
ALYSIS
NASA

1
00:00:00,000 --> 00:00:28,440
I

2
00:00:33,310 --> 00:00:31,450
okay we'll go into match drilling and

3
00:00:37,180 --> 00:00:33,320
fastener holes this is something that I

4
00:00:39,190 --> 00:00:37,190
touched on earlier which has to do with

5
00:00:40,870 --> 00:00:39,200
making sure that the holes match whether

6
00:00:44,410 --> 00:00:40,880
they're in their true position or not

7
00:00:46,030 --> 00:00:44,420
and by having a pilot hole in one part

8
00:00:49,090 --> 00:00:46,040
and then drilling all the way through

9
00:00:52,479 --> 00:00:49,100
with the mating pieces clamped in

10
00:00:55,119 --> 00:00:52,489
position this way you have a precision

11
00:00:57,939 --> 00:00:55,129
hole even if the holes are not in their

12
00:01:00,160 --> 00:00:57,949
troop positions because they can be off

13
00:01:03,310 --> 00:01:00,170

a little bit and still still be close

14
00:01:08,020 --> 00:01:03,320
enough and I have some examples of

15
00:01:12,940 --> 00:01:08,030
mismatched countersunk holes in the next

16
00:01:17,410 --> 00:01:12,950
figure now notice that this mismatch

17
00:01:20,530 --> 00:01:17,420
usually causes head bending which is bad

18
00:01:22,690 --> 00:01:20,540
news these these are cases in which see

19
00:01:27,160 --> 00:01:22,700
in the first one there the holes match

20
00:01:29,020 --> 00:01:27,170
the counter sunk is not in line so you

21
00:01:32,679 --> 00:01:29,030
have head bending where the era is up

22
00:01:37,569 --> 00:01:32,689
there the over here we even use the

23
00:01:41,350 --> 00:01:37,579
wrong counter snug hole and because

24
00:01:45,219 --> 00:01:41,360
there are two normal types 82 degree and

25
00:01:48,090 --> 00:01:45,229
100 degree countersunk heads and so if

26
00:01:51,490 --> 00:01:48,100
you use the wrong one you're in trouble

27
00:01:54,760 --> 00:01:51,500
here we have the holes parallel but not

28
00:01:56,590 --> 00:01:54,770
in line and here the holes weren't even

29
00:02:01,749 --> 00:01:56,600
parallel so we're real trouble there on

30
00:02:03,969 --> 00:02:01,759
bending on both of these so what you

31
00:02:07,060 --> 00:02:03,979
have here is a case in which you need on

32
00:02:09,609 --> 00:02:07,070
countersunk holes to use the same drill

33
00:02:12,040 --> 00:02:09,619
fixture put all the holes in through

34
00:02:17,260 --> 00:02:12,050
everything so that at least even if it's

35
00:02:20,170 --> 00:02:17,270
a little bit off the 90-degree alignment

36
00:02:21,760 --> 00:02:20,180
at least everything will match and

37
00:02:23,320 --> 00:02:21,770
you're in better shape that way than you

38
00:02:24,610 --> 00:02:23,330

are if you have one of them drilled

39
00:02:28,559 --> 00:02:24,620
right and the other one drilled it a

40
00:02:35,170 --> 00:02:31,980
now knife edges in a countersunk whole

41
00:02:39,070 --> 00:02:35,180
knife edges or stress risers and are to

42
00:02:40,990 --> 00:02:39,080
be avoided in fact the aerospace

43
00:02:44,800 --> 00:02:41,000
industry makes a big issue over this

44
00:02:49,480 --> 00:02:44,810
thou shalt not do it so if we go on to

45
00:02:51,190 --> 00:02:49,490
the next sheet it will show some

46
00:02:58,440 --> 00:02:51,200
examples of this and I can just talk

47
00:03:03,670 --> 00:02:58,450
from the examples there is a knife edge

48
00:03:06,340 --> 00:03:03,680
right here and you see that edge can be

49
00:03:09,430 --> 00:03:06,350
very jagged and developed cracks real

50
00:03:11,550 --> 00:03:09,440
easy so therefore you're not supposed to

51
00:03:14,500 --> 00:03:11,560
have that at all in a critical

52
00:03:16,870 --> 00:03:14,510
application you're supposed to make sure

53
00:03:19,390 --> 00:03:16,880
that you have enough thickness that you

54
00:03:21,760 --> 00:03:19,400
