Yanfeng Gauge Standards

Yanfeng and Supplier Managed Gauges

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INTRODUCTION

TO OUR GAUGE SUPPLIERS

The intent of this manual is to define the Yanfeng Global Automotive Interiors requirements for Gauges and Gauges. It also goes beyond the simple design and build requirements and sets forth other requirements for our Gauge Supplies. Since Yanfeng has many customers, it is important to understand that our manual is to be used as a guide in conjunction with our customers' standards. **The intent of these standards is to supersede any customer requirements that are more lenient but to utilize any customer requirements that are more demanding.** We understand that all customer requirements are different, but we believe that by using this manual, there will be less confusion and more consistency in designing and building Gauges for Yanfeng. The intent of this manual IS NOT to dictate the process of HOW to build a Gauge but to GUIDE you in completing your task.

While this manual sets forth certain minimum Gauge and procedural requirements, it is not intended to be absolute. It is both Yanfeng's and the Gauge Suppliers' responsibility to continuously improve and to be objective in its approach to any Gauge program. Therefore, your independent analysis of these requirements and suggested changes or improvements are welcomed. We do ask, however, that any proposed deviation from this manual be approved by the Yanfeng Gauge Engineer prior to its incorporation.

Your responsibility in our TEAM is a large one. The quality, functionality, value and timeliness of these Gauges are a direct reflection of your company. You have to not only show the expertise in your field, but also provide invaluable assets like responsiveness, integrity, dependability and ingenuity. These assets are an EXPECTATION and will not be deviated from.

Sincerely

Doug Stewart
Gauge Engineer
Yanfeng Global Automotive Interiors

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SCOPE

This Gauge Standard applies to all of Yanfeng Global Automotive Interiors and its Gauge Suppliers.

This Gauge Standard establishes requirements for Gauges and Gauges that are used in conjunction with the dimensional inspection, measurement, and evaluation of the part. Such Gauges and Gauges are CMM holding Gauges, Attribute Gauges, and SPC Gauges, or any combination thereof. For purposes of the Standard, Gauges and Gauges are defined as:

GAUGE

- A device that is used to hold one or more parts while various operations are performed. For instance, a Gauge is used to hold the part while a dimensional layout is performed.

GAUGE

- An instrument that is used to measure the part. For instance, a gauge is a Gauge with an Attribute rail or SPC indicator port attached to it.

PLEASE NOTE: *The terms Gauge and gauge are commonly referred to as the same piece of equipment. A Gauge and a gauge can be the same, but not always. If the measuring instrument is not attached to the holding device, then it is only a Gauge [CMM holding Gauge], whereas, if the measuring instrument is attached to the holding device [Attribute Gauge, SPC Gauge], it becomes a gauge.*

This Gauge Standard does not establish requirements for jigs, assembly Gauges, milling Gauges, assembly nests, headliner tub Gauges, calipers, micrometers and the like. It does, however, provide instructions or guidelines that could be used with these types of equipment.

Please note the following terms and their definitions as they are used in this document:

Term	Definition
Yanfeng representative	Yanfeng Global Automotive Interiors representative
Gauge Engineer	Yanfeng Global Automotive Interiors Gauge Engineer
Supplier	Gauge Supplier
Gauge	All Yanfeng Dimensional Gauges and Gauges

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GENERAL REQUIREMENTS

1. The Supplier must quote in compliance with the Reliability and Maintainability requirements as stated on the Gauge Request for Quote form. If these requirements cannot be met, the Supplier must either "no quote" the job or obtain a written deviation from the Yanfeng representative.
2. Receipt of the hardcopy purchase order does not represent the start date of the work to be completed. The start date will be established when the purchase order number is sent via e-mail (or verbally) or the receipt of the CAD model or prints, whichever is later. The start date plus the quoted timing will establish the Gauge delivery date. All deviations from the delivery date must be communicated to the Yanfeng team in writing. Only circumstances fully outside of the Supplier's control will be considered as acceptable program delays.
3. All work that is started without a purchase order number and/or CAD model will be the Supplier's responsibility if the program is delayed or canceled.
4. The Supplier is responsible for the accuracy of all Gauges and Gauges. Work resulting from the use of "out of calibration" equipment or defective processes, including any sub-supplier's equipment and processes, will be the Supplier's responsibility and must be corrected without cost to Yanfeng. Return to Gauge Build Requirements – Section A. Gauge Certification, item #1
5. If a Gauge was used to qualify a part or process and then it was found to be in error (i.e. built or certified with equipment that is out of calibration, a net surface is cut to the wrong side of material, etc.), the Supplier may be charged for prevailing layout cost, air freight part shipment charges, labor charges and/or other charges directly related to the discrepant Gauge. In addition, if a tool has been modified using a Gauge that was not dimensionally correct, the Supplier will be charged for the tool work to correct the part. Yanfeng will make every effort to ensure the Gauges are re-verified within the same parameters (temperature, humidity) as the Supplier. To ensure that equipment changes are not done hastily or needlessly, the YANFENG representative must allow the Supplier to re-verify the Gauge before any changes are initiated. If there is a question or concern, the YANFENG representative, the Supplier and the Gauge Engineer will meet to resolve the issue. Return to Gauge Build Requirements – Section A. Gauge Certification, item #1.
6. The Supplier is responsible for part to Gauge clearance issues regardless of when parts are available. If the Gauge is shipped to Yanfeng prior to part availability, the return shipping cost will be Yanfeng responsibility.
7. All Gauges must be warranted against manufacture's defects for the life of the program. Warranty items may consist of substandard materials, poor labeling or any items that may cause bodily injury. Any detail in need of repair or replacement due to operator error, poor maintenance, or overall neglect is not considered warranty items. If a warranty item is in question, it will be brought to the Gauge Engineer's attention and decided upon jointly, between the Gauge Engineer, the YANFENG representative, and the Supplier.
8. Throughout the life of the program, the Supplier may be requested to provide a cost breakdown for quoted and/or completed work. The Yanfeng Gauge Cost Breakdown form must be used to supply this information.
9. No Gauges will be modified from the original design without the prior consent of the YANFENG representative.
10. If a Gauge is to be used in a country other than the continental United States, all labeling and documentation must be in English and the respective native language. The Gauge Request for Quote form will indicate whether or not international labeling and documentation is required, but the YANFENG representative will make the final determination of which specific labels or documents are to be translated. The YANFENG representative will assist in the translations as required.
11. If Yanfeng provides or assists in the development of new or innovative devices or techniques, the Supplier may not disclose this information (verbal or tangible) to anyone outside of Yanfeng without the written permission of the Gauge Engineer. This shall prevail for a period of three years after delivery of the Gauge. All trade secrets and/or patent rights are the property of Yanfeng.
12. A Supplier shall not share any photograph or video images of any Yanfeng Gauges with anyone outside of Yanfeng without the written permission of the Gauge Engineer. All images are the property of Yanfeng.
13. Every effort must be made to design and manufacture a Gauge that is operator friendly. Safety is top priority at Yanfeng and it must be carried over into the equipment that is purchased. Refer to the Ergonomic Repetition Benchmark Matrix, Ergonomic Force Benchmark Matrix, and the Ergonomic Posture Benchmark Matrix for further clarification. The Supplier may contact the Yanfeng Ergonomics team for clarification.
14. If an ergonomic issue is in question after a Gauge is built, the YANFENG representative and Supplier must determine the course of action and financial responsibility. If agreement cannot be made the Gauge Engineer will arbitrate.
15. The entire Gauge must be free of any sharp edges, or burrs, paying very close attention to the "operator's area of movement."
16. Attention must be given when purchasing or designing and building toggle clamps, hinge drops, and other movable details that can pinch the operator. Clamps that are free of pinch points must be used whenever possible.
17. Toggle Clamps and hinged drops must have mechanisms installed that prevent free falling onto the operator (handle stops, toggle clamp lockout, hinge drop lockout). This pertains not only in its built position but also if it will be rotated into a different orientation for inspection purposes.

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SAFETY AND ERGONOMIC REQUIREMENTS

18. Every effort must be taken to ensure that any removable detail does not exceed 40-lbs. In those circumstances the 40-lb. weight is exceeded, assist devices such as counter balances must be used. Also, considerations must be given to the ease of removal and assembly of these details. Hand cutouts, handles, forklift sleeves or eyebolts must be installed whenever possible.
19. The following weight restrictions apply:
    - Gauges < 40 pounds must have two (2) handles installed.
    - Gauges > 40 pounds but < 65 pounds must have four (4) handles installed.
    - Gauges > 65 pounds but < 300 pounds must have a dedicated cart or table with casters.
    - Gauges > 300 pounds must have eyebolts or forklift sleeves installed.

      NOTE: The YANFENG representative is responsible to determine the method of procurement (internal fabrication, manufacturing plant purchase or Supplier fabrication) for the cart or table. Also, regardless of procurement method, the cart must be designed and fabricated with full and direct support on center of the Gauge (center pillar with caster or leveling jack).
20. As a general practice, all handles that are attached to a Gauge should have a minimum grip length of 4", a minimum grip width of 1", and minimum hand access height of 1".
21. The Supplier must make every effort to incorporate or allow for the following ergonomic information when designing and building a Gauge:

Operator (See anthropometric chart below)	**Gauge design**	**Gauge efficiency** (Operator motion efficiency)
Arm reach	Inspection tool placement	Task / operation time
Work envelope	Proper clearances	Operator postures
Arm elevation	Mechanisms are easily accessible	Operator fatigue
Work forces	Mechanisms are operated easily	Eliminate unnecessary motions
Motion – bending / twisting	Tools / mechanisms can be used by both right and left handed people	Minimize operator reaches per cycle
Right hand vs. left hand	Working height of Gauge is 39"- 41"	Part location on the Gauge

Anthropometric Measurements

Body Dimension	Range of Motion Low – High
Working (standing) elbow height	38 – 47
Maximum frequent arm elevation	50 – 62
Standing eye height	57 – 70
Optimal horizontal work envelope (measured from the center of rotation of the shoulder)	12 – 15
Functional non-extended horizontal reach (measured from the shoulder blade)	25 – 32

Range of Motion figures are in inches.

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QUOTATION REQUIREMENTS

1. Each Gauge quotation must contain the following information:
    - Yanfeng program name
    - Part description
    - Detailed description of the work to be accomplished.
    - Any deviations from the quotation.
    - Itemized cost
        - Design
        - Build
        - 3rd Party Certification**
        - Gauge R
    - Itemized cost per gauge
    - Quotation total cost
    - Itemized timing
        - Design
        - Build (**NOTE:** Timing for internal Certification, 3rd Party Certification and Gauge R must be included in the Gauge build timing.)

    ** See Gauge Build Requirements – Section B. 3rd Party Certification, Item #1 for 3rd Party Certification requirements.
2. The Supplier's quote must reflect the use of the materials listed in the Standard Materials list. Reference Appendix C. Standard Material List.
3. If a Supplier intends to use recycled components on the Gauge, it must be identified on the quote. If it is not noted, the Gauge must be built using new components.
4. It is important that the Supplier understands the specific quote requirements at the time of quotation. Cost and timing must reflect these requirements. Further, any assumptions and/or exceptions that affect cost and timing must be clearly identified on the quotation.
5. When a quotation requires flush and feeler details, sheet metal representations, or part surface representations, aluminum or Gauge plank must be used. Overall Gauge weight and/or detail wear resistance are items to consider when determining which material to use.
6. If a part requires CMM dimensional inspection on the underside of the part, then the part must be held a minimum of nine (9) inches off the base, otherwise it may be held as close to the base as feasibly possible. Return to Gauge Design Requirements – Gauge Design, Item #9
7. The Gauge base size must be a minimum of four (4) inches larger on each side than the size of the part as held on the Gauge. The base type, MIC 6 tooling plate verses cast aluminum, will be determined by the Gauge size. For parts that require bases bigger than 400 in², a cast aluminum base will be required (a welded steel or aluminum base may be used with the approval of the Yanfeng representative). All other parts will require a MIC 6 tooling plate base. MIC 6 tooling plate bases must be a minimum of one (1) inch thick. In some cases, due to part configuration and/or gauging requirements, a cast aluminum base smaller than 400 in² may be required. It is the Supplier's responsibility to ensure that the proper base size and type will be used. If the base is in question, the Supplier must contact the Gauge Engineer or Yanfeng representative for clarification. Return to Gauge Build Requirements – Section A. Bases, item #4
8. If a Supplier chooses to "no quote" a single Gauge or Gauge program, a 24-hour (or less) response time is required.

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GAUGE DESIGN REQUIREMENTS

A. CONCEPT DRAWING

NOTE: The concept drawing/design will be required on an "as needed" basis as dictated by the OEM or Yanfeng representative.

1. The Concept drawing is to be drawn on an 8.5" x 11" sheet of paper.
2. The Concept drawing must show the "Gauge Intent." It should reflect the Geometric Dimensioning and Tolerancing (GDT) scheme and any special requirements reviewed during the Gage RFQ process. It should show approximate base size, part orientation, location of datums, location and orientation of clamps, location of flush rails / feeler rails, and location of SPC ports. The concept must be labeled with the Yanfeng Gauge number and Gauge description.
3. The concept review and approval DOES NOT give the authority to order materials. As shown in the Gauge Design Requirements – Section B. Gauge Design, item #11, approval of the Gauge design authorizes the ordering of materials and components. If Gauge materials have been ordered prior to final design approval, and changes are made to the Gauge design that affect these materials, the material costs for the unusable stock will be absorbed by the Supplier.

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B. GAUGE DESIGN

1. All Gauge designs produced for Yanfeng must be computer generated. All designs must be in NATIVE format, both wire frame and surface data included. The Gauge must be designed using 3d solid modeling software for proper interpretations during design signoffs.
2. The 3d Gauge design is intended to be an accurate representation of the Gauge. It should reflect how the Gauge will be constructed and must include the basic information such as, base size and type, part orientation, location, size and orientation of all stanchions, details and clamps, size and location of datums, location of flush rails / feeler rails, and location of SPC ports. If required, a 2d design may be developed, in conjunction with the 3d model, to generate all the necessary section cuts and blow ups views. Also, all internally manufactured "one-of-a-kind" components need to be drawn and dimensioned on the 2d design.
3. Datums that are located on or near parting lines, gates, ejector pins, welds or any similar features must be brought to the attention of the Yanfeng representative for correction.
4. All stock items should be commercially purchased whenever possible.
5. All 2d designs must have an isometric view of the Gauge on the design.
6. All designs must list all parts (assemblies, subassemblies or versions) that can be verified on the Gauge. Part numbers that are referenced must be the less finish part number(s) without color designation.
7. All designs will be drawn and dimensioned using the metric system (except Standard English stock sizes) unless otherwise specified by the Yanfeng representative.
8. Each design must have three Tooling balls or two Tooling holes and a Surface Target with start coordinates labeled on the Gauge base. If a Gauge is to be sub-based, these items must be on each base.
9. All datum surfaces and locators must be labeled on the design with the respective GDT datum callout.
10. When a slot or similar feature is used as a Regardless of Material Boundary (RMB) 4-way locator, it must be so designed as to allow each locating feature to move independently.
11. All Pins and Blocks used for part inspection (i.e. go/no go pin, plug gage, virtual condition pin) must be labeled on the design with their respective size as well as the calculation(s) used to obtain that size.
12. If the design reflects a coordinate system other than the automotive X, Y, Z system, then the design must be clearly identified with the appropriate coordinate references (i.e. H, W, L or TL, BL, WL).
13. If the part is to be positioned in a different coordinate system than the CAD model (tool die draw or work line verses body position), the design must be labeled in a distinct manner with the appropriate rotation point and angle to move to and from the original system. Return to Gauge Build Requirements – Section K. Labeling, item #3
14. The design must show the storage locations for removable details or interchangeable details, and loose components (SPC indicator, Go-No Go pins, plug gages). Also, when loose details or components are needed, a general note for tethering of the details is required to be on the design. Return to Gauge Build Requirements – Section E. Removable Details, item #1
15. The design must reflect the proper clearance for dimensional layout inspection. Reference Quotation Requirements – Item # 4.
16. The Yanfgeng representative must approve the initial Gauge design and subsequent design changes. It is recommended that two reviews take place – one at or about 50% completion and one at 100% completion. The design does not have to be signed at the 50% review, but must be for the 100% review. The Yanfeng representative and the Supplier must sign the final design. Other signatures may be required, as dictated by the customer design standards and/or the Yanfeng representative. It is the Supplier's responsibility to notify the Yanfeng representative, prior to completing the design, to determine who is required to sign the final design.

17. Design approval gives the authority for the Supplier to order Gauge materials. If materials have been ordered prior to final design approval and changes are made to the Gauge design that affect these materials, the material costs for the unusable stock will be absorbed by the Supplier. Return to Gauge Design Requirements – Section A. Concept Drawing, item #3
18. All design changes must be recorded in a standard change column on the design.
19. All Gauge details must be confined within the boundaries of the base, including details that move (toggle clamps, hinge drops, etc.)
20. The approved (signed) design is the property of Yanfeng and will be stored at the Supplier. An electronic copy (and hard copy as required by the Yanfeng representative) must be supplied with the Gauge each time the design is updated. Reference Gauge Build Requirements – Section H. Records, Item #2.
21. Yanfeng will supply all CAD in its native format (CATIA, UNIGRAPHICS, etc.). Every effort will be made to minimize the file size while ensuring all the critical data is supplied. All IGES translation errors or problems are the Supplier's responsibility.
22. Consideration for maximum CMM access must be given when designing the clamp type and location. Horizontal handle or bayonet type clamps should be used when CMM access is a priority.

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GAUGE BUILD REQUIREMENTS

A. BASES

1. It is the Supplier's responsibility to ensure that the base meets the flatness, parallelism and squareness tolerances as specified below. The datum scheme for these base measurements is defined as the base bottom as it sits in the horizontal position.

k	0.10	A	**Per 300 mm²**
k	0.20	A	**Not to exceed over entire base**
h	0.10	A	**Between top and bottom surfaces**
Ô	0.15		**All machined edges**

NOTE: All Tolerances specified are in millimeters.

2. All edges must be machined square and beveled.
3. The base must have the J-Corner identified.
4. All Tooling plate bases smaller than 200 in² require four (4) jig feet, one at each corner. Bases between 200 in² and 400 in² require five (5) jig feet, one at each corner and one in the center. Bases larger than 400 in² a cast aluminum base is required. A welded steel or aluminum base may be used with the approval of the Yanfeng representative. Reference Quotation Requirements – Item # 5.
5. Tooling plate bases must be a minimum of 1" thick.
6. Cast aluminum, welded aluminum or steel bases must be stress relieved.
7. All bases must be of uniform thickness. It is the Supplier's responsibility to inspect the base for uniformity before construction. If the Gauge is constructed and the base is found to be varying in thickness, the base will have to be replaced and reconstructed at the expense of the Supplier.

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B. TOOLING BALLS / TOOLING HOLES

1. Three (3) Tooling balls or Tooling holes must be located and identified with the start coordinates on the base of the Gauge. These features will be used to establish the origin of the Gauge for certification and part layout. Reference Gauge Build Requirements – Section D. Details, Item #11, for tooling ball requirements as single point net representations (datum target).
2. Tooling ball size will be .500 inch. Tooling hole size will be a minimum of 10 millimeters.
3. Each Tooling ball or Tooling hole must have a protective cover. The cover must not interfere with the start coordinate labels.

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C. RISERS and STANCHIONS

1. The risers and stanchions must be attached to the base securely with a minimum of two (2) dowels and two (2) cap screws unless specified in the design as a removable detail. Reference Gauge Build Requirements – Section E. Removable Details.
2. Risers and stanchions may be relieved or cut away in certain areas to gain access to the part for dimensional inspection. It is the Supplier's responsibility to ensure the area(s) that are removed do not affect the integrity or stability of the Gauge.

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D. DETAILS

1. All details must be attached to the base securely with dowels and cap screws. It is the Supplier's responsibility to ensure that the correct quantities of dowel and cap screws are used. If the quantity is not correct, the Supplier must fix or replace the detail without costs to Yanfeng. Reference GAUGE BUILD REQUIREMENTS – Section E. Removable Details for details that are to be built as removable.
2. Details shall not be shimmed during construction.
3. Details used as net surfaces must be made of steel. Steel plates located on aluminum details may be used.
4. Flush rails, feeler rails and sheet metal representations must be constructed of aluminum or fixture plank. Fixture plank must be sectioned into details that are no larger than 400 mm in length each.
5. A 6 mm gap distance is to be used, unless otherwise specified by the Yanfeng representative or OEM Gauge Build standards.
6. All net details that net around the area of a hole or cutout in the part must have CMM probe clearances cut into the detail. These clearances must be a minimum of five (5) mm deep and two (2) mm bigger than the part feature.

