



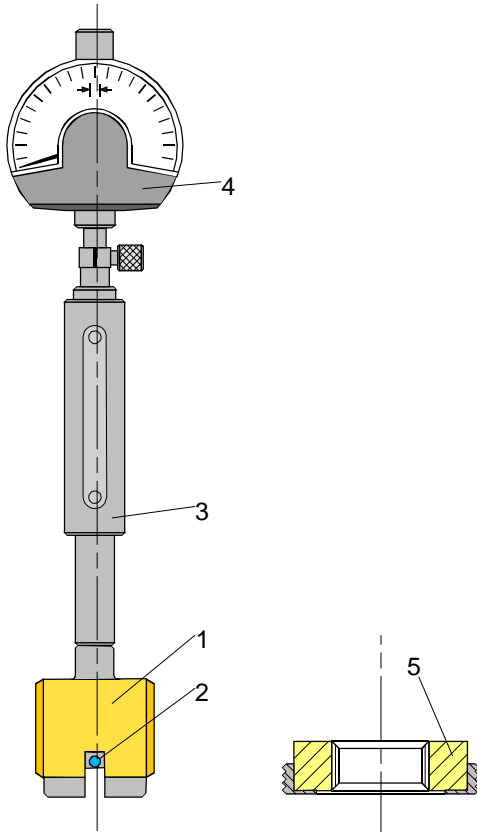
# Users Manual

## Indicating Spline Plug Gages Type IVM 1x1



# 1. The complete Indicating Spline Gage IVM 1x1

Indicating spline plug gages are precise gaging systems and should be handled with care. The instruments are delivered in assembled condition. Remove the protective coating from the surface of the plug and the setting ring.



1. Plug gage
2. Measuring insert with tungsten carbide balls
3. Handle or table stand
4. Frenco dial indicator or electronic readout unit
5. Setting ring max. actual
6. Control ring min. actual (optional)

The plug gage may be ordered to have a

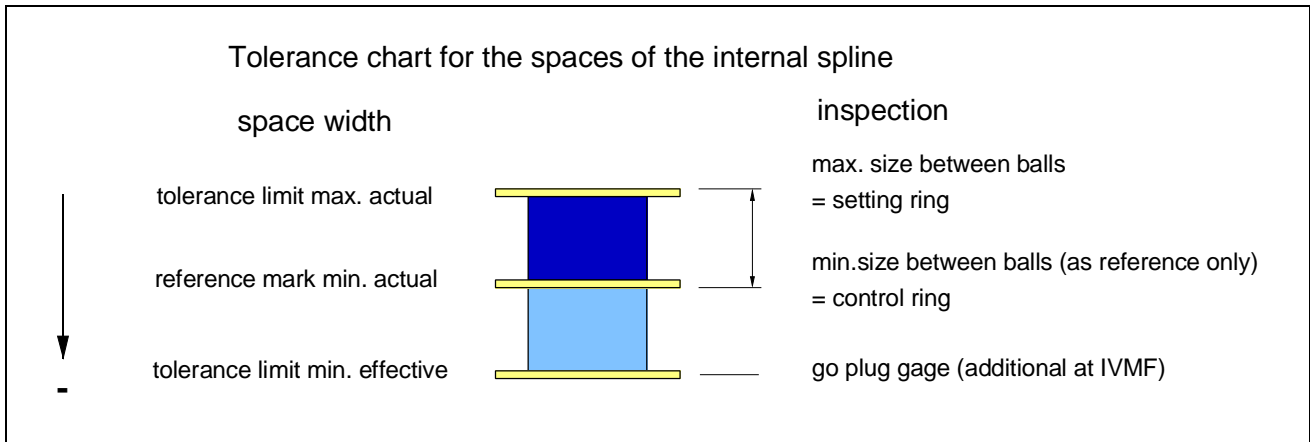
- + Guiding spline profile (black colour) , type IVMF
- + A go gage profile identical to the sizes of the composite go gage plug (ground surface), Type IVML
- + A go gage profile identical to the sizes of the composite go gage plug with clearance in the front section (ground surface with front step), Type IVML/F

## 2. Design

The indicating gage has been designed specifically for the spline data of the part drawing submitted to this order. It does only fit this specified spline..

