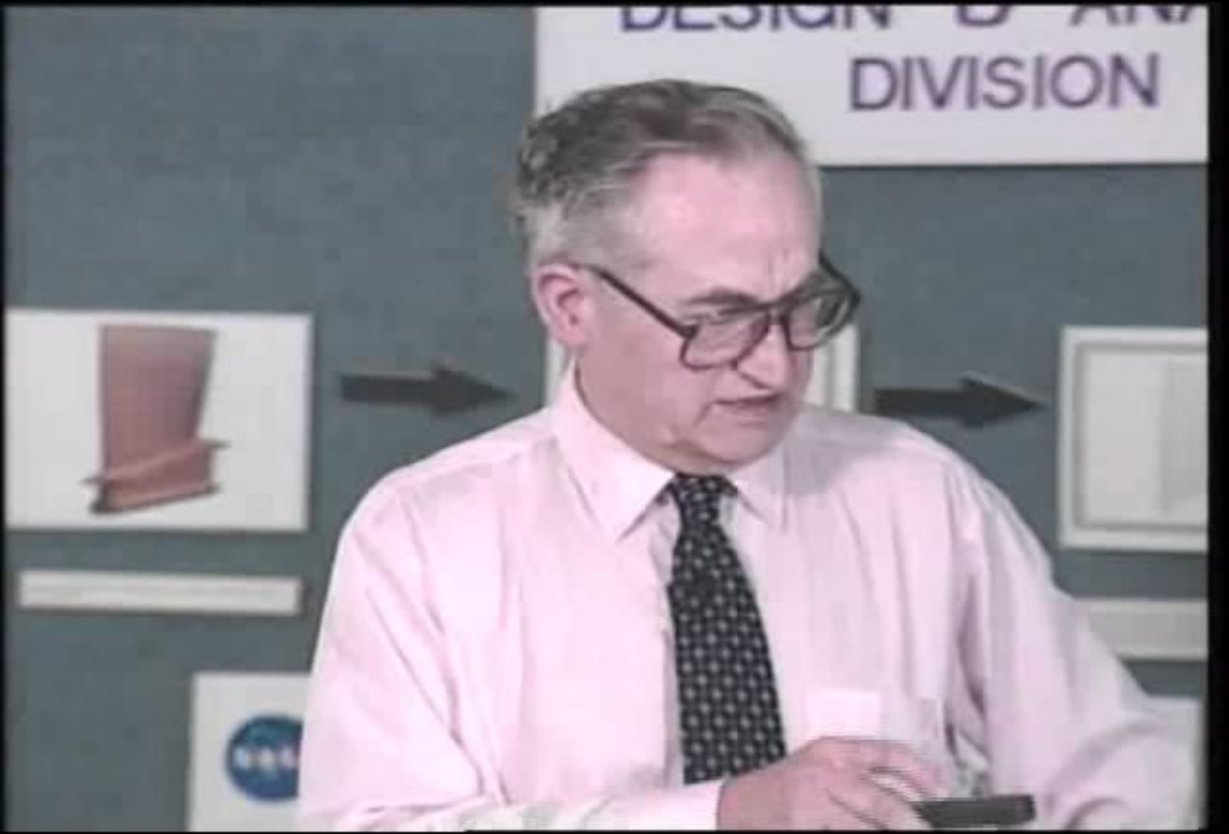
DIVISION

1
00:00:21,370 --> 00:00:18,550
okay we'll take a look at this furnace

2
00:00:24,670 --> 00:00:21,380
for checking the carbon content and you

3
00:00:28,300 --> 00:00:24,680
see this is just an ordinary induction

4
00:00:31,750 --> 00:00:28,310
coil put the stuff in there heat it up

5
00:00:35,880 --> 00:00:31,760
to about 2600 degrees with oxygen and it

6
00:00:38,619 --> 00:00:35,890
will burn and then you can proceed now

7
00:00:40,270 --> 00:00:38,629
on the resistance high temperature

8
00:00:44,560 --> 00:00:40,280
furnace which is another one that's used

9
00:00:50,800 --> 00:00:44,570
you have carbide or moly die silicide

10
00:00:52,930 --> 00:00:50,810
elements then the accelerators use you

11
00:00:56,830 --> 00:00:52,940
have a catalysts in it and then you can

12
00:00:58,990 --> 00:00:56,840
detect the separated gases by one of the

13
00:01:00,880 --> 00:00:59,000

two detection systems that we had

14
00:01:04,229 --> 00:01:00,890
previously mentioned that provide a

15
00:01:07,060 --> 00:01:04,239
specific and consistent signal and

16
00:01:09,609 --> 00:01:07,070
process it electronically it's a lot of

17
00:01:13,240 --> 00:01:09,619
a lot of electronic stuff but you can

18
00:01:18,730 --> 00:01:13,250
come up with an answer on the infrared

19
00:01:21,120 --> 00:01:18,740
detection you can apply it on the basis

20
00:01:23,740 --> 00:01:21,130
that various gases can absorb energy

21
00:01:26,850 --> 00:01:23,750
within a specific wavelength of the

22
00:01:31,649 --> 00:01:26,860
infrared spectrum now this is similar to

23
00:01:34,060 --> 00:01:31,659
a scanning electron microscope analysis

24
00:01:35,830 --> 00:01:34,070
when you analyze something and you

25
00:01:38,620 --> 00:01:35,840
actually have a wavelength for a given

26
00:01:42,399 --> 00:01:38,630
element so that you can determine how

27
00:01:45,070 --> 00:01:42,409
much of each one you have in it there on

28
00:01:47,230 --> 00:01:45,080
the thermal conductive detection system

29
00:01:49,810 --> 00:01:47,240
it's based on the principle that each

30
00:01:52,780 --> 00:01:49,820
gas has a distinct capability of

31
00:01:56,499 --> 00:01:52,790
carrying heat from the body so you can

32
00:01:58,899 --> 00:01:56,509
take the carbon dioxide and determine

33
00:02:02,050 --> 00:01:58,909
the thermal conductive chains generated

34
00:02:05,609 --> 00:02:02,060
by it and come up with the amount of

35
00:02:09,550 --> 00:02:05,619
carbon that was expected and in any

36
00:02:11,350 --> 00:02:09,560
sense you can determine then the total

37
00:02:14,970 --> 00:02:11,360
amount of carbon that was in the sample

38
00:02:17,920 --> 00:02:14,980

and get it a an accurate reading on it

39
00:02:21,940 --> 00:02:17,930
now let's go to thread inspection and

40
00:02:25,780 --> 00:02:21,950
this one is something that people talk

41
00:02:27,340 --> 00:02:25,790
about a lot but kind of like politics

42
00:02:30,790 --> 00:02:27,350
they talk about it a lot but

43
00:02:34,330 --> 00:02:30,800
but it's not a lot done so I found out

44
00:02:38,050 --> 00:02:34,340
when I went to checking into it the

45
00:02:39,880 --> 00:02:38,060
common methods of inspection that are

46
00:02:44,530 --> 00:02:39,890
given once again in this Mel handbook

47
00:02:48,990 --> 00:02:44,540
age 28 and are the system's 21 22 and 23

48
00:02:52,480 --> 00:02:49,000
they're also covered in antsy B 1.3 em

49
00:02:56,350 --> 00:02:52,490
now in general the system 21 requires

50
00:02:58,480 --> 00:02:56,360
the least amount of inspection system 22

51
00:03:04,450 --> 00:02:58,490
is an intermediate amount and 23 is the

52
00:03:06,220 --> 00:03:04,460
most stringent and so our each one of

53
00:03:08,110 --> 00:03:06,230
these is practically a separate document

54
00:03:10,330 --> 00:03:08,120
so I'll just try to summarize them a

55
00:03:15,030 --> 00:03:10,340
little bit but one of the things we

56
00:03:20,260 --> 00:03:15,040
found out is that most people just use

57
00:03:25,200 --> 00:03:20,270
system 21 and on system 21 all you're

58
00:03:29,980 --> 00:03:25,210
doing is checking the OD your ID and

59
00:03:32,380 --> 00:03:29,990
using a go/no-go gage anyway some of the

60
00:03:34,570 --> 00:03:32,390
things that you are looking for on

61
00:03:36,460 --> 00:03:34,580
threads now this was up earlier in the

62
00:03:37,630 --> 00:03:36,470
course but nevertheless just to go

63
00:03:41,320 --> 00:03:37,640

through it again to familiarize

64
00:03:42,730 --> 00:03:41,330
ourselves with it here is the the pitch

65
00:03:44,710 --> 00:03:42,740
of the threads the distance between

66
00:03:47,680 --> 00:03:44,720
threads here is that angle which is

67
00:03:50,110 --> 00:03:47,690
usually this alpha 1 alpha 2 the sum of

68
00:03:53,650 --> 00:03:50,120
those normally is 60 degrees on threads

69
00:03:59,500 --> 00:03:53,660
here is your banish cone where you run

70
00:04:02,440 --> 00:03:59,510
out your threads and here is the major

71
00:04:05,470 --> 00:04:02,450
diameter which is the outside rest of

72
00:04:08,620 --> 00:04:05,480
the threads the minor diameter which is

73
00:04:10,630 --> 00:04:08,630
from the diameter at the root and then

74
00:04:12,010 --> 00:04:10,640
the pitch diameter which is a very

75
00:04:14,410 --> 00:04:12,020
important thing and that's of course

76
00:04:17,220 --> 00:04:14,420
where if you mated the threads up

77
00:04:19,960 --> 00:04:17,230
perfectly you would have the same

