



Engine Lift Bracket

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This Component Technical Specification covers supplier requirements for general purpose engine lift brackets.

1.2 Applicability. This specification covers permanent and removable lift brackets.

1.3 Remarks. This specification contains all information necessary to design, analyze, develop, validate, and manufacture engine lift brackets.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

AIAG CQI-15	ISO 9001	SAE J1392	SAE J1442
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2.2 GM Standards/Specifications.

GMW2	GMW3059	GMW3359	GMW15272
GMW5	GMW3200	GMW14671	GMW16267
GMW10	GMW3286	GMW14674	

2.3 Additional References.

- Component Technical Specification
- Global Engine Durability (GED) Test
- GM Specification Chart 12554927
- Magnaflux North America, Glenview, Illinois (www.magnaflux.com)
- Stamped Steel Questionnaire

3 Requirements

3.1 System/Subsystem/Component/Part Definition.

3.1.1 Appearance. Not applicable.

3.1.2 Content. This specification shall cover the requirements for engine lift brackets including design, analysis, development, validation and manufacturing issues. These brackets provide engine and assembly plant capability to lift and carry the engine with hooks and other lift devices. They may also provide for service of the engine in the field.

3.1.2.1 Physical Content. Usually consists of two stamped steel brackets attached to the engine cylinder heads and or cylinder block.

3.1.2.2 Functional Content. Each bracket must have a hole in it accessible to the lift feature on the engine bridle used on the conveyor in the assembly plant to transfer it through the assembly process, and for service to remove the engine or powertrain from the vehicle. Some lift brackets are only used in assembly and some remain on the powertrain, depending on packaging and the engine mix in the assembly plants.

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3.1.3 Ambient Environment. Varies by application, but assumed to be -40 °C to 121 °C.

3.1.4 Interfaces. Not applicable.

3.1.5 Usage Definition. Not applicable.

3.2 Product Characteristics.

3.2.1 Performance Requirements.

3.2.1.1 Load Requirement. The brackets, whether two or three in number, depending on the assembly plant requirement, must individually be capable of supporting the combined mass of the engine and transmission. In cases where the lift bridles are rigid and single point engagement is not possible, this requirement may be waived. Service loads must also be considered. There will be different supported loads depending on the assembly plant process. It is necessary to consider the worst case condition for the lifetime of the design, including future model years for which the assembly process is undefined to avoid redesign and/or revalidation.

3.2.1.1.1 Design Loads. These loads are divided into three classifications:

3.2.1.1.1.1 Vertical Loads. Vertical loads are applied to a Finite Element Analysis (FEA) model to all bracket lift features (usually eyes/holes) simultaneously. These loads are first assumed to be five times the mass supported to simulate a drop of 100 mm.

3.2.1.1.1.2 Offset Loads. These loads result from lifting the entire supported load with one of the brackets at a time. The direction of application is determined by the center of mass of the supported mass trying to be located on a vector directly below the lift feature. This may bend the bracket, which is acceptable with the steel brackets, and the bending load may prevent the mass from reaching the center of the vertical vector. Testing may be required to confirm the loading assumptions used in the FEA model, but is usually not necessary. In the case of either cast brackets or thick fabricated brackets with pin engagement by a rigid lift bridle, bending is not permitted since it can result in release of the lift feature or fracture of the lift bracket.

3.2.1.1.1.3 Service Loads. Service loads can be assumed to be the result of a single ring on the end of a chain fall lifting the engine through separate chain spans extending from the ring over to each lift feature where a hook is located to engage the lift bracket eye. This angular load can be defined as the resultant angle between the lift feature and the ring (in a straight line) which will not pass through any other component on the engine (interference with another component could damage the contacted component and reduce the angle). A spreader bar is usually employed to protect other engine installed hardware. There are some lift systems that prevent this condition, and which employ a bridle that is rigid. See 4.1.1.2.

Judgment must be used to establish the reasonable lift condition for each application. The engine attitude is controlled by the offset between the eye on the chain fall and the center of mass of the supported mass. Once the supported mass is free of its mounting, it will swing until the center of mass is below a vertical vector through the chain fall ring. The mass to be lifted by design shall be the engine, transmission and four wheel drive transfer case, as applicable. This requirement must consider the method of removal (from top or bottom) during the life cycle of the bracket design.

3.2.2 Physical Characteristics. Not applicable.

3.2.2.1 Dimensions and Capacity. Not applicable.

3.2.2.2 Mass Properties. Not applicable.

3.2.3 Reliability.

3.2.3.1 Reliability Evaluation Point. Evaluated by performance by GM to validation test series and manufacturing process approval.

3.2.3.2 Reliability Requirements. The supplier must have production manufacturing process approved by global technical specialist.

