



Gage Fixture Requirements

Revised: March 25, 2008

MODINEER COMPANY GAGE FIXTURE REQUIREMENTS

1. Scope

This procedure applies to Modineer suppliers involved with designing and developing gage fixtures. This standard applies to gage fixtures internally designed and constructed by Modineer.

2. Purpose

To establish a uniform standard for the design and construction of Modineer gage fixtures.

3. Supporting Documents

Standards: ASME Y14.5M – 1994 – Dimensioning and Tolerancing
ISO/IEC 17025 – General Requirements for the Competence of
Testing and Calibration Laboratories

4. Definitions

Attribute Gage: A gage designed to check the GO (Ok) or NO GO (Not Ok) acceptability of a part feature. This type of gage will not provide variable measurement data. This gage may be part of a gage fixture.

Variable Gage: A gage designed to provide variable measurement data for a part feature. This type of gage is best used when SPC data of a part feature is required. This gage may be part of a gage fixture.

Gage Fixture (Check Fixture): A permanent gage to be used for the qualification of production parts. It can be comprised of individual gages, both attribute and/or variable. It can be designed to check an entire part or check a specific detail or area.

Hand Apply Fixture: A permanent hand held gage to be used for the qualification of production parts. It is either a part of a gage fixture or an individual gage designed to check a specific detail, characteristic or feature.

Holding Fixture: A fixture to be used for the qualification of prototype, pre-production, or production parts. It contains no attribute or variable checking feature and is intended to orient (locate) the part in body position (A, B, C datums) for layout inspection.

Template: A pattern, out line or shape that is used to compare itself to another geometric shape or pattern.

5. Concept Development and Control

- 5.1 When requirements create the need for additional gage fixtures, the assigned Modineer Program Manager will initiate a check fixture gage concept / design review meeting. Typical attendees for the check fixture gage concept/design review meeting will include the assigned Program Manager, the assigned Quality Engineer, a Manufacturing representative, and the selected gage builder.
- 5.2 When the concept is completed, Modineer team members, and, if required, a customer representative (e.g. GM, Ford, Chrysler), will sign the concept that will serve as a release for construction of the gage fixture and will indicate the approved engineering level.
- 5.3 Upon approval, original concepts and associated designs are the property of Modineer.
- 5.4 Unless otherwise approved by Modineer in accordance to section 15.1 of this standard, compliance to approved concepts and associated designs/drawings in conjunction with this standard is mandatory. Failure to comply can result in rejection of the gage.
- 5.5 Changes to a gage fixture gage concept and/or design approval by the Modineer gage team must be submitted in writing and approved by Modineer in accordance to section 15.1 of this standard. No changes are to be initiated without written approval by Modineer.

6. Design Requirements and Supplier Obligations

- 6.1 The gage fixture design will be based upon the gage builder's drawing(s) and the associated Modineer inspection plan.
- 6.2 Unless otherwise specified, gage fixture designs will ensure a Gage Reproducibility and Repeatability (R & R) value of 10% or less for each measured feature per the current revision of the Automotive Industry Action Group (AIAG) guidelines and applicable customer specified standards.
- 6.3 The contracted supplier assumes responsibility for quality, good construction technique, and any interference problems hindering gage usage.
- 6.4 Fully dimensioned design drawings are required. The contracted supplier will assume full responsibility for all calculations.

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- 6.5 Designs must be reviewed and approved by Modineer. Design approval by Modineer does not limit the obligation of the supplier to provide design satisfying specification requirements and fit for use.
- 6.6 The assigned Modineer Program Manager and Quality Engineer will approve the final gage design. Approval and acceptance of design drawings/concepts by Modineer does not relieve the supplier of responsibility for any error found during construction.
- 6.7 The gage fixture builder will supply Modineer with gage drawings and associated CAD data. The gage builder will be responsible for retaining gage records (drawings, purchase orders, etc.) for the life of the part plus one-year.