78
00:04:23,620 --> 00:04:19,970
thickness through the cross-section of

79
00:04:29,140 --> 00:04:23,630
the thread as you do in here as you do

80
00:04:31,420 --> 00:04:29,150
in the mating thread here and here is

81
00:04:36,010 --> 00:04:31,430
here's another one that I wanted to show

82
00:04:37,690 --> 00:04:36,020
you for this reason this is kind of a

83
00:04:40,920 --> 00:04:37,700
close-up that shows the difference

84
00:04:44,640 --> 00:04:40,930
between having an unrated through

85
00:04:48,540 --> 00:04:44,650
and having a radius thread the other

86
00:04:52,620 --> 00:04:48,550
thing is this circle here represents the

87
00:04:55,290 --> 00:04:52,630
pins that are used for measuring the

88
00:04:57,780 --> 00:04:55,300

pitch diameter there's a method to call

89
00:05:00,210 --> 00:04:57,790
the three pin method that they can put

90
00:05:02,129 --> 00:05:00,220
the pins a two on one side one on the

91
00:05:04,350 --> 00:05:02,139
other side but flat plates across

92
00:05:07,469 --> 00:05:04,360
measure it then you go to a table and

93
00:05:09,659 --> 00:05:07,479
you can find out from this table based

94
00:05:11,760 --> 00:05:09,669
on the size thread you're using the

95
00:05:15,240 --> 00:05:11,770
diameter of these pins you can come up

96
00:05:21,629 --> 00:05:15,250
with an accurate reading of the pitch

97
00:05:27,800 --> 00:05:21,639
diameter of the thread now for external

98
00:05:31,140 --> 00:05:27,810
threads system 21 just includes go/no-go

99
00:05:34,409 --> 00:05:31,150
diameter and the major diameter that's

100
00:05:37,080 --> 00:05:34,419
all that they do and you can either

101
00:05:39,420 --> 00:05:37,090
measure this you usually measure it with

102
00:05:43,379 --> 00:05:39,430
what the color ring gauge which is

103
00:05:46,710 --> 00:05:43,389
nothing more than a calibrated thread in

104
00:05:48,690 --> 00:05:46,720
a ring that to replace replace what you

105
00:05:51,240 --> 00:05:48,700
would normally use as a nut and you try

106
00:05:55,710 --> 00:05:51,250
to thread the fastener into it if it

107
00:05:57,870 --> 00:05:55,720
goes it's fine you turn the the use the

108
00:05:59,670 --> 00:05:57,880
other one the no go and if it doesn't go

109
00:06:02,760 --> 00:05:59,680
in that one that means you are within

110
00:06:06,150 --> 00:06:02,770
the acceptable limits it doesn't tell

111
00:06:07,650 --> 00:06:06,160
you exactly what your dimensions are but

112
00:06:10,560 --> 00:06:07,660
it just tells you that the thing will

113
00:06:15,480 --> 00:06:10,570

work so that's called the the functional

114
00:06:17,820 --> 00:06:15,490
diameter if you will system 22 includes

115
00:06:20,250 --> 00:06:17,830
the system 21 measurements plus pitch

116
00:06:27,629 --> 00:06:20,260
diameter you can either measure it with

117
00:06:33,600 --> 00:06:27,639
a pitch micrometer which is a micrometer

118
00:06:36,360 --> 00:06:33,610
that has a grooved head on one end of it

119
00:06:39,390 --> 00:06:36,370
that fits over a thread then you have a

120
00:06:44,270 --> 00:06:39,400
pin type on the other one that fits in a

121
00:06:49,589 --> 00:06:44,280
thread and you can span this across the

122
00:06:54,529 --> 00:06:49,599
OD of the threaded area and get a

123
00:06:57,269 --> 00:06:54,539
reading which will give you the actual

124
00:06:59,399 --> 00:06:57,279
diameter pitch diameter that you want

125
00:07:00,989 --> 00:06:59,409
and you can look on the table in and see

126
00:07:04,679 --> 00:07:00,999
whether it's within the tolerances that

127
00:07:08,699 --> 00:07:04,689
you want the thread groove diameter

128
00:07:11,819 --> 00:07:08,709
which is the measurement between threads

129
00:07:14,069 --> 00:07:11,829
at the pitch diameter point the

130
00:07:17,699 --> 00:07:14,079
functional diameter which you get from

131
00:07:20,719 --> 00:07:17,709
up here with a go/no-go gauge leading

132
00:07:23,669 --> 00:07:20,729
flank angles and that's just go no go

133
00:07:27,659 --> 00:07:23,679
minor diameter and then you can measure

134
00:07:30,329 --> 00:07:27,669
the route profile but I found that that

135
00:07:34,699 --> 00:07:30,339
is not done that much unless somebody

136
00:07:37,589 --> 00:07:34,709
insists that it's done system 23

137
00:07:39,629 --> 00:07:37,599
includes all the others plus now you get

138
00:07:43,739 --> 00:07:39,639

into the roundness of the pitch cylinder

139
00:07:46,129 --> 00:07:43,749
itself the taper of it in other words if

140
00:07:50,189 --> 00:07:46,139
you take the whole thing as a cylinder

141
00:07:54,119 --> 00:07:50,199
do you have a taper on it is it round or

142
00:07:56,429 --> 00:07:54,129
is it lopsided the cumulative thread

143
00:07:58,949 --> 00:07:56,439
form variation going through the thing

144
00:08:01,559 --> 00:07:58,959
and checking to see whether it varies

145
00:08:03,869 --> 00:08:01,569
any from one end to the other the

146
00:08:07,949 --> 00:08:03,879
leading helix angle variation the flank

147
00:08:11,519 --> 00:08:07,959
angle variation on the threads run out

148
00:08:14,069 --> 00:08:11,529
an even surface texture now surface

149
00:08:17,159 --> 00:08:14,079
texture on the threads usually is not a

150
00:08:19,279 --> 00:08:17,169
problem but you could measure can see it

151
00:08:21,839 --> 00:08:19,289
would only be if the thing had been

152
00:08:25,739 --> 00:08:21,849
coated with some sort of a coating that

153
00:08:28,199 --> 00:08:25,749
was not electronically directly

154
