



## V. Inspection program QM-PLAIN

### V.1. Characteristic of the program QM-PLAIN

The QM-PLAIN program is designed for the inspection of the following types of plain gauges:

- GO Plain ring gauges acc. to DIN 7150-2:2007, BS 269:1982, ANSI/ASME B89.1.6M, NF E 02-202
- NO GO ring gauges acc. to DIN 7150-2:2007, BS 269:1982, ANSI/ASME B89.1.6M, NF E 02-202
- Master rings acc. to DIN 2250-1, BS 4064, BS 4065, ANSI/ASME B89.1.6M, NF E 11-011
- GO plain plug gauges acc. to DIN 7150-2:2007, BS 269:1982, ANSI/ASME B89.1.6M, NF E 02-202
- NO GO plain plugs acc. to DIN 7150-2:2007, BS 269:1982, ANSI/ASME B89.1.6M, NF E 02-202
- GO/NO GO plain plug gauges acc. to DIN 7150-2:2007, BS 269:1982, ANSI/ASME B89.1.6M
- GO plain snap gauges acc. to DIN 7150-2:2007
- NO GO plain snap gauges acc. to DIN 7150-2:2007
- GO/NO GO (double sided) plain snap gauges acc. to DIN 7150-2:2007
- Master setting disks (Style 1, 2 and 3) acc. to ANSI/ASME B89.1.6M
- Rod gauges with spherical ends acc. to DIN 7150-2:2007
- Check plugs for snap gauges acc. to DIN 7150-2:2007
- Setting standards for micrometers acc. factory standards

The inspection itself runs in accordance with the related VDI/VDE/DGQ 2618 guidelines.

The user must first enter the type and size of the gauge being inspected. The program will, then, automatically evaluate the whole set of gauge nominal values. It is also possible to use customer specific gauge nominal data.

Measurement data can be entered through an on-line measuring machine or on the keyboard. When using an on-line measurement device, the connection between the device and the computer is realised by one of the serial ports of the computer (V.24, RS-232) or by a PC interface card (Heidenhain IK220, SIP "LMC" interface unit) or TRIMOS LabConcept with WINDHI software. For more information see the manual of the related indication program.

Results can be produced on the screen and/or the printer and/or in a file. The nominal values of the gauge will be processed in connection with the inspection conditions and the measurement results in the results record. Tolerance excesses are marked and identified. It is possible to customise calibration certificates using the so called "certificate layout files".

The QM-PLAIN program can be started up directly from the QM-MANAG gauge data management system. In this case, QM-PLAIN will receive all necessary nominal data necessary directly from the data base. At the end of the inspection the results and the calibration certificate will automatically be transferred back to the QM-MANAG data base.

### V.2. Program start

You can start the QM-PLAIN program directly from the QMSOFT-command-Shell (click the corresponded symbol in the shell). Before working with the program you have 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, IK220DRV 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.

### V.3. Program settings

Working with the program you should make different settings to define the program environment and especially program conditions.

#### V.3.1. "Settings | General settings"

**Program settings**

General | Files / Directories | Instructions | Settings for gauge evaluation / inspection decision

☒ Show help texts

Language  
English

Transfer measuring values from  
Online

Number of digits  
Metric 5 Inch 6

Unit of deviations (only for inch meas.)  
☐ thou.inch ☒ µin.

Save certificates as  
☒ RTF ☐ PDF ☐ DOC ☐ TXT

☐ Save certificates automatically

To create the file name use  
☒ Identity number ☐ Certificate number

OK Cancel

**Figure: Program 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, on-line measuring machine). If you set the "Keyboard" as the default device the Online connection 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.

**Unit to show deviations...:** You can set the number of digits for "mm" and "inch" readings.

**Unit of deviations (only for inch meas.):** Select if you want to print out "Deviations" in "thou.inch" (inch/1000) or in "micro inch". This setting does only affect the format of the related "Placeholders (Fields)" in the certificate layout file.

### Register "Files / Directories"

For some functions (e.g. indicating of measuring values) external programs will be used. Here you can enter the directory where the corresponding program can be found. Additionally you can set a directory to save your calibration certificates.

All directories will be set while doing the program installation to a correct value!

