HNA Technic

737NG货舱地板损伤处置与修理

海技北分区域波音技术组

2023.09.05

背景

近期多架飞机出现货舱地板损伤，且安排调回北京修理。此类损伤日常比较常见，因此结合近期案例，将货舱地板损伤处置、补片损伤、修理方案等进行梳理介绍。

穿孔

补片损伤

货舱地板材料、厚度等信息查询

在SRM可以找到货舱地板材料及厚度等信息：

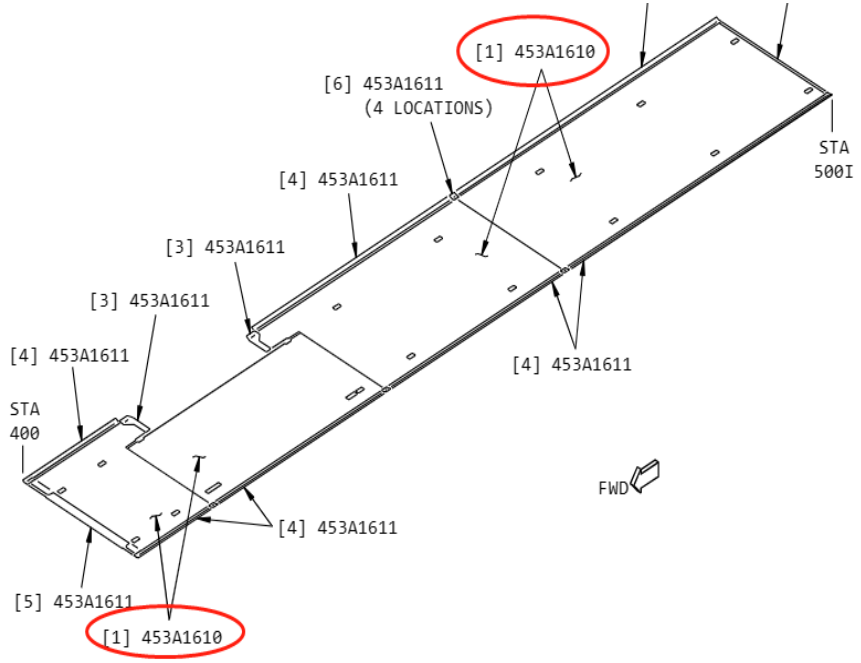
- 前货舱参考SRM 53-30-53-0I-1 IDENTIFICATION 1 - Section 43 Forward Cargo Compartment Floor Panels
- 后货舱参考SRM 53-60-53-0I-1 IDENTIFICATION 1 - Section 46 Cargo Compartment Floor Panels

以前货舱为例，进入SRM可以看到货舱地板标号为[1]，可以看到货舱地板有5种材料（只有2024-T3 是金属，其他非金属，因此通过实物外观可以快速判断材质），我司基本都是2024-T3 clad sheet（铝板），厚度0.071inch（1.8mm）

Table 2:

LIST OF MATERIALS FOR FIGURE 2

ITEM	DESCRIPTION	T*[1]	MATERIAL	EFFECTIVITY
[1]	Deck Panel	0.070 (1.79)	GILLINER 1266 Gill Coated (white) fiberglass	Refer to the Engineering Drawing
		0.090 (2.29)	GILLINER 1266 Gill Coated (white) fiberglass	
		0.071 (1.80)	2024-T3 clad sheet	
		0.090 (2.29)	Conolite P/N A90RG1W	
		0.058 (1.47)	BMS 7-326, Class 2/1, Grade C, Type VII	
[2]	Cap Strip		BAC1513-286-2024-T3511 extrusion	



