



Threaded Extrusions for Fasteners Applications

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 will provide detailed design criteria of threaded, extruded barrels for fastening applications of metric screw threads; M6, M8, M10, and M12 and unified inch screw threads, $\frac{7}{16}$ in. These barrels may be used in heat treated and non-heat treated steel plates for which the material will be limited. Specific manufacturing requirements will also be outlined. Different types of extruded barrels can be formed in each type of steel. This standard will require a type of base steel, design code designation and thread size after the standard number, see Section 8.

1.1.1 Mission/Theme. This document should be used in two (2) manners:

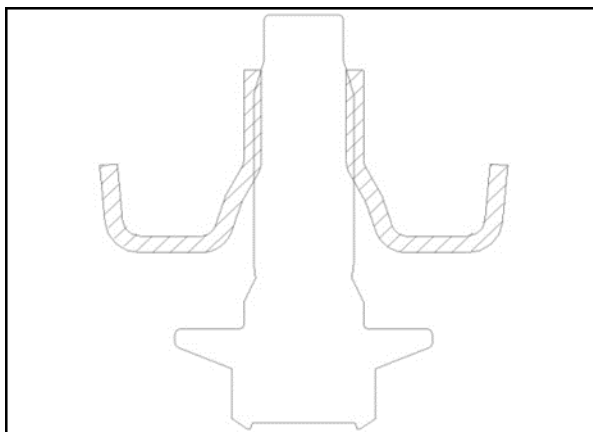
1.1.1.1 GM design groups should use this document as design information to choose the best extrusion design for their system and then use the provided dimensioning detail to add to the base part design. This standard should be added to the math or drawing as a controlling specification for the individual extrusions on the base part.

1.1.1.2 The part supplier should build the part to meet the design and performance requirements contained in this standard.

1.1.2 Classification. This standard will be available to all GM divisions and requesting suppliers.

1.1.3 Extruded. The term extruded is used in metalworking and is defined as; to force, press, or push through a die. Extruded fasteners use a stamping process to develop a drawn barrel to replace the traditional fastener. Parts are made in a progressive die and can be threaded on or off the primary stamping line. Figure 1 shows the basic concept of the fastened joint using an extruded plate. In the case of this standard, all extrusions are made from a base steel plate. The base plate steel is moved and used to form the extruded barrel.

Figure 1: Extruded Barrel in Plate with Bolt Shown for Insertion Directionality



1.1.4 Heat Treatment. Part processing for the two (2) types of materials covered by this standard is very different:

1.1.4.1 Non-heat treated parts are completed parts after the stamping and threading operations.

1.1.4.2 Heat treated parts receive oven treating at a prescribed temperature for a prescribed time to obtain the strength characteristics prescribed in the appropriate material specification. This heat treating is how a thinner, smaller heat treated part can perform like a non-heat treated part.

1.2 Applicability. Applicable for use on all GM vehicles and Vehicle Partitioning & Product Structure (VPPS) levels as appropriate.

1.3 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

ASME B1.1	ISO 68	ISO 725	ISO 965-3
ASME B1.3M	ISO 261	ISO 898-2	ISO 4759-1
ASME B1.13M	ISO 683-18	ISO 965-1	ISO 5864
ASME Y14.5M	ISO 724	ISO 965-2	SAE J995

2.2 GM Standards/Specifications.

GMW2	GMW3032	GMW3059
------	---------	---------

2.3 Additional References.

- American Society of Mechanical Engineers (ASME) specifications as listed in 2.1.
- Equivalent International Organization for Standardization (ISO) where requirements that cover all Geometric Dimensioning and Tolerancing (GD&T) criteria appear.

3 Test Preparation and Evaluation

3.1 Resources.

3.1.1 Facilities. Not applicable.

3.1.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.1.2 Equipment. The equipment necessary to evaluate extrusions is the tensile load tester and a steel cutter to cross section each extrusion. Magnification and photographic equipment should be used to evaluate these sections.