**ATTENTION:** Make sure that these entries are correct. A lot of errors happen while operating the program are caused by incorrect settings in the screen "Directories".

### Register "Instructions" (Inspection procedures)

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

### V.3.2. "Settings | Inspection conditions"

Using this option you have the following registers to set "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, roughness and cylindricity 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 of the gauge.

#### **Default certificate layout file for...:**

Here, you can enter the name of the "Certificate layout file(s)" 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 different files are used.

NOTE: Because the program will be installed to support different languages you will find a lot of "L32" files in the related directory. Using the Windows-Explorer you can delete all certificate layout files you do not use.

## Register "Ring gauges"

The screenshot shows a software window titled "Inspection conditions" with a tabbed interface. The "Ring gauges" tab is selected. The window contains the following fields and controls:

- Inspection period:** A numeric input field set to "1" and a dropdown menu labeled "Year(s)".
- Method of measurement:** A dropdown menu currently showing "T-shaped ball probes".
- GO side:** A column of settings for the "GO" side.
  - Number of meas. planes:** A numeric input field set to "3".
  - Number of meas. points:** A numeric input field set to "2".
- NO GO side:** A column of settings for the "NO GO" side.
  - Number of meas. planes:** A numeric input field set to "2".
  - Number of meas. points:** A numeric input field set to "1".
- Save as default:** A checkbox that is currently checked.
- Buttons:** "OK" (with a green checkmark icon) and "Cancel" (with a red X icon) buttons at the bottom.

**Figure:** Inspection conditions for ring gauges

### **Method for int. measurement:**

Select the default measuring method for "GO" and "NO GO" ring measurements. Available methods are: "measuring brackets", "T-shaped ball probe" and "Single ball probe". If you work with a QMSOFT indication program for the Online connection to a measuring machine this program will be set to measuring mode selected in this field. Using ball probes make sure that the probes are calibrated before you use it! See also section V.3.3. "Probes".

The following parameters are divided in "GO" and "NO GO". You can set only the values for the gauge type selected.

### **Number of meas. planes:**

Enter the number of planes where you want to measure the ring. A usual number is "3". In this case you take the first value near the top face of the ring, the second in the middle and the third near the bottom face.

### **Meas. values for each plane:**

Enter the number of measures for each plane. A usual number is "2". This means after measuring one diameter in the given measuring planes you should turn the ring around 90 Degrees and repeat the measurements.

### **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.

Press the "OK" button if you want to keep your changes!

**Register "Plug gauges"**

The screenshot shows the 'Inspection conditions' dialog box with the 'Plug gauges' tab selected. The 'Inspection period' is set to 1 Year(s). The 'Method of measurement' is set to 'Differential measurement'. Under the 'GO side' column, 'Number of meas. planes' is 3 and 'Number of meas. points' is 2. Under the 'NO GO side' column, 'Number of meas. planes' is 3 and 'Number of meas. points' is 2. The 'Inspection of depth measures' checkbox is unchecked. The 'Save as default' checkbox is checked. The 'OK' button is highlighted with a green checkmark, and the 'Cancel' button is highlighted with a red X.

**Figure:** Inspection conditions for plug gauges and master discs

**Method for ext. measurement:** Select the default measuring method for external measurements. Available are: direct measurement and differential measurement. Differential measurement means you will use a master to set your indication device and to expand your measuring range.

If you work with a QMSOFT indication program for the Online connection to a measuring machine this program will be set to measuring mode selected in this field.

**Inspection of depth measures:** In some cases a "GO" plug gauge may have a "Depth stop" which also needs to be measured. If you switch on this option you will get an additional screen to enter the nominal and actual values for this depth stop.

All the other fields are comparable to the settings for "Ring gauges".

**Register "Snap gauges"**

The screenshot shows the 'Inspection conditions' dialog box with the 'Snap gauges' tab selected. The 'Inspection period' is set to 1 Year(s). The 'Method of measurement' is set to 'Measuring brackets'. Under the 'GO side' column, 'Number of meas. points' is 5. Under the 'NO GO side' column, 'Number of meas. points' is 5. The 'Bending up compensation' checkbox is checked for both 'GO side' and 'NO GO side'. The 'Save as default' checkbox is checked. The 'OK' button is highlighted with a green checkmark, and the 'Cancel' button is highlighted with a red X.