7. All loose details (Plug Gages, Go/No Go pins) must be tethered to the Gauge using chain, Car-Lane cable, or retractable spring-loaded cases with cable lockouts. These chains or cables may be removed if the detail is to be used when the part is scanned.
8. All noncircular plug gages must be keyed for orientation.
9. Unless otherwise specified by the customer, a plug gage located in a bushing and clamped on top will be the method to represent a screw or fastener pin.
10. When a single point datum target is required, a tooling ball must be used. The associated clamp must be adjusted to not deform the part. Return to Gauge Build Requirements – Section B. Tooling Balls – Item #1
11. Each feeler rail must have an associated go/no go feeler pin that reflects the proper tolerance.

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E. REMOVABLE DETAILS

1. All removable details must use hardened bushings and bullet nose dowels. The bushings must be in the detail and the dowels must be in the mating component. Reference Design Requirements – Section B. Gauge Design, item #14.
2. When there are similar removable details used on the same Gauge, the details must have a unique locating scheme for each. Each detail and storage location must be clearly labeled or color-coded.

   Reference Gauge Build Requirements – Section C. Risers and Stanchions – Item #1
   Reference Gauge Build Requirements – Section D. Details – Item #1

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F. HINGED DETAILS

1. All hinge drop details must be counterbalanced or have a lock out mechanism installed. This also pertains if the Gauge will be tipped 90° to inspect the part.
2. All hinge drop details must have rubber stops installed to prevent damage.

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G. LOCATING PINS

1. All locating pins must be match the datum modifier used on the GDT for the part. The Gauge Engineer or Yanfeng representative must approve any deviation from this requirement.
2. All tapered RMB pins must locate the part approximately at the midpoint of the taper.
3. All locating pins must be made of hardened steel.
4. If a locating pin must be locked out to load the part, the lockout mechanism must be positive. For instance, if a detail has an “L” shaped cut to lockout the locating pin, the cut must have enough lead in to disengage the locating pin and hold it out of position.
5. The locating pin spring pressure must be strong enough to locate the part without distortion when laying in free state.
6. Spring loaded locating pins must move freely in all directions except the locating direction.

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H. CLAMPS

1. All clamps must have a clamp direction of 90° to the part surface.
2. Clamps that are spring loaded must have a positive lockout mechanism.
3. When clamping over a hole, the clamp foot must be cut to allow access to the hole.
4. When engaging a clamp, it must not interfere with the part or any other detail(s) on the Gauge.
5. Clamp pressure must be the minimum required to locate the part, but stronger than the opposing spring-loaded features.
6. All clamp pressure feet must be mar-proof. Examples are rubber, neoprene or nylon. If metal clamp feet are required, they must be free of burrs and sharp edges and have a mar-proof coating.

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I. SCRIBE LINES / TOLERANCE BANDS

1. All scribe lines and tolerance bands must be scribed or milled into the surface. Painted lines on the surface are not acceptable.
2. All scribe lines and tolerance bands must be identified with a distinct color to ensure good visibility for measurement. If a nominal line is included in the tolerance band, the nominal line must be contrasting color within the tolerance band.
3. Every effort must be made to minimize or eliminate the effect of the parallax error.

4. As required by the Customer or Yanfeng representative, Gauge bases may have bodylines scribed on them. It is recommended that the bodylines are scribed every 100 mm for smaller Gauges and 200 mm for larger Gauges. These bodylines must be labeled with the appropriate body coordinate and left hand (-) or right hand (+) signification.

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J. SPC INDICATORS

1. The SPC indicator type to be used on all Gauges supplied to Yanfeng will be Mitutoyo series 543 or 575. Specific indicator features (resolution, discrimination, travel, and sensitivity) will be dictated by each application.
2. Master set blocks will be at a length of 31mm and 50mm for applications that require more CMM access.
3. All indicators must be set up to zero out in the approximate center of its travel length. For instance, if an indicator has a 1-inch travel, the indicator must be zeroed out at .5 inch.
4. The SPC indicator port and bushing sizes will be 3/8" I.D. and O.D. respectively.
5. The check direction of each indicator must be 90º to the surface it is measuring.
6. The proper indicator tip must be used for each application. Examples are listed below:
    - Ball point / spherical / conical tip – used to check a point on a surface
    - Flat tip – used to check a part edge or surface that is radial at the checkpoint.
    - Knife blade (chisel) tip – used to check a part edge with a flat contour.
7. Indicator extensions should be used sparingly or only as the application dictates. Extensions must be kept to the shortest length possible to obtain an accurate measurement.
8. All indicator extensions and tips must be tightened without using lock-tite or other chemical fasteners.
9. A feather-light indicator must be used if the inspection point on the part is flexible or touch sensitive.

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K. BUILD TOLERANCES

NOTE:

- Tolerances are established using the following Gauge certification datum scheme - the primary datum is the surface plane established by the tooling balls or tooling holes, the secondary datum is the longer line established by the tooling balls or tooling holes and the tertiary datum is the shorter line established by a single tooling ball or surface target.
- The check direction is defined as the direction(s) in which the part is to be held or measured.
- The non-check direction is defined as the direction(s) that the part is not to be held or measured.
- All tolerances are in millimeters unless otherwise noted.

1. Net Surfaces

k	0.10	A	B	C	**Check direction**
k	1.00	A	B	C	**Non-check direction**

2. Round Pin Locators (4-way / 2-way)

¿	Ø 0.10	A	B	C	**Check direction**
¿	Ø 0.50	A	B	C	**Non-check direction**

3. All other Locators

¿	0.10	A	B	C	**Check direction**
¿	0.50	A	B	C	**Non-check direction**

4. Attribute rail – flush and/or feeler [vector check]

k	0.40	A	B	C

5. Attribute rail – flush and/or feeler [set two check one check]

¹	0.40	A	B	C

6. Sheet metal representation

k	0.30	A	B	C

7. SPC port location

¿	Ø 0.20	A	B	C	**Check direction**
¿	Ø 0.50	A	B	C	**Non-check direction**

8. Scribe lines

¹	0.60	A	B	C

9. Sight checks (painted)

¹	1.00	A	B	C

10. Slides

·	0.10	A	B	C	**Entire travel**

11. Check pin location (MMC, LMC or VC pin)

¿	Ø 0.15	A	B	C	**Check direction**

12. Go Pin size

    +0.00 / -0.02

13. No go Pin size

    +0.02 / -0.00

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L. LABELING

1. All labeling on the Gauge must be legible and descriptive. The labeling must be placed so it can be easily ready when the part is on the Gauge. Labels may be engraved, printed or stamped. If tags are used, they must be permanently attached to the Gauge.
2. The following detail types must be labeled on the Gauge:
   - All datums (net surfaces and locators)
   - Clamp sequence
   - Flush rail location and offset measurement
   - Feeler rail location and offset measurement
   - Go/No Go pin sizes
   - Indicator port reference number
   - Master set block offset measurement
   - Body line references (appropriate customer references – XYZ or LWH)
   - Specific measurement locations
3. Tooling balls or tooling holes on the base must be clearly labeled with their respective start coordinates. If there are more than three (3) tooling balls or tooling holes on the base, the three (3) that are used to certify the Gauge must be labeled with the word "Origin" next to the coordinate. Coordinates will be assumed to be in body position, but if they are in work line or other, they must be clearly identified with the coordinate system used. Reference Gauge Design Requirements, Section B. Gauge Design, item #7.
4. Each Gauge must have a Supplier Identification tag permanently attached to it. Each tag must be labeled with the following information:
   A. Supplier name, address and phone number
   B. Supplier job number
   C. Customer
   D. Yanfeng Gauge Number (84xxxx)
   E. Gauge Description
   F. Part Revision Level
   G. Certification date
   H. Program name(s) and part name(s)

   As Required
   I. 3rd Party source name, address, phone number and certification date
   J. List of part numbers and names (if Gauge checks multiple parts)
5. Gauge instructions must be affixed to the Gauge. Reference Gauge Build Requirements - Section P. Gauge Instructions, item #2.

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M. CORROSION PROTECTION

1. All steel components must be black oxided.
2. All non-mating surfaces must be painted with the customer-required color. If a color is not specified, blue is to be used.

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N. GAUGE CERTIFICATION

1. It is the Supplier's responsibility to ensure that the cutter path and certification data are correct. See General Requirements – item #4 & General Requirements – item #5 for clarification. The accuracy of the Gauge must be verified using a certified CMM (traceable to a national standard). One of a kind details, like step blocks or thickness feelers, may be certified with traceable hand held equipment (micrometers, calipers). Purchased inspection details and devices (Gauge pins, scales, protractors, indicators) may be certified by including the certification report from the manufacturer. If a report is not sent, the detail must be certified using appropriate means.
2. The Supplier Internal Certification must use a vector check for all net surfaces, sheet metal representations and compound surfaces. A "set two, check one" check may be used on details that represent a one-direction check like a net point, flush rail, or feeler rail. SPC bushing locations must be verified and reported in the check direction but only verified in the non-check direction. Pin size and location and hole size and location must be verified and reported.
3. The number of certification masters developed for each detail is dependent on the size and complexity of the detail. It is the Supplier's responsibility to develop a sufficient amount of points to demonstrate that the Gauge is dimensionally correct. As an example, on a typical 25 mm x 25 mm net block, it is recommended that a minimum of five (5) masters be used. There must be enough masters to evaluate any single or combination of elements of size, position, orientation and profile.
4. All Gauge certifications must include a "road map" of the certification points.

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O. 3RD PARTY CERTIFICATION

1. A 3rd Party Certification is required on all Gauges that are manufactured by a Supplier whose certification department IS NOT accredited to a nationally recognized laboratory or inspection standard (i.e. ISO Guide 25 or ISO Guide 17025). This accreditation must be performed by a duly recognized accreditation body (American Association for Laboratory Accreditation – A2LA or equivalent). Certification to the QS9000 or TE9000 standard DOES NOT supersede this requirement; it is in conjunction with it. Refer to the AIAG QS9000 manual paragraph 4.11.2.b.1 for clarification.

   This 3rd Party certification must be performed one of two ways:

   - The 3rd Party source verifies the certification masters against the CAD model and inspects the Gauge at the 3rd Party facility.
   - The 3rd Party source develops new certification masters and inspects the Gauge at the 3rd Party facility.

   Return to Quotation Requirements – item #1
2. It is the Supplier's responsibility to ensure the accuracy and on time delivery of the 3rd Party Certification.
3. If the 3rd Party Certification is found to be discrepant, it is the Supplier's responsibility to correct it without cost to Yanfeng, up to and including the internal and 3rd Party recertification.

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P. GAUGE INSTRUCTIONS

1. All Gauges must have Gauge instructions attached to the Gauge. Also, an electronic copy must be supplied on a CD upon delivery of the Gauge. Reference Gauge Build Requirements – Section H. - Gauge Records, item #2.
2. The Gauge instructions must be detailed and understandable with references to the Gauge clearly labeled. They must identify the Gauge preparation, loading, clamping, inspection and unloading of the part. The instructions must include all part configurations. They must include a picture of the Gauge with the appropriate references identified (locators, net surfaces, check points, etc.). Return to Gauge Build Requirements – Section K. – Labeling, Item #5

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Q. FUNCTION CHECK

1. A function check must be performed prior to delivery of the Gauge. The Supplier may utilize their own completion checklist, but it must include all the items listed on the Gauge completion checklist in the appendix. The function check of the Gauges must consist of the following steps as a minimum:
   A. Evaluate the Gauge against the Gauge design.
   B. Function all components on the Gauge.
   C. Using the Gauge instructions, load the part on the Gauge.
   D. Identify and remove all interferences.
   E. Document the results.
   F. Correct any discrepancies.

2. It is the Supplier's responsibility to request parts for the function check. If the Gauge is to be delivered prior to part availability, all items above must be performed, with the exception of items C and D. When parts become available, it is the responsibility of the Supplier to complete the function check.

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R. MEASUREMENT SYSTEMS ANALYSIS

1. A Measurement Systems Analysis study (Gauge R) must be performed prior to delivery and/or final buy off of the Gauge. For engineering changes, refer to step #8.

   The primary function of the Gauge, when delivered will determine which study is to be performed. Reference matrix below.

   - For a single-function Gauge (CMM holding Fixture, SPC Gauge, Attribute Gauge), one study must be performed.
   - For a single-function Gauge that will become a multi-function Gauge (CMM/SPC Gauge, CMM/Attribute, SPC/Attribute) later in the program, a study must be performed at each build phase.
   - For a multifunctional Gauge that is built from the initial kickoff, only one study is to be performed, of which the easiest variable study takes precedence.

Gauge Type	1st Build	Perform MSA study referring to this Step # below	2nd Build	Perform MSA study referring to this Step # below
CMM holding Gauge	C	2.1.1	N/A	N/A
SPC Gauge	S	2.1.2	N/A	N/A
Attribute Gauge	A	3.1.1	N/A	N/A
CMM – SPC Gauge	C – S	2.1.2	N/A	N/A
CMM – SPC Gauge	C	2.1.1	S	2.1.2
CMM – Attribute Gauge	C – A	2.1.1	N/A	N/A
CMM – Attribute Gauge	C	2.1.1	A	3.1.1
CMM – SPC – Attribute Gauge	C – S – A	2.1.2	N/A	N/A
CMM – SPC – Attribute Gauge	C	2.1.1	S – A	2.1.2
SPC – Attribute Gauge	S – A	2.1.2	N/A	N/A
SPC – Attribute Gauge	S	2.1.2	A	3.1.1
Key: C = CMM holding Gauge S = SPC Gauge A = Attribute Gauge				

2. The Gauge R study will use one (1) operator loading one (1) part ten (10) times.

   2.1. The study must be performed one of two ways as listed below:

   2.1.1. CMM HOLDING GAUGE

   A. Obtain one (1) part from the Yanfeng representative.
   B. Using the CAD model, obtain nine (9) body coordinate points, three in each direction (X, Y, and Z) to show the most variation in each axis.

      NOTE: The Yanfeng representative may choose the points for the study or consensus must be gained from the Yanfeng representatives to use the points chosen by the Supplier. It is preferred that each point be on an edge to allow the CMM to "shank" check the part, checking only in the primary check direction. GR Study Coordinates
   C. Using the Gauge instructions, load the part on the Gauge.
   D. Using a CMM, measure each of the body coordinates. Record the deviation from the master check direction for each coordinate.
   E. Unload the part.
   F. Repeat steps C–E until the ten (10) trials are complete.
   G. Input data into form, calculate and analyze the result.
   H. If study is found to be unacceptable, the Yanfeng representative and the Supplier must jointly determine the improvements needed to obtain an acceptable result.

   2.1.2. SPC GAUGE

   A. Obtain a part from the Yanfeng representative.
   B. Using the Gauge instructions, load the part on the Gauge.
   C. Measure each SPC location. Record the measurement(s).
   D. Unload the part.
   E. Repeat until the ten (10) readings at each SPC location have been obtained.

F. Input data into form, calculate and analyze the result.
G. If study is found to be unacceptable, the Yanfeng representative and the Supplier must jointly determine the improvements needed to obtain an acceptable result.

2.2. Acceptance criteria for the study will be as follows:

>20%	Will not be accepted without approval from the YANFENG representative.
10% - 20%	Borderline acceptable. Must investigate cost and timing impact to improve measurement system. YANFENG representative must approve plan.
0% - 10%	Acceptable.

3. The Attribute study will use two (2) operators loading twenty (20) parts two (2) times each.

3.1. The Attribute study must be performed as listed below:

3.1.1. ATTRIBUTE GAUGE

A. Obtain twenty (20) parts from the Yanfeng representative.

NOTE: The parts used in this study should represent acceptable and rejectable parts. If the Yanfeng representative deems acceptable, the parts may be modified (trim or sand an edge, ream a hole) to ensure that the parts are rejectable.

B. Using the Gauge instructions, load a part on the Gauge.
C. Using all the attribute inspection devices, measure the part. Record the inspection result for each device.
D. Unload the part.
E. Repeat steps B-D until the twenty (20) parts have been measured.
F. Repeat steps B-E for the second operator.
G. Repeat steps B-F for the second trial.
H. Input data into form, calculate and analyze the result.
I. If study is found to be unacceptable, the Yanfeng representative and the Supplier must jointly determine the improvements needed to obtain an acceptable result.

3.2. Acceptance criteria for the Attribute study will be as follows:

PASS	Acceptable
FAIL	Will not be accepted without approval from the YANFENG representative.

4. If an engineering change is completed that affects the locating or measurement scheme of the Gauge, the Measurement Systems Analysis process must be re-verified. If the engineering change is in question, it is the Suppliers' responsibility to contact the Yanfeng representative for clarification.
5. Completion of the Gauge R study or Attribute study does not waive the Supplier's responsibility to repair or adjust the Gauge (at no cost to Yanfeng) if the Gauge Repeatability and Reproducibility study or Attribute study required for PPAP is unacceptable. The Yanfeng representative and the Supplier must jointly determine the improvements needed to obtain an acceptable result.

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S. SHIPPING / TRANSPORTATION

1. All Gauges must be completely protected from the elements when being shipped.
2. All Gauges must be secured when shipped.
3. Yanfeng will accept full responsibility of the Gauge when it is delivered and unloaded at Yanfeng receiving location.

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T. PREVENTIVE MAINTENANCE INSTRUCTIONS

1. All Gauges must have Preventive Maintenance instructions supplied electronically on the CD upon delivery.
2. The Preventive Maintenance instructions must be detailed and understandable with references to the Gauge clearly labeled. They must identify the maintenance instructions, recommended frequency of maintenance, recommended chemicals / solutions to use for maintenance and long-term storage preparation instructions. NOTE: If the chemicals / solutions cannot be purchased "over the counter", then a hardcopy of the MSDS sheet must be included with the Gauge upon delivery.

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U. RECORDS

1. The Supplier is responsible to provide an itemized Gauge Timing chart for each Gauge from initial kickoff to delivery on a periodic basis. The report will be due every week but may be modified by the Yanfeng representative. Delays in program timing must be reported immediately, first verbally, then on the hardcopy timeline. For Gauges with total timing of less than three (3) weeks, no timeline is required.

2. The Supplier is responsible to provide two (2) electronic copies of the latest documents and data on a Compact Disk each time the Gauge is modified*. One copy will be attached to the Gauge and the other will be delivered to the Yanfeng representative. This disk must contain the following:
    - Native CAD model
    - Gauge Design
    - Gauge Certification
    - Gauge R and/or Attribute study or studies
    - Gauge Instructions
    - Gauge Preventive Maintenance Instructions
    - Digital picture of the Gauge
    - Any other pertinent documents as required
    - Final Gauge timeline - OPTIONAL
    - Final Gauge checklist - OPTIONAL

    * Modified is defined as any change to the Gauge or its documents due to a Yanfeng or OEM directed change, repair, correction, etc. All modifications do NOT necessarily constitute a YANFENG representative level change.

    Return to Gauge Design Requirements – Section B. Gauge Design, Item #21
    Return to Gauge Build Requirements – Section C. Gauge Instructions, Item #2
3. The CD jacket must be labeled with the Supplier name, Supplier job number, Yanfeng Tool Number, Gauge Description, and revision level.
4. All documents that require signed approval will be in original hard copy format and kept at the Supplier.

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V. SPECIALTY GAGING

NOTE: Specialty Gaging is defined as any Gauge that employs the use of non-contact or technologically advanced devices used in place of more commonly used analog devices. Examples may include Lasers probes, Vision systems, or Magnetic systems.

1. The Supplier is responsible to prove-out and validate Specialty Gaging using the same methods as a Gauge as defined in this standard. In addition, the Supplier is responsible to verify all software applications and/or written code provided with the Gauge. This verification is to be performed by testing the input and output relationships and results with a minimum of 3 replications on 10 different parts. This verification study must be documented and supplied with the Gauge.
2. Specialty Gauges must meet the Yanfeng Special Equipment General Specifications (SEGS) and Special Equipment Safety Specifications (SESS) as well as any applicable industry standards that may not be covered in the SESS and SEGS documents. If aspects of these manuals are in question, contact the Yanfeng representative or Capital Equipment Buyer for clarification.

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W. AUTOMATED and SEMI-AUTOMATED GAUGING

NOTE: Automated Gauging is defined as piece of equipment that is used to assess the acceptability of the part without operator intervention, except for loading and unloading of the part. Semi-Automated Gauging is defined as a piece of equipment that is used to assist the operator in loading, clamping, measurement and/or unloading of the part. Examples for both types of Gauges may include pneumatic equipment or electronic equipment.

