



XIII Inspection program QM-TAPTHREAD32

XIII.1 Characteristics of the program QM-TAPTHREAD32

The QMSOFT Taper Thread program has been designed as a support system for the computer aided inspection for taper pipe threads and taper thread gauges.

All thread nominal values can be generated through this program in accordance with the following standards:

- Pipe Threads, General purpose (NPT..) according to ANSI/ASME B1.20.1 - 1983
- Pipe Threads where pressure-tight joints are made on the threads acc. to ISO 7-2:2000
- Pipe threads for tubes and fittings according to BS21:1985
- Metric External Taper Screw Threads according to DIN 158
- Gages for Dryseal Pipe Threads (e.g. NPTF..) according to ASME B1.20.5-1991
- Whitworth Pipe threads for threaded pipes and fittings acc. to DIN 2999 – July 1983

Attention: The measurement process for taper threads requires a special hardware environment. In case that the thread diameter is defined in a special gauge plane you need the possibility to get the readings of two axis. One for the gauges diameter and the second to determine the distance to the gauge plane.

Before starting up the program, the user should be familiar with the guidelines being applied as well as the measurement procedure for the inspection of screw thread gauges.

Only a basic knowledge of computers is necessary in order to use the QM-TAPTHREAD program.

Measurement data can be entered through an on-line connection of the measurement device or on the keyboard. If the former is the case, the measurement device must be connected to the serial interface of the PC (V.24, RS 232), by a PC interface card (Heidenhain IK121, 220, Mahr) or by a special manufacturers hardware solutions – like MAHR, TRIMOS or SIP.

The QM-TAPTHREAD program can be started directly from the gauge data management system QM-MANAG. The primary function of the program is to calculate all of the required gauge sizes and tolerances according to the thread standards and type of gauge being applied (for example: Screw thread GO ring gauge). Any limitations of the applied standard will be pointed out.

After selecting the standard, the type of gauge, (for example: Screw thread GO ring gauge) and entering the thread designation, for example: "R1", all of the required gauge nominal values and tolerances will be calculated automatically. The limitations and restrictions of the norms being applied will be indicated.

The program supports the nominal value generation and the measurement process for all types of thread gauges being standardised and also for all types of plain gauges used to check the minor or major diameter of screw threads.

The results of the evaluation can be produced on the screen and/or on the printer and/or in a file. The nominal values of the gauge will be processed in the calibration certificate according to the inspection requirements and the measurement results. Tolerance excesses will be noted and identified.

XIII.2 Starting the program QM-TAPTHREAD

You can start the QM-TAPTHREAD program directly from the QMSOFT-command-Shell (click the corresponded symbol in the shell).

Before working with the program you have the possibility to customise some things according your individual needs and wishes.

The following program settings you have to do:

- Configuration of the On-line Interface:

If you use a direct linkage between the computer and your measuring machine to transfer measuring values, at first you should start the indication program required (RS232DRV, IK102021 or SIDDRV depended on the device and the interface connection you use) and set the correct parameters for the Online Interface (see also the manual of the used program).

- Program settings and inspection conditions:

Here you can set some general things for the program environment; for example: the default way to transfer measuring values (machine or keyboard) or the unit used for the evaluation. See section V.3 for this.

Attention: An incorrect selection of the parameters for the online connection (e.g. for the serial port) can produce a system crash while measure data input ! Make sure that you are informed about your computer system and the correct name of the serial port for on-line interface. For settings of the serial interface see also Appendix D.

XIII.3 Program settings

Before starting the measurement itself, you have to set few parameters to define the program environment and describing the inspection conditions.

XIII.3.1 "Settings | General settings"

Using this option you have the following registers to change program settings:

Register "General"

Here you can choose the program language, set the default unit for the gauges and select the default data input device (keyboard of the computer, online connection to an indication device).

If you set "Online" as the default device the Online connection to the device installed (see page "Directories" – "Indication program") will be started automatically if a gauge measurement will start.

Using the option "Save certificates automatically" any calibration certificate will be saved into the "Certificate directory" (see register "directories"). The file name will be created by of the gauges identity number or the entered certificate number. You can set if you want to save the certificate as "RTF", "PDF",... file format.

