GM WORLDWIDE ENGINEERING STANDARDS	General Specification	GMW17426

Engine Accessory Drive Electronically Controlled Belt Tensioner Mechanical Requirements

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 standard covers supplier requirements for engine accessory drive electronically controlled belt tensioners. It is confined to the mechanical requirements common to all such tensioner designs. These tensioners are controlled electronically, but the controls and electronic components fall into two general classifications: those motor driven and those solenoid driven. The requirements that address the electrical components will be added to Appendix C of the application Statement of Requirements (SOR).

1.2 Applicability. This standard contains all information necessary to design, analyze, develop, validate, and manufacture accessory drive electronic belt tensioners as related to the mechanical subcomponents and the assembly.

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	GMW14671	GMW16290
GMW5	GMW3286	GMW15272	GMW16291
GMW3044	GMW3359	GMW16242	GMW17081
GMW3059			

2.3 Additional References.

- Kinsler, L. E. and Frey, A. R. (2000). Fundamentals of Acoustics (4th ed.), New York: Wiley.
- Statement of Requirements (SOR) Appendix C
- Super Cycle 2 (SC02), Receive and Use Direct Material and Services Process
- Super Cycle 3 (SC03), Receive and Use Indirect Material and Services Process
- Tucker's Pottery Supplies, 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 on components where this material is used.

3.1.2 Content.

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3.1.2.1 Physical Content. The tensioner consists of two aluminum castings on either end of a spring strut, as well as an arm, which has a pivot and an attachment for one end of the strut. It will also contain an electrically driven solenoid or motor or other subcomponent which is electronically controlled. The pivot and the other end of the strut attach to the engine. It may also contain additional mechanical componentry, depending upon the supplier execution. Damping subcomponents, if equipped, are incorporated into the arm pivot. 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.

The electronically controlled component will be unique to the supplier.

3.1.2.1.1 Drawing. This standard shall be referenced “Must meet requirements of GMW17426” 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 preapproved by the GM Powertrain Technical Specialist. The purpose of this approval is to prevent submission of low bid designs with poor construction, function or durability. Tensioners must be pre-validated, before they can be quoted to satisfy a SOR and prior to any experimental part build.

3.1.2.1.2 Cross Sectional View. The internal part description shall detail all internal parts. Each part shall be listed by supplier part number, material and latest change date. 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.

A general description of the electronically controlled component is required, including performance related data: voltage, current, resistance interfaces compliant to Super Cycle 2 (SC02) or Super Cycle 3 (SC03), as applicable with the vehicle electronic control unit.

3.1.2.1.3 Pulley. Pulley construction options shall be described as specified in GMW16290, i.e.,

- Steel grade and finish expressed as SAE International (SAE) callout and GM specification respectively.
- Thermoset plastic: Acceptable quality parts are available in Europe only, source and filler content and grade shall be specified. Only approved sources are permitted to be used.
- Thermoplastic: Can be used for grooved applications, with an approved source and filler content and grade specified. Suppliers for backside applications must be preapproved, and will be fewer than grooved pulley suppliers.
- Ball bearing: approved sources/content only.
- Seal: Elastomer material and approved seal lip design type.
- Grease: Source and grade/type.
- Cage: Polymer material and grade and approved design.
- 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, 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 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 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 hydropulser or cable driven test, and

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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 ground flat or the coil helix flattened to avoid a bending load in the strut. Other design executions must have approval of the Technical Specialist.

3.1.2.1.6.5 Sealing. Contamination protection designs must be approved by the Technical Specialist. If nonmetallic materials are used, these materials 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 4.3.7.4.1.

3.1.2.1.6.5.1 Tensioner Sealing. Sealing depends on the particular design. Pivots need at least a labyrinth, or in some cases elastomeric or polymeric seals to adequately protect the bushing and perhaps damping packages.

3.1.2.1.7 Idler Bearings. The idler bearings must meet standard GMW16291, Appendix titled: “Ball Bearing Approved Suppliers and Content” 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 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. Alternative configurations require Release Engineer and Technical Specialist approval.

3.1.2.1.10 Fracture Resistance. The rotation feature and stops in the arm casting must be capable of resisting twice the rotational torque of the internal spring or a greater value as called out in the application SOR. 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, but may be impossible to implement. Release Engineer and Technical Specialist approval is required.

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, if applicable, must be provided to control its angular location. Release Engineer approval is required.

3.1.2.1.13 Multiple Ear Attachment Provision. If applicable**,** tensioner mounting holes must conform to net hole/net slot design concept. One hole must be 8.00 mm to 10.00 mm (minimum) to 8.20 mm to 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 to 10.00 mm) to (8.20 mm to 10.20 mm) and length of 11.50 mm.

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 standard, Section 4.

3.1.3 Ambient Environment. Varies by application, but assumed to be no less stringent than -40 °C to 121 °C. Exposure to contaminants covered in Section 4.

3.1.4 Interfaces. The belt/pulley interface is covered in SAE J1459, and also referenced in GMW16242 in the figure titled, “Belt Dimensioning Template” for the belt, and GMW16290 in the section titled “Drawings (Reference SAE J1459)” for the pulley.

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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 (designated by bold letters in parentheses).

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 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 bearing and pulley assembly supplier based on mounted clearance and pulley material. Mounted clearance is a function of the pulley design, and the specified clearance from the bearing supplier.

Note: 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, which is not covered in 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 GM Materials Engineer and the Technical Specialist.

3.3.1.1 Material Guidelines.

3.3.1.1.1 General material specifications shall be limited to North American, European or Japanese controlled standards in that order, when available (e.g., GMW first, and if not available, SAE, ASTM, MPIF or international standards, such as ISO, DIN, JIS and the like). Chinese standards are not acceptable and must be converted to

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