Rivets

Cherry Buck Rivets (Cherry Rivet Co.) (cont'd)

These rivets can be used in steel, aluminum or titanium and up to 600° F. They are available in both flush and protruding heads.

Figure 56-Cherry Buck Rivet

1
00:00:22,419 --> 00:00:20,169
now we would like to move into one of

2
00:00:26,370 --> 00:00:22,429
the topics for the aerospace world its

3
00:00:30,220 --> 00:00:26,380
major the major one Ribbit's Ribbit's

4
00:00:31,810 --> 00:00:30,230
are relatively low-cost permanently

5
00:00:34,930 --> 00:00:31,820
installed fasteners that are lighter

6
00:00:36,640 --> 00:00:34,940
weight than bolts they are interference

7
00:00:38,950 --> 00:00:36,650
fit which makes them a lot different

8
00:00:40,840 --> 00:00:38,960
from bolts when you analyze them or put

9
00:00:43,990 --> 00:00:40,850
them in combination with other fasteners

10
00:00:46,030 --> 00:00:44,000
and rivet installation is faster than

11
00:00:49,349 --> 00:00:46,040
bolt installation because it can be done

12
00:00:52,330 --> 00:00:49,359
in a lot of cases with automatic tools

13
00:00:54,520 --> 00:00:52,340

ribbits worked the best in thin sheet

14
00:00:57,759 --> 00:00:54,530
designs where shear is the dominant load

15
00:01:02,369 --> 00:00:57,769
since a rivet really does not have very

16
00:01:06,910 --> 00:01:02,379
good tensile properties tensile capacity

17
00:01:12,070 --> 00:01:06,920
the rivets should also be designed to be

18
00:01:15,430 --> 00:01:12,080
critical in bearing since you are

19
00:01:18,249 --> 00:01:15,440
normally considering them as a big

20
00:01:20,589 --> 00:01:18,259
pattern of fasteners holding a load so

21
00:01:22,270 --> 00:01:20,599
since they have to work together they

22
00:01:25,930 --> 00:01:22,280
need to be bearing critical so they can

23
00:01:29,199 --> 00:01:25,940
distribute the loads properly the longer

24
00:01:31,029 --> 00:01:29,209
the grip length of a rivet or that is

25
00:01:33,940 --> 00:01:31,039
the total thickness of sheets being

26
00:01:36,510 --> 00:01:33,950
joined the more difficult it becomes to

27
00:01:39,219 --> 00:01:36,520
lock the rivet because you're trying to

28
00:01:42,279 --> 00:01:39,229
compress all these sheets and sometimes

29
00:01:47,920 --> 00:01:42,289
it's difficult to get them drawn up

30
00:01:53,000 --> 00:01:50,570
now even though rivets are designed with

31
00:01:56,180 --> 00:01:53,010
an interference fit they're not airtight

32
00:01:57,980 --> 00:01:56,190
or watertight so if you want to seal a

33
00:02:02,480 --> 00:01:57,990
joint you have to apply some type of

34
00:02:04,700 --> 00:02:02,490
sealant to the joint around the rivets

35
00:02:06,469 --> 00:02:04,710
and here's another very important

36
00:02:09,380 --> 00:02:06,479
feature since rivets are permanently

37
00:02:11,570 --> 00:02:09,390
installed they have to be removed by

38
00:02:13,880 --> 00:02:11,580

drilling or punching them out and

39
00:02:17,630 --> 00:02:13,890
replace them with oversized rivets and

40
00:02:19,970 --> 00:02:17,640
this is a real laborious task from the

41
00:02:22,960 --> 00:02:19,980
standpoint of both getting the old rivet

42
00:02:27,080 --> 00:02:22,970
out without screwing up the hold where

43
00:02:29,420 --> 00:02:27,090
it's impossible to install another rivet

44
00:02:31,610 --> 00:02:29,430
in it without going to a much larger

45
00:02:33,800 --> 00:02:31,620
size which might get you in trouble an

46
00:02:37,610 --> 00:02:33,810
edge distance and spacing and that type

47
00:02:41,900 --> 00:02:37,620
of thing rivet materials are made of

48
00:02:44,930 --> 00:02:41,910
various carbon steels corrosion

49
00:02:48,500 --> 00:02:44,940
resistant steel brass aluminum Monello

50
00:02:50,810 --> 00:02:48,510
titanium and they have to be ductile

51
00:02:54,680 --> 00:02:50,820
enough that you can form a head on them

52
00:02:57,740 --> 00:02:54,690
without cracking so you need a high

53
00:02:59,630 --> 00:02:57,750
strength so it is a kind of a balancing

54
00:03:02,770 --> 00:02:59,640
act to try to get one that's ductile

55
00:03:06,229 --> 00:03:02,780
enough to form but on the other hand

56
00:03:08,990 --> 00:03:06,239
will have a high enough strength to give

57
00:03:14,170 --> 00:03:09,000
you the load carrying capacity that you

58
00:03:16,759 --> 00:03:14,180
want now in the table 13 of course is a

59
00:03:20,600 --> 00:03:16,769
list of some of the aerospace materials

60
00:03:22,340 --> 00:03:20,610
and some of these rivets contain more

61
00:03:26,330 --> 00:03:22,350
than one material that can actually come

62
00:03:30,830 --> 00:03:26,340
up with a hybrid rivet and use a softer

63
00:03:32,539 --> 00:03:30,840

material for the shop head so that you

64
00:03:36,680 --> 00:03:32,549
can buck the thing in place and still

65
00:03:41,540 --> 00:03:39,320
here is a list of the common ones of

66
00:03:45,220 --> 00:03:41,550
course the the aircraft industry uses a

67
00:03:49,400 --> 00:03:45,230
lot of the abs and DD is which are the

68
00:03:53,810 --> 00:03:49,410
ms-20 four to six and two oh four seven

69
00:03:58,820 --> 00:03:53,820
ho the the ADEs are used normally up to

70
00:04:04,330 --> 00:03:58,830
a 5/32 diameter and they can be readily

71
00:04:07,670 --> 00:04:04,340
formed at room temperature the the d DS

72
00:04:10,210 --> 00:04:07,680
there if they're made out of 2024 they

73
00:04:13,550 --> 00:04:10,220
have to be kept in an icebox until

74
00:04:15,110 --> 00:04:13,560
you're ready to install them because you

75
00:04:16,760 --> 00:04:15,120
can only cold work them when they're

76
00:04:19,490 --> 00:04:16,770
down around zero degrees without

77
00:04:21,740 --> 00:04:19,500
cracking them eleven hundred aluminum

78
00:04:24,230 --> 00:04:21,750
that's usually non structural a fifty

79
00:04:28,640 --> 00:04:24,240
fifty six is a special one in this

80
00:04:32,060 --> 00:04:28,650
respect they're still used some people

81
00:04:34,910 --> 00:04:32,070
are not aware I don't think that they

82
00:04:36,860 --> 00:04:34,920
are stress corrosion sensitive and they

83
00:04:41,140 --> 00:04:36,870
really should not be used in anything

84
00:04:44,720 --> 00:04:41,150
other than a magnesium joint where

85
00:04:47,870 --> 00:04:44,730
magnesium is more stress corrosion

86
00:04:51,920 --> 00:04:47,880
sensitive than the 50:56 so therefore

87
00:04:54,320 --> 00:04:51,930
the 50:56 will work out better we had a

88
00:04:56,780 --> 00:04:54,330

case on the Atlas vehicle with fifty

89
00:04:58,460 --> 00:04:56,790
fifty six rivets in which the heads were

90
00:05:02,420 --> 00:04:58,470
popping off with the things that on the

91
00:05:06,220 --> 00:05:02,430
pad but from stress corrosion so they

92
00:05:12,140 --> 00:05:06,230
should not be used in most applications

93
00:05:15,380 --> 00:05:12,150
now which is a 67 percent nickel and

94
00:05:17,540 --> 00:05:15,390
thirty percent copper material is used a

95
00:05:21,200 --> 00:05:17,550
lot for rivets because it is ductile and

96
00:05:23,330 --> 00:05:21,210
yet it is higher strength than aluminum

97
00:05:26,630 --> 00:05:23,340
and it's used for joining us stainless

98
00:05:28,060 --> 00:05:26,640
steels titanium and canals copper is

99
00:05:33,590 --> 00:05:28,070
usually used for non structural

100
00:05:35,090 --> 00:05:33,600
applications the 70 50 T 73 that's the

101
00:05:39,950 --> 00:05:35,100
one that is not sensitive to stress

102
00:05:41,840 --> 00:05:39,960
corrosion is used it can be installed at

103
00:05:47,690 --> 00:05:41,850
room temperature and it's used as an

104
00:05:50,070 --> 00:05:47,700
alternate to the 2024 ice box rivet it

105
00:05:52,409 --> 00:05:50,080
has almost as good as strength as

106
00:05:54,140 --> 00:05:52,419
the 2024 and yet you don't have to worry

107
00:06:12,110 --> 00:05:54,150
about carrying them around in an icebox

108
00:06:19,619 --> 00:06:16,589
Jimmy go ahead all right we move on then

109
00:06:23,490 --> 00:06:19,629
now that we got the microphone hooked up

110
00:06:26,010 --> 00:06:23,500
properly we will move on to the head

111
00:06:28,800 --> 00:06:26,020
types of Ribbit's now here are some of

112
00:06:30,540 --> 00:06:28,810
the common head types that are used this

113
00:06:33,180 --> 00:06:30,550

is not to say that somebody else can

114
00:06:35,159 --> 00:06:33,190
have a one of their own because one of

115
00:06:39,290 --> 00:06:35,169
the things that you find as different

116
00:06:44,070 --> 00:06:39,300
manufacturers have their own ideas on

117
00:06:48,649 --> 00:06:44,080
how to manufacture fasteners and so it

118
00:06:55,439 --> 00:06:52,619
here is the the common ones of course or

119
00:06:58,529 --> 00:06:55,449
the countersunk or flesh head are and

120
00:07:02,790 --> 00:06:58,539
here is the flat that is used a lot now

121
00:07:04,860 --> 00:07:02,800
of course if on the planes that the jet

122
00:07:07,980 --> 00:07:04,870
planes normally have to have the flight

123
00:07:10,740 --> 00:07:07,990
ribbits some of the older ones I know we

124
00:07:14,159 --> 00:07:10,750
have a an old twin otter here I believe

125
00:07:16,709 --> 00:07:14,169
that has the button head or flat head

126
00:07:19,260 --> 00:07:16,719
rivets on it because it doesn't fly fast

127
00:07:21,860 --> 00:07:19,270
enough to for the Greg to be that much

128
00:07:25,980 --> 00:07:21,870
of a problem with the protruding rivets

129
00:07:29,879 --> 00:07:25,990
moving on to the solid rivets which are

130
00:07:35,149 --> 00:07:29,889
the ones usually used on skin

131
00:07:38,760 --> 00:07:35,159
construction on airplanes they're a

132
00:07:42,200 --> 00:07:38,770
little bit different from some of the

133
00:07:45,959 --> 00:07:42,210
others so we'll cover them separately