00:08:30,239 --> 00:08:28,209
deposited in other words if you had

155
00:08:33,980 --> 00:08:30,249
galvanized threads then you could have

156
00:08:36,629 --> 00:08:33,990
have a problem because you'd have extra

157
00:08:38,670 --> 00:08:36,639
plating material in the threads and

158
00:08:44,179 --> 00:08:38,680
after you've gone through all of these

159
00:08:46,470 --> 00:08:44,189
things this is just four threads

160
00:08:48,720 --> 00:08:46,480
nothing's been done on on the rest of

161
00:08:50,249 --> 00:08:48,730
the fastener so you could have a huge

162
00:08:52,259 --> 00:08:50,259
crack in and it wouldn't make any

163
00:08:53,790 --> 00:08:52,269

difference because if you passed

164
00:08:55,759 --> 00:08:53,800
everything else the guys say well I

165
00:08:58,170 --> 00:08:55,769
inspected the threads and they're good

166
00:09:02,470 --> 00:08:58,180
so you still have to look to see if

167
00:09:08,890 --> 00:09:05,500
now for internal threads you have the go

168
00:09:11,830 --> 00:09:08,900
no-go and the minor diameter and that's

169
00:09:15,700 --> 00:09:11,840
about all it's usually check the the go

170
00:09:17,890 --> 00:09:15,710
no-go gauge one end fits the other one

171
00:09:20,590 --> 00:09:17,900
doesn't and then with the minor diameter

172
00:09:22,420 --> 00:09:20,600
you use a regular plug to slip in to

173
00:09:26,920 --> 00:09:22,430
check to see if it is okay

174
00:09:29,320 --> 00:09:26,930
then you move to the system 22 it

175
00:09:31,540 --> 00:09:29,330
includes the 21 and then you go for

176
00:09:34,060 --> 00:09:31,550
minimum material pitch diameter a thread

177
00:09:36,610 --> 00:09:34,070
groove diameter and the angles on the

178
00:09:39,610 --> 00:09:36,620
threads but since this is internal

179
00:09:43,320 --> 00:09:39,620
thread this is hard to do so usually

180
00:09:47,560 --> 00:09:43,330
people don't do it now here's a go/no-go

181
00:09:49,900 --> 00:09:47,570
gauge one side will thread in if it's in

182
00:09:53,950 --> 00:09:49,910
normal tolerance the other side won't

183
00:09:57,580 --> 00:09:53,960
and this is used to check internal

184
00:09:59,440 --> 00:09:57,590
threaded or tapped holes and that's the

185
00:10:02,950 --> 00:09:59,450
only usually that's about the only

186
00:10:06,870 --> 00:10:02,960
acceptance that people use I found here

187
00:10:10,150 --> 00:10:06,880
is the go no-go pen for just checking

188
00:10:15,270 --> 00:10:10,160

the minimum diameter in a threaded hole

189
00:10:18,550 --> 00:10:15,280
to see if it is within tolerances and so

190
00:10:22,950 --> 00:10:18,560
this one is fine if it and this one's

191
00:10:25,480 --> 00:10:22,960
not supposed to go it is bigger than the

192
00:10:32,310 --> 00:10:25,490
tolerance bandwidth will a lot would

193
00:10:35,620 --> 00:10:32,320
allow it the hole to be then for the

194
00:10:37,630 --> 00:10:35,630
system 23 it includes the the others

195
00:10:42,270 --> 00:10:37,640
plus the roundness of the pitch cylinder

196
00:10:46,900 --> 00:10:42,280
and they taper the pitch cylinder and

197
00:10:49,840 --> 00:10:46,910
but still nothing on the internal thread

198
00:10:52,180 --> 00:10:49,850
radius regardless of what you call out

199
00:10:54,520 --> 00:10:52,190
it's not measured unless you would go in

200
00:10:57,250 --> 00:10:54,530
and tell somebody you have to have it

201
00:11:01,960 --> 00:10:57,260
and then as as I mentioned earlier using

202
00:11:04,180 --> 00:11:01,970
this dental plaster type stuff you can

203
00:11:06,310 --> 00:11:04,190
you can actually cast it and then take

204
00:11:07,780 --> 00:11:06,320
it put it on an optical comparator to

205
00:11:11,480 --> 00:11:07,790
see whether you have the radius that you

206
00:11:19,220 --> 00:11:15,829
so now we move on and and to the the

207
00:11:21,290 --> 00:11:19,230
cold hard facts of life that even though

208
00:11:23,780 --> 00:11:21,300
you've inspected the heck out of the

209
00:11:25,429 --> 00:11:23,790
threads if with these three systems if

210
00:11:26,540 --> 00:11:25,439
you run it through all of them

211
00:11:29,960 --> 00:11:26,550
you still haven't looked for

212
00:11:36,679 --> 00:11:29,970
manufacturing defects for defects in the

213
00:11:38,929 --> 00:11:36,689

the threads FF s eighty-six federal spec

214
00:11:41,869 --> 00:11:38,939
gives examples of acceptable and

215
00:11:46,759 --> 00:11:41,879
unacceptable defects and we'll look at

216
00:11:48,829 --> 00:11:46,769
those and subsequent figures and you

217
00:11:51,350 --> 00:11:48,839
will note that the acceptance of the

218
00:11:53,540 --> 00:11:51,360
thread defects becomes more critical as

219
00:11:56,299 --> 00:11:53,550
the fastener strength increases and the

220
00:11:59,030 --> 00:11:56,309
ductility decreases so there has to be

221
00:12:03,109 --> 00:11:59,040
some engineering judgment exercised on

222
00:12:05,660 --> 00:12:03,119
it now here's one of the things threads

223
00:12:09,169 --> 00:12:05,670
should have no laps or seams at the root

224
00:12:11,900 --> 00:12:09,179
or the flanks the here's the root here's

225
00:12:14,749 --> 00:12:11,910
the flank of the thread and so in

226
00:12:18,470 --> 00:12:14,759
general what you're saying on this is

227
00:12:21,289 --> 00:12:18,480
any defects below the pitch diameter

228
00:12:23,929 --> 00:12:21,299
because you're loading this part of the

229
00:12:26,809 --> 00:12:23,939
thread a lot more than you are this part

230
00:12:29,869 --> 00:12:26,819
