GM	WORLDWIDE ENGINEERING STANDARDS	General Specification	GMW16326

Engine Accessory Drive Linear Belt Tensioner

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. The purpose of this standard is to cover supplier requirements for engine accessory drive linear belt tensioners.

1.2 Applicability. This standard applies to only linear belt tensioners. There are two other accessory drive belt tensioner specifications that cover Belt Alternator Starters (BAS), GMW16327, and conventional rotary mechanical tensioners, GMW16244, that are not part of this standard. Future development includes electronically controlled tensioners (eTensioners) with requirements to be covered in a separate standard.

1.3 Remarks. This standard contains all information necessary to design, analyze, develop, validate, and manufacture accessory drive linear belt tensioners.

2 References

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

2.1 External Standards/Specifications.

ACEA A3/B3	ISO 9001	JIS Z8732	SAE J2236
ISO 1431-1	ISO 11469	SAE J1459	SAE J2436
ISO 3745			

2.2 GM Standards/Specifications.

GMW2	GMW3116	GMW15272	GMW16291
GMW5	GMW3286	GMW16244	GMW16327
GMW3044	GMW3359	GMW16290	GMW17081
GMW3059	GMW14671		

2.3 Additional References.

- Forest City Technologies, Wellington, Ohio (www.forestcitytech.com)
- Global Engine Durability (GED) Test
- Kinsler, L. E. and Frey, A. R. (2000). Fundamentals of Acoustics (4th edition). New York: Wiley.
- Statement of Requirements (SOR)
- Tucker's Pottery Supplies, Incorporated, Richmond Hill, Ontario, Canada (www.tuckerspottery.com)

3 Requirements

3.1 System/Subsystem/Component/Part Definition.

3.1.1 Appearance. The surface of the tensioner must be as-cast aluminum with minimal die checking. Plastic subcomponent parts may also be possible, but must be approved by the Technical Specialist prior to adoption for a quote package.

3.1.2 Content.

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3.1.2.1 Physical Content. The tensioner consists of two castings, a base and an arm, with a spring between them. Damping subcomponents are contained between the pivot and arm. The arm rotates relative to the stationary base. A pulley is at the end of the arm. Construction details are at the discretion of the supplier, but must result in fulfilling the requirements of this standard. Substitution of other materials requires preapproval by the Technical Specialist.

3.1.2.1.1 Drawing. This standard shall be referenced “Must meet requirements of GMW16326” and shall appear on the detail drawing for each tensioner.

No tensioner design shall be proposed by the supplier which uses other than the design which has been preapproved. Tensioners to the preapproved design must be pre-validated before quote, to satisfy a Statement of Requirements (SOR), and prior to any experimental part build.

3.1.2.1.2 Cross Sectional View. The preapproved design as well as the released drawing shall detail all internal parts. The preapproved design shall include details of that design. Each subcomponent part shall be listed by supplier part number, material and latest change date and described. Plastic and elastomeric parts, as well as greases, shall be described by specifying the second tier source and material supplier for that subcomponent, and the material source alpha numeric description of the grade and base polymer involved. The released detail drawing shall use material callouts without proprietary content.

3.1.2.1.3 Pulley. Pulley construction options shall be described as specified in GMW16290:

- Steel grade and finish expressed as SAE (SAE International) callout and GM specification respectively.
- Thermoset plastic: Thermoset plastic pulleys can be used for both backside and grooved pulleys, but only from approved suppliers. Acceptable quality parts are available in Europe only. Source and filler content and grade shall be specified.
- Thermoplastic: Can be used for grooved applications only, and then only from approved suppliers. Source and filler content and grade must be specified. Backside thermoplastic pulley suppliers are few and regional, and require preapproval of the Technical Specialist.
- Ball bearing: Approved sources/content only.
- Seal: Elastomer material and lip design type.
- Grease: Source and grade/type.
- Cage: Polymer material and grade.
- Shield design showing full bearing coverage and labyrinth configuration.
- Pulley bolt shall have a flange with a minimum 23.5 mm diameter flat on the underside to cover the bearing inner race. This will reduce the stress in the bolted joint, prevent yield of the shield under the clamp load, and avoid high stress in the bearing inner race.

3.1.2.1.4 Charts. Written information shall be charted for clarity.

3.1.2.1.5 Confidentiality. The drawing(s) shall be reserved as a record to specify the design being quoted. It shall not be shown to another source or copied for distribution outside General Motors.