Type	description
IVMF	If the plug has a guiding spline <b>type IVMF</b> , the instrument measures the size between balls, but not the go condition.
IVML	If the plug is a go gage plug <b>type IVML</b> , it checks the go condition as well. If the plug does not fit the internal spline of the part, the minimum effective space width is smaller than the min. effective tolerance limit. In this case, the size between balls cannot be inspected, because the plug does not enter the part.
IVML/F	If the plug is a go gage plug with clearance in the front section <b>type IVML/F</b> , the size between balls can be inspected even if the go gauge plug does not enter the part. It will enter the the part half way only.

The setting ring is designed to the maximum actual space width and represents the tolerance limit of the max. size between balls. This maximum setting ring is used to calibrate the gauge. If a control ring is delivered as an option, it is designed to the minimum actual space width. The control ring is used to control the measuring accuracy of the gauge.



### 3. Indicator or electronic probe selection

Frenco dial indicators have a limited range of travel, approximately 0,2 mm (.008"). Other indicators may be used but total travel should not exceed 0,5 mm (.020"). Indicators having too much range may damage the measuring insert.

The measuring force required for the indicators is approximately 100 gr.. This value is common to most indicators. Electronic probes usually have a measuring force of 50 to 80 gr. In some cases is that too soft. We recommend to always use a measuring pressure of 100 gr. and order electronic probes to this force.

### 4. Setting adjustment

Fit the plug into the setting ring max. actual. Carefully fit the dial indicator or electronic probe into the handle or table stand until the indication shows a value close to " 0", which represents the tolerance limit of maximum size between balls.

The setting ring is made to the max. actual size between balls as shown on the part print. Due to manufacturing variations, the setting ring will slightly vary from this size. For that reason, the setting ring is marked with 2 sizes:

1. The max. actual size between pins according to the part print

2. The deviation from this size due to manufacturing variations

**Example:**

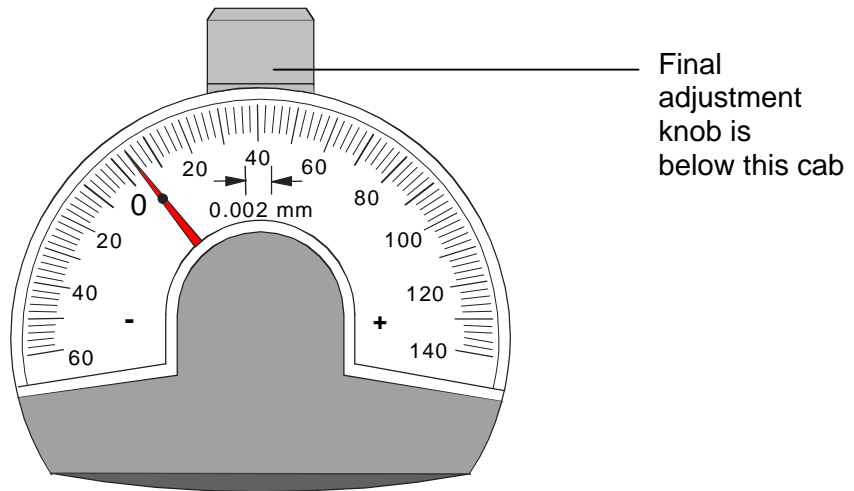
1. Part DBP 2,5 = 34,573 max.  
(max. allowed dimension between 2,5mm dia pins = 34,573)

**marking:**

2. Actual size = - 0,004  
(True size of setting ring deviates from the 34.573 mm dimension by - 0.004 mm, in other words, it is 34.569.