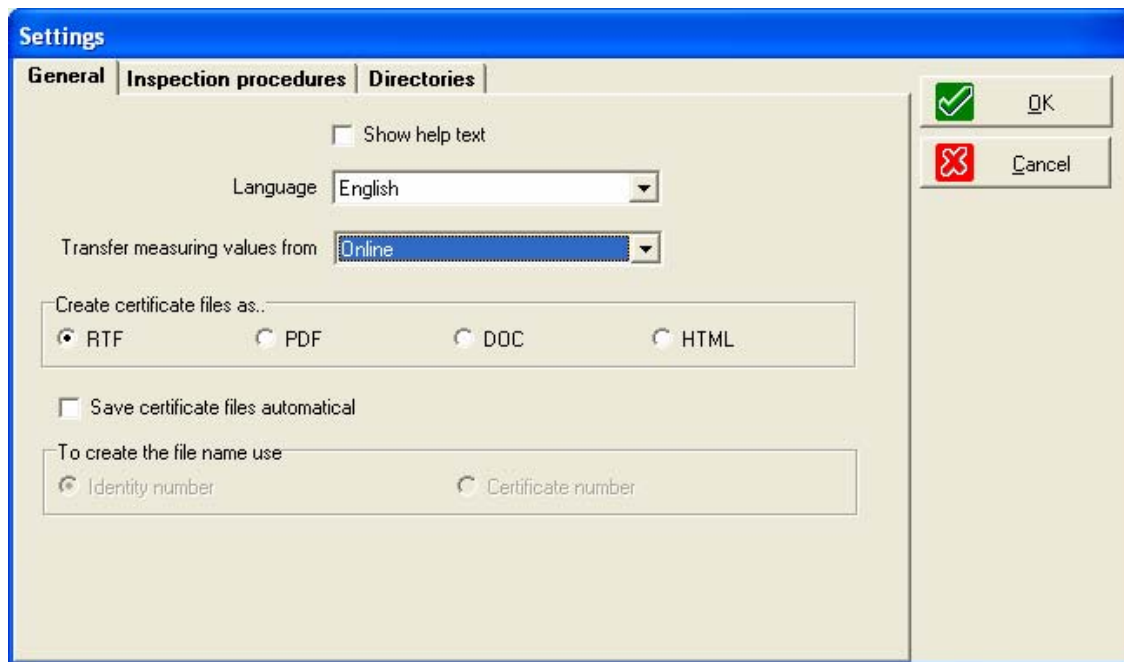


Figure: General program settings

Register "Inspection procedures"

Here you can enter for each gauge type a reference to a corresponded text file including the inspection procedure as a text. Note that this "inspection procedure" does not influence the inspection process. It will be set using the option "Inspection conditions".

Register "Directories"

For some functions (indicating of measuring values; creation and edit of calibration certificates) external programs will be used. Here you can enter the directory where the corresponded program can be found. Additional you can set a directory to save your calibration certificates.

While doing the program installation all directories will be set to a correct value!

ATTENTION: Make sure that these entries are correct. Errors may be happen while operating the program caused by incorrect settings in the screen "Directories"

XIII.3.2 "Settings | Inspection conditions"

Using this option you have the following registers to set "inspection conditions":

Register "General"

Figure: Inspection conditions

Type of inspection: According to VDI/VDE/DGQ guidelines, two different kinds of evaluation for the gauge inspection we have. The "incoming inspection" includes (beyond to the inspection of the gauge diameters) the inspection of hardness of the gauge. For the evaluation of gauge diameter the manufacturing tolerances of the gauge will be used. For "periodical inspection", the gauge evaluation will be done using the wear limit.

Unit for evaluation: Select the wished unit for the gauge evaluation.

File name to save the certificate: Here you can enter a default file name to save the calibration certificate. Note, if the option "Save certificates as RTF-file" is switched on (see menu "Settings | General settings") the name entered will not be used. In this case the program will create the file name using the "Identity number" (Note: the file name consist of the, at maximum, first 8 characters of the identity number, the file extension is "RTF");

Default certificate layout file for...: Here, you can enter the name of the "Certificate layout" file used to create the layout of your calibration certificate. This file includes all information about the layout and the content of the record list being created. For "mm" and "inch" measurements you can use different files.

NOTE: Because the program will be installed to support different languages you will find serious "L32" files in the related directory. The file name (for example "QMTAPTHREAD_English") will show you the language related. Using the Windows-Explorer you can delete all certificate layout files you do not use.

Gauge type depended settings

Before starting the measuring process a series of parameters you can change. The parameters you have to set are depended on the type of gauge you have to inspect. Use the related register screens to set the inspection conditions.

Register “Taper threaded plugs”

Note: You can not access to this page before selecting a “Taper threaded plug” in the main menu !

The screenshot shows a software window titled "Inspection conditions" with a blue header bar. Below the header is a tabbed interface with six tabs: "General", "Taper thread plugs", "Taper thread rings", "Parallel thread ring gauges", "Taper plain plugs", and "Taper plain rings". The "Taper thread plugs" tab is currently selected. The main area of the window is light beige and contains several settings:

- Measuring method:** A dropdown menu showing "Two-Ball-Measurement (Two axis measurement)".
- Used series of ball/wire diam.:** A dropdown menu showing "Table T-shaped ball probes".
- Number of measures:** A numeric input field with a spinner, set to "2".
- Inspect gauge length and step:** An unchecked checkbox.
- Inspection period:** A numeric input field set to "12" and a dropdown menu showing "Month(s)".

At the bottom of the window are two buttons: "OK" with a green checkmark icon and "Cancel" with a red X icon.

Figure: Inspection conditions for taper thread plugs

Measuring method:

Here, choose the measuring method for measurement of external taper threads. Currently there is only the "Two-Ball-measurement" method implemented. This can be done only on a machine with a two axis measurement capability!

Used series of ball diameters:

Choose here, from the list provided, the table with the balls should be used for the automatically selection of a ball diameter. Usually you should use the "T-shaped ball probes" for the measurement.

Number of measures:

Type the number of measures for the effective diameter.

Inspection period:

Enter an "Inspection period" if you want to calculate a "Next inspection date" for the certificate.

Register “Taper threaded rings”

Note: You can not access to this page before selecting a “Taper threaded ring” in the main menu !

The screenshot shows a software window titled "Inspection conditions" with a blue header bar. Below the header is a tabbed interface with six tabs: "General", "Taper thread plugs", "Taper thread rings" (which is selected), "Parallel thread ring gauges", "Taper plain plugs", and "Taper plain rings". The main area of the window contains several input fields:

- "Measuring method": A dropdown menu showing "Two-Ball-Measurement (Two axis measurement)".
- "Used series of ball diameter": A dropdown menu showing "Table T-shaped ball probes".
- "Number of measures": A numeric input field with the value "2".
- A checkbox labeled "Inspect ring thickness and step", which is currently unchecked.
- "Inspection period": A numeric input field with the value "12" and a dropdown menu showing "Month(s)".