134
00:07:50,939 --> 00:07:45,969
here are the ones for construction and

135
00:07:53,790 --> 00:07:50,949
and that is almost a thing of the past

136
00:07:57,180 --> 00:07:53,800
using construction construction rivets

137
00:07:59,420 --> 00:07:57,190
because welding has pretty much replaced

138
00:08:03,930 --> 00:07:59,430

riveting in the construction industry

139
00:08:05,640 --> 00:08:03,940
but anyway for the construction type

140
00:08:08,220 --> 00:08:05,650
but they're usually larger diameters

141
00:08:10,770 --> 00:08:08,230
5/16 through two inches and are made of

142
00:08:13,560 --> 00:08:10,780
steel and they can't be installed coals

143
00:08:18,510 --> 00:08:13,570
so they have to be preheated about 1,800

144
00:08:23,610 --> 00:08:18,520
degrees now in the past all the bridges

145
00:08:26,790 --> 00:08:23,620
that you saw had riveted lattice bars on

146
00:08:30,810 --> 00:08:26,800
them in the old days you used four

147
00:08:33,990 --> 00:08:30,820
angles and lattice bars to make your

148
00:08:38,480 --> 00:08:34,000
main trust members for a through tres

149
00:08:41,149 --> 00:08:38,490
tape bridge and the portal bracing on

150
00:08:45,180 --> 00:08:41,159
across the top that's the part that

151
00:08:50,190 --> 00:08:45,190
holds the two trusses together as a unit

152
00:08:52,800 --> 00:08:50,200
was also riveted but on the newer

153
00:08:56,300 --> 00:08:52,810
designs they use welded girders for that

154
00:09:01,140 --> 00:08:56,310
so riveting is pretty much going out

155
00:09:03,240 --> 00:09:01,150
with the times because of the labor cost

156
00:09:06,300 --> 00:09:03,250
now if you're interested in construction

157
00:09:12,090 --> 00:09:06,310
rivets they're still in ASTM spec ASTM a

158
00:09:14,340 --> 00:09:12,100
502 covers construction rivets now for

159
00:09:17,660 --> 00:09:14,350
aerospace usage of course you're talking

160
00:09:22,890 --> 00:09:17,670
about small diameters here like 1/8

161
00:09:25,950 --> 00:09:22,900
through a quarter of an inch and if you

162
00:09:29,070 --> 00:09:25,960
remember on the drawings where you have

163
00:09:32,070 --> 00:09:29,080

the ad like an ad 5 or something like

164
00:09:33,780 --> 00:09:32,080
that called out with the little little X

165
00:09:36,120 --> 00:09:33,790
it has the ad on the left-hand corner

166
00:09:42,570 --> 00:09:36,130
and a 5 on the right-hand corner that is

167
00:09:47,700 --> 00:09:42,580
a 5/32 ribbon and so a big gribbit in

168
00:09:52,950 --> 00:09:47,710
the aerospace industry is 3/16 or 1/4

169
00:09:54,510 --> 00:09:52,960
you just use millions of them so and of

170
00:09:59,400 --> 00:09:54,520
course I had mentioned previously the

171
00:10:03,840 --> 00:09:59,410
2020 44 ice box rivet and so since you

172
00:10:06,240 --> 00:10:03,850
have to have both sides of a rivet

173
00:10:07,950 --> 00:10:06,250
accessible sometimes you run into

174
00:10:10,320 --> 00:10:07,960
problems trying to use solid rivets

175
00:10:12,750 --> 00:10:10,330
because you have to have a bucking bar

176
00:10:15,540 --> 00:10:12,760
on the manufactured head of the rivet

177
00:10:20,369 --> 00:10:15,550
and a pneumatic hammer on the other end

178
00:10:26,019 --> 00:10:23,199
so that brings up the subject of blind

179
00:10:27,729 --> 00:10:26,029
rivets blind rivets get their name from

180
00:10:31,030 --> 00:10:27,739
the fact that they can be installed from

181
00:10:34,299 --> 00:10:31,040
one side and in a lot of cases that's

182
00:10:37,030 --> 00:10:34,309
the only thing you can can install so

183
00:10:39,789 --> 00:10:37,040
they have this the following advantages

184
00:10:43,329 --> 00:10:39,799
over solid rivets there is only one

185
00:10:45,910 --> 00:10:43,339
Operator required the installation tool

186
00:10:48,579 --> 00:10:45,920
is portable it's comparable to an

187
00:10:51,100 --> 00:10:48,589
electric drill and size and you only

188
00:10:55,689 --> 00:10:51,110

need one one side available for the

189
00:10:58,569 --> 00:10:55,699
workpiece and you can use a variable

190
00:11:01,509 --> 00:10:58,579
grip length with a lot of them you can

191
00:11:05,859 --> 00:11:01,519
whereas with the solid rivets the grip

192
00:11:07,900 --> 00:11:05,869
length is very critical on them in order

193
00:11:10,179 --> 00:11:07,910
to head them you you can't go too long

194
00:11:15,150 --> 00:11:10,189
or too short that's the part the grip

195
00:11:18,009 --> 00:11:15,160
length is the part between sheets so

196
00:11:20,769 --> 00:11:18,019
with the blind rivet they're more

197
00:11:23,919 --> 00:11:20,779
adaptable the amount of pull that you

198
00:11:30,220 --> 00:11:23,929
put on them you can have some variation

199
00:11:32,379 --> 00:11:30,230
in the length of the shank itself the

200
00:11:35,350 --> 00:11:32,389
installation time is lot faster than for

201
00:11:37,809 --> 00:11:35,360
solid rivets the clamping force is more

202
00:11:40,780 --> 00:11:37,819
uniform because you're pulling it with a

203
00:11:43,470 --> 00:11:40,790
machine rather than two people looking

204
00:11:47,109 --> 00:11:43,480
at it and saying okay this is enough and

205
00:11:48,489 --> 00:11:47,119
you need less operator training OSHA

206
00:11:54,119 --> 00:11:48,499
likes them better because they don't

207
00:11:57,249 --> 00:11:54,129
make as much noise now getting into

208
00:12:00,609 --> 00:11:57,259
specific blind rivets here is one call

209
00:12:03,489 --> 00:12:00,619
it's a pole mandrel type operation and

210
00:12:06,759 --> 00:12:03,499
you just simply shove it in the hole

211
00:12:10,210 --> 00:12:06,769
from from the one side you have a

212
00:12:13,269 --> 00:12:10,220
serrated stem that you clamp on to with

213
00:12:15,460 --> 00:12:13,279

one part of the gun and the other the

214
00:12:17,049 --> 00:12:15,470
head of it pushes against here to hold

215
00:12:19,569 --> 00:12:17,059
it in place and then you just simply

216
00:12:23,919 --> 00:12:19,579
pull the stem through when the proper

217
00:12:27,460 --> 00:12:23,929
load is reached the stem is notched so

218
00:12:32,660 --> 00:12:27,470
that it breaks off leaving you a fairly

219
00:12:39,240 --> 00:12:36,570
now on a threaded stem rivet you have

220
00:12:43,410 --> 00:12:39,250
pretty much the same thing except that

221
00:12:47,250 --> 00:12:43,420
your stem is threaded and you thread it

222
00:12:51,030 --> 00:12:47,260
through and we have one of those and a

223
00:12:57,180 --> 00:12:51,040
couple of them in Figure 48 here are two

224
00:13:00,030 --> 00:12:57,190
different types that you're actually

225
00:13:03,480 --> 00:13:00,040
threading it through and you see the the

226
00:13:08,130 --> 00:13:03,490
the goal on this is to pull it up tight

227
00:13:12,240 --> 00:13:08,140
and form a shop head on this side by

228
00:13:16,200 --> 00:13:12,250
expanding the tubular type body of the

229
00:13:19,680 --> 00:13:16,210
rivet on in this case you are pulling

230
00:13:21,840 --> 00:13:19,690
the thing up by compressing here by

231
00:13:28,260 --> 00:13:21,850
pulling through by threading and you're

232
00:13:31,950 --> 00:13:28,270
holding the hex there here is a drive

233
00:13:34,380 --> 00:13:31,960
pin ribbit these are not used in the

234
00:13:36,360 --> 00:13:34,390
aerospace world or in the industrial

235
00:13:38,760 --> 00:13:36,370
world they're simple to install but

236
00:13:42,150 --> 00:13:38,770
you're not sure just how they're turning

237
00:13:44,130 --> 00:13:42,160
out because all you do is get them and

238
00:13:46,260 --> 00:13:44,140

stick them in a hole and take a hammer

239
00:13:48,660 --> 00:13:46,270
and pound that in and it expands it out

240
00:13:49,680 --> 00:13:48,670
on this side to form a head and if

241
00:13:51,450 --> 00:13:49,690
you're wanting to hold a couple pieces

242
00:13:55,020 --> 00:13:51,460
of sheet metal together in your shop

243
00:13:58,250 --> 00:13:55,030
that's fine but you don't trust them

244
00:14:01,110 --> 00:13:58,260
that far with the airplane installations

245
00:14:04,560 --> 00:14:01,120
here's another type of industrial rivet

246
00:14:08,280 --> 00:14:04,570
a full tubular rivet and which you're

247
00:14:13,050 --> 00:14:08,290
actually this has a hole in it you poke

248
00:14:15,950 --> 00:14:13,060
it through and pound it and flare this

249
00:14:19,800 --> 00:14:15,960
end out and form a head on that side

250
00:14:21,150 --> 00:14:19,810
it's a weaker rivet than some of the

251
00:14:23,340 --> 00:14:21,160
others because you see the wall

252
00:14:30,060 --> 00:14:23,350
thickness right in there is not not that

253
00:14:32,190 --> 00:14:30,070
much the semi tubular rivet is pretty

254
00:14:34,110 --> 00:14:32,200
much the same thing except the hole is

255
00:14:37,950 --> 00:14:34,120
not drilled in as far so you get more

256
00:14:40,020 --> 00:14:37,960
solid shank in the hole which makes it a

257
00:14:42,180 --> 00:14:40,030
little bit better now with all of these

258
00:14:43,620 --> 00:14:42,190
one of the things you have to keep in

259
00:14:48,629 --> 00:14:43,630
mind is they have to be done

260
00:14:51,960 --> 00:14:48,639
pull so ductility goes up strength goes

261
00:14:54,059 --> 00:14:51,970
down so this this rivet is not a very

262
00:14:56,189 --> 00:14:54,069
strong rivet because if you made it very

263
00:15:00,420 --> 00:14:56,199

strong then it would crack when you form

264
00:15:04,530 --> 00:15:00,430
the head on it the the metal piercing

265
00:15:09,540 --> 00:15:04,540
rivet is you actually grab it into the

266
00:15:12,269 --> 00:15:09,550
second sheet and so so that one flares

267
00:15:16,100 --> 00:15:12,279
out and creates a head like this on up

268