The following setting procedure is necessary for above example:

As the setting ring shows a - 0.004 mm deviation from the max. actual size between balls, the pointer is now set by the fine adjustment knob as shown below:



**Indicator readings to the right of "0" represent minus deviations.**

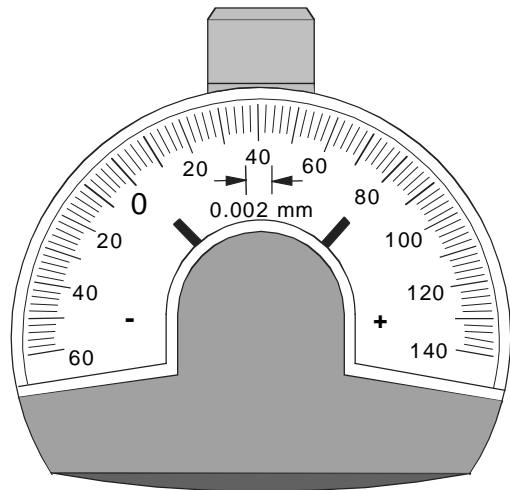
## 6. Checking the part

Set the tolerance signs on the dial indicator. The sign for the maximum actual tolerance limit is always set to the zero, because the setting ring is made to it and the deviation from the true size has already been corrected. The minimum actual tolerance sign does not represent a tolerance limit, but a reference mark. Set it as shown in below example:

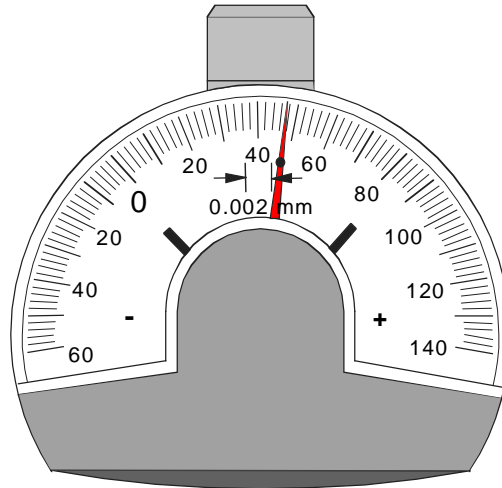
Example: DBP max. = 34,573  
 DBP min. Ref. = 34,499

Set the tolerance sign for max. actual reference mark to::

DBP max.	34,573
-DBP min Ref.	<u>- 34,499</u>
=	- 0,074



Fitting the part on the gage may be done horizontally, vertically or in any other position. The size between balls will be shown on the dial indicator nearly without any movement of the pointer, even when the part is moved on the gage within the clearance. When the gauge is inside the part, the dial indicator may show the following result and this indicates:



1.	The indicator reading provides the true dimension between balls, thus the deviation from the maximum actual size ( $34,573 - 0,046=34,527$ ).
2.	The size between balls is smaller than maximum actual tolerance limit and ok.
3.	The size between balls is larger than the minimum actual reference mark and does not cause a problem.
4.	<b>Only at IVML, where the plug is a go gage plug:</b> As the go plug fits the part, the minimum effective size is inside the tolerance limit

If the dial indicator readings are right of the min. actual reference mark, the size of the parts come into critical section. But the parts are ok as long as the go gage plug fits.

## 7. Cleaning

Indicating gages are precise measuring devices and a clean gage helps to get high accuracy. As the reading has 0,002 mm graduations, a clean part has advantages as well.

It may be necessary to clean the gage periodically. Use an air blast for easy cleaning and a cleaning fluid if desired. Cleaning fluids will not damage the gage. Where dirt effects the proper functioning of the gage and cannot be removed by these simple methods, we suggest returning the gage to us.

## 8. Trouble shooting

### 1. The Part does not fit the gage and the plug is a go gage plug IVML:

- part is too small or form errors are too large or both.

Suggestion: Check the part between pins by use of gage bolcks. If the size is within part tolerance, form errors are to blame. Use an analytical inspection machine to determine the kind of form error so to correct the source of the problem.

If this problem occurs often, it is possible to have us alter the go gage plug. Under this circumstance the front section of the go plug can be ground undersize to Type IVML/F in order to allow insertion and show size between balls even if the go gage does not fit.

### 2. The part does not fit the gage and the plug has a guiding spline IVMF

- The size is much too small or the form errors are much too large or both. The guiding spline is smaller than a go gage plug and should fit in any case. Find the reason as shown in 8.1.

