

NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)	NUMBER: MPAPS F-1068	
	Former Designation: <i>TMS-1068</i>	
TITLE: Bellows Flexible Pipe	CURRENT REV No.: 1705	DATE: MAY 2017
WRITTEN/EDITED BY: W. Cook	APPROVED BY: R. Goluch	SUPERSEDES: Rev. 1308 – August 2013
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<i>This specification may involve hazardous materials, equipment, and procedures. This specification does not purport to address all of the safety issues associated with its use. The user is responsible to consult appropriate safety and health practices and to determine the applicability of regulatory limits prior to use.</i>		

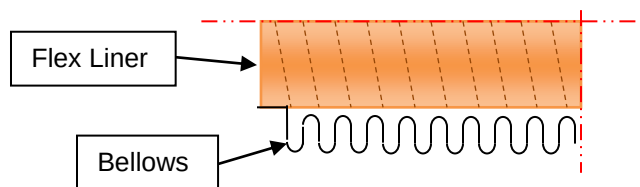
1.0 APPLICATION

This specification covers two types of bellows (flexible steel pipe) used for making connections between pipes used in the exhaust system. Each application needs to be developed on a case by case basis due to the differences in displacement and/or vibrations in the different vehicle/application/location. The bellows described in this document is to be used when raw fuel is present in the exhaust gas traveling through the piping, or when spiral wound flex (MPAPS F-1050) cannot meet the leak rate required by the engine/after-treatment provider. Spiral wound flex per MPAPS F-1050 may be used if it is after the treatment areas (DOC, DPF, SCR) of the exhaust system or there is no raw fuel or other reactant present in the exhaust gas at that point.

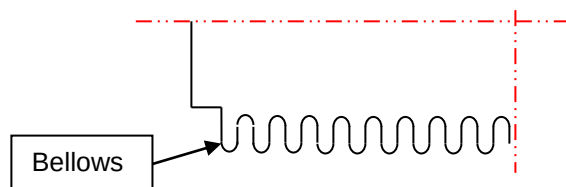
2.0 SCOPE

This specification covers requirements for the material, construction, dimensions, quality, leakage, installation, design guidance, source approval and quality control, for both types of bellows. TYPE I is meant to be used in high temperature applications as the liner insulates the bellows from the exhaust gas heat, or to act as a dual wall pipe to insulate surrounding components from the exhaust heat.

TYPE I - Bellows with inner liner



TYPE II - Bellows only



Additional qualifiers: A & B to provide additional protection from stones or other debris.

A is with no additional outer protective shielding/mesh

B is with additional outer protective shielding/mesh

2.1 Restricted Chemical Substances

Effective January 1, 2007, all product supplied to the requirements of this specification must comply with the requirements of the MPAPS B-50 specification.

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3.0 REFERENCE DOCUMENTS

Unless otherwise specified the latest issue of all referenced standards shall apply. The following specifications and standards are referenced in this specification.

Quality System Standard <i>ISO 9001</i> or TS-16949	NAVISTAR MPAPS F-1058
CFR Title 29, Part 1910	NAVISTAR MPAPS B-50
CFR Title 40, Part 205	NAVISTAR MPAPS F-1050
NAVISTAR Engineering Design Std. A-16	NAVISTAR MPAPS A-37
NAVISTAR Supplier Packing and Shipping Std. D-13	

4.0 REQUIREMENTS

4.1 Material

The primary material to be used for the bellows shall be 300 series stainless steel per MPAPS A-37 (or better); Materials Engineering and After-treatment Engineering group must provide written approval prior to use of alternate materials. After-treatment Engineering may make modifications to the material requirements when application guidelines from Engine Manufacturers dictate. All vendor prints must indicate all material types and specifications comprising a bellows assembly.

4.2 Construction

Bellows shall be constructed of a series of corrugations that allow flexibility, so as to require a **maximum** pulling force of 35 pounds to achieve an extension of 15% from the nominal length. Extension shall be 2.5 in/ft minimum from the compressed position. The end treatment of the bellows should be designed for welding or attachment to pipes with clamps based on MPAPS F-1069, Figures 4 and 5. Both ends shall have all burrs removed.

4.3 Leakage Rate

Maximum leakage rate of bellows in the designed to position shall be less than 0.01 standard cubic feet of air per minute at 10 psig.

4.4 Dimensions

Bore Diameter - Type I & II

<u>ID</u>		<u>Tolerance</u>	
<u>inch</u>	<u>Mm</u>	<u>inch</u>	<u>Mm</u>
2.00	50.0	+0.030/-0.000	+0.75/-0.000
2.25	57.0	+0.030/-0.000	+0.75/-0.000
2.50	65.0	+0.030/-0.000	+0.75/-0.000
2.75	70.0	+0.030/-0.000	+0.75/-0.000
3.00	75.0	+0.030/-0.000	+0.75/-0.000
3.25	82.0	+0.030/-0.000	+0.75/-0.000
3.50	90.0	+0.030/-0.000	+0.75/-0.000
4.00	100.0	+0.030/-0.000	+0.75/-0.000
5.00	125.0	+0.030/-0.000	+0.75/-0.000

Bore ovality tolerance will not exceed the total applicable ID tolerance; this only applies to the interface area between the pipe and the bellows.

4.5 Length - applies to both Type I and Type II

There is no rule of thumb for the proper length for bellows as there is with spiral wound flex pipe. The required length for a design will depend on how much movement is necessary, and the vibration loads from the engine. Packaging also plays a role in the length. The supplier will need to determine the

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