00:15:21,720 --> 00:15:19,559
this one is okay for sheet metal

269
00:15:25,019 --> 00:15:21,730
installations that type of thing but it

270
00:15:31,370 --> 00:15:25,029
is not considered a structural type

271
00:15:34,410 --> 00:15:31,380
rivet either and here's here's one that

272
00:15:37,559 --> 00:15:34,420
goes back aways these have been around a

273
00:15:39,509 --> 00:15:37,569
long time the old farmers use these to

274
00:15:42,650 --> 00:15:39,519
repair harness and things of this nature

275
00:15:45,090 --> 00:15:42,660
this is the split copper rivet and

276
00:15:47,639 --> 00:15:45,100
although I couldn't find a picture of

277
00:15:49,110 --> 00:15:47,649
the holder there's a little wire holder

278
00:15:51,660 --> 00:15:49,120
that you put these in so that you don't

279
00:15:54,300 --> 00:15:51,670
pound your hands with them and all you

280
00:15:57,269 --> 00:15:54,310
do is lay the two pieces of leather down

281
00:15:59,100 --> 00:15:57,279
and these things are fairly sharp on the

282
00:16:01,319 --> 00:15:59,110
points and take a hammer and pound the

283
00:16:04,319 --> 00:16:01,329
thing through the leather and once you

284
00:16:06,210 --> 00:16:04,329
get it through then you get it spread

285
00:16:08,160 --> 00:16:06,220
here and go ahead and pound a little

286
00:16:11,550 --> 00:16:08,170
more and you clinch it and it holds

287
00:16:15,660 --> 00:16:11,560
quite well on harness straps things of

288
00:16:20,300 --> 00:16:15,670

that nature now here is everybody's

289
00:16:23,129 --> 00:16:20,310
favorite for home use the pop rivet and

290
00:16:24,840 --> 00:16:23,139
just to satisfy the people from Black

291
00:16:26,509 --> 00:16:24,850
and Decker who wrote a nasty letter

292
00:16:29,819 --> 00:16:26,519
about the fact that I hadn't changed

293
00:16:31,650 --> 00:16:29,829
their name over to the association with

294
00:16:35,819 --> 00:16:31,660
this because it used to be United shoe

295
00:16:39,410 --> 00:16:35,829
that owned the company pop rivets our

296
00:16:43,319 --> 00:16:39,420
blind rivets used for home repairs and

297
00:16:45,629 --> 00:16:43,329
we mentioned earlier about the repairing

298
00:16:48,179 --> 00:16:45,639
fenders of cars with duct tape that that

299
00:16:50,970 --> 00:16:48,189
was a non structural type repair pop

300
00:16:53,819 --> 00:16:50,980
rivets worked better because they have a

301
00:16:56,970 --> 00:16:53,829
nail type stem which is gripped by a

302
00:16:59,340 --> 00:16:56,980
handheld gun and you drill a hole

303
00:17:02,250 --> 00:16:59,350
thing in pull it through with the stem

304
00:17:05,309 --> 00:17:02,260
then the stem breaks off sometimes it

305
00:17:06,900 --> 00:17:05,319
falls out all together and then you put

306
00:17:08,760 --> 00:17:06,910
bondo over these to keep them from

307
00:17:11,400 --> 00:17:08,770
rusting and sand them down and you got a

308
00:17:14,159 --> 00:17:11,410
good repair job but they're they're not

309
00:17:16,799 --> 00:17:14,169
a structural type that you would use on

310
00:17:18,720 --> 00:17:16,809
an airplane here's an example of the

311
00:17:20,429 --> 00:17:18,730
installation of a pop rivet where you

312
00:17:23,250 --> 00:17:20,439
start out by poking the thing through

313
00:17:25,650 --> 00:17:23,260

and this is bulb back here and so you

314
00:17:30,990 --> 00:17:25,660
pull it through and expand it back here

315
00:17:32,430 --> 00:17:31,000
and you have yourself a decent rivet to

316
00:17:35,610 --> 00:17:32,440
hold a couple of pieces of sheet metal

317
00:17:37,380 --> 00:17:35,620
together one of the things with these

318
00:17:42,000 --> 00:17:37,390
that you've got to watch about though if

319
00:17:44,010 --> 00:17:42,010
you are repairing aluminum gutters or

320
00:17:46,590 --> 00:17:44,020
something that nature make sure that you

321
00:17:48,060 --> 00:17:46,600
use the aluminum rivets rather than the

322
00:17:49,799 --> 00:17:48,070
steel because then you get into the

323
00:17:52,049 --> 00:17:49,809
galvanic corrosion problem and I

324
00:17:53,970 --> 00:17:52,059
mentioned earlier you use steel rivets

325
00:17:57,870 --> 00:17:53,980
there rest up like crazy in the aluminum

326
00:18:00,120 --> 00:17:57,880
because of the galvanic corrosion so and

327
00:18:02,700 --> 00:18:00,130
they do make aluminum pop rivets that

328
00:18:08,270 --> 00:18:02,710
you can use on aluminum and the others

329
00:18:12,510 --> 00:18:08,280
for steel now here's one that is a used

330
00:18:16,049 --> 00:18:12,520
some in the I believe in the aerospace

331
00:18:18,690 --> 00:18:16,059
world for secondary type structures it's

332
00:18:20,100 --> 00:18:18,700
a rib nut made as far as I know it's

333
00:18:23,310 --> 00:18:20,110
still made the BF Goodrich

334
00:18:25,680 --> 00:18:23,320
it's a tubular rivet with internal

335
00:18:29,730 --> 00:18:25,690
threads and you deform it in place to

336
00:18:33,419 --> 00:18:29,740
kind of form a nut plate and if you look

337
00:18:36,810 --> 00:18:33,429
at the next picture of one I think it

338
00:18:43,460 --> 00:18:36,820

will show how you do it see it's it's

339
00:18:46,710 --> 00:18:43,470
actually a a bolt if you will with a

340
00:18:49,760 --> 00:18:46,720
threaded piece here you stick the thing

341
00:18:54,270 --> 00:18:49,770
through a hole then you hold it up here

342
00:18:57,650 --> 00:18:54,280
while you twist the threaded part of it

343
00:19:05,180 --> 00:18:57,660
and actually pull this up and deform it

344
00:19:08,130 --> 00:19:05,190
to where you get a installed nut plate

345
00:19:09,720 --> 00:19:08,140
which then you can use to install

346
00:19:13,320 --> 00:19:09,730
fasteners in

347
00:19:17,520 --> 00:19:13,330
and those have been around for several

348
00:19:20,010 --> 00:19:17,530
years and we haven't used them around

349
00:19:21,480 --> 00:19:20,020
here but they are used some by people in

350
00:19:28,290 --> 00:19:21,490
the industrial and I believe on

351
00:19:36,150 --> 00:19:28,300
secondary aerospace structures okay for

352
00:19:38,100 --> 00:19:36,160
the now for the the ad and DD rivets we

353
00:19:40,140 --> 00:19:38,110
mentioned those earlier the fact that

354
00:19:43,650 --> 00:19:40,150
those are the most common ones the most

355
00:19:46,740 --> 00:19:43,660
preferred ones and one of the things

356
00:19:48,270 --> 00:19:46,750
that I wanted to point out on this that

357
00:19:54,240 --> 00:19:48,280
was called to my attention by one of the

358
00:19:58,260 --> 00:19:54,250
guys from Lockheed Martin is that they

359
00:20:01,350 --> 00:19:58,270
had had some problems on using rivets

360
00:20:07,040 --> 00:20:01,360
that were not exactly the same material

361
00:20:11,100 --> 00:20:07,050
as the skin because when you think of it

362
00:20:15,480 --> 00:20:11,110
at 45,000 feet you have about minus

363
00:20:18,270 --> 00:20:15,490

sixty-five temperature and on the runway

364
00:20:22,530 --> 00:20:18,280
out in Phoenix you have about a hundred

365
00:20:26,990 --> 00:20:22,540
and forty degrees on the skin so you

366
00:20:32,700 --> 00:20:27,000
need to have rivets and skin that are

367
00:20:36,600 --> 00:20:32,710
very close metallurgically in order to

368
00:20:38,340 --> 00:20:36,610
prevent differential thermal loads and

369
00:20:41,820 --> 00:20:38,350
they had had some trouble and had to

370
00:20:44,430 --> 00:20:41,830
change to fasteners that were exactly

371
00:20:48,720 --> 00:20:44,440
the same material as the skin in order

372
00:20:52,170 --> 00:20:48,730
to get away from that the and the ice

373
00:20:54,150 --> 00:20:52,180
box rivets I mentioned earlier are have

374
00:20:56,790 --> 00:20:54,160
to be installed at zero degrees which

375
00:20:58,860 --> 00:20:56,800
makes them not very popular the other

376
00:21:03,350 --> 00:20:58,870
thing too you run into a problem with

377
00:21:06,630 --> 00:21:03,360
them if you don't use a batch of them

378
00:21:08,370 --> 00:21:06,640
you have to take them back if they've

379
00:21:11,870 --> 00:21:08,380
been exposed to room temperature for

380
00:21:15,750 --> 00:21:11,880
very long you have to take them back and

381
00:21:17,610 --> 00:21:15,760
reheat treat them before and then cool

382
00:21:20,340 --> 00:21:17,620
them down again before you can use them

383
00:21:22,140 --> 00:21:20,350
so sometimes they've had trouble with

384
00:21:23,370 --> 00:21:22,150
people short cutting things and oh well

385
00:21:24,900 --> 00:21:23,380
they weren't out that long

386
00:21:26,520 --> 00:21:24,910
so therefore we'll just go ahead and

387
00:21:29,910 --> 00:21:26,530
reuse them and then they get rid of

388
00:21:32,610 --> 00:21:29,920

cracking so so they're very hard to

389
00:21:33,990 --> 00:21:32,620
control to make sure that you get a good

390
00:21:37,050 --> 00:21:34,000
heading operation on them

391
00:21:38,760 --> 00:21:37,060
the 50:56 I mentioned is stress

392
00:21:42,660 --> 00:21:38,770
corrosion sensitive and all materials

393
00:21:45,930 --> 00:21:42,670
except magnesium and now here's one of

394
00:21:48,660 --> 00:21:45,940
the things too that is very important

395
00:21:51,240 --> 00:21:48,670
solid rivets are expanded to an

396
00:21:55,620 --> 00:21:51,250
interference fit so they should not be

397
00:21:58,590 --> 00:21:55,630
used in composite materials because the

398
00:22:00,020 --> 00:21:58,600
the hoop tension in the hole in a

399
00:22:03,300 --> 00:22:00,030
composite material can cause

400
00:22:07,800 --> 00:22:03,310
delamination of the material surfaces so

401
00:22:10,440 --> 00:22:07,810
you should use a tight fit but non

402
00:22:19,590 --> 00:22:10,450
expanding type rivet in composite

403
00:22:21,870 --> 00:22:19,600