货舱地板材料、厚度等信息查询

如果通过外观无法判断材质，还可以通过工程图纸查询，具体步骤如下：

- 在IPC确认地板件号
- 在工程图该件号地板信息

下面以前货舱地板（下图item[25]）为例

（1）首先在IPC找到件号：453A1610-103

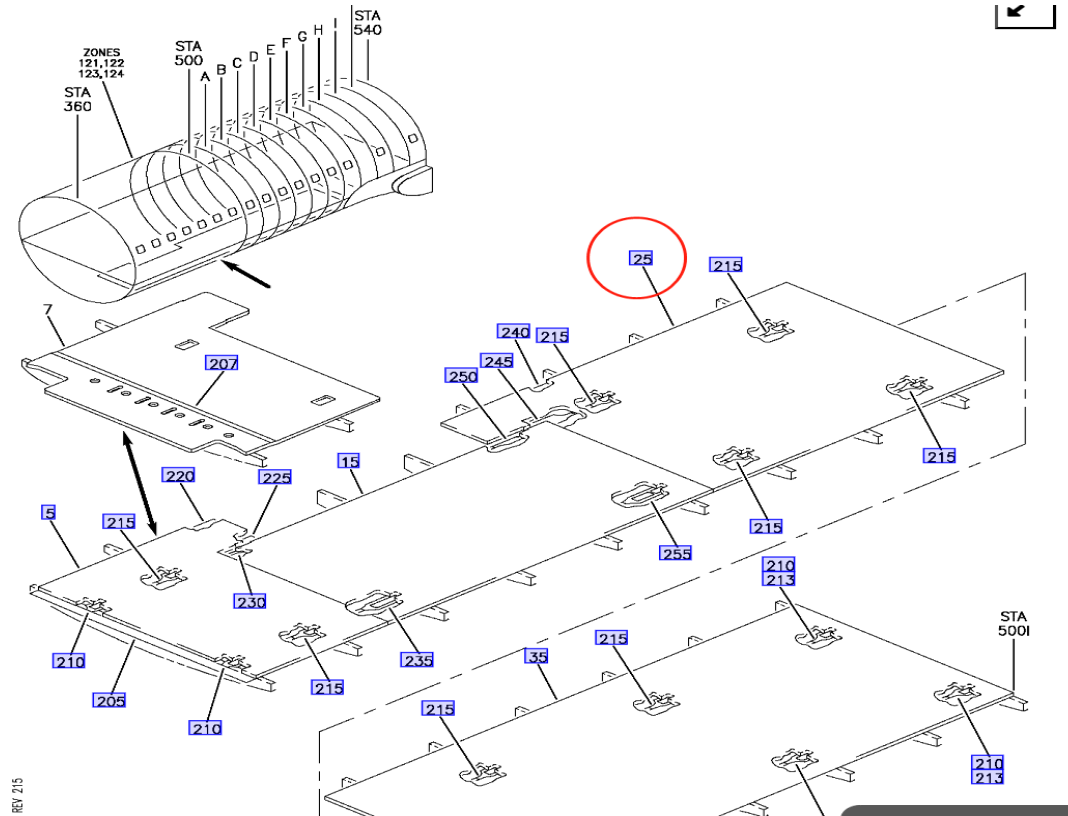


Fig Item	Part Number	Nomenclature
		81205
- 20	BACS12GR3L10	. SCREW SUPPLIER CODE: 81205
25	453A1610-103	. PANEL SUPPLIER CODE: 81205 ATTACHING PARTS
- 30	BACS12ER3K10	. SCREW SUPPLIER CODE: 81205
- 30	BACS12GR3L10	. SCREW SUPPLIER CODE: 81205
35	453A1610-20	. PANEL SUPPLIER CODE: 81205 ATTACHING PARTS

货舱地板材料、厚度等信息查询

（2）根据件号453A1610-103，在toolbox中找到图纸，进入图纸可以查到部件的材料信息

PARTS LIST	BOEING	CORPORATE OFFICES SEATTLE, WA 98124	EXPORT CONTROL COM	CAGE 81205	NUMBER 453A1610-103		REV A	SHEET 2 of 3
LIST TITLE PANEL					MODEL	CONTRACT NUMBER	DATE 04-16-2009	

(CONTINUED FROM PRECEDING PAGE)

NOTE TITLE	NOTE DESCRIPTION
	AUTOMATED OR MANUAL EQUIPMENT. DO NOT REMOVE CLAD LAYER.
PROCESS SPECIFICATION	RUBBER STAMP PART NUMBER PER BAC 5307, CODE RO.
SPARES INTERCHANGEABILITY	453A1610-103 IS AN ATA CODE 1 - ONE WAY INTERCHANGEABLE REPLACEMENT FOR 453A1610-80.

* *

. . . COMPONENTS . . .