 At the bottom of the window are two buttons: "OK" with a green checkmark icon and "Cancel" with a red X icon.

Figure: Inspection conditions for “Taper threaded rings”

- Measuring method:** Here, choose the measuring method for measurement of external taper threads. Currently there is only the "Two-Ball-measurement" method implemented. This can be done only on a machine with a two axis measurement capability!
- Used series of ball diameters:** Choose here, from the list provided, the table with the balls should be used for the automatically selection of a ball diameter. Usually you should use the “T-shaped ball probes” for the measurement.
- Number of measures:** Type the number of measures for the effective diameter.
- Inspection of minor diameter:** Marking this field, you can decide if you want to measure the minor diameter additionally to the effective diameter.
- Inspection period:** Enter an “Inspection period” if you want to calculate a “Next inspection date” for the certificate. Starting the program through the QM database this parameter will not be used because the “Inspection period” will be managed in the database system.

There are additional registers for the inspection conditions for parallel thread rings and taper plain gauges

In case that the program does also support the inspection of “parallel thread ring gauges” and taper plain gauges used for thread gauging there are additional registers to set the related parameters for this types of gauge.

The parameters are comparable the things described in the sections for “Taper thread plugs” and “Taper thread rings”.

XIII.3.3 "Settings | Probes"

Using this option you can start the probe and masters management program TASTER32. Here you can insert new probes to a list and calibrate this.

Remember that "T-shape ball probes" and "Single (stylus) ball probes" used for internal measurements should be calibrated before you can use it

See the manual for the probe management program for more detailed information.

XIII.3.4 Certificate layouts

The program QM-TTAP gives you the possibility to customise the layout of your calibration certificate. The layout of the calibration certificate is based on the so called "Certificate layout file". This file contains all information about the form of the certificate and the values should appear in this. By editing this certificate layout file you can change the layout. Saving this file with another file name give you the possibility to work with different certificate layouts.

All this certificate layout files you have created will be saved in the working directory of the QM-THREAD program. The files have the extension ".L32".

Using the option "**Certificate layouts | Show/edit..**" you can load a certificate layout file into the QMSOFT editor program.

NOTE:

- Do *never* open a "**L32**" certificate file outside of the program. In this case you will loose all "placeholders" representing the "actual values" when the certificate will be created !
- If you want to open a certificate layout file you will see a serious of such files to support different languages. Using the Windows-Explorer you can delete all "L32" files you do not need.

A certificate layout file is consisting of three different types of information:

- "**Standard text**": is text information just like in a known text processing application; you can change the text as you want and you can set the different text parameters;
- "**Placeholders**" ("**Fields**"): a "Field" is including variable information about the gauge, the measuring process or the measuring environment. A "field" will be fulfilled with the actual information while executing the program.
While editing a certificate layout file you can change "field" positions, delete "fields" (if you do not need the related information) and insert new "fields".
- "**Line conditions**": A line condition gives you the possibility to control the certificate layout in dependence of different program situations. A text or field following to an line condition will be print out on the certificate only if the condition is "true". For example you can print a special text only if an "External measurement" was done. Please open an existing certificate layout and see the comments for the "Line conditions" available.

The usage of "Place holders" (fields):

To insert a new "Place holder" in your certificate layout use the menu "**View / Fields**". Using this menu you can also see all available "Place holders" (Fields) and the related information. The fields are grouped to different categories (e.g. Gauge nominal values). If you select a field (click on it) you can see the field designation.