1. Prior to design and build of any Automated Gauging, the Yanfeng Representative must complete an Equipment Specification sheet. This sheet will be used in place of the Gauge Request for Quote. The Supplier is responsible to meet all requirements of the Equipment Specification.
2. The Supplier is responsible to prove-out and validate Automated and Semi-Automated Gauging using the same methods as a Gauge as defined in this standard. In addition, the Supplier is responsible to verify all software applications and/or written code provided with the Gauge. This verification is to be performed by testing the input and output relationships and results with a minimum of 3 replications on 10 different parts. This verification study must be documented and supplied with the Gauge.
3. Automated and Semi-Automated Gauges must meet the Yanfeng Special Equipment General Specifications (SEGS) and Special Equipment Safety Specifications (SESS) as well as any applicable industry standards that may not be covered in the SESS and SEGS documents. If the Supplier is in need of a copy of these manuals or if aspects of these manuals are in question, contact the Yanfeng representative or Capital Equipment Buyer for clarification.
4. The Supplier is responsible for dry cycling the Automated and Semi-Automated gaging. This dry cycle will consist of a continuous 20 hours of operation or as defined by the YANFENG representative. The dry cycle results must be documented and supplied with the Gauge.

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APPENDIX A – Documents

APPENDIX A1. Supplier Internal Certification

Return to Gauge Build Requirements, Section A. Gauge Certification, Item #2.
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ABC Corporation 123 West 12th Street Somewhere MI 99998

ABC Job#: 1290A

Customer: Johnson Controls
Part Name: GMT236 Overhead Console
Part Number: 9999998

Date Chkd: 04/Mar/00
Chkd By: D. P.
File: 1290

START COORDINATES
X = 3820.000 Y = -580.000 Z = 350.000

Detail No.	X Master	X Check	X Diff	Y Master	Y Check	Y Diff	Z Master	Z Check	Z Diff.	Vec. Dev.	Chk Type	Ln #	Pt #	Dim.
Net Surface - Datum A1														
1	2691.010	2690.981	-0.029	-827.998	-827.996	0.002	770.456	770.512	0.056	-0.063	Surf Rd	1	1	
1	2691.010	2690.989	-0.021	-826.552	-826.497	0.055	794.329	794.346	0.017	0.061	Surf Rd	1	2	
1	2702.691	2702.777	0.086	-827.116	-827.108	0.008	783.204	783.202	-0.002	-0.086	Surf Rd	1	3	
1	2713.000	2712.996	-0.004	-827.788	-827.801	-0.013	770.456	770.499	0.043	0.045	Surf Rd	1	4	
1	2713.000	2713.026	0.026	-827.998	-827.996	0.002	794.329	794.361	0.032	0.041	Surf Rd	1	5	
Net Surface - Datum A2														
2	3030.000	3030.001	0.001	-827.351	-827.359	-0.008	769.233	769.303	0.070	-0.070	Surf Rd	1	6	
2	3030.000	3029.910	-0.090	-827.265	-827.259	0.006	749.962	749.976	0.014	0.091	Surf Rd	1	7	
2	3042.000	3042.019	0.019	-827.279	-827.261	0.018	758.999	758.999	0.000	-0.026	Surf Rd	1	8	
2	3055.000	3055.003	0.003	-827.198	-827.189	0.009	769.233	769.237	0.004	0.010	Surf Rd	1	9	
2	3055.000	3054.995	-0.005	-827.000	-826.989	0.011	749.922	749.919	-0.003	0.012	Surf Rd	1	10	
Net Surface - Datum A3														
3	3262.000	3261.999	-0.001	-858.205	-858.199	0.006	920.000	919.999	-0.001	0.006	Surf Rd	1	11	
3	3262.000	3262.000	0.000	-859.191	-859.215	-0.024	897.999	898.002	0.003	0.024	Surf Rd	1	12	
3	3286.000	3286.000	0.000	-859.676	-859.728	-0.052	898.000	898.007	0.007	-0.052	Surf Rd	1	13	
3	3286.000	3286.006	0.006	-837.471	-837.491	-0.020	920.000	920.000	0.000	0.021	Surf Rd	1	14	
Centerline of Hole - Datum A3														
4-WAY PIN	3275.80	3275.81	0.005	-858.72	-858.758	0.032	911.1	911.2	0.084	0.090	Hole	1	15	6.789
Net Surface - Datum A4														
4	3520.00	35	0.009	0.009	-8	-837.577	-0.01	975.0	975.003	0.003	0.021	Surf Rd	1	16	
4	3520.00	35	0.010	0.010	-8	-837.46	-0.034	975.0	97	0.000	0.0	Surf Rd	1	17	
4	3545.00	3544.989	-0.011	-837.	-837.	-0.041	950.0	0.073	0.073	0.084	Surf Rd	1	18	
4	3545.00	3545.000	0.000	-837.18	-837.	-0.062	950.0	950.011	0.011	-0.063	Surf Rd	1	19	
Centerline of Hole - Datum A4														
2-Way PIN	3534.555	3534.547	-0.008	-837.471	-837.392	0.079	962.500	962.511	0.011	0.080	Hole	1	20	7.032

APPENDIX A2. 3rd Party Certification

Return to Gauge Build Requirements, Section B. 3rd Party Certification, Item #1.
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FCS - Fixture Certification Service

1001 Springs Road
Somewhere, MI 99998
Office - (810) 123-0987 Fax - (810) 123-7890

FCS Job #: FCS9684

Customer: Johnson Controls
Part Name: GMT236 Overhead Console
Part Number: 9999998

Date Chkd: 12/Mar/00
Chkd By: R. S.
File: FCS9684

START COORDINATES

X = 3820.000 Y = -580.000 Z = 350.000

Detail No.	X Master	X Check	X Diff	Y Master	Y Check	Y Diff	Z Master	Z Check	Z Diff	Vec. Dev.	Chk Type	Ln #	Pt #	Dim.
Net Surface - Datum A1														
1	2691.010	2691.005	-0.005	-827.998	-828.002	-0.004	770.456	770.521	0.065	-0.065	Surf Rd	1	1	
1	2691.010	2690.998	-0.012	-826.552	-826.549	0.003	794.329	794.369	0.040	0.042	Surf Rd	1	2	
1	2702.691	2702.721	0.030	-827.116	-827.191	-0.075	783.204	783.205	0.001	-0.081	Surf Rd	1	3	
1	2713.000	2713.059	0.059	-827.788	-827.816	-0.028	770.456	770.502	0.046	0.080	Surf Rd	1	4	
1	2713.000	2712.961	-0.039	-827.998	-828.009	-0.011	794.329	794.336	0.007	0.041	Surf Rd	1	5	
Net Surface - Datum A2														
2	3030.000	3030.058	0.058	-827.351	-827.419	-0.068	769.233	769.230	-0.003	-0.089	Surf Rd	1	6	
2	3030.000	3030.021	0.021	-827.265	-827.305	-0.040	749.962	749.950	-0.012	0.047	Surf Rd	1	7	
2	3042.000	3042.034	0.034	-827.279	-827.276	0.003	758.999	759.002	0.003	-0.034	Surf Rd	1	8	
2	3055.000	3054.953	-0.047	-827.198	-827.191	0.007	769.233	769.190	-0.043	0.064	Surf Rd	1	9	
2	3055.000	3055.035	0.035	-827.000	-827.069	-0.069	749.922	749.921	-0.001	0.077	Surf Rd	1	10	
Net Surface - Datum A3														
3	3262.000	3261.976	-0.024	-858.205	-858.210	-0.005	920.000	920.019	0.019	0.031	Surf Rd	1	11	
3	3262.000	3262.000	0.000	-859.191	-859.150	0.041	897.999	898.052	0.053	0.067	Surf Rd	1	12	
3	3286.000	3286.016	0.016	-859.676	-859.678	-0.002	898.000	898.017	0.017	-0.023	Surf Rd	1	13	
3	3286.000	3286.012	0.012	-837.471	-837.416	0.055	920.000	920.009	0.009	0.057	Surf Rd	1	14	
Centerline of Hole - Datum A3														
4-WAY PIN	3275.806	3275.798	-0.008	-858.726	-858.715	0.011	911.116	911.112	-0.004	0.014	Boss	1	15	6.789
Net Surface - Datum A4														
4	3520.000	3520.023	0.023	-837.558	-837.512	0.046	975.000	975.012	0.012	0.053	Surf Rd	1	16	
4	3520.000	3520.010	0.010	-837.432	-837.500	-0.068	975.000	975.008	0.008	-0.069	Surf Rd	1	17	
4	3545.000	3545.069	0.069	-837.337	-837.307	0.030	950.000	950.003	0.003	0.075	Surf Rd	1	18	
4	3545.000	3545.004	0.004	-837.185	-837.178	0.007	950.000	950.019	0.019	-0.021	Surf Rd	1	19	
Centerline of Hole - Datum A4														
2-Way PIN	3534.555	3534.570	0.01	-837.4 1	-837.43	0.039	962.50	962. 98	-0.002	0.042	Boss	1	20	7.032

APPENDIX A3. Gauge Repeatability Study

Return to Gauge Build Requirements, Section E. Measurement System Analysis, Item #2.
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JOHNSON CONTROLS **Gage Repeatability Study Sheet**

Measurement Analysis

n	X	$\bar{X}$	$(X - \bar{X})$	$(X - \bar{X})^2$
1	0.35	0.356	-0.006	0.0000
2	0.36	0.356	0.004	0.0000
3	0.34	0.356	-0.016	0.0003
4	0.38	0.356	0.024	0.0006
5	0.35	0.356	-0.006	0.0000
6	0.34	0.356	-0.016	0.0003
7				

Date: 3/3/00
Part Name: GMT 236 Overhead Console
Characteristic: Overall Length
Gage Name: Overhead Console Assembly fixture

APPENDIX A4. Gauge Completion Check List

Return to Gauge Build Requirements, Section Q. Function Check, Item #1.
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GAGE CHECK LIST

GAGE #: 849111 DESCRIPTION: Overhead Console Assembly DATE: 03/02/00

SUPPLIER: ABC Corporation PROJECT: 2001 GMT236

ITEM DESCRIPTION	RESULT		
DELIVERABLES	YES	NO	N/A
Documentation	Documentation		
Compact disk	X		
> Design	X		
- Approved	X		
> Certification	X		
- Meets specification	X		
> 3rd Party certification	X		
- Meets specification	X		
> Gage R	X		
- Meets specification	X		

ITEM DESCRIPTION	RESULT		
FUNCTIONALITY	YES	NO	N/A
Micro Slides	Micro Slides		
> Move freely	X		
> Protective stops	X		
> Certification pin attached	X		
Stanchions	Stanchions		
> Securely fastened	X		
> Sharp edges rounded		X	
Net blocks	Net blocks		
> Securely fastened	X		
> Sharp edges rounded	X		

APPENDIX A5. Supplier Quotation

Return to Quotation Requirements, Item #1.
Go to Appendix List Go to Table of Contents

ABC Corporation 123 West 12th Street Somewhere MI 99998

March 30, 2000

Mr. John Johnson
Yanfeng
921 E 32nd Street
Holland, MI 49435

Dear Mr. Johnson:

SUBJECT: CMM HOLDING GAUGE – GMT236 Overhead Console

ABC Corporation is pleased to submit this quotation for your approval on the above subject. Our quotation is based on the following assumptions:

Assumptions:

- *ABC Corporation* to construct one (1) CMM holding Gauge.
- Design will be a computer generated 3D model with views and sections as required.
- Customer to supply all CAD models and GDT information.
- Gauge will be 180º out of body.
- Gauge to include:
  - 1 - aluminum tooling plate with 4 jig feet
  - 4 – U/D net pads
  - 1 – C/C & F/A 4-way RFS tapered pin
  - 1 – C/C 2-way RFS tapered pin on a slide
- Design and Build Requirements to meet Yanfeng and OEM Gauge standard Requirements.
- Quote to include internal certification.
- Cost and timing as stated in this letter will remain in effect for 60 day from the date of this letter.

Cost Summary:

	GMT236 Overhead Console	
Design	(Delivery 2 wks)	$ 750.00
Build	(Delivery 5 wks)	5200.00
3rd Party Certification		350.00
Gauge R & R study		250.00
	GRAND TOTAL	$ 6550.00

Thank you for giving *ABC Corporation* the opportunity to provide this quotation. If you have any questions, please feel free to contact me at (110) 123-4567.

Sincerely,

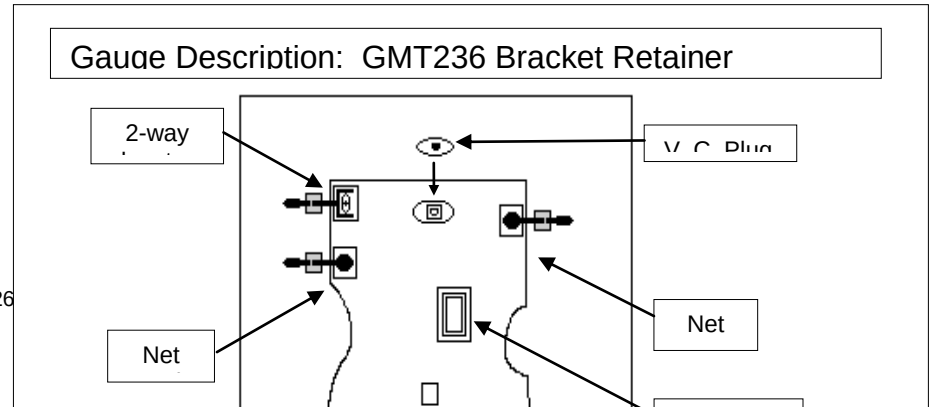
Joe Smith

Joe Smith
Account Representative

FN: 330119.doc
ABC #330119
cc: R. Thomas C. McPherson

APPENDIX A6. Gauge Concept Drawing

Return to Gauge Design Requirements, Section A. Concept Drawing, Item #2.
Go to Appendix List Go to Table of Contents



APPENDIX A7. Supplier Identification Tag

Return to Gauge Build Requirements, Section L. Labeling, Item #4.
Go to Appendix List Go to Table of Contents

ABC Corporation

123 West 12th Street
Somewhere, MI 99998
Office - (810)123-4567
Fax - (810)123-7654

ABC Corp. JOB NUMBER: 1290A

EXAMP

APPENDIX A8. Gauge Request for Quote (page 1)

Return to General Requirements, Item #1.
Return to General Requirements, Item #10.
Go to Appendix List Go to Table of Contents

JOHNSON CONTROLS

GAGE REQUEST FOR QUOTE

Date:	11/02/99	**Program Name:**	GMT 236 Overhead Console
Program Number:	12345	**Customer:**	GENERAL MOTORS

Contact: Doug Stewart **Phone:** 8199

Use Gage standards produced by GENERAL MOTORS & JOHNSON CONTROLS

Sequence	Gage / Child Number	Gage Description	Gage Delivery Date Required	Quote Elements					Gage Type			Attached Information						
				Design	Build	Certification	3rd Party Cert.	Gage R	CMM	Attribute	SPC	Sketch	Print	Math Data	Part	GD&T	Assy. Drw.	Other
1	841999	Overhead Console Assembly	02/14/01	X	X	X	X	X	X			X		X		X		
2	849999	Bracket Retainer	02/14/01	X	X	X	X	X	X	X	X	X		X		X		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		

PROGRAM REQUIREMENTS

PROGRAM INFORMATION

Program Duration:	4
Annual Volume:	200k - 300k
Shifts per Day:	2
Frequency of Use:	2 - 4

ENVIRONMENTAL CONDITIONS

Operating Temperature:	30° - 150°
Operating Humidity:	0% - 100%
***Presence of Chemical:**	No
***Presence of Vibration:**	No

***If Yes, describe type of chemical or vibration below:**

Special Requirements

RELIABILITY and MAINTAINABILITY TARGETS

Targeted Gage Life:	Production life + 1 year
Targeted Mean-Time-To-Repair, (MTTR):	< 1 week
Targeted Mean-Time-To-Maintain, (MTTM):	3 - 7 days
Targeted Mean-Time-Between-Failures, (MTBF):	> 6 months
Targeted Mean-Time-Between-Maintenance, (MTBM):	15 - 30 minutes

APPENDIX A8. Gauge Request for Quote (page 2)

Return to General Requirements, Item #1.

Return to General Requirements, Item #10.

Go to Appendix List Go to Table of Contents

JOHNSON CONTROLS

GAGE ASSUMPTIONS

Date:	11/02/1999	Program Name:	GMT 236 Overhead Console			Project #:	12345
Gage Number:		841999	849999				
Gage Description:		Overhead Console Assembly	Bracket Retainer				
Part Size in milimeters (approximate)	Length (F/A):	305	355				
	Width (C/C):	200	305				
	Depth (U/D):	25	12				
	Cubic milimeters:	1525000	1299300				
Orientation	Body Position:	Rotated 180°	In Body				
Net Pads	Quantity:	4	4				
4-way Locator	Type:	RFS pin for hole	RFS pin for hole				
	Describe as required:						
2-way Locator (#1)	Type:	RFS pin for hole on slide	RFS pin for slot				
	Describe as required:						
2-way Locator (#2)	Type:	NONE	NONE				
	Describe as required:						
2-way Locator (#3)	Type:	NONE	NONE				
	Describe as required:						
SPC Point (#1)	Type:	NONE	4-way to 2-way				
	Qty / Describe as required:		1				
SPC Point (#2)	Type:	NONE	NONE				
	Qty / Describe as required:						
Attribute Rail #1	Type:	NONE	Internal feature - gap				
	Length (mm.) / Describe as required:		300 Sun glass bin opening				
Attribute Rail #2	Type:	NONE	Localized blocks - gap				
	Length (mm.) / Describe as required:		150 Front edge (2 x 75mm)				
Go-Nogo / Plug Gage #1	Type:	NONE	Feature size & location				
	Describe as required:		Rear oval opening				
Go-Nogo / Plug Gage #2	Type:	NONE	NONE				
	Describe as required:						
Scribe Line	Type:	NONE	Nominal Line				
	Describe as required:		Front edge and interior feature				
Special Features #1	Type:	NONE					
	Describe as required:						
Special Features #2	Type:	CMM access on bottom side	CMM access on bottom side				
	Describe as required:						

Special Requirements:

APPENDIX A9. Gauge Instructions

Return to Gauge Build Requirements, Section E. Measurement System Analysis, Item #2.1.1.
Go to Appendix List Go to Table of Contents

GAGE OPERATING INSTRUCTIONS

GAGE #: 849999 **GAGE NAME:** GMT236 Overhead Console Bracket Retainer

E/C LEVEL: Rel **E/C DATE:** 10/14/99 **RECERT. FREQ:** Bi-Annually

TYPE OF FIXTURE: ☑ CMM ☑ SPC ☑ ATTR

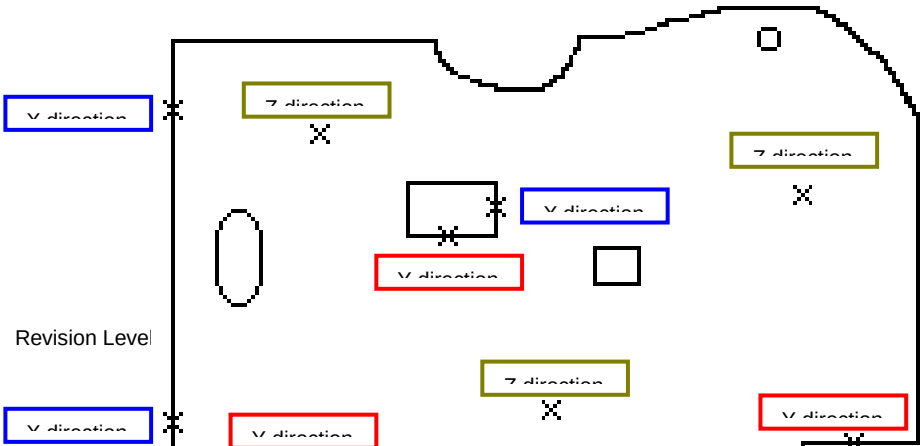
GAGE CHECKS PART NUMBER(s): 999998 and 999999

INSTRUCTIONS:

1	Inspect fixture for damage.
2	Disengage all clamps.
3	Load part onto 4-way locator and 2-way locator pins, ensuring part is resting on all nets.
4	Starting with clamp #1, engage all clamps in sequence.
5	Turn the SPC indicator on, place it in the master set block and press the "zero" button.
6	Place the indicator in the SPC port and record reading.
7	Remove the indicator from the SPC port and place it in the storage box.
8	Place the plug gage into hole. Record results.
9	Remove the plug gage and place it in its storage clip.
10	Using the Go/Nogo gage, inspect the gap rail at the opening in the part and at the front edge. Record result for each inspection area.
11	Place the plug gage into its storage clip.
12	Turn the SPC indicator off.
13	Open all clamps and remove part.
14	

APPENDIX A10. Gauge Repeatability Study Coordinates

Return to Gauge Build Requirements, Section E. Measurement System Analysis, Item #2.1.1.
Go to Appendix List Go to Table of Contents



Revision Level

APPENDIX A11. Gauge Cost Breakdown

Return to General Requirements, Item #8.
Go to Appendix List Go to Table of Contents

YANFENG GLOBAL AUTOMOTIVE

GAGE COST BREAKDOWN WORKSHEET

Gage Shop: ABC Corporation
123 West 12th Street
Somewhere, MI 99998
Contact: Jim Smith