7. General Gage Fixture Requirements

- 7.1 The gage fixture must be dimensionally stable and must be capable of maintaining this stability.
- 7.2 Gage fixture base material will be Aluminum Tooling Plate or Cast Aluminum. Bases 12" x 12" or less must be at least $\frac{3}{4}$ " thick. Bases larger than 12" x 12" must be 1" thick. Bases larger than 24" X 24" must be cast aluminum (Wolverine or equivalent).
- 7.3 Gage fixture bases must have at a minimum $\frac{3}{4}$ " clearance risers attached to the bottom of the base plate at each of the four (4) corners, unless otherwise specified. Larger bases may have additional risers and/or clearance.
- 7.4 Gage fixtures / die models shall be based in three planes with base locations and tool ball XYZ locations identified. Grid lines (body lines) must be identified by etching or metal stamping required information.
- 7.5 The unit of measure used for dimensions on the gage or its elements will correspond to those on the part print; i.e., if the print is metric, then the readouts, construction dimensions, etc., also will be metric.
- 7.6 Gage details/features must be doweled and screwed in place
- 7.7 Sharp corners on non-gauging surfaces will have an edge break up to 0.5 mm (.020") unless otherwise specified.
- 7.8 Gauging (nets, stab pins, and locators) and non-gauging surfaces are to be protected from corrosion.
- 7.9 Elements must function smoothly without the use of excessive force and with no play. Gage pins, dial indicators, transducers, etc. must slide into associated bushings. "Swing gates" and other moveable elements must lock into proper location with minimal effort.

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- 7.10 Locating and checking features shall be plainly marked in agreement with the inspection plan.
- 7.11 Gages fixtures weighing an excess of 25 pounds must have lifting handles attached or “hand slots” in the base.
- 7.12 Gage fixtures weighing an excess of 75 pounds must be provided with a wheeled gage cart / table unless otherwise specified. Cost of the cart must be included as a separate line item of each gage quote.
- 7.13 When possible, standard catalog items will be used for parts such as clamps, handles, key pulls, etc.
- 7.14 Clamps used will be “heavy duty” and provide the proper amount of tension on the part being measured. Clamps will be properly adjusted at time of delivery to Modineer so that no additional adjustments will need to be made by Modineer personnel. Clamps must be numbered to provide identification.
- 7.15 Springs used will provide the proper amount of tension on the part being measured. Springs will be properly adjusted at time of delivery to Modineer so that no additional adjustments will need to be made by Modineer personnel.
- 7.16 Loose and hand held details will be stamped or otherwise identified with associated gage number and be tethered to the gage fixture by the use of key pulls.
- 7.17 Key pulls must not be excessive in length and must be attached securely (20 lb. minimum pull off) with removable fasteners. Key pulls must be chain-type and be located on the gage fixture adjacent to the feature being measured or attached to a “gage rail”. Height and location of “gage rail” may vary depending on the check fixture design. “Gage rail” height and location must be approved by and the assigned Modineer Program Manager and Quality Engineer. Attachment clips for the tethered features must not be mounted onto the key pull cases.
- 7.18 Double sided hand held attribute gages consisting of GO size, indicated with a green collar and a NO GO size, indicated with a red collar will be used to check holes sizes, slot sizes, surface profile and/or flatness (feeler check), etc. unless variable data is required. The hand held gages will be tethered to the gage fixture base in accordance to 7.16 and 7.17.
- 7.19 When an attribute check of a hole diameter is required, separate GO and NO GO pins are required to measure hole diameter. Combination step gages to measure hole diameters are not permitted unless difference between the high and low tolerance limit is 1.5 mm (0.60”) or greater AND approved by the designated Modineer Quality Engineer.
- 7.20 When an attribute check of a slot is required, separate GO and NO GO pins are required to measure slot length and slot width.

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- 7.21 When an attribute check of a surface is required, separate GO and NO GO pins are required to measure the surface profile/flatness (feeler check). Feeler checks are established using a 3.0 mm nominal feature. Feeler pins provided for checks between surfaces must be bent appropriately to allow for correct function. The gaging surfaces and length used for a feeler check as well as the amount of feeler clearance between part and checking features must be stamped or otherwise identified and must be visible to the gage operator when part is in gage. If more than one tolerance exists, color code and stamp checking surfaces and the associated feeler pins / scrape templates.
- 7.22 When a “flush” check of a feature is required, the gaging surfaces used for flush checking must be stamped or otherwise identified with the word “flush” and must be visible to the gage operator when part is on gage fixture.
- 7.23 Templates are to either be 1/8” thick steel or ¼” aluminum and beveled unless otherwise specified.
- 7.24 When variable data collection is required, the builder must provide a list including make and model of dial indicators and/or data collection transducers to the designated Quality Engineer for approval prior to purchase. Bushing utilized to position dial indicators and/or transducers (SPC ports) must be numbered to provide identification.
- 7.25 Sight lines must be indented into the appropriate surface and clearly marked. Sight lines must be colored, preferably yellow, to provide maximum visibility.
- 7.26 Gage User Information and Gage Instructions will be included in accordance to section 11 of this standard.
- 7.27 The builder must provide dimensional inspection results and a roadmap (ballooned) drawing indicating inspected features for each fixture gage in accordance to section 14.3 of this standard. The gage fixture builder is required to have each gage third party certified in accordance to section 14.2 of this standard unless otherwise specified by the assigned Quality Engineer.

