

	<p style="text-align: center;">SPARTANBURG STEEL PRODUCTS Department Procedure</p> <p style="text-align: center;">CHECKING FIXTURE SPECIFICATION UNCONTROLLED COPY</p>	<p style="text-align: right;">Document No.: S09.001fixspec.QA</p> <p style="text-align: right;">Issue Date: 21 July 08 Revision: 8 Page 1 of 11</p>
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DOCUMENT CONTROL COVER SHEET

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Quality Assurance Master File
Engineering Department

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ISSUE DATE	REV. #	PAGE#	REASON FOR REVISION
01 Aug 00	0	All	Issued to reflect document review
17 Jan 03	1	All	Made into an Electronic version
07 April 03	2	All	Revision of overall Specifications
07 May 03	3	9	Fixture Concept approval
06 Dec 03	4	2,3,4	Plug and Go/No-Go gage requirement.
10 March 04	5	2,6	Removed references to section that are no longer applicable, added datum reference requirements, and tooling ball requirements.
18 April 05	6	All	Added in specific BMW requirements.
02 June 05	7	11	Removed a duplicate requirement.
21 July 08	8	4,10	Change Go/No-Go pin requirement.

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1. PURPOSE

The purpose of this specification is to establish the standard by which automotive part checking fixtures are to be built and certified.

2. SCOPE

This procedure applies to all production and CMM automotive checking fixtures for parts and assemblies.

3. RELATED PROCEDURES AND OTHER DOCUMENTS

<u>Procedure No.</u>	<u>Description of Procedure</u>
QP 4.2-05	Fixture Buyoff

<u>Form No.</u>	<u>Description of Form</u>
F 09.014	Fixture Checklist

4. DEFINITIONS

“MMC”	Maximum Material Condition
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5. PROCEDURE

5.1 All measurements to be taken in a temperature controlled environment. All dimensions are in millimeters unless otherwise specified.

5.2 If Customer specifications are different from SSP specification, a Quality Engineer from SSP shall make a decision in writing to the procedure to be followed.

5.3 Surfaces, Holes and Notches - Tolerance of Size and Location

5.3.1 Nets and datum reference features are to be held to +/- 0.1 from nominal. Alignment shall be made to the fixture base and part datum's (2-way and 4-way locators), not fixture secondary and tertiary datum's. All nets shall be square, or rectangle, no round or spherical nets allowed. SSP requirements for BMW fixtures require +/- .05 from nominal on Net locations to fixture datum's. Round Nets are permissible, size 12mm square or round, smaller nets may be used if geometry of part requires it. Nets shall be held to 3.0mm from any tangent or radii.

5.3.2 The tolerance of location between the four-way locator and two-way locator is +/- 0.1. SSP requirements for BMW fixtures, +/- .05

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- 5.3.3 The tolerance of location for the two-way and four-way locators to the fixture datum's (base surface, base edges, spheres...) is +/- 0.1. SSP requirements for BMW fixtures, +/- .05
- 5.3.4 A 0.01/0.04 diametral clearance shall exist between removable plugs and pilot holes in the fixture.
- 5.3.5 Pins and plugs used as locators shall have a diametral size 0.02/0.05 less than the part hole or slot, in the direction of control, at MMC.
- 5.3.6 Pilot holes used to check the location of part features not including main, secondary or transfer locators shall have a tolerance of position of +/- 0.08 from nominal. SSP requirements for BMW fixtures, +/- .05
- 5.3.7 The tolerance of location for pins used in a portable fixture element used to check a group of holes shall be +/- 0.03. SSP requirements for BMW fixtures, +/- .025
- 5.3.8 The axis for plugs and pins shall be normal to the part surface, +/- .5 degree.
- 5.3.9 At the discretion of the SSP Quality Engineer, tapered, spring loaded pins may be used for non-removable and/or removable locators. SSP requirements for BMW fixtures less than 100mm can use either.
- 5.3.10 Sight Checks shall be machined as called out by the SSP Quality Engineer. SSP requirements for BMW fixtures, hole size greater than 3.0mm dia. And all notches and cut-outs greater than 6.0. Roll pins shall be used if hole dia. Is less than 3.0
- 5.3.11 When sight checking the location of a hole, the distance between the panel and the fixture shall be 3.00 +/- 0.10. The SSP Quality Engineer may require a greater distance depending upon the geometry of a particular part. SSP requirements for BMW fixtures, 5.0 +/- .10
- 5.3.12 Sight checks shall be cut normal to metal, +/- .5 degree.
- 5.3.13 The distance between the part and the fixture behind the part shall be 3.00 +/- 0.10. The SSP Quality Engineer may specify a distance different than that listed for a particular part, SSP requirements for BMW fixtures, 5.0 +/- .10