Date: 11/24/00
Quote #: ABC1234
Invoice #: 12345
Purchase Order #: M999888

Revision Level: 006 – 04/26/16

Program Name: 2001 GMT236 OHC

Gage Desc: Overhead Console

Gage Number: 849999

APPENDIX A12. Gauge Preventive Maintenance Instruction

Return to Gauge Build Requirements, Section G. Preventive Maintenance instructions, Item #1.
Go to Appendix List Go to Table of Contents

GAGE PREVENTIVE MAINTENANCE INSTRUCTIONS

GAGE #: 849999 **GAGE NAME:** GMT236 Overhead Connsole Bracket Retainer

E/C LEVEL: Rel **E/C DATE:** 10/14/99 **RECERT. FREQ:** Bi-Annually

TYPE OF FIXTURE: ☑ CMM ☑ SPC ☑ ATTR

GAGE CHECKS PART NUMBER(s): 999998 and 999999

	INSTRUCTIONS:	RESP.	MAINTENANCE FREQUENCY	TOOLS NEEDED
1	Inspect fixture for damage.	VE	Every use	None
2	Inspect electronic equipment for damage and ensure it powers up.	VE	Every use	None
3	Remove all loose debris and wipe clean.	VE	End of shift	Broom, rag, mild soap.
4	Lubricate moving parts. Ensure all scews and bolts are tight.	VE	Once a month	Light oil, silicone

APPENDIX A13. Attribute Study

Return to Gauge Build Requirements, Section E. Measurement System Analysis, Item #3.
Go to Appendix List Go to Table of Contents

Attribute Gauge R&R - Data / Calculation sheet

Gauge Name:	Example Attribute study	**Part Name:**	00 Front Trimplate	**Date:**	1/1/00
Gauge Number:	840123	**Part Number:**	VE4567	**Performed By:**	Lewis
Gauge Type:	Go/No go pin check	**Characteristic:**	Gap to Console	**Phone #:**	555-1211
Accept Criteria - GO:	1.50	**Reject Criteria - NOGO:**	4.50	**Units:**	mm

ATTRIBUTE GAUGE R and R RESULTS

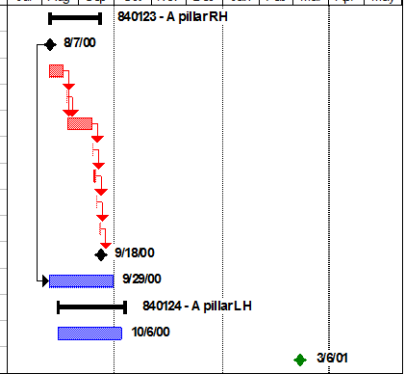
FAIL

PART	APPRAISER A		APPRAISER B	
	Mike		Mary	
	TRIAL 1	TRIAL 2	TRIAL 1	TRIAL 2
1	g	g	g	g
2	g	g	g	g
3	ng	g	g	g
4	ng	ng	ng	ng
5	g	g	g	g
6	g	g	g	g
7	ng	ng	ng	ng
8	g	g	g	g
9	g	g	g	g
10	ng	ng	ng	ng
11	g	g	g	g
12	g	g	g	g
13	ng	ng	ng	ng
14	ng	ng	ng	ng
15	g	g	g	g
16	ng	ng	ng	ng
17	g	g	g	g
18	g	g	g	g
19	ng	ng	ng	ng
20	g	g	g	g

APPENDIX A14. Gauge Timing Chart

Return to Gauge Build Requirements, Section H. Records, Item #1.
Go to Appendix List Go to Table of Contents

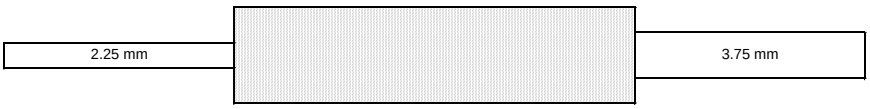
ID	Task Name	Duration	Start	Finish
1	**840123 - A pillar RH**	**6.2 wks**	**Mon 8/7/00**	**Mon 9/18/00**
2	Gage Kickoff	0 days	Mon 8/7/00	Mon 8/7/00
3	Design	2 wks	Mon 8/7/00	Fri 8/18/00
4	Design Approval	1 day	Mon 8/21/00	Mon 8/21/00
5	Build	3 wks	Tue 8/22/00	Mon 9/11/00
6	Certification	1 day	Tue 9/12/00	Tue 9/12/00
7	3rd Party Certification	2 days	Wed 9/13/00	Thu 9/14/00
8	Gage R	1 day	Fri 9/15/00	Fri 9/15/00
9	Function Check	1 day	Mon 9/18/00	Mon 9/18/00
10	**GAGE DELIVERY**	**0 days**	**Mon 9/18/00**	**Mon 9/18/00**
11	**Quoted Timing**	**8 wks**	**Mon 8/7/00**	**Fri 9/29/00**
12	**840124 - A pillar LH**	**8.2 wks**	**Mon 8/14/00**	**Mon 10/9/00**
22	**Quoted Timing**	**8 wks**	**Mon 8/14/00**	**Fri 10/6/00**
23	**PPAP DATE**	**0 days**	**Tue 3/6/01**	**Tue 3/6/01**



APPENDIX A15. Check Pin and Check Block Calculation

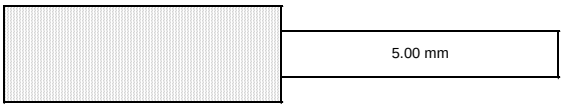
Return to Gauge Design Requirements, Section B. Gauge Design, Item #6.
Go to Appendix List Go to Table of Contents

Go / Nogo Pin



Feeler rail = 3.00 mm
Tolerance = +/- .75 mm
Go pin = 3.00 - .75 = 2.25 mm
Nogo pin = 3.00 + .75 = 3.75 mm

Virtual Condition Pin



Hole Size = 8.00 mm
Hole Size Tolerance = +/- .50 mm
Hole Location Tolerance = +/- 2.50 mm
Virtual Condition pin = 8.00 - .50 - 2.5 = 5.00 mm

APPENDIX A16. Ergonomic Repetition Benchmarks matrix

Return to Safety and Ergonomic Requirements, Item #9.
Go to Appendix List Go to Table of Contents

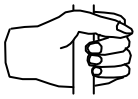
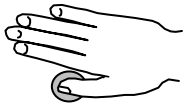
Repetition Benchmarks

LOW	MODERATE	HIGH
Leisurely Pace Frequent Pauses Non-cyclical Tasks	Steady Pace Infrequent Pauses	Rapid Pace No Rest Pauses Bottleneck Stations High Frequency of Similar Tasks

APPENDIX A17. Ergonomic Force Benchmarks matrix (page 1)

Return to Safety and Ergonomic Requirements, Item #9.
Go to Appendix List Go to Table of Contents

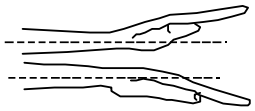
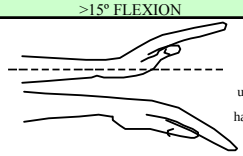
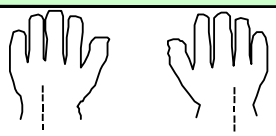
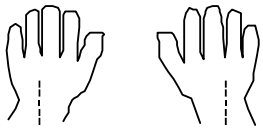
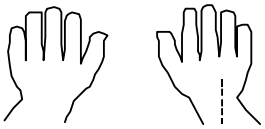
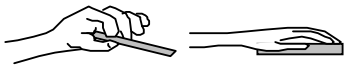
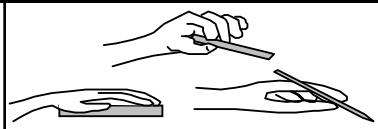
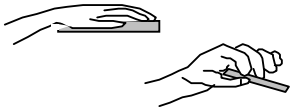
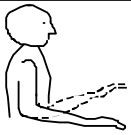
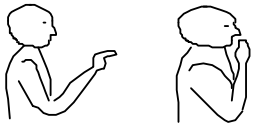
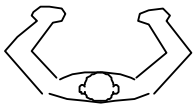
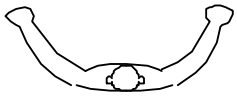
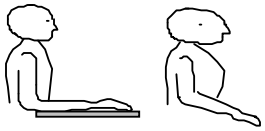
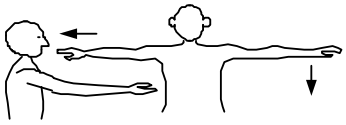
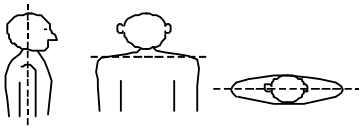
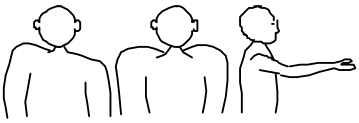
Force Benchmarks

~~TYPE OF HAND~~	~~ILLUSTRATION~~	~~LOW~~	~~MODERATE~~	~~HIGH~~
POWER GRIP		< 14#	14# -	21# - 48#
2 POINT PINCH		< 3#	3# - 4.5#	4.5# - 9#
3 POINT PINCH		< 4#	4# -	6# - 14#
LATERAL PINCH		< 4#	4# -	6# - 14#
THUMB PUSH		< 7#	7# - 10.5#	10.5# - 19#
PALM PRESS		< 10#	10# - 15#	15# - 35#
FOOT CONTROL		< 10#	10# - 16#	16# - 37#
OTHER POSTURES		NO EFFORT NEEDED (</= 20% Average Maximum Effort)		GREATEST EFFORT POSSIBLE (>/= 60% Average Maximum Effort)

APPENDIX A18. Ergonomic Posture Benchmarks matrix (page 2)

Return to Safety and Ergonomic Requirements, Item #9.
Go to Appendix List Go to Table of Contents

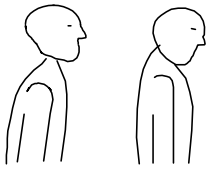
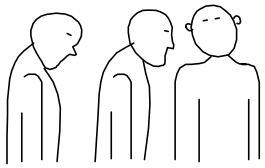
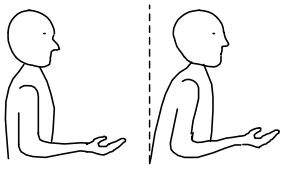
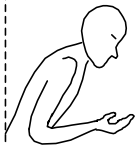
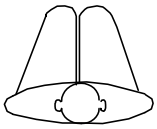
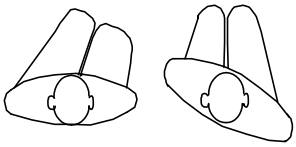
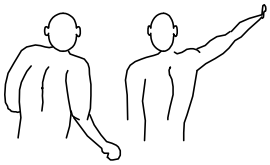
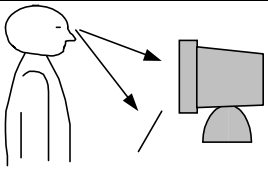
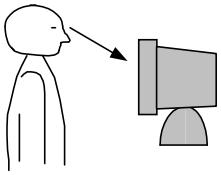
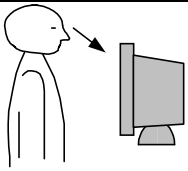
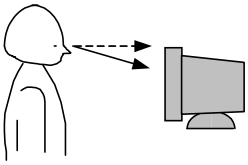
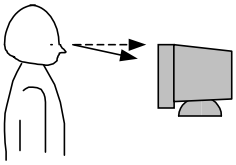
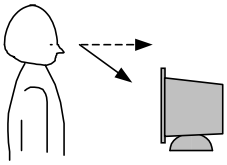
Posture Benchmarks

	Low Risk	Moderate Risk	High Risk
HAND and WRIST	0-15º EXTENSION	15 - 30º EXTENSION 0 - 15º FLEXION	30 º EXTENSION >15º FLEXION
			
	0-15º ULNAR DEVIATED WRIST	5-15º ULNAR DEVIATED WRIST	>15º ULNAR DEVIATED WRIST
			
	NEUTRAL & RELAXED FINGER GRIP	TENSED / AWKWARD FINGER GRIP	TENSED / AWKWARD FINGER GRIP
			
ARM and SHOULDER	RELAXED or SUPPORTED ELBOW	<45º EXTENDED >70º FLEXION ELBOW	<70º FLEXION ELBOW
			
	NEUTRAL or SUPPORTED FOREARM	UNSUPPORTED FOREARM	REACH & UNSUPPORTED FOREARM
			
	SUPPORTED or NEUTRAL UPPER ARM	REACHING / SHOULDER <60º FLEXION	REACHING / SHOULDER >60º FLEXION
			
	NEUTRAL SHOULDERS	SLOUCHED / FORWARD SHOULDERS	ASSYMETRICAL / TENSED SHOULDERS
			

APPENDIX A18. Ergonomic Posture Benchmarks matrix (page 3)

Return to Safety and Ergonomic Requirements, Item #9.
Go to Appendix List Go to Table of Contents

Posture Benchmarks

	Low Risk	Moderate Risk	High Risk
HEAD & NECK	NUETRAL	<15º FLEXION & CHIN IN	>15º FLEXION or CHIN PROTRUDED
			
Torso	RECLINE	VERTICAL	FLEXED
			
	SYMETRICAL	TWISTED	BEND / REACH / LIFT
			
VIEW DISTANCE	15" - 24" TO SCREEN 14" - 16" TO DOCUMENT	<16" TO SCREEN	8" - 12" TO SCREEN
	 OR HIGH RESOLUTION		
VIEW ANGLE	15 - 30º	<15 or <30º	>10 or <35º
			

APPENDIX A19. Gauge Assumptions / Gauge Cost Model (page 1)

Return to General Requirements, Item #1.
Return to General Requirements, Item #10.
Go to Appendix List Go to Table of Contents

GAGE ASSUMPTIONS / GAGE COST MODEL

Date:	11/02/99	**Program Name:**	GMT 236 Overhead Console
Program Number:	12345	**Customer:**	GENERAL MOTORS
Contact:	Doug Stewart	**Phone:**	06/12/1922

Use Gage standards produced by GENERAL MOTORS & JOHNSON CONTROLS — *Gage Assumptions Rev Lvl: Rel*

Sequence	Gage / Child Number	Gage Description	Gage Delivery Date Required	Gage Cost	Gage Timing (Estimate)	Quote Elements: Design	Build	Certification	3rd Party Cert.	Gage R	Gage Type: CMM	Attribute	SPC	Attached Information: Sketch	Print	Math Data	Part	GD&T	Assy. Drw.	Other
1	841999	Overhead Console Assembly	02/14/05	$6,100	7 wks	X	X	X	X	X	X			X		X		X		
2	849999	Bracket Retainer	02/14/05	$8,300	8 wks	X	X	X	X	X	X	X	X	X		X		X		
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				
		Program Total:		$14,400																

PROGRAM REQUIREMENTS

PROGRAM INFORMATION

Program Duration:	7+
Annual Volume:	300k - 500k
Shifts per Day:	2
Frequency of Use:	2 - 4

ENVIRONMENTAL CONDITIONS

Operating Temperature:	50° - 120°
Operating Humidity:	0% - 100%
***Presence of Chemical:**	No
***Presence of Vibration:**	No

***If Yes, describe type of chemical or vibration below:**

Special Requirements

RELIABILITY and MAINTAINABILITY TARGETS

Gage Life:	Production life + 1 year
Mean-Time-To-Repair, (MTTR):	< 1 week
Mean-Time-To-Maintain, (MTTM):	3 - 7 days
Mean-Time-Between-Failures, (MTBF):	> 6 months
Mean-Time-Between-Maintenance, (MTBM):	15 - 30 minutes

APPENDIX A19. Gauge Assumptions / Gauge Cost Model (page 2)

Return to General Requirements, Item #1.
Return to General Requirements, Item #10.
Go to Appendix List Go to Table of Contents

JOHNSON CONTROLS

GAGE ASSUMPTIONS / GAGE COST MODEL

Date: 11/02/1999		Program Name: GMT 236 Overhead Console				Project #: 12345
Gage Number:		841999	849999			
Gage Description:		Overhead Console Assembly	Bracket Retainer			
Part Size in milimeters (approximate)	Length (F/A):	305	350			
	Width (C/C):	200	305			
	Depth (U/D):	25	13			
	Cubic milimeters:	1525000	1367750			
Orientation	Body Position:	Rotated 180°	In Body			
Net Pads	Quantity:	4	4			
4-way Locator	Type:	RFS pin for hole	RFS pin for hole			
	Describe as required:					
2-way Locator (#1)	Type:	RFS pin for hole on slide	RFS pin for slot			
	Describe as required:					
2-way Locator (#2)	Type:	NONE	NONE			
	Describe as required:					
2-way Locator (#3)	Type:	NONE	NONE			
	Describe as required:					
SPC Point (#1)	Type:	NONE	4-way to 2-way			
	Qty / Describe as required:		1			
SPC Point (#2)	Type:	NONE	NONE			
	Qty / Describe as required:					
Attribute Rail #1	Type:	NONE	Internal feature - gap			
	Length (mm.) / Describe as required:		300 Sun glass bin opening			
Attribute Rail #2	Type:	NONE	Localized blocks - gap			
	Length (mm.) / Describe as required:		150 Front edge (2 x 75mm)			
Go-Nogo / Plug Gage #1	Type:	NONE	Feature size & location			
	Describe as required:		Rear oval opening			
Go-Nogo / Plug Gage #2	Type:	NONE	NONE			
	Describe as required:					
Scribe Line	Type:	NONE	Nominal Line			
	Describe as required:		Front edge and interior feature			
Special Features #1	Type:	NONE				
	Describe as required:					
Special Features #2	Type:	NONE	NONE			
	Describe as required:					
Gage Cart	Size:	Not Required	Not Required			
	Cost Estimate:					
Cost Model Estimate:		$6,100	$8,300			
Expert Estimate Override:						
Build Timing:		7 wks	8 wks			

QE SIGNATURE: _____ **DATE:** _____

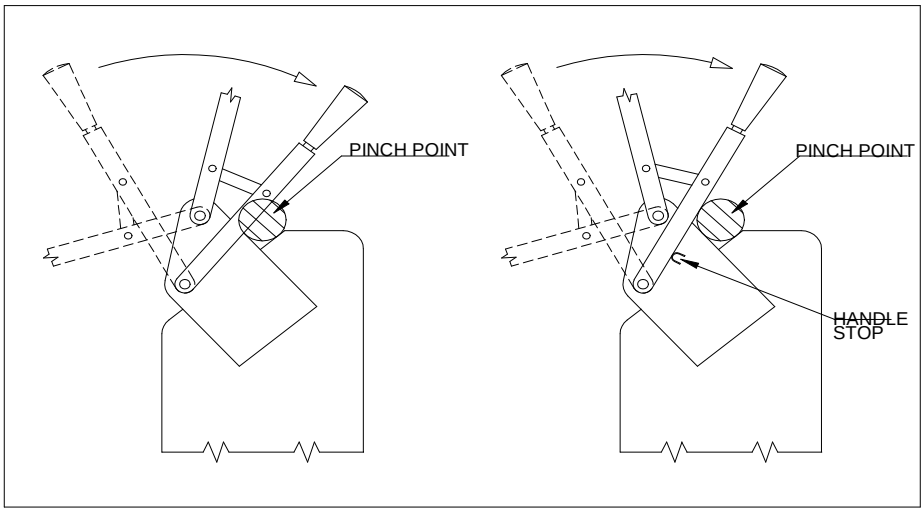
Special Requirements:

Go to Table of Contents

APPENDIX B - Diagrams

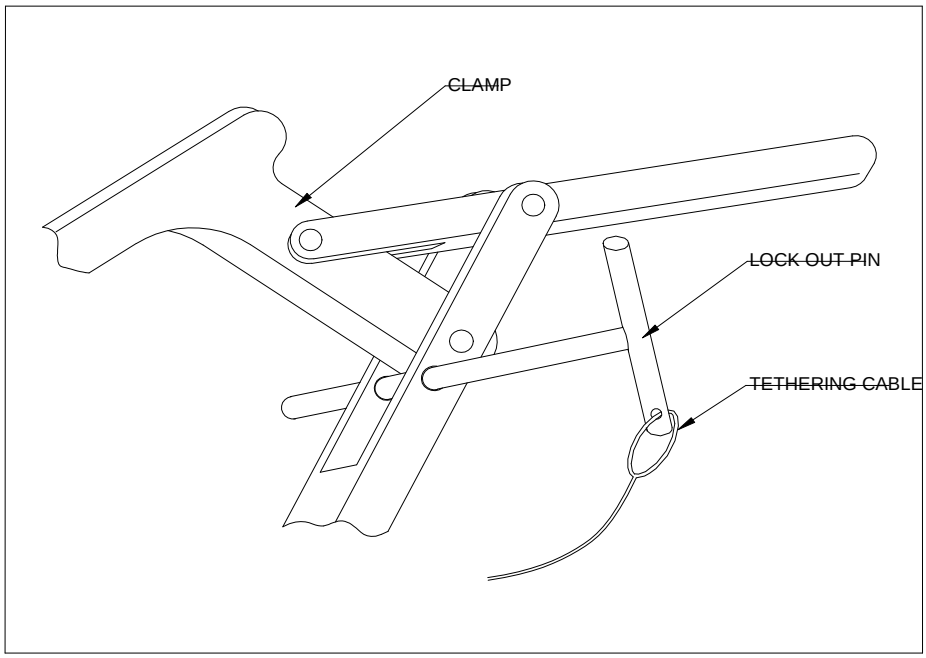
APPENDIX B1. Toggle Clamp with Handle Stop