QTY REQD	PART OR IDENTIFYING NUMBER	DESCRIPTION	NOTE TITLE	NOTE DESCRIPTION
1	MX211F	ALUMINUM ALLOY, CLAD SHEET; SEE RM PL REPORT FOR COMPLETE DEFINITION	THICKNESS	.071
			WIDTH	48
			LENGTH	90

损伤核实——首次损伤（非补片、非修复区域再损伤）

货舱地板的损伤在SRM 53-00-53-1A-1 ALLOWABLE DAMAGE 1 - Forward and Aft Cargo Compartment Floor Panels中核实

ALLOWABLE DAMAGE 1 - Forward and Aft Cargo Compartment Floor Panels

1. **Applicability**

   A. This subject gives the allowable damage limits for the forward and aft cargo compartment floor panels shown in Forward and Aft Cargo Compartment Floor Panel Locations, Figure 101/ALLOWABLE DAMAGE 1.

   B. The allowable damage limits given are only applicable to the strength properties of the forward and aft cargo compartment floor panels. It is possible that the damage in a panel is less than the allowable damage limits, but the panel does not function satisfactorily. If the panel does not function satisfactorily, you can repair it to put it back to a serviceable condition.

   C. The allowable damage limits for cracks, holes and punctures are only applicable if they are sealed and inspected as given in Paragraph 2.A./ALLOWABLE DAMAGE 1 and Paragraph 3.A./ALLOWABLE DAMAGE 1.

Figure 101. Forward and Aft Cargo Compartment Floor Panel Locations

Sheet 1

2. **General**

   A. Seal cracks, holes and punctures that go through the floor panel and nicks, gouges and scratches in fiberglass, glare and aluminum-fiberglass laminate panels with BMS 5-146, Type I, Class 1, Grade A cargo liner joint sealing tape. As an alternative, you can make the seal with aluminum foil tape (speed tape).

3. **Inspection Requirements**

   A. Do a visual inspection at 400 flight cycles maximum to make sure the sealing tape is in a satisfactory condition. Replace the tape if there are signs of deterioration.

   B. Replace the cargo compartment floor panel or do a permanent repair at 4,000 flight cycles maximum from the time the tape was applied.

5. **Allowable Damage Limits for the Forward and Aft Cargo Compartment Floor Panels**

   A. Aluminum

      (1) The total damage must not be more than 30 percent of the panel area.

         (a) Cracks:

            1) Cracks are permitted if they are:

               a) A maximum of 3.0 inches (76.2 mm) in length.

               b) Sealed and inspected as given in Paragraph 2.A./ALLOWABLE DAMAGE 1 and Paragraph 3.A./ALLOWABLE DAMAGE 1.

            2) Stop drill a 0.25 inch (6.35 mm) hole at the ends of a crack. The stop hole must be a minimum of 1.0 inch (25.4 mm) from a fastener hole.

               a) Install a 2117-T3 or 2117-T4 rivet. Install the rivet without sealant.

            3) Cracks that are between three adjacent fastener holes are permitted at the end of the panel that is attached.

         (b) Nicks, Gouges, Scratches, and Corrosion are permitted if:

            1) The dimensions of the damage is less than the limits given in Figure 102/ALLOWABLE DAMAGE 1.

         (c) Dents are permitted if they are:

            1) A maximum of 3.0 inches (76.2 mm) in diameter.

         (d) Holes and Punctures are permitted if they are:

            1) A maximum of 2.0 inches (50.8 mm) in diameter.

            2) Sealed and inspected as given in Paragraph 2.A./ALLOWABLE DAMAGE 1 and Paragraph 3.A./ALLOWABLE DAMAGE 1.

损伤核实——补片、修复区域再损伤

对于补片或修理区域再次损伤的情况，因当前部件状态不再是原始出场状态，不可以直接应用SRM进行标准核实，此情况需和结构工程师或厂家进行一事一议评估。

注：按目前经验，上述情况通报厂家的结果基本就是立即修复，厂家基本不会通过偏离申请。

损伤核实——TA-737-53-2021-001的要求

在日常维护过程中，一些飞机前后货舱地板报告裂纹、破洞和穿孔损伤，经核实为SRM 允许损伤后可按手册贴金属胶带保留4000FC，每400FC 目视检查确保金属胶带状态完好。实际检查发现金属胶带的状态一般不能保持400FC，而胶带的损坏可能会导致货舱腐蚀液体渗漏至飞机底部造成结构腐蚀。因此下发此TA-737-53-2021-001《737 飞机前后货舱地板贴金属胶带后的检查要求》对货舱地板裂纹、破洞和穿孔损伤贴金属胶带的保留期限做保守控制。