can counter sink and still have a piece

55
00:03:26,949 --> 00:03:21,770
left here to avoid that knife edge in

56
00:03:30,070 --> 00:03:26,959
fact having the countersink be no more

57
00:03:33,340 --> 00:03:30,080
than two-thirds of the thickness of the

58
00:03:35,650 --> 00:03:33,350
sheet is one of the criteria that the

59
00:03:41,080 --> 00:03:35,660
aircraft companies use then going to the

60
00:03:43,660 --> 00:03:41,090
next page now here we have dimpled and

61
00:03:47,289 --> 00:03:43,670
countersunk holes in this case we have

62
00:03:49,060 --> 00:03:47,299
the countersink in the bottom sheet we

63
00:03:51,550 --> 00:03:49,070

dimpled it just simply by hitting it

64
00:03:54,160 --> 00:03:51,560
with a tool to make this one fit so we

65
00:03:56,410 --> 00:03:54,170
could have a place surface up here and

66
00:03:58,810 --> 00:03:56,420
that's in in the case where you where

67
00:04:01,060 --> 00:03:58,820
the top sheet is too thin to countersink

68
00:04:03,460 --> 00:04:01,070
in it then we're both of them are too

69
00:04:06,000 --> 00:04:03,470
thin you can actually dimple both of

70
00:04:10,680 --> 00:04:06,010
them and still have a flesh surface now

71
00:04:17,770 --> 00:04:10,690
as I understand it this is still allowed

72
00:04:20,620 --> 00:04:17,780
mr. murky on small airplanes they still

73
00:04:22,780 --> 00:04:20,630
allow dimpling yeah Mario you put you

74
00:04:25,450 --> 00:04:22,790
fly so so this will this make you feel

75
00:04:27,550 --> 00:04:25,460
better they allow dimpled holes on small

76
00:04:31,270 --> 00:04:27,560
aircraft but they don't allow them on

77
00:04:33,790 --> 00:04:31,280
the big ones because the fact that where

78
00:04:39,969 --> 00:04:33,800
you deform the metal like that there's

79
00:04:42,520 --> 00:04:39,979
danger of developing cracks so so the

80
00:04:47,800 --> 00:04:42,530
the major aircraft manufacturers

81
00:04:49,690 --> 00:04:47,810
prohibit that now dowel pins there

82
00:04:53,050 --> 00:04:49,700
they're a very important thing and have

83
00:04:54,550 --> 00:04:53,060
an important function but sometimes

84
00:04:57,040 --> 00:04:54,560
people want to use them in way

85
00:04:59,250 --> 00:04:57,050
they shouldn't be used there are close

86
00:05:02,340 --> 00:04:59,260
tolerance pins which are used on lane

87
00:05:05,020 --> 00:05:02,350
mating components and that's really the

88
00:05:07,330 --> 00:05:05,030

their major function they usually

89
00:05:10,720 --> 00:05:07,340
mounted in what in one of the pieces

90
00:05:13,000 --> 00:05:10,730
with a slight interference fit then the

91
00:05:15,310 --> 00:05:13,010
meeting piece has a close tolerance hole

92
00:05:17,710 --> 00:05:15,320
the slip over it and you get good

93
00:05:19,480 --> 00:05:17,720
alignment of the pieces and then you

94
00:05:22,000 --> 00:05:19,490
bold them together or ever ever how you

95
00:05:24,730 --> 00:05:22,010
want to fasten together and you analyze

96
00:05:27,670 --> 00:05:24,740
the bolts for the total shear load and

97
00:05:29,740 --> 00:05:27,680
you don't use the dowel pins and bolts

98
00:05:31,990 --> 00:05:29,750
together to calculate the load because

99
00:05:34,090 --> 00:05:32,000
one of them is interference fit and the

100
00:05:36,700 --> 00:05:34,100
other one isn't so therefore the dowel

101
00:05:38,200 --> 00:05:36,710
pins would load up first so now if you

102
00:05:39,940 --> 00:05:38,210
want to put enough dowel pins in the

103
00:05:41,500 --> 00:05:39,950
carry all the load you could do that and

104
00:05:44,110 --> 00:05:41,510
then just hold them together with the

105
00:05:47,560 --> 00:05:44,120
intention with the bolts but you can't

106
00:05:51,940 --> 00:05:47,570
use two different fasteners that have

107
00:05:53,290 --> 00:05:51,950