Return to Safety and Ergonomic Requirements, Item #4.
Go to Appendix List Go to Table of Contents



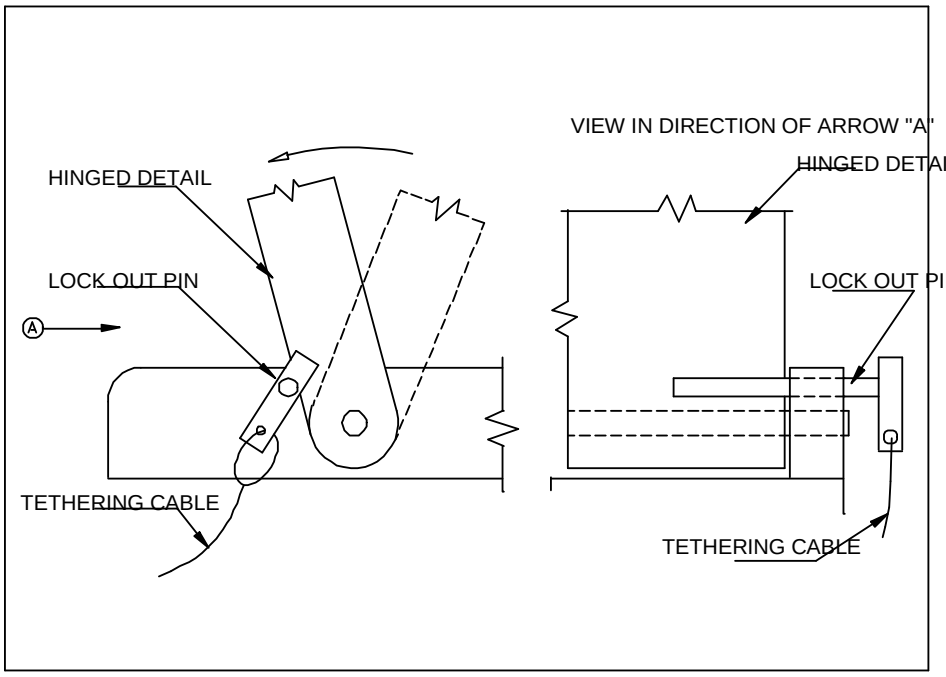
APPENDIX B2. Toggle Clamp with Lock-out Pin

Return to Safety and Ergonomic Requirements, Item #4.
Go to Appendix List Go to Table of Contents



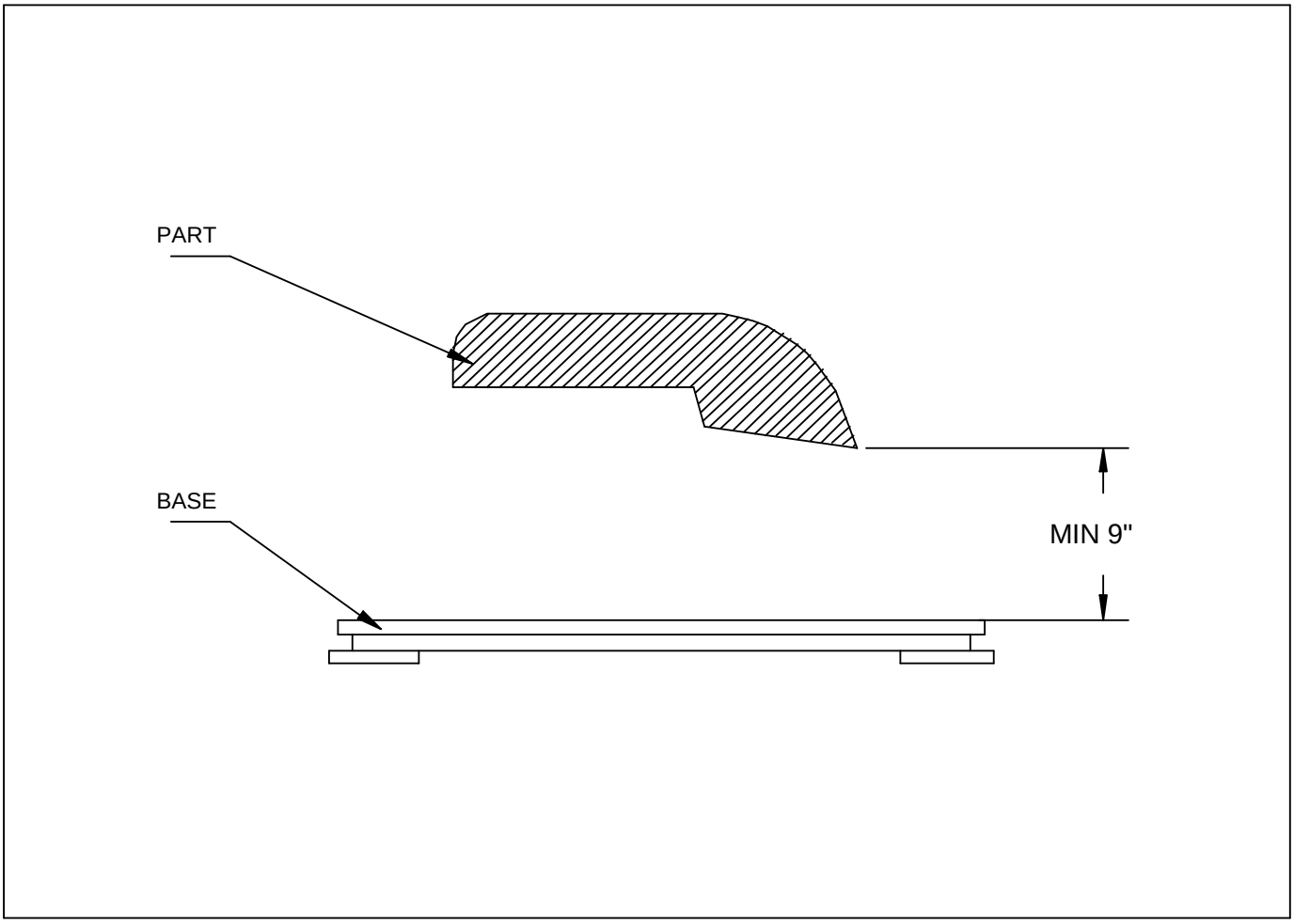
APPENDIX B3. Hinge Drop Detail with Lock-out Pin

Return to Safety and Ergonomic Requirements, Item #4.
Return to Build Requirements, Section F. Hinged Details, Item #1.
Go to Appendix List Go to Table of Contents



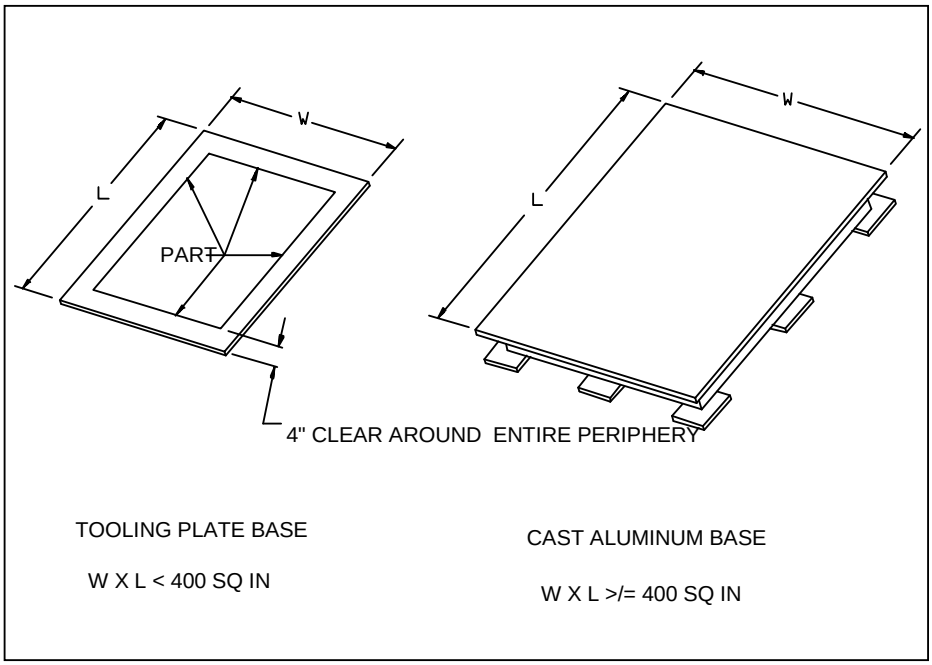
APPENDIX B4. Minimum CMM Probe Access Distance

Return to Quotation Requirements, Item #4.
Go to Appendix List Go to Table of Contents



APPENDIX B5. Gauge Base Size

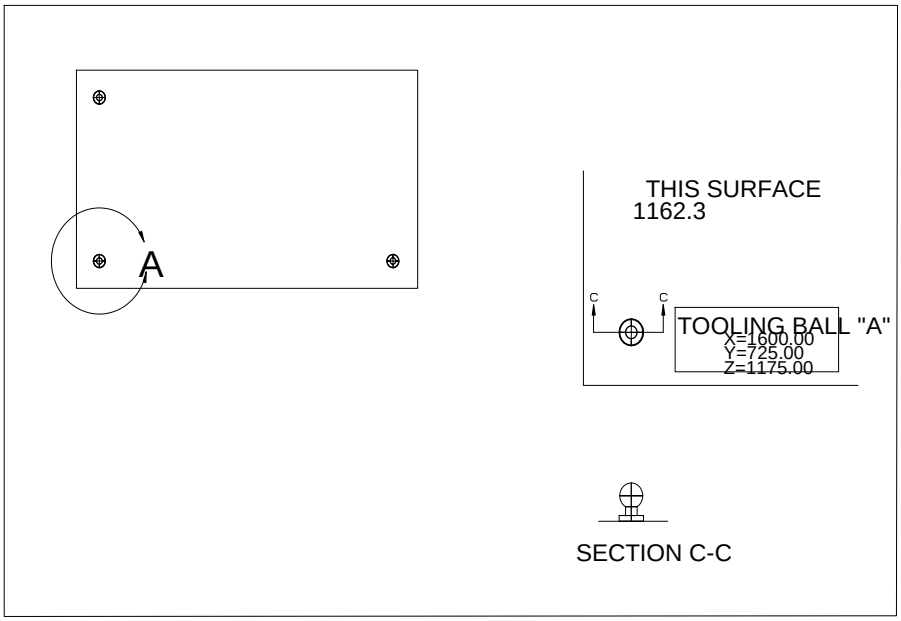
Return to Quotation Requirements, Item #5.
Go to Appendix List Go to Table of Contents



APPENDIX B6. Tooling Ball Labeling

Return to Design Requirements, Section B. Design, Item #8.
Return to Build Requirements, Section L. Labeling, Item #3.

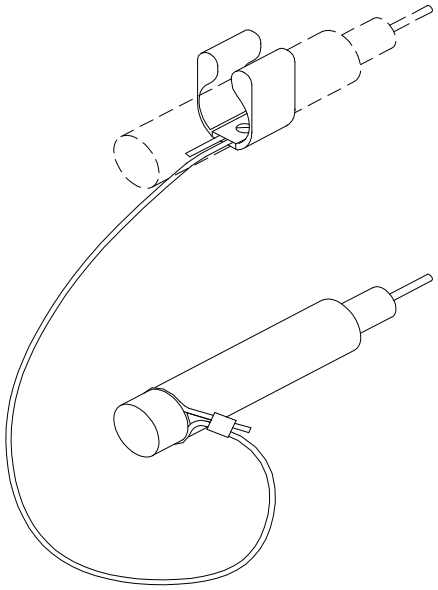
Go to Appendix List Go to Table of Contents



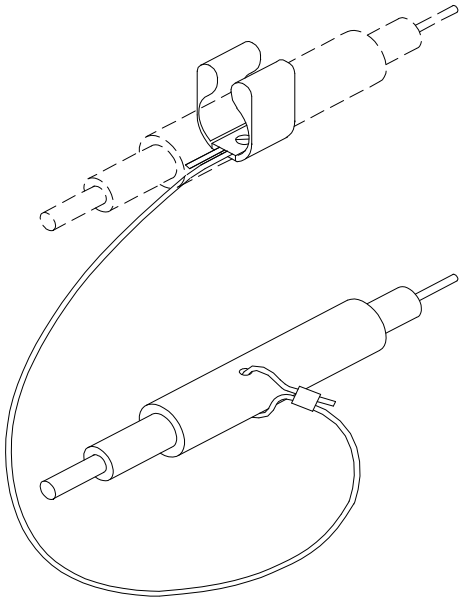
APPENDIX B7. Go / No Go Gauge and Screw Pin Tethering and Storage

Return to Design Requirements, Section B. Gauge Design, Item #14.
Go to Appendix List Go to Table of Contents

SCREW PIN

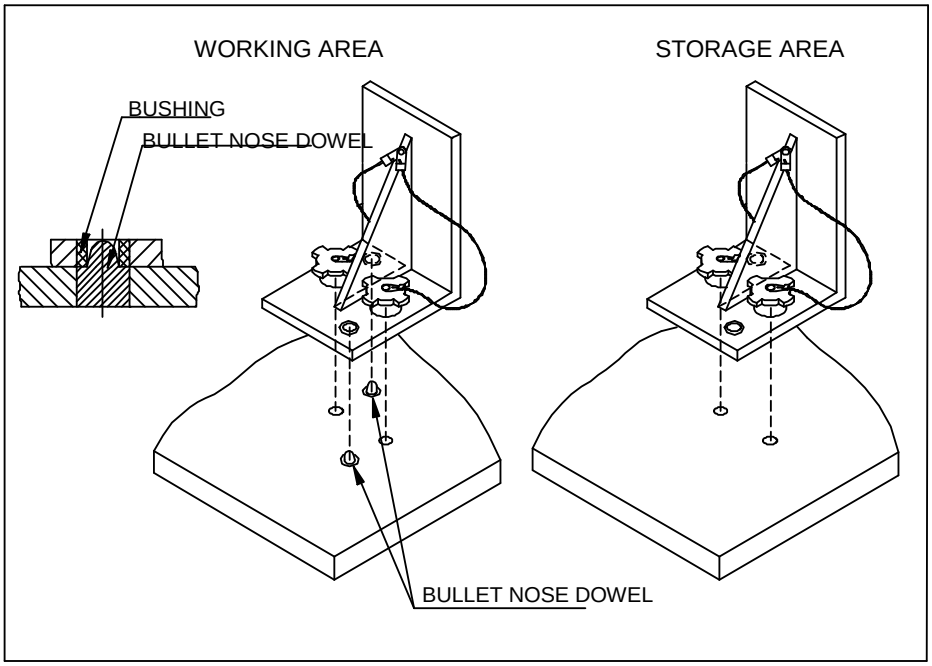


Go/No go GAUGE



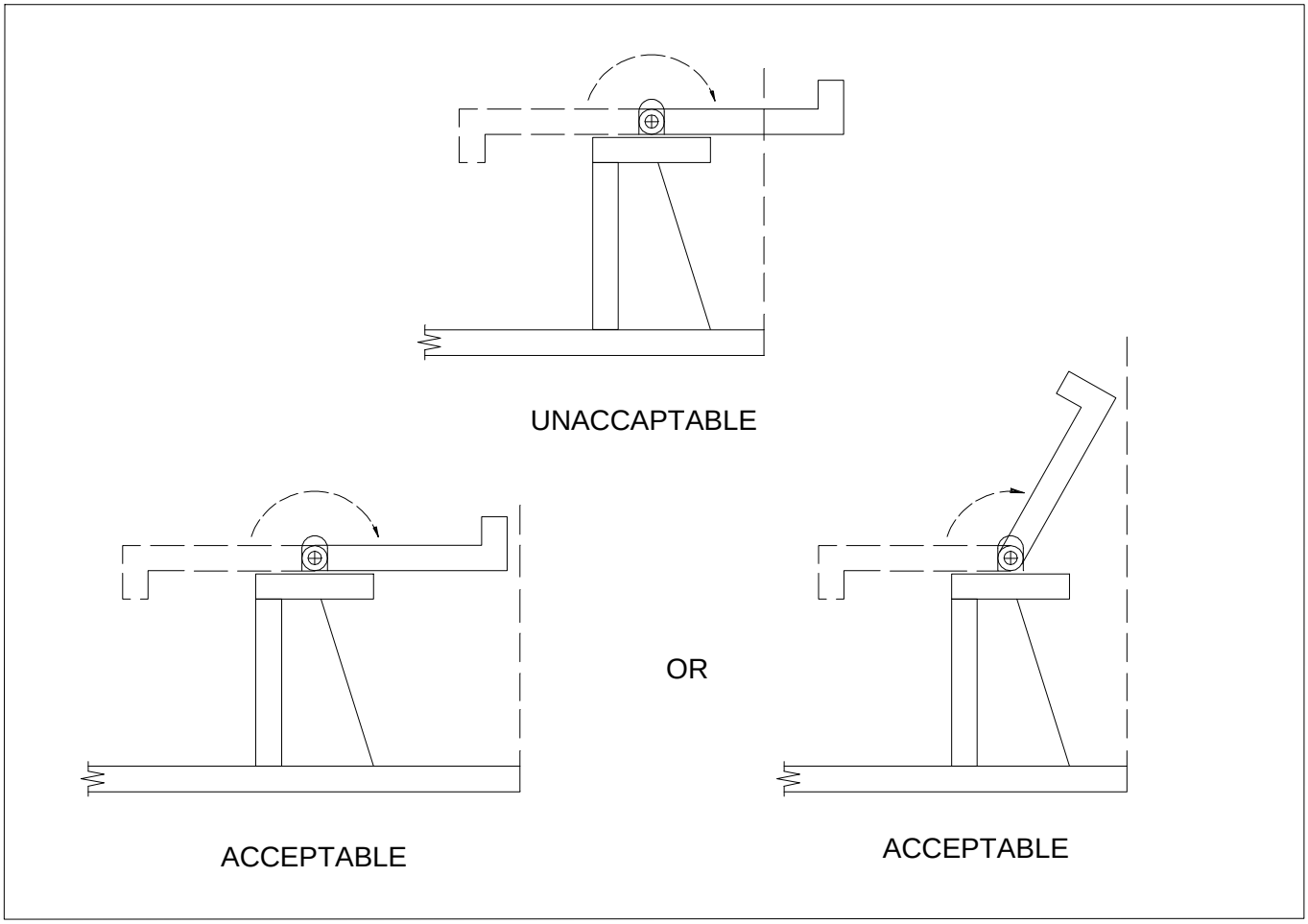
APPENDIX B8. Removable Detail Tethering and Storage

Return to Design Requirements, Section B. Gauge Design, Item #14.
Go to Appendix List Go to Table of Contents



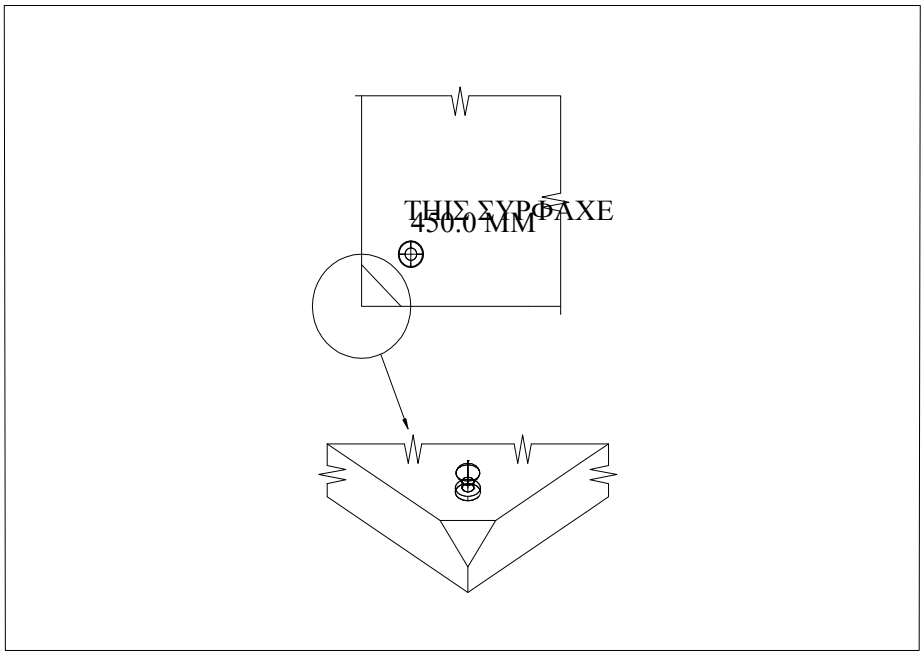
APPENDIX B9. Details Overhanging Base

Return to Design Requirements, Section B. Gauge Design, Item #20.
Go to Appendix List Go to Table of Contents