3.1.3 Test Vehicle/Test Piece. An extrusion strength test shall be performed per ISO 898-2 on an extrusion from the actual application, i.e., do not use an extrusion from a representative coupon, use the extrusion from the actual part in this test.

3.1.4 Test Time.

Calendar time:	0 days
Test time:	2 hours
Coordination time:	0 hours

3.1.5 Test Required Information. Provide tensile test pass/fail results per ISO 898-2 and provide load deflection graphs from the test.

3.1.6 Personnel/Skills. Capability to perform tensile test per ISO 898-2.

3.2 Preparation. Perform tensile test per ISO 898-2 and 3.1.3.



3.3 Conditions.

3.3.1 Environmental Conditions. No environmental controls are required for this specification. All tests should be performed at ambient conditions.

3.3.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

3.4 Instructions.

3.4.1 Tensile Test. Perform the tensile test on each barrel to failure of the barrel while recording load and deflection data. This test will be performed per requirements detailed in 3.8.3.

3.4.2 Extrusion Cross Sections. Cut the plate through the center of the extrusion. Examine the wall thickness and threads. Magnify and photograph each extrusion barrel for later examination.

3.5 Data.

3.5.1 Tensile Test. The data required for the tensile test are the load versus deflection curves for each sample of a given extruded, tapped barrel.

3.5.2 Extrusion Cross Sections. Each barrel of a plate shall be sectioned and evaluated per this specification. The cross section evaluation shall show completeness of entire thread and compliance to 3.8.1.2 of this document. A crest imperfection determination shall be made per 3.8.5.4.3 and a statistical evaluation will show compliance.

3.6 Safety.

This standard may involve hazardous materials, operations, and equipment. This standard does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

3.7 Documentation. Samples of components or material released to this standard shall be tested for conformity with the requirements of this standard and approved by the responsible GM Department prior to the start of delivery of production level components or materials.

Any change to the component or material, e.g., design, function, properties, manufacturing process and/or location of manufacture requires a new release of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process, and to apply for a new release.

If not otherwise agreed to, the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases, a shorter test can be agreed to between the responsible GM department and the supplier.

3.7.1 Test Results. Test results must be documented in tables that show statistical analysis of the data. Individual test values must be shown. Pictures should show test setup and sectioning results. This data should be shown for acceptance prior to full production.

3.8 Requirements. The following requirements specifically define each possible stamped extrusion that should be used by GM. Figure 1 shows the basic concept of the fastened joint using an extruded plate. The stamped plate will contain the extrusion defined by these requirements. The extruded plate will then accept standard screws as defined by GM Fastening Engineering. Directionality of screw insertion is important.

3.8.1 Non-Heat Treated Extrusions.

3.8.1.1 Material. Base metal material used for the part containing the Type 1 extrusion will be chosen from two (2) GM specifications; GMW2; Low Carbon Sheet Steel or GMW3032; High Strength Sheet Steel, 180 MPa thru 420 MPa Yield Strengths. Material selection should be based on the required strength of the base part. Extrusions covered by this specification should not be made from material with minimum yield strengths greater than 340 MPa.

3.8.1.2 Extrusion Types. Two (2) basic designs of low carbon steel extruded barrel designs are available. Not all suppliers have the capability to make both extrusions. The original extruded barrel design will be coded **O** for the standard coding in Section 8. The second extruded barrel design will be coded **T** because the base of the extrusion next to the base metal is thicker/wider.

3.8.1.2.1 Code O Extruded Barrels. This is the original technology for threaded extruded barrels in sheet steel. The wall thickness is constant from the base to the top of the barrel. Design is shown in Figure 2 and defined in Table 1. See Figure 3 for a graphical representation. See 3.8.1.3 for variable definitions.