5.4 Plugs and Locating Pins

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5.4.1 All holes with a tolerance of less than +/- .5mm on location shall have a stab pin for location. (Reference ASME Y14.5M-1999, paragraph 2.8 for applicability of RFS, MMC, and LMC.) Unless specified on a print all stab pins shall be made to RFS.

5.4.2

5.4.3 Go/No-Go plug gages shall be supplied to check for size if holes are datum's for fixture or functional for BMW or the size has a tolerance of less than +/- .5mm. This is to include Go/No-Go feeler checks if required from either Customer or SSP Quality Engineer. In some cases Feeler Gage may be used.

5.4.4 Plugs are normally to be a two-step design, a pilot diameter and locating or checking diameter.

5.4.5 A nylon cable must be provided to attach the plug to the fixture. Means of storing plugs must also be provided.

5.4.6 All plugs must have a minimum penetration into the fixture equal to the diameter of the pilot, before the checking diameter makes contact with the panel. An air vent must be provided if the plug is used in a blind hole.

5.4.7 The gauging member of a plug must penetrate a minimum of 1.5 beyond the metal thickness of the part.

5.5 Part Orientation

5.5.1 Checking fixtures (production and CMM) shall be designed in such a manner that the part is positioned the way the part will be used in car body position, unless otherwise instructed by the customer. If this information is unknown, the fixture shall be designed such that the part is positioned the way the part print is dimensioned.

5.6 Clamps

5.6.1 The Fixture Construction Source shall define the usage of clamps and their sequence if not already defined by the customer. The Quality Engineer shall define the size of the contact surface if not already defined by the customer.

5.6.2 Contact forces shall be 3.0 ft. lbs unless otherwise specified.

5.6.3 Commercial clamps shall be used where possible. Clamp tips shall have an elastomer surface.

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5.7 Rails

- 5.7.1 The checking fixture shall be provided with a full rail to check flush and feeler around the entire periphery of the part.
- 5.7.2 Feeler spacing shall be 3.00 +/- 0.10, **SSP requirements for BMW fixtures, shall be 5.0 +/- .10**
- 5.7.3 Flush dimensions shall be 0.00 +/- 0.10. In all cases, flush check trim lines 90 degrees to the surface of metal.

Exception! Scribe lines shall be used to define the flush condition when non-metallic (resin) contour surfaces are used. Sufficient material shall be present beyond the scribe lines to minimize handling damage.

5.8 Mating Surfaces

- 5.8.1 The SSP Quality Engineer shall define Mating Surfaces if not defined on the part print.
- 5.8.2 All Mating Surfaces shall be checked with fixed or swing templates if not already checked by rail. Swing templates shall be positioned at centerline of the mating surface.
- 5.8.3 Other non-mating areas may require checking by templates. The SSP Quality Engineer shall define those areas if not defined on the part print.
- 5.8.4 Methods of locking swing templates shall be provided.
- 5.8.5 Feeler spacing shall be 3.00 +/- 0.10, SSP requirements for BMW fixtures shall be 5.0 +/- .10

5.9 Painting/Coloring

Iron and steel fixture supports and frames shall be painted to prevent corrosion.

+/- 0

5.9.1.1 .5mm tolerances shall be marked in “red”.

5.9.1.2 +1.0/-0mm or +0/-1.0mm tolerances shall be marked in “black”.

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5.9.2 Bonding/ Machined surfaces used for measurements shall not be painted. SSP Quality Engineer shall supply color code to be used.

5.9.3 Sight checks shall be painted white.

5.9.4 SSP requirements for BMW fixtures, feeler areas for tight tolerance (<+/-1.5mm free form) checks shall be marked and Identified.