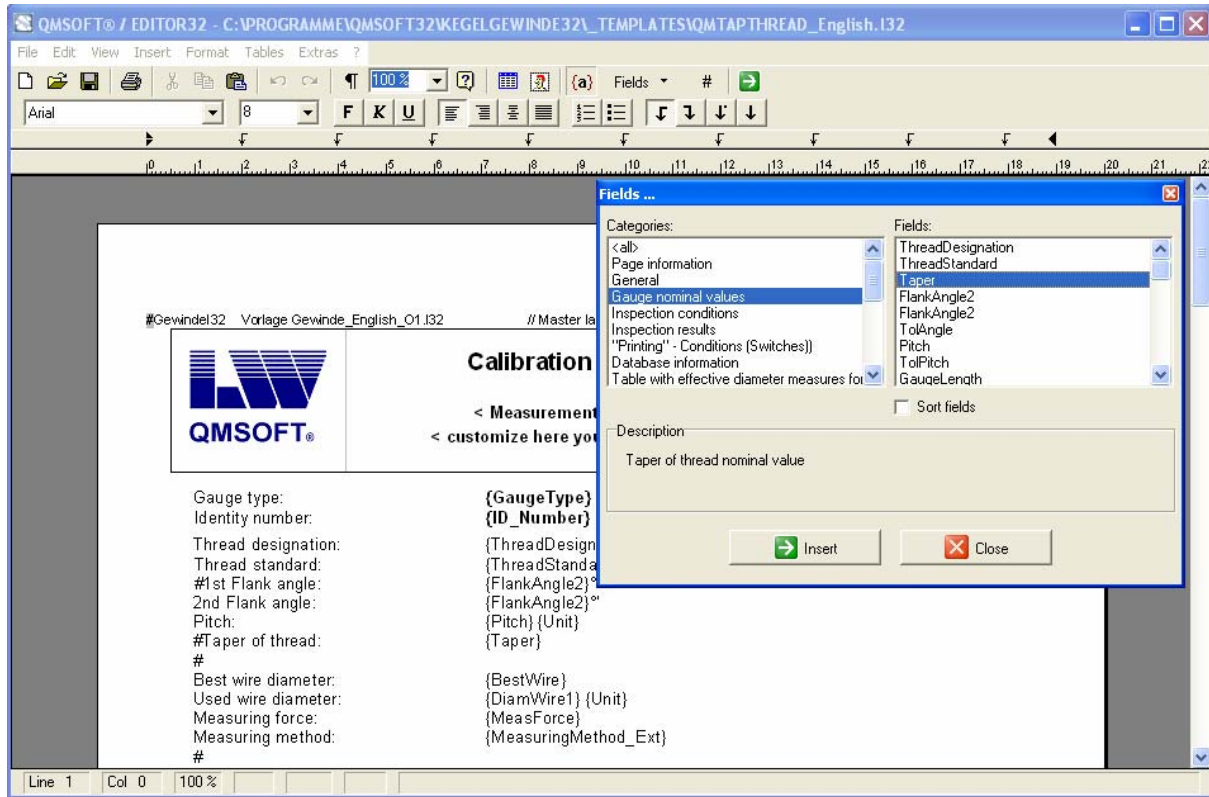


Figure: Inserting of fields into a Certificate layout file

Clicking the "Insert" button will insert the field selected at the current "Cursor" position!

Note: Fields which does contain text information can have an property "Language". To open the "Field property" dialogue click the right mouse key on the related field. If this dialogue have a field "Language" (see figure) you can change it to create "Multilingual" certificates.

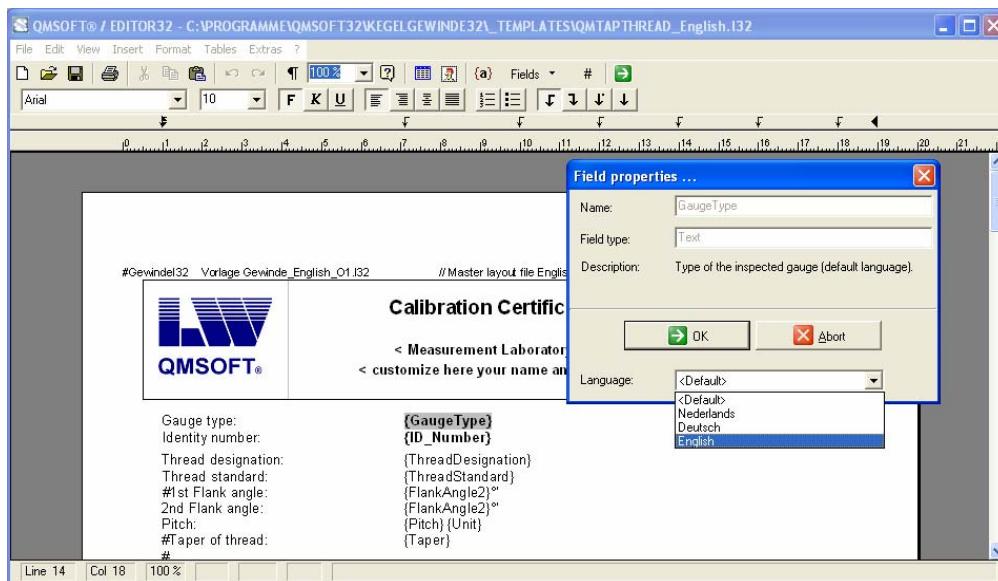


Figure: Field property "Language"

The usage of "Text conditions" (Switches):

Use the menu " **View / Text conditions** " to show the "Text conditions" available (see figure). Please click in the field "Field name" and select the item "Printing - conditions (Switches)" to see the list of the conditions available (see figure).