Figure 2: Code O, Non-Heat Treated Extrusion Dimension Definition

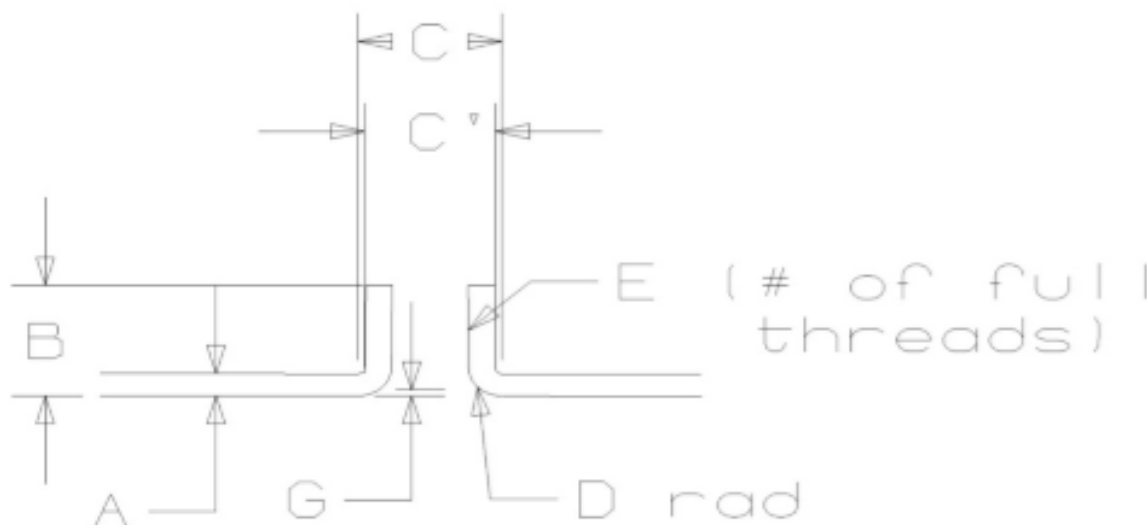
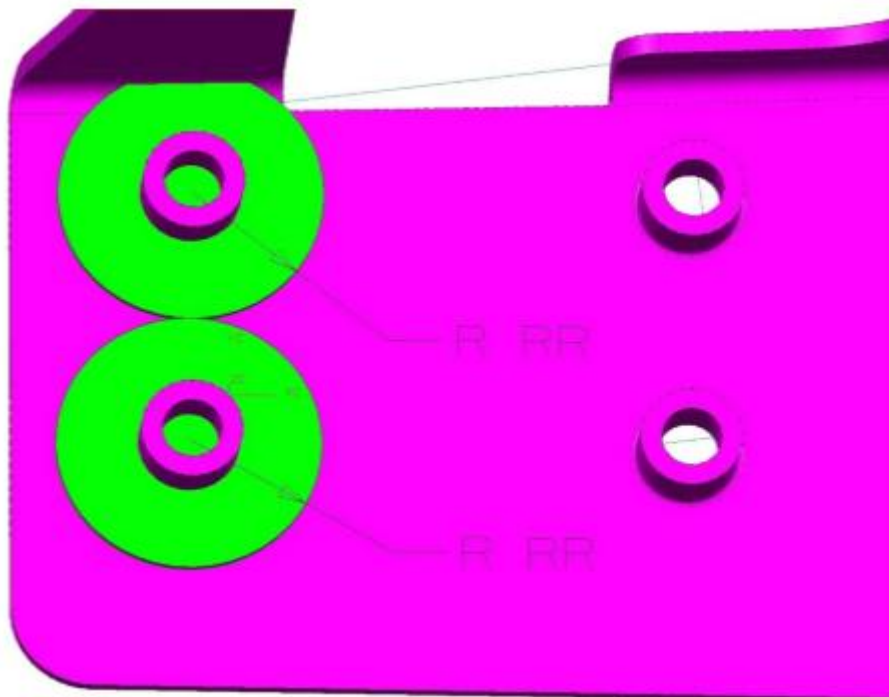


Table 1: Code O Threaded Barrel Definition (Metric Dimensions in Millimeters (mm))