so anything below the pitch diameter in

231
00:12:33,079 --> 00:12:29,879
the way of a defect a noticeable defect

232
00:12:35,869 --> 00:12:33,089
you're not going to accept when you get

233
00:12:39,259 --> 00:12:35,879
things above the pitch diameter or

234
00:12:41,210 --> 00:12:39,269
outboard of it here now you can accept

235
00:12:44,600 --> 00:12:41,220
more defects there because it is more

236
00:12:47,499 --> 00:12:44,610
likely loaded but even so there are

237
00:12:51,049 --> 00:12:47,509
limits on how much you can accept on it

238
00:12:52,369 --> 00:12:51,059

so so it once again you look at it and

239
00:12:55,639 --> 00:12:52,379
if you find too many cracks in a

240
00:12:58,129 --> 00:12:55,649
fastener you really should reject it now

241
00:13:01,069 --> 00:12:58,139
here's something that is a lesser

242
00:13:02,809 --> 00:13:01,079
problem it just looks bad having little

243
00:13:04,489 --> 00:13:02,819
nicks or something like that as long as

244
00:13:07,359 --> 00:13:04,499
it's not a crack that's just a nick from

245
00:13:09,530 --> 00:13:07,369
handling and it doesn't affect the

246
00:13:11,900 --> 00:13:09,540
functioning of the threads you could

247
00:13:15,559 --> 00:13:11,910
probably accept a nick on the outside

248
00:13:18,379 --> 00:13:15,569
surface of the threads now here is

249
00:13:23,650 --> 00:13:18,389
another method of thread inspection a

250
00:13:25,220 --> 00:13:23,660
laser inspection method most

251
00:13:27,950 --> 00:13:25,230
manufacturing facility

252
00:13:33,250 --> 00:13:27,960
would not have this at all because it is

253
00:13:35,830 --> 00:13:33,260
a set up with a full computer printout

254
00:13:39,560 --> 00:13:35,840
availability and I think cost about

255
00:13:43,280 --> 00:13:39,570
$100,000 so you wouldn't find them in

256
00:13:46,450 --> 00:13:43,290
your normal inspection shop but it is a

257
00:13:51,350 --> 00:13:46,460
very accurate method of checking threads

258
00:13:55,430 --> 00:13:51,360
it uses laser triangulation sensors and

259
00:13:58,640 --> 00:13:55,440
a motion sensor to digitize the thread

260
00:14:02,840 --> 00:13:58,650
and form and it's a non-contact method

261
00:14:04,940 --> 00:14:02,850
you're using a laser beam and the the

262
00:14:07,280 --> 00:14:04,950
measurements are made by comparing the

263
00:14:09,650 --> 00:14:07,290

data obtained by laser scanning the

264
00:14:11,840 --> 00:14:09,660
thread to a perfect mating part that has

265
00:14:17,480 --> 00:14:11,850
been mathematically created in software

266
00:14:19,160 --> 00:14:17,490
and the thread axis is the method you

267
00:14:23,500 --> 00:14:19,170
use for spinning it around so you can

268
00:14:29,470 --> 00:14:23,510
check it at different points now these

269
00:14:31,940 --> 00:14:29,480
machines though are used for inspecting

270
00:14:33,650 --> 00:14:31,950
inspection equipment because they're

271
00:14:36,290 --> 00:14:33,660
accurate enough for instance you can use

272
00:14:40,160 --> 00:14:36,300
them to inspect the thread plug gauges

273
00:14:42,980 --> 00:14:40,170
and go/no-go gauges dyes and taps and

274
00:14:45,830 --> 00:14:42,990
they can handle parts up to six inches

275
00:14:48,920 --> 00:14:45,840
in diameter and four to 64 threads per

276
00:14:51,620 --> 00:14:48,930
inch now it's a time consuming thing so

277
00:14:56,600 --> 00:14:51,630
the the places that you would use it as

278
00:14:59,180 --> 00:14:56,610
say you don't have very many bolts

279
00:15:03,020 --> 00:14:59,190
holding an engine on a plane so on a 747

280
00:15:05,240 --> 00:15:03,030
if you wanted to inspect the super high

281
00:15:07,580 --> 00:15:05,250
strength alloy steel bolts that are

282
00:15:09,410 --> 00:15:07,590
holding it on you would run them through

283
00:15:14,060 --> 00:15:09,420
an inspection procedure like this check

284
00:15:18,260 --> 00:15:14,070
every one up because they're your it's a

285
00:15:20,360 --> 00:15:18,270
super critical application on the figure

286
00:15:23,540 --> 00:15:20,370
seventy eight is a picture of this one

287
00:15:26,750 --> 00:15:23,550
you set the fastener down on the the

288
00:15:30,860 --> 00:15:26,760

head you can turn it you scan the thread

289
00:15:38,180 --> 00:15:30,870
in and because this is on a rotary

290
00:15:42,290 --> 00:15:38,190
spindle here and once you you scan it

291
00:15:47,139 --> 00:15:42,300
then the the table will index to another

292
00:15:49,699 --> 00:15:47,149
location then you get a thread profile

293
00:15:54,139 --> 00:15:49,709
that you can compare it to a perfect

294
00:15:56,210 --> 00:15:54,149
thread so if you're really doing

295
00:16:00,230 --> 00:15:56,220
something critical this will work in

296
00:16:03,199 --> 00:16:00,240
fact I believe marshal I think got one

297
00:16:06,679 --> 00:16:03,209
of these machines because they wanted to

298
00:16:11,769 --> 00:16:06,689
use it for checking some of the super

299
00:16:13,670 --> 00:16:11,779
critical flight Hardware for shuttle and

300
00:16:16,610 --> 00:16:13,680
installations that they were putting

301
00:16:18,769 --> 00:16:16,620
together there so I went looked at him

302
00:16:21,650 --> 00:16:18,779
there's a company here in West Lake I

303
00:16:25,610 --> 00:16:21,660
believe handles them and they do work

304
00:16:28,790 --> 00:16:25,620
well except that you would not inspect

305
00:16:30,619 --> 00:16:28,800
something that was just an ordinary

306
00:16:34,819 --> 00:16:30,629
production part because it's too eh too