5.9.4.1 Sealing contact surfaces shall be marked in “yellow”.

5.9.5 The "Go" handle of the Go/No-go gage shall be colored green. The "No"-go handle of the Go/No-go gage shall be colored red.

5.9.6 Identification plates shall be permanently affixed to the fixture and use letters no smaller than 1/4 inch. Information shall include:

5.9.7 Customer Part Number (including revision)

5.9.8 SSP Part Number (including revision)

5.9.9 Customer Release Number, if required

5.9.10 Customer Part Name

5.9.11 Built By (Company)

5.9.12 Certification Date

5.9.13 Certification By

5.9.14 Safety Critical Part Designation

5.9.15 Engineering Change Level

5.9.16 Asset tag if required.

5.10 Materials

5.10.1 Structural materials shall be steel or aluminum; surfaces used to define shape may be constructed from “Die Plank DP-1051” aluminum filled urethane (Ref: Tool Chemical Co., Inc.). **SSP requirements for BMW fixtures could also use plastic, plastic must meet the following requirement:**

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- 5.10.1.1 Hardness ≥ 60 Shore-D
- 5.10.1.2 Tensile ≥ 24.8 MPa
- 5.10.1.3 Density $\geq .75$ grams/cm³

5.10.2 Materials shall be consistent throughout all major structures to minimize differential thermal expansion; i.e., castings (rail, body) shall be steel if the base is steel; castings shall be aluminum if the base is aluminum. Steel and iron are treated as identical material in this regard.

5.10.3 Bill of material list shall be provided @ fixture concept.

5.10.4 Cast aluminum base material shall be minimum HRB 74.

5.10.5 All control surfaces, pins, plugs and swing gates must be steel.

5.10.6 Plugs, bushings and locating pins/nets shall be hardened to a minimum HRC 50.

5.11 General Design and Tolerance

5.11.1 All welded steel and cast aluminum bases shall have top, bottom and all four sides machined square and parallel.

5.11.1.1 Accuracy of stamped, machined edges shall be as defined in 5.3.1. Stamped values SHALL NOT be approximate.

5.11.1.2 At least 3 Tooling Balls shall be included on the fixture with stamped dimensions for locating, and also to include Tooling Ball covers, unless the Quality Engineer signs off that the customer does not require them.

5.11.1.3 Parallelism between top and bottom surfaces: 0.1.

5.11.1.4 The Secondary datum edge shall be straight to within 0.05

5.11.1.5 The tertiary datum edge shall be perpendicular to the secondary datum edge to within 0.1

5.11.1.6 Flatness in any square foot: 0.05.

5.11.1.7 Flatness in any four foot of length: 0.25.

5.11.2 Machines surfaces shall be 100 microfinish or better.

5.11.3 Symmetrical parts shall be checked on fixtures having symmetrical datum bases.

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5.11.4 Two or more tapped holes of sufficient size shall be provided for eyebolts if the total weight of the fixture exceeds 45 lbs.

5.11.5 Precision pads shall be affixed to the corners of all base plates when the entire fixture weighs greater than 50lb. Pads shall be 1" thick nominal. Flatness shall be 0.25 with respect to the upper surface of the plate. Additional pads may be placed near the center of the fixture base when required to minimize distortion of large fixtures.

5.11.6 If fixture weighs less than 45 lbs pads shall be fixed to the corners of all base plates, pads shall be at least 12mm thick.

5.11.7 No shims shall be used in construction.

5.12 Collets

5.12.1 All SPC points (requiring ongoing capability studies) must be provided with DataMyte collets.

5.12.2 Collets shall be 3/8 inch inside diameter to fit standard DataMyte instruments. The smaller OD shall be 5/8 inch. The Larger OD shall be 25/32+/- 1/32 inch. **THREADED COLLETS SHALL NOT BE USED.** Collets shall be locked into place using adhesive.

5.12.3 The distance from the top surface (datum) of the collet to the panel shall be 31.00 +/- 0.05.

5.12.4 A zero block shall be provided for zeroing DataMyte instruments.

5.12.5 At the direction of the SSP Quality Engineer, holders for other measuring instruments may be required.

5.12.6 Design must be such that interference does not occur when using the following preferred indicators:

5.12.6.1 Mitutoyo Model ID-S1012EB (60mm dia x 25mm x ~100mm)

5.12.6.2 Mitutoyo Model IDU-1025E (40mm x 25mm x ~200mm)

5.13 Accessibility

5.13.1 All SPC points (requiring initial capability study only) must be accessible by standard CMM probes.

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5.13.2 Straight-line clearance to the collet must be 8.0 inches minimum.

