (dr. 42).

Drawing 42. Window **Settings for nesting maps and shelf view**

Note. This window can be called also with menu item **NESTING > SERVICE >**

Automatic variant for thermal cutting takes into consideration technological requirements for placing long narrow parts (placement of parts in inner holes is not included). While sheet nesting there are detected rectangular usable scraps and they are written into scraps table of DB.

Automatic type for thermal cutting takes into consideration special technology demands to long narrow parts placement along big edges. It can be seen in the window **Automatic nesting options** (dr. 43).

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

End of autonesting is shown by information window with summary data (dr. 44).
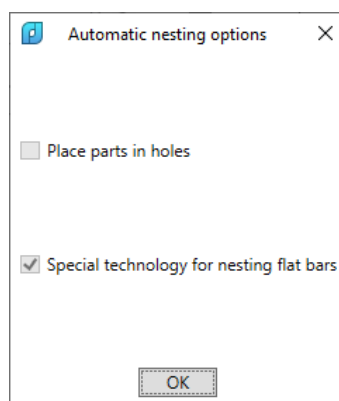
Drawing 43. Window **Automatic nesting options**
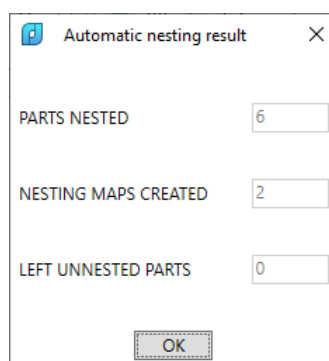
Drawing 44. Window **Automatic nesting result**

Program saves created maps to DB. If in the settings window checkbox **Put all the maps on shelf after autonesting** is set then generated maps drawings after saving are put on shelf (like in operation of map edit). In such a case created maps are marked as selected for correction (see next chapter about shelf).
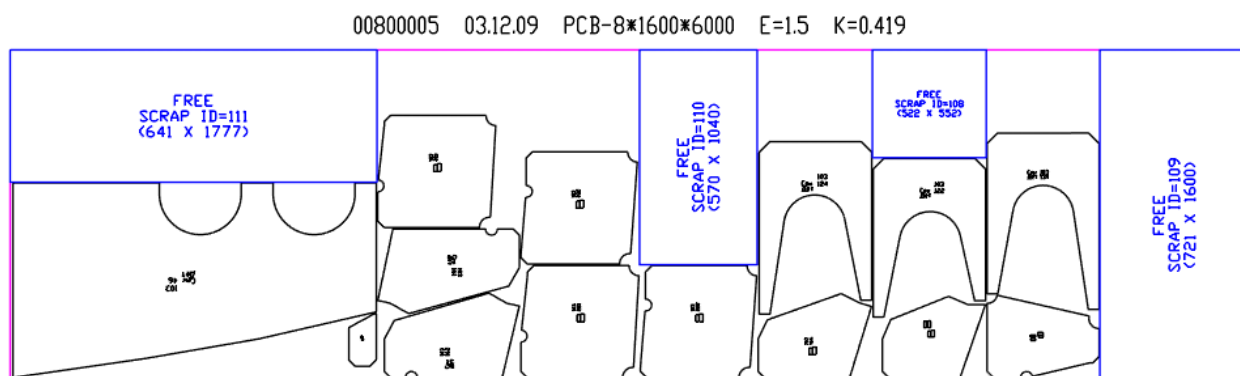
Sample map created with automatic nesting (dr. 45):
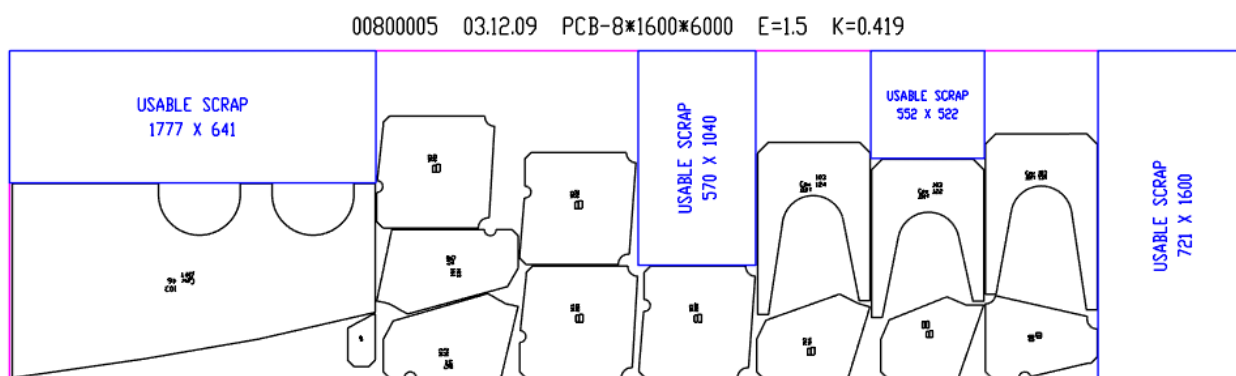
Drawing 45. Map after autonesting (scraps of type 0)

Scraps on the drawing are decorated as scraps of type 0.

If activate mode with priority for sraps of type 1 (with attributes) then map drawing after autonest will change a little (dr. 46):

00800005 03.12.09 PCB-8*1600*6000 E=1.5 K=0.419

Drawing 46. Map after autonesting (scraps of type 1)

9.3. Interactive nesting

In interactive variant of nesting parts and sheets are initially placed on the so called **shelf** that is a special drawing zone (upper viewport) (dr. 47).
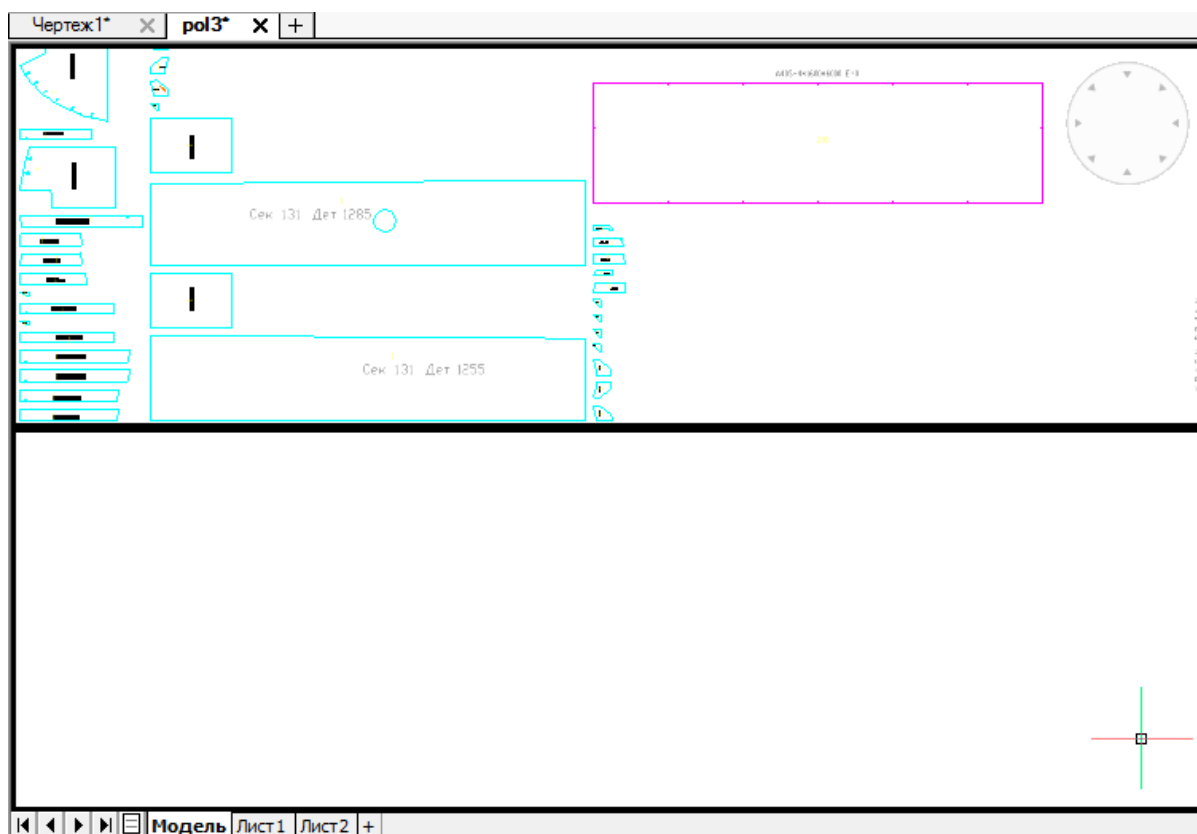
Drawing 47. Shelf with sheets and parts

Shelf drawing is a graphical image of current state of JNG. It contains available sheets and unnested parts of this JNG (the same grade and thickness).

During interactive nesting shelf must be gradually freed from parts by moving them to sheet becoming nesting map whose drawing is located on **nesting place** in the lower viewport of screen. 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). It is shown in the field **Shelf DWG** for selected JNG in the window **Dispatcher of joint nesting groups**.

Non-empty property **Shelf DWG** is a sign of interactive work 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 maps. In this case maps selected for editing are placed on shelf.

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

Interactive nesting is done with a group of special commands from toolbars **Shelf** and **Placement** (or using submenus **Placement** and **Set**).

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 of toolbar **Shelf**. Taken sheet appears in the nesting place in the lower viewport (dr. 48).
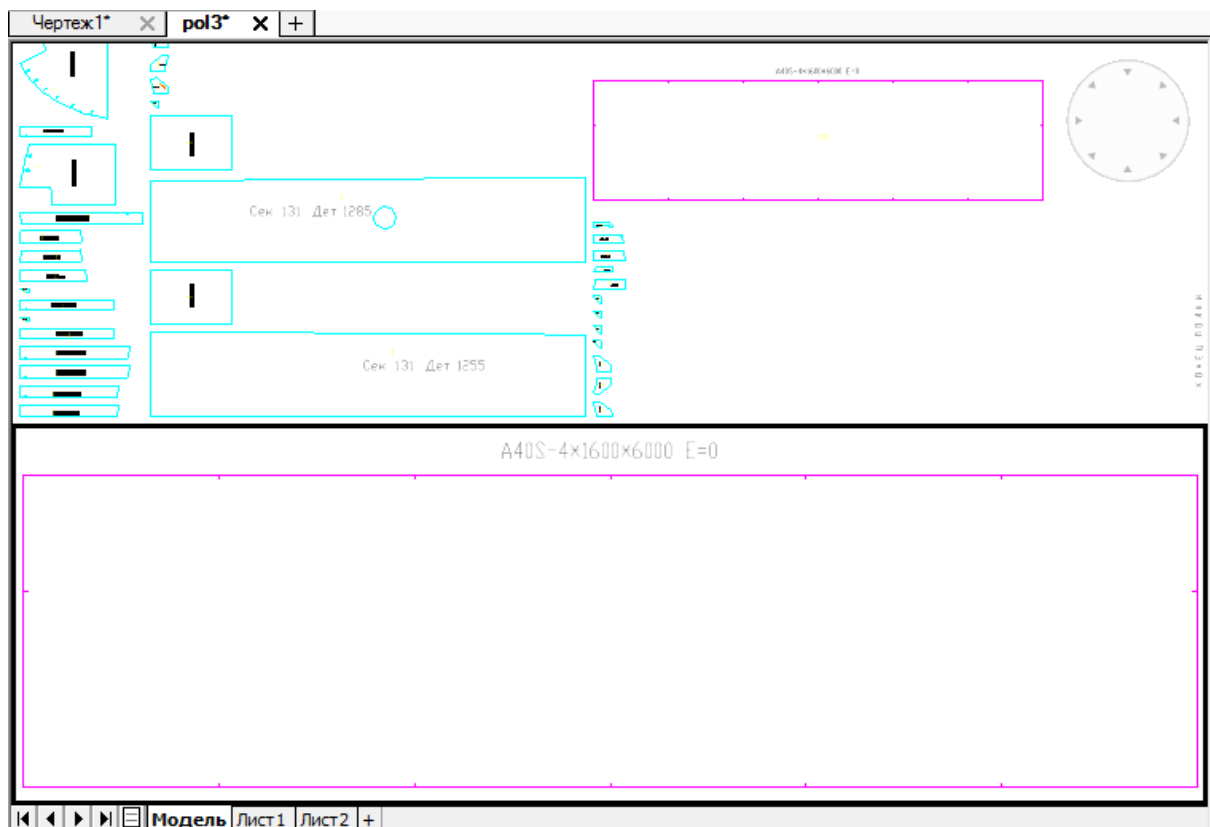
Drawing 48. Nesting place after inserting sheet

Next with placement commands (move, rotate, combine etc.) user fills sheet with parts. After moving parts to nesting map parts disappear from the shelf or their quantity reduces by used number of copies (multiplicity set in specification). Placement commands are discussed herein after.

Map is saved with **NESTING > Save nesting map** or with button 🖫 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).

10   Edit and delete sheet nesting maps

Sheet nesting maps can be deleted, their attributes can be edited. Map can be put on shelf to modify placement.

10.1.   Edit nesting maps

For editing existing nesting map(s) (correction targets are: change part placement, remove part, add scrap, etc.) user must put them on shelf. It is done with command **NESTING > Edit nesting map** or button 🛒 of toolbar **JNG**. Command opens dialog box **Select sheet nesting maps for correction** (dr. 49).
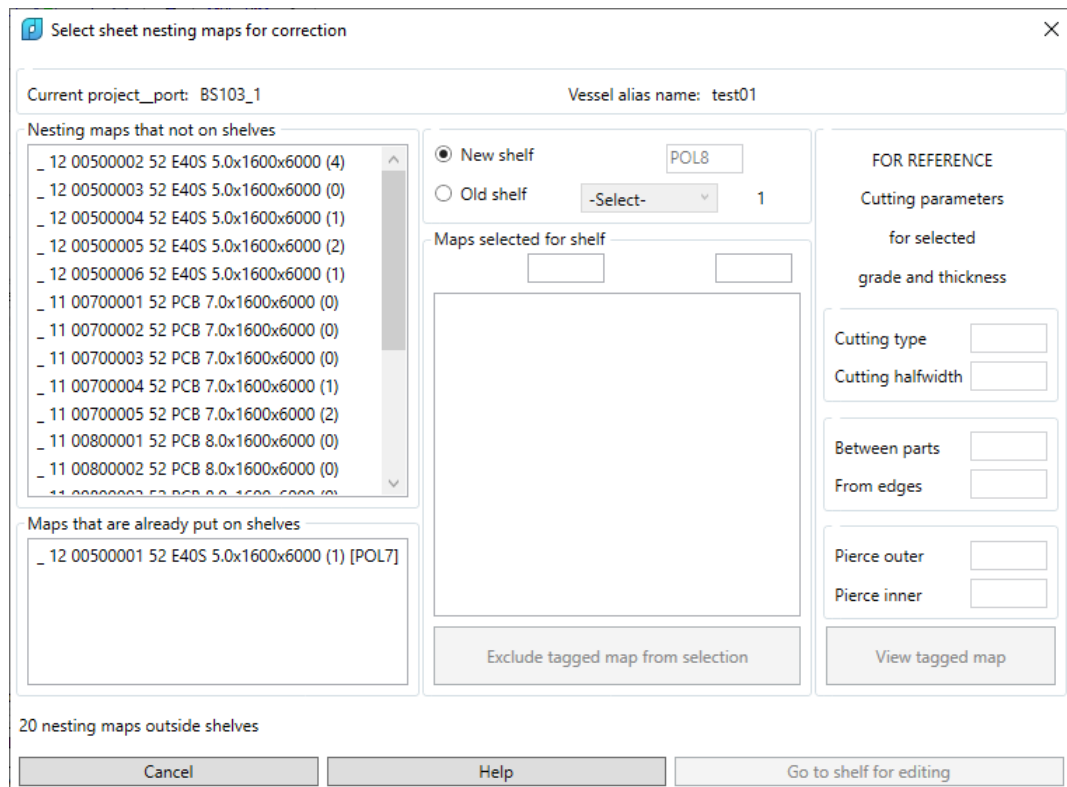
Drawing 49. Window **Select sheet nesting maps for correction**

Window serves for selection of one or several maps of the same material grade and thickness for modification. These maps can be either put on a new shelf or added to other maps on an existing shelf.

List **Nesting maps that not on shelves** shows names (NM) of all the nesting maps of the current project_port that are not being edited (on shelves). In the list **Maps that are already put on shelves** there are maps that are already have been put on shelves for other modifica-

tions (shelf name is given in brackets).

In the middle upper zone of the window there is an area with two radio buttons of mode. Radio button **New shelf** is used in the case when it is required to create a new shelf for maps correction. To the right there is shown new shelf name to be created.

Radio button **Old shelf** is used in the mode of adding maps on existing (old) shelf. To the right of radio button there is a combobox with names of existing shelves (at the start time it shows text **-Select-**) and number (it reflects total quantity of old shelves existing in the project_port for all materials). Old shelf name can be selected either at initial stage or after maps selection.

One map or more should be selected for correction, but with the same material, thickness and cutting type. Selection is made by left click on an element in the list **Maps that are already put on shelves**. Name of selected map is copied to the middle lower list (dr. 50). In the right zone there is displayed for help cutting parameters for material grade and thickness of selected map.
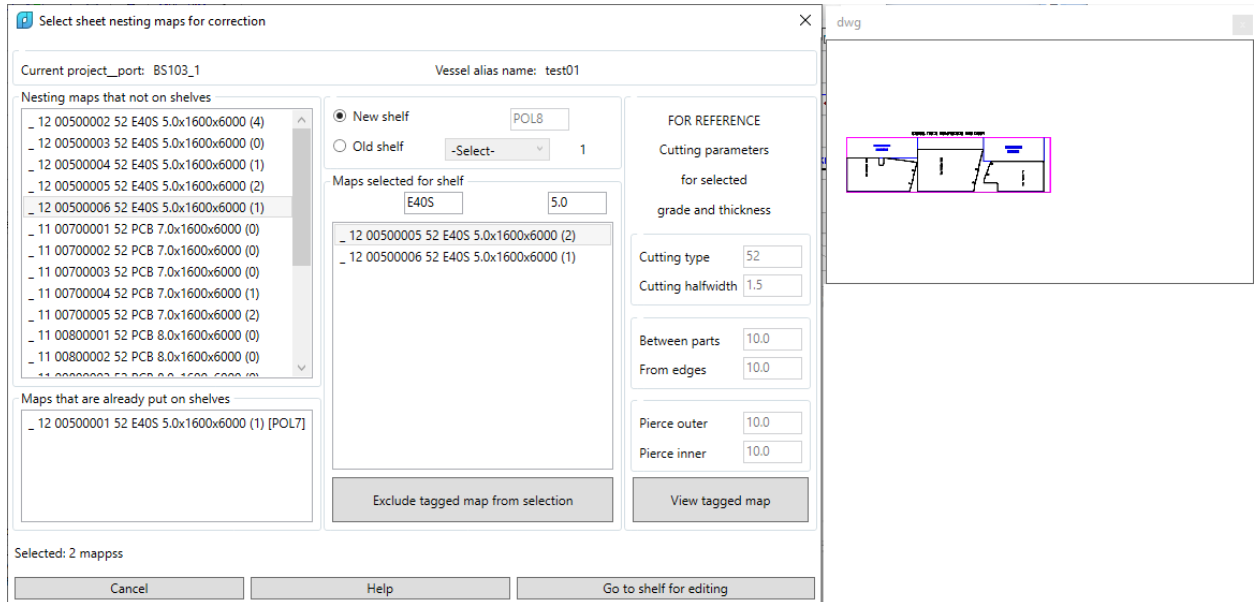

Drawing 50. Selection of maps for shelf

Simultaneous correction may be done only for maps of one grade and one thickness that are displayed in the upper part of area **Maps selected for shelf** (on dr. 50 E40S and 5.0). If user tries to add map with another grade or thickness then he will get error message.

