1.0 INTRODUCTION

1.1 This Design Standard specifies the minimum material thickness for machine countersinking for the installation of flush head fasteners.

1.2 For the purposes of this standard, countersinking includes preparation of the top sheet in an assembly to receive the manufactured head of a fastener, substrate sheets in a stack to receive a dimple and countersinking two (2) sides of an assembly to facilitate double flush installations.

2.0 DESIGN NOTES - GENERAL

2.1 The primary purpose of this standard is to serve as a quick reference guide to the designer to ensure that the material thickness selected in combination with a specific flush head type fastener, meets the minimum thickness requirements to avoid creating a knife edge (high-stress concentration) condition at the base of the countersink.

2.2 The minimum material thicknesses specified herein have been calculated based on the COUNTERSINK DEPTH required to meet the installed fastener head flushness requirements as per the applicable Production Process Standard (PPS), and the PARALLEL HOLE LENGTH required to meet stress and fatigue requirements. Refer to Figure 1 for general description of a countersink installation.

2.2.1. For metallic structure, non-fatigue sensitive applications, the STANDARD material thickness limits specified in the applicable fastener table, will ensure a minimum parallel hole length of 0.005 inches.

2.2.2. For metallic structure, fatigue sensitive applications, the FATIGUE material thickness limits specified in the applicable fastener table will ensure a minimum parallel hole length of 0.015 inches or 1/4 the fastener head height, whichever is greater.

2.2.3. For composite structures, the material thickness limits specified in the applicable fastener table, will ensure a minimum parallel hole length equal to 1/2 the fastener head height

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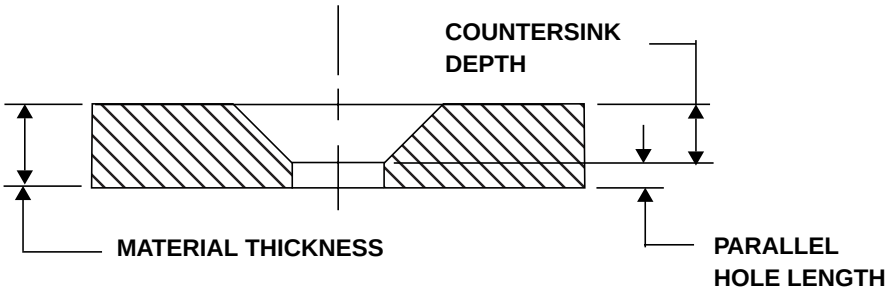
2.2.4. The specified minimum material thickness dimension is applicable to all fabricated thicknesses, i.e. machined or chemically milled surfaces, composite lay-ups, etc.

2.2.5. Minimum material gauge refers to the nearest equivalent standard sheet or plate gauge which meets the minimum parallel hole length requirements.

2.2.6. Refer to DS 129 for a listing of standard plate and sheet gauge thicknesses.

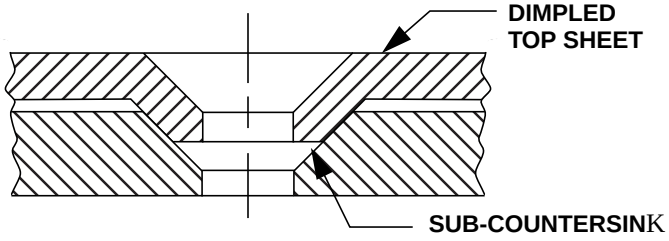
FIGURE 1 - TYPICAL COUNTERSINK



3.0 SUB-COUNTERSINKING - SHEET THICKNESS

3.1 The minimum sheet thicknesses for sub-countersinking, for the purpose of nesting a dimpled top sheet, are identical to the minimum sheet thicknesses for machine countersinking as shown in Tables 1 through 8 for the applicable fastener to be installed. See Figure 2.

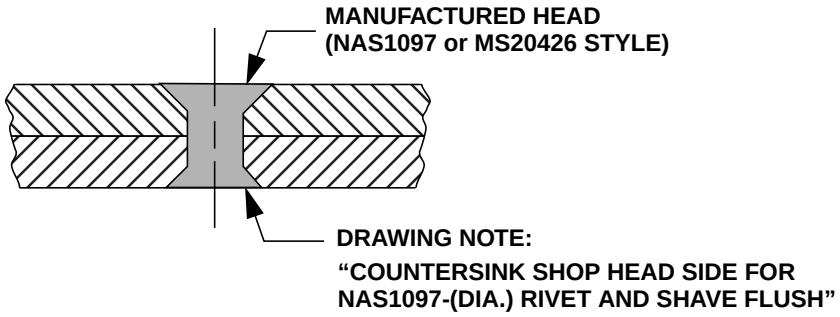
FIGURE 2- SUB-COUNTERSINK INSTALLATION



4.0 SHEET THICKNESS FOR DOUBLE FLUSH INSTALLATIONS

4.1 For double flush installations, the countersink diameter for the driven shop head shall be equal to a NAS1097 shear type manufactured head. Consequently, the minimum sheet thickness of the back sheet shall be the same as the minimum sheet thickness specified in Table 2 for NAS1097 rivets, regardless of the manufactured head style.

FIGURE 3- DOUBLE FLUSH INSTALLATION



5.0 METALLIC STRUCTURES

5.1 Refer to Tables 1 through 7 for minimum sheet thickness for machine countersinking metallic structures for a particular fastener type and size.