Thread Size	Circular Hole Diameter	A (min)	B (min)	C (min)	C' (min)	D (min)	D (max)	E THREADS (min)	G (max)	RR (max)
M6 × 1.0	10.0	1.8	9.0	8.6	8.6	1.8	2.7	7	0.1	12.0
	14.0	2.0	10.0	9.0	8.6	2.0	3.0	7	0.1	12.0
	18.0	2.5	10.5	10.0	9.0	2.5	3.8	7	0.1	12.0
	20.0	3.0	11.0	10.5	9.0	3.0	4.5	7	0.1	12.0
M8 × 1.25	12.0	2.0	12.0	11.2	11.2	2.0	3.0	7	0.2	16.0
	15.0	2.5	12.5	11.5	11.2	2.5	3.8	7	0.2	16.0
	20.0	3.0	13.0	13.0	11.5	3.0	4.5	7	0.2	16.0
	25.0	3.5	14.0	13.5	11.5	3.5	5.3	7	0.2	16.0
M10 × 1.5	15.0	3.0	14.5	16.0	14.5	3.0	4.5	9	0.3	20.0
	20.0	3.5	15.0	16.5	14.5	3.5	5.3	9	0.3	20.0
	25.0	4.0	17.0	17.0	15.0	4.0	6.0	9	0.3	20.0
	30.0	4.5	18.0	17.5	15.0	4.5	6.8	9	0.3	20.0
M12 × 1.75	15.0	3.0	20.5	16.8	16.8	3.0	4.5	9	0.4	24.0
	20.0	3.5	21.0	17.5	17.0	3.5	5.3	9	0.4	24.0
	25.0	4.5	22.0	18.0	17.5	4.5	6.8	9	0.4	24.0
	30.0	5.0	23.0	19.0	17.5	5.0	7.5	9	0.4	24.0
7/16 × 20	12.0	2.5	12.7	15.5	14.7	2.5	4.0	9	0.4	22.0
	15.0	3.0	13.2	16.5	15.0	3.0	4.5	9	0.4	22.0
	20.0	3.5	13.7	20.0	15.5	3.5	5.0	9	0.4	22.0
	25.0	4.0	14.2	24.0	16.0	4.0	5.5	9	0.4	22.0

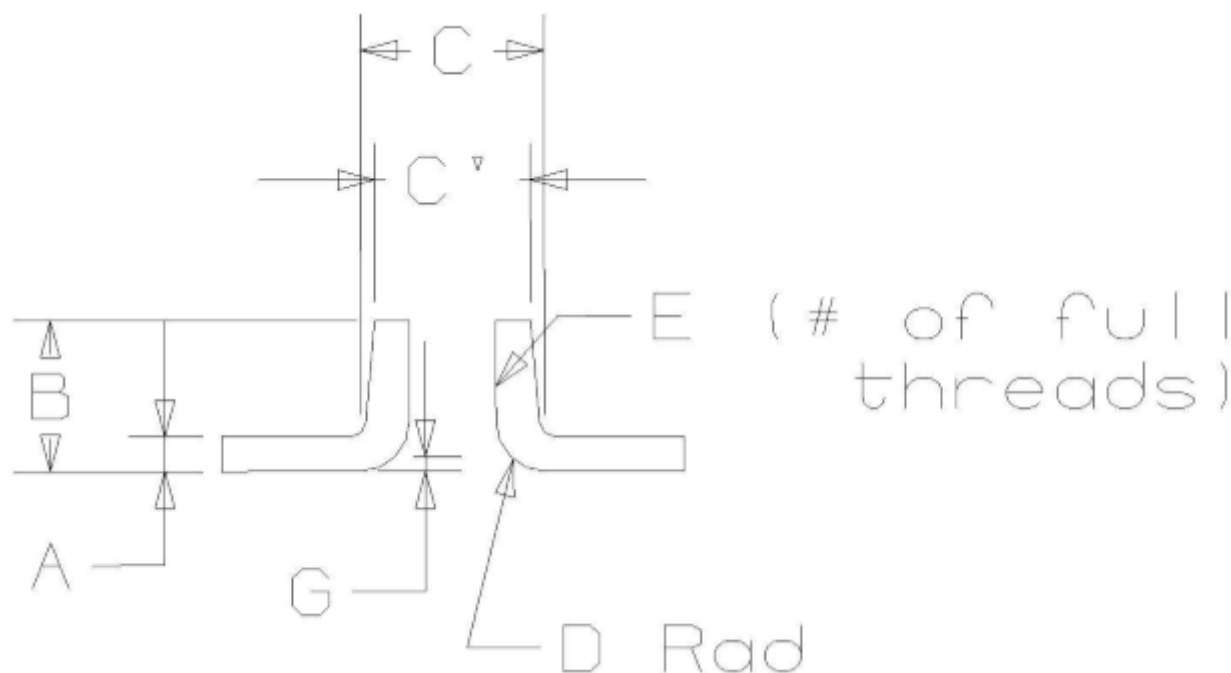
Note: (min) = (minimum), (max) = (maximum), RR = Radius of thickness reduction disturbance due to extrusion formation.