### 3. The part fits the plug, but the size between balls is left of "0"

- The size between balls is too large and therefore your part is out of tolerance.

Note: It may occur that you have to produce your parts oversize to allow your go plug to fit. The reason for it are exceeded form errors. They are that large that no tolerance is left for actual size. In this case check the tooling, your machine or the process.

### 4. The part fits the go gage, but the size between balls is smaller than the min. reference mark

- congratulations, you have less form errors than allowed. The contact area of the profile is better than specified

Suggestion: You may proceed as long as the go ring fits.

### 5. You do not get an indicator reading at all

- the spacer between the indicator shaft and the ball point is too short
- the dial indicator has to be positioned deeper into the gage

## 6. Readings do not repeat

- are you using the correct dial indicator or probe force of 100 gramm?
- are the screws of measuring insert and spacer fastened tight enough ?
- is the dial indicator or the probe working correctly?
- is the function of the indicating gage affected by dirt?
- is the part acceptably clean for inspection?

Note: If your problem does not apply to the items above and you require further assistance, please call us.

## 9. Wear

The go gage plug and the measuring balls are of course subject to wear. Wear flats will appear on the measuring balls even though they are made of tungsten carbide after a certain period of use. The flats do not influence the accuracy as the contact points are identical to the setting ring spline profile. If the flats become too large (more than 0,5 mm), the measuring balls should be replaced.

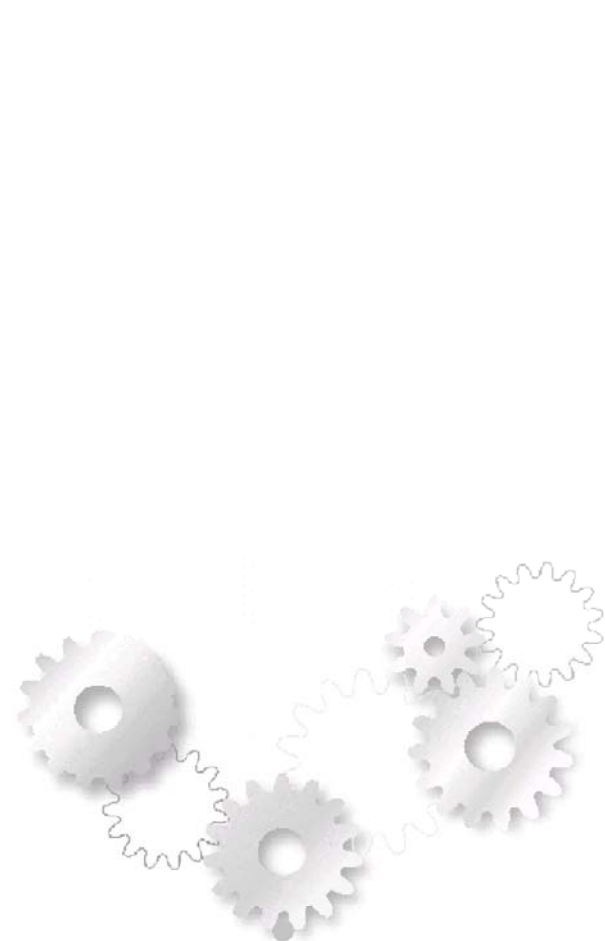
Gage wear should be checked periodically in accordance with normal practices. The gage drawing shows a worn dimension over pins and for the individual form errors for the go gage plug. When the go gage plug is smaller than the worn dimension or the form errors exceed the worn values, the plug must be replaced.

Please order according to the numbers supplied on your drawing. We will refit your measuring insert to the new go plug at no additionally charge and in a very short period of time. Order your parts in advance of your need. Allow 6 weeks minimum for a go gage and 4 weeks minimum for a new measuring insert.

The setting ring has to be inspected periodically too. There is no worn size on the drawing. If the size changes after a period of use, the true size between pins has to be remarked. If the form errors of the setting ring exceed the worn form errors given on the drawing due to wear, the setting ring has to be reground and remarked.

The easiest way of handling the wear inspection of indicating spline plug gages is to send back the complete indicating gage to us for checking wear inspection periodically.

If there are any additionally questions, please contact us.



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