注：因TA不定期更新，下述截图金工参考，遇到问题时请使用最新版TA

正文/Text：

在日常维护过程中，对于前后货舱地板的裂纹、破洞和穿孔这三类损伤，在参考 SRM53-00-53-1A-1 贴金属胶带处理时，需按如下要求执行：

1. 发现货舱地板破洞或穿孔（裂纹除外）后，需办理运行限制，要求所运输的液体类货物应严格按照《货物运输手册》中的要求进行规范包装，否则不允许装载。
2. 每 50FC 目视检查金属胶带确保其状态完好，如果有损坏的迹象需更换胶带。
3. 在贴金属胶带后的 600FC 内更换货舱地板或完成永久修理。

   注释：地板更换或修理前，拆下货舱地板检查损伤底部区域（扩展检查区域至前后一个隔框和桁条）的机身蒙皮、隔框和桁条等结构有无液体渗漏或其他损伤（参考附图 1）。

除了以上要求外，其他要求按 SRM53-00-53-1A-1 执行。

接报的货舱地板损伤的处置要求

1、核实是否有保留

2、按要求进行信息通报

3、核实损伤是初次损伤还是补片或修复区域损伤：

- 对于首次损伤，依据SRM和TA完成标准核实和处置，对于损伤超标的，通报结构和执管（决策或申请偏离）
- 对于补片或修理区域再次损伤，收集位置、照片、损伤情况后直接联系结构席处理（决策）

4、对于破洞或穿孔损伤，同时发现货舱地板有液体且怀疑液体已经流到地板下部时，及时通报执管和结构席，评估是否立即拆下地板检查（基本都会要求拆下检查，提前准备航材和人力）

5、根据上述处置结果，视情安排修复或办理保留

货舱地板修理——大致流程

货舱地板修理参考SRM 53-00-53-2R-1 REPAIR 1 - Forward and Aft Cargo Compartment Floor Panels

修理流程可以简单的概况为：

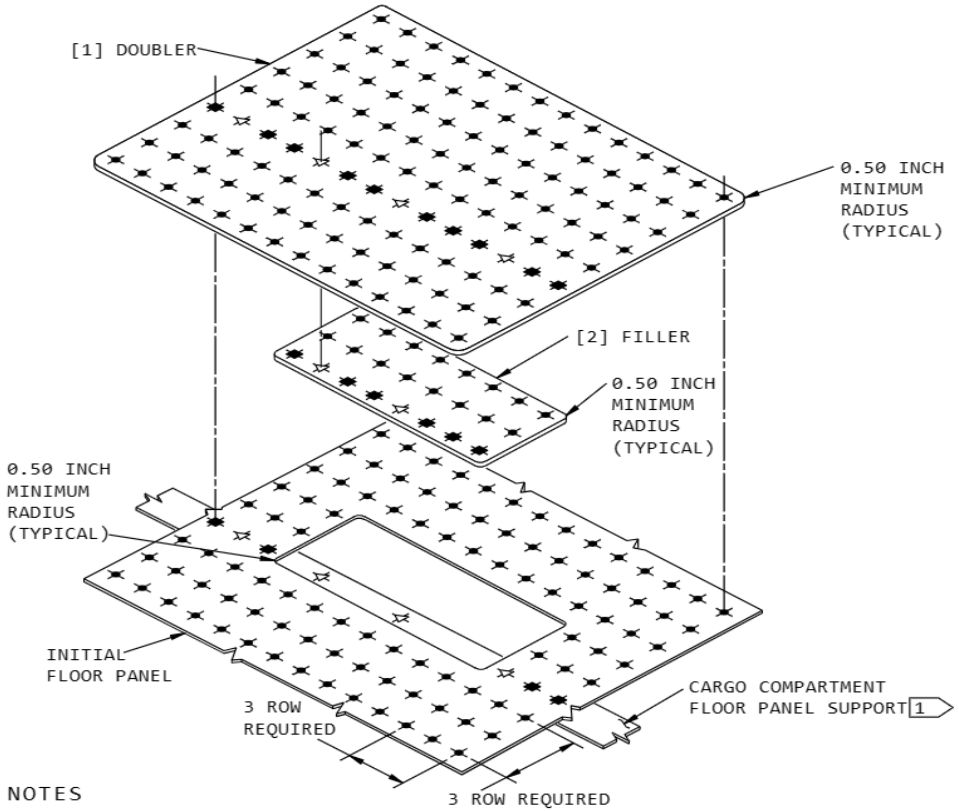
1、拆下地板

2、切除地板损伤区域材料

3、制作补片、安装补片

4、安装地板

货舱地板修理——示意图



NOTES

1 DO NOT DRILL THROUGH CARGO COMPARTMENT FLOOR PANEL SUPPORT. INSTALL DOUBLE FLUSH REPAIR RIVETS ON THE REPAIR PARTS AT THIS LOCATION.