307
00:16:37,699 --> 00:16:34,829
time-consuming too expensive now there

308
00:16:41,449 --> 00:16:37,709
have been various discussions through

309
00:16:44,889 --> 00:16:41,459
the years on how variation in pitch

310
00:16:49,550 --> 00:16:44,899
diameter on a fastener can do them in

311
00:16:51,800 --> 00:16:49,560
and I guess this arguments been going on

312
00:16:54,050 --> 00:16:51,810
for 30 or 40 years or something like

313
00:16:57,829 --> 00:16:54,060

that so the industrial fasteners

314
00:17:01,189 --> 00:16:57,839
Institute here in Cleveland initiated a

315
00:17:03,829 --> 00:17:01,199
research effort in 1993 to manufacture

316
00:17:06,529 --> 00:17:03,839
measure and test a bunch of fasteners

317
00:17:09,230 --> 00:17:06,539
that were deliberately made out of

318
00:17:12,649 --> 00:17:09,240
tolerance on pitch diameter just to see

319
00:17:14,899 --> 00:17:12,659
how bad it was and they put out an

320
00:17:19,299 --> 00:17:14,909
article on that in mechanical

321
00:17:23,539 --> 00:17:19,309
engineering in the December 1996 edition

322
00:17:26,960 --> 00:17:23,549
and the conclusion was the variations in

323
00:17:28,820 --> 00:17:26,970
pitch diameter don't have a very big

324
00:17:31,279 --> 00:17:28,830
effect on the joint strength fatigue

325
00:17:33,020 --> 00:17:31,289
life and clamping performance in other

326
00:17:37,039 --> 00:17:33,030
words it can be out of Tolerance quite a

327
00:17:39,470 --> 00:17:37,049
bit and still pass the standard tensile

328
00:17:42,860 --> 00:17:39,480
and proof load requirements which kind

329
00:17:44,060 --> 00:17:42,870
of surprised a lot of people I I thought

330
00:17:46,460 --> 00:17:44,070
it would have more effect than that

331
00:17:49,360 --> 00:17:46,470
because varying the pitch diameter of

332
00:17:51,490 --> 00:17:49,370
course you are loading your threads

333
00:17:55,260 --> 00:17:51,500
unevenly

334
00:17:58,150 --> 00:17:55,270
but evidently what happens is that

335
00:18:01,480 --> 00:17:58,160
though you are loading them unevenly

336
00:18:03,760 --> 00:18:01,490
you're spreading the load around of

337
00:18:04,900 --> 00:18:03,770
where you get more yielding and it'll

338
00:18:08,200 --> 00:18:04,910

still carry the load

339
00:18:11,380 --> 00:18:08,210
so they some of the people who did the

340
00:18:15,940 --> 00:18:11,390
testing were surprised if it was that it

341
00:18:17,950 --> 00:18:15,950
was that good now moving to the other

342
00:18:22,990 --> 00:18:17,960
parts of the fastener the head and shank

343
00:18:24,940 --> 00:18:23,000
inspection there's one of the places

344
00:18:27,460 --> 00:18:24,950
where you can really get in front into

345
00:18:31,810 --> 00:18:27,470
trouble with a fastener is having any

346
00:18:33,940 --> 00:18:31,820
kind of a defect in the Phillip radius

347
00:18:37,240 --> 00:18:33,950
under the head because since that is one

348
00:18:40,600 --> 00:18:37,250
of your highest loaded areas any kind of

349
00:18:46,120 --> 00:18:40,610
a crack there usually will propagate to

350
00:18:48,640 --> 00:18:46,130
cause failure so a list of defects and

351
00:18:54,010 --> 00:18:48,650
their definitions are given an ASTM F

352
00:18:59,130 --> 00:18:54,020
788 that is for the fasteners and nut

353
00:19:01,930 --> 00:18:59,140
inspection is covered in ASTM F 812

354
00:19:05,320 --> 00:19:01,940
there are very similar methods of

355
00:19:10,210 --> 00:19:05,330
inspections so I'll cover primarily the

356
00:19:16,260 --> 00:19:10,220
ones here just for fasteners and leave

357
00:19:23,260 --> 00:19:19,350
quench cracks are caused by excessively

358
00:19:29,650 --> 00:19:23,270
high thermal and transformation stresses

359
00:19:32,170 --> 00:19:29,660
during heat treatment and so getting one

360
00:19:35,530 --> 00:19:32,180
of those means that you've got problems

361
00:19:42,760 --> 00:19:35,540
with the material so you could have a

362
00:19:46,930 --> 00:19:42,770
problem with it so in general quench

363
00:19:49,290 --> 00:19:46,940

cracks of any detectable size by visual

364
00:19:52,360 --> 00:19:49,300
inspection make the fastener

365
00:19:57,630 --> 00:19:52,370
unacceptable and here's another one this

366
00:20:01,330 --> 00:19:57,640
is a pet peeve of mine socket head depth

367
00:20:04,030 --> 00:20:01,340
even though if you go to any of the Aunt

368
00:20:07,300 --> 00:20:04,040
suspects and

369
00:20:08,380 --> 00:20:07,310
or mil spects any of these on socket

370
00:20:11,500 --> 00:20:08,390
head fasteners

371
00:20:14,770 --> 00:20:11,510
they give dimensions for the depth of

372
00:20:20,250 --> 00:20:14,780
socket but I have yet to find anybody

373
00:20:25,840 --> 00:20:20,260
that's ever checked one we had a problem

374
00:20:29,410 --> 00:20:25,850
here a couple years ago with some na s

375
00:20:32,310 --> 00:20:29,420
fasteners that the heads popped off of

376
00:20:36,990 --> 00:20:32,320
them in a wind tunnel installation and

377
00:20:42,480 --> 00:20:37,000
when we looked at him the socket depth

378
00:20:45,370 --> 00:20:42,490
was too deep well see in a socket head

379
00:20:48,070 --> 00:20:45,380
if that depth gets too deep you wind up

380
00:20:51,120 --> 00:20:48,080
with a small annulus of area there is

381
00:20:53,650 --> 00:20:51,130
all you have left if you get below the

382
00:20:56,830 --> 00:20:53,660
the bottom of the head with the socket

383
00:21:01,240 --> 00:20:56,840
depth you're in trouble and that's what

384
00:21:06,100 --> 00:21:01,250