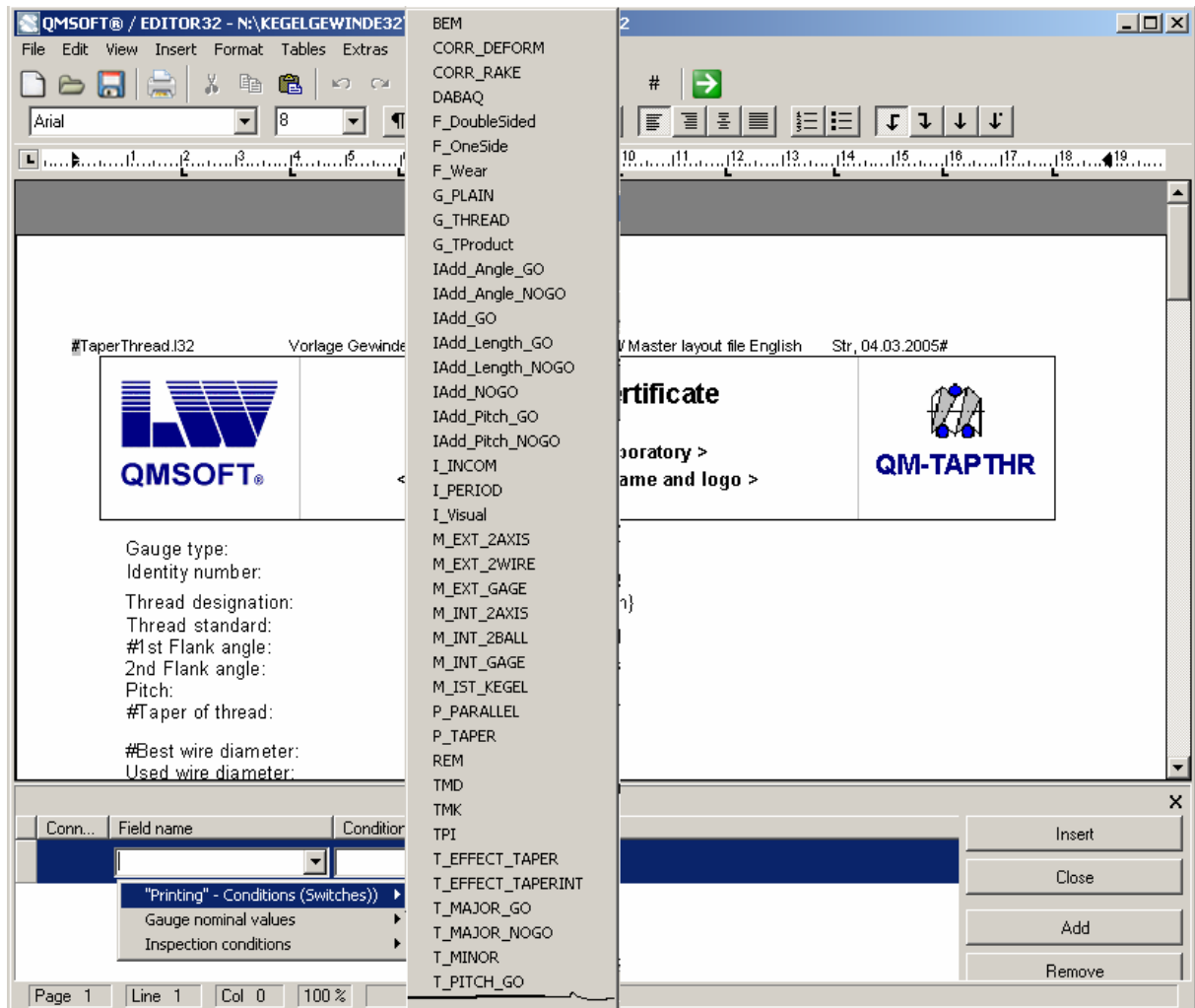


Figure: Text conditions to control the print out of information

Select a text condition in the shown list to get there description.

After selecting a condition use the "Add to list" button to move it to the "conditions list". You can now add more conditions and can combine it with the selected "Logical operator" ("AND" or "OR")

Use the "Insert" button to insert the selected condition in your certificate layout. A "#" will be appear at this position.

Note: A "Text condition" is not restricted to one line in your layout. The condition is active until a new "Text condition" is defined or an "empty" condition is set. The text after an "empty" condition will appear on your certificate in any cases.