3.1.2.1.6 Internal Configuration.

3.1.2.1.6.1 Pivot Bearing. Must be constant diameter pivot independent of the damping package with bushing of sufficient length/clearance, to meet wear and parallelism dimension in 3.2.2.1.2. Exceptions must be preapproved after durability testing for wear with contamination, to satisfaction of the Technical Specialist and Release Engineer.

3.1.2.1.6.2 Pivot Pulley and Spring Alignment. The pulley, pivot, and spring centerlines must be in the same plane. This guarantees alignment with wear from arm rotation and engine vibration.

3.1.2.1.6.3 Damping Package. Must be stable over time after break-in and be completely independent of the pivot for consistency over time. This means short break-in, < 5 minutes on the cable durability test, and stabilized damping within the specified value in 4.3.3 for the life of the part. All designs require Section 4 durability testing of six samples minimum, unless otherwise specified, representing the range of damping element variation possible in production. Generic design performance must be demonstrated prior to source consideration for an engineering application.

3.1.2.1.6.4 Spring Ends. The spring ends must be parallel to one another, either thru forming, grinding, or by end cap construction.

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3.1.2.1.6.5 Sealing. Contamination protection designs for each opening to atmosphere using either casting overlap labyrinth designs, elastomers, or resins, must be provided to meet the requirements of the most severe application. If nonmetallic materials are used, these must meet requirements of ozone exposure 70 h at 100 pphm with a zero (0) rating per ISO 1431-1 (A100, C24, 4), as well as heat aging 1008 h at 130 °C to 150 °C (depending upon material) with 50% retention of elongation and tensile strength per SAE J2236. These provisions will be implemented on an application by application basis. Parts run on hot cycle test must be exposed to these tests prior to start of 4.3.7.4.1.

3.1.2.1.6.5.1 Tensioner Sealing. The tensioner must be designed with 360 degree labyrinth or elastomeric sealing for the pivot. Labyrinth sealing is adequate as a design approach, but must be continuous and not allow a straight path from the atmosphere to the internal parts. Separation between castings must not exceed 1.0 mm. Exceptions would require a longer labyrinth overlap or elastomeric seal by design, proven by testing to verify the function and durability of the design.

3.1.2.1.7 Idler Pulley Bearings. The idler pulley bearings must meet standard GMW16291 (Appendix titled: Drawings from SAE J1459), relative to grease, seal, and cage versus supplier. Improved plastic cage materials (higher temperature capability) and seal materials (abrasion/wear; tear resistance at temperature) are encouraged, and will be added to the bearing specification as they become available.

3.1.2.1.8 Idler Pulley Bearing Dust Shields. Idler pulley bearing dust shields are required on both sides of the bearing. They must cover 100% of the bearing face with a maximum clearance of 1.00 mm (or longer labyrinth) to at least two surfaces (not flat but rather semi-labyrinth). There shall be no straight path from outside the bearing dust shield to the plane of the bearing inner race and seal lip interface.

3.1.2.1.9 Installation Provision. An arm rotation provision must be provided as dictated by the packaging and accessibility to the tensioner.

3.1.2.1.9.1 Configuration. Every effort will be made to package a 9.6 mm (intended for ⅜ in breaker bar, ratchet or extension) square hole/feature for arm rotation. For high load applications, a 13 mm (½ in breaker bar) square feature may be required. A 15 mm across the flats hex bolt on idler pulley (10.00 mm hex height) will be used only when cast square hole cannot be executed.

3.1.2.1.10 Fracture Resistance. The rotation feature and stops in the arm and base castings must be capable of resisting twice the rotational torque of the internal spring or a greater value as called out on the detail drawing. Performance must be demonstrated on six (6) samples of parts off of each cavity of production tooling.

3.1.2.1.11 Arm to Spring Housing Angular Location Indicator. This feature may be required in a visible location as installed in vehicle. Technical Specialist approval is required. Packaging or design construction may preclude this feature.

3.1.2.1.11.1 Location Indicator Configuration. The configuration is application specific and will be discussed and agreed upon with the supplier and the Release Engineer.

3.1.2.1.12 Anti-Rotation/Angular Location Feature. A feature on the tensioner mounting surface must be provided to control its angular location. Technical Specialist approval is required.

3.1.2.1.13 Multiple Ear Attachment Provision. Tensioner mounting holes must conform to net hole/net slot design concept. One hole must be 8.0 mm/10.00 mm minimum to 8.20 mm/10.20 mm maximum and the other hole in the same plane must be a slot with its major centerline intersecting the center of the net hole. Width is to be 8.00 mm/10.00 mm to 8.20 mm/10.20 mm, and length 9.50 mm/11.50 mm, depending on application bolt size, load, and packaging.