In case of bad selection any element of the lower list can be removed: select it and press button **Exclude tagged map from selection** (after selection the button becomes enabled). Excluded map will be moved from **Maps selected for shelf** to **Maps that are already put on**
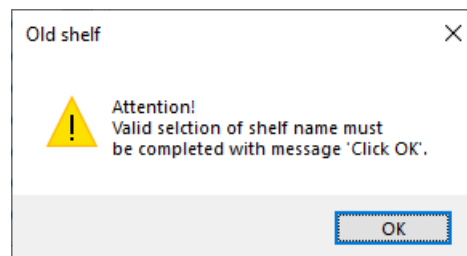
shelves.

If click an element in **Maps selected for shelf** then button **View tagged map activates too**. Pressing it opens raster image of the in auxiliary window **dwg** to the right from the dialog box **Select sheet nesting maps for correction** (dr. 51).

Drawing 51. Viewing image of tagged map from selection list

Afterselection of maps there will be less opportunities to go from the mode **New shelf** to the mode **Old shelf**. List of available shelves will reduce up to shelves only with selected grade and thickness.

On press radio button **Old shelf** there appears warning how to complete choosing name of old shelf (dr. 52).

Drawing 52. Warning during transfer to mode **Old shelf**

After **OK** to close warning window number of old shelves changes (only with tagged grade and thickness). Contents of the combobox **–Select-** changes too and shows only available shelves.

Attention! The current version of Platform nanoCAD is specific and proper selection of old shelf name is achieved only after output of additional confirmative message **Click OK** (dr. 53).
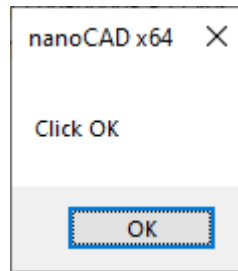
Drawing 53. Confirmation of old shelf name selection

After selection of maps for correction and getting name of shelf (new or old) it is necessary to press button **Go to shelf for editing**.

Process of generating nesting task file starts and opens window with the task for maps correcitio (dr. 54).
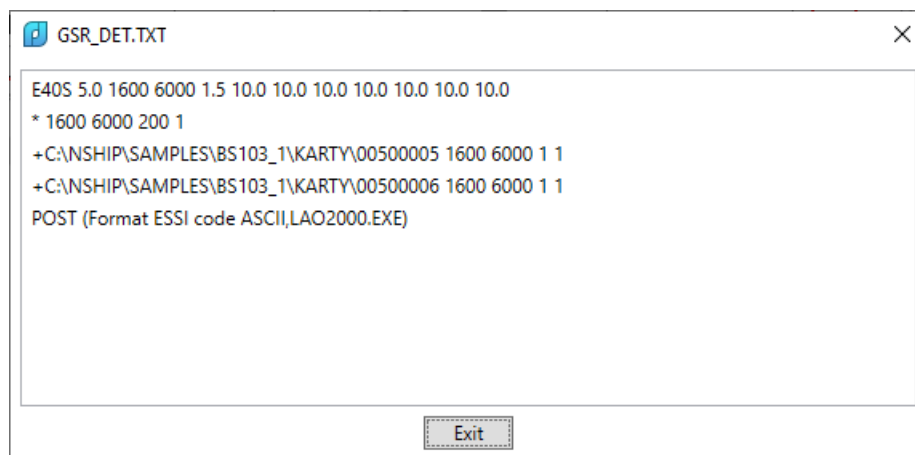
Drawing 54. Task for nesting with correction of maps

Note. In case of program fail message *Error opening file D:\NSHIP\GSR_DET.TXT* user must close nanoCAD and repeat procedure of selecting maps for correction in a new session.

Next program forms DWG file of shelf (new or old) with placing on it selected sheet nesting maps. If successful then shelf file opens and a message of readiness for work appears (dr. 55).

It is necessary to move map one by one from shelf down to nesting place. Command **NESTING > Set > Get map from shelf** or button of toolbar **Shelf** are used.

Maps should be edited and new variants saved to DB. Map edit operations are discussed in ch. 11.

Note. If in the map put on shelf program finds scraps of type other than the current scrap type with attributes (on/off) then message with offer to convert to necessary type is issued (dr. 56).

If **Yes** (Да) scraps are converted, if **No** (Нет) work continues without conversion. On scrap modes see ch. 15.
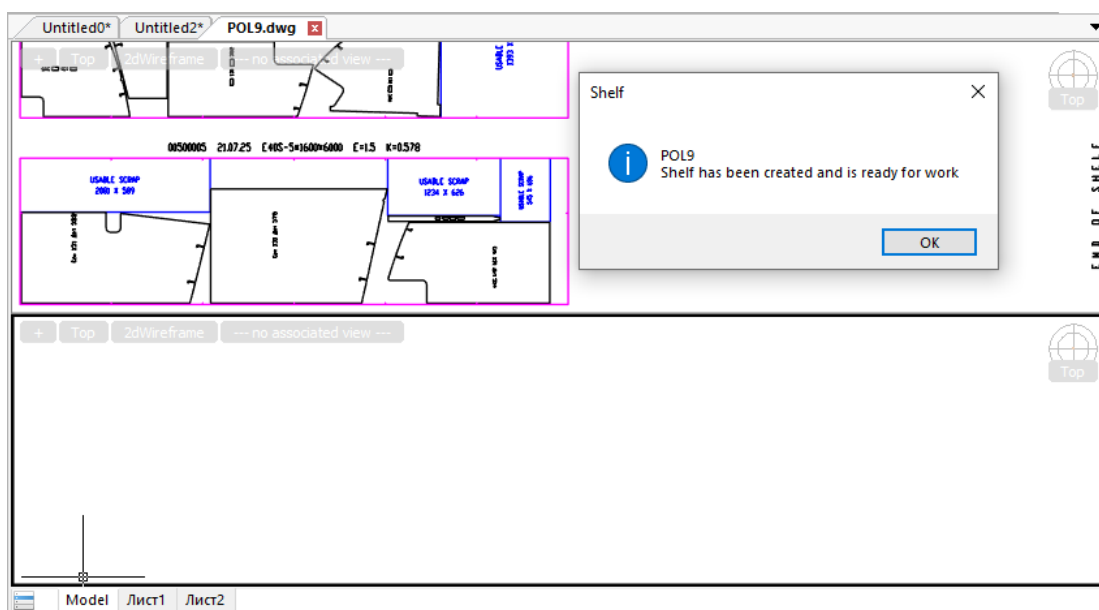
Drawing 55. Shelf with nesting maps to edit
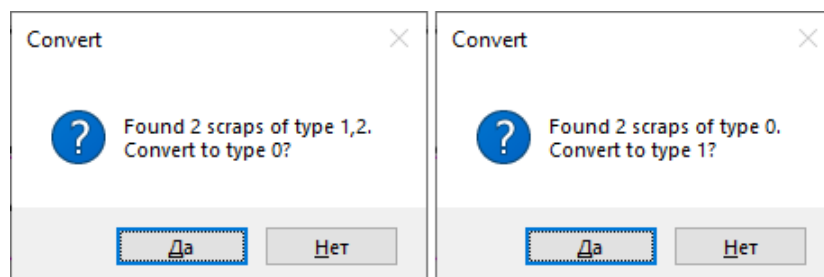
Drawing 56. Offer to convert scraps to priority type

### 10.2. Delete and rename nesting maps

It is recommended to delete and to rename nesting maps in module **Bdata** (menu command **BDATA > TABLES > Nesting maps**).

Similar command **Delete/rename maps** working only with sheet maps is inserted into submenu **NESTING > SERVICE** (dr. 57). Renaming and deletion of profile maps is to be done only in module **Bdata**.

Command opens dialog box **Delete/Rename nesting maps** (dr. 58).

It is necessary to mark the map to be deleted or renamed.

Note. If map was created in the system version for AutoCAD or BricsCAD then in the lower free zone silde of the selected map will be shown. It is impossible to create slides in Platform nanoCAD.
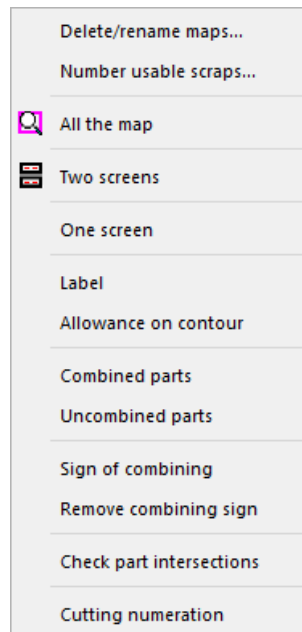
Drawing 57. Submenu **SERVICE**
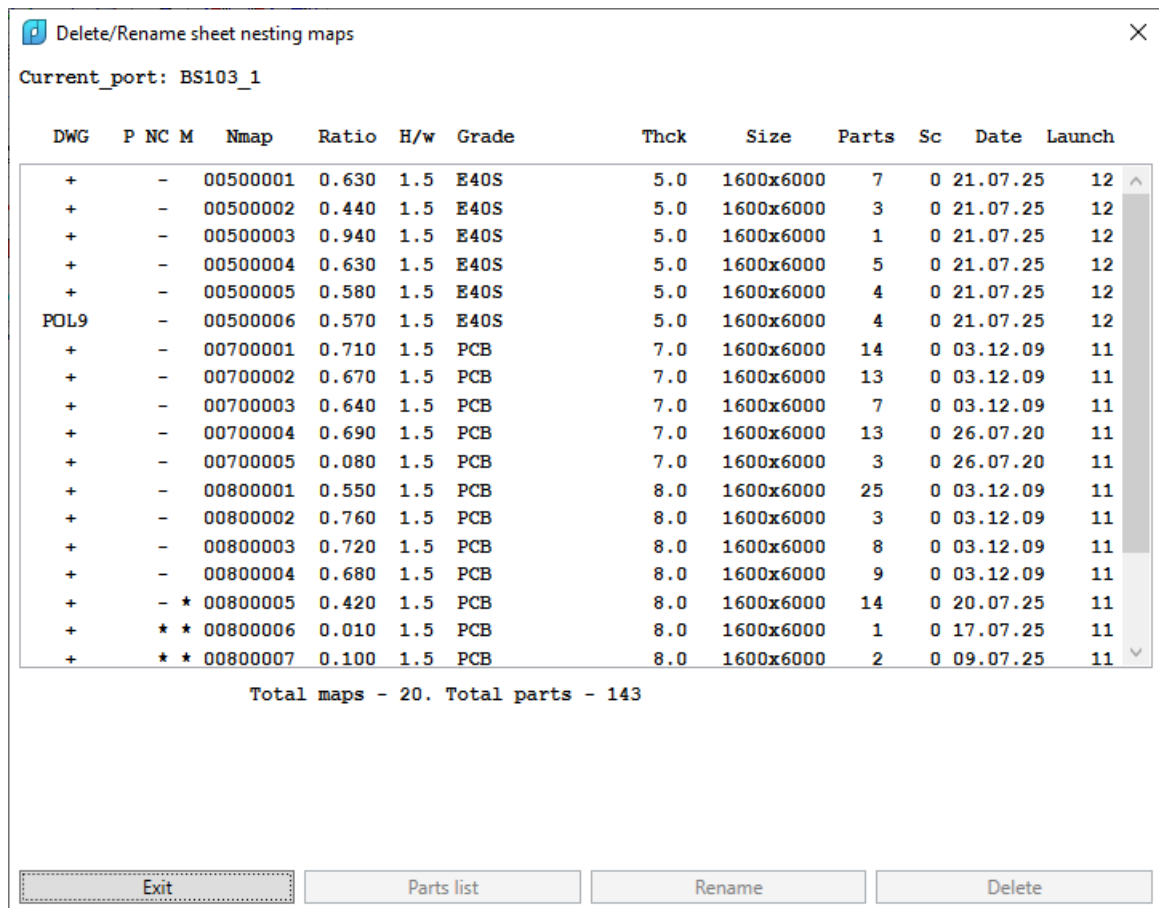
Drawing 58. Window **Delete/Rename sheet nesting maps**

If user wishes to delete map then he must click on button **Delete**. Program asks for confirmation of operation (dr. 59).
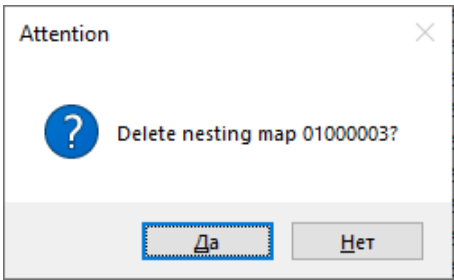
Drawing 59. Confirmation for delete request

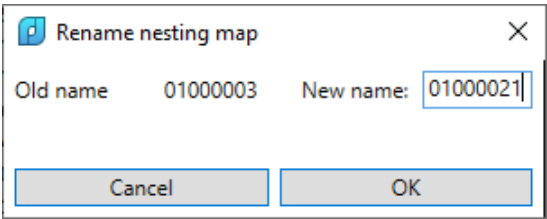Button **Rename** serves for renaming operation. New map name is requested (it must not coincide with names of other maps inside current project_port, dr. 60).

Drawing 60. Window **Rename nesting map**

Button **Parts list** shows list of parts included into nesting map, with bounding boxes (gabarits) dimensions (dr. 61). For each part there are darw name, position number, part DWG name, gabarit dimensions, token of correction.

Drawing 61. List of parts from selected map

Button **Exit** closes window **Delete/Rename sheet nesting maps** with no action. Deleting and renaming is possible only for one map per operation.

10.3.   Restore deleted nesting maps

Nesting maps can be deleted in the modules **Nesting** and **Bdata**.

Both commands before deletion can create backup copies of files to be changed (in *Dbf* folder of current project_port 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).

Attention. Option of backup copies requires machine resources therefore it is disabled in the standard version of the system.

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 to make changes by DBF editor of module **Bdata**.

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

Submenu **NESTING > Undo deletion** (dr. 62) is intended for restoration of nesting maps just deleted in the previous operation.
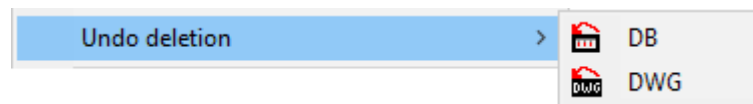
Drawing 62. Submenu **Undo deletion**

Submenu has two items: **DB** and **DWG**. They correspond to buttons and of the toolbar **JNG**.

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. 63).

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

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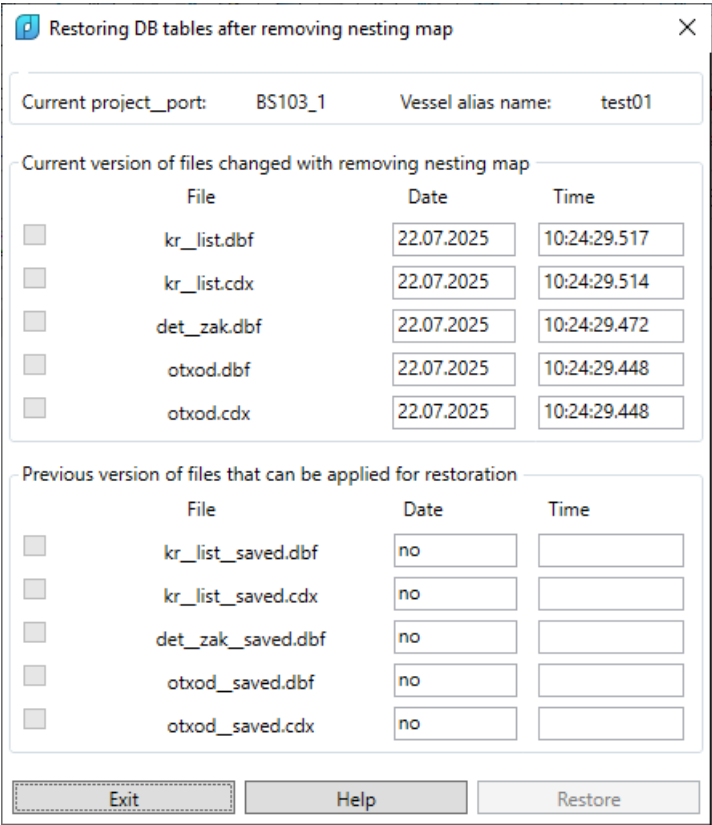*D:\NSHIP\SAMPLES\BBBBB_2\DBF\kr_list.dbf.*

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

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

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

*File D:\NSHIP\otxod_saved.cdx copied to D:\NSHIP\otxod.cdx.*

Restored 5 files.

Drawing 63. Window **Restoring DB tables after removing nesting map**

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. 64).
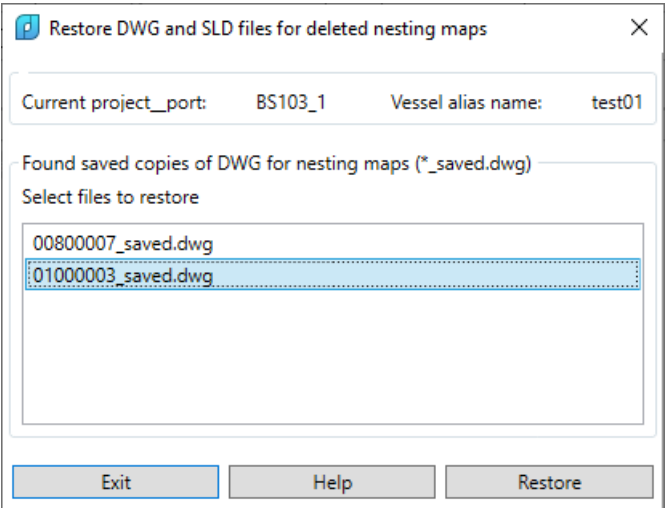
Drawing 64. Window **Restore DWG and SLD files for deleted nesting maps**

In the listbox user must select names of the DWG files to be restored from backup copies. 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.

Note. In nanoCAD nesting maps are created without SLD files.

Here are sample restoration messages:

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

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

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

Removed file D:\NSHIP\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. Commands are collected in submenu **Placement** (dr. 65) and in some toolbars.
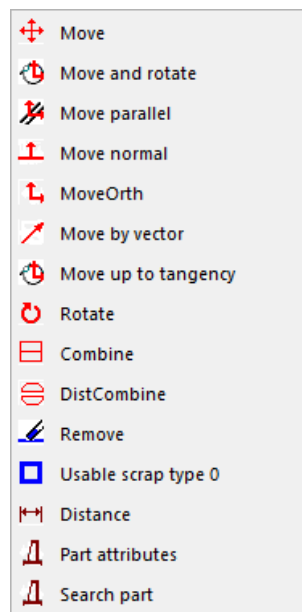
Drawing 65. Submenu **Placement**

11.1. 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**. Nesting map on shelf is selected by click on map header or sheet edge. As a result map moves to the lower viewport of the screen divided into two areas. On dr. 66 at the beginning on shelf there were empty sheet and two maps and after getting one map has moved to nesting place and in the upper viewport there left sheet and only one nesting map.
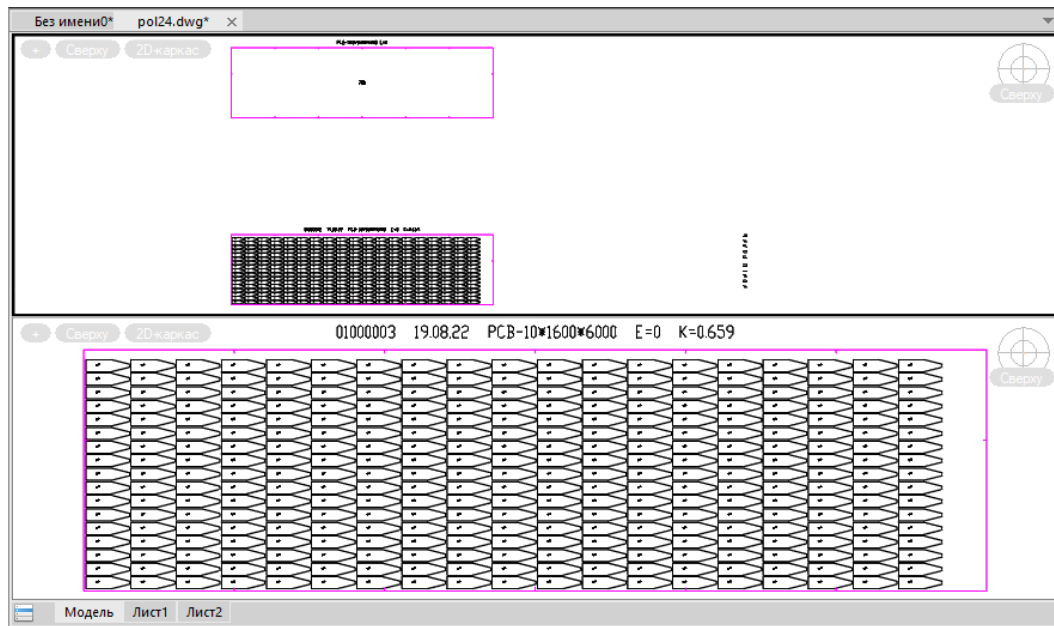
Drawing 66. Getting map from shelf

11.2. Move commands

11.2.1. Move commands (for moving parts inside map, shelf and between map and shelf) are included in toolbars **Move** and **Move-2** (dr. 67) and in submenu **NESTING > Placement**.