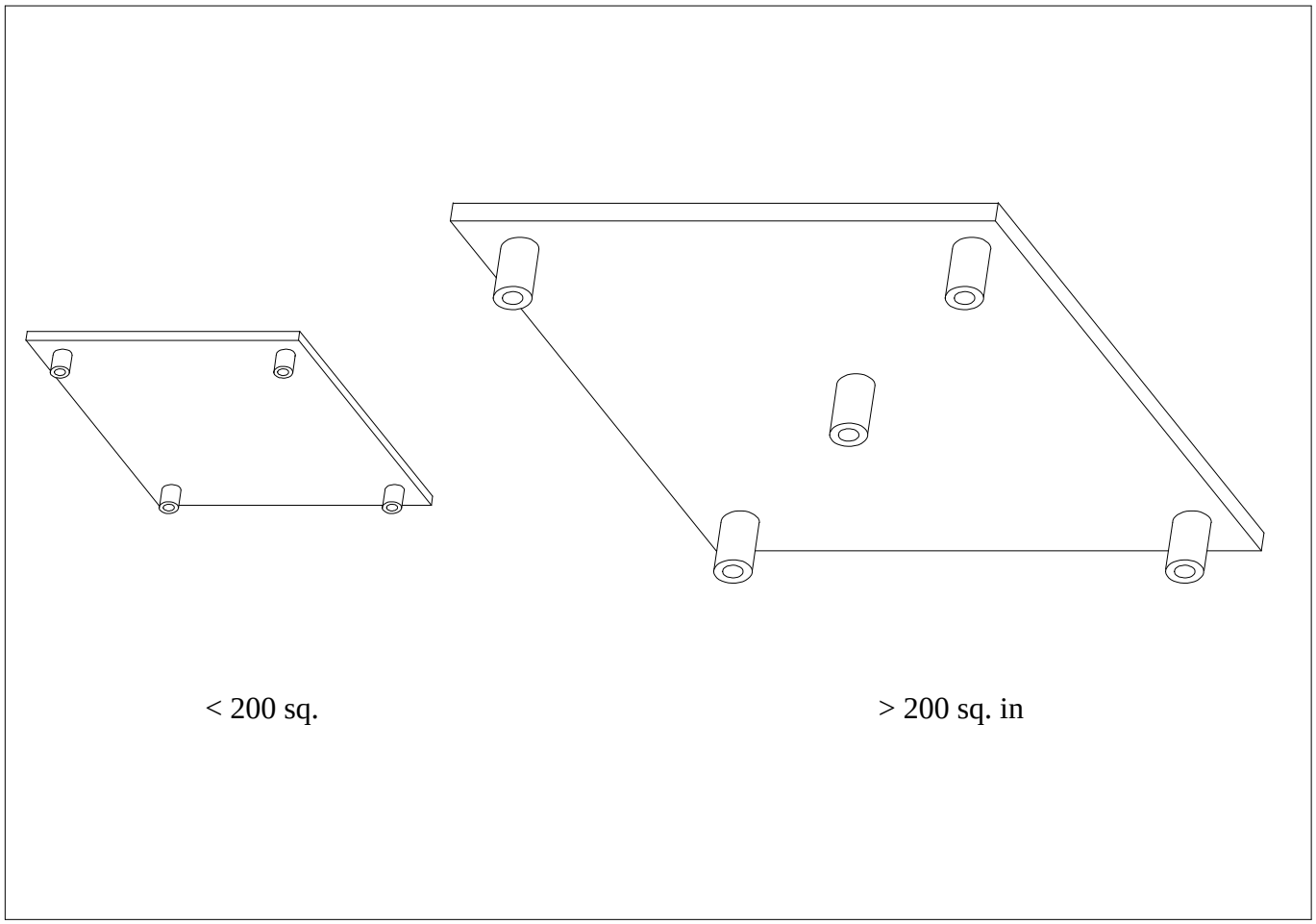
APPENDIX B10. J-Corner Identification

Return to Build Requirements, Section A. Bases, Item #3.
Go to Appendix List Go to Table of Contents



APPENDIX B11. Jig Foot Location

Return to Build Requirements, Section A. Bases, Item #4.
Go to Appendix List Go to Table of Contents

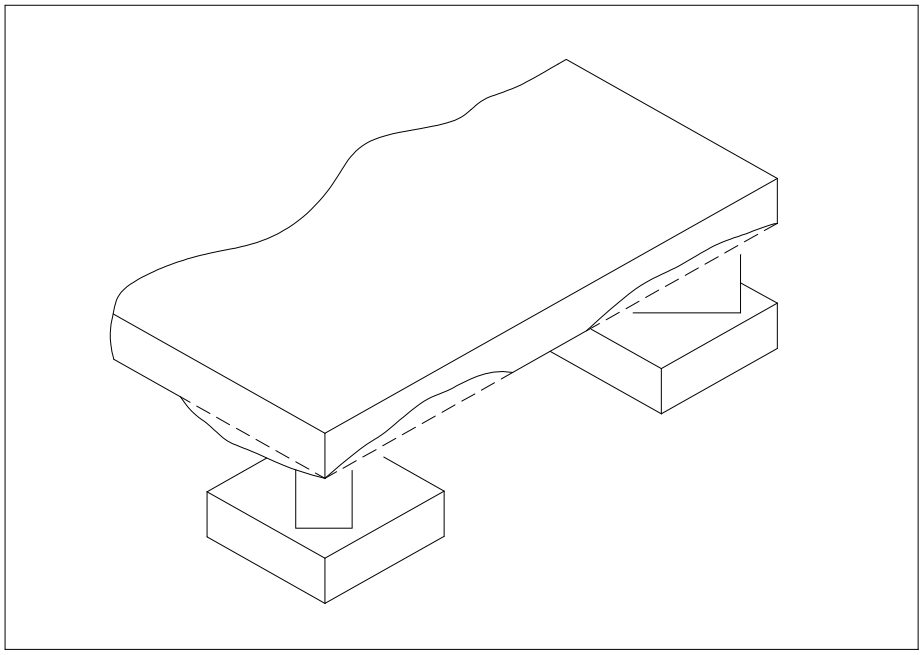


< 200 sq.

> 200 sq. in

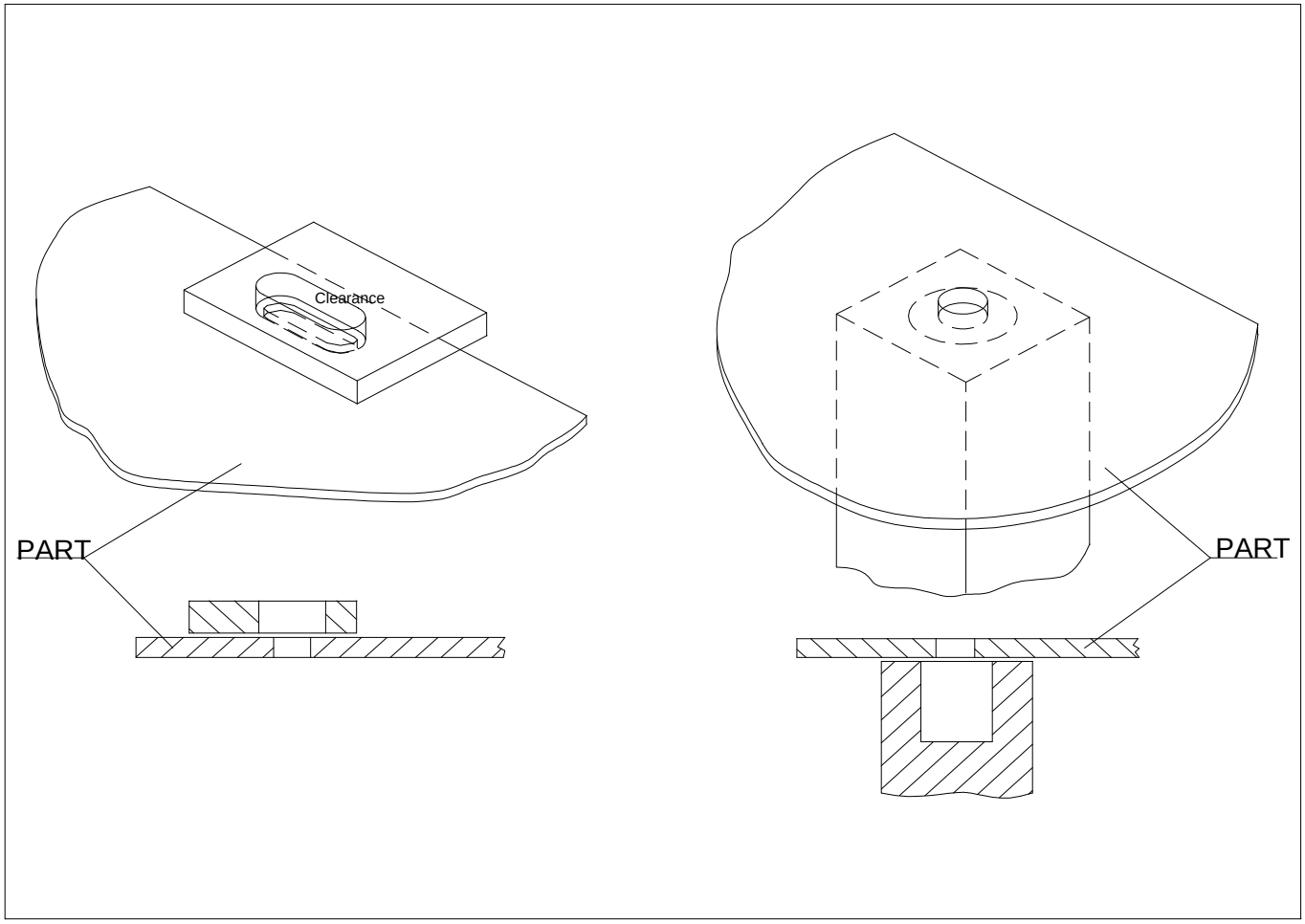
APPENDIX B12. Base Thickness Uniformity

Return to Build Requirements, Section A. Bases, Item #6.
Go to Appendix List Go to Table of Contents



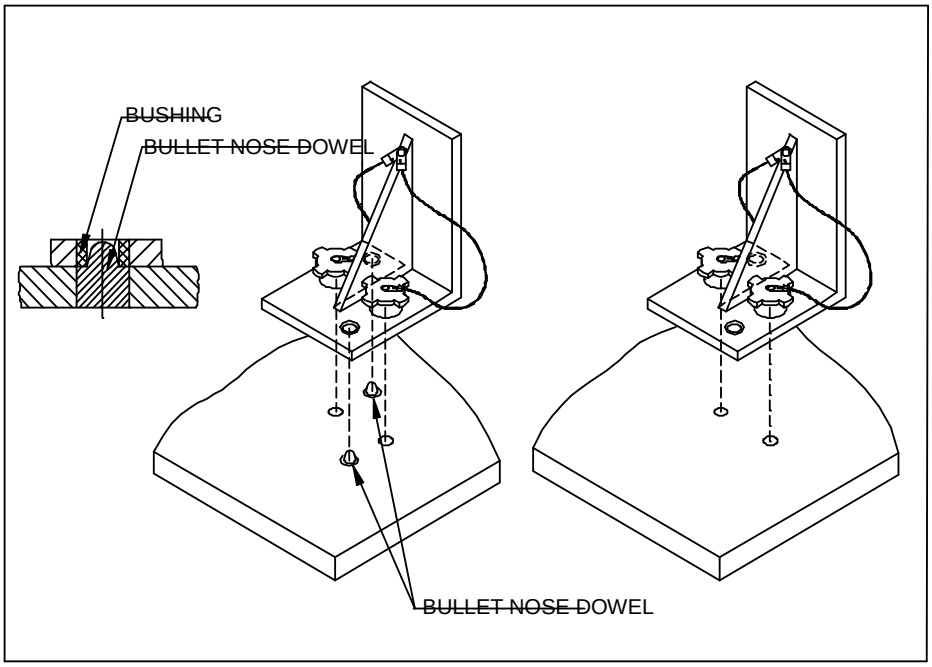
APPENDIX B13. Hole Clearance for CMM Access

Return to Build Requirements, Section D. Details, Item #7.
Go to Appendix List Go to Table of Contents



APPENDIX B14. Bullet Nose Dowel Location

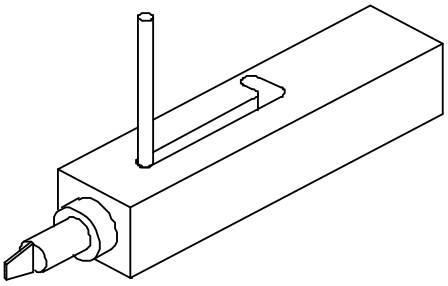
Return to Build Requirements, Section E. Removable Details, Item #1.
Go to Appendix List Go to Table of Contents



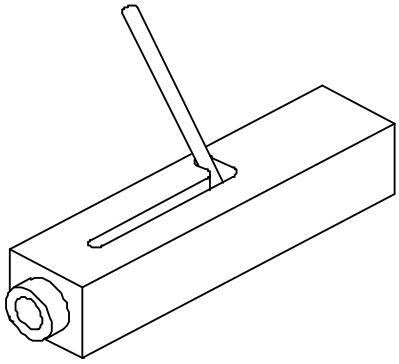
APPENDIX B15. Locating Pin with Lock-out Pin

Return to Build Requirements, Section G. Locating Pins, Item #4.
Go to Appendix List Go to Table of Contents

WORKING POSITION

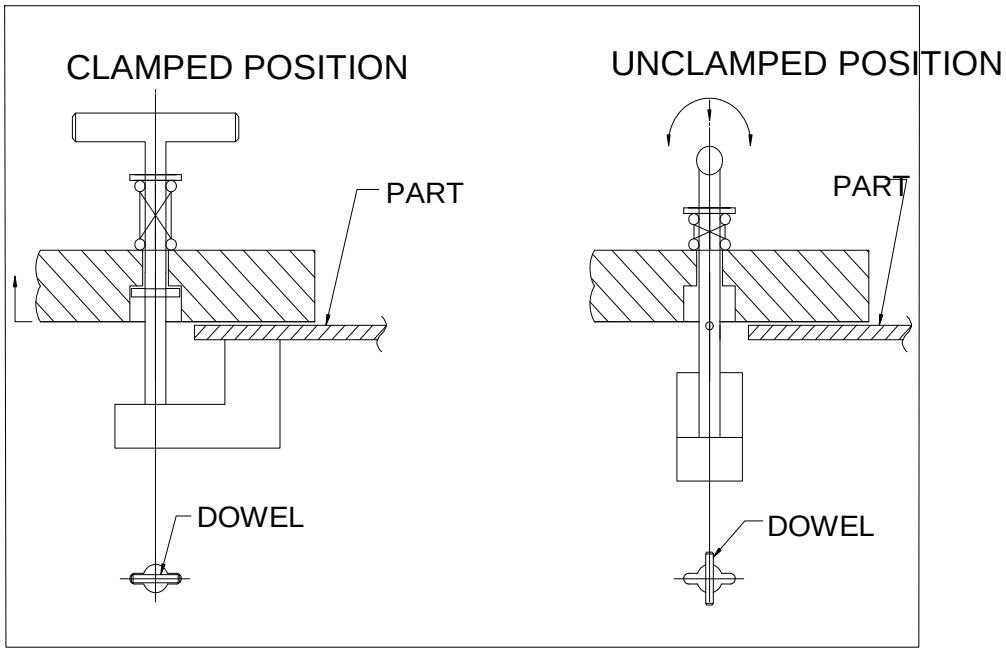


LOCK 0UT PIN POSITION



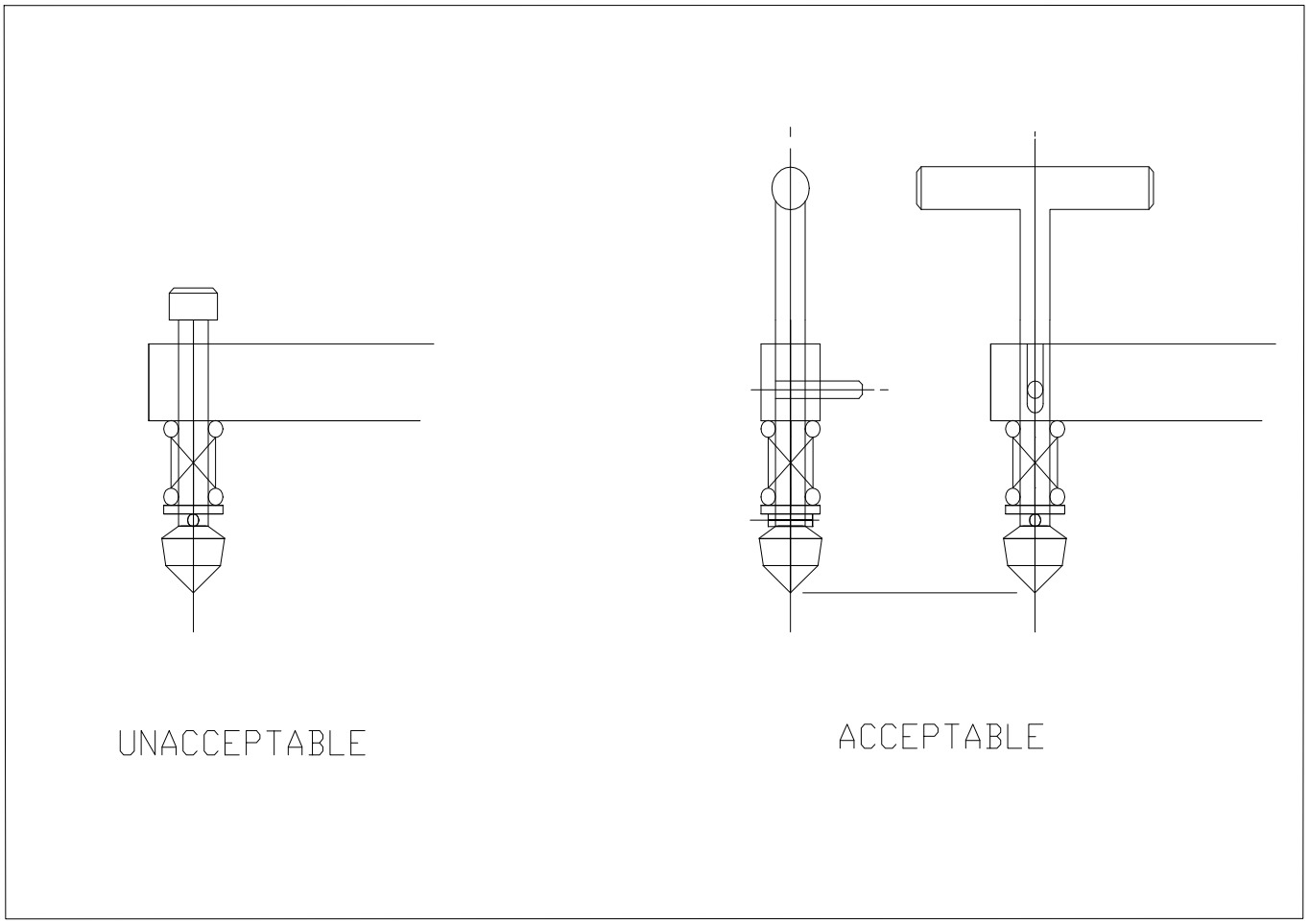
APPENDIX B16. Bayonet Clamp Location to Allow for CMM Access

Return to Build Requirements, Section H. Clamps, Item #1.
Go to Appendix List Go to Table of Contents