8. Dimensional Requirements

Bases

- Squareness +/- .0005” per foot not to exceed .005” over all squareness relationship of machined edges in any size- length and width.
- Flatness +/- .001” per foot not to exceed +/- .010” overall.
- Parallelism +/- .003” between top and bottom surfaces.

Locators

- 4- Way +/- .05mm from alignment points, i.e. tooling balls or edge of base

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- 2-Way Locating direction +/- .05mm from alignment points i.e. tooling balls or edges of base. Non-Locating direction 10% of part tolerance but not less than +/- .05mm from alignment points, i.e. tooling balls or edges of base.

Note: When locators are used as alignment features, they will have no tolerance in the locating directions.

Net Pads

+/- .05mm from setup points, i.e. tooling balls or edges of base.

Note: When nets are used as alignment features, they will have no tolerance as long as they are on a common plane. Nets not on a common plane will have a +/- .05mm tolerance to each other.

Feeler Checks

10% of feature tolerance but not tighter than +/- .05mm

Flush Checks

10% of feature tolerance but not tighter than +/- .05mm

Pin Checks

10% of feature tolerance but not tighter than +/- .05mm

SPC Bushings

10% of feature tolerance but not tighter than +/- .05mm

- Location of Bushings +/- .25mm
- Measuring Distance +/- .05mm
- Set Blocks +/- .01mm

Go/No Go Checks

- Hole, Slot and Feeler Pins
 - Go** + .005mm / -.00mm
 - No Go** + .00mm / -.005mm

Note: Elements not specified above must not exceed 10% of the associated part print feature tolerance.

9. Coordination

- 9.1 When duplicate gages are required, gages shall obtain an R&R error of 10% or less.

10. Geometric Tolerancing and Dimensioning

- 10.1 Positional features, to be checked, with identical datum references, must be checked simultaneously. Sizes of features may be checked independently. Holes and slots that do not have specific positional tolerances will use general size and positional tolerance exhibited on the associated part print.

11. Gage User Instructions

- 11.1 Unless otherwise specified, a “*Gage User Information Tag*” will be secured to the gage fixture with removable fasteners and covered Plexiglas. The user information will explain part orientation and clamping sequence. The user information will be attached in a manner in which the user can easily read them when using the gage fixture. In addition, gage instructions that provide photos showing proper technique for making each measurement will be provided in an editable format.
- 11.2 The user information tag will be created by the responsible manufacturer of the gage/check fixture and, when appropriate, with input from the Modineer personnel representing Modineer manufacturing, engineering and quality departments. Content of the user information tag must be brief yet clearly identify how to use the check fixture/gage properly.
- 11.3 In addition to how to use the gage fixture, the gage user information tag will display the assigned gage number.

12. Gage Fixture Identification Tag

- 12.1 Two identification tags will be completed with the following information, unless otherwise specified, and attached to the check fixture/gage with removable fasteners. The method of marking the tag must be letter stamped.

Tag #1

- Manufactured By – Name of the gage fixture manufacture. Company logos may also be used on tag.
- Gage Name – Description of gage type/name
- Gage Number – Gage fixture number supplied by Modineer as called out on the gage work order.
- Gage Revision – Current gage fixture revision letter or number. New gage fixtures start with letter A or number 0. Alpha characters are used if the part print revision level is numeric and numeric is used if the part print revision level is an alpha character.
- Manufacture Date – Original manufacture date of the gage fixture.
- Change Date – Date when changes were made to the gage fixture.

Tag #2

- Part Number - Name of part as listed on part print. If the gage fixture is designed to measure two or more different part numbers, each part number must be listed on the tag.

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- Part Revision Level – Revision level(s) of part(s) as listed on part print
- Owner - Name of customer as specified to gage builder by Modineer.

13. Shipping Requirements

13.1 Gages fixtures must be crated for shipment in durable containers. Adequate crate guards / braces shall be provided to protect the gage fixture from damage in shipment. Unpainted surfaces shall be coated with light oil before shipment. Typically, containers will be labeled with the following information:

- Gage Vendor Name
- Gage Number
- Gage Revision Level
- Fixture _____ of _____
- “Contents: Checking Fixture Gage”

14. Submission Procedure

14.1 Contracted gage fixture suppliers must maintain original delivery date as specified on the purchase order without sacrifice to quality, dimensional accuracy, or gage function. Any problems, which may compromise the delivery, must be brought to the immediate attention of the assigned Modineer Program Manager.