materials I had mentioned Mennella

404
00:22:24,540 --> 00:22:21,880
rivets earlier

405
00:22:28,440 --> 00:22:24,550
manal of course is 67 percent nickel and

406
00:22:30,540 --> 00:22:28,450
30% copper it is stronger has a shear

407
00:22:32,760 --> 00:22:30,550
element of 49 ksi and more heat

408
00:22:35,610 --> 00:22:32,770
resistant than aluminum and yet it's

409
00:22:38,250 --> 00:22:35,620
ductile enough to cold form without

410
00:22:40,530 --> 00:22:38,260
cracking and they're used for joining a

411
00:22:42,930 --> 00:22:40,540
stainless steel titanium and in canals

412
00:22:45,240 --> 00:22:42,940
but it shouldn't be used for joining the

413
00:22:49,440 --> 00:22:45,250

aluminum because it is way down in the

414
00:22:51,540 --> 00:22:49,450
galvanic series compared to aluminum and

415
00:22:54,330 --> 00:22:51,550
it also of course would have different

416
00:22:56,820 --> 00:22:54,340
thermal expansion properties the

417
00:23:01,200 --> 00:22:56,830
titanium columbium rivets this is a

418
00:23:03,570 --> 00:23:01,210
hybrid one that is there well they

419
00:23:07,290 --> 00:23:03,580
actually have have two types there's one

420
00:23:09,870 --> 00:23:07,300
that they actually join two pieces

421
00:23:12,500 --> 00:23:09,880
together I guess and this one is just

422
00:23:15,930 --> 00:23:12,510
the the one that is part columbium and

423
00:23:17,760 --> 00:23:15,940
they have a shear strength of 50 ksi but

424
00:23:20,270 --> 00:23:17,770
they can be formed room temperature and

425
00:23:22,410 --> 00:23:20,280
they're used for joining titanium and

426
00:23:24,660 --> 00:23:22,420
aluminum because they they have enough

427
00:23:27,480 --> 00:23:24,670
columbium in them to make them

428
00:23:29,130 --> 00:23:27,490
compatible with aluminum and they

429
00:23:32,430 --> 00:23:29,140
generally don't need to have the

430
00:23:34,350 --> 00:23:32,440
corrosion protection on them except for

431
00:23:35,520 --> 00:23:34,360
sealing in the hollow when you install

432
00:23:41,460 --> 00:23:35,530
the rivet

433
00:23:44,520 --> 00:23:41,470
now here is the table we showed earlier

434
00:23:49,830 --> 00:23:44,530
on this so I won't go through it again

435
00:23:52,110 --> 00:23:49,840
but just to let you know that these

436
00:23:56,400 --> 00:23:52,120
these two are the ones you concentrate

437
00:23:57,900 --> 00:23:56,410
the most on in the aircraft world now

438
00:23:59,280 --> 00:23:57,910

here here's the cherry buck ribbit

439
00:24:04,920 --> 00:23:59,290
that's the one I was thinking of it

440
00:24:12,500 --> 00:24:04,930
actually has a friction welded piece of

441
00:24:17,460 --> 00:24:12,510
soft titanium on it so that when you

442
00:24:20,100 --> 00:24:17,470
form it that most of the harder stuff is

443
00:24:24,420 --> 00:24:20,110
in the hole so you only have a little

444
00:24:27,830 --> 00:24:24,430
bit of the softer material in the hole

445
00:24:30,600 --> 00:24:27,840
so you get a higher overall strength

446
00:24:34,490 --> 00:24:30,610
because this one has a shear strength up

447
00:24:38,310 --> 00:24:34,500
to almost 95 ksi which is excellent and

448
00:24:40,860 --> 00:24:38,320
they can be used up to 600 degrees and

449
00:24:48,150 --> 00:24:40,870
they're available in both flesh and

450
00:24:51,870 --> 00:24:48,160
protruding heads now cherry rivets are a

451
00:24:54,660 --> 00:24:51,880
very popular one in fact they're almost

452
00:24:55,980 --> 00:24:54,670
a generic although all fast and some of

453
00:24:57,660 --> 00:24:55,990
the others would not want me to say that

454
00:25:02,880 --> 00:24:57,670
about it since they make competing

455
00:25:06,600 --> 00:25:02,890
rivets but cherry rivet is a blind rivet

456
00:25:09,480 --> 00:25:06,610
with a locking collar and you have a

457
00:25:11,730 --> 00:25:09,490
pull stem on it but it is a better

458
00:25:15,780 --> 00:25:11,740
structural rivet because they have

459
00:25:19,260 --> 00:25:15,790
better materials in it then then say a

460
00:25:22,110 --> 00:25:19,270
pop rivet would have they're also

461
00:25:27,420 --> 00:25:22,120
available in oversized diameters where

462
00:25:29,370 --> 00:25:27,430
if you have if you have to replace a

463
00:25:31,620 --> 00:25:29,380

rivet of course when you drill the hole

464
00:25:34,260 --> 00:25:31,630
drill the old rivet out then you have to

465
00:25:36,570 --> 00:25:34,270
ream the hole to get it prepared better

466
00:25:38,870 --> 00:25:36,580
and that takes enough material off of it

467
00:25:42,450 --> 00:25:38,880
that you can't get an interference fit

468
00:25:45,780 --> 00:25:42,460
so you have to use an oversized rivet so

469
00:25:47,400 --> 00:25:45,790
they make specific oversized rivets and

470
00:25:48,509 --> 00:25:47,410
given sizes I forget know how many

471
00:25:52,229 --> 00:25:48,519
thousands they are over

472
00:25:54,959 --> 00:25:52,239
sighs but they they will fit a reworked

473
00:25:58,889 --> 00:25:54,969
poll they have shear strengths

474
00:26:02,789 --> 00:25:58,899
comparable to the the ad solid aluminum

475
00:26:05,039 --> 00:26:02,799
rivets and they're used a lot on

476
00:26:07,859 --> 00:26:05,049
secondary structures but they're not

477
00:26:10,859 --> 00:26:07,869
used on primary structure you normally

478
00:26:15,089 --> 00:26:10,869
use the solid rivets on primary

479
00:26:18,089 --> 00:26:15,099
structure in an airplane now note that

480
00:26:19,859 --> 00:26:18,099
all of these blind rivets along with cut

481
00:26:21,690 --> 00:26:19,869
can all fast is restricted by the

482
00:26:24,709 --> 00:26:21,700
guidelines here's an EM aspect that

483
00:26:27,060 --> 00:26:24,719
tells you how you should use them and

484
00:26:31,769 --> 00:26:27,070
there's the statement also about the

485
00:26:36,209 --> 00:26:31,779
secondary structures versus primary here

486
00:26:38,669 --> 00:26:36,219
is the part of a installation in which

487
00:26:40,589 --> 00:26:38,679
you have the gun here that holds the

488
00:26:43,049 --> 00:26:40,599

head in place then you start the process

489
00:26:47,609 --> 00:26:43,059
of pulling the stand through to expand

490
00:26:50,310 --> 00:26:47,619
it if you go on to the next figure you

491
00:26:52,560 --> 00:26:50,320
have the completed installation there's

492
00:26:55,349 --> 00:26:52,570
a little locking collar this is the part

493
00:26:58,229 --> 00:26:55,359
that's shown in black tier that comes in

494
00:27:00,869 --> 00:26:58,239
and is pushed in around the shank after

495
00:27:04,259 --> 00:27:00,879
you have broken it off which gives you a

496
00:27:12,829 --> 00:27:04,269
good seal on it to make sure that the

497
00:27:17,639 --> 00:27:12,839
stem stays in place on it now here is a

498
00:27:21,469 --> 00:27:17,649
table of cherry rivet materials and

499
00:27:24,989 --> 00:27:21,479
notice that the the stem and the sleeve

500
00:27:28,319 --> 00:27:24,999
are not different materials because the

501
00:27:30,690 --> 00:27:28,329
stem has to be strong to pull through

502
00:27:32,789 --> 00:27:30,700
and deform the sleeve the sleeve has to

503
00:27:36,029 --> 00:27:32,799
be ductile enough to farm without

504
00:27:38,159 --> 00:27:36,039
cracking so you have so so the strength

505
00:27:40,829 --> 00:27:38,169
of the rivet is a combination of those

506
00:27:43,409 --> 00:27:40,839
two materials so like here if you have

507
00:27:45,989 --> 00:27:43,419
the 5055 a looming it with alloy steel

508
00:27:49,680 --> 00:27:45,999
minal with stainless steel and here's

509
00:27:53,909 --> 00:27:49,690
inconel 600 with an Inc and LX 750 pull

510
00:27:57,680 --> 00:27:53,919
stem on it and look at the you can kick

511
00:28:04,690 --> 00:27:57,690
the temperature way up by going to the

512
00:28:11,090 --> 00:28:07,400
now Huck is also one of the big

513
00:28:14,450 --> 00:28:11,100

suppliers of rivets there's are similar

514
00:28:17,990 --> 00:28:14,460
to cherry in fact if you look in mill

515
00:28:21,500 --> 00:28:18,000
handbook five for rivet allowables there

516
00:28:24,410 --> 00:28:21,510
are a lot of men there and I know on in

517
00:28:28,430 --> 00:28:24,420
our fastener Task Group one of the

518
00:28:30,650 --> 00:28:28,440
things we have argued and fought over

519
00:28:31,790 --> 00:28:30,660
there is trying to come up with

520
00:28:34,430 --> 00:28:31,800
allowables

521
00:28:38,570 --> 00:28:34,440
that will include all of these

522
00:28:40,400 --> 00:28:38,580
manufacturers under one heading so that

523
00:28:42,800 --> 00:28:40,410
we won't have trouble with somebody

524
00:28:46,100 --> 00:28:42,810
saying hi and you're favoring our

525
00:28:48,110 --> 00:28:46,110
company versus company X and so on so

526
00:28:50,570 --> 00:28:48,120
you have to come up with a generic table

527
00:28:53,360 --> 00:28:50,580
to give allowables for this type of

528
00:28:58,970 --> 00:28:53,370
ribbon so that it uncover Huck and

529
00:29:00,440 --> 00:28:58,980
cherry and all fast now move on to the

530
00:29:02,600 --> 00:29:00,450
next figure and we'll look at a standard

531
00:29:04,370 --> 00:29:02,610
Huck gribbit to see this is this is

532
00:29:07,040 --> 00:29:04,380
pretty much similar the other one except

533
00:29:10,100 --> 00:29:07,050
and in this case you're compressing the

534
00:29:12,500 --> 00:29:10,110
sleeve a little bit this way but the the

535
00:29:16,400 --> 00:29:12,510
principle is still the same you have a

536
00:29:18,590 --> 00:29:16,410
locking collar you have a serrated pin

537
00:29:20,270 --> 00:29:18,600
that you pull through and then when

538
00:29:23,270 --> 00:29:20,280

after you pulled it through it's not

539
00:29:25,310 --> 00:29:23,280