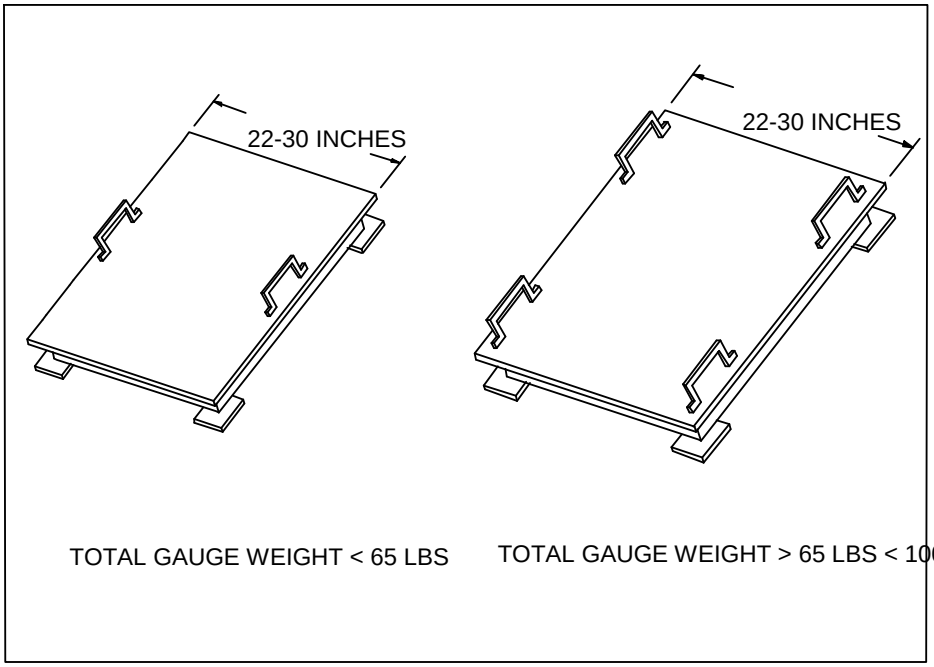
APPENDIX B17. Clamp Lock-out Mechanism

Return to Build Requirements, Section H. Clamps, Item #3.
Go to Appendix List Go to Table of Contents



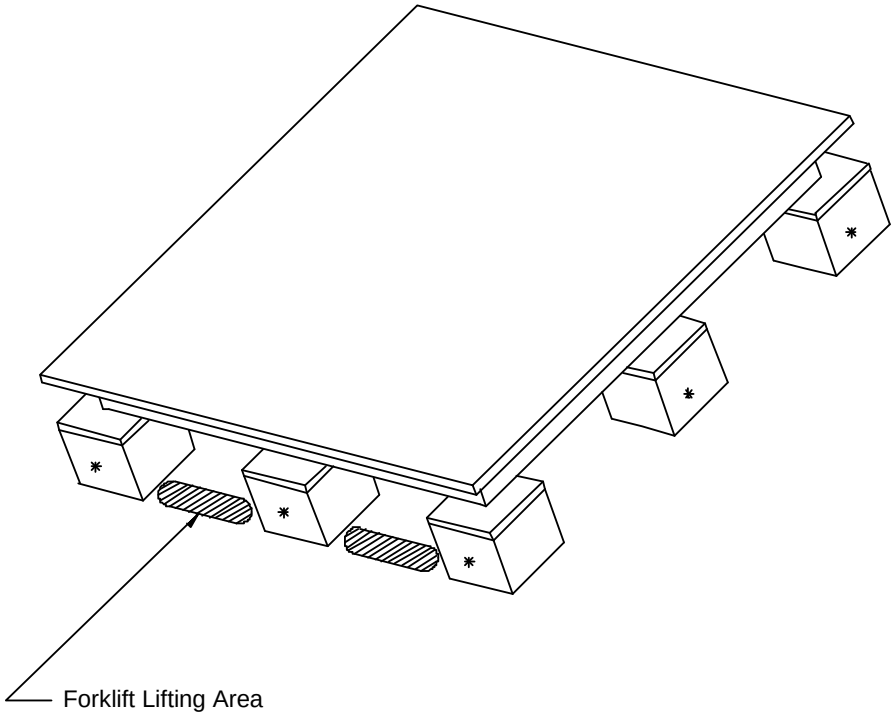
APPENDIX B18. Handle Installation

Return to Safety and Ergonomic Requirements, Item #6.
Go to Appendix List Go to Table of Contents



APPENDIX B19. Forklift Sleeve Installation

Return to Safety and Ergonomic Requirements, Item #6.
Go to Appendix List Go to Table of Contents

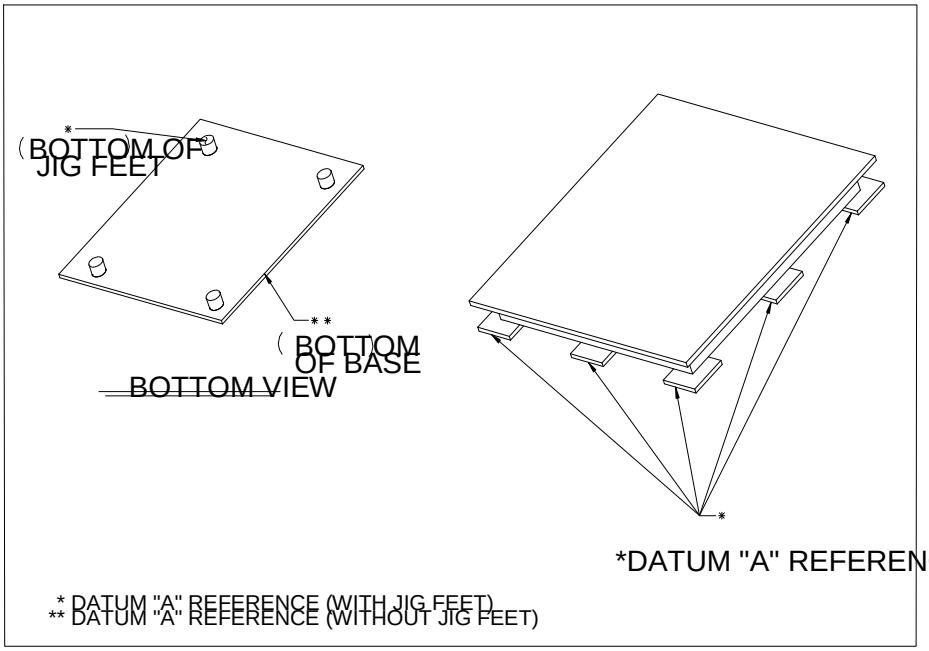


OVERALL GAUGE WEIGHT > 100

* - 4” Riser Blocks may be attached to base feet for cart.

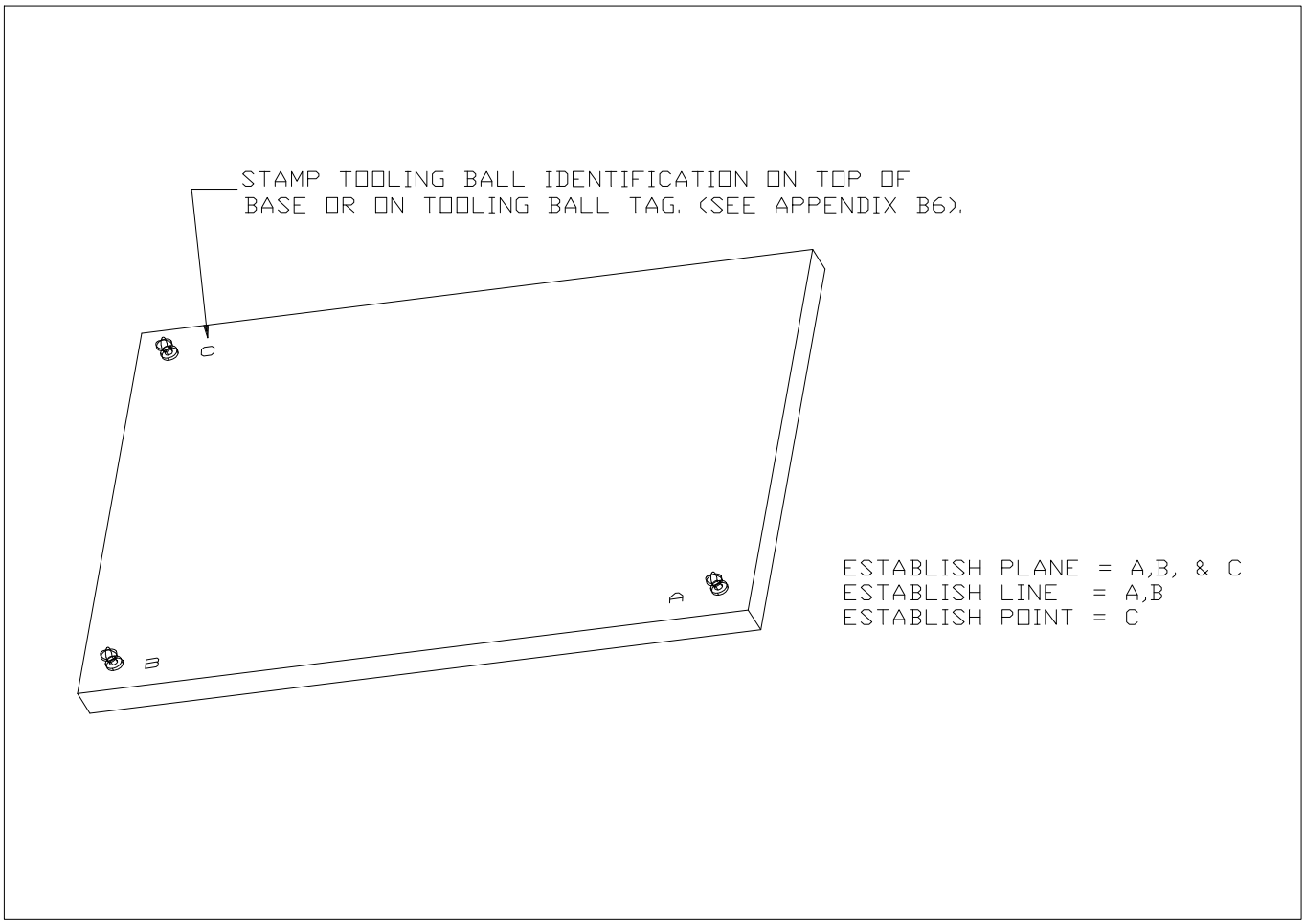
APPENDIX B20. Datum Scheme for Base Certification

Return to Build Requirements, Section A. Bases, Item #1.
Go to Appendix List Go to Table of Contents



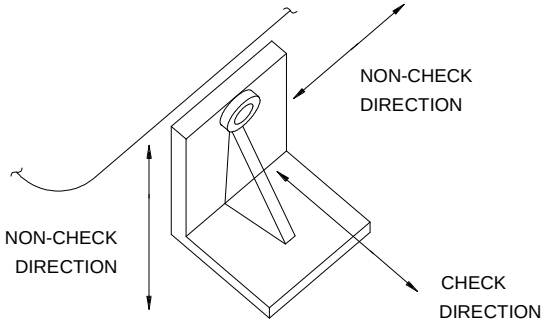
APPENDIX B21. Gauge Certification Datum Set-up

Return to Build Requirements, Section K. Build Tolerances, Note #1.
Go to Appendix List Go to Table of Contents

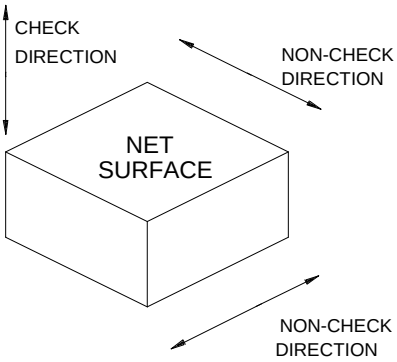


APPENDIX B22. Check Direction / Non-check Direction for Certification

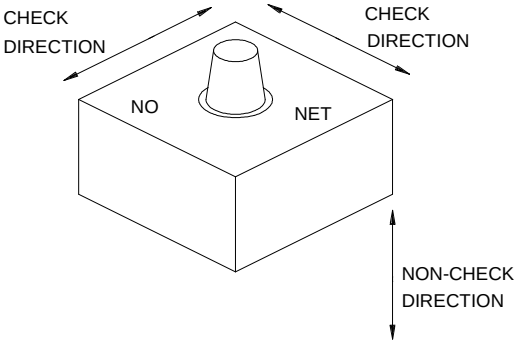
Return to Build Requirements, Section K. Gauge Build Tolerances, Note #2.
Return to Build Requirements, Section K. Gauge Build Tolerances, Note #3.
Go to Appendix List Go to Table of Contents



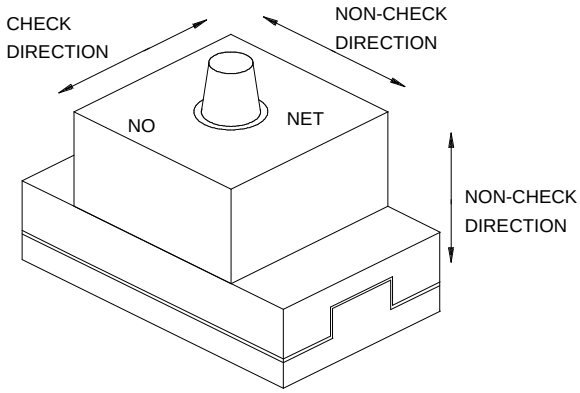
SPC POINT



NET PAD
ATTRIBUTE RAIL



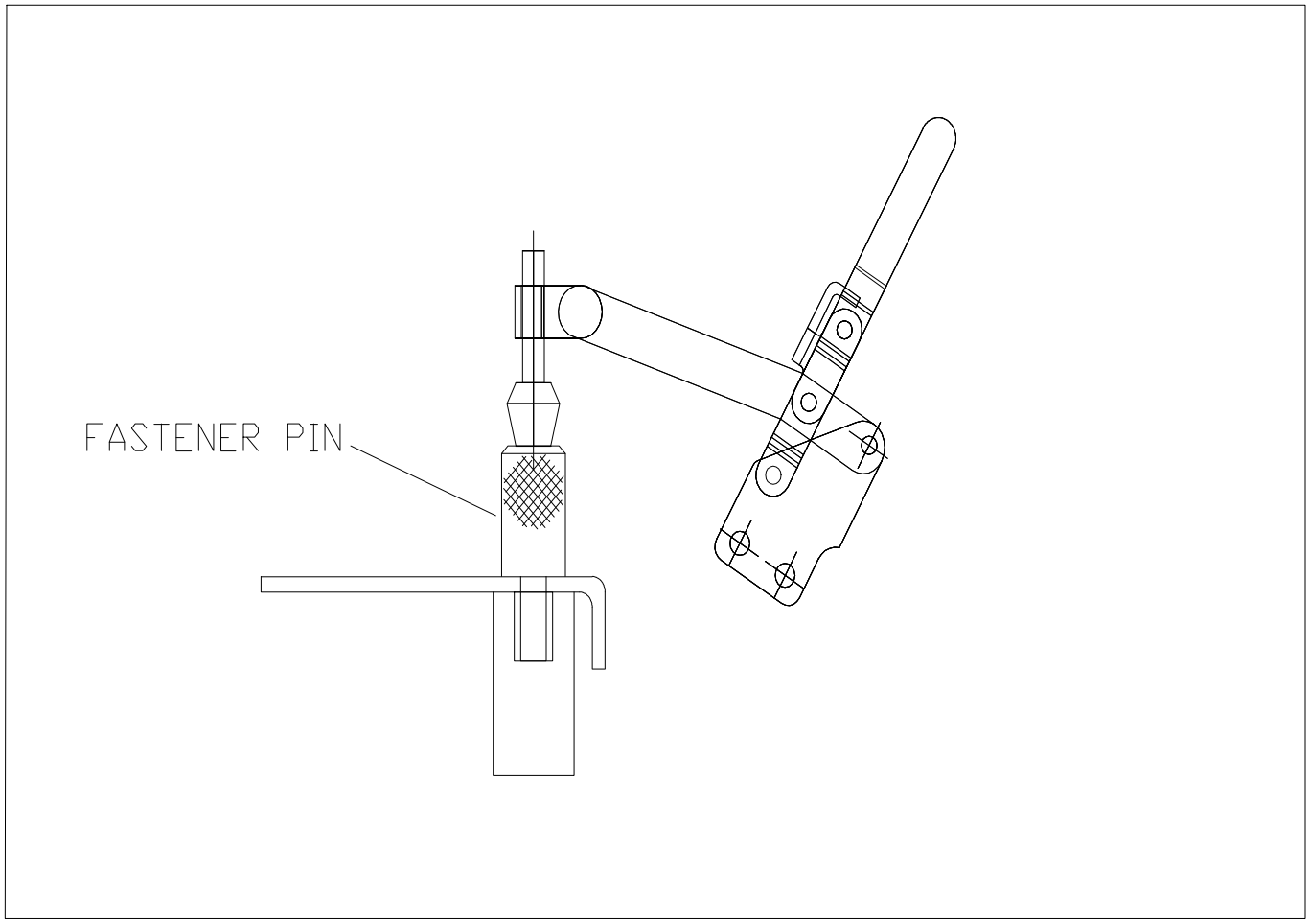
ROUND LOCATOR (4-WAY)



ROUND LOCATOR (2-WAY)

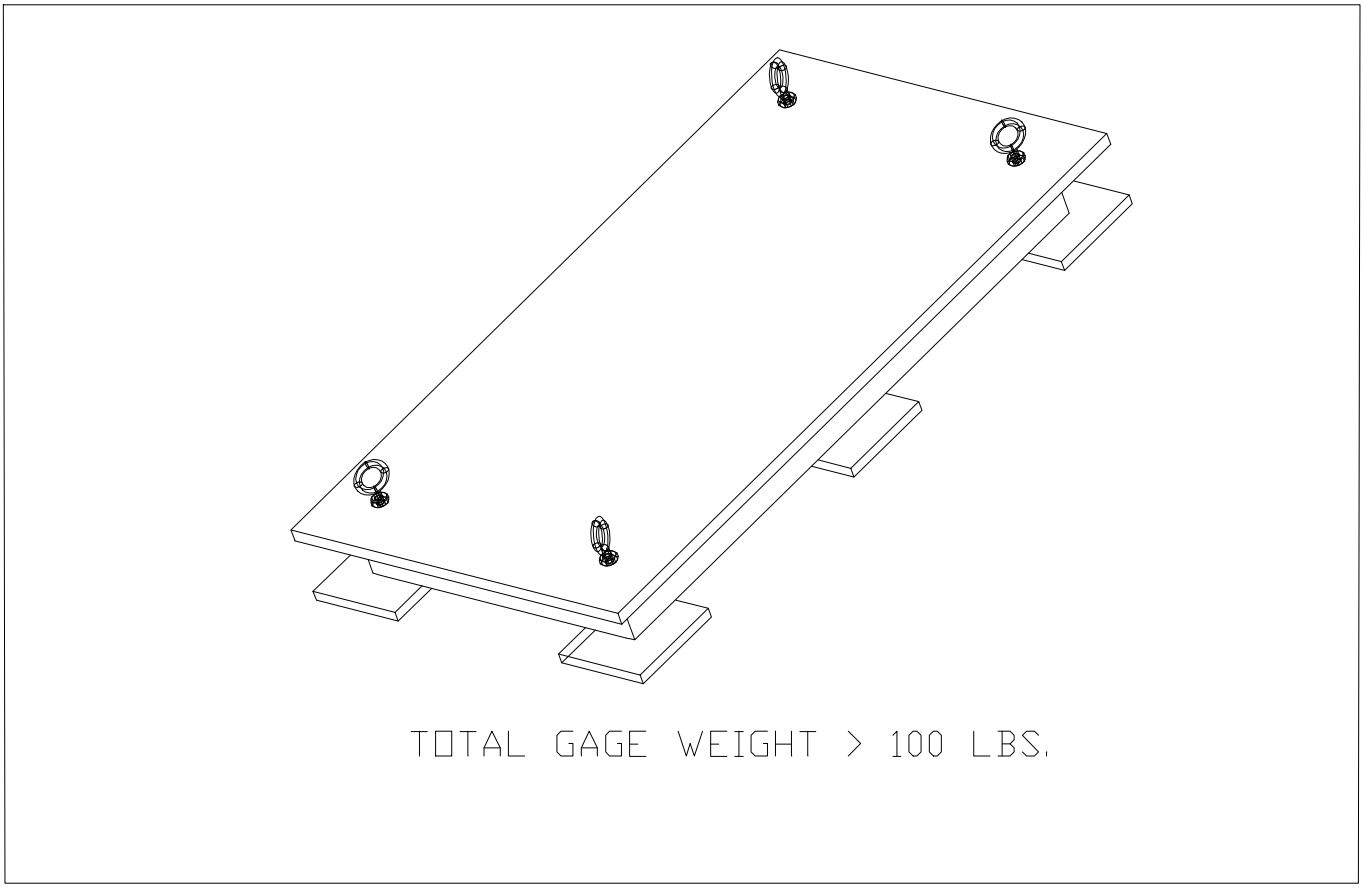
APPENDIX B23. Fastener Pin Representation

Return to Build Requirements, Section D. Details, Item #10.
Go to Appendix List Go to Table of Contents