5.2 Provided that Stress Engineering approval has been obtained, components which have been metal bonded as per PPS 36.10 may be considered as a single sheet for the purposes of determining the minimum material thickness for countersinking.

6.0 COMPOSITE STRUCTURES

6.1 Refer to Tables 1 through 8 for minimum material thickness for machine countersinking composite structures for a particular fastener type and size.

6.2 Where a metal strip has been co-cured in a composite assembly, the total thickness of the metal and composite can be considered as a single sheet for the purposes of determining the minimum material thickness for countersinking, provided that Stress Engineering approval has been obtained,

Table 1: SOLID RIVETS - TENSION HEAD - Minimum Countersinking Thickness

FASTENER		METALLIC STRUCTURE				COMPOSITE STRUCTURE
DESIGNATION	DIA	STANDARD		FATIGUE		
		MIN THK	MIN GA	MIN THK	MIN GA	MIN THK
BACR15BA MS20426 B0205013 B0205017	1/16	.025	.025	N/A		.030
	3/32	.040	.040	.050	.050	.050
	1/8	.045	.045	.055	.056	.060
	5/32	.060	.063	.070	.071	.080
	3/16	.075	.080	.090	.090	.100
	1/4	.100	.100	.120	.125	.140
	5/16	.110	.112	.125	.125	.160
	3/8	.140	.140	.170	.180	N/A

Table 2: SOLID RIVETS - SHEAR HEAD - Minimum Countersinking Thickness

FASTENER		METALLIC STRUCTURE				COMPOSITE STRUCTURE
DESIGNATION	DIA	STANDARD		FATIGUE		
		MIN THK	MIN GA	MIN THK	MIN GA	MIN THK
BACR15CE NAS1097 B0205015 B0205018	3/32	.025	.025	.035	.036	N/A
	1/8	.030	.032	.040	.040	
	5/32	.040	.040	.050	.050	
	3/16	.050	.050	.060	.063	
	1/4	.063	.063	.075	.080	

Table 3: BLIND RIVETS - TENSION HEAD - Minimum Countersinking Thickness

FASTENER			METALLIC STRUCTURE				COMPOSITE STRUCTURE
DESIGNATION	DIAMETER		STANDARD		FATIGUE (1)		
			MIN THK	MIN GA	MIN THK	MIN GA	MIN THK
MS20605 CR3214	NOM	3/32	.040	.040	.050	.050	.055
		1/8	.045	.045	.055	.056	.060
		5/32	.060	.063	.070	.071	.080
		3/16	.075	.080	.085	.090	.100
		1/4	.100	.100	.120	.125	.160
M7885/7 M7885/9 CR3243	O/S	1/8	.040	.040	.050	.050	.055
		5/32	.055	.056	.063	.063	.075
		3/16	.070	.071	.080	.080	.100

NOTE 1 - BLIND RIVETS SHALL ONLY BE USED IN FATIGUE APPLICATIONS WITH STRESS ENGINEERING APPROVAL

Table 4: BLIND RIVETS - SHEAR HEAD - Minimum Countersinking Thickness

FASTENER			METALLIC STRUCTURE				COMPOSITE STRUCTURE
DESIGNATION	DIAMETER		STANDARD		FATIGUE (1)		
			MIN THK	MIN GA	MIN THK	MIN GA	MIN THK
B0207004	NOM	1/8	.032	.032	.045	.045	N/A
		5/32	.040	.040	.050	.050	
		3/16	.050	.050	.060	.063	

NOTE 1 - BLIND RIVETS SHALL ONLY BE USED IN FATIGUE APPLICATIONS WITH STRESS ENGINEERING APPROVAL

Table 5: TWO-PIECE PERMANENT FASTENERS (Hi-Lites, Lockbolts) - TENSION HEAD - Minimum Countersinking Thickness

FASTENER		METALLIC STRUCTURE FATIGUE APPLICATIONS	
DESIGNATION	DIA	MIN THK	MIN GA
B0206004 B0206044 B0206054	5/32	.075	.080
	3/16	.090	.090
	1/4	.120	.125
	5/16	.135	.140
	3/8	.170	.180

Table 6: TWO-PIECE PERMANENT FASTENERS (Hi-Lites, Lockbolts) - SHEAR HEAD - Minimum Countersinking Thickness

FASTENER		METALLIC STRUCTURE FATIGUE APPLICATIONS	
DESIGNATION	DIA	MIN THK	MIN GA
B0206002 B0206042 B0206052	5/32	.063	.063
	3/16	.070	.071
	1/4	.085	.090
	5/16	.090	.090
	3/8	.105	.112

Table 7: BLIND BOLTS - Minimum Countersinking Thickness

FASTENER		METALLIC STRUCTURE FATIGUE APPLICATIONS	
DESIGNATION	DIA	MIN THK	MIN GA
MS90353	5/32	.085	.090
	3/16	.095	.100
	1/4	.125	.125

Table 8: COMPOSITE FASTENERS - Minimum Countersinking Thickness

FASTENER		COMPOSITE STRUCTURE
DESIGNATION	DIA	MIN THK
COMPOSI-LOK B0207001	5/32	.055
	3/16	.060
	7/32	.060
	1/4	.070
	9/32	.070
	5/16	.090