Drawing 67. Toolbars **Move**, **Move-2**

Names of move commands: **Move**, **Move rotate**, **DistCombine**, **MoveOrth**, **Move by vector**, **Move parallel**, **Move normal**, **Move to tangency**.

11.2.2. Command **Move** moves parts inside shelf, inside map and between them. Command has 3 kinds, depending on source and target zones (from – to).

11.2.2.1. Moving part from shelf to map is done with button [button] of toolbar **Move-2**. Graphical screen must be divided in two (upper is shelf with parts and sheets, lower is nesting place with map to be edited or with sheet).

First request:

Moving part block from shelf to the nesting map.

Select part block:

If lower screen is active then activate the upper one by left mouse click in a free zone of upper screen (after activation viewport boundaries will be drawn with thick black line).

In the upper screen select part by click on the part boundary. Part block must be on layer 3, otherwise there will be error message.

1 found

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Click by left mouse button in the lower screen (it will be activated, boundaries will get thick lines). Next pick point inside sheet (part will be moved into it for the center point).

If completed move exhausted all the copies of the part on shelf then there will be a message:

Part 1030340 removed from shelf.

Moving part block from shelf to the nesting map.

Select part block:

Command is cycled. To end command press Esc in answer to request *Select part block:*.

If multiplicity of moved part was greater than 1, then in the next line there will be message how many copies (KOL) of this part left on shelf, for example:

Attribute KOL of part 1030340 on shelf changed to 2.

11.2.2.2. Moving part from map to shelf is done with button [   ] of the toolbar **Move-2**. Graphical screen must be divided in two (upper is shelf with parts and sheets, lower is nesting place with map to be edited or with sheet).

First request:

Moving part block from the nesting map to shelf.

Select part block:

If upper screen is active then activate the lower one by left mouse click in a free zone of lower screen (after activation viewport boundaries will be drawn with thick black line).

In the lower screen select part by click on the part boundary. Part block must be on layer 2, otherwise there will be error message.

1 found

Click by left mouse button in the upper screen (it will be activated, boundaries will get thick lines). Next pick point inside shelf (part will be moved into it for the center point).

Part block 1310138 moved to shelf.

Moved part block will disappear from the map and will appear on shelf (if this part was not on shelf earlier).

If copy of this part block was already on shelf then new block will not appear but value of its attribute KOL will increase by 1, for example:

Attribute KOL of part 1310138 on shelf changed to 2.

Command is cycled. To end command press Esc in answer to request *Select part block:*.

11.2.2.3. For simple moving part(s) inside the map use button [   ] of the toolbar **Move-2**. Graphical screen must be divided in two, operation is run in the lower viewport.

First request:

Moving part blocks inside the nesting map. Select objects:

Select objects

User can select one or several parts one by one (blocks on layer 2).

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Next:

1 found

Select objects

For end of selection press Enter. Next messages:

Selected 1 object.

While picking move point one should consider that magnitude and direction of move vector is defined by the center point of rectangle described around first part. After giving point part(s) will move.

Command is cycled therefore there will be repetition of request for selecting part objects inside map. For end press Esc.

11.2.3. Command of moving with rotation realizes movement along shelf, map and from shelf to map, combines moving with rotating selected parts. Can be run from menu item **Placement > Move and rotate** or with click on button 🔄 . There is a request:

Select parts: [_Window/_Crossing/_Previous]

Select objects:

It is necessary to select parts by any method for graphicl editor. After the first move there will be requested rotation angle that can be entered as number or with button of rotation submenu in the toolbar **Placement** (dr. 68).
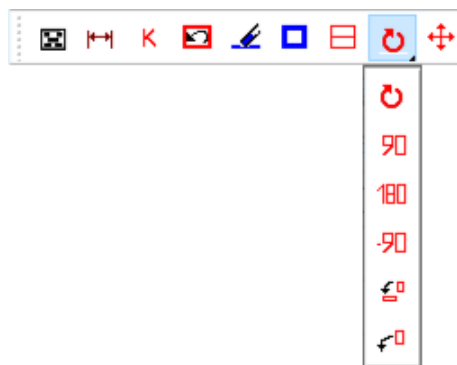
Drawing 68. Rotation submenu in the toolbar **Placement**

At the moment group of parts can be rotated by fixed angle -90°, 90° or 180°, or by arbitrary angle, or up to pallelity picked edges (button 📐). Option of fixed angle should be chosen by click on option from the list shown in the command line.

It is possible to change rotation center that is initially a center of the first part. It is done wth button 📐 and picking point of the new rotation center. This center will be base point for the next movement of parts. After mouse right click rotation angle will be previous and new move will start. For end of command press Esc in answer to request of group move point or rotation angle.

Parts will be fixed in the last position.

11.2.4. Command of orthogonal moving makes move parallel to axes X or Y. It is real-

ized in two variants.

11.2.4.1. The first variant of command is used by **Placement > MoveOrth** or button ⬚
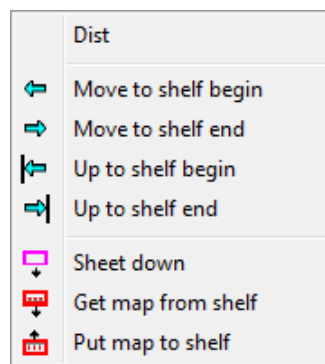There is a request:

Command of orthogonal move runs move along axis OX or OY up to specified distance beteen parts. It can be called with button ⬚. Command requests:

NEAREST osnap IS ON. DIST BTW PARTS = 10 mm

Select PART to move:

Select stationary PART:

Pick point on the second part. Moving is done along X or Y axis, depending on axis with greater coordinate increment. Dist is taking into account. Moving displacement is decreased by value of Dist defined by item **Dist**, from submenu **NESTING > Set** (dr. 69).

Drawing 69. Submenu **Set**

11.2.4.2. The second variant of command **MoveOrth** works after click on button ⬚ of toolbar **Move-2**.

There is a request:

Select point 1 on PART to be moved:

User must select part with automatically activated osnap function **Nearest**. Next it is necessary to pick second point. Move vector is calculated as vector from point 1 to point 2 and **ORTHO** mode will be appplied. Point 2 can be given in any place (in contrast to the first variant of command **MoveOrth**). The Dist parameter is not used here.

After picking point 2 part moves to a new position and request for point 1 is repeated.

Command is cycled. For end press Esc.

11.2.5. Command of moving by vector realizes movement of parts group along specified vector. It is run with submenu item **Placement > Move by vector** or by pressing button ⬚. After selecting parts there is a request:

Pick vector start point:

Osnap **Nearest** is activated. Next:

Pick vector end point:

After second point movement is done along the vector but for distance equal to vector

length minus value **Dist** in submenu **Set**.

11.2.6. Command of moving parallel realizes moving of parts parallel to specified straight part edge. It can be done with **Placement > Move parallel** and also be called by button . After selection of parts there is a request:

Select straight edge of the part along which to move:

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

Enter distance <10>:

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

Enter move direction:

Specify second point to the side that clarifies move direction (it must create an angle less than 90° beginning from the first specified point), preferably on the same edge. As a result parts group will be moved along specified edge, on given distance and required direction.

11.2.7. Command of moving normal moves parts along vector that is perpendicular to specified edge. It is run with **Placement > Move normal** or by button . After selection of parts there is a request:

Select straight edge of part normally to which to move:

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

Enter distance <10>:

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.

11.2.8. Command **Placement > Move up to tangency** moves selected objects up to tangency (minus **Dist**) with sheet or specified part. It can be also called by button . After selecting parts there is a request:

Select unmovable 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**.

11.3. Combine with distance

Command realizes combining of the first part edge with specified edge of another part up to **Dist** of submenu **Set**. Use submenu item **Placement > DistCombine** 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**.

11.4. 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** 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 sub-

menu item **NESTING > SERVICE > Combined parts** 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**.

11.5. Rotate parts

Command is used for rotation of parts group. Implemented as command **NESTING > Placement >** Rotate and as button ⟳ of toolbar **Rotate**. 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 -9⌐), 90° (button 9⌐) or 180° (button 18⌐) or up to paralllelity of specified edges (button ⌐).

User can change rotation center (initially it is center of part). This can be done with button ⌐ (pick new rotation center point). This center will be used as base point in the following move commands.

End of command is pressing key Esc in answer to parts selection request.

11.6. Replace part in the map without renesting

If part geometry has changed insignificantly and it is not necessary to modify its position in existing nesting map then there is an opportunity to replace old part geometry by a new geometry without deletion of nesting map or recreating it. For example if the part changed only quantity or form of holes. But map's cutting route must be recreated.

Menu command **NESTING > Replace part in the map** and button ⛁ of toolbar **JNG** run replacement of old cutting and marking lines of the part to corresponding lines from the new DWG file.

Command opens dialog box **Select sheet map for replacing part** (dr. 70). In the info line there is a message with total number of maps in the table kr_list.dbf of current project_port.

In the left zone of the window there is list of nesting maps in the current project_port. Column **DWG/She** contains either shelf name (e.g., POL9) or sign of presence for map DWG file (+), or sign of absence for map DWG file (–). Command can make part replacement only for maps having DWG and not being on shelf.

In column **M** there is an asterisk for those maps whose cutting route is generated. **CT** denotes cutting type (line, tool).

The first step is selecting map for replacing part (dr. 71).

Drawing 70. Window **Select sheet map for replacing part**

Drawing 71. Window **Select sheet map for replacing part** (map selected)

After selection info line shows map name, total number of nested parts and positions (the same position can be present in several copies). In the right zone there is list of positions with draw name, position number, DWG file name, gabarits, number of copies and correction sign (if it is present in parts DB), e.g.: **BS103-112.03-010 375 1310375 (1466x1933) 1 R**.

The second step is select the part position with corrected geometry that should be re-placed in the map (dr. 72).
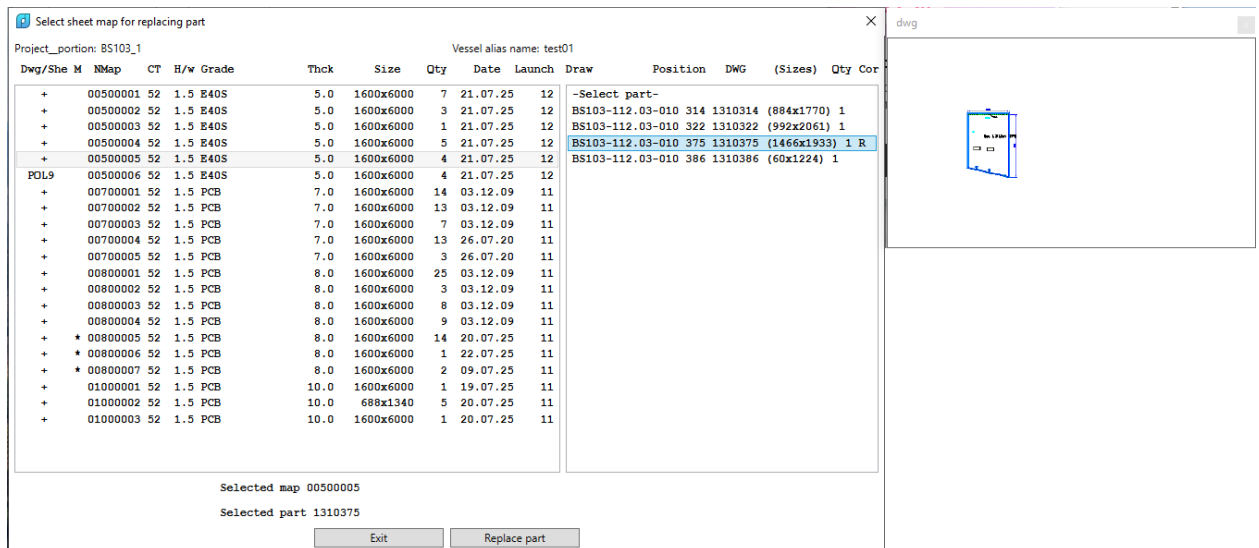
Drawing 72. Window **Select sheet map for replacing part** (part selected)

The right auxiliary window demonstrates raster image of the selected part DWG file. Button **Replace part** is activated, it should be pressed to go on.

After click on button **Replace part** window closes and DWG file of the map to be corrected is loaded to nanoCAD. In its drawing all the copies of the part to be replaced are highlighted (dr. 73).
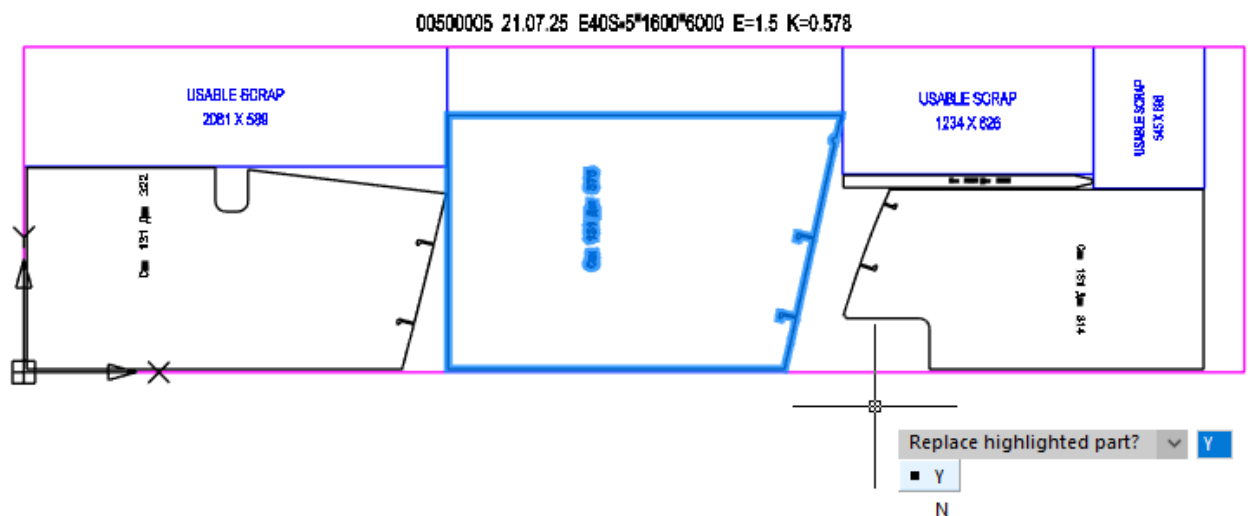
Drawing 73. Nesting map with highlighted part

In the command line there is a message *Replace highlighted part? [Y/N] <Y>:*. It is duplicated in the graphical screen, therefore reply may be done either by typing keys **Y** or **N**, or by clicking on keyword **Y** or **N** on screen by cursor. The third option is mouse left-click in command line on subscribed hyperlink symbol **Y** or **N**.

After **Y** part replacement continues. Cutting route is deleted (if it was applied earlier). Part block is cleared (old cutting and marking lines are removed) and instead of them there copied from from part DWG file new lines from layers KALL, KHALL, RAZM. If in the map header cutting halfwidth is non-zero then offset objects to main outer and inner contour lines are creat-

ed (offset value is taken equal to cut halfwidth). Therefore insert points and rotation angles for blocks remain unchanged.

Next program suggest to save modified map to DB as well its DWG file (dr. 74).
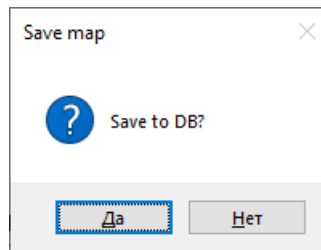
Drawing 74. Request for saving map to DB (after replacement of part)

In case of positive reply DWG file is replaced and DBF table is updated. Sample finishing dialog in command line:

Replace highlighted part? [Y/N] <Y>: Y

Route deleted.

Cleaned block 1310375.

Objects in the new part KALL=1 KHALL=2 RAZM=0

Equidistance=1.5

Number of copied objects: 4

In the map there was replaced block of the part 1310375.

Part copy sent for saving in the file D:\NSHIP\SAMPLES\BS103_1\IDX\1310375_1.dwg.

Map copy sent for saving in the file

D:\NSHIP\SAMPLES\BS103_1\KARTY\1310375_1.dwg.

Saved file D:\NSHIP\SAMPLES\BS103_1\KARTY\00500005.dwg.

Updated data of the map 00500005 в kr_list.dbf.

Note. While saving map NC program is not created because cutting route was removed.

11.7.   Measure distance

To measure distance between parts or between part and sheet edge use command **NESTING > Placement > Measure distance** or click button ⊢⊣ of toolbar **Placement**. After command start pick point on the first straight edge (NEARest osnap is active) and then pick on other edge (PERpendicular osnap is activated). If point on arc is picked then request will be repeated but without NEAR osnap. Second point is automatically modified with PER osnap function. Result is calculated between snapped points and output in command line as well as increments on both axes and inclination angle.

11.8.   Display or hide part labels

Command **NESTING > SERVICE > Label** hides part labels if they are visible. If labels

are hidden then this command restores label visibility.

11.9. Identify part

If part image is very small and its label is small too, then command **NESTING > Placement > Part attributes** 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**).

11.10. Search part

To find part in a big nesting map use command **NESTING > Placement > Search part**. Command requests:

Enter part name:

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

11.11. Scrap creation

Operations with scraps are explained in ch. 14 и 15.

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.).

