DELPHI

TOOL DESIGN - MANUFACTURING DESIGN SPECIFICATIONS FOR TOOLING AND EQUIPMENT

SECTION E - GAGE DESIGN

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SECTION E - GAGE DESIGN

E. 1 GENERAL

1. 1 Gage drawings must adhere to the general specifications of Sections “A” thru “F” of the DTS Manufacturing Design Standards.

1. 2 All gages must be permanently stamped, machine engraved, or laser etched with the gage number (no hand etching). Storage box be provided & permanently labeled. Gage number is to be shown in position on CAD model and drawings.

1. 3 Use black oxide or similar type preventive treatment on materials that might become corroded.

1. 4 The gage must not permanently distort the piece/part during the checking operation.

1. 5 When clamping is necessary, use a quick clamping method that does not damage the piece/part.

1. 6 If grinding is required on drill rod pins, oversize stock must be specified in the Bill of Material.

1. 7 The support and locating surfaces must be relevant to the gaging dimensions being checked. Whenever possible duplicate those surfaces used on the production fixtures.

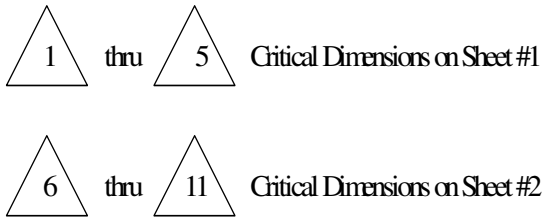
1. 8 Dimensions requiring inspection must be identified with triangles and numbered consecutively. Wherever possible these dimensions should reflect dimensions from the piece/part drawing.

1. 8. 1 An index of the triangles and their sheet location must appear on the first assembly sheet.

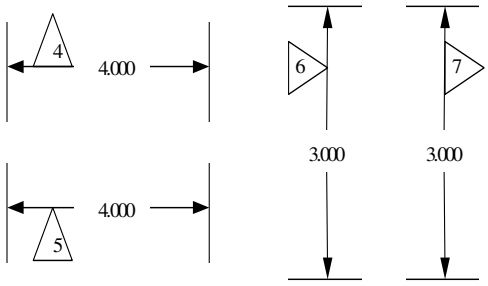
1. 8. 2 The triangles must be equilateral, with sides of .25 minimum to .50 maximum.

1. 8. 3

Example: First Assembly Sheet Index.



Example: Suggested Triangle Locations



1. 9 Construction holes must be located to allow for inspection without removing details from the gage assembly.

1. 10 Gage balls shall be utilized where checking to construction holes would be difficult.

1. 11 All construction holes must be numbered consecutively.

E. 2 INDICATORS

2. 1 All indicators must have restricted travel.

2. 1. 1 An indicator must be selected whose range allows the total piece/part tolerance to be read.

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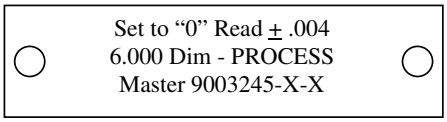
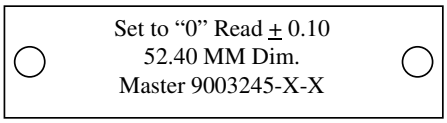
2.2 Provide a brass or plastic tag on indicator gages. The tag is to be stamped or engraved with the dimension and tolerance being checked plus the number of the set-up master used. Tag to be shown on CAD model and drawings. Include the word "process" after the dimension if it is not a piece/part dimension.

Example: Stamp or Engrave as shown attach with screws.





2.3 Use Federal split bushings when mounting on the stem. Mount in such a way as to prevent damaging the indicator by over travel.

2.4 Protect indicator points and stems from side loads or bumping.

2.5 Use on brand of standard gage components per gage.

2.6 Use standard gages where possible.

E.3 SET-UP MASTERS

3.1 A set-up master is used to set the gage or verify the gaging dimension.

3.2 A set-up master must duplicate the piece/part gaging dimension, not necessarily the size or shape of the piece/part.

3.3 Use standard set-up masters where possible.

3.4 All set-up masters must be hardened.

3.5 The gage drawing must specify that all set-up masters be supplied with a durable storage container.

3.5.1 The storage container must be called for in the B/M. (KUDL-pak, wood, etc.).

3.6 The set-up master should be stamped with the dimension it is checking in English and metric, the gage "9100123.001-X-X where the first X is the current gage # and the second the current master #. Current master numbers are kept in gage lab.

E.4 TOLERANCE

4.1 The total gage tolerance, on all gages, must not exceed 10 percent of the total piece/part tolerance.

4.2 Flush pin gage tolerances must not exceed .0005.

4.3 The unilateral system will be used, keeping all gage tolerance with the tolerance of the piece/part.

4.3.1 Using a male type gage, keep all gage tolerance of the "Go" member plus (from the minimum dimension), and the "No-Go" member minus (from the maximum dimension).

4.3.2 Using a female type gage, keep all gage tolerance of the "Go" member minus (from the maximum dimension), and the "No-Go" member plus (from the minimum dimension).

E.5 CONSTRUCTION & DURABILITY

5.1 The gage must be repeatable and capable of passing a R & R study. When a piece/part is checked, after rechecking, it must give the same readings.

5.2 Use steel bases on gages if strength is an important consideration. This is particularly true if the gage has high posts.

5.3 Base plates must be of substantial thickness so no warpage or bending occurs in the plant environment.

5.4 Gages with high posts should have posts constructed of welded assemblies with sub-bases. Square tubing may be used for these posts to reduce weight of gage.

5.5 Gage members must be of substantial strength to eliminate deflection.

5.6 Any part of a gage that may be bent or deformed while in use should be hardened so it will break, rather than bend and make a faulty check.

E.6 SPECIAL APPLICATIONS

6.1 For plug gages, use pin type or taperlock design up to and including 1.510" (38.3 mm) diameter. Use trilock design above 1.510" (38.3 mm) diameter.

6.2 Specify a "Slip Fit" on sliding pins. Clearance tolerance may be added.

6.3 The length of contact for "Slip Fit" pins must be a minimum of two (2) times the pin diameter.

6.4 Provide a note that alignment gages must have the gage number, and all the piece/part and model numbers stamped on the gage.

If the stamped surface is a working surface, a pocket should be machined to receive the stamped numbers to preserve the integrity of the working surface.

E.7 PLUG GAGE

7.1 Drawings must be issued for plug gages requiring special features.

7.1.1 Special plug gages should be modified from A.N.S.I. plugs when possible and call for standard A.N.S.I. bushings and handles.

7.2 When feasible, alterations made on "GO" plugs should be made on both ends of the plug to allow quick change of worn first end.

E.8 FLUSH PIN GAGE

8.1 Grind the gage step on the gage body.

8.2 Flush pin gages must not be used when total piece/part tolerance is less than .005.

8.3 Harden the pin and body to R/C 58-62.

8.4 Gage tolerance is 10% total piece/part tolerance but not to exceed .001 total (set dimension tolerance plus step tolerance). Example:

Total piece/part tolerance minus the minimum depth.
Tolerance = "Gage Step" or .010 (-) .0005 = .0095.
Gage Step with gage tolerance = .0095 + .0000/-.0005.
Maximum depth dimension = 1.255 on piece/part.
Minimum depth dimension = 1.245 on piece/part.

E.9 SNAP GAGES

9.1 Use purchased snap gages where possible.