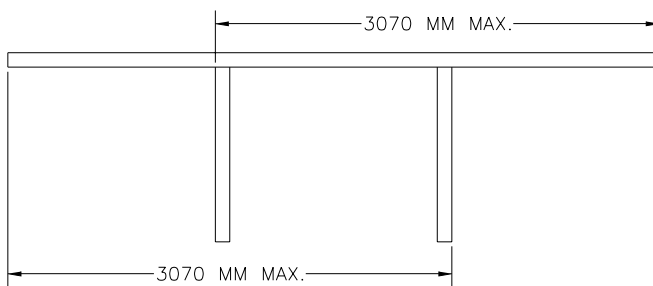
5.13.3 Active parts of the fixture shall be less than 1750mm from the base of the legs, when fully extended.

5.14 Stands

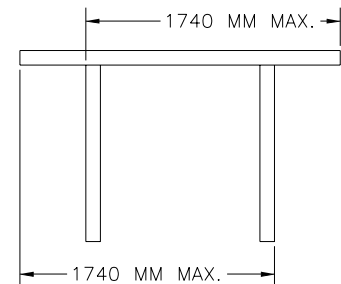
5.14.1 Stands shall be required when specified by contract.

5.14.2 Fixture legs shall meet the following dimensional constraints. This is important for fixtures which are extremely long or wide. Stand height shall not exceed 42" to top of fixture surface, preferred height is 36".

LONG DIMENSION:



SHORT DIMENSION:



5.14.3 Leveling jacks or adjustable feet shall be provided on all stands.

5.14.4 Closed channels shall be provided through the narrow dimension for forklift movement if 1) the narrow dimension of the base plate exceeds 4ft, or 2) the fixture elements are greater than 2ft tall with respect to the upper surface of the base plate.

5.14.4.1 Channels shall have a nominal internal cross section equaling 8.0"x 2.5".

5.14.4.2 Channels shall be centered along the long dimension and be nominally 30" between centers.

5.14.4.3 Channels shall go through the entire narrow dimension of the fixture base. Stands that are narrower than the fixture base must have channels that extend to the edges of the fixture base (beyond the stand dimensions).

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5.14.4.4 Channels shall be placed as low as practical on the stands.

5.15 Certification and Description of Alignment (See also section 5.2)

5.15.1 Certification shall be done in Pc-Dmis software. All fixtures shall be certified by a third party by CMM or other suitable means as meeting this standard and part dimensions. Certification is to be recorded on the Identification Plate as described in Section 5.9.

5.15.2 The top surface of fixture bases shall be used as the primary fixture datum.

5.15.3 Two-way and four-way shall be set to zero for final alignment.

5.15.4 The primary fixture datum shall be identified by four (4) target circles for the purpose of calculating the primary datum plane. The plane shall be calculated by the "least squares" method. Fixture edges shall be dimensioned for purposes of initial alignment.

5.16 Prints

5.16.1 Fixture prints shall become the property of Spartanburg Steel Products, Inc. upon receipt of the fixture. AutoCAD or CATIA files shall be provided if available.

5.16.2 All fixture design concepts shall be approved prior to build by the CMM Lab Manager or designate.

5.17 Deviations

5.17.1 Deviations to this standard shall be approved by the responsible Spartanburg Steel Products, Inc. Quality Assurance Engineer (or QA Manager) prior to build.

5.18 Gage Repeatability and Reproducibility

5.18.1 **Ten pieces, 3-person, 3 trial (90 total runs)** GR&R shall be performed on all new fixtures. Total error shall be less than 20%. The Supplier and Fixture Construction Source are required to offer suggestions to SSP Quality Engineer for the correction of such fixtures failing GR&R.

5.19 Fixture Instructions

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5.19.1 All fixtures shall have loading and operation instructions included.

5.20 Condition

5.20.1 All fixtures shall be shipped to the production facility in “like new” condition.