12.1. 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. 75). Select map and click on button **Route**.

| DWG	P	NC	M	Nmap	Ratio	H/w	Grade	Thck	Size	Parts	Sc	Date	Launch
+	–			00500001	0.630	1.5	E40S	5.0	1600x6000	7	0	21.07.25	12
+	–			00500002	0.440	1.5	E40S	5.0	1600x6000	3	0	21.07.25	12
+	–			00500003	0.940	1.5	E40S	5.0	1600x6000	1	0	21.07.25	12
+	–			00500004	0.630	1.5	E40S	5.0	1600x6000	5	0	21.07.25	12
+	–			00500005	0.580	1.5	E40S	5.0	1600x6000	4	0	24.07.25	12
POL9	–			00500006	0.570	1.5	E40S	5.0	1600x6000	4	0	21.07.25	12
+	–			00700001	0.710	1.5	PCB	7.0	1600x6000	14	0	03.12.09	11
+	–			00700002	0.670	1.5	PCB	7.0	1600x6000	13	0	03.12.09	11
+	–			00700003	0.640	1.5	PCB	7.0	1600x6000	7	0	03.12.09	11
+	–			00700004	0.690	1.5	PCB	7.0	1600x6000	13	0	26.07.20	11
+	–			00700005	0.080	1.5	PCB	7.0	1600x6000	3	0	26.07.20	11
+	–			00800001	0.550	1.5	PCB	8.0	1600x6000	25	0	03.12.09	11
+	–			00800002	0.760	1.5	PCB	8.0	1600x6000	3	0	03.12.09	11
+	–			00800003	0.720	1.5	PCB	8.0	1600x6000	8	0	03.12.09	11
+	–			00800004	0.680	1.5	PCB	8.0	1600x6000	9	0	03.12.09	11
+	–	*		00800005	0.420	1.5	PCB	8.0	1600x6000	14	0	20.07.25	11
+	*	*		00800006	0.010	1.5	PCB	8.0	1600x6000	1	0	22.07.25	11
+	*	*		00800007	0.100	1.5	PCB	8.0	1600x6000	2	0	09.07.25	11
+	–			01000001	0.010	1.5	PCB	10.0	1600x6000	1	0	19.07.25	11
+	–			01000002	0.270	1.5	PCB	10.0	688x1340	5	0	20.07.25	11

Drawing 75. Window **Generation of cutting route for nesting map**

DWG file of nesting map is being loaded into editor, and parts get red color (dr. 76). Red color means that route mode is activated.
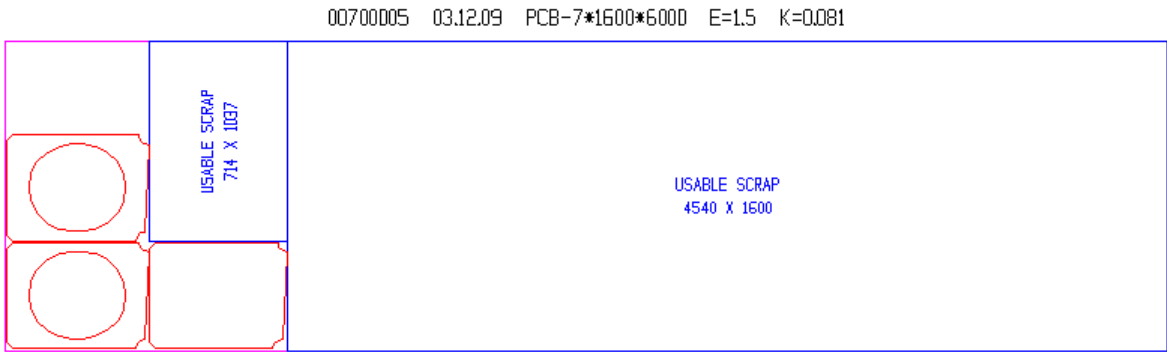
Drawing 76. Map before generation of route

If activating route mode has not completed (parts without red color) then it is possible to do with command **InterRoute** of submenu **NESTING > Route** (dr. 77) or with button [image] of toolbar **Interactive route**.
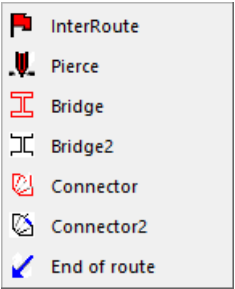
Drawing 77. Submenu **Route**

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12.2. Pierce

Character of cutting instrument (cutter) movement, switching on or off is ruled by pierce parameters.

To set pierce point on part contour use command **NESTING > Route > Pierce** 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 defining 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 (segment) 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 segment of combined parts then pierce point will be nearest point of common segment. Cutting path will be generated on common segment extension independing of current pierce type (except "arbitrary" type; here user will be suggested to pick point defining direction of inlet segment). Next, in accordance with current rule of curtting 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 be 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:

- coming up 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. 78) can be used (see more information hereinafter).
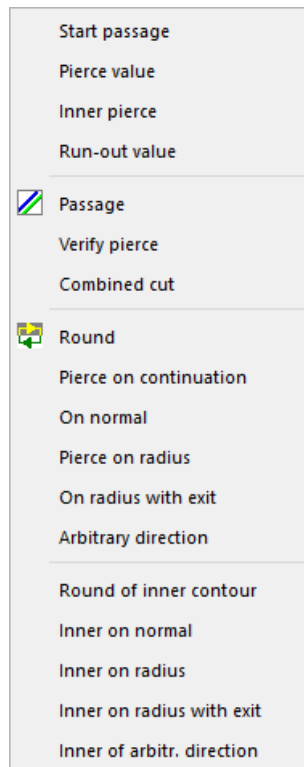

Drawing 78. Submenu **Set route parameters**

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**.

12.3. Bridge

For uniting parts contours into one cut path use command **NESTING > Route > Bridge** or button of toolbar **Interactive route** or command **Bridge2** (button).

First part from which bridge (piece) will be created must be already cut out (its contour must be polyline on layer 1, color yellow or green). Contour of the second part yet must not be cut out (polyline on layer 0, colo red). An example is on dr. 79.
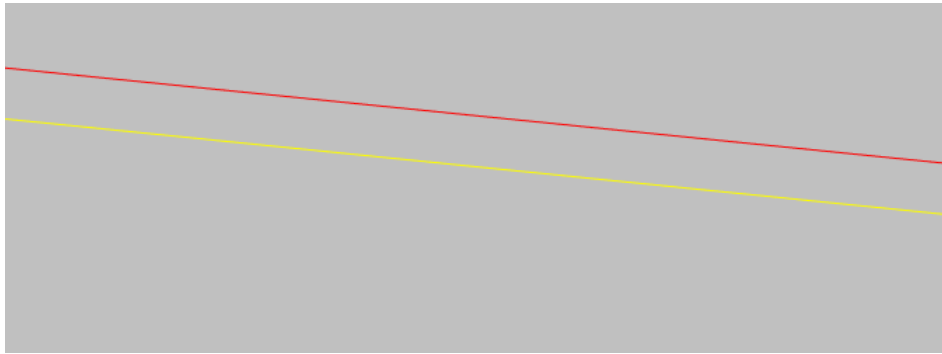
Drawing 79. Parts contours before building bridge

12.3.1. Command **Bridge**. After command start there is a request:

Bridge start point:

Pick the point on cut contour from which bridge should be built. Next:

Bridge end point:

Pick second point of bridge axis on contour of the part that is not yet cut. Next request:

Bridge width <20>:

Previous width from **Bridge** is used as default value. As a result there will be built cut trajectory beginning in the start bridge point, going to second point along line segment, next going along the contour of the second part and up to the segment that is a second bridge line whose width is taken from user's input.

Next start request is repeated (for the new bridge).

12.3.2. Command **Bridge2**. First request:

First point of bridge axis (on layer 1):

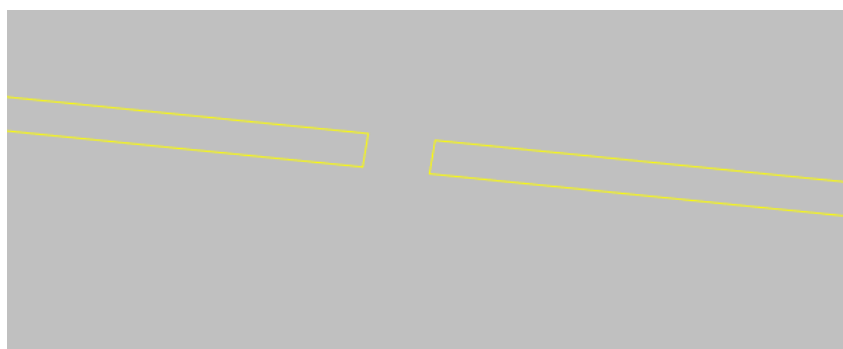Pick the point on cut contour for bridge axis begin. Next:

Second point of bridge axis (on layer 0):

Pick second point.

Bridge width <20>:

Previous width from **Bridge2** is suggested as default value. As a result bridge will be built.

Bridge sample is shown on dr. 80.

Drawing 80. Part contours connected by bridge

12.4. Current settings for outer contour

To define current parameters of route generation there is submenu **NESTING > Outer contour** (dr. 81). All these parameters are connected with cutting outer contour.
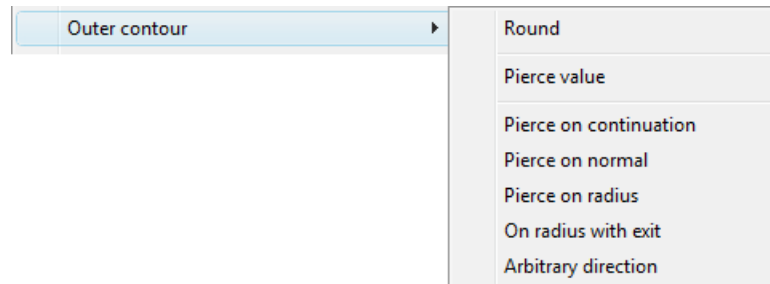
Drawing 81. Submenu **Outer contour**

Commands of submenu **Outer contour** change outer contour cut attributes, round direction, outer pierce value and type.

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.

12.5. Current settings for inner contour

Submenu **NESTING > Inner contour** (dr. 82) is designed for inner contour settings.
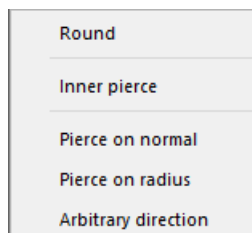
Drawing 82. Submenu **Inner contour**

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

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

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.

12.6.   Change route settings

Submenu **NESTING > Set route parameters** 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 total recreation of 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 be each time offered to pick additional point defining inlet direction. Inlet is executed along straight line.

12.7. Edit existing route

Submenu **NESTING > CHANGE** (dr. 83) is used for edit of existing route.
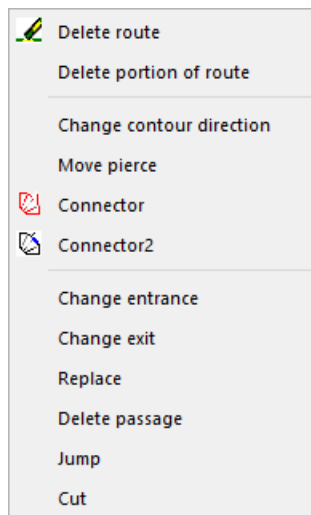
Drawing 83. Submenu **CHANGE**

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.

12.8. 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.

12.9. Move pierce point

Command **CHANGE > Move pierce** allows to move pierce point to other point of contour.

Command requests:

Pick new pierce point:

Specify new point. Old inlet segement will be deleted and cut path will be rebuilt with the same round and with new pierce. Command does not work with contours having outlets after

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which there are bridges to other parts or connectors. For these cases route must be removed completely and new route must be created.

12.10. 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 [icon] of toolbar **Inter-active route**, or on button [icon].

12.10.1. Command **Connector** ([icon]) issues the following requests:

Piece point start:

Specify point on part contour.

Piece length <20>:

Enter length or specify second point. After that pierce direction is requested.

Set pierce direction:

Specify point for adding pierce. Pierce value is taken from settings.

Result is shown on dr. 84.

Drawing 84. Result of command **Connector**

12.10.2. Command **Connector2** ([icon]) has the following requests:

First point of connector (on layer 1):

Pick the start point on polyline of layer 1.

1 found

Second point of connector (on the same object):

Pick second point, in required direction on contour (exact length is still unimportant).

1 found

Preliminary length of connector = 33.9. To change length? [Y/N] <Y>:

If new length value is necessary then answer *Y.*

New length value:

Enter number (e.g., *24*).

Length = 24

Next there is a request on pierce implementation:

Add pierce? [Y/N] <Y>:

To create pierce enter *Y.* Program will automatically finds outside position analyzing part

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contour direction and will build pierce by normal with the length taken from pierce settings.

End of connector building.

Result is demonstrated on dr. 85.
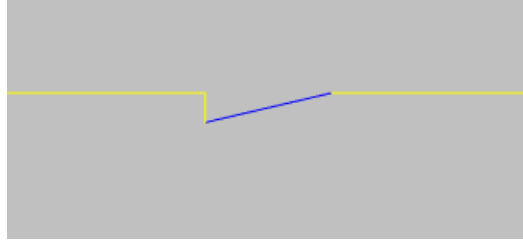
Drawing 85. Result of command **Connector2**

12.11. Passages between parts

As an opportunity to edit passages between parts, if parts placement is changed 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. If this osnap is unneeded then first click on free place and then pick necessary point or enter its coordinates.

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

12.12. 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 correction of parts placement 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 of cuts and jumps and pierces number. There will be message about generation of NC program and saving it in subfolder *Pl* of current project_port. DWG file of map with route will be saved with its name in subfolder *Karty* (it is used for storing nesting map DWGs).

12.13. 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 ⎕ of toolbar **Interactive route**.

Command **Output NC** calls dialog box **Formats and codes for NC** (dr. 86).

Window displays current format and code of NC structure (from previous session). It is possible to change data or check additional formats. It will result in one or several programs, in specified codes and formats. Divided NC for cutting and marking are possible too. Then next dialog box **NC program output** opens (dr. 87).

In the dialog **NC program output** user must select maps for which NCs must be generated. Only nesting maps with route (with '*' in column M) can be selected.

Button **All NCs** 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 86. Dialog **NC formats and codes**

Drawing 87. Window **NC program output**
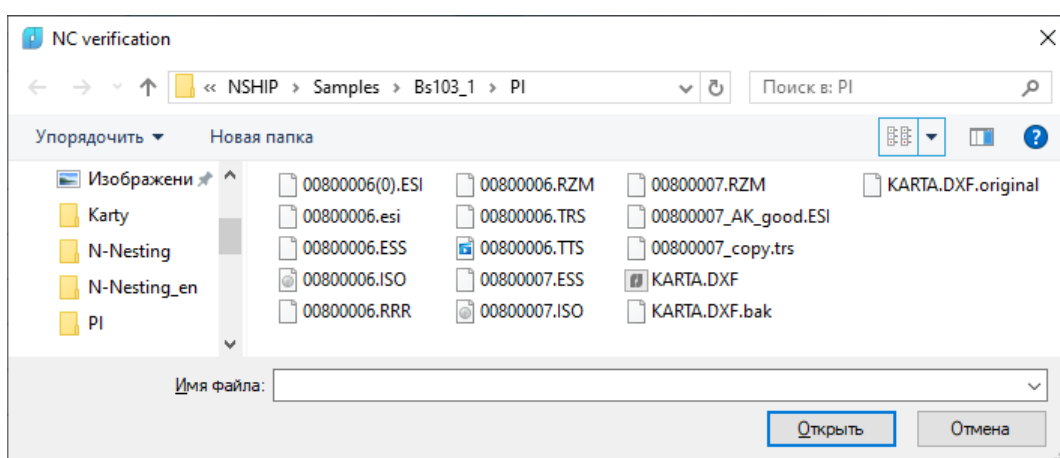
12.14. Verify NC

For visual control of NC there is submenu **NESTING > VIEW** (dr. 88).
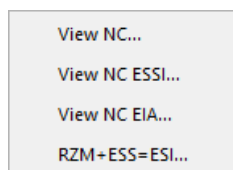

Drawing 88. Submenu **VIEW**

12.14.1. Command **View NC** is used for viewing programs without marking.

It calls dialog box **NC verification** (dr. 89). It displays all the NC files saved in subfolder *PI* of current order.

Drawing 89. Window **NC verification**

Select required NC file and click on button **Open** (Открыть). NC will be visualized on the screen with cutting trajectory and jumps (dr. 90).
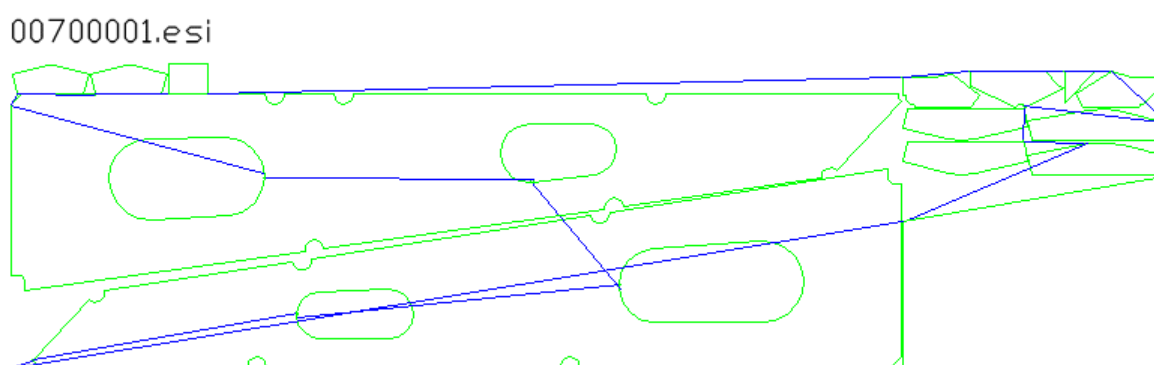
Drawing 90. Visualization of NC

Cutting lines are displayed in green. Jumps have blue color.

Command is cycled therefore window **NC verification** will open once more for selection of next NC file. To stop process click **Cancel** button.

12.14.2. Command **View NC ESSI** is used for visualization of NC programs for cutting, marking and NC cutting+marking.

Dialog box **NCP visualization settings** (dr. 91) open, user should choose file extension and folder with NC program files.
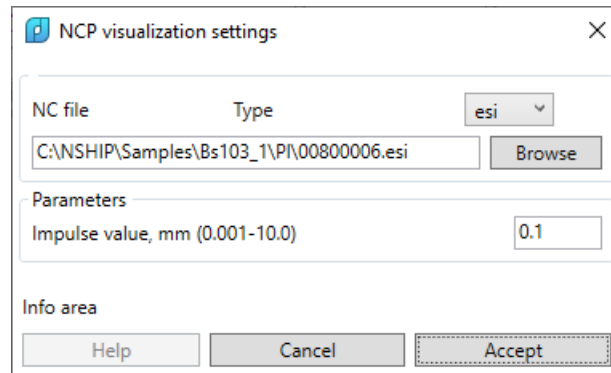
Drawing 91. Window **NCP visualization settings**

In the field **Type** recommended extensions are ess, rzm, esi. Click on button **Browse** opens window **Select NC file** (dr. 92), by default it is folder *PI* of current project_port.
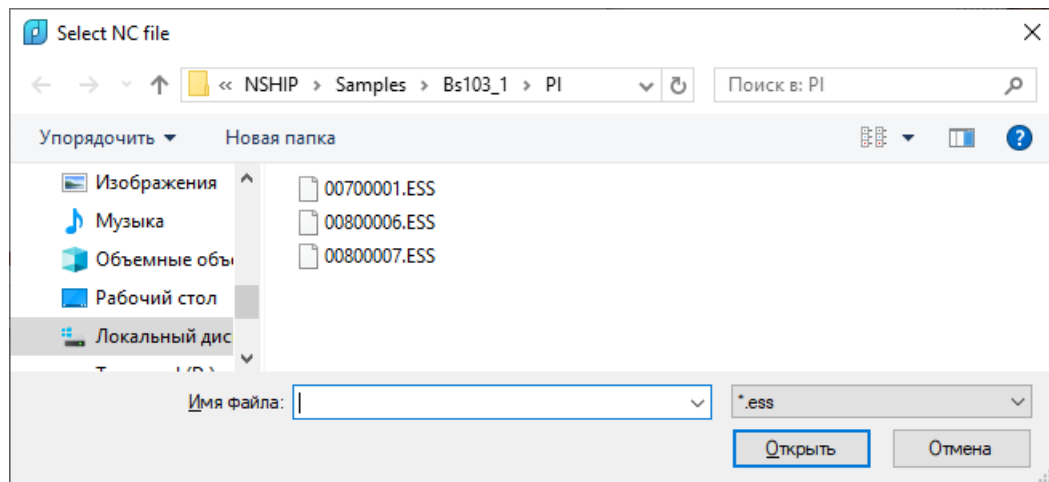
Drawing 92. Window **Select NC file**

One must select file of required NC and press button **Open**. Screen will show NC image with cutting trajectory and jumps (dr. 93).