3.1.2.2 Functional Content. The tensioner provides load to the belt through its pulley to prevent belt slip, and damping to resist torsional input vibration. Function is addressed in the requirements of the tests in this standard, Section 4.

3.1.3 Ambient Environment. Varies by application, but assumed to be -40 °C to 121 °C. Exposure to contaminants covered in Section 4.

3.1.4 Interfaces. The belt/pulley interface is covered in GMW16290 Appendices.

3.1.5 Usage Definition. General purpose.

3.2 Product Characteristics.

3.2.1 Performance Requirements. Durability and noise performance are addressed in Section 4.

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3.2.1.1 Specification Values. Design must be capable of default values shown in applicable paragraphs (with bold letters in parentheses) referring to Table A1, Appendix A. Sensitive or quiescent applications, however, may be assigned more or less stringent values from Table A1 in Appendix A corresponding to alpha codes in text.

3.2.2 Physical Characteristics.

Note: Bold letters in parenthesis throughout text refer to alpha codes in Table A1, Appendix A.

3.2.2.1 Dimensions and Capacity. Dimensional requirements are incorporated in the detail drawing of individual applications.

3.2.2.1.1 Dimensional. To be reflected on engineering drawing. Gage Repeatability and Reproducibility (R&R), as well as procedure/fixture for measurement, must be reported with dimensional capability/ measurement, prior to the GMPT Beta design phase. Note that shadowgraphs for measuring compliance to pulley profile requirements are not permissible in favor of digital profilometers or approved vision systems.

3.2.2.1.2 Tensioner Mounting Surface Offset to Idler Pulley Bearing Seat. With the tensioner against its mounting surface and the arm rotated to its nominal position, and design hub load applied in the design direction relative to the arm centerline, the plane of the mounting surface must be parallel to the plane of the idler pulley bearing seat within 0.33 degrees **(L)**. This value may increase to 0.38 degrees **(M)** at 240 000 km. In addition, the dimension from plane of mounting to plane of bearing seat must be within 0.4 mm (± 0.2 mm) **(N)** at nominal arm location. See Appendix A, Table A1.

3.2.2.1.3 Mounting Surface Flatness. The surface flatness must be within 0.08 mm **(P)**. This is intended to imply machining on sensitive applications; usually with ear mounting. Normal flatness is 0.12 mm for as-cast applications. See Appendix A, Table A1.

3.2.2.1.4 Pulley Centerline to Bearing Seat. The pulley centerline (or reference surface) must be located relative to bearing seat within 0.25 mm **(R)** excluding free rock. This applies to groove side pulleys, but only at the specific request of the Release Engineer. See Appendix A, Table A1.

3.2.2.1.5 Pulley Runout. The radial and lateral runouts are to be within 0.25 mm. Exceptions for very large pulleys must be approved by the Release Engineer and Technical Specialist.

3.2.2.1.6 Pulley Bearing Free Rock. There is no specific free rock requirement since it is not generally measured in the bearing industry. It is a function of clearance and race curvature, which is at the discretion of the supplier and approved by GM through validation. Mounted clearance is a function of the pulley design, and the specified clearance from the bearing supplier. Measurement may be performed by rotating the outer race about a centered ball on one side with 2 N side force applied on the other side.

Note: Free rock can also be calculated from radial clearance range with a given source/race curvature (usually 1.02 times to 1.04 times the ball diameter).

3.2.2.2 Mass Properties. Not applicable.

3.2.3 Reliability.

3.2.3.1 Reliability Evaluation Point. Evaluated by performance to validation test series in Section 4 and manufacturing process approval.

3.2.3.2 Reliability Requirements. Supplier must meet requirements of Section 4, and have production manufacturing process approved by Global Technical Specialist.

3.2.4 Serviceability. This is a system issue, not applicable to this standard. An arm rotation feature is required to facilitate belt installation and removal.

3.2.5 User System/Subsystem/Component/Part Interface. The supplier must meet the packaging environment of the math data delivered with the SOR.

3.3 Design and Construction.

3.3.1 Materials, Processes and Parts Selection Guidelines. All subcomponent materials must be specified by the supplier, and approved by the Technical Specialist.

3.3.1.1 Material Guidelines.

3.3.1.1.1 General material specifications used shall be GMW specifications, when applicable documents exist. If not, then international standards (e.g., ISO, JIS or DIN) can be used, with permission from the GM Technical

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