14.2 The gage fixture builder will have the gage fixture 3rd party certified prior to delivery to Modineer, unless otherwise instructed by the assigned Program Manager. This certification must be performed at an A2LA or IEC 17025 facility that has sufficient capability and has the required A2LA or IEC 17025 accreditation to certify the gage fixture.

14.3 The following documents must be included in the certification package:

- Copy of approved concept design.
- Latest gage fixture drawing(s) and CAD data.
- Sample part, when supplied by Modineer.
- Copies of any deviations and/or document clarifications.
- Inspection reports that exhibit X-Y-Z readouts that include variation from nominal dimensions.
- Roadmap (ballooned) drawing of gage fixture inspection points that correlates with the inspection report.
- Signed certificate certifying the dimensional results meet the tolerances of the gage features as related to the associated part print as well as to the gage fixture drawings.
- Completed Gage User Instruction Sheet and Gage Instructions.

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Note: If the above documents are not supplied with the gage certification, Modineer retains the right to reject the gage fixtures and withhold final payment.

- 14.4 Compliance to Construction Requirements is mandatory. Immediate corrective action is required for dimension discrepancy or specification not met. Gage fixtures will be returned to supplier for correction/re-certification and completion of the required documentation.
- 14.5 The assigned Modineer Quality Engineer or designate will review the submission package and issue Modineer approval of the gage fixture by signing the Check Fixture Build Sign-off Sheet. A copy of the signed and approved sheet must accompany the invoice for the gage.

15. Exceptions to Procedures Contained in this Specification

- 15.1 Exceptions to this standard, including deviations from approved gage designs or concepts, may be granted for valid reasons. Deviation requests must be submitted in writing through the assigned Program Manager with a detailed explanation, and the section(s) of this specification that is relevant to the request. Requests will be reviewed and approved by Modineer Director of Engineering and Director of Quality.
- 15.2 The assigned Modineer Program Manager and Quality Engineer will address feature(s) that cannot be held to the above tolerances, on a case-by-case basis.

16. Customer Specific Requirements – General Motors

- 16.1 Go /No Go pin sizes, Stab Pin Gage and Pilot sizes and Feeler Sizes must be documented on the gage design record.
- 16.2 X, Y, Z location of all datums specified on the GD&T print must appear on the design record.
- 16.3 Cross sections views of all nets must appear on the design record.
- 16.4 All nets are to be 6mm diameter and size documented on the design record.
- 16.5 All features on the GD&T drawing must be included on the design record.
- 16.6 Gage fixture identification tags must have part name, program designation, GM part number, Product Level (Math Data Level), GD&T Drawing Level, Final Certification Date, “Property of General Motors” and Modineer Gage Number.
- 16.7 Gage R&R studies must be conducted utilizing measurements obtained from a Coordinate Measurement Machine (CMM). R&R studies consisting of 10 parts, 2 different operators, with a minimum of 2 point taken on each

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measured axis must be submitted to the assigned Modineer Quality Engineer for review and approval.

Modineer Approval

Title	Signature	Date
Director of Quality	<i>Bruce Chambers</i>	<i>March 25, 2008</i>

16. REVISION LOG

Revision	Date	Originator	Description of Revision
01	10/17/01	G. Schelske	Updated paragraph 9.3, Gage Instructions to include part no., rev. level and part name. Updated section 13.0 re. Gage identification tag information.
02	04/22/02	G. Schelske	Added note under section 12.3.8 relating to final payment.
03	02/01/07	B. Chambers	Added "ISO/IEC 17025" to standards in section 3. Revised 6.2 to refer to AIAG and customer gage R&R requirements. Revised 6.7 to include CAD data. Revised 7.2 to include small base gage fixtures. Added 7.14, 7.15, 7.18, 7.19, 7.24, 7.25, 7.26. Revised 7.11 to include "hand slots". Revised 7.17 to specify "chain type" key pulls. Revised 7.27 to include dimensional inspection. Revised dimensional requirements in Section 8 of GO/NO GO pins from .01 mm to .005 mm and added NOTE at end of section. Revised 11.1 to include gage instructions. Revised 11.3 to add gage number and eliminate part number, part revision level and part name on Gage User Information tag. Revised Section 12 to include tag #2. Revised 14.2 to include 3 rd party certification prior to shipment.
04	12/10/07	D. Graham	Added Section 16.1 Customer Specific Requirements - General Motors, paragraphs 16.1 through 16.6.

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05	03/25/08	B. Chambers	Revised section 7.17 to include use of "gage rails". Revised section 8 to standardize pin tolerances for hole, slot and feeler checks.
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