**Figure:** Inspection conditions for snap gauges

Inspect snap gauges the following fields will be appear additionally:

**Measurement values (snap gauges):** Enter here the number of measuring values for the measurement of snap gauges.

**Bending up compensation:** If you are using a snap gauge to inspect an outside diameter, caused by the form of construction the gauge will be bent up. You can take this effect in consideration if you calculate this "bending up" value with the program. In the certificate you will get the original measure and the measure including the "bending up" compensation.  
Depended on the form of the gauge being inspected select the option "single sided" or "double sided". If you do not want to calculate these corrections then select "no compensation".

### **V.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 explanations.

### V.3.4. Certificate layouts

The program QM-PLAIN 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-PLAIN program. The files have the extension ".L32".

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

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

- "normal" 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. Editing a certificate layout file you can change "field" positions, delete "fields" (if you do not need the related information) and insert new "fields". To insert a new "field" in your certificate layout use the menu "**Insert / Fields**". Using this menu you can also see all available "Fields" and the related information. For numerical fields you can set the number of decimal points using the menu "**Insert / Fields**".

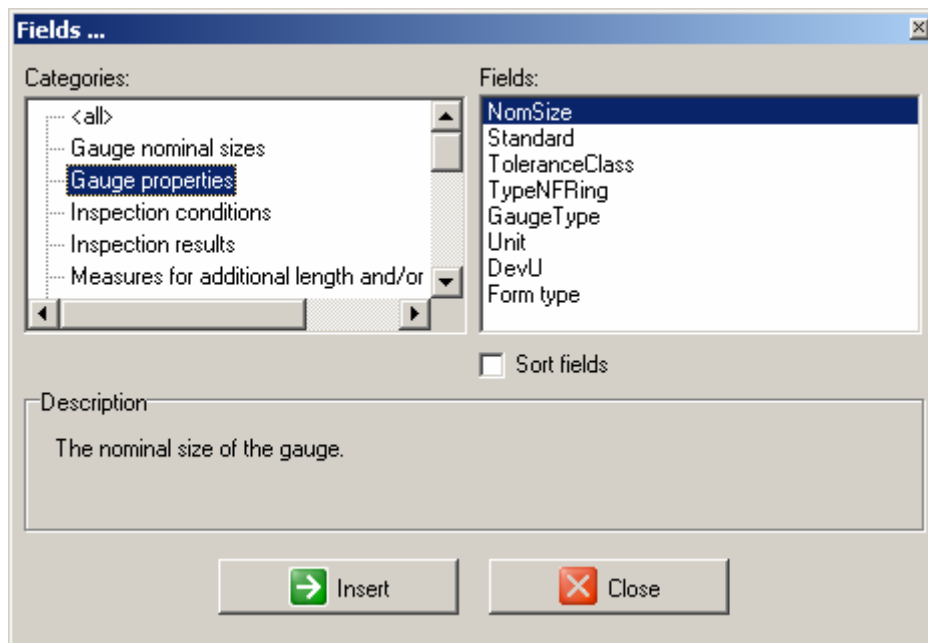


Figure: Dialogue to insert „Fields“ in to a calibration certificate

- "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.