3.2.4 Serviceability. This is a system issue, which is not covered in this specification.

3.2.5 User System/Subsystem/Component/Part Interface. Not applicable. The interface is not the responsibility of supplier.

3.3 Design and Construction.

3.3.1 Materials, Processes and Parts Selection Guidelines.

3.3.1.1 Material Guidelines. In general, lift brackets are made from stamped cold rolled steel sheet metal. Upon occasion, they may be made from die cast aluminum or sand cast iron, although the fracture resistance required

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makes this a less favorable option, and their use is discouraged in order to avoid the extra care and work involved to design and validate same. There may also be occasional use of steel weldments to fabricate heavy brackets of significant thickness, which are not practical as stamping applications.

3.3.1.1.1 Material Specifications. Shall be limited to GM regionally accessible (e.g., GMW, SAE, ASTM, and MPIF) standards. International standards (e.g., DIN, JIS, etc.), are acceptable when the regionally acceptable standards are not written to address required materials or requirements.

3.3.1.1.2 Restricted and Reportable Substances. All component parts must meet GMW3059. This includes, but is not limited to, hexavalent chrome free finishes. All drawings must include the note: "Restricted and Reportable Substances per GMW3059".

3.3.1.1.3 Part Cleanliness. Every detail drawing must call out, "Parts as delivered to assembly plant shall be clean and free of debris, residual abrasive material and corrosion products adversely affecting function or appearance".

3.3.1.1.4 Coatings/Platings/Finishes. All finishes must be called out on the detail drawing to the appropriate GM specification. If an Electrodeposition Primer (ELPO) or powder epoxy finish is used, the following are options:

- Clean, zinc phosphate and paint black via Cathodic Electrodeposition per GMW14671, Type A-U/H, requiring only scribed neutral salt spray test for 168 h per GMW3286 and meeting GMW15272 Appendix Table titled, "Cosmetic Corrosion Resistance Requirements" with a minimum rating of seven (7). Clean, phosphate and paint black with powder epoxy per GMW14671, Type D-U/H, requiring only scribed neutral salt spray test for 168 h per GMW3286 and meeting GMW15272 Appendix titled "Cosmetic Corrosion Resistance Requirements" with a minimum rating of (7).
- For removable brackets, which are not shipped with the vehicle, ink or other less corrosion resistant coatings are acceptable with assembly plant approval.

3.3.1.1.5 Metals. Callouts are required on the detail drawing as in 3.3.1.1.5.1 through 3.3.1.1.5.4.

3.3.1.1.5.1 Die Cast Aluminum. Shall employ GMW5 specification. A380 is equivalent to GMW5M-Al-C-D-Si8Cu3Fe, and A383 is equivalent to GMW5M-Al-C-D-Si10Cu2Fe1. Note that the GMW5 callouts follow ISO 9001, based on chemical symbols applicable to all the light metals and their alloys. International symbols are used in GMW5 to cover the major alloying elements and significant residual elements. Alloying elements, defined as those with an upper and lower limit (other than zero) in the chemical composition, are listed left to right in order of decreasing content, or in alphabetical order in the case of equal percentages. Each chemical symbol is followed by whole numbers denoting the nominal percent present in the alloy.

3.3.1.1.5.2 Steel Stampings. GMW2M-ST-S-CR1/HR0 cold or hot rolled steel is the normal material of choice. Higher strength steel may be used, if required to prevent overload of a spatially constrained bracket, which is occasioned under some packaging circumstances.

3.3.1.1.5.3 Aluminum. Die cast grade aluminum as expressed with Global Specifications is used in the case of a die cast design, usually in combination with a mounting bracket of very high stiffness. Must meet the requirements of the Engine Accessory Drive Cast Mounting Bracket general specification GMW16267. In general, use of such brackets is forbidden, because of fracture risk, without expressed approval of the Technical Specialist.

3.3.1.1.5.4 Steel Weldments. This option is generally employed for removable brackets, i.e., not shipped with the vehicle. If low carbon steel has sufficient strength, GMW2M-ST-S-CR1/HR0 steel is to be used. In some cases, the material required may be high strength, low alloy per SAE J1442 grade 415F, when the thickness is equal to or exceeds 5.8 mm, and SAE J1392 410X when the thickness is < 5.8 mm to give material properties which are retained with welded construction. Affected areas must be welded securely, which in this context is defined as:

- The weld shall be free of cracks
- Weld penetration must be sufficient such that deformation/fracture shall take place in the parent metal before weld separation

3.3.1.1.5.5 Cast Iron. Must meet the requirements of the bracket specification. The material specification shall be:

- Nodular Iron GMW10M-IR-C-N550-3

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