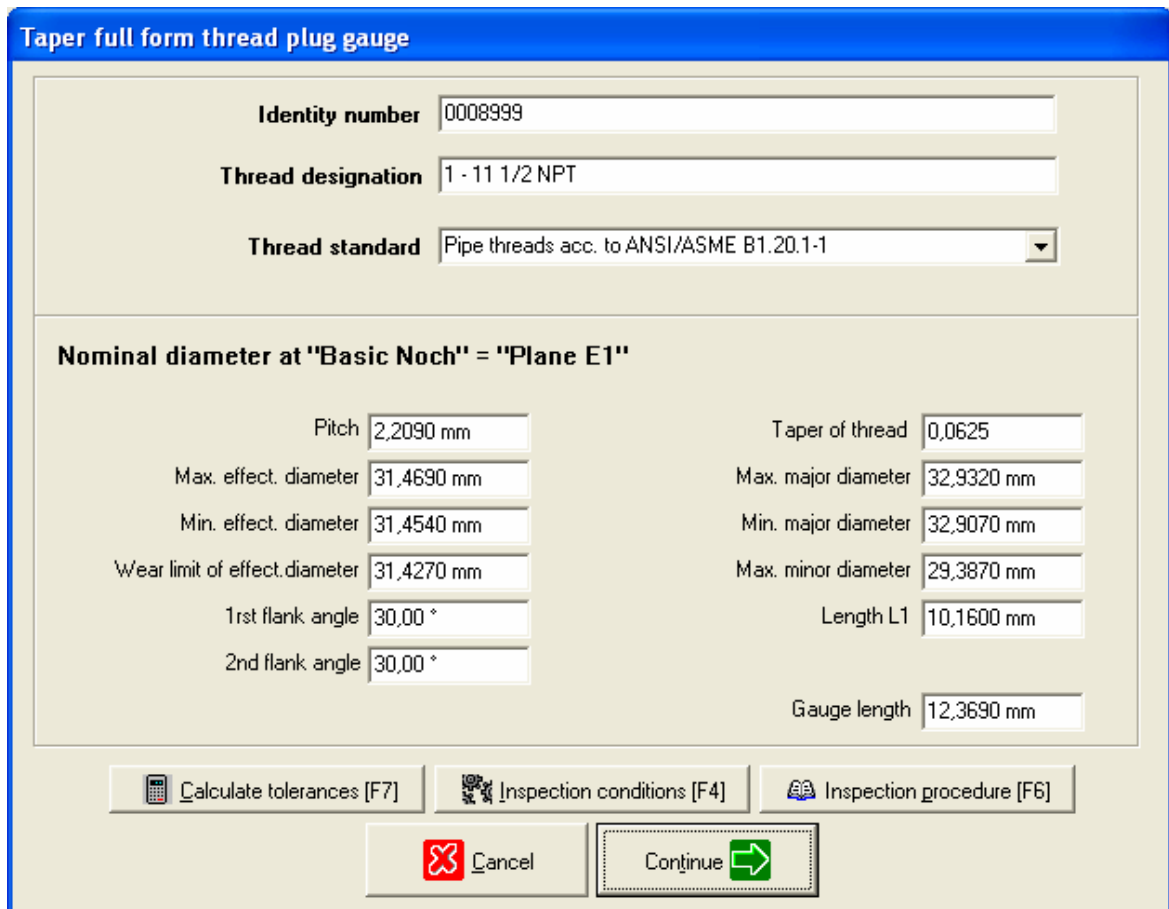
XIII.4 Doing a gauge inspection

XIII.4.1 Entering gauge nominal data

To create a measurement record it is necessary to take the measuring values of the thread and to compare this actual values with the thread nominal values and it's tolerances. This nominal values and tolerances can be generated in the QM-THRETAP program for all Thread standards listed in section XIII.1 of this manual.

After choosing the type of gauge to be inspected (using the related button on the start screen **or the menu "Inspection"**), a dialog box will appear on your screen corresponding with your selection in which the gauge nominal values are to be entered (see Figure, dialog for a Taper thread plug gauge).

The fields in this dialog box should be filled with the corresponding values. If the program is started up from the gauge data management system **QM-MANAG** this possibility is blocked and the nominal values of the gauge will be transferred from the database.



Taper full form thread plug gauge

Identity number: 0008999

Thread designation: 1 - 11 1/2 NPT

Thread standard: Pipe threads acc. to ANSI/ASME B1.20.1-1

Nominal diameter at "Basic Noch" = "Plane E1"

Pitch	2,2090 mm	Taper of thread	0,0625
Max. effect. diameter	31,4690 mm	Max. major diameter	32,9320 mm
Min. effect. diameter	31,4540 mm	Min. major diameter	32,9070 mm
Wear limit of effect.diameter	31,4270 mm	Max. minor diameter	29,3870 mm
1st flank angle	30,00 °	Length L1	10,1600 mm
2nd flank angle	30,00 °	Gauge length	12,3690 mm

Calculate tolerances [F7] Inspection conditions [F4] Inspection procedure [F6]

Cancel Continue

Figure: Entering of gauge designation, calculation of gauges nominal values

Following is a description of the fields in the nominal data dialog box:

Identity number:

This field is used as a label for the gauges using an identity number. This ID number will appear in the calibration certificate.

Thread designation:

Enter here the standardised designation of the thread you want to inspect. The program is checking this designation and will calculate all related sizes and tolerances according to the chosen standard (see the next field).

Thread standard:

Select the thread standard from the list provided.

After entering this information use the "Calculate tolerances" button to calculate the gauge nominal sizes.

Please note that the diameters are calculated from the software are related to the used "Gauge plane". The position of this "Gauge plane" does depend from the standard selected and the gauge type.

To check or to change the inspection conditions use the related button.

XIII.4.2 Some notes to the different Standards and Gauge type – the used "Gauge plane"

In case that the Gauges (the most of them) which are be handled with this program are tapered. The calculated diameter values are only valid for the related Gauge Plane. This related plane does depend from the standard and the gauge type. Here you will find a description what reference planes are used in the program to calculate the nominal and actual pitch diameter.

XIII.4.2.1. Taper-threaded plugs

- a) NPT taper-threaded plugs and NPTF L1 plug gauge:
the calculated diameters are related to the "Small End" of the plugs; in the standard this plane is called the E_0 plane;
- b) NPTF L3 plug:
the calculated diameters are related to the "Small End" of the plugs; for L3 plugs this plane is called the E_3 plane;
- c) BS 21 taper full-form plug gauge:
the diameters are related to the "Gauge plane"; for System A the gauge plane is located at the gaging notch; for System B gauges the gauge plane is located at the distance "s" (the "datum dimension") from the "end" face (marked "+") of the gauge;
- d) ISO 7-2:2000 (also older release ISO 7-2:1994) full form threaded plug gauge:
it is similar to BS 21 System B; the gauge plane is located at the distance "l1" from the "end" face (marked "+") of the gauge;
- e) DIN 2999 full form threaded plug
it is similar to BS 21 System B; the gauge plane is located at the distance "l3" from the "end" face of the gauge;
- f) DIN 158 – only threaded "Check Plug" does exist:
in case that this standard does define external taper threads only; there is only a "check plug" for the "parallel thread ring gauge" is defined; the diameters are related to the "Gauge plane" which is located at the gaging notch;

XIII.4.2.2. Taper-threaded rings

- a) NPT taper threaded rings and NPTF L1 rings
the calculated diameters are related to the the "Large End" of the ring; in the standard this plane is called the E_1 plane;
- b) NPTF L2 ring gauge:
the calculated diameters are related to the "Large End" of the ring; for L2 rings this plane is the E_2 plane;
- c) BS21 - System A ring gauge and ISO 7-2:1994 (old):
the calculated diameters are related to the "Large End" of the ring; this plane is the "Gauge plane";
- d) BS 21 – System B ring gauge:
the diameters are related to the "Gauge plane"; the gauge plane is located at the distance "m" (the "datum dimension") from the "small end" (marked "+") of the gauge;
- e) the other standards (DIN 2999, ISO 7-2:2000 and DIN 158) does not define taper threaded rings OR does not give nominal sizes for it; in this case only gaging with the "Taper check plug" is permissible to inspect this gauges;

XIII.4.3 The handling of "Parallel threaded ring gauges"

Few standards (ISO 7-2:2000, DIN 2999 and DIN 158) does define "Parallel threaded ring gauges" to check the Taper external product thread. The pitch diameter of this gauges will be controlled by the related "Taper thread form check plug gauge" only!