different tolerances and say that both

108
00:05:55,060 --> 00:05:53,300
of them are going to carry load equally

109
00:05:57,790 --> 00:05:55,070
just like you don't use bolts and rivets

110
00:05:59,320 --> 00:05:57,800
together because the rivets would fail

111
00:06:00,730 --> 00:05:59,330
before the bolts pick up any load

112
00:06:05,800 --> 00:06:00,740
because the rivets and her parents fit

113
00:06:08,440 --> 00:06:05,810

the mold isn't so so that's that's the

114
00:06:10,779 --> 00:06:08,450
way that they're supposed to be used now

115
00:06:12,490 --> 00:06:10,789
you can design them to carry all the

116
00:06:15,880 --> 00:06:12,500
cheer load although normally you don't

117
00:06:19,000 --> 00:06:15,890
and now here's here's one of the things

118
00:06:22,060 --> 00:06:19,010
you can run into with dowel pins if you

119
00:06:27,940 --> 00:06:22,070
put them in blind holes they're kind of

120
00:06:30,190 --> 00:06:27,950
hard to remove so particularly if it's a

121
00:06:32,680 --> 00:06:30,200
solid pin so it's a lot better to have a

122
00:06:34,330 --> 00:06:32,690
through-hole to put a dowel pin in so

123
00:06:39,820 --> 00:06:34,340
you can take a punch to the back side

124
00:06:42,640 --> 00:06:39,830
and knock the thing out or use a vetted

125
00:06:44,379 --> 00:06:42,650
been with a groove or a flat edge for

126
00:06:49,390 --> 00:06:44,389
blind installations is to make sure you

127
00:06:53,560 --> 00:06:49,400
get the thing out and tapered dowel pins

128
00:06:56,980 --> 00:06:53,570
are available and pins with external

129
00:06:59,260 --> 00:06:56,990
serrations or ridges to prevent pin boat

130
00:07:00,940 --> 00:06:59,270
rotation so you drive the thing in place

131
00:07:04,779 --> 00:07:00,950
and it has the Russians on the edge of

132
00:07:06,760 --> 00:07:04,789
it that keeps it and rotating now sure

133
00:07:07,690 --> 00:07:06,770
allowables for dowel pins are usually

134
00:07:09,730 --> 00:07:07,700
determined by the

135
00:07:11,560 --> 00:07:09,740
manufacturers test program because a lot

136
00:07:15,490 --> 00:07:11,570
of the times the irregularity of the

137
00:07:18,100 --> 00:07:15,500
cross section means it is difficult for

138
00:07:21,400 --> 00:07:18,110

you to calculate the cross sectional

139
00:07:24,700 --> 00:07:21,410
area that you have so it's easier to use

140
00:07:26,620 --> 00:07:24,710
the manufacturers values for it so some

141
00:07:35,400 --> 00:07:26,630
of the common types of dowel pins that

142
00:07:40,780 --> 00:07:35,410
we have here is a plain solid one and

143
00:07:43,030 --> 00:07:40,790
pebble greened even this one is one of

144
00:07:46,150 --> 00:07:43,040
the ones that we Fred year since people

145
00:07:48,160 --> 00:07:46,160
made for me with some sort of a new

146
00:07:52,720 --> 00:07:48,170
system that they had gave it kind of a

147
00:07:55,630 --> 00:07:52,730
rough surface then we go to the drilled

148
00:07:57,940 --> 00:07:55,640
and tapped dowel pin with vents these

149
00:08:00,040 --> 00:07:57,950
are these even have little grooves

150
00:08:02,590 --> 00:08:00,050
around them so that they will vent and

151
00:08:05,740 --> 00:08:02,600
you can pull them out and then they have

152
00:08:08,890 --> 00:08:05,750
a drilled and tapped hole so that you

153
00:08:10,750 --> 00:08:08,900
can run a threaded rod in there of some

154
00:08:20,290 --> 00:08:10,760
kind or screw and actually pull the

155
00:08:23,380 --> 00:08:20,300
thing out with the ride here is a groove

156
00:08:30,910 --> 00:08:23,390
dowel pin and this one actually this

157
00:08:34,240 --> 00:08:30,920
this groove is on it to give it a little

158
00:08:36,850 --> 00:08:34,250
bit of compressibility you so this the

159
00:08:39,790 --> 00:08:36,860
grooved end would be slightly larger and