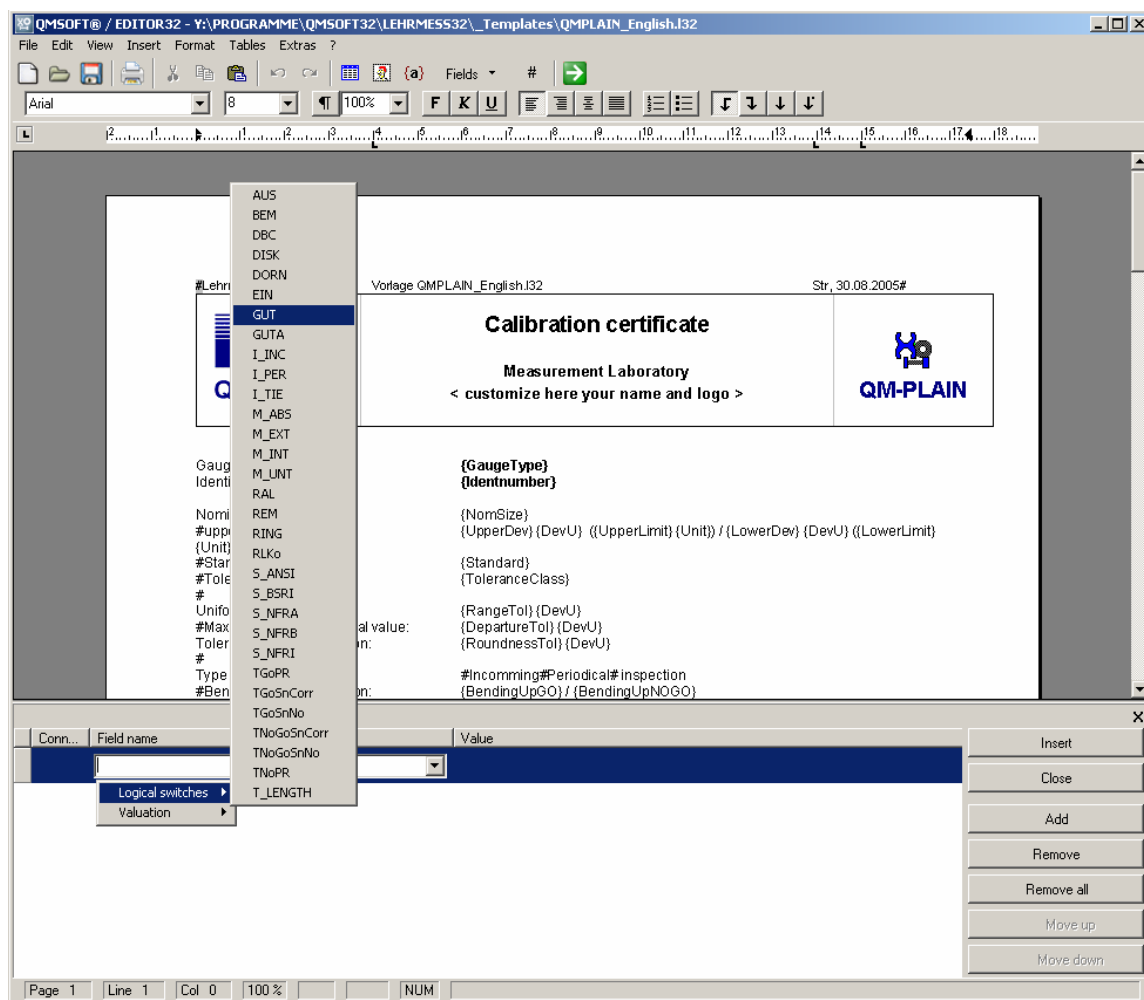


Figure: Setting of conditions for the output on the calibration certificate



### V.3.5. The usage of "Factory tolerances"

To calculate the gauge limits for non standard gauges the program does offer the possibility to enter tables with "Factory tolerances".

Use the menu "Settings | Factory tolerances" to create new tolerance tables or to edit existing tables. The tables with the "factory tolerances" are divided in "mm" and "inch" tables. Also the tables are related to the different types of gauges (Plug gauges, Ring gauges,... ) and the different kinds of the tolerance calculation in accordance to ISO/R 1938:1971 rather DIN 7150-2 February 2007 or similar the regulations in the "British Standard BS 969:1982".

Depended on the kind of tolerance calculation you have to type in different values in the related tolerance tables.

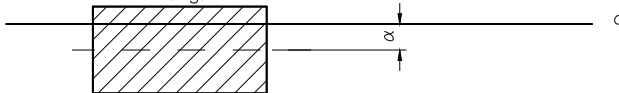
For an "ISO – conform" tolerance you need: the gauge manufacturing tolerance " $H/2$ ", the value to calculate the wear limit " $y$ ", the value " $z$ " as the distance of the middle of the tolerance field of the new Go gauge to the Maximum Material Limit of the work piece. For gauges over 180mm there may exist an additional "safety distance" " $\alpha$ ". See the related figures for it.