FASTENER SYMBOLS

- REPAIR FASTENER LOCATION. INSTALL A BACR15CE6D() OR BACR15GF6D() RIVET. OPTIONAL TO USE BACR15GJ6E() OR BACR15FP6E() BLIND RIVET.
- REPAIR FASTENER LOCATION. INSTALL A DOUBLE FLUSH BACR15CE6D() OR BACR15GF6D() RIVET.
- INITIAL FASTENER LOCATION. INSTALL A FASTENER THAT IS THE SAME TYPE AND SIZE AS THE INITIAL FASTENER.

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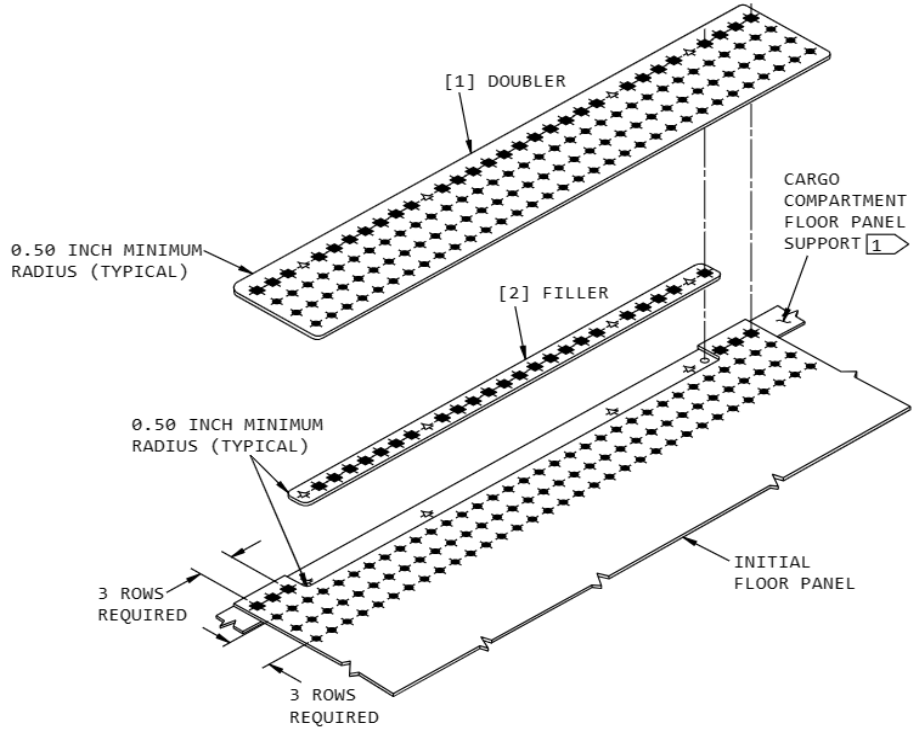
Damage Away from Panel Edge



NOTES

1 DO NOT DRILL THROUGH CARGO COMPARTMENT FLOOR PANEL SUPPORT. INSTALL DOUBLE FLUSH REPAIR RIVETS ON THE REPAIR PARTS AT THIS LOCATION.

FASTENER SYMBOLS

- REPAIR FASTENER LOCATION. INSTALL A BACR15CE6D() OR BACR15GF6D() RIVET. OPTIONAL TO USE BACR15GJ6E() OR BACR15FP6E() BLIND RIVET.
- REPAIR FASTENER LOCATION. INSTALL A DOUBLE FLUSH BACR15CE6D() OR BACR15GF6D() RIVET.
- INITIAL FASTENER LOCATION. INSTALL A FASTENER THAT IS THE SAME TYPE AND SIZE AS THE INITIAL FASTENER.

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Damage At Panel Edge

货舱地板修理

货舱地板修理参考SRM 53-00-53-2R-1 REPAIR 1 - Forward and Aft Cargo Compartment Floor Panels

修理流程检查的可以概况为：

1、拆下地板

2、切除损伤区域

3、安装补片

4、安装地板

附.NRC修理步骤

下述NRC步骤仅供参考，实际使用时注意飞机、客户、前/后货舱位置等信息不要直接套用NRC，避免错误