160
00:08:42,040 --> 00:08:39,800
that then you can pound it in and the

161
00:08:45,460 --> 00:08:42,050
groove will close up on some as you're

162
00:08:47,320 --> 00:08:45,470
pounding it in which is because you

163
00:08:50,020 --> 00:08:47,330

notice the groove doesn't go all the way

164
00:08:54,250 --> 00:08:50,030
down it is just it to one end then this

165
00:08:56,380 --> 00:08:54,260
is a vented dowel pin here and the

166
00:08:58,300 --> 00:08:56,390
groove does go all the way down so that

167
00:09:01,590 --> 00:08:58,310
you can get so she don't pull any vacuum

168
00:09:05,550 --> 00:09:01,600
when you put the thing in the blind hole

169
00:09:08,320 --> 00:09:05,560
now here's a tape that that I like and

170
00:09:11,950 --> 00:09:08,330
we use some of these because you can

171
00:09:14,920 --> 00:09:11,960
pull them this is the tapered dowel pin

172
00:09:16,750 --> 00:09:14,930
with a jacking net so that one you can

173
00:09:18,250 --> 00:09:16,760
slap it in the hole and then when you

174
00:09:20,440 --> 00:09:18,260
get ready to take it out all you got to

175
00:09:21,509 --> 00:09:20,450
do is tighten the nut up and that will

176
00:09:24,699 --> 00:09:21,519
pull it

177
00:09:26,139 --> 00:09:24,709
so those those are pretty pretty good if

178
00:09:30,639 --> 00:09:26,149
you if you've got a place where you can

179
00:09:34,779 --> 00:09:30,649
use them that way now roll pins are

180
00:09:38,710 --> 00:09:34,789
sometimes called spring pins are

181
00:09:42,429 --> 00:09:38,720
actually made by rolling a piece of thin

182
00:09:44,559 --> 00:09:42,439
alloy steel or stainless steel to a

183
00:09:46,359 --> 00:09:44,569
given diameter with a temper on each end

184
00:09:49,989 --> 00:09:46,369
of it so you can take a hammer and drive

185
00:09:55,119 --> 00:09:49,999
it in the hole it's then heat-treated a

186
00:09:57,819 --> 00:09:55,129
real high hardness and the coiled cross

187
00:09:59,589 --> 00:09:57,829
section on it decreases in diameter as

188
00:10:03,279 --> 00:09:59,599

you're driving it so that you have an

189
00:10:05,289 --> 00:10:03,289
interference fit now the slotted tubular

190
00:10:08,079 --> 00:10:05,299
pin is one that it's not really rolled

191
00:10:10,659 --> 00:10:08,089
up it's just a cylindrical piece of

192
00:10:14,739 --> 00:10:10,669
tubing with a slight cut in it and you

193
00:10:16,869 --> 00:10:14,749
can use that also SI spring pin so

194
00:10:19,269 --> 00:10:16,879
there's one of each shown on the next

195
00:10:22,899 --> 00:10:19,279
page here here is the roll pin which is

196
00:10:24,759 --> 00:10:22,909
wound up if you look at that one I

197
00:10:27,279 --> 00:10:24,769
believe you can see it better there that

198
00:10:30,489 --> 00:10:27,289
it's actually overlapped rolls of

199
00:10:33,789 --> 00:10:30,499
material so that it will develop more

200
00:10:36,909 --> 00:10:33,799
load of course than the single slotted

201
00:10:41,739 --> 00:10:36,919
tubular pin here these are used for

202
00:10:44,349 --> 00:10:41,749
installing cranks and I know that I've

203
00:10:48,369 --> 00:10:44,359
seen them used on bicycle cranks to hold

204
00:10:49,809 --> 00:10:48,379
them together and they're easy to tap in

205
00:10:51,969 --> 00:10:49,819
place and if they're in a through-hole

206
00:10:56,340 --> 00:10:51,979
then you can take a punch and knock them

207
00:11:02,079 --> 00:10:58,989
the once again the load carrying

208
00:11:04,329 --> 00:11:02,089
capabilities for these are usually

209
00:11:06,249 --> 00:11:04,339
determined and tabulated by the pin

210
00:11:08,049 --> 00:11:06,259
manufacturer because due to the

211
00:11:14,820 --> 00:11:08,059
irregularity of the cross section it's

212
00:11:21,790 --> 00:11:18,640
and that will conclude roll pins in our