chair so that it breaks off and you have

540
00:29:31,630 --> 00:29:25,320
the complete completed rivet

541
00:29:38,320 --> 00:29:36,260
now the here is a Huck Clint rivet which

542
00:29:43,810 --> 00:29:38,330
is a little bit different it has a

543
00:29:46,340 --> 00:29:43,820
separate sleeve here that compresses

544
00:29:49,460 --> 00:29:46,350
inside when you pull the thing through

545
00:29:52,130 --> 00:29:49,470
and kind of gives you a seal on it that

546
00:29:54,769 --> 00:29:52,140
one I'm not sure how widely used it is

547
00:29:56,899 --> 00:29:54,779
by the aerospace companies I did not get

548
00:30:01,130 --> 00:29:56,909
a benchmark on it from any of the

549
00:30:04,760 --> 00:30:01,140
companies prior to this course now all

550
00:30:11,690 --> 00:30:04,770
fast makes several types both solid and

551
00:30:16,760 --> 00:30:11,700
blind and their wire draw rivet has a

552
00:30:19,850 --> 00:30:16,770
tapered stem bulb and so that it expands

553
00:30:23,389 --> 00:30:19,860
the tubular body which is a little bit

554
00:30:27,919 --> 00:30:23,399
different than the the regular cherry

555
00:30:31,480 --> 00:30:27,929
and Huck so you see this one I guess it

556
00:30:35,720 --> 00:30:31,490
shows up better over here this is

557
00:30:38,389 --> 00:30:35,730
actually tapered so that it it pulls

558
00:30:40,669 --> 00:30:38,399
through and keeps expanding as the

559
00:30:45,649 --> 00:30:40,679
poster whereas the other one was a solid

560
00:30:47,870 --> 00:30:45,659
tape but the the final installation

561
00:30:49,909 --> 00:30:47,880
there is the same because you wind up

562
00:30:52,039 --> 00:30:49,919
with a the thing pulled through to

563
00:30:57,380 --> 00:30:52,049

expand it and then you have the locking

564
00:31:02,899 --> 00:30:57,390
collar around the stem at just inboard

565
00:31:09,110 --> 00:31:02,909
of where it broke now high shear makes

566
00:31:12,409 --> 00:31:09,120
other types of rivets and one of the

567
00:31:17,269 --> 00:31:12,419
ones that they make is a high-strength

568
00:31:22,310 --> 00:31:17,279
stem with a swage collar that you put on

569
00:31:24,740 --> 00:31:22,320
it and over and this one if the collar

570
00:31:27,260 --> 00:31:24,750
is size such that you can look at it

571
00:31:29,389 --> 00:31:27,270
from the outside and inspect it to tell

572
00:31:32,990 --> 00:31:29,399
whether it was installed properly so if

573
00:31:37,130 --> 00:31:33,000
you turn to figure 61 this is a high

574
00:31:42,460 --> 00:31:37,140
shear installation this is usually a 20

575
00:31:44,840 --> 00:31:42,470
20 44 collar and you just pull the thing

576
00:31:47,210 --> 00:31:44,850
through Suede's it on here

577
00:31:49,460 --> 00:31:47,220
and the way that it's wages on you can

578
00:31:51,980 --> 00:31:49,470
look around the top of it here and see

579
00:31:55,070 --> 00:31:51,990
whether it was farmed properly so that

580
00:31:59,870 --> 00:31:55,080
it can be inspected from that side now

581
00:32:03,290 --> 00:31:59,880
this is not a an expanding rivet that's

582
00:32:08,870 --> 00:32:03,300
the difference this one these are used a

583
00:32:12,470 --> 00:32:08,880
lot for installing brackets that are

584
00:32:15,830 --> 00:32:12,480
structural type things to heavy frames

585
00:32:20,660 --> 00:32:15,840
and so on in planes where you want a

586
00:32:24,110 --> 00:32:20,670
real good fastener but you'd rather not

587
00:32:26,210 --> 00:32:24,120
use bolts and nuts because you can get a

588
00:32:27,920 --> 00:32:26,220

these these would be installed in a

589
00:32:36,560 --> 00:32:27,930
drilled and reading hole so it would

590
00:32:40,820 --> 00:32:36,570
give you a tighter tolerance on now lock

591
00:32:44,200 --> 00:32:40,830
bolts are also commonly used and they

592
00:32:46,670 --> 00:32:44,210
are a non expanding high-strength

593
00:32:49,510 --> 00:32:46,680
fastener that has either a suede scholar

594
00:32:53,840 --> 00:32:49,520
a threaded Collard to lock them in place

595
00:32:55,490 --> 00:32:53,850
it's a variation of the high fear that I

596
00:32:57,800 --> 00:32:55,500
just showed you they're accepted in this

597
00:33:02,420 --> 00:32:57,810
case you normally have a have a stem

598
00:33:05,510 --> 00:33:02,430
that you compress the collar on a lock

599
00:33:08,150 --> 00:33:05,520
bolt is similar to a rivet in one

600
00:33:11,540 --> 00:33:08,160
respect it's hard to remove once you

601
00:33:13,370 --> 00:33:11,550
install it and it's not very strong in

602
00:33:15,800 --> 00:33:13,380
tension because once again it's a

603
00:33:19,400 --> 00:33:15,810
metallurgical balancing act you want the

604
00:33:21,890 --> 00:33:19,410
collar to farm but on the other hand it

605
00:33:23,960 --> 00:33:21,900
can't crack so it can't be nearly as

606
00:33:26,390 --> 00:33:23,970
strong as the shank so what you have is

607
00:33:30,320 --> 00:33:26,400
a fastener which is very strong and

608
00:33:31,940 --> 00:33:30,330
shear but is weak in tension so normally

609
00:33:38,210 --> 00:33:31,950
you try to design them such that they're

610
00:33:41,840 --> 00:33:38,220
not in tension now they're difficult to

611
00:33:47,480 --> 00:33:41,850
inspect so if it's something that you

612
00:33:50,450 --> 00:33:47,490
need to have a more positive lock on you

613
00:33:55,310 --> 00:33:50,460

should look for a bolt nut assembly but

614
00:33:58,730 --> 00:33:55,320
they're fast in style and on the next

615
00:34:04,419 --> 00:33:58,740
page is one type of lock bolt this is a

616
00:34:08,540 --> 00:34:04,429
Joe Bolt and what you have here the

617
00:34:12,080 --> 00:34:08,550
locking sleeve their collar is expanded

618
00:34:16,310 --> 00:34:12,090
to form a shop head because you're

619
00:34:18,980 --> 00:34:16,320
rotating the stem in a gun and holding

620
00:34:22,490 --> 00:34:18,990
the hex head in place so you're running

621
00:34:26,240 --> 00:34:22,500
this through a threaded year to expand

622
00:34:28,790 --> 00:34:26,250
the sleeve to form a head then the the

623
00:34:36,860 --> 00:34:28,800
stem is not so that when you reach the

624
00:34:43,910 --> 00:34:42,110
now the the Huck bolt is a one with the

625
00:34:50,530 --> 00:34:43,920
serrations on the shank rather than

626
00:34:56,450 --> 00:34:54,020
the one thing about them since you don't

627
00:34:58,670 --> 00:34:56,460
have threads they can't back off because

628
00:35:00,290 --> 00:34:58,680
you just have straight serrations so

629
00:35:01,910 --> 00:35:00,300
they're used a lot in the trucking

630
00:35:04,250 --> 00:35:01,920
industry for putting truck bodies

631
00:35:06,980 --> 00:35:04,260
together because they're available in

632
00:35:09,980 --> 00:35:06,990
fairly large diameters you can get up up

633
00:35:12,320 --> 00:35:09,990
to about a half inch diameter on them

634
00:35:13,940 --> 00:35:12,330
and of course they're very good in

635
00:35:17,600 --> 00:35:13,950
fatigue because once you put them

636
00:35:21,260 --> 00:35:17,610
together and clamp the collar on they

637
00:35:23,990 --> 00:35:21,270
can't come loose very well unless the

638
00:35:25,910 --> 00:35:24,000

collar would actually break and they're

639
00:35:28,460 --> 00:35:25,920
available in carbon steel stainless

640
00:35:32,450 --> 00:35:28,470
steel and aluminum and on the next page

641
00:35:37,070 --> 00:35:32,460
is Huck bolt installed and you see what

642
00:35:39,640 --> 00:35:37,080
what they have is a notched stem you

643
00:35:43,910 --> 00:35:39,650
pull the thing in place

644
00:35:46,550 --> 00:35:43,920
there's your unser rated shank that you

645
00:35:48,560 --> 00:35:46,560
put in the joint and then it breaks off

646
00:35:55,880 --> 00:35:48,570
once the thing is that the collar is

647
00:35:59,170 --> 00:35:55,890
switched in place now high fear makes a

648
00:36:02,480 --> 00:35:59,180
high lock which is a similar one and

649
00:36:06,050 --> 00:36:02,490
it's it has to be fed through a hole

650
00:36:08,750 --> 00:36:06,060
from the fire side and held with a key

651
00:36:11,180 --> 00:36:08,760
to prevent rotation while the about is

652
00:36:13,010 --> 00:36:11,190
being torqued with a tool then the outer

653
00:36:17,300 --> 00:36:13,020
portion of the nut breaks off on this

654
00:36:21,530 --> 00:36:17,310
one now the high locks are available in

655
00:36:24,680 --> 00:36:21,540
super high strength materials the alloy

656
00:36:28,070 --> 00:36:24,690
steel h-11 tool steel stainless steel

657
00:36:29,300 --> 00:36:28,080
and titanium now one of the things I

658
00:36:31,760 --> 00:36:29,310
wanted to call your attention here

659
00:36:35,390 --> 00:36:31,770
though the h-11 tool steel which has

660
00:36:38,420 --> 00:36:35,400
been used in the past by SPS for a lot

661
00:36:40,520 --> 00:36:38,430
of their super high strength bolts it is

662
00:36:42,950 --> 00:36:40,530
stress corrosion sensitive and some of

663
00:36:46,190 --> 00:36:42,960

the companies have kind of backed off on

664
00:36:47,750 --> 00:36:46,200
using it or using it in the real

665
00:36:50,360 --> 00:36:47,760
high-strength see this hundred and

666
00:36:55,000 --> 00:36:50,370
fifty-six ksi here that is

667
00:36:57,980 --> 00:36:55,010
if you that's about a 260 heat-treat

668
00:37:00,830 --> 00:36:57,990
bolt so the elongation gets pretty low

669
00:37:05,060 --> 00:37:00,840
on it and if it's stress corrosion

670
00:37:07,370 --> 00:37:05,070
sensitive then you have to really do a

671
00:37:08,660 --> 00:37:07,380
good job of protecting it in order to

672
00:37:14,170 --> 00:37:08,670
assure yourself you're not gonna have

673
00:37:18,290 --> 00:37:14,180
some problems now here is a high lock

674
00:37:22,010 --> 00:37:18,300