was happening and although everybody

385
00:21:13,080 --> 00:21:06,110
talks about him there like UFOs no

386
00:21:22,350 --> 00:21:17,640
here are some examples of the things in

387
00:21:26,310 --> 00:21:22,360
head and shank inspection and cracks in

388
00:21:29,460 --> 00:21:26,320

general these are quenched cracks which

389
00:21:34,830 --> 00:21:29,470
you can see can happen in the heads in

390
00:21:36,210 --> 00:21:34,840
the shank around the top of the head but

391
00:21:38,850 --> 00:21:36,220
here's the one that really gets you if

392
00:21:42,000 --> 00:21:38,860
you have any cracks here in this radius

393
00:21:42,750 --> 00:21:42,010
fill it radius under the head you're in

394
00:21:50,880 --> 00:21:42,760
real trouble

395
00:21:53,640 --> 00:21:50,890
so that is from that FF s 86 or ASTM 788

396
00:21:57,780 --> 00:21:53,650
I don't remember now which forging

397
00:22:01,050 --> 00:21:57,790
cracks now remember I mentioned on

398
00:22:04,830 --> 00:22:01,060
fasteners that the higher strength ones

399
00:22:08,850 --> 00:22:04,840
usually have forged heads because you

400
00:22:11,580 --> 00:22:08,860
don't want to have the discontinuity in

401
00:22:14,940 --> 00:22:11,590
green flow at the particularly tough

402
00:22:17,790 --> 00:22:14,950
illustrate Phillip radius so you can get

403
00:22:19,710 --> 00:22:17,800
forging cracks during the cut off or

404
00:22:21,870 --> 00:22:19,720
forging operation or even cold forging

405
00:22:24,240 --> 00:22:21,880
you can get some on the material if the

406
00:22:26,970 --> 00:22:24,250
material is a little bit too hard when

407
00:22:29,220 --> 00:22:26,980
you're when you're cold forging it and

408
00:22:31,680 --> 00:22:29,230
these are located on the top of the head

409
00:22:36,330 --> 00:22:31,690
or on the raised periphery around the

410
00:22:38,940 --> 00:22:36,340
indented head bolts and screws and you

411
00:22:41,370 --> 00:22:38,950
can you can except some of them if they

412
00:22:43,710 --> 00:22:41,380
are very very slight so that they're

413
00:22:47,790 --> 00:22:43,720

more or less a street grid than a crack

414
00:22:52,890 --> 00:22:47,800
just just a indentation mark as long as

415
00:22:55,080 --> 00:22:52,900
they have a very shallow depth but once

416
00:22:57,510 --> 00:22:55,090
again depends on the criticality of the

417
00:23:03,390 --> 00:22:57,520
installation as to how much you accept

418
00:23:06,440 --> 00:23:03,400
in the cracks here's one that shows a

419
00:23:10,050 --> 00:23:06,450
forging track on the top of the head and

420
00:23:15,180 --> 00:23:10,060
if you look at those a limits on depth

421
00:23:20,430 --> 00:23:15,190
you'll see that if you take 0.04 times

422
00:23:23,460 --> 00:23:20,440
the diameter or something like that for

423
00:23:26,370 --> 00:23:23,470
a bolt that is a 1/4 inch in diameter

424
00:23:26,700 --> 00:23:26,380
that's a pretty shallow crack it's

425
00:23:29,269 --> 00:23:26,710
enough

426
00:23:32,789 --> 00:23:29,279
more than a streak that you can see so

427
00:23:35,220 --> 00:23:32,799
so so that type of crack wouldn't so

428
00:23:41,220 --> 00:23:35,230
called crack would be acceptable now

429
00:23:44,909 --> 00:23:41,230
here is a fear burst and that's an open

430
00:23:51,889 --> 00:23:44,919
break in the in the metal from forming

431
00:23:55,769 --> 00:23:51,899
and you can you can accept these only if

432
00:23:57,720 --> 00:23:55,779
there is it's in the flats and extends

433
00:23:59,279 --> 00:23:57,730
in the crown chamfer circle at the top

434
00:24:03,419 --> 00:23:59,289
of the head or in the under head bearing

435
00:24:05,519 --> 00:24:03,429
circle and none of you located at the

436
00:24:07,769 --> 00:24:05,529
intersection of the wrenching flats that

437
00:24:10,230 --> 00:24:07,779
reduces the width across corners below

438
00:24:15,000 --> 00:24:10,240

its specified minimum in other words you

439
00:24:18,480 --> 00:24:15,010
can you can accept some of these once

440
00:24:21,210 --> 00:24:18,490
again if they are so shallow that they

441
00:24:25,289 --> 00:24:21,220
don't look like a crack itself but just

442
00:24:27,570 --> 00:24:25,299
beware of them because the this is one

443
00:24:29,220 --> 00:24:27,580
here and you see this is really this one

444
00:24:31,950 --> 00:24:29,230
amounts to just a little dent on the

445
00:24:34,049 --> 00:24:31,960
corner of the flat so so that would

446
00:24:36,889 --> 00:24:34,059
probably be acceptable as long as it did

447
00:24:39,720 --> 00:24:36,899
not look like a crack itself

448
00:24:43,019 --> 00:24:39,730
Foles that's the kind of a doubling over

449
00:24:46,049 --> 00:24:43,029
material which occurs during the forging

450
00:24:48,919 --> 00:24:46,059
operation and usually occurs near the

451
00:24:53,570 --> 00:24:48,929
intersection of diameter changes

452
00:24:56,460 --> 00:24:53,580
particularly with non circular heads and

453
00:25:00,419 --> 00:24:56,470
the only problem that you look at with

454
00:25:02,430 --> 00:25:00,429
that is you can allow them in some cases

455
00:25:08,760 --> 00:25:02,440
at the corners but you don't want any

456
00:25:12,510 --> 00:25:08,770
near the Phillip radius of the fastener

457
00:25:15,899 --> 00:25:12,520
in in this area here now here you're

458
00:25:21,990 --> 00:25:15,909
getting it because you're trying to form

459
00:25:23,669 --> 00:25:22,000
a round cross-section in the square so

460
00:25:26,669 --> 00:25:23,679
it's kind of hard to form that without