Cutting lines with counterclockwise direction are displayed in green color, with clockwise direction with yellow color, rest lines are drawn in black. Jumps between cuts have blue color. Marking lines are orange, mark jumps are cyan.

After NC output system requests: *Start block by block drawing?* In case of positive reply command requests value of interval between blocks:

Weak videocard requires big delay between NC blocks.

Enter delay (in milliseconds) <1000>:

BS103.00700001 25/07/25 15-33-37 6000.0 1600.0 7.0
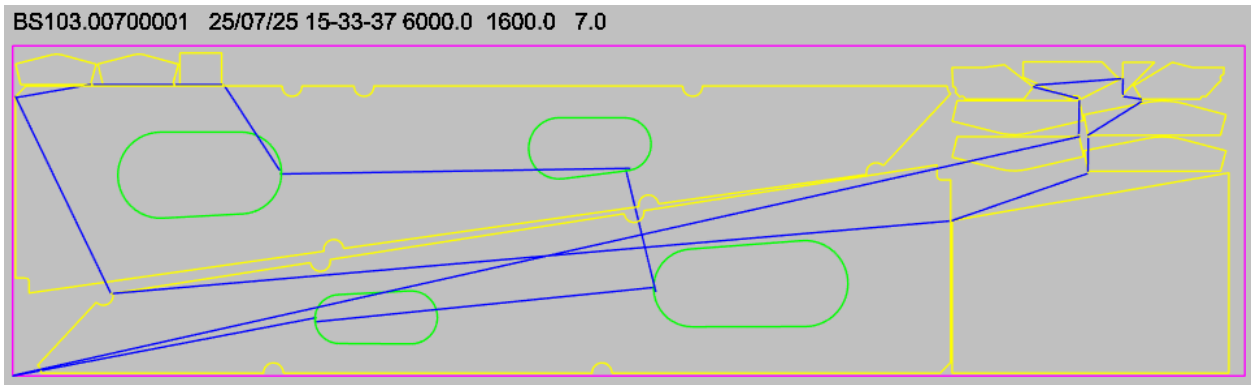
Drawing 93. Visualization of NC

Speed of screen redrawing must reply to videocard capabilities. By weak videocard re-draw will be missed and final view will be output only at the end of visualization. In such cases it is recommended to increase delay interval.

After entering delay value program will go block-by-block mode of line redrawing with width (thickness) 1 mm. It will allow user to watch sequential draw of blocks beginning from the first (dr. 94):
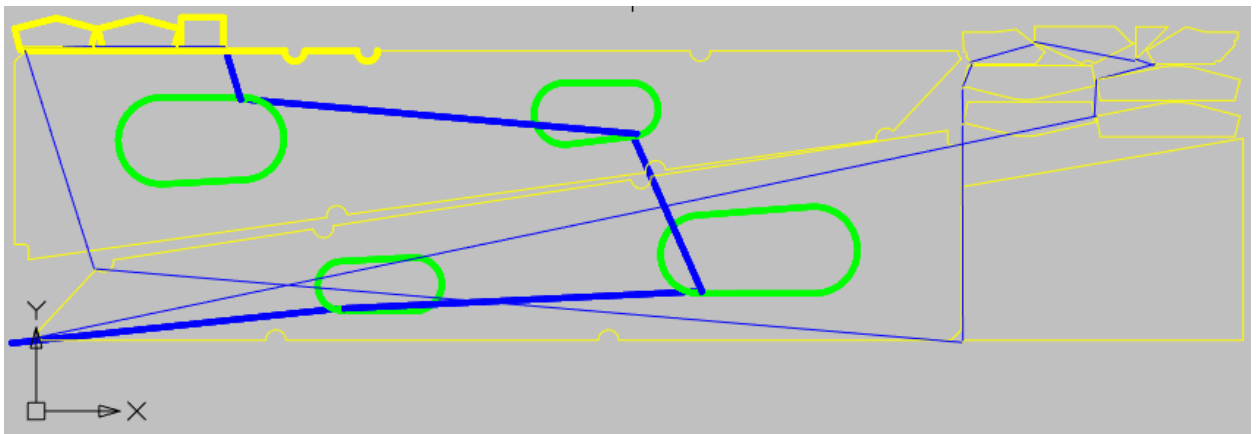
Drawing 94. NC block-by-block viewing

At the moment fixed on dr. 94, starting blocks are output with thicker lines. In command line there are number of processed blocks and total number of blocks (e.g. 56/184).

12.14.3. Command **View NC EIA** is designed for viewig NC in format EIA (G codes). Command opens window **NCP visualization settings EIA** (рис. 95).
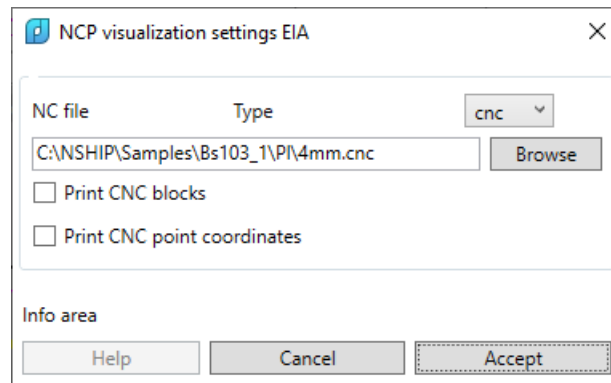
Drawing 95. Dialig box **NCP visualization settings**

Extension cnc is recommended for the field **Type**. Auxiliary parameters are checkboxes **Print CNC blocks** and **Print CNC point coordinates**.

On dr. 96 There is a sample visualization with unchecked boxes.

Drawing 96. Visualization of EIA NC

If check the box **Print CNC point coordinates**, then on screen contour points will be marked with symbol X and ordinal number (dr. 97).
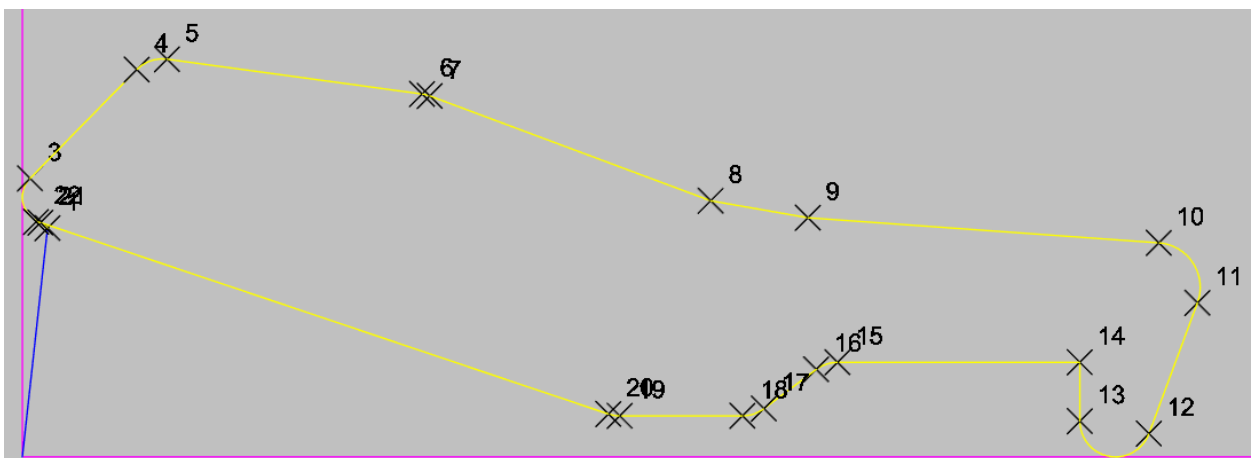
Drawing 97. Visualization of EIA NC with points

Moreover with checked box **Print CNC point coordinates** there will be additional information on CNC segments and point coordinates. Example:

Pt1 line ((0.0 0.0) (28.238 256.328))

G43 Kerf=X1.39

G41 Left kerf compensation

Pt2 line ((28.238 256.328) (20.424 262.569))

Pt3 arc ((20.424 262.569 0.0 0.0 -0.553617) (8.6 312.024)) r=-29.9998

Pt4 line ((8.6 312.024) (128.466 434.032))

Pt5 arc ((128.466 434.032 0.0 0.0 -0.236721) (162.404 445.632)) r=-40.0001

Pt6 line ((162.404 445.632) (448.403 406.632))

Pt7 arc ((448.403 406.632 0.0 0.0 -0.0554103) (456.975 404.478)) r=-39.9999

Pt8 line ((456.975 404.478) (771.998 287.0))

Pt9 line ((771.998 287.0) (880.998 268.0))

……………..

If check box **Print CNC blocks** then blocks text will be additionally output in command line. Example:

1 (ProNest Version 14.0.2.7521)

2 G21

3 G91

4 (CutPro Wizard - Load Material: Mild Steel;1320.997mm x 445.999mm;4.mm)

5 M36 T1

6 M37 T1

7 G00X28.238Y256.328

8 (Seq 1 - ????????? - ???????? ?????? v2)

9 G59 V502 F34

10 G59 V503 F1

11 G59 V504 F80

12 G59 V505 F2

13 G59 V506 F1

14 G59 V507 F52

15 G59 V600 F120.

16 G59 V601 F0.2

17 G59 V602 F200

18 G59 V603 F2.

19 G59 V604 F200.

20 G43X1.39

G43 Kerf=X1.39

21 G41

G41 Left kerf compensation

22 M07 HS

23 M51

24 F4300.

25 G01X-7.814Y6.241

26 G02X-11.824Y49.455I9.576J28.43

27 G01X119.866Y122.008

28 G02X33.938Y11.6I28.534J-28.033

29 G01X285.999Y-39.

……………..

If both boxes are checked then there texts will be output to command line alternately.

This command also requests block-by-block visualization.

12.14.4. Command **RZM+ESS=ESI** unites marking NC (extension rzm) and cutting NC (extension ess) to a single NC file with extension esi.

Here file with extension rzm is requested, and after selection an ess file with the same name is searched. If ess file is found then program unites both of them in a new file with the same name and extension esi.

12.15. Interactive marking

Command **Marking > Interactive marking** is used for marking in the sequence that will be deined by customer in dialog mode.

The variant may be applied for maps with few marking lines. If there is a big number of marking lines then automatic marking must be taken, when program itself creates sequence for marking before parts cutting.

User selects marking lines one by one pointing object after request:

Specify marking line

After selecting all the marking lines user must go to creation of cutting route for parts.

After saving nesting map with route by command **Save map** a marking NC will be formed automatically before cutting NC and written to the folder *PI* of current project_port.

13   Preparation of nesting maps for print

If production workflow if a shipyard requires printing maps in a special scale and with detailed decoration. Maps are to be prepared so that all the data were readable. Corresponding commands are included into submenu **NESTING > Prepare map to print** (dr. 98) and toolbar **Prepare to print** (dr. 99).
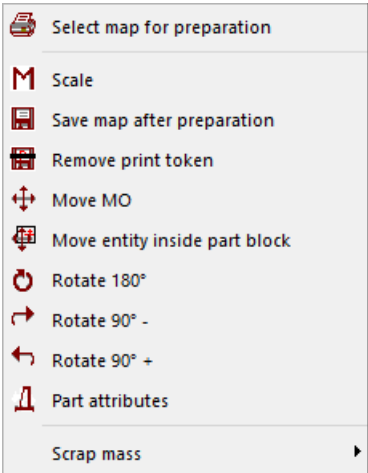
Drawing 98. Submenu **Prepare map to print**

Drawing 99. Toolbar **Prepare to print**

13.1. Select map

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

Command calls dialog box (dr. 100).
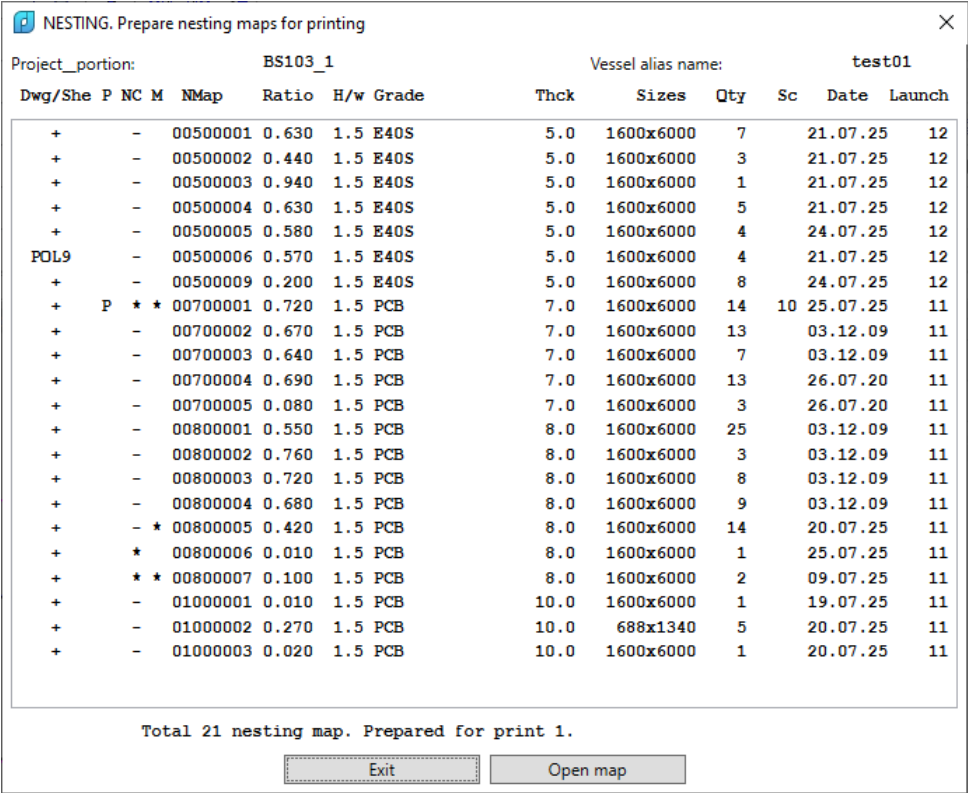
Drawing 100. Window **Prepare nesting maps for printing**

In the window maps that already prepared to print have symbol P in column P. Total number of prepared maps is written in info line. It is necessary to select map with created route (Having route is marked by asterisk in the column M) and press button **Open map**.

Dialog box will be closed and a DWG file of selected map will be opened on screen.

13.2. Scaling

For group scaling texts inside map command **Prepare map to print > Scale** and button ![M] are used. Command calls dialog box **Tuning map decoration for print preparation** (dr. 101).

Drawing 101. Window **Tuning map decoration for print preparation**

User must set general scale for map print (usually 1:10). Next it is necessary to check corresponding boxes of text heght modification and to set view of part labels. After click on button **Apply changes** window will be closed and marked texts will be scaled. In the command line we can see sample messages:

Please wait. Texts are being scaled in the nesting map...

Scaling is finished. Scale is 1:10. Text height is 3 mm.

Height of the nesting map header is 2.6 mm.

13.3.   Change texts inside part blocks

13.3.1. After scaling texts some of them can overlap each other. There are program tools to improve text positions in map (spread, rotate, remove). Specific commands allow editing part block without its exploding. All the commands are cycled therefore to end command it is necessary to press key Esc.

13.3.2. Command **Move MO** (⊕) is used to move objects that are not inside block, for example circle and numbers of part cut sequence. Works similar to editor command MOVE.

Command requests:

Entity outside block:

Pick object to be moved. Program will output coordinates of point in which object was selected.

1 found (2096.9 1024.87 0.0)

Move point:

After specifying new point object will move to it. Next the first request is repeated.

Command **Move entity inside part block** (⊕) is created for moving technological texts that are part/scrap block components but are not references to nested blocks. Request:

Entity inside block of part:

Select text inside part. Selection point will be used as start point of move vector. Program shows coordinates of this point:

(1633.37 430.15 0.0)

Selected entity TEXT inside block 0080000_1

Move point:

Pick point for moving text. Program shows its coordinates:

(1690.22 390.794 0.0)

Text will move to a new position inside block. Request for entities inside block will be repeated.

13.3.3. Three **rotation commands** allow to rotate texts in part block by 90, -90 or 180 degrees.

Command ⟳ rotates text by 180 degrees. Request:

Entity:

Select text inside block. Selection point will be used as base rotation point. Program prints point coordinates:

(1690.22 390.794 0.0)

As a result text will be upturned.

Command ↰ rotates text by 90 degrees counter clockwise. Works similar to the previous rotation command.

Command [icon] rotates text by 90 degrees oclockwise. Similar to previous rotation commnds.

13.3.4. Command **Delete inside block of part** ([icon]) allows to delete txt object from the part block. Request:

Entity (block subentity) for deletion:

Pick object inside block ans it will be removed from block definition. Command is cycled (press end for finish).

13.4. Text with scrap mass

Some production services demand adding to scrap images text with scrap mass. To solve this task submenu **Prepare map to print** has its own submenu **Scrap mass** (dr. 102) and toolbar **Prepare to print** includes buttons in the right part.
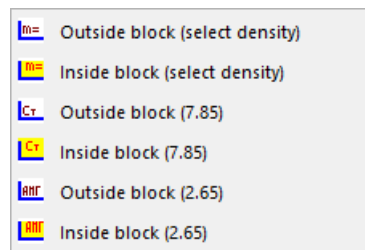
Drawing 102. Submenu **Scrap mass**

Corresponding commands allow quickly insert text with mass of scrap, they are divided into three groups:

- steel scrap (density 7.85 g/cm3);

- AMG scrap (density 2.65);

- scraps of any materials with option of additional setting (enter density, etc.).

Mass text can be created in two forms:

- text included in scrap block definition;

- free text on layer TD and drawn over scrap image, but not included in block definition.

Note. Both forms can improperly interact with the main command of saving map ([icon]). Therefore it is recommended to save sucj a map **only** with special command for saving map prepared to print ([icon]).

Sample mass text for wide scrap of type 0 is shown on dr. 103:

Text always includes MASS =, mass amount in kg, prefix that is tuned (for example, US) and density value in parentheses at the end. In the shown example text is **US MASS = 399.2 kg (7.85)**.

USABLE SCRAP
4540 X 1600
US MASS = 399.2 kg (7.85)
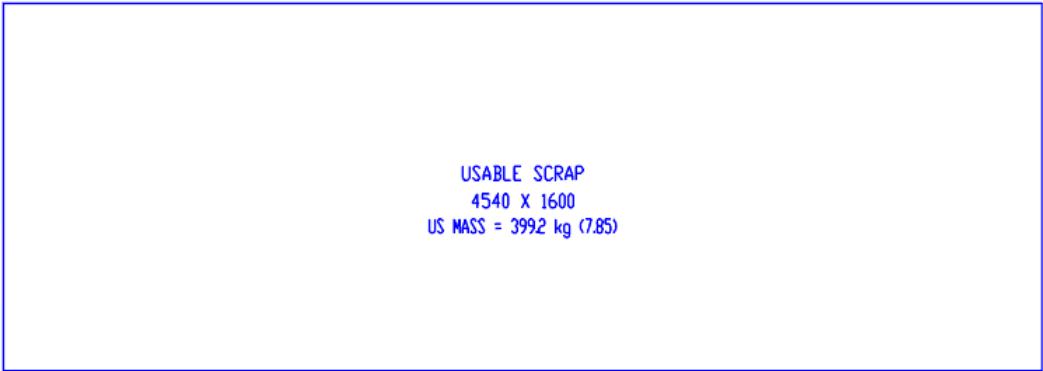
Drawing 103. Additional text with scrap mass

13.5.1. Mass text settings are saved in the file *NSHIP\Ini\np_tm_en.ini* and if possible are applied in the next calculation.