installation now this is threaded on so

675
00:37:25,100 --> 00:37:22,020
the the threaded diameter is a little

676
00:37:28,340 --> 00:37:25,110
bit smaller here so that you can slide

677
00:37:32,030 --> 00:37:28,350
it through from the backside without

678
00:37:37,490 --> 00:37:32,040
screwing up the threads then you hold it

679
00:37:40,100 --> 00:37:37,500
it has a internal hex in it so you put a

680
00:37:42,770 --> 00:37:40,110
key in it with the gun to hold it in

681
00:37:44,540 --> 00:37:42,780
place then tighten it down the outer

682
00:37:46,820 --> 00:37:44,550
part of the nut that you're talking with

683
00:37:54,080 --> 00:37:46,830
breaks off when you reach the proper

684
00:37:56,990 --> 00:37:54,090
torque now here is an unusual one the

685
00:37:59,000 --> 00:37:57,000
Hyatt Teague is a high lock which is

686
00:38:02,350 --> 00:37:59,010
actually driven into an interference fit

687
00:38:05,330 --> 00:38:02,360
hole before the color is installed and

688
00:38:07,060 --> 00:38:05,340

of course because you have the threads

689
00:38:10,640 --> 00:38:07,070
are slightly smaller you can do this

690
00:38:15,590 --> 00:38:10,650
then of course the interference fit

691
00:38:18,050 --> 00:38:15,600
increases the fatigue resistance and it

692
00:38:21,830 --> 00:38:18,060
actually will hold it in place while you

693
00:38:32,599 --> 00:38:21,840
are tightening it down and I don't have

694
00:38:46,049 --> 00:38:39,690
the taper lock is made by SPS and it has

695
00:38:48,240 --> 00:38:46,059
a threaded stem tapered shank and it's

696
00:38:52,500 --> 00:38:48,250
installed with an interference fit in a

697
00:38:55,349 --> 00:38:52,510
drilled and reamed hold now the tapered

698
00:38:58,620 --> 00:38:55,359
shank is that's only a 1 and don't ask

699
00:39:02,730 --> 00:38:58,630
me how this becomes a critical thing

700
00:39:06,150 --> 00:39:02,740
it's a 1.19 degree taper that has on the

701
00:39:07,589 --> 00:39:06,160
sides and you lubricate the shank so you

702
00:39:09,720 --> 00:39:07,599
don't have to do anything as the hole

703
00:39:12,049 --> 00:39:09,730
you just drive the thing in but this

704
00:39:15,380 --> 00:39:12,059
interference fit keeps it from rotating

705
00:39:18,059 --> 00:39:15,390
while the lock nut with a captive washer

706
00:39:24,049 --> 00:39:18,069
attached to it is installed and there is

707
00:39:33,180 --> 00:39:30,540
so you have this is kind of showing this

708
00:39:35,640 --> 00:39:33,190
way although it in reality it isn't in

709
00:39:37,859 --> 00:39:35,650
in steps that much you would not be able

710
00:39:40,890 --> 00:39:37,869
to see the steps on it do that slight

711
00:39:43,890 --> 00:39:40,900
angle but then you install it with this

712
00:39:45,750 --> 00:39:43,900
this nut on it and you can sense it's

713
00:39:52,289 --> 00:39:45,760

driven in place if the friction will

714
00:39:58,480 --> 00:39:55,089
now next here is an eddy bolt and

715
00:40:00,039 --> 00:39:58,490
they're used a lot by Boeing in the

716
00:40:05,130 --> 00:40:00,049
airplane business

717
00:40:08,109 --> 00:40:05,140
I understand they use millions of Monday

718
00:40:10,630 --> 00:40:08,119
777s 747s and so on

719
00:40:16,599 --> 00:40:10,640
and it's kind of an oddball in my

720
00:40:20,140 --> 00:40:16,609
opinion it has a deformed threads such

721
00:40:24,130 --> 00:40:20,150
that it that you use a kind of a socket

722
00:40:25,599 --> 00:40:24,140
type head that deforms to the point that

723
00:40:31,420 --> 00:40:25,609
it starts slipping and then you know

724
00:40:33,010 --> 00:40:31,430
that you it is installed properly so be

725
00:40:40,180 --> 00:40:33,020
easier just to go with the picture on

726
00:40:43,779 --> 00:40:40,190
the next page maybe I guess the better

727
00:40:46,180 --> 00:40:43,789
with this one this one has a fluted

728
00:40:49,210 --> 00:40:46,190
threads on the stem here you can see it

729
00:40:51,520 --> 00:40:49,220
and so you start out you have a nut that

730
00:40:54,640 --> 00:40:51,530
has these protrusions on it and you have

731
00:40:57,339 --> 00:40:54,650
a special wrench to fit on that so you

732
00:41:01,390 --> 00:40:57,349
tighten the doggone thing until the nut

733
00:41:05,230 --> 00:41:01,400
deforms to where these protrusions push

734
00:41:07,990 --> 00:41:05,240
it in and it pushes in and locks on

735
00:41:11,230 --> 00:41:08,000
these flutes here and then when you

736
00:41:13,620 --> 00:41:11,240
start spinning you know you have a the

737
00:41:17,260 --> 00:41:13,630
proper installation which is kind of

738
00:41:22,120 --> 00:41:17,270

strange but they work then they have

739
00:41:24,970 --> 00:41:22,130
another tape that has a swags color like

740
00:41:26,650 --> 00:41:24,980
the the ones that the lock bolts that

741
00:41:28,450 --> 00:41:26,660
I've been showing you and on that one of

742
00:41:30,519 --> 00:41:28,460
course you need a bucking bar on the

743
00:41:34,019 --> 00:41:30,529
back of it to hold it in place because

744
00:41:36,730 --> 00:41:34,029
you're actually pushing down here and

745
00:41:38,950 --> 00:41:36,740
deforming the collar around it but the

746
00:41:40,900 --> 00:41:38,960
locking is the same it still has this

747
00:41:45,180 --> 00:41:40,910
type of shank on this shank is the same

748
00:41:48,579 --> 00:41:45,190
as this one and those are used

749
00:41:51,400 --> 00:41:48,589
extensively and they're fairly new

750
00:41:55,569 --> 00:41:51,410
they've only been around for a few years

751
00:42:01,809 --> 00:41:55,579
now here's remember earlier I mentioned

752
00:42:05,590 --> 00:42:01,819
that you don't want to use solid rivets

753
00:42:09,280 --> 00:42:05,600
in the composite material

754
00:42:13,300 --> 00:42:09,290
fiberglass reinforced plastics this type

755
00:42:16,780 --> 00:42:13,310
of thing and all because it will start

756
00:42:19,480 --> 00:42:16,790
unraveling at the surfaces well here is

757
00:42:24,360 --> 00:42:19,490
one made specifically for composite

758
00:42:27,100 --> 00:42:24,370
materials it is a titanium lock bolt and

759
00:42:29,620 --> 00:42:27,110
instead of it has a hundred and thirty

760
00:42:31,030 --> 00:42:29,630
degree head on it because you don't want

761
00:42:34,990 --> 00:42:31,040
the counters thank you very much on them

762
00:42:36,720 --> 00:42:35,000
because you want to avoid the grinding

763
00:42:40,630 --> 00:42:36,730

on the surfaces as much as possible

764
00:42:44,890 --> 00:42:40,640
because of the reinforcing fibers so so

765
00:42:49,960 --> 00:42:44,900
this is a very flat big head that they

766
00:42:51,850 --> 00:42:49,970
have on them and that gives smaller

767
00:42:55,240 --> 00:42:51,860
contact stresses on the composite

768
00:42:59,970 --> 00:42:55,250
surfaces it's it's it's a tight fit but

769
00:43:04,630 --> 00:42:59,980
not an interference fit then they have a

770
00:43:10,450 --> 00:43:04,640
different type of serration on them that

771
00:43:14,140 --> 00:43:10,460
they have a 20 degree angle here instead

772
00:43:16,420 --> 00:43:14,150
at 20 and 40 rather than the 30 30 that

773
00:43:19,330 --> 00:43:16,430
you would normally have on a nut on the

774
00:43:22,000 --> 00:43:19,340
serrations to give you better holding

775
00:43:24,640 --> 00:43:22,010
power because now with this flatter

776
00:43:27,610 --> 00:43:24,650
angle here you can when you put the

777
00:43:29,770 --> 00:43:27,620
collar in place it's harder to pull it

778
00:43:32,110 --> 00:43:29,780
off because you're trying to pull

779
00:43:37,060 --> 00:43:32,120
against that angle when you install the

780
00:43:42,400 --> 00:43:37,070
thing and here is one of them installed

781
00:43:44,500 --> 00:43:42,410
and now see see notice that how odd this

782
00:43:46,780 --> 00:43:44,510
head looks because it's 130 degrees

783
00:43:48,400 --> 00:43:46,790
instead of 82 or 100 most of the

784
00:43:54,730 --> 00:43:48,410
aerospace stuff is 100 degree

785
00:43:56,800 --> 00:43:54,740
countersunk head and then see the it's a

786
00:43:58,450 --> 00:43:56,810
installed very similar to the rest of

787
00:44:02,230 --> 00:43:58,460
the lock bolts and stuff like that it's

788
00:44:04,030 --> 00:44:02,240

a color that is pushed in here you have

789
00:44:09,160 --> 00:44:04,040
a pole stem that breaks off when you've

790
00:44:15,640 --> 00:44:12,579
I believe monogrammed fasteners is the

791
00:44:17,400 --> 00:44:15,650
outfit that makes that one out of was

792
00:44:22,930 --> 00:44:17,410
there one of the companies out of

793
00:44:26,440 --> 00:44:22,940
California so general guidelines for

794
00:44:29,049 --> 00:44:26,450
selecting rivets and lock bolts don't

795
00:44:30,640 --> 00:44:29,059
use expanding rivets and composites as

796
00:44:33,280 --> 00:44:30,650
we've talked about here

797
00:44:34,930 --> 00:44:33,290
don't use 50:56 aluminum rivets and

798
00:44:38,339 --> 00:44:34,940
anything other than magnesium since the

799
00:44:41,980 --> 00:44:38,349
50:56 a stress corrosion sensitive a

800
00:44:43,960 --> 00:44:41,990
threaded lock bolt that's one of the

801
00:44:46,059 --> 00:44:43,970
ones that has the nut on it to actually

802
00:44:48,370 --> 00:44:46,069
threads on and then breaks off the outer

803
00:44:51,039 --> 00:44:48,380
portion of it can carry up to the

804
00:44:53,140 --> 00:44:51,049
tensile allowable of the shank but each

805
00:44:57,430 --> 00:44:53,150
design should be checked individually

806
00:45:00,460 --> 00:44:57,440
and since drilled fastener holes are not

807
00:45:03,940 --> 00:45:00,470
plated or coated it's necessary to use

808
00:45:07,809 --> 00:45:03,950
some type of sealant over the raw

809
00:45:09,730 --> 00:45:07,819
material surfaces to retire to prevent