461
00:25:31,350 --> 00:25:26,679
getting some deformation and burgers

462
00:25:34,110 --> 00:25:31,360
around it so so once again you look to

463
00:25:39,730 --> 00:25:34,120

see where it's at and evaluate it before

464
00:25:48,200 --> 00:25:44,060
now seams are usually in the raw

465
00:25:51,830 --> 00:25:48,210
material before forming and they're

466
00:25:54,380 --> 00:25:51,840
pretty straight and see seams are

467
00:25:58,010 --> 00:25:54,390
acceptable because usually they're

468
00:26:00,590 --> 00:25:58,020
they're not a crack per se and they're

469
00:26:02,930 --> 00:26:00,600
they're shallow and don't have and have

470
00:26:07,550 --> 00:26:02,940
a pretty good radius now see here if you

471
00:26:13,430 --> 00:26:07,560
look at this it's point O three times

472
00:26:15,410 --> 00:26:13,440
the diameter so if you go with a 1/2

473
00:26:16,820 --> 00:26:15,420
inch fastener you see you still have

474
00:26:19,790 --> 00:26:16,830
something there that you would have

475
00:26:26,000 --> 00:26:19,800
trouble even seeing it's so shallow so

476
00:26:28,670 --> 00:26:26,010
so that would be okay surface voids you

477
00:26:33,230 --> 00:26:28,680
can get this in a material due to the

478
00:26:35,870 --> 00:26:33,240
way it's formed but you got to watch if

479
00:26:37,280 --> 00:26:35,880
it's it indicates there's probably

480
00:26:40,010 --> 00:26:37,290
something wrong with the chemistry of

481
00:26:43,550 --> 00:26:40,020
the material if you're getting a lot of

482
00:26:47,840 --> 00:26:43,560
voids in the surface and once again the

483
00:26:50,780 --> 00:26:47,850
void depth look at the amount here that

484
00:26:53,030 --> 00:26:50,790
you're allowed point O two times the

485
00:26:55,780 --> 00:26:53,040
shank diameter that's still or ten

486
00:26:59,600 --> 00:26:55,790
thousandths all right at ten thousandths

487
00:27:04,520 --> 00:26:59,610
void is a pretty shallow one and then

488
00:27:10,370 --> 00:27:04,530

the this one I would look at if you had

489
00:27:13,430 --> 00:27:10,380
void areas that are that high a

490
00:27:15,410 --> 00:27:13,440
percentage of the under head bearing

491
00:27:18,590 --> 00:27:15,420
area I would look at the material to see

492
00:27:20,570 --> 00:27:18,600
whether I had the right material

493
00:27:24,410 --> 00:27:20,580
chemistry or not and whether I'd want to

494
00:27:28,850 --> 00:27:24,420
reject it on that basis now tool marks

495
00:27:31,490 --> 00:27:28,860
Nicks and gouges they're permitted on

496
00:27:34,850 --> 00:27:31,500
the under head surface but you notice

497
00:27:39,940 --> 00:27:34,860
the restriction on that astonish your

498
00:27:44,420 --> 00:27:39,950
micro inch surface roughness does not go

499
00:27:48,620 --> 00:27:44,430
under the 125 well you see a 125 is

500
00:27:52,250 --> 00:27:48,630
really not not too rough it's a rough

501
00:27:54,830 --> 00:27:52,260
machining surface and

502
00:27:56,810 --> 00:27:54,840
so the the other place that you would

503
00:27:59,390 --> 00:27:56,820
look at if the head is banged up a

504
00:28:02,330 --> 00:27:59,400
little bit and it's on the corners out

505
00:28:05,770 --> 00:28:02,340
of the way you could probably accept it

506
00:28:10,310 --> 00:28:05,780
as long as the plating surface is not

507
00:28:11,780 --> 00:28:10,320
gouged now plating inspections this is

508
00:28:15,890 --> 00:28:11,790
another this is another one of those

509
00:28:18,730 --> 00:28:15,900
that we talked about and people don't do

510
00:28:21,440 --> 00:28:18,740
other than look at it same yep that's

511
00:28:24,380 --> 00:28:21,450
that's a gold color so it means it's got

512
00:28:28,220 --> 00:28:24,390
chromate in it and don't see that it's

513
00:28:31,610 --> 00:28:28,230

got up too much so guess it's alright

514
00:28:33,980 --> 00:28:31,620
most of the platings we've discussed

515
00:28:36,230 --> 00:28:33,990
earlier and but we didn't discuss

516
00:28:41,900 --> 00:28:36,240
discuss anything on the inspection of

517
00:28:44,000 --> 00:28:41,910
them so we'll kind of limit our coverage

518
00:28:46,460 --> 00:28:44,010
here to zinc and cadmium platings

519
00:28:51,890 --> 00:28:46,470
except for just visually looking at the

520
00:28:54,680 --> 00:28:51,900
things and the substitution of zinc for

521
00:28:59,270 --> 00:28:54,690
cadmium and using a dye and amassed the

522
00:29:04,549 --> 00:28:59,280
color is a common way to cheat it's done

523
00:29:08,390 --> 00:29:04,559
off a lot and because the the chromate

524
00:29:11,060 --> 00:29:08,400
dye that you use usually you look at it

525
00:29:15,020 --> 00:29:11,070
and the fasteners are gold type color

526
00:29:18,260 --> 00:29:15,030
and it you can't tell by looking at it

527
00:29:22,159 --> 00:29:18,270
whether it's a zinc or cadmium so the

528
00:29:26,870 --> 00:29:22,169
only way to find out is actually to run

529
00:29:31,669 --> 00:29:26,880
a test now you can do two different

530
00:29:33,289 --> 00:29:31,679
things on it you can destroy the plating

531
00:29:35,330 --> 00:29:33,299
on a fastener and take a chunk of the

532
00:29:38,530 --> 00:29:35,340
plating and go put it in a scanning

533
00:29:42,320 --> 00:29:38,540
electron microscope and see whether it's

534
00:29:43,730 --> 00:29:42,330
mostly cadmium are mostly zinc but then

535
00:29:52,690 --> 00:29:43,740
there are other things that you can do

536
00:29:55,010 --> 00:29:52,700
here too then in inspecting now zinc is

537