The figure will illustrate it for an ISO 7-2:2000 Parallel threaded ring gauge:

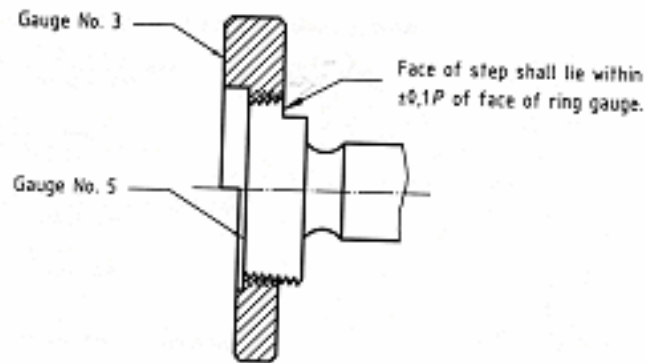


Figure: Gaging of a Parallel threaded ring gauge acc. to ISO 7-2:2000

If you select a "Parallel threaded ring gauge" in the program only the "Inspection method" : "Gaging with the master gauge" is permissible.

The program will give you the limits for the engagement as shown in the figure:

Gaging with checking gauge / Measuring of the engagement

	Minimum value - Ring	Maximum value - Ring	Max. distance - wear gauge
Gauge nominal value	<input type="text" value="58,1350 mm"/>		
Engaging length - Nominal value	<input type="text" value="0,0000 mm"/>		
Limits for the plane distance	<input type="text" value="-0,2309 mm"/>	<input type="text" value="0,2309 mm"/>	<input type="text" value="0,8650 mm"/>
Used reference plane	<input type="text" value="Distance to gauge plane, basic gaging notch"/>		
Meas. value of plane distance gauge to checking gauge	<input type="text" value="0,0000 mm"/>		

XIII.4.4. The Measurement Process – using a "Two-axis" Machine

The measurement process depends on the selected "Measuring method". Currently there is only the "Two ball measurement" method implemented which requires a two axis measuring machine! The measuring process for internal and external taper thread gauges is quite similar if this method is used.

a) Determine the "Gauge end" reference (using a "Two-axis" machine)

Simplified is the procedure to measure the effective diameter of a taper thread similar the measuring of a parallel thread. The main difference is that the taper threads effective diameter is only defined in the gauge plane. Therefore a definite position at which the measurement is to be made must located.

To get this definite position we have now to set our "Y-Axis" reference on the front end of the taper gauge. It may be helpful if you set your "Y-axis" reading on the machine to "Zero" before taking over the value.

Determine the "gauge end" reference / Measure gauge step / 1 - 11 1/2 NPT / 00899

No. of meas.	Measure
1	0,234

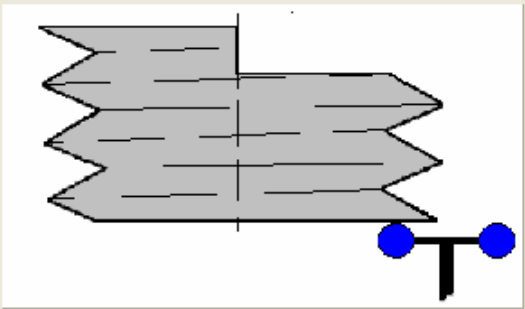
Nominal value gauge length: 12,3690 mm


Distance of gaging notch (L2): 10,1600 mm

"best" ball diameter: 1,2753 mm

Current ball diameter: 1,3500 mm

Probe constant: 2,5002 mm








 Back  Online 

Figure: Define the reference for the "Y-Axis"

Before starting the measurement you should make sure that the correct probe parameters (Ball diameter and Probe constant) are selected and that the probe is correctly calibrated (see also appendix E: Probe management). The program will be made an automatically pre-selection from your stored probe table. The "best" ball diameter is shown to check if the selected "Current ball diameter" is useful.

If you want to change the probe or to calibrate or recalibrate it use the "Wires/Balls" button to do this. Please note that you can not change the probe later.

b) Measuring the effective diameter

Measurement eff. diameter - tapered thread external

1st measure		
No. of meas.	Measure X-Axis	Measure Y-Axis [Z]
1	-0,4321 mm	-1,7534 mm
2	-0,4963 mm	-3,9568 mm
3	34,2342 mm	-2,8573 mm

Reading (incl. probe)

Distance to gauge plane

Effective diameter

Gauge limits: min max

"best" ball diameter: Current ball diameter:

Pitch Probe constant

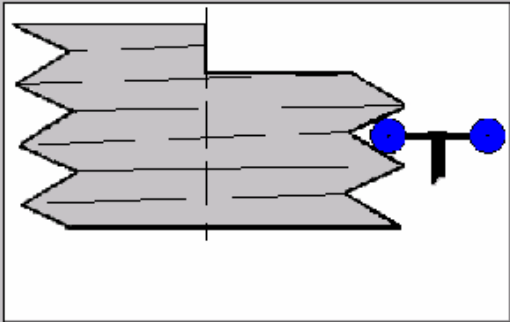


Figure: Measuring the effective diameter on a "Two-Axis" machine

After setting the "Y-reference" value the measuring of the effective diameter will be started.