810
00:45:14,049 --> 00:45:09,740
galvanic corrosion between the fastener

811
00:45:16,569 --> 00:45:14,059
in the joint material and of course you

812
00:45:20,589 --> 00:45:16,579
can find lots of information on joints

813
00:45:24,579 --> 00:45:20,599

and rivet allowables which were

814
00:45:26,680 --> 00:45:24,589
determined by tests and mill handbook 5

815
00:45:30,299 --> 00:45:26,690
I think it's chapter 9 the mill handbook

816
00:45:31,420 --> 00:45:30,309
5 has a all these joint allowables

817
00:45:36,160 --> 00:45:31,430
rivets

818
00:45:38,160 --> 00:45:36,170
they cover they give you a table of

819
00:45:42,789 --> 00:45:38,170
rivet in a given thickness of material

820
00:45:44,710 --> 00:45:42,799
how much it'll carry in here they even

821
00:45:46,359 --> 00:45:44,720
show the knife edge cut off so remember

822
00:45:48,760 --> 00:45:46,369
I talked about the knife edges yesterday

823
00:45:50,170 --> 00:45:48,770
to avoid they show where you cut it off

824
00:45:53,740 --> 00:45:50,180
to make sure you don't get knife edges

825
00:45:56,559 --> 00:45:53,750
and all that type of thing ribbon

826
00:46:00,880 --> 00:45:56,569
installations are covered by mil

827
00:46:05,020 --> 00:46:00,890
standard 403 some corrosion prevention

828
00:46:09,760 --> 00:46:05,030
methods are covered by these two mill

829
00:46:13,150 --> 00:46:09,770
specs design and selection requirements

830
00:46:16,990 --> 00:46:13,160
for blind structural rivets are given

831
00:46:19,990 --> 00:46:17,000
that ms 33 5 22 and testing of fasteners

832
00:46:22,540 --> 00:46:20,000
is covered in mil standard 13 12 that is

833
00:46:24,400 --> 00:46:22,550
a huge document which I will at

834
00:46:27,940 --> 00:46:24,410
the end somewhere along the line I have

835
00:46:30,310 --> 00:46:27,950
a listing of all the different tests

836
00:46:33,100 --> 00:46:30,320
that are covered in that document it's a

837
00:46:34,600 --> 00:46:33,110
whole three-ring notebook of standards

838
00:46:36,570 --> 00:46:34,610

for the different testings I think 30

839
00:46:41,020 --> 00:46:36,580
Sims sections or something like that

840
00:46:43,690 --> 00:46:41,030
then this Naas 5:23 gives ribbit codes

841
00:46:45,910 --> 00:46:43,700
and call-outs that's the one the covers

842
00:46:49,930 --> 00:46:45,920
I believe the little X with the

843
00:46:52,690 --> 00:46:49,940
different designations on it for how to

844
00:46:54,490 --> 00:46:52,700
call out a specific ribbit on a drawing

845
00:46:57,030 --> 00:46:54,500
whether it's counter something years I

846
00:47:00,370 --> 00:46:57,040
had person I'd know that business and

847
00:47:02,860 --> 00:47:00,380
then one of the other important things

848
00:47:04,930 --> 00:47:02,870
review the fastener manufacturers design

849
00:47:07,660 --> 00:47:04,940
criteria before incorporating his

850
00:47:10,270 --> 00:47:07,670
fasteners into your design and that's

851
00:47:15,430 --> 00:47:10,280
one of the things that day for Trek I

852
00:47:19,060 --> 00:47:15,440
found out call the manufacturer and find

853
00:47:22,060 --> 00:47:19,070
out what his fasteners sell for before

854
00:47:24,760 --> 00:47:22,070
you decide that you're going to use a

855
00:47:27,070 --> 00:47:24,770
few hundred of money or designed because

856
00:47:34,440 --> 00:47:27,080
they can get expensive particularly in

857
00:47:37,180 --> 00:47:34,450
small quantities now moving on to

858
00:47:41,020 --> 00:47:37,190
inspection and acceptance of fasteners

859
00:47:45,910 --> 00:47:41,030
this is one of the things that is not

860
00:47:48,910 --> 00:47:45,920
covered very well by most people because

861
00:47:54,100 --> 00:47:48,920
we can specify all the things that we

862
00:47:56,890 --> 00:47:54,110
want in fasteners and but when we get

863
00:48:01,150 --> 00:47:56,900

them we don't necessarily get what we

864
00:48:02,770 --> 00:48:01,160
ordered and the the criticality of the

865
00:48:05,500 --> 00:48:02,780
fastener design should determine how

866
00:48:07,800 --> 00:48:05,510
much inspection we have on it so we'll

867
00:48:15,660 --> 00:48:07,810
cover some of the inspection methods

868
00:48:19,720 --> 00:48:15,670
that are used now on ordinary fasteners

869
00:48:24,550 --> 00:48:19,730
bolts nuts and stuff like that we can

870
00:48:27,910 --> 00:48:24,560
use hardness testing as a that's a

871
00:48:31,750 --> 00:48:27,920
simple one you use

872
00:48:34,770 --> 00:48:31,760
Brunell tests for aluminum usually and

873
00:48:38,550 --> 00:48:34,780
rockwell for steel

874
00:48:41,280 --> 00:48:38,560
and the what what these in general do

875
00:48:43,470 --> 00:48:41,290
you have a little ball that gives you an

876
00:48:46,020 --> 00:48:43,480
indentation and the amount of

877
00:48:48,360 --> 00:48:46,030
indentation that you get is correlated

878
00:48:50,220 --> 00:48:48,370
to the hardness of the material and that

879
00:48:55,680 --> 00:48:50,230
in turn to the strength of the material

880
00:48:58,410 --> 00:48:55,690
so for example if you go to a table rock

881
00:49:02,760 --> 00:48:58,420
and see a great eight fastener is about

882
00:49:04,740 --> 00:49:02,770
a rock well thirty c-33 I believe and at

883
00:49:06,780 --> 00:49:04,750
least it gives you some indications and

884
00:49:08,880 --> 00:49:06,790
there that's an easy test to run because

885
00:49:12,060 --> 00:49:08,890
you have a little machine you just slap

886
00:49:17,490 --> 00:49:12,070
the thing in there run the test or at

887
00:49:22,040 --> 00:49:17,500
least a beginning test on it the Brinell

888
00:49:25,680 --> 00:49:22,050

is used for testing their aluminum stuff

889
00:49:28,770 --> 00:49:25,690
usually although Brunel and Rockwell can

890
00:49:31,320 --> 00:49:28,780
be correlated because Wilson company

891
00:49:34,140 --> 00:49:31,330
makes all this equipment and they put

892
00:49:37,290 --> 00:49:34,150
out tables that give you the correlation

893
00:49:39,420 --> 00:49:37,300
between them you also have a Rockwell B

894
00:49:41,630 --> 00:49:39,430
scale for medium hardness materials

895
00:49:45,450 --> 00:49:41,640
usually your your carbon Steel's are

896
00:49:49,950 --> 00:49:45,460
rated on the the B scale and then when

897
00:49:54,210 --> 00:49:49,960
you get up I think a a B 100 is

898
00:49:55,890 --> 00:49:54,220
equivalent to around a C 18 or 20 or

899
00:50:00,050 --> 00:49:55,900
something like that for the harder

900
00:50:03,090 --> 00:50:00,060
materials so if we go to the next figure

901
00:50:05,310 --> 00:50:03,100
here's a Brinell hardness tester and

902
00:50:07,290 --> 00:50:05,320
what you have is a little table that you

903
00:50:09,390 --> 00:50:07,300
put your sample on the ball is in the

904
00:50:11,430 --> 00:50:09,400
headgear and you actuate the thing this

905
00:50:13,800 --> 00:50:11,440
one this is an older one I think when

906
00:50:16,830 --> 00:50:13,810
you just use a handle to actuate it

907
00:50:18,560 --> 00:50:16,840
nowadays it probably on these they

908
00:50:23,340 --> 00:50:18,570
probably make them that if there are

909
00:50:27,180 --> 00:50:23,350
electronically actuated that one is for

910
00:50:29,570 --> 00:50:27,190
the aluminum and then here is the Iraq

911
00:50:31,920 --> 00:50:29,580
well this is one of the newer Rockwell

912
00:50:35,130 --> 00:50:31,930
models that got out of one of their

913
00:50:40,080 --> 00:50:35,140

catalogs or Wilson catalog same thing

914
00:50:44,340 --> 00:50:40,090
you have a headgear to put your sample

915
00:50:46,470 --> 00:50:44,350
on or platform and then you have the the

916
00:50:48,180 --> 00:50:46,480
ball as in this part of it you program

917
00:50:51,410 --> 00:50:48,190
the thing to give you

918
00:50:53,430 --> 00:50:51,420
given amount of load and it measures the

919
00:50:55,470 --> 00:50:53,440
indentation and gives you a reading

920
00:50:58,849 --> 00:50:55,480
which you can use with the table to

921
00:51:05,579 --> 00:51:03,510
this mil standard 1312 de 6 gives a

922
00:51:07,200 --> 00:51:05,589
standard pest method and specifies the

923
00:51:08,760 --> 00:51:07,210
apparatus to be used for hardness

924
00:51:13,440 --> 00:51:08,770
testing and all types of structural

925
00:51:17,069 --> 00:51:13,450
fasteners now the the B scale this is

926
00:51:19,109 --> 00:51:17,079
the the size diameter ball and the the

927
00:51:22,349 --> 00:51:19,119
load you to use with it and then the C

928
00:51:24,630 --> 00:51:22,359
has has its own diameter and and the

929
00:51:27,480 --> 00:51:24,640
load and here's another one a Rockwell

930
00:51:30,410 --> 00:51:27,490
superficial hardness tester except the

931
00:51:33,779 --> 00:51:30,420
indentation is smaller and then new and

932
00:51:35,069 --> 00:51:33,789
Vickers micro hardness testers some of

933
00:51:36,359 --> 00:51:35,079
these they have them small enough that

934
00:51:38,579 --> 00:51:36,369
you can actually take them out on the

935
00:51:43,049 --> 00:51:38,589
job and test your parts without having

936
00:51:45,329 --> 00:51:43,059
to pull them out and take take them into

937
00:51:50,819 --> 00:51:45,339
the shop you may metallurgical lab to

938
00:51:52,559 --> 00:51:50,829

get them checked now for fastener

939
00:51:54,960 --> 00:51:52,569
hardness testing one of the problems you

940
00:51:57,990 --> 00:51:54,970
run into of course is how do you get an

941
00:52:01,650 --> 00:51:58,000
accurate reading and if you have cold

942
00:52:03,930 --> 00:52:01,660
work the fastener and farming it if you

943
00:52:06,870 --> 00:52:03,940
take a reading on the outside someplace

944
00:52:11,250 --> 00:52:06,880
it may not necessarily be the proper

945
00:52:17,339 --> 00:52:11,260