Forming mass text with possibility of editing settings is done with commands **Scrap mass > Outside block (select density)** ( ) and **Scrap mass > Inside block (select density)** ( ). Commands start work with request:

Scrap block:

After object selection (block reference) dialog box **Text with scrap mass** opens (dr. 104).
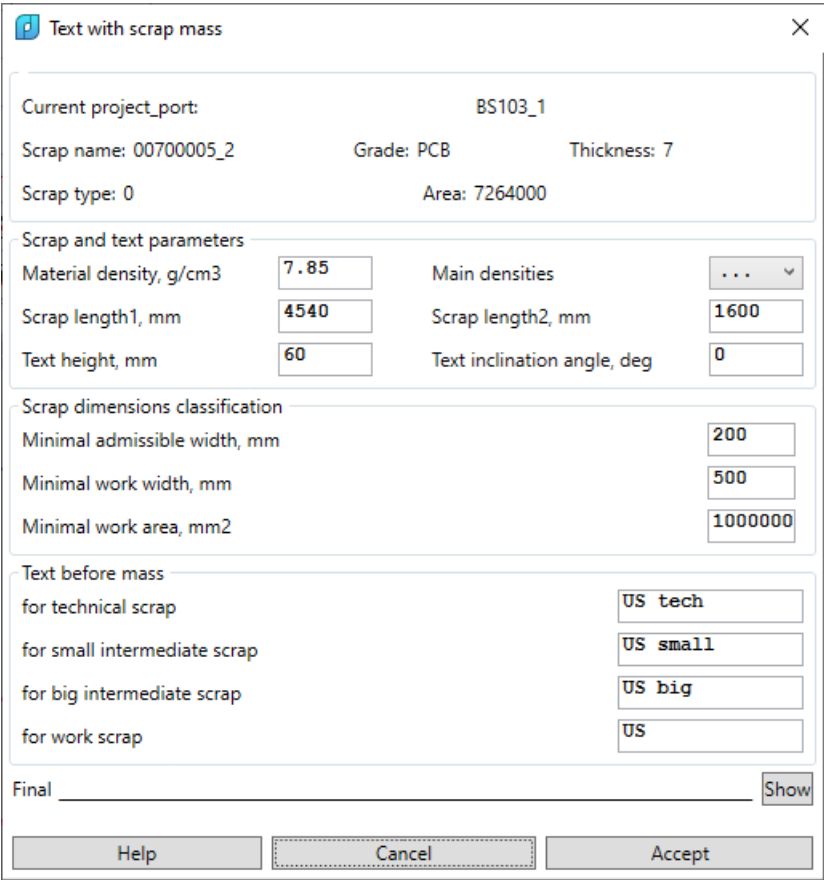
Drawing 104. Window **Text with scrap mass**

In the upper area there are **Current project_port** and basic data of selected scrap (**Scrap name**, **Grade**, **Thickness**, **Scrap type**, **Area**).

Note. Scrap type can be as follows: rectangular of old type (0), rectangular of new type (1), curved (2). Standard version of system uses only type 0.

In the area **Scrap and text parameters** There are horizontal (**Scrap length1, mm**) and vertical (**Scrap length2, mm**) gabarits of scrap and parameters of textual entity (**Text height, mm** and **Text inclination angle, deg**). All of them can be edited, however it is of no sense. But **Material density, g/cm3** is to be changed, if current scrap material has density different from density of previous calculation. Direct editing is possible in the field **Material density, g/cm3** or selection from the list **Main densities**, containing the most popular values included into the program: 7.85, 2.65, 7.50, 2.71, 2.80, 8.85, 8.93, 8.80.

Note. If user wishes to modify contents of the list **Main densities**, then he must edit the first line in the file *Ini\np_tm_en.ini*, preserving its structure: ("7.85" "2.65" "7.50" "2.71" "2.80" "8.85" "8.93" "8.80"). Every value in the list is bounded by double quotes, and list line is framed by parentheses.

Variuos prefixes are available for scraps depending on dimensions. For these cases in the area **Scrap dimensions classification** there are three parameters: **Minimal admissible width, mm**, **Minimal work width, mm** and **Minimal work area, mm2**. All the scraps having width less than the first parameter, (200 on dr.), are treated as **narrow**. Those having width equal to or greater than the second parameter (500 on dr.), are regarded as **wide**.

Note. As scrap **width** program takes the least dimension of scrap rectangle, regardless of orientation (horizontal or vertical).

In the area **Text before mass** there are prefixes that are inserted to the final text before the word MASS. That's why with these settings as on dr. narrow scraps will get **US tech**, and wide ones will get **US**.

Intermediate scraps having 200 <= width < 500 are divided into **small intermedate** and **big intermediate**, depending on area. Small intermediate scraps have area (in sq. mm) less than value in the field **Minimal work area, mm2** (1000000 on dr.). Prefix value for scrap mass of these types is given in **for small intermediate scrap** and **for big intermediate scrap**.

13.5.2. For steel scraps with the most **popular** density 7.85 there are quick commands **Scrap mass > Outside block (7.85)** ( ) and **Scrap mass > Inside block (7.85)** ( ).

13.5.3. Two quick commands for AMG material with density 2.65 are implemented: **Scrap mass > Outside block (2.65)** ( ) and **Scrap mass > Inside block (2.65)** ( ).

13.5.   Additional dimensions

Commands (horizontal) and (vertical) allow adding dimensions to map drawing.

13.6. Save map after preparation

After preparation to print map should be rewriten in DB, with appending token of print readiness and printing scale.

Command **Save map after preparation** (🖫) writes token of print readiness and printing scale with the following messages in command line:

Saving map 00900001, print scale=10.

Saved map 00900001.

Before saving map drawing must be open in nanoCAD and on screen.

13.7. Remove print preparation token from the map

If it is necessary to remove token of print readiness from the map then use command **Remove print token** (🖬). Map must not be open on screen.

Command opens window **Clean nesting map preparation for printing feature** (dr. 105).

Clean nesting map preparation for printing feature

Project_portion:			BS103_1			Vessel alias name:			test01	
Dwg/She P NC M	NMap	Ratio	H/w Grade	Thck	Sizes	Qty	Sc	Date	Launch
+	−	00500001	0.630	1.5 E40S	5.0	1600x6000	7		21.07.25	12
+	−	00500002	0.440	1.5 E40S	5.0	1600x6000	3		21.07.25	12
+	−	00500003	0.940	1.5 E40S	5.0	1600x6000	1		21.07.25	12
+	−	00500004	0.630	1.5 E40S	5.0	1600x6000	5		21.07.25	12
+	−	00500005	0.580	1.5 E40S	5.0	1600x6000	4		24.07.25	12
POL9	−	00500006	0.570	1.5 E40S	5.0	1600x6000	4		21.07.25	12
+	−	00500009	0.200	1.5 E40S	5.0	1600x6000	8		24.07.25	12
+ P ★ ★	00700001	0.720	1.5 PCB	7.0	1600x6000	14	10	25.07.25	11
+	−	00700002	0.670	1.5 PCB	7.0	1600x6000	13		03.12.09	11
+	−	00700003	0.640	1.5 PCB	7.0	1600x6000	7		03.12.09	11
+	−	00700004	0.690	1.5 PCB	7.0	1600x6000	13		26.07.20	11
+	−	00700005	0.080	1.5 PCB	7.0	1600x6000	3		26.07.20	11
+	−	00800001	0.550	1.5 PCB	8.0	1600x6000	25		03.12.09	11
+	−	00800002	0.760	1.5 PCB	8.0	1600x6000	3		03.12.09	11
+	−	00800003	0.720	1.5 PCB	8.0	1600x6000	8		03.12.09	11
+	−	00800004	0.680	1.5 PCB	8.0	1600x6000	9		03.12.09	11
+	− ★	00800005	0.420	1.5 PCB	8.0	1600x6000	14		20.07.25	11
+	★	00800006	0.010	1.5 PCB	8.0	1600x6000	1		25.07.25	11
+ P ★ ★	00800007	0.100	1.5 PCB	8.0	1600x6000	2	10	09.07.25	11
+	−	01000001	0.010	1.5 PCB	10.0	1600x6000	1		19.07.25	11
+	−	01000002	0.270	1.5 PCB	10.0	688x1340	5		20.07.25	11
+	−	01000003	0.020	1.5 PCB	10.0	1600x6000	1		20.07.25	11

Total 21 nesting map. Prepared for print 2.

Exit   Clean feature

Drawing 105. Window **Clean nesting map preparation for printing feature**

For cleaning map user must act one by one: select map in the window and press nutton **Clean feature**. There will be amessage in command line, for example:

In the map 00900001 print feature was cleaned.

To finish command click on button **Exit**.

14   Work with usable scraps

Free zones of sheet nesting maps can be classified as usable scraps, on which user can create new nesting maps. Remainders left after nesting profile also can be treated as scraps. Sheet scraps data are kept in the table otxod.dbf, profile scraps data in otxodpr.dbf.

The system works with 3 scrap types: 0, standard rectangular (without attributes); 1, rectangular with attributes; 2, curved with attributes. There are two modes: standard (default) mode uses only type 0, curved scraps mode deals with types 1 and 2 (see ch. 15).

14.1.   Create rectangular usable scrap of type 0

Usable scrap is a special object (mostly 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 of metal sheets. Automatic nesting creates usable scraps itself with sizes not less than predefined. In the interactive nesting mode customer can create scraps himself.

Attention! Creation of usable scrap is possible only while editing **named (earlier saved) sheet map**, because map name will be included into scrap name. If condition of map name presence is not fulfilled then a message is generated:

Cannot create usable scrap in the map, that was never saved.

Save nesting map and put it on shelf for editing.

Nesting maps can be created not only on standard raw sheets but on usable scraps too. Map on scrap is called **child**, and map having scrap with child map on it is called **parent**.

For creating usable scrap of type 0 there is command **Usable scrap type 0** of submenu **Placement** and button of toolbars **Placement** and **Scrap**.

Creation of scrap having type 0 (old type) is possible when there is set scrap mode without attributes (see ch. 15). If mode os scraps with attributes is active then after command start a request to cancel operation appears (dr. 106).
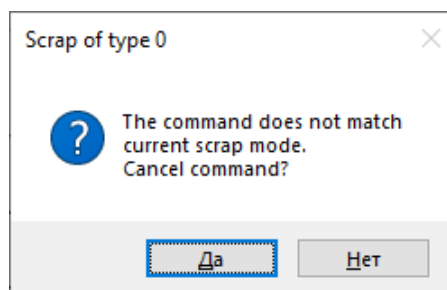
Drawing 106. Request to cancel creation of scrap type 0

Reply **Yes** (Да) stops command, **No** (Нет) continues creation.

Next there are requests for picking two diagonal points defining rectangle to become new usable scrap:

First point of rectangular scrap [eXit]:

Pick first corner point.

Second point of rectangular scrap [eXit]:

After second point program creates blue rectangle of new usable scrap with gabarits (dr. 107).
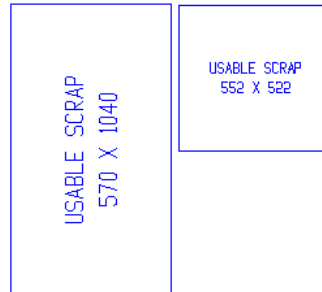
Drawing 107. Sample usable scraps of type 0

Program controls scrap position and does not allow to pick corner points outside of sheet.

If user saves map with scraps then scrap parameters will be written to the table otxod.dbf. Scrap object is created as block on layer TD, with the name containing map name, for example: 00500010_1. Scrap number is located in the block name after underscore symbol.

Free scrap on the illustration has type 0 and two inscriptions with text **USABLE SCRAP** and gabarit sizes, e.g. **1777 X 641**.

In the inscription the first gabarit is horizontal and the second one is vertical.

Note. Scrap block can be expanded by text with mass and metal density. Corresponding commands are discussed in the chapter **Preparation of nesting maps for print**.

14.2. Delete usable scrap

To delete unnested scrap from nesting map use command **Placement > Remove** or button of toolbars **Placement** and **Scrap**. The first request:

Select scrap blocks to be removed from the map:

Select objects

It is necessary to select usable scraps and press Enter. Program verifies selection and does not allow to delete objects different from scraps:

Selected 3 objects. Analysis of selection.

Object 1. LWPOLYLINE skipped.

*Object 2. **Block 00500010_1 removed**.*

Object 3. Block 1310239 skipped.

Next user is recommended to save map:

Save map 00500010 to run deletion from the scrap table.

Scrap cannot be deleted if on it a child map was already created.

14.3. Maps on scraps

Scraps table of DB contains not only scraps data but names of child maps located in scraps too. If parent map with scrap having child map is put on shelf for correction then such a scrap changes its color to red (dr. 108).
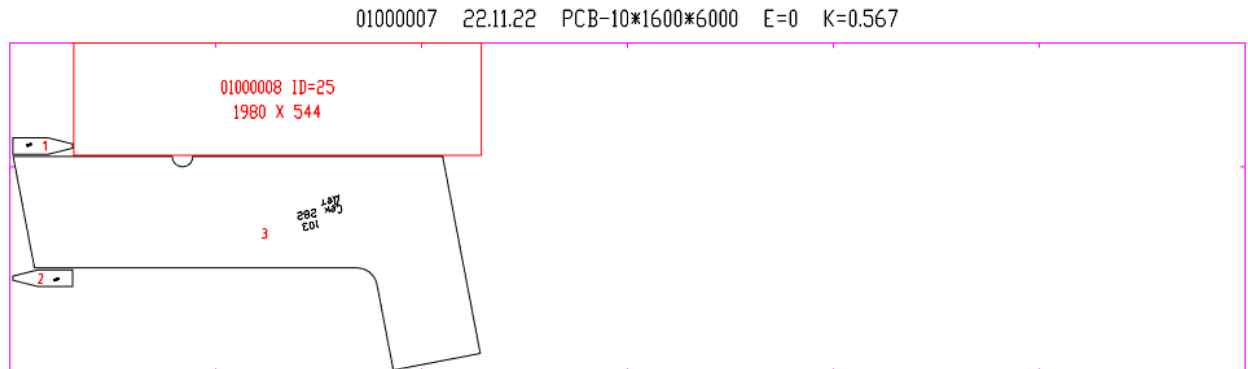
Drawing 108. Parent map with nested usable scrap

In occupied scrap the first inscription is replaced with number of child map and ID from scraps table. For example: **01000008 ID=25**, where 01000008 is a name of child map located on usable scrap, and 25 is a scrap ID. ID is an identifier (address) of scrap in the otxod.dbf table.

If there will be an attempt to delete scrap with child map from parent map, then a message will be generated to start with deletion of child map form DB.

After deletion of child map (on scrap) from DB the scrap becomes free for reuse or for removal. If user puts parent map afterwards on shelf for editing then elements of freed scrap will change their color from red to blue and the first inscription will return text **USABLE SCRAP**.

14.4. Profile scraps

Data of profile scraps available for reuse are formed as a result of automatic nesting profile JNG and are stored in the file otxodpr.dbf.

15   Additional types of sheet scraps

Toolbar **Scrap** (dr. 109) and submenu **NESTING > Scrap** (dr. 110) are included into configuration of module **Nesting**, permitting switch on/off mode of using scraps with attributes (among them curved scraps).
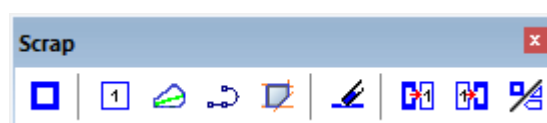
Drawing 109. Toolbar **Scrap**
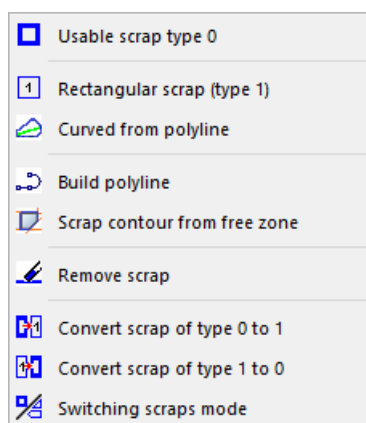
Рис. 110. Подменю **Отход**

15.1. Sheet scrap types

Standard scrap type is 0 (described in the previous chapter). Two types were added to the system for possibility to work with nonrectangular scraps: 2 (curved, with attribures) and 1 (rectangular, with attributes). Samples are shown on dr. 111 and 112.

Drawing 111. Sample rectangular scrap of type 1

Drawing 112. Sample curved scrap (type 2)

Decoration of these scraps differs from scraps of type 0 by presence of three textual attributes.

Notes. Scrap blocks can be extended by mass text. It is not a block attribute.

The first two attributes of the scrap just after creation get standard values **FREE** and **SCRAP ID=0**. The third attribute get value from gabarits of rectangular contour for type 1, and gabarits of bounding rectangular box for type 2 (e.g. **(1383 X 2024)**) when the bounding box is built with sides parallel to green base line and normal to it (the least gabarit is written as first).

After saving map the scrap data are written into otxod.dbf and scrap receives numeric ID, its value (N) is inserted into attribute with text **SCRAP ID=N**. After creation of child map on the scrap the value of attribute with text **FREE** is replaced by the child map name.

15.2. Manage the mode of scraps with attributes

System provides two scrap modes: standard (priority to type 0, without attributes) and curved (priority to types 1 and 2, with attributes). In both modes all the foubd scrap types are processed, but if scraps of nonpriority types are found then system suggests to convert them.

Management of scrap mode is run by command **NESTING > Scrap > Switching scraps mode** or by button of toolbar **Scrap**. Button opens dialog box **Switching scraps mode** (dr. 113).
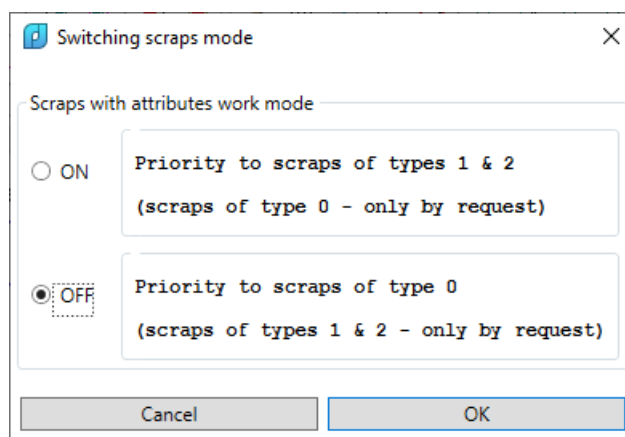
Drawing 113. Window **Switching scraps mode**

In the standard mode режиме (set switch **OFF**) priority is given to scraps without attributes. After setting switch **ON** priority is set to scraps with attributes (in particular, assures work with curved scraps).

On pressing button **OK** selected mode is saved to settings (file *NSHIP\Ini\sccur.ini*).

15.3. Create scrap of type 1 (rectangular)

It is done by menu command **NESTING > Scrap > Rectangular scrap (type 1)** ( ).

Creating scrap of type 1 supposes that there is set mode of scraps with attributes. If mode without attributes is active then priority is type 0. Therefore after start of command there opens suggestion on cancelling operation (рис. 114).
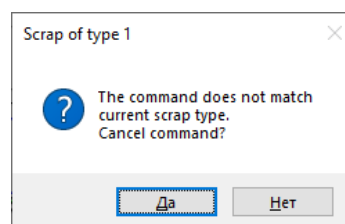
Drawing 114. Request to cancel creation of scrap type 1

Reply **Yes** cancels command, **No** continues building.

Command dialog:

Scraps: ("00700005_4" "00700005_3" "00700005_2")

Maximal scrap number in this map - 4

Building rectangular usable scrap by two points...

First corner of rectangular scrap <exit>:

Second corner <exit>:

First of all program gets list of existing scraps, calculates maximal number and assigns number of new scrap as 1 greater. Next there are requested two points defining scrap dimensions and new scrap is created.

Before saving map in DB new scrap ID gets value 0.