Nominal size [mm]	Workpiece tolerance [μm]	Tolerance T/2 [μm]	Wear allow. W [μm]	Indent val. "z" [μm]	Safety zone "alpha" [μm]	Roundness [μm]
10	6	0,75	1,0	1,0	0,0	0,6
30	21	2,0	2,0	2,0	0,0	1,5
30	52	2,5	0,0	7,0	0,0	1,5
30	100	4,0	0,0	9,0	0,0	2,0
60	50	2,5	4,0	0,0	0,0	1,0

Figure: Entering of ISO conform tolerance values for "Plug gauges"

The entered tolerance values are related to the nominal value (nominal size up to and including) and the related workpiece tolerance. The line marked in the above figure is valid for nominal values over 10 mm up to 30 mm and a tolerance until 21 μm.

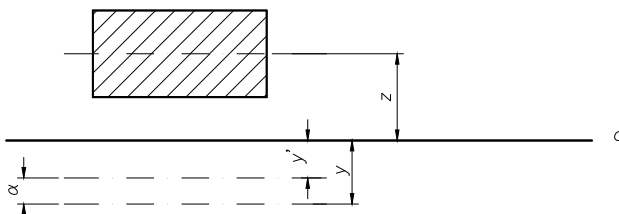
Least Material Limit = High limit for hole = Not go side  
 $H(H_S)$



In the figure you can see the usage of factory tolerances for plug gauges

The "Go plug gauge" controls the Max.-Material-Limit (Low limit) of the hole. The "Not go plug gauge" controls the Least-Material-Limit (High limit) of the hole.

The "safety" range " $\alpha$ " will usually be used only for plug gauges over 180mm. For plug gauges until 180mm the value for " $\alpha$ " has to be entered as "0".

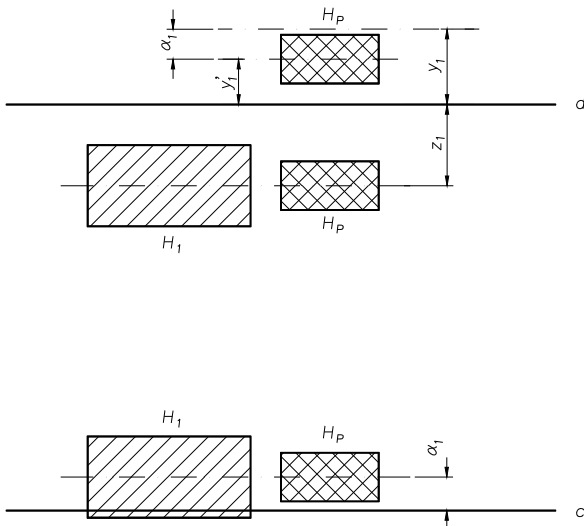


Maximum Material Limit = Low limit for hole = Go-side

Example for the calculation of a "GO / No go plug gauge": workpiece is a hole "25H7"; using the tolerance values as shown in the figure it will result the following gauge limits.

- The basic deviations of a hole "25H7" (based on ISO 286) are "0.0 $\mu$ m" und "21.0 $\mu$ m", it will result the hole limits as "25,000mm" and "25,021mm"
- Go plug gauge: The gauge limits of the "new" Go plug gauge has to be calculated by the low limit of the hole plus the "indentation" value "z" plus / minus the half of the factoring tolerance "H".  
The required tolerance values you will find in the tolerance table shown in the figure. See the marked line with the nominal value " $\leq 30$ mm" and the related workpiece tolerance  $\leq 21\mu$ m). The calculation is now: 25,000mm + 0,002mm  $\pm$  0.002mm, the gauge limits for the "new" gauge are 25,000mm and 25,004mm. The "wear limit" has to be calculated as: low limit of hole minus the wear limit "y", the result is 24,998mm.
- No go plug gauge: the limit values of the No go plug gauge has to be calculated using the hole high limit plus / minus the half of the factoring tolerance "H" (the value " $\alpha$ " is "0"). The results are 25.023mm and 25.019mm.

Maximum Material Limit = High limit for shaft. = Go side



Least Material Limit = Low limit for shaft = Not go side

The figure will show the usage of ISO conform factory tolerances for ring and snap gauges (gauges for shafts).