strength so to get accurate readings you

946
00:52:22,049 --> 00:52:17,349
need to get core hardness so you can you

947
00:52:24,329 --> 00:52:22,059
can take a machine it down and get two

948
00:52:27,870 --> 00:52:24,339
flat parallel surfaces and use one of

949
00:52:29,190 --> 00:52:27,880
them for hardness testing and the other

950
00:52:31,289 --> 00:52:29,200
thing you could do if you have small

951
00:52:35,640 --> 00:52:31,299
fasteners that you can't do that with

952
00:52:37,650 --> 00:52:35,650
then you can mount them and the these

953
00:52:40,140 --> 00:52:37,660
metallurgical people can put them in a

954
00:52:45,870 --> 00:52:40,150
nice little thermoplastic type setting

955
00:52:48,539 --> 00:52:45,880
that you can then put it on the platform

956
00:52:51,120 --> 00:52:48,549
and get hardness testing and the the

957
00:52:55,049 --> 00:52:51,130
beauty of that is since you can't get

958
00:52:57,799 --> 00:52:55,059
through hardening in a fastener and a

959
00:53:01,560 --> 00:52:57,809
lot of materials above about

960
00:53:04,890 --> 00:53:01,570
three-quarter inch diameter so you need

961
00:53:07,350 --> 00:53:04,900
to take both hardness readings close to

962
00:53:10,140 --> 00:53:07,360
the threads and at the core to see

963
00:53:14,730 --> 00:53:10,150

whether you're getting the true strength

964
00:53:18,060 --> 00:53:14,740
indication for the fastener so sew on

965
00:53:21,750 --> 00:53:18,070
the little ones this is a zero door

966
00:53:25,950 --> 00:53:21,760
number five so that's 60 to 60

967
00:53:28,470 --> 00:53:25,960
thousandths to 1/8 diameter and in same

968
00:53:31,320 --> 00:53:28,480
thing for rivets you can set those and

969
00:53:34,290 --> 00:53:31,330
then on larger ones you can get there is

970
00:53:36,210 --> 00:53:34,300
a way of measuring the shank if it's not

971
00:53:39,030 --> 00:53:36,220
cowork too much that you can get a

972
00:53:41,910 --> 00:53:39,040
ballpark tape reading if the thing is

973
00:53:43,530 --> 00:53:41,920
big enough but this is not a very

974
00:53:46,290 --> 00:53:43,540
accurate reading it's only if you're

975
00:53:50,520 --> 00:53:46,300
looking something just a general type

976
00:53:52,320 --> 00:53:50,530
reading now tensile testing this is

977
00:53:54,180 --> 00:53:52,330
something of course you can do and that

978
00:53:56,820 --> 00:53:54,190
they do a little bit of that around here

979
00:54:00,540 --> 00:53:56,830
curl Bergquist is the guy that does it

980
00:54:04,740 --> 00:54:00,550
on taking a few samples out of the greed

981
00:54:07,590 --> 00:54:04,750
eights and socket head cap screws and

982
00:54:13,770 --> 00:54:07,600
pulling them just to see what they are

983
00:54:16,440 --> 00:54:13,780
good for so in general you take a few

984
00:54:19,920 --> 00:54:16,450
out run them if any of them fails you

985
00:54:22,110 --> 00:54:19,930
reject the light and what you do is you

986
00:54:25,590 --> 00:54:22,120
use a regular tensile testing machine

987
00:54:28,230 --> 00:54:25,600
that has large enough fixtures that you

988
00:54:30,150 --> 00:54:28,240

get essentially no deformation from the

989
00:54:32,160 --> 00:54:30,160
fixtures themselves because you want all

990
00:54:34,650 --> 00:54:32,170
the deformation to be in the fastener

991
00:54:40,850 --> 00:54:34,660
that way you can even measure the yield

992
00:54:49,260 --> 00:54:44,340
here's another test that can be used and

993
00:54:53,790 --> 00:54:49,270
of course counterfeit fasteners most of

994
00:54:58,380 --> 00:54:53,800
the time are made by cheating on the

995
00:55:01,680 --> 00:54:58,390
carbon content in order to heat treat a

996
00:55:04,680 --> 00:55:01,690
fastener and and we have in the

997
00:55:06,810 --> 00:55:04,690
specifications for a alloy steel

998
00:55:10,410 --> 00:55:06,820
fastener it has to be a minimum of 28

999
00:55:12,660 --> 00:55:10,420
points of carbon in order to get heat

1000
00:55:14,130 --> 00:55:12,670
treating and usually you use them up

1001
00:55:18,829 --> 00:55:14,140
around 40

1002
00:55:21,059 --> 00:55:18,839
so the counterfeiters can add boron

1003
00:55:22,859 --> 00:55:21,069
increases the harden ability of steel

1004
00:55:25,710 --> 00:55:22,869
and boron is cheap and you don't need

1005
00:55:28,680 --> 00:55:25,720
very much of it to add so you can take

1006
00:55:30,319 --> 00:55:28,690
1020 steel and add little boron to it

1007
00:55:33,620 --> 00:55:30,329
and heat-treated

1008
00:55:36,569 --> 00:55:33,630
so one of the tests that is used on

1009
00:55:40,519 --> 00:55:36,579
acceptance of alloy steel fasteners is a

1010
00:55:44,009 --> 00:55:40,529
carbon content test and there's

1011
00:55:46,410 --> 00:55:44,019
different ways of doing it one of the

1012
00:55:47,670 --> 00:55:46,420
company that I believe makes the

1013
00:55:52,049 --> 00:55:47,680

equipment that we have around here is

1014
00:55:56,640 --> 00:55:52,059
called Li CO and what you have is some

1015
00:56:02,609 --> 00:55:56,650
type of a furnace in which you it's even

1016
00:56:07,440 --> 00:56:02,619
either an induction or high-frequency

1017
00:56:09,390 --> 00:56:07,450
type a resistance type furnaces and you

1018
00:56:11,609 --> 00:56:09,400
take a little chunk of this stuff and

1019
00:56:14,579 --> 00:56:11,619
put enough oxygen in with it that you

1020
00:56:17,519 --> 00:56:14,589
can burn it and then you have different

1021
00:56:19,859 --> 00:56:17,529
ways of measuring by getting the carbon

1022
00:56:22,890 --> 00:56:19,869
dioxide from the combustion you can

1023
00:56:26,190 --> 00:56:22,900
measure it and get the carbon content

1024
00:56:28,230 --> 00:56:26,200
out of your sample so I'll kind of go

1025
00:56:33,749 --> 00:56:28,240
into this and a little bit more detail

1026
00:56:35,430 --> 00:56:33,759
here for a couple minutes yet it's high

1027
00:56:37,499 --> 00:56:35,440
temperature combustion and you have two

1028
00:56:40,259 --> 00:56:37,509
types of furnaces a high frequency and

1029
00:56:42,809 --> 00:56:40,269
resistance high temperature and you use

1030
00:56:45,269 --> 00:56:42,819
two different methods of carbon sulfur

1031
00:56:46,769 --> 00:56:45,279
detection infrared absorption and

1032
00:56:48,680 --> 00:56:46,779
thermal conductivity are the two

1033
00:56:53,759 --> 00:56:48,690
different methods that are used for it

1034
00:56:56,609 --> 00:56:53,769
the the test theory of course is to

1035
00:56:59,029 --> 00:56:56,619
determine the content of carbon and

1036
00:57:06,720 --> 00:56:59,039
sulfur and you can separate them out and

1037
00:57:08,460 --> 00:57:06,730
find out which is which and the so that

1038
00:57:11,339 --> 00:57:08,470

you get carbon dioxide and sulfur

1039
00:57:13,019 --> 00:57:11,349
dioxide and so with this furnace you

1040
00:57:14,579 --> 00:57:13,029
take it you have to take it up to a

1041
00:57:16,920 --> 00:57:14,589
pretty high temperature even with the

1042
00:57:18,599 --> 00:57:16,930
oxygen to burn the carbon off of the

1043
00:57:22,260 --> 00:57:18,609
steel because steel doesn't burn very

1044
00:57:29,290 --> 00:57:25,270
the other oxide compounds that you get

1045
00:57:32,650 --> 00:57:29,300
during this combustion you can siphon

1046
00:57:34,510 --> 00:57:32,660
them off and get them out and you also

1047
00:57:38,230 --> 00:57:34,520
remove the moisture with some sort of a

1048
00:57:41,410 --> 00:57:38,240
diskant such as Herald even put in there

1049
00:57:45,310 --> 00:57:41,420
what to use magnesium perchlorate Carol

1050
00:57:49,510 --> 00:57:45,320
Casper helped me on coming up with all

1051
00:57:51,910 --> 00:57:49,520
of this stuff the samples here's one of

1052
00:57:56,920 --> 00:57:51,920
the important thing you have to make

1053
00:57:59,740 --> 00:57:56,930
sure that you know exactly how much

1054
00:58:02,740 --> 00:57:59,750
weight you have in your sample in order

1055
00:58:07,000 --> 00:58:02,750
to do the testing because what you're

1056
00:58:11,470 --> 00:58:07,010
looking at is the carbon per late in it

1057
00:58:13,840 --> 00:58:11,480
and since it's such a small amount the

1058
00:58:17,710 --> 00:58:13,850
the weight of the sample has to be

1059
00:58:20,200 --> 00:58:17,720
accurate the limitations on it also the

1060
00:58:22,200 --> 00:58:20,210
specimens must be homogeneous in other

1061
00:58:25,180 --> 00:58:22,210
words if you spoke of the

1062
00:58:28,180 --> 00:58:25,190
decarburization if you had say heavy

1063
00:58:31,960 --> 00:58:28,190

content of carbon in the surface of the

1064
00:58:34,030 --> 00:58:31,970
thing due to the way it was heat treated

1065
00:58:35,530 --> 00:58:34,040
then you would get an erroneous reading

1066
00:58:39,010 --> 00:58:35,540
it would show that it had a higher

1067
00:58:42,480 --> 00:58:39,020
carbon content then it really had

1068
00:58:44,920 --> 00:58:42,490
throughout graphite bearing specimens

1069
00:58:46,780 --> 00:58:44,930
you have trouble with in other words you

1070
00:58:48,940 --> 00:58:46,790
can't have graphite on the outside for

1071
00:58:57,970 --> 00:58:48,950
the lubricant and of course the method

1072
00:59:00,010 --> 00:58:57,980
is destructive so getting a sample and

1073
00:59:01,200 --> 00:59:00,020
weighing it is a fairly short thing and

1074
00:59:05,110 --> 00:59:01,210
then you have the high frequency

1075
00:59:11,640 --> 00:59:05,120
furnaces that to use is it actually has

1076
00:59:15,190 --> 00:59:11,650
a coil a heating coil on it and you have

1077
00:59:18,880 --> 00:59:15,200
a a ceramic crucible that holds the

1078
00:59:21,190 --> 00:59:18,890
sample and you heat it up and cook it

1079
00:59:26,530 --> 00:59:21,200
out and here's one of them on the next