15.4. Create scrap of type 2 (curved) from prepared polyline

Outer contour of curved scrap must be twodimensional closed object of type LWPOLYLINE, drawn inside free area of sheet map. Example is on dr. 115.
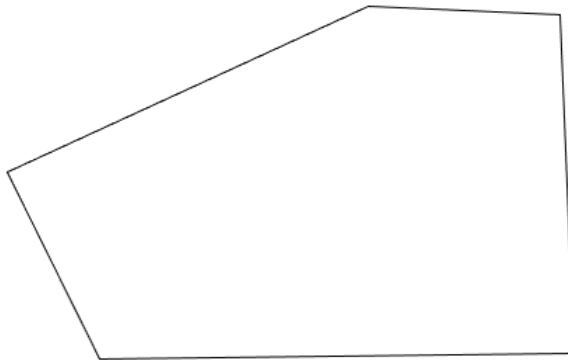
Drawing 115. Closed polyline

The first way of creating closed polyline is to use command **Scrap > Build polyline** or button of toolbar **Scrap**. nanoCAD command PLINE is applicable too. Polyline can contain straight line and arc segments.

Next step is to convert polyline to scrap of type 2, with the help of menu command **Curved from polyline** ( ). Sample requests and replies:

Scraps: ("01200007_5" "01200007_4" "01200007_3" "01200007_2")

Maximal scrap number in this map - 5

Select closed two-dimensional polyline to be the outer contour of the reusable scrap:

1 found

Closed LWPOLYLINE was selected.

Base point of reference line (on the scrap contour):

Reference line is an orientation line (green dashed segment), by which curved scrap will be positioned on neting place before launching cutting NC program. Next:

94

Second point of reference line:

At the ends of orientation line there are drawn markers-arrows of two types to distinguish first and second points. At the beginning messages on type and coordinates of the first end marker:

Marker type:

1

Marker vertex:

(944.6,275.8)

Next requests group is devoted to defining marker size and its orientation. User should give replies moving cursor with dynamic marker and making mouse left clicks. For end points object snap is activated.

Marker axis location:

(1086.9,526.0)

Arrow length:

247.9

Arrow halfwidth:

44.1

Rotation angle (by point):

250.0 deg.

The first marker is being built of three lines with common vertex. Similar group of requests is for the second marker:

Marker type:

2

Marker vertex:

(2558.3,1477.5)

Marker axis location:

(2499.5,1301.0)

Arrow length:

195.8

Arrow halfwidth:

41.3

Rotation angle (by point):

73.8 deg.

The second marker is being built of four lines and looks like ordinary arrow. After that three textual attributes parallel to reference line (dr. 116).

Further value **FREE** of the first attribute will be replaced by the name of child nesting map, created on this scrap, and in the seond attribute value 0 will be replaced by scrap ID generated after saving parent map into DB.
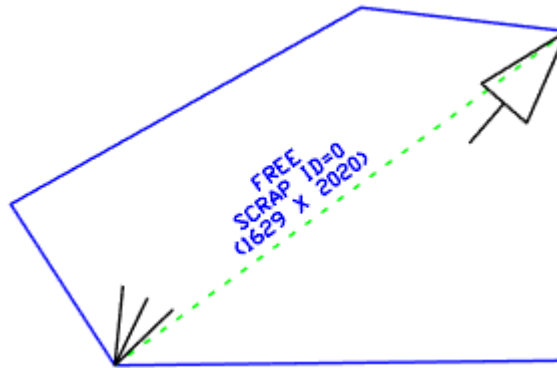
Drawing 116. Result of building curved scrap

15.5. Create scrap of type 2 (curved) from free zone

The second way of creating polyline for curved scrap contour is command **Scrap contour of free zone** ( ).

Here is a sample map having free zone for curved scrap (its fragment is on dr. 117):
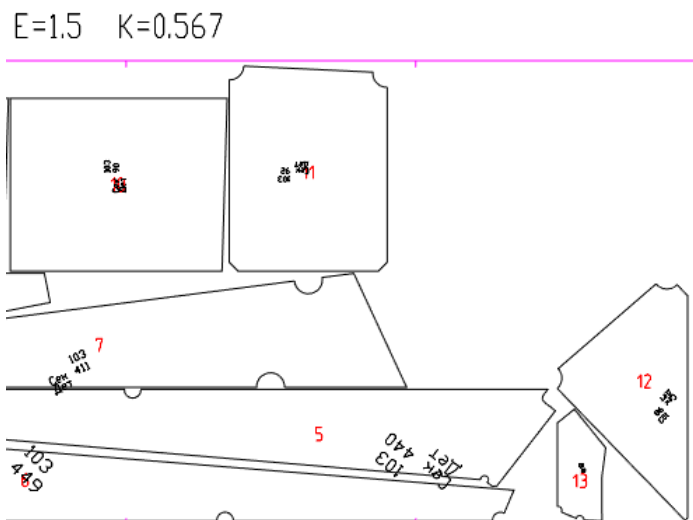
Drawing 117. Map with free zone

Scrap contour will consist of part contours, raw sheet contour and lines of additional cuts between parts (for closing contour). Cut lines must be accompanied with parallel lines at distance of kerf halfwidth.

Sample messages and requests of command:

Creating closed polyline in free zone for usable scrap boundary. You will need to select objects needed for construction (sheet, parts and auxiliary cuts).

Distance for parallelity (kerf width) <3>: 3

Select parts to which parallel lines should be created at a distance of kerf width <none>:

You need to point the parts whose contours will be used in the boundary of the new scrap.

Select objects

1 found

Select objects

1 found

Select objects

1 found

Select objects

1 found

Select objects

End of selection is pressing Enter. On dr. 118 four parts participating in forming free zone are highlighted.

Drawing 118. Parts bounding free zone

Selected parts: 4.

Add more parts? [Y/N] <N>: N

Going to creating lines parallel to outer contours of selected parts.

After selection marked parts temporarily change color to green. Next stage is selection of fragment of magenta metal sheet to be included into contour of new scrap.

Going to metal sheet contour selection (if contour is needed for scrap geometry).

Select metal sheet block <none>:

Select objects

1 found

As objects (parts and metal sheet), participating in creation of new contour, are isolated one from another (do not intersect), so there are needed straight line for auxiliary cuts, to fill gaps.

Going to creating cut lines and parallels to them. It is preferable to enter draft lines for cuts something longer.

First point <exit>:

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Second point <exit>:

Select side for offset to the draft line for cut:

For each auxiliary cut lines it is necessary to pick two points and side to which cut will be offsetted (dr. 119).
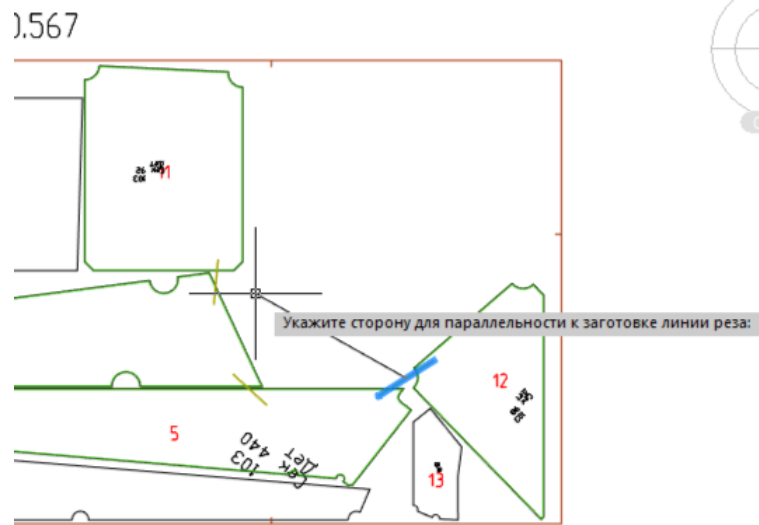
Drawing 119. Selection of side for parallelity to auxiliary cut line

Auxiliary cuts have dark green color. Side of parallelity is to be shown with point inside free zone. End of input auxiliary lines is Enter instead of the first cut point.

Next step is to pick points inside free zone for proper boundary construction in nanoCAD command BOUNDARY.

Point round which nanoCAD is to calculate complex scrap contour <to build manually>:

See. dr. 120.
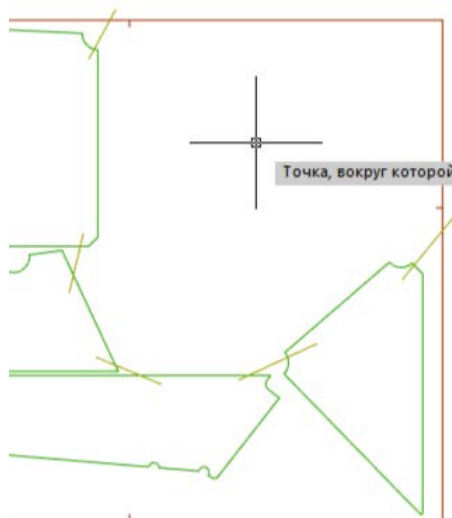
Drawing 120. Pick point inside free zone

Contour for complex scrap has been created. Check it for correctness.

Remove intermediate objects? [Y/N] <Y>: Y

User must visually estimate validity of contour and confirm deletion of intermediate construction lines (dr. 121).
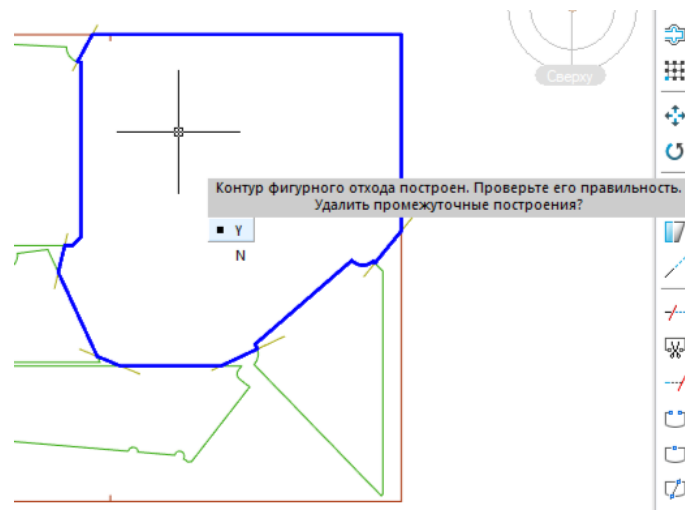
Drawing 121. Visual verification of figure scrap contour

Reply **Y** agrees with result and deletes all unnecessary objects.

Is it necessary to run Undo? Y/N] <N>: N

Reject (**N**) finishes command (dr. 122).

In the final step user must convert polyline to scrap of type 2 (![icon]( )).
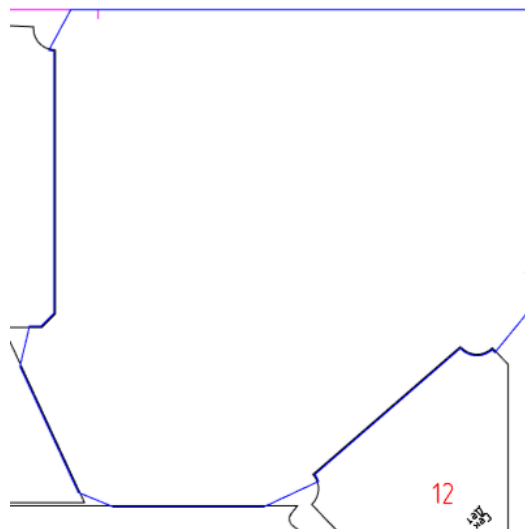
Drawing 122. Generated contour

15.6. Change scrap type (0 and 1)

As rectangular scraps of types 0 and 1 are close and differ only in decoration, then in submenu **Scrap** There are commands for conversion of one type to another: **Convert scrap of type 0 to 1** (![icon]( )),**Convert scrap of type 1 to 0** (![icon]( )).

Work of these command is pretty obvious. The second command also deals with scraps of type 2 (curved) replacing to rectangular scraps of type 0 described around outer contour.

15.7. Add scrap mass text (for types 1 and 2)

It is possible to add mass text to scraps of type 1 and 2, using the same commands of adding mass text to scraps of type 0. Sample scraps are on dr. 123.
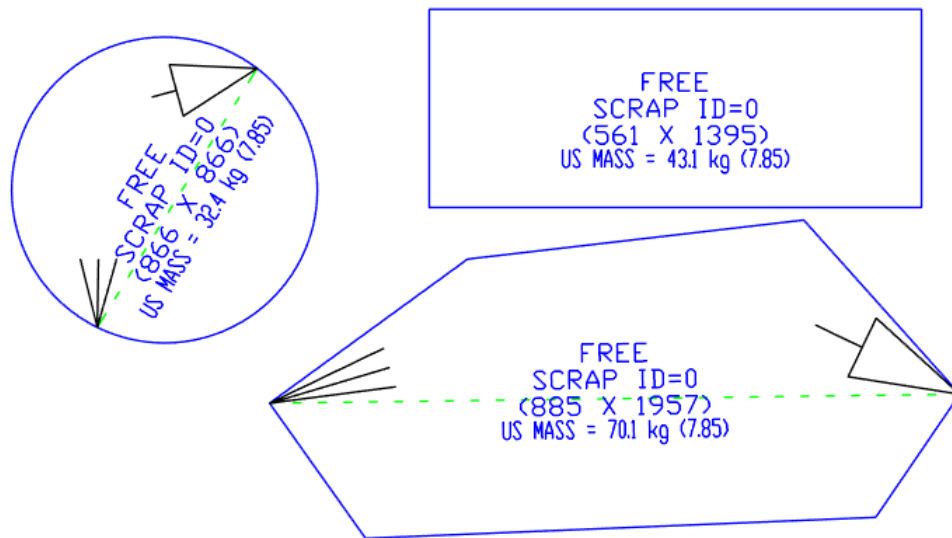
Drawing 123. Sample scraps of type 1 and 2 with mass texts

16 TNCs for nesting maps

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

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

16.1. Forms 102 and 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. 124, sample form 103 is shown on dr. 125.

Drawing 124. Sample form 102 of nesting map TNC

Drawing 125. Sample form 103 of nesting map TNC

16.2.   Output of TNC

Command **NESTING > Create TNC (forms 102-103)** calls dialog box **Select map DWG file** (dr. 126). Dialog displays list of existing DWG files for nesting maps of subfolder *Karty* of the current project_port.
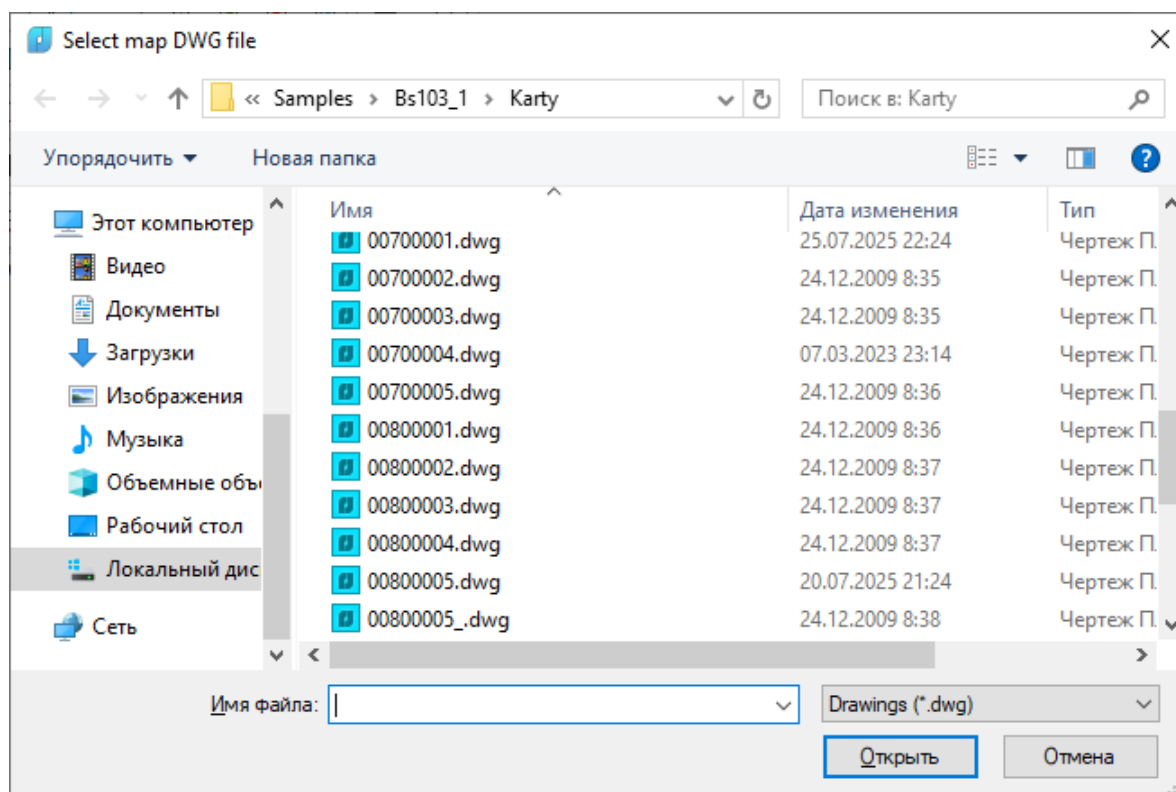
Drawing 126. Window **Select map DWG file**

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

Next messages in the command line:

Selected: "D:\NSHIP\\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 project_port.

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

16.3.   Detailed TNC

One more command is **NESTING > Detailed TNC (f. 102-103)**. It provides opportunity to display inside nesting map in TNC full decoration of parts, including designations of allowances, chamfers, bevels, etc. Moreover you can see source lines of part outer and inner contours with offset by halfwidth of cut. On dr. 127 there is a sample result of command execution.

17   Nesting of profile metal

Module **Nesting** has program of automatic nesting for profile. Creating joint nesting group (JNG) for profile metal is an obligatory step before nesting and it was described earlier.

MATERIAL			NESTING MAP \ 00500009						USABLE SCRAPS pc.			
									DIMENSIONS mm	NN NUMBER SCRAPS	DIMENSIONS mm	NN NUMBER SCRAPS	
CODE	00524358079		MASS kg										
GRADE	E40S	NO. OF SHEETS	SHEET	PARTS IN MAP	NESTING RATIO	LENGTH CUT m	LENGTH JUMPS m	HALFWIDTH CUT mm	NO. OF PIERCES				
STANDARD	ГОСТ19903-74												
SHEET SIZE mm	5x1600x6000		377 kg	213.4 kg	0.581	37.29	12.58	1.5	11				

N SEQ.	DRAW NUMBER	PART POS.	QUANTITY IN PLATE		SECTION	HANDLING ROUTE NUMBERS	N SEQ.	DRAW NUMBER	PART POS.	QUANTITY IN PLATE		SECTION	HANDLING ROUTE NUMBERS
			PC.	MASS						PC.	MASS		
1	BS103-112.03-010	1005	1	76.64	131	2							
2	BS103-112.03-010	773	1	12.16	131	1							
3	BS103-112.03-010	668	1	12.38	131	5							
4	BS103-112.03-010	1156	1	10.52	131	6							
5	BS103-112.03-010	631	1	12.80	131	7							
6	BS103-112.03-010	842	1	10.31	131	4							
7	BS103-112.03-010	885	1	78.56	131	3							

CREATED		VERIFIED									Sheet
Карпушкина Н.Г.				Ch.	Sheet	Document No.	Signature	31.08.25 Date			1

Drawing 127. Sample detailed TNC for nesting map

17.1. Send profile JNG to nesting

To create profile JNG use menu command **NESTING > Create JNG (profile)** or button ⬜ of toolbar **JNG**.

Note. Before nesting there must be entered cutting parameters for required material grade and profile type.

