GM	WORLDWIDE ENGINEERING STANDARDS	General Specification	GMW16244

Engine Accessory Drive 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. This specification contains all information necessary to design, analyze, develop, validate, and manufacture accessory drive belt tensioners.

1.2 Applicability. This Component Technical Specification (CTS) covers supplier requirements for general purpose engine accessory drive belt tensioners. Both main drive and auxiliary drive belt tensioners are potential applications.

1.3 Remarks. This specification covers only general purpose belt tensioners. There are two other accessory drive belt tensioner specifications that cover linear and belt alternator starter tensioners.

2 References

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

2.1 External Standards/Specifications.

ACEA A3/B3	ISO 3745	ISO 11469	SAE J2236
ANSI S1.35	ISO 4527	JIS Z8732	SAE J2436
ISO 1431-1	ISO 9001	SAE J1459	

2.2 GM Standards/Specifications.

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

2.3 Additional References.

- Global Engine Durability (GED) Test
- Kinsler, L. E. (2000). *Fundamentals of Acoustics* (4th edition) New York: Wiley.
- Rotary Fatigue Test
- Statement of Requirements (SOR)
- Tucker's Pottery
  15 W. Pearce St. Unit No. 7
  Richmond Hill, Ontario, Canada
  info@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.

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 sub-components are contained in this spring housing. 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 specification.

3.1.2.1.1 Drawing. This specification shall be referenced "Must meet requirements of GMW16244" and shall appear on the detail drawing for each tensioner. No tensioner design shall be proposed by the supplier which uses other than one already pre-validated to this specification. The purpose of this is to prevent submission of low bid designs with poor construction, function or durability. Designs must be pre-validated, before they can be quoted to satisfy a Statement of Requirements (SOR).

3.1.2.1.2 Cross Sectional View. The supplier submission drawing as well as the released drawing shall detail all internal parts. Each 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 callout and GM specification respectively.
- Thermoset plastic: Note this material shall not be used for backside applications unless the first or second tier supplier is approved by the Technical Specialist. Polymer source and filler content and grade shall be specified.
- Thermoplastic: Can be used only if approved by the Technical Specialist. Polymer source and filler content and grade must be specified.
- 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 on both sides of the bearing.
- 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, and prevent yield of the shield under the clamp load.

3.1.2.1.4 Charts. Written information shall be charted for clarity.

3.1.2.1.5 Confidentiality. The supplier drawing(s)/Tech Review proposals 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.

3.1.2.1.6.1.1 Pivot Shaft Requirements. Normal rotary tensioners for applications without excessive arm motion will typically employ 4/6 polyamide pivot bushings. For applications with large arm motion, DU bushings (reference 6.1) will be required to improve wear resistance. If the shaft is steel and the DU bushing has copper/bronze layers under the Poly Tetra Fluoro Ethylene (PTFE), the shaft shall be plated with nickel to avoid galvanic corrosion which can seize the shaft and prevent proper function. The drawing shall specify the nickel plating as follows:

Autocatalytic nickel coating ISO 4527-Fe<G10450 or G40370>[SR(350)1]/NiP(5-9)25/[HT(200)2]

3.1.2.1.6.2 Pivot Couple Compensation. Pulley centerline to bearing centroid offset couple must be compensated for internally, to avoid diagonal point wear on the pivot bushing. Design also requires preapproval.

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

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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 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 Tangs. Offset couple over length of spring between tangs must be compensated via angular tang location relative to arm at nominal position so that arm parallelism can be held over normal range of operation.

3.1.2.1.6.5 Sealing. Contamination protection designs for each opening to atmosphere using casting overlap labyrinth designs or elastomers or resins must be provided to meet the requirements of this Specification. If non-metallic materials are used, these must meet requirements of ozone exposure 70 h at 100 pphm with a zero (0) rating per ISO 1431-1, 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.

3.1.2.1.6.5.1 Main Drive Tensioner. The main drive tensioner must be designed with 360 degree labyrinth sealing for arm and spring housing split line. Spring tangs must terminate internally and both ends of the pivot must be sealed or have labyrinth construction. 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 by design proven by testing to verify the function and durability of the design.

3.1.2.1.6.5.2 Auxiliary Tensioner. Must be designed same as 3.1.2.1.6.5.1 with labyrinth sealing for arm and spring housing split line and plugs, or internal spring tang seats and both ends of the pivot. Continuous labyrinth sealing is adequate as a design approach.

3.1.2.1.7 Idler Bearing. The idler bearing must meet drawings from SAE J1459 in specification GMW16291 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 Bearing Dust Shields. Idler 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 Main Drive Tensioner. Every effort will be made to package a 9.6 mm (intended for 0.375 in breaker bar, ratchet or extension) square hole/feature for arm rotation. For high load applications, a 13 mm (0.50 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. Auxiliary tensioners shall have the same provisions.

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 samples of parts off of each cavity of production tooling.

3.1.2.1.11 Arm to Spring Housing Angular Location Indicator. This feature is required in a visible location as installed in vehicle. General Motors Powertrain (GMPT) Engineering approval is required.

3.1.2.1.11.1 Location Indicator Configuration. Provide one mark on the arm or spring housing with a range marking opposite it on the opposing casting in the nominal angular position. Range is to cover maximum to minimum belt length dimension and wear. No nominal mark shall be made within range. No 1% stretch indicator is permitted unless the maximum belt mark is removed. The intent is to have only two marks to avoid service confusion.

3.1.2.1.12 Anti-Rotation/Angular Location Feature. A pin or other feature on the tensioner mounting surface must be provided to control its angular location. GMPT Engineering approval is required.

3.1.2.1.12.1 This feature not required with multiple bolt mounting.

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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 8.00 mm minimum to 8.20 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 and length 9.50 mm unless otherwise specified.

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

3.1.3 Ambient Environment. May vary by application, but assumed to be -40 °C to 121 °C. Exposure to contaminants covered in Section 4. Function and performance must be demonstrated at both extremes and at room temperature during application development.

3.1.4 Interfaces. The belt/pulley interface is covered in Appendix A, Table A1.

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.

3.2.1.1 Specification Values. Design must be capable of default values shown in applicable paragraphs. 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.

3.2.2.1 Dimensions and Capacity. Dimensional requirements are in Appendix A, Table A1.

3.2.2.1.1 Dimensional. To be reflected on engineering drawing. Gage Repeatability and Reproducibility (Gage 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 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: Can also be calculated from radial clearance range with a given source/race curvature (usually 1.02 times to 1.03 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.

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