Figure 3: Graphic Depicting Dimension RR and the Metal Thickness Disturbance Area



3.8.1.2.2 Code T Extruded Barrels. This is a newer technology threaded extruded barrel. Few suppliers can make this type of barrel. The wall thickness varies along the barrel height. The thickest wall is next to the bearing surface at the base of the barrel. The barrel wall thickness reduces as distance increases away from the bearing surface. Several advantages can be gained by using this type of extrusion. Higher structural strength can be obtained with the thicker base wall thickness. In certain circumstances, thinner base material thickness can be used as compared to the code **O** barrels. Code **T** design is shown in Figure 4 and defined in Table 2. See Figure 3 for a graphical representation. See 3.8.1.3 for variable definitions.

Figure 4: Code T, Non-Heat Treated Extrusion Dimension Definition



Note: Rad = Radius, # = Number.

Table 2: Code T Threaded Barrel Definition (Metric Dimensions in Millimeters (mm))

Thread Size	Circular Hole Diameter	A (min)	B (min)	C (min)	C' (min)	D (max)	E (min)	G (max)	RR (max)
M6 × 1.0	9.0	1.25	9.0	9.3	8.5	2.2	7	0.1	12.0
	11.0	1.8	9.6	11.0	8.6	2.8	7	0.1	12.0
	12.0	2.25	10.3	12.3	10.0	3.3	7	0.1	12.0
	13.0	2.5	10.6	13.0	10.5	4.0	7	0.1	12.0
M8 × 1.25	12.0	1.5	11.0	12.0	11.2	2.5	7	0.2	16.0
	13.0	2.0	11.5	13.5	11.2	3.0	7	0.2	16.0
	15.0	2.5	12.5	15.0	13.2	3.6	7	0.2	16.0
	17.0	3.0	13.0	16.5	13.5	4.3	7	0.2	16.0
M10 × 1.5	15.0	2.0	13.0	15.3	14.5	3.3	9	0.3	20.0
	16.5	2.5	13.7	17.0	14.5	4.2	9	0.3	20.0
	18.5	3.0	14.2	18.5	15.5	5.1	9	0.3	20.0
	20.0	3.5	14.7	19.8	15.5	6.0	9	0.3	20.0
M12 × 1.75	18.0	2.25	15.75	18.0	16.8	4.0	9	0.4	24.0
	20.0	3.0	15.75	20.0	17.0	5.0	9	0.4	24.0
	22.0	3.5	16.25	22.0	18.0	6.0	9	0.4	24.0
7/16 × 20	15.0	2.0	12.2	16.5	14.7	3.8	9	0.4	22.0
	20.0	3.25	13.5	20.2	16.5	4.8	9	0.4	22.0
	25.0	4.0	14.2	24.0	18.0	5.8	9	0.4	22.0

Note: (min) = (minimum), (max) = (maximum), RR = Radius of thickness reduction disturbance due to extrusion formation.