Button **Nesting** of dialog box **Dispatcher of joint nesting groups** is used for sending profile JNG to nesting. Window **Select billets, scraps for prohile JNG** (dr. 128).

In the upper zone of window there are values **JNG** (number), **Material grade**, **Profile type**. Under them the full name of current profile scraps file otxodpr.dbf is given for help (it is different from otxod.dbf with sheet scraps), cutting parameters, tolerance.

At the initial moment button **Accept** is locked in the window.

List **Billets** gets those billets (raw profiles), that were entered as materials of selected grade and profile type in module **Bdata**. Profile billet string has the following sample view: **sht 6000 200 00309453074**. Components of the string:

sht — type (sht for billet, scr for scrap),

6000 — billet length,

200 — quantity of billets of current length and material (default is 200);

Drawing 128. Window **Select billets, scraps for prohile JNG**

00309453074 — material code (up to 11 symbols), helps to distinguish billets of the same length and grade but with different properties.

List **Scraps** displays only those free scraps that fit by material grade and profile type. Sample string:**scr [BS103_1] [test01] P0000029_1 A40S 7 L=147 76**. Its components:

scr — type (sht for billet, scr for scrap),

BS103_1 — name of project_port, from which scrap has come,

test01 — vessel (alias) name for the order from which scrap has come,

P0000029_1 — scrap name (here: scrap 1 in map P0000029),

A40S — material grade,

7 — profile type,

L=147 — scrap length,

76 — ID (address) of scrap in scraps table of DB.

In the window **Select billets, scraps for prohile JNG** it is necessary to select billets and scraps that will be used in JNG nesting. Selected is done with mouse left click on line in the lists **Billets** and **Scraps**. Selected object is copied to the list **Selected for JNG**. Objects must be placed by descending priority of nesting (maximal priority is for the most top object in the list **Se-**

lected for JNG). Sample selection is shown on dr. 129.

Drawing 129. Selection of billets and scraps for profile nesting is done

List of selected objects can be edited with right buttons that will be activated after click on object in **Selected for JNG**.

Order of selected objects (billets/scraps) can be edited with buttons **Up** and **Gown**, they move marked object one position up or down. With button **Delete** user can remove object that was included by error. For marked object there are displayed parameters: **Length (5)**, **Number (3)**.

Digits in brackets show number of maximal permitted symbols in values while editing. Moreover, length cannot be greater than 50000 mm. **Number** for billets must not exceed 200, and for scraps it is always equal to 1.

Edited values replace corresponding parameters in the left list **Selected for JNG** after pressing button **Replace**, but they are not written to DB, they are used only in current task for nesting JNG. For example, number of billets may be changed from 200 to 2, if is required by production situation. With the use of editing one can define billet with length that was not previously inserted into materials table of DB.

After finish of processing list of selected billets and scraps it is necessary to press button

Accept. Button **Cancel** cancel procedure of nesting JNG.

By button **Accept** window is closed and nesting task is being created. It is written to text file PRGSR_DET.TXT (dr. 130).
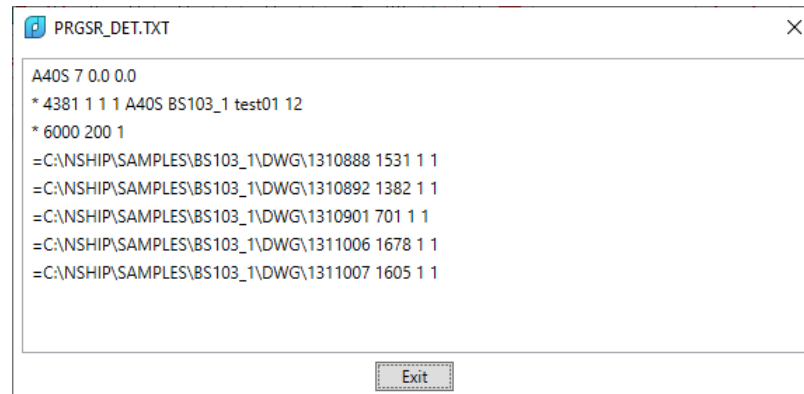
Drawing 130. Nesting task in the file PRGSR_DET.TXT

Befor launching immediate nesting process program verifies JNG start map name for existence of maps with similar names in DB. Moreover searches maps with the same prefix and big numbers because they can be overwritten in case of generating several maps for one calculation. A warning **Danger of destroying nesting maps** is generated (dr. 131).
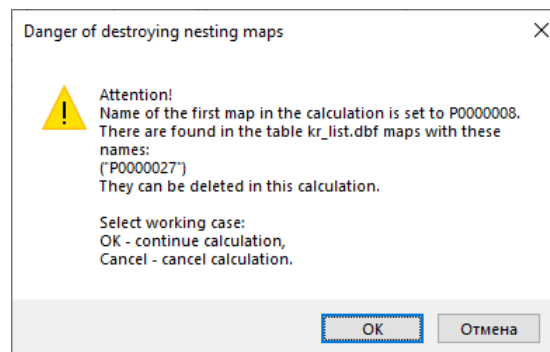
Drawing 131. Warning **Danger of destroying nesting maps**

If there is a real risk of destroying existant nesting maps then click **Cancel** and in **Dispatcher of joint nesting maps** change start number to more safe. Pressing **OK** in window **Danger of destroying nesting maps** launches program of automatic nesting profile metal according to prepared task.

17.2. Profile nesting results

Automatic nesting program itself writes maps to DB. On finish there is a suggestion to save Excel worksheet with calculation results (dr. 132).
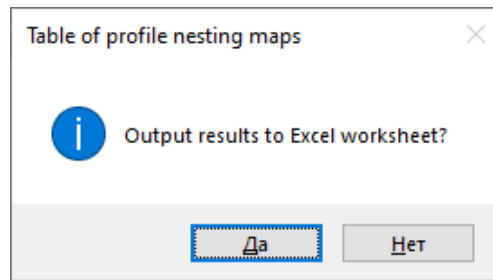
Drawing 132. Request for putting results in Excel table

After positive reply in subfolder *Doc* of current project_port folder there will be created Excel file with name _Profile_nesting_maps_list_, appending prefix of project_port (project_portion) and vessel name, as well as suffix with number by one greater than maximal number of existing files *_Profile_nesting_maps_list_*.xls. For example:

BS103_1_test01_Profile_nesting_maps_list_4.xls

Full listing with calculation results is output to command line. Here is sample listing:

Management of joint nesting groups...

Select billets and scraps for JNG 82...

Scrap ID=16 was marked as TAKEN.

Forming task for nesting selected parts...

Calculated 10 nesting maps (profile 7). Cutting width=12, Tolerance=100.

Billet sequential No., map name, nested parts (length + DWG name + KDRAW + position):

0: P0000035 ((2098 "1310326" "2" "326") (1802 "1310480" "2" "480"))

scrap 199 (4123 IDp=16)

1: P0000036 ((1946 "1310251" "2" "251") (1802 "1310560" "2" "560") (1753 "1310562" "2" "562"))

scrap 463 (6000)

2: P0000037 ((1678 "1310886" "2" "886") (1678 "1311006" "2" "1006") (1619 "1310210" "2" "210") (874 "1311064" "2" "1064"))

scrap 103 (6000)

3: P0000038 ((1619 "1310210" "2" "210") (1619 "1310210" "2" "210") (1619 "1310210" "2" "210") (878 "1310899" "2" "899"))

scrap 217 (6000)

4: P0000039 ((1605 "1310887" "2" "887") (1605 "1311007" "2" "1007") (1552 "1311053" "2" "1053") (874 "1311084" "2" "1084"))

scrap 316 (6000)

5: P0000040 ((1552 "1311073" "2" "1073") (1545 "1310582" "2" "582") (1531 "1310888" "2" "888") (1166 "1310462" "2" "462"))

scrap 158 (6000)

6: P0000041 ((1492 "1310584" "2" "584") (1492 "1310504" "2" "504") (1382 "1311012" "2" "1012") (1355 "1310891" "2" "891"))

scrap 231 (6000)

7: P0000042 ((1355 "1311011" "2" "1011") (1339 "1311079" "2" "1079") (1317 "1311058" "2" "1058") (1166 "1310541" "2" "541") (532 "1311087" "2" "1087"))

scrap 231 (6000)

8: P0000043 ((1166 "1310540" "2" "540") (830 "1310233" "2" "233") (800 "1310900" "2" "900") (800 "1311020" "2" "1020") (794 "1311085" "2" "1085") (761 "1310439" "2" "439") (507 "1310565" "2" "565"))

scrap 258 (6000)

9: P0000044 ((761 "1310519" "2" "519") (755 "1310284" "2" "284") (741 "1310858" "2" "858") (736 "1310259" "2" "259") (697 "1311086" "2" "1086") (507 "1310485" "2" "485") (365 "1310566" "2" "566") (365 "1310486" "2" "486"))

scrap 977 (6000)

Nesting map P0000035 saved to kr_list.dbf.

List of parts for nesting map P0000035 saved to det_zak.dbf.

Scrap ID=16 marked as nested.

Scrap of nesting map P0000035 (BS103_1, order_from=test01, launch_from=11) saved in otxodpr.dbf with ID=24.

Nesting map P0000036 saved to kr_list.dbf.

List of parts for nesting map P0000036 saved to det_zak.dbf.

Scrap of nesting map P0000036 (BS103_1, order_from=test01, launch_from=11) saved in otxodpr.dbf with ID=25.

Nesting map P0000037 saved to kr_list.dbf.

List of parts for nesting map P0000037 saved to det_zak.dbf.

Scrap of nesting map P0000037 (BS103_1, order_from=test01, launch_from=11) saved in otxodpr.dbf with ID=26.

Nesting map P0000038 saved to kr_list.dbf.

List of parts for nesting map P0000038 saved to det_zak.dbf.

Scrap of nesting map P0000038 (BS103_1, order_from=test01, launch_from=11) saved in otxodpr.dbf with ID=27.

Nesting map P0000039 saved to kr_list.dbf.

List of parts for nesting map P0000039 saved to det_zak.dbf.

Scrap of nesting map P0000039 (BS103_1, order_from=test01, launch_from=11) saved in otxodpr.dbf with ID=28.

Nesting map P0000040 saved to kr_list.dbf.

List of parts for nesting map P0000040 saved to det_zak.dbf.

Scrap of nesting map P0000040 (BS103_1, order_from=test01, launch_from=11) saved

in otxodpr.dbf with ID=29.

Nesting map P0000041 saved to kr_list.dbf.

List of parts for nesting map P0000041 saved to det_zak.dbf.

Scrap of nesting map P0000041 (BS103_1, order_from=test01, launch_from=11) saved in otxodpr.dbf with ID=30.

Nesting map P0000042 saved to kr_list.dbf.

List of parts for nesting map P0000042 saved to det_zak.dbf.

Scrap of nesting map P0000042 (BS103_1, order_from=test01, launch_from=11) saved in otxodpr.dbf with ID=31.

Nesting map P0000043 saved to kr_list.dbf.

List of parts for nesting map P0000043 saved to det_zak.dbf.

Scrap of nesting map P0000043 (BS103_1, order_from=test01, launch_from=11) saved in otxodpr.dbf with ID=32.

Nesting map P0000044 saved to kr_list.dbf.

List of parts for nesting map P0000044 saved to det_zak.dbf.

Scrap of nesting map P0000044 (BS103_1, order_from=test01, launch_from=11) saved in otxodpr.dbf with ID=33.

Summary of processing JNG 82 (45 parts):

created maps = 10

nested parts = 45

unnested parts = 0

List of parts for JNG 82 removed from g_svmrsc.dbf.

JNG 82 removed from spr_gsr.dbf.

Output of profile nesting maps list generated for JNG 82...

Map P0000035; L=4123 mm (ID=16); nest.r.=0.95; scrap=199 mm (ID=24)

Map P0000036; L=6000 mm; nest.r.=0.92; scrap=463 mm (ID=25)

Map P0000037; L=6000 mm; nest.r.=0.98; scrap=103 mm (ID=26)

Map P0000038; L=6000 mm; nest.r.=0.96; scrap=217 mm (ID=27)

Map P0000039; L=6000 mm; nest.r.=0.95; scrap=316 mm (ID=28)

Map P0000040; L=6000 mm; nest.r.=0.97; scrap=158 mm (ID=29)

Map P0000041; L=6000 mm; nest.r.=0.96; scrap=231 mm (ID=30)

Map P0000042; L=6000 mm; nest.r.=0.96; scrap=231 mm (ID=31)

Map P0000043; L=6000 mm; nest.r.=0.96; scrap=258 mm (ID=32)

Map P0000044; L=6000 mm; nest.r.=0.84; scrap=977 mm (ID=33)

Created file C:\NSHIP\SAMPLES\BS103_1\Doc

BS103_1_test01_Profile_nesting_maps_list_4.xls.

TAKEN was removed from scrap ID=16.

In the above sample for one calculation there were created 10 nesting maps (the forst

one of them on scrap with length 4123 mm), total number of worksheets = 4.

Numbering of nested billets/scraps in listing is done from 0 (not from 1).

Next lines

0: P0000142 ((2098 "1310326" "2" "326") (2001 "1310325" "2" "325"))

  scrap 326 (4445 IDp=112)

tell that on billet 0 map P0000142 of 2 parts (DWG files 1310326.dwg, 1310325.dwg) was created. Instead of billet a scrap with ID=112 (length 4445 mm). As a result a new scrap with length 326 mm was written.

If any billets were selected improperly (e.g. too short), then result of their processing is decorated so:

1: <------> no parts

  scrap 147 (147 IDp=76)

Lines

Summary of processing JNG 82 (45 parts):

created maps = 10

nested parts = 45

unnested parts = 0

contain aggregate calculation data.

In Excel table information on every map contains header line and lines of parts included into the map. Sample header (in bold font):

Map P0000035; L=4123 mm (ID=16); nest.r.=0.95; scrap=199 мм (ID=24)

The line contains map name (P0000035), source scrap length (4123), parent scrap ID (16), nesting ratio of billet/scrap (0.95), child scrap length (199), child scrap ID (24).

The line with data of part included into map looks like this:

[12]BS103-112.03-010   326   1   8.35   2098

In square brackets there is launch number. Next: draw name, position number, quantity of parts, part mass, part length.

On dr. 133 worksheet 1 of Excel table is shown.

18   Description of toolbars

Standard configuration of module **Nesting** includes ten toolbars. This section contains description of functions (commands), connected with buttons of these toolbars.

Drawing 133. Sheet 1 of calculated profile nesting maps table

18.1. Toolbar *JNG*

Toolbar **JNG** (dr. 134) is intended for work with joint nesting maps (JNG), as well as for editing existing maps.

Drawing 134. Toolbar **JNG**

Toolbar buttons:

 – call window of cutting parameters;

 – call window for new joint nesting group creation;

 – call window for creating new profile JNG;

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

 – send nesting map to shelf for editing operation;

 – replace part in nesting map;

 – restore DB tables for just deleted maps;

 – restore DWG files for just deleted maps.

18.2. Toolbar *Placement*

Toolbar **Placement** (dr. 135) includes most usable commands for placing parts inside nesting map.

Drawing 135. Toolbar **Placement**

Toolbar buttons:

⊢⊣ – measure distance;

K – calculate nesting ratio;

– rotate map by 180°;

– delete free usable scrap;

– create rectangular usable scrap of type0;

– combine parts;

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

– move part.

18.3. Toolbar *Shelf*

Toolbar **Shelf** (dr. 136) contains buttons for most popular commands for work with shelf or setting shelf modes.

Drawing 136. Toolbar **Shelf**

Toolbar buttons:

– open window **Settings for nesting maps and shelf view**;

– ZOOM Extents;

– decorate sheet as panel (horizontal lines according 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;

– move map from nesting place to shelf;

112

[Q] – ZOOM all the map;

[Ø] – ZOOM Previous;

[Q] – ZOOM Window.

[▤] – open window with autonesting options.

18.4. Toolbar *Interactive route*

Toolbar **Interactive route** (dr. 137) includes commands for setting route in nesting map.

Drawing 137. Toolbar **Interactive route**

Toolbar buttons:

[▣] – select map for setting route;

[▣] – activate mode of interactive setting route;

[▣] – set pierce;

[▣] – set bridges between parts;

[▣] – set bridges between parts (2);

[▣] – set piece (connection);

[▣] – set piece (connection 2);

[↩] – command **Undo**;

[↪] – command **Redo**;

[▣] – reset;

[↙] – return cutter to start corner;

[▣] – delete route;

[▣] – save nesting map;

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

[P] – add project name to map header;

[Nc] – output NC;

[▣] – call help.

18.5. Toolbar *Prepare to print*

Toolbar **Prepare to print** (dr. 138) contains commands for preparation of map to print.
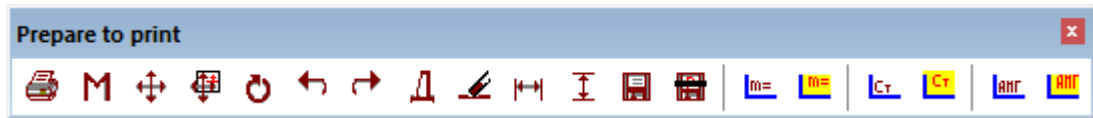
Drawing 138. Toolbar **Prepare to print**

Toolbar buttons:

– select map for print preparation;

– scale inscriptions of map;

– move text outside part block;

– move text inside part block;

– rotate text on 180°;

– rotate text on 90° counterclockwise;

– rotate text on 90°clockwise;

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

– delete drawing objects;

– horizontal dimension;

– vertical dimension;

– save map after preparation to print;

– clean sign of preparation to print;

– mass text outside scrap block (select density);

– mass text inside scrap block (select density);

– mass text outside scrap block (density 7.85);

– mass text inside scrap block (density 7.85);

– mass text outside scrap block (density 2.65);

– mass text inside scrap block (density 2.65).

18.6.   Toolbars *Move* and *Move-2*

Toolbars **Move** and **Move-2** (dr. 139) assures access to move commands.

Drawing 139. Toolbars **Move** and **Move-2**

Toolbar buttons:

– move commands (see **Move-2**);

– move and rotate;

– move ortho (up to dist);

– group objects;

– ungroup;

– move parallel;

– move normally to vector;

– move along vector;

– move up to tangency;

– combine parts with distance.

– move part from shelf to map;

– move part from map to shelf;

– move part inside map;

– command **MoveOrth2**.

18.7.   Toolbar *Rotate*

Toolbar **Rotate** (dr. 140) includes rotation commands.

Drawing 140. Toolbar **Rotate**

Toolbar buttons:

– rotate;

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

– number 180 (as reply to angle request);

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

– rotate up to parallelity of edges;

– change rotation center.

18.8.   Toolbar *Select*

Toolbar **Select** (dr. 141) contains commands of forming selection set.

Drawing 141. 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.

18.9. Toolbar *Trace*

Toolbar **Trace** (dr. 142) can be used in setting route.
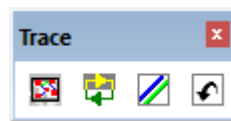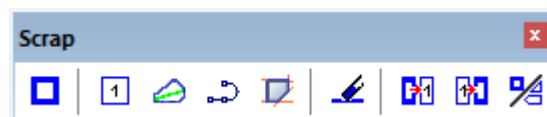

Drawing 142. Toolbar **Trace**

Toolbar buttons:

▨ – set pierce;

▨ – change round direction;

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

▨ – undo command.

18.10. Toolbar Scrap

Toolbar **Scrap** (dr. 143) is used for work with scraps.

Drawing 143. Toolbar **Scrap**

Toolbar buttons:

▨ – create rectangular scrap of type 0 (old type);

▨ – create rectangular scrap of type 1;

▨ – create curved scrap from polyline;

▨ – create polyline (editor command POLYLINE);

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

▨ – delete free scrap from nesting map.

▨ – convert scrap from type 0 to type 1;

 – convert scrap from type 1 to type 0;

 – switch scrap mode.