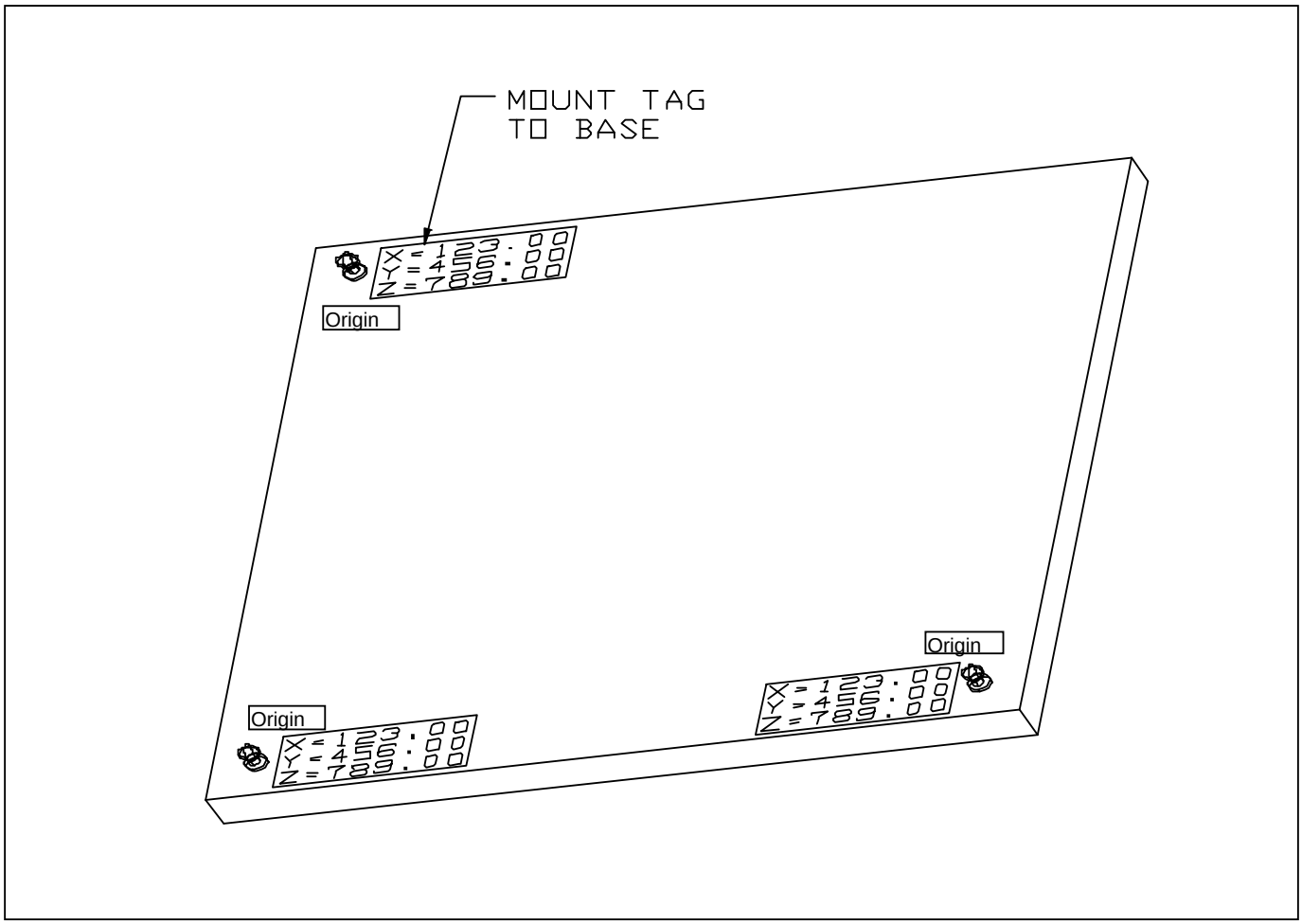
APPENDIX B24. Eyebolt Installation

Return to Safety and Ergonomic Requirements, Item #6.
Go to Appendix List Go to Table of Contents



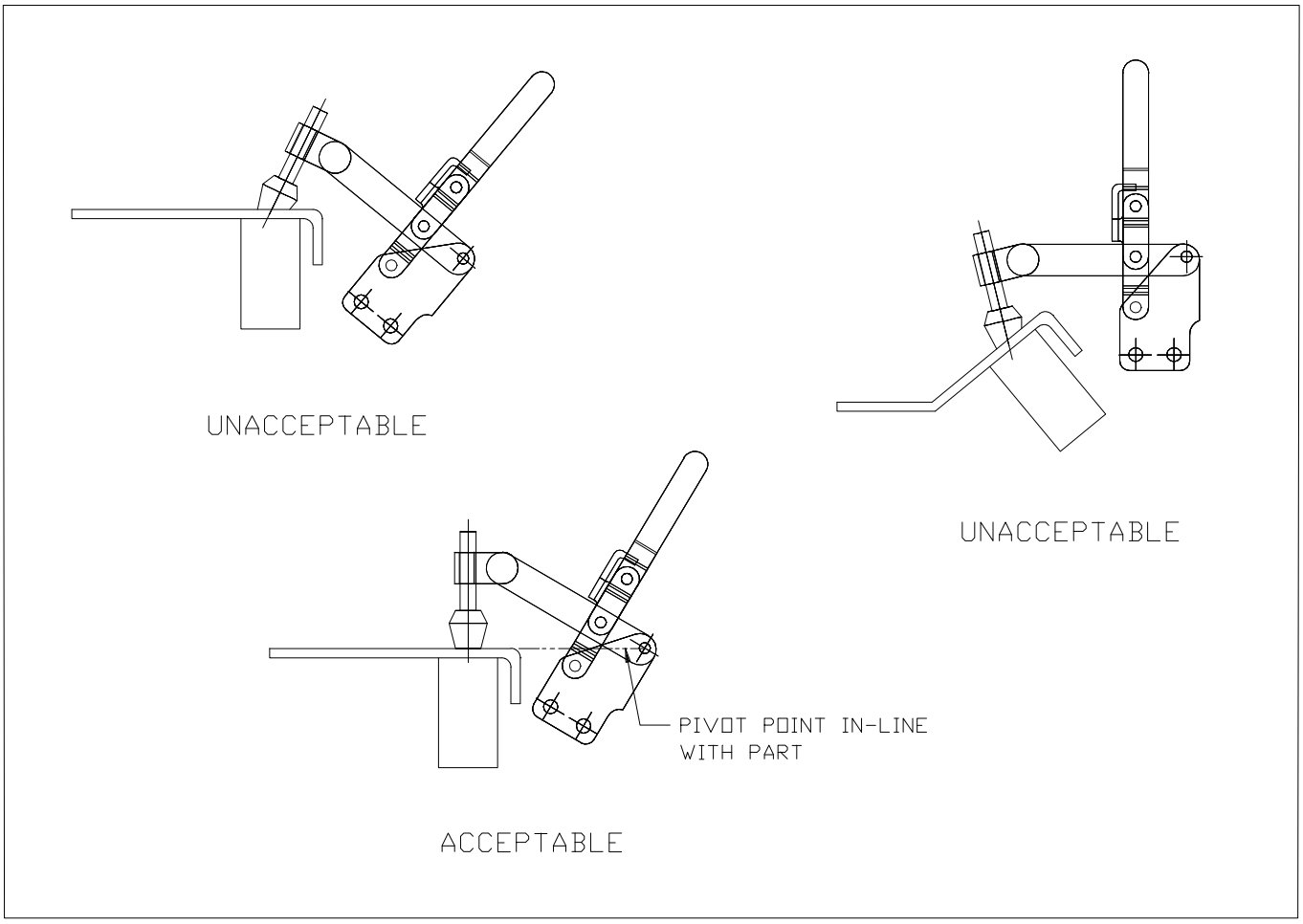
APPENDIX B25. Tooling Ball Origin Identification

Return to Build Requirements, Section A. Bases, Item #1.



APPENDIX B26. Clamping Direction

Return to Build Requirements, Section H. Clamps, Item #2.


UNACCEPTABLE
UNACCEPTABLE
PIVOT POINT IN-LINE
WITH PART
ACCEPTABLE

APPENDIX B27. Tooling Hole and Surface Target Labeling

Return to Design Requirements, Section B. Design, Item #8.
Return to Build Requirements, Section L. Labeling, Item #3.

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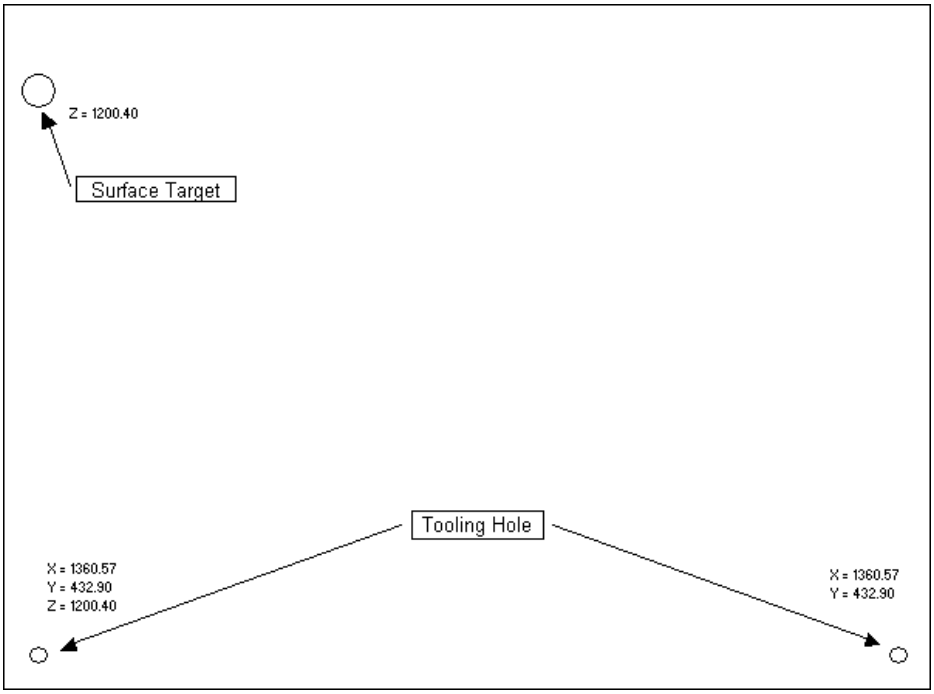

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APPENDIX C – STANDARD MATERIAL LIST

Return to Quotation Requirements, Item #2.

Material	Product Code (grade)	Applications*
Aluminum	6061	Details, Flush/feeler rails
	Mic 6 Tooling Plate	Bases
Steel	1018	Details, Net pads, Sheet metal representations
	1020	Details, Net pads, Sheet metal representations
Gauge Plank	MP 1055	Flush / feeler rails, Attribute tub Gauges, Sheet metal representations
	MP1054	Flush / feeler rails, Attribute tub Gauges, Sheet metal representations
	Prolab 65	Flush / feeler rails, Attribute tub Gauges, Sheet metal representations
	Lab 1000	Flush / feeler rails, Attribute tub Gauges, Sheet metal representations
	Ren Shape 450	Flush / feeler rails, Attribute tub Gauges, Sheet metal representations
	Ren Shape 470	Flush / feeler rails, Attribute tub Gauges, Sheet metal representations

- Applications refer to examples and are not intended to be finite.

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APPENDIX D – REVISION TABLE

Level	Date	Description
Release	03/15/02	a. Release for publication.
001	11/07/02	a. Added Gauge Supplier signatures to Introduction page. b. Added note to Gauge Build Requirements - Section K. Build Tolerance, All tolerances are in millimeters unless otherwise noted. c. Updated Gauge Build Requirements - Section K. Build Tolerances to include the Check pin location tolerance. d. Updated Gauge Build Requirements - Section K. Build Tolerances to include Go and No go pin size tolerances.
002	03/03/04	a. Changed Automotive Systems Group to Automotive Group.
003	05/05/04	a. Added reference to Gauge Assumption/Gauge Cost Model form in General Requirements #1 and #10. b. Added reference to Gauge Assumption/Gauge Cost Model form in Quotation Requirements #8. c. Added Quotation Requirements #9, referencing customer cost breakdowns using the Gauge Assumptions / Gauge Cost Model form. d. Revised wording of Gauge Design Requirements - Section B. Gauge Design #16 for clarification. e. Moved Gauge Build Requirements - Section H Clamps #1 to Gauge Design Requirements - Section B. Gauge Design #23. Also, reworded entry for clarification. f. Revised wording of Gauge Build Requirements - Section D. Details #1 for clarification. g. Revised wording of Gauge Build Requirements - Section D. Details #4 for clarification. h. Revised wording of Gauge Build Requirements - Section D. Details #5 for clarification. i. Revised wording of Gauge Build Requirements - Section I Scribe Lines / Tolerance Bands #1 for clarification. j. Revised wording of Gauge Build Requirements - Section I Scribe Lines / Tolerance Bands #2 for clarification. k. Revised wording of Gauge Build Requirements - Section J SPC Indicators #2 for clarification. l. Changed Gauge Build Requirements - Section K SPC Indicators #3 entry from center of indicator travel to approximate center of indicator travel. m. Changed Gauge Build Requirements - Section K SPC Indicators #8 reference from tips must be secure to tips must be tightened. n. Revised wording of Gauge Build Requirements - Section K SPC Indicators #9 for clarification. o. Revised wording of Gauge Build Requirements - Section L Labeling #5 for clarification. p. Revised wording of Gauge Build Requirements - Section N Gauge Certification #1 for clarification. q. Revised wording of Gauge Build Requirements - Section N Gauge Certification #2 for clarification. r. Changed Gauge Build Requirements - Section N Gauge Certification #2 entry from one-direction check like a flush or feeler rail to one-direction check like a net point, flush rail, or feeler rail. s. Changed Gauge Build Requirements - Section O 3rd Party Certification #3 entry by adding up to and including the internal and 3rd Party recertification. t. Changed Gauge Build Requirements - Section P Gauge Instructions #2 entry from it must include to they must include. u. Revised wording of Gauge Build Requirements - Section Q Function Check #1 for clarification. v. Added Gauge Assumption / Gauge Cost Model to Appendix A – Documents as Appendix A19.

004	07/25/06	a. Changed all references of Gauge Buyer to Gauge Engineer. b. Corrected the Quotation Requirements #7 entry by changing the 600 in² reference to 400 in². c. Changed Gauge Design Requirements - Section B. Gauge Design #8 to include Tooling Holes and Surface Target. Added Tooling Holes and Surface Target picture to Appendix B – Diagrams as Appendix B27. d. Added wording to Gauge Design Requirements - Section B. Gauge Design #19 to include, including details that move (toggle clamps, hinge drops, etc.) e. Changed Gauge Build Requirements - Section B. Tooling Balls to include reference to Tooling Holes. f. Changed Table of Contents Gauge Build Requirements – Section B to include Tooling Holes. g. Renumbered Table of Contents. h. Added reference to Gauge Build Requirements - Section B. #1 to include Tooling Holes. i. Changed Gauge Build Requirements - Section B. #2 to include reference for Tooling Holes size requirement. j. Changed Gauge Build Requirements - Section I. Scribe Lines / Tolerance Bands #4 to have scribe lines on the Gauge base as an option, as determined by the Customer or YANFENG Representative. k. Changed Gauge Build Requirements – Section K. Build Tolerances Note #1 to include the reference of tooling holes. l. Changed Gauge Build Requirements – Section L. Labeling #3 to include the reference of tooling holes.
005	12/01/12	a. Added JCI Supplier Portal header and footer to cover page.
006	04/26/16	a. Changed all references of Johnson Controls to Yanfeng Global Automotive Interiors or Yanfeng. b. Revised Introduction page and eliminated Gauge Partner references. c. Updated content for clarity. d. Removed Johnson Controls references in Appendices.

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APPENDIX E – REFERENCE LIST

Reference Title	Author / Publisher	Publish Date
ASME Y14.5- 2009 Geometric Dimensioning and Tolerancing	ASME	2009
CG Model and Gauge Gauge Build Standards	CG Model and Gauge	Unknown
Chrysler Truck Platform Interior Systems Dimensional Quality Plan	DaimlerChrylser Corporation – Truck Platform	6/00
Chrysler AME Gauge Standards	DaimlerChrylser Corporation	9/98
Chrysler Corporation Checking Gauge Design and Build Standards	DaimlerChrylser Corporation	4/93
Ford Vehicle Operations Final Assembly Engineering Tooling Aids – Design and Build Guidelines	Ford Motor Company	2/97
GM Checking Gauge/Gauge Standards (PED:114)	General Motors	10/01
GM Global Checking Gauge Standards	General Motors	9/99
GM Mid/Lux Supplier Development/Quality Part Fixturing Design/Build Standards	General Motors Mid/Lux Division	4/96
ISO Guide 25 Laboratory Certification	ISO / IEC	12/90
ISO / IEC 17025 Laboratory Certification	ISO / IEC	12/90
Jay Enn Gauge Build Standards	Jay Enn Corporation	1/97
Yanfeng Athens Plant General Gauge Specifications	Yanfeng Athens	6/98
Yanfeng Interiors Special Equipment General Specifications	Yanfeng Equipment Development Team	5/01
Yanfeng Interiors Special Equipment General Specifications	Yanfeng Equipment Development Team	5/01
Yanfeng Thermobond Headliner Substrate Standards	Yanfeng Tooling	12/99
Yanfeng Acousticor Headliner Substrate Standards	Yanfeng Tooling	10/98
Yanfeng Honda Business Unit Gauge and Gauge Criteria	Yanfeng Honda BU	4/99
Yanfeng Injection Mold Standards	Yanfeng Tooling	1/00
Yanfeng Integration Center Gauge (CMM Gauge) Development Criteria	Yanfeng Integration Center	3/99
Yanfeng Lakeshore Gauge Standards	Yanfeng Lakeshore	Unknown
Yanfeng Reynosa Plant General Gauge Specifications	Yanfeng Reynosa	9/99
Measurement Systems Analysis Reference Manual	Chrysler/Ford/General Motors Supplier Quality Requirements Task Force	6/98
MMMA Checking Gauge Tolerance Standard	Mazda Motors	5/90
MP Components Gauge Build Standards	MP Components	1/99
Peterson Jig and Gauge, Inc. Gauge Build Standards	Peterson Jig and Gauge	Unknown
Quality Systems Requirements - QS9000 Manual	Chrysler/Ford/General Motors Supplier Quality Requirements Task Force	3/98
Quality Systems Requirements – Tooling & Equipment Supplement	Chrysler/Ford/General Motors Tooling and Equipment Representatives	6/98
Supplier Quality Assurance Manual for Parts and Components (Section 17 – Checking Gauges, Gauges and Test Equipment)	Toyota Motor Manufacturing North America, Inc.	3/00

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APPENDIX F – GLOSSARY OF TERMS

Return to General Requirements Return to Safety and Ergonomics Requirements Return to Quotation Requirements
Return to Gauge Design Requirements Return to Gauge Build Requirements

(Pass cursor over term to read definition.)

2-way locator	4-way locator	90º out of body	180º out of body	A2LA	Accuracy	Analysis of variance (ANOVA)
Anthropometry	Appraiser variation (AV)	ASME Y14.5M-1994	ASME Y14.5.1M-1994	Attribute rail	Attribute study	Base
Bayonet clamp	Bias	Body position	Bullet-nose dowel	Bushing	Calibration	Cartesian coordinate system
Cast aluminum base	Certification	Certification target	Clamp	Clamping direction	Clamp pressure	Concept drawing
Contour template	Coordinate measuring machine	Datum	Datum Axis	Datum feature	Datum point	Datum reference frame
Datum surface	Datum target	Design approval	Detail	Discrimination	Drop template	Equipment variation (EV)
Feeler rail	Gauge	Gauge plank	Flatness	Flush rail	Gauge	Gauge design
Gauge R study	Gauge R&R study	Gauge instructions	Gaging tolerance	Geometric Dimensioning and Tolerancing	Go/NoGo pin	Hinge drop
IGES	I-J-K check	Inspection	ISO Guide 25	ISO Guide 17025	J corner	Jig feet
Linearity	LMC	Maintainability	Master set block	Mean Time Between Failures	Mean Time Between Maintenance	Mean Time to Repair
Measurement	Measurement system	Measurement system analysis	Measurement system error	Measurement uncertainty	Microslide	MMC
NC machining	Net surface	Out of calibration	Operator's area of movement	Parallax error	Parallelism	Part Alignment
Part orientation	Phase I Gauge	Phase II Gauge	Pinch point	Plug Gauge	Precision	Primary datum
Profile of a line	Profile of a surface	QAF	QS9000	Reliability	Repeatability (EV)	Reproducibility (AV)
Resolution	RFS	Riser	Scribe line	Secondary datum	Set two check one check	Sheet metal Representation
Significant characteristic	Simulated datum	Site check	SPC indicator	SPC port	Squareness	Stability
Stanchion	Start Coordinates	Step Gauge	Sub-base	TE9000	Tertiary datum	3rd Party certification
Toggle clamp	Tooling ball	Tooling plate	Total variation	True position	Tulip	Vector check
Virtual condition	Warranty	X-Y-Z coordinate system				