The "Go ring gauge" controls the Max.-Material-Limit (High limit) of the shaft. The "Not go ring gauge" controls the Least-Material-Limit (Low limit) of the shaft.

The "safety" range " $\alpha_1$ " will usually be used only for ring gauges over 180mm. For gauges until 180mm the value for " $\alpha_1$ " has to be entered as "0".

Note: The double hatched tolerance fields are valid for checking plugs for snap gauges.

Using factory tolerances in the way of placing the gauge limits in accordance to the British Standard BS 969 only the values for the gauge tolerance "T" and the wear allowance "W" are required.

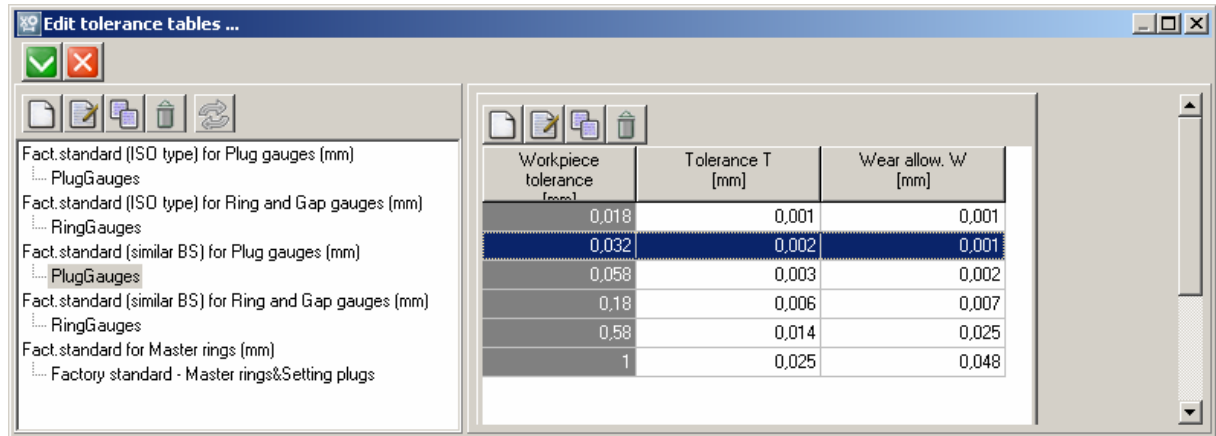


Figure: Entering of factory tolerances placing the tolerance limits in acc. to BS 969

Entering the tolerances similar to the BS standard the tolerances are only related to the workpiece tolerance. The nominal size of the workpiece does no matter for the assignment of the gauge tolerances.

## V.4. Doing a gauge inspection

### V.4.1. Entering gauge nominal data

After choosing the type of gauge to be inspected ( use the menu “Inspection” to select a “Master setting disc”), the dialog box shown in the figure will appear on your screen. Corresponding with your selection there are different fields showing the gauge parameters. Here you will see it for a GO/NO GO plug gauge.

If the program is started up from the gauge data management system **QM-MANAG** the dialogue fields are blocked and the nominal values of the gauge will be transferred from the database.

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. The ID number will appear in the calibration certificate.

**Nominal size of gauge:** Enter here the basic size of the gauge or rather the product limits. See the next points to explain the meaning and the differences caused by different standards.

#### V.4.1.1. Entering gauge nominal data – ISO conform

Calculating the values according to ISO 286 or BS969 the product limits will determine the gauge sizes and tolerances. In case that the gauge tolerances are directly depended from the product tolerance the calculation requires the upper and the lower limit of the product.

The simplest way to enter the product limits is using a standard ISO designation. This will be done by entering the basic size and the tolerance class. A tolerance class shall be designated by the letter(s) representing the fundamental deviation followed by the number representing the standard tolerance grade. Examples: H7, G8 ....

If you have entered an ISO designation you can click on the “Nominal size” button (or press function key “F7”) to get the gauges deviation. Now you will get also the explicit deviations constituting the product limits.

**Figure:** Entering a gauge designation according to ISO rules

If there is no ISO designation given you can also enter the explicit deviations.