The measurement has to be done by probing the gauge on three positions – two on the left and the third on the right side of the gauge. During the inspection you get a picture of the probe position on the screen.

Make sure that the second probe position is placed in the next thread groove related to the first probe position. The third probe position on the opposite side has to be placed in the thread groove between the both positions on the left side.

The average of the two readings "Position1 to Position3" and "Position2 to Position3" will give the "Reading over balls" (shown in the related field on the screen) which will be used to calculate the effective diameter.

The "Y-value" of the third measure will give us the distance L from the gauge plane used to calculate the effective diameter at the gaging notch.

XIII.5 Output of results

After entry of the measurement data has been completed, the screen "*End of inspection*" will appear.

Figure: End of inspection / show certificate

If the inspection is finished you get the screen shown above. The summary result of the inspection is shown. Here you can enter the name of the customer, the date for the next inspection and also some remarks to the inspection.

Before creating the calibration certificate you can change the "certificate layout file" will be used. To start the output of the results press the "Show certificate" button.

All functions for the editing and the output of calibration certificates will be controlled by the EDITOR - program. See the manual of this program (Appendix B) to see how to operate it.

Saving of certificate files:

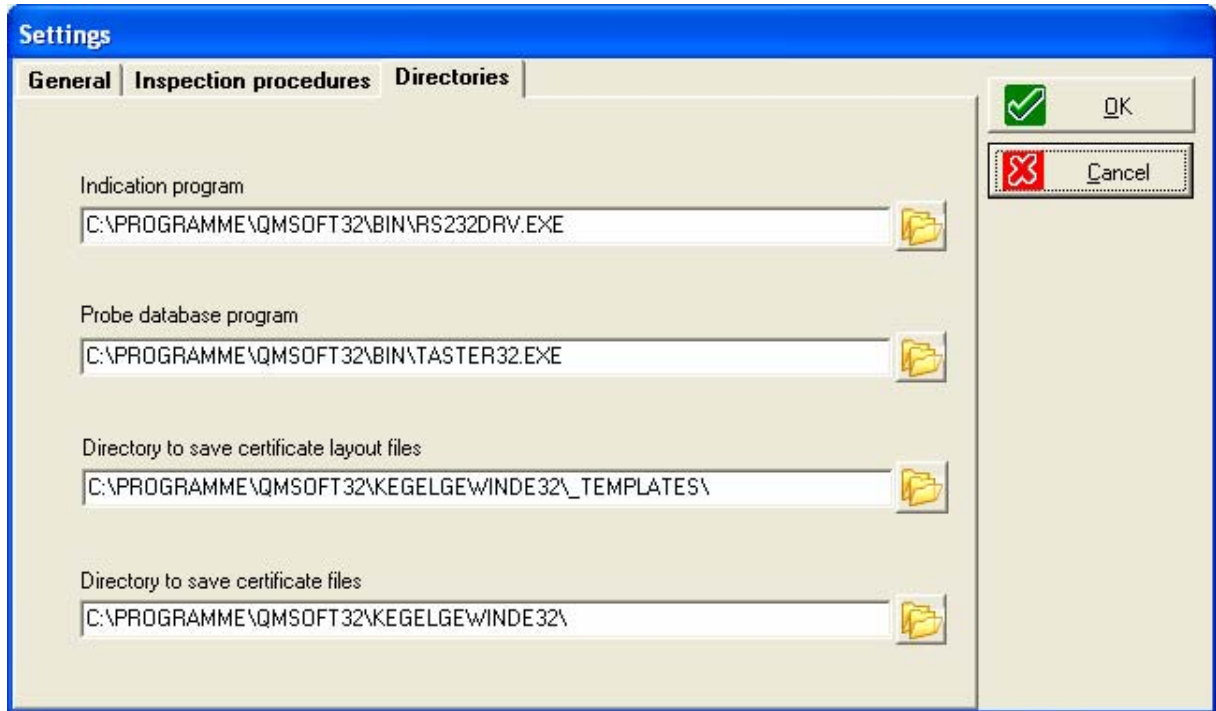
After completing a measurement you can save the inspection certificate into a file. The file extension is always „RTF“. This file format is compatible to the most common text programs (e.g. MS Word).

If you use the "**Save to..**" option you can select the directory where you want to save the file and you can enter the file name.

Using the **“Save”** Icon the directory and the file name will be set by the programs default values.
To change the default values see the following section.

1) *the directory to save certificates*

You can set the directory where you want to save your certificate files using the menu **“Settings | General settings”** in the page **“Directories”** (see figure / last line !)



2) *the used file name*

there are two options for the default setting of the used file name:

a) using a fixed file name:

the name of this file is set in the menu **“Settings | Inspection conditions”** in the page **“General”**; there is a field **“File name to save certificate.”**.

For the QM-THREAD program the default name is **“THRE_TAP.RTF”**.

Note: if you use the fixed file name the **“save”** dialogue will overwrite the existing certificate !

b) creating a new file name for each measurement:

using the menu **“Settings | General settings”** you will find in the page **“General”** a click box named

“Save certificates as...” (see figure). If you activate this option the program will save the certificate automatically. The file name will be created either by using the first 8 characters of the gauges identity number or of the entered certificate number. You have to select the wished option.

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