For example if your gauge is marked as “100 -0,050 -0,100” then enter:  
the “Nominal gauge size” = “100”; the “Upper deviation” = “-50” [µm] and  
the “Lower deviation” = “-100” [µm]

#### V.4.1.2. Entering gauge nominal data for ANSI gauges

The tolerances of a gauge calculated according to the ANSI B89.1.6M standard are depended from the nominal size and the tolerance class. The product limits are not required to calculate the tolerances.

Naturally for a double sided GO/NO GO gauge the entering of the product limits is useful because it does not make sense to calculate both gauge sides for an identical diameter. For example you can enter “**10.0 / 10.04**” for the “Nominal size” to define the product limits. The program will calculate the gauge tolerances and give you also the “Upper” and “Lower” deviation in relation to the products basic size (in this case 10.00 “)

As described for the entering of ISO gauges you can also enter an ISO designation (for example 30K8) to calculate gauge tolerances.

QMSOFT@ / QM-PLAIN - Inspection of plain gauges

File Settings Help

**Enter gauge data**

Identity number: 08999

Nominal size: 1.00000 " / 1.02000 "

Unit: inch

Nominal values acc. to: ANSI/ASME B89.1.6M - 1984

Class of accuracy: X

Calculate

Upper deviation workpiece:

Lower deviation workpiece:

Upper deviation - GO side: 60 µInch

Lower deviation - GO side: 0 µInch

GO side - wear limit:

Upper deviation - NO GO side: 20000 µInch

Lower deviation - NO GO side: 19940 µInch

Abort Menu\_Instruction Inspection conditions... Continue

**Figure:** Entering parameters for an ANSI/ASME gauge

After you have completed your entries in the dialog box, press the "continue button.

### V.4.2. The measuring process

Inspection - GO side of gauge - GO / NOGO plug gauge "08899"

	1. Meas. value	Tolerance field	2. Meas. value	Tolerance field
Meas. plane 1	49.97030 mm	---x-----		
Meas. plane 2	49.97120 mm	---x-----	49.97180 mm	---x-----
Meas. plane 3	49.97210 mm	---x-----	49.97210 mm	---x-----

Limit to nom. size: lower -32.00 µm, upper -19.00 µm  
 Gauge limit: 49.96800 mm, 49.98100 mm  
 Method of measurement: Differential measurement

QMSOFT® / R5232DRV Indication program for seri...  
 File Settings General settings Help  
 External measurement abs ACTIV  
 49.9707 mm  
 NEG SET  
 [Stop]

Abort Online Back Continue

**Figure:** Entering of measuring values

Measurement values are always entered in a sequence of measurement values 1 to n for gauge position 1 (corresponding with measuring plane 1 to n), measurement value 1 to n for gauge position 2 etc. While inspecting snap gauges a number of measurement values will be received for each side of gauge. Measuring double sided GO/NO GO plain plugs or double sided snap gauges is done first on the GO - side of gauge and then on the NO GO side.

The measuring will be supported by a graphic display showing the measured value in the gauge tolerance field.

If you want to take over measuring values from an Online connected measuring machine, press the "Online" Button to start the indication program.

**ATTENTION:** Use the menu option "*Settings | General Settings*" to set the "Transfer measuring values from.." to the option "Online". Please check, that in the register "*Directories*" the correct "*Indication device*" is selected.

### V.4.3. The Button "Probes"

If you execute an internal measurement on a ring or snap gauge, here you have the access to the probe management program.

You can use this to calibrate probes before starting the measurement process. See the user manual of this program if you need more information about the handling of this.

### V.4.4. Selection of a probe

The usage of a special probe for internal measurements is related with the usage of an Online connection with a QMSOFT **indication program**. Therefore the probe selection has to be made in the indication program using the menu "**Settings**". See the user manual of the related indication program for this.

## V.5. Output of results

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

QMSOFT® - End of inspection / Valuation: "08899"

Customer: Flintstone & Sons Ltd.

Calibration certificate number: 2009\_07\_21\_0017

Valuation: usable

Comments:

Actual Date: 24.07.2009 Next inspection: 24.07.2010 Operator: Neil

Inspection certificate layout: QMPLAIN\_English

Edit cert. layout

Show certificate

Print certificate

Abort Back Finish

**Figure:** End of inspection – show / print 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 to see how to operate this.

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