00:29:58,580 --> 00:29:55,020
usually covered by ASTM

538
00:30:04,789 --> 00:29:58,590

B 633 and cadmium is covered by a

539
00:30:06,080 --> 00:30:04,799
federal spec uqp 416 you can do process

540
00:30:10,130 --> 00:30:06,090
control inspection

541
00:30:12,710 --> 00:30:10,140
and the plating outfits are supposed to

542
00:30:15,560 --> 00:30:12,720
do that and most of them do so that they

543
00:30:17,720 --> 00:30:15,570
control the amount of additives they put

544
00:30:19,760 --> 00:30:17,730
in if their bath gets tired they can add

545
00:30:26,870 --> 00:30:19,770
chemicals to it and so on and take new

546
00:30:29,170 --> 00:30:26,880
readings determine how it is plating and

547
00:30:31,700 --> 00:30:29,180
you can do a lot sampling inspection

548
00:30:36,500 --> 00:30:31,710
visual inspection and plating thickness

549
00:30:38,360 --> 00:30:36,510
tests there is in fact I believe a guy

550
00:30:41,330 --> 00:30:38,370
from here at Lewis just recently

551
00:30:45,230 --> 00:30:41,340
developed a method of inspecting the

552
00:30:47,870 --> 00:30:45,240
thickness of plating Dan Roth works over

553
00:30:49,550 --> 00:30:47,880
in M and s or the what used to be M and

554
00:30:52,310 --> 00:30:49,560
s I believe developed one but there are

555
00:30:54,410 --> 00:30:52,320
methods of looking at and I think

556
00:30:58,820 --> 00:30:54,420
ultrasonically measuring plating

557
00:31:01,190 --> 00:30:58,830
thickness on materials you can do an

558
00:31:03,590 --> 00:31:01,200
adhesion test you can do a corrosion

559
00:31:06,560 --> 00:31:03,600
test and you do hydrogen embrittlement

560
00:31:11,060 --> 00:31:06,570
test although the hydrogen embrittlement

561
00:31:13,280 --> 00:31:11,070
test you can get that with both zinc and

562
00:31:17,270 --> 00:31:13,290
cadmium so that in itself would not be

563
00:31:22,430 --> 00:31:17,280

conclusive the lot sampling technique

564
00:31:25,760 --> 00:31:22,440
you can take a lot of plated fasteners

565
00:31:29,150 --> 00:31:25,770
of the same metal composition and so on

566
00:31:32,300 --> 00:31:29,160
and take a bunch of samples out visually

567
00:31:34,490 --> 00:31:32,310
inspect them look to see if the plating

568
00:31:36,620 --> 00:31:34,500
is smooth and to see whether that here

569
00:31:40,520 --> 00:31:36,630
is properly whether it has blisters in

570
00:31:42,350 --> 00:31:40,530
it fits and that sort of thing and then

571
00:31:44,990 --> 00:31:42,360
you could alright you can measure them

572
00:31:47,510 --> 00:31:45,000
non-destructively by these various

573
00:31:50,540 --> 00:31:47,520
testers an electronic test eddy current

574
00:31:52,640 --> 00:31:50,550
magnetic beta radiation back scatter and

575
00:31:59,440 --> 00:31:52,650
all these things that's covered in one

576
00:32:05,930 --> 00:31:59,450
of the sections of the mill handbook h28

577
00:32:08,360 --> 00:32:05,940
you can take plated specimens for the

578
00:32:10,490 --> 00:32:08,370
required adhesion corrosion and hydrogen

579
00:32:13,550 --> 00:32:10,500
embrittlement tests from a production

580
00:32:17,899 --> 00:32:13,560
lot at scheduled times you can determine

581
00:32:19,759 --> 00:32:17,909
the adhesion and this is a real

582
00:32:22,969 --> 00:32:19,769
scientific method by scraping the

583
00:32:25,039 --> 00:32:22,979
surface with a knife and then looking at

584
00:32:27,889 --> 00:32:25,049
it to see whether it is adhering

585
00:32:30,049 --> 00:32:27,899
properly with a magnifying glass that's

586
00:32:35,769 --> 00:32:30,059
a method of inspection that you can do

587
00:32:42,190 --> 00:32:38,899
now corrosion resistance is determined

588
00:32:47,840 --> 00:32:42,200

of course by doing your salt spray test

589
00:32:51,139 --> 00:32:47,850
which runs 96 hours and after the

590
00:32:54,619 --> 00:32:51,149
exposure the presence of corrosion

591
00:32:56,299 --> 00:32:54,629
products visible to the unaided eye at

592
00:32:58,549 --> 00:32:56,309
normal reading distance is caused by

593
00:33:03,379 --> 00:32:58,559
rejection because you should not get any

594
00:33:05,810 --> 00:33:03,389
rusting on it or deposition of corrosion

595
00:33:10,279 --> 00:33:05,820
products and for the 96 hours now

596
00:33:13,099 --> 00:33:10,289
hydrogen embrittlement testing this one

597
00:33:15,440 --> 00:33:13,109
is there are different schools of

598
00:33:17,690 --> 00:33:15,450
thought on where you should start on the

599
00:33:19,969 --> 00:33:17,700
hydrogen embrittlement testing some of

600
00:33:22,849 --> 00:33:19,979
the faster manufacturers of the lower

601
00:33:24,799 --> 00:33:22,859
strength fasteners say gee you don't

602
00:33:26,359 --> 00:33:24,809
have to do it on lower strength

603
00:33:30,009 --> 00:33:26,369
fasteners because you can't get hydrogen

604
00:33:33,349 --> 00:33:30,019
embrittlement well a guy by the name of

605
00:33:37,519 --> 00:33:33,359
Lou Raymond who is kind of the Guru in

606
00:33:40,219 --> 00:33:37,529
the US on hydrogen embrittlement ran

607
00:33:42,200 --> 00:33:40,229
some tests and decided that you get

608
00:33:44,869 --> 00:33:42,210
hydrogen embrittlement all the way down

609
00:33:47,080 --> 00:33:44,879
to about a great 5 fastener the only

610
00:33:54,669 --> 00:33:47,090
thing is it takes it longer to show up

611
00:33:57,080 --> 00:33:54,679
so in this ASTM spec it only they go

612
00:33:58,879 --> 00:33:57,090
anything above a hundred and forty four

613
00:34:01,930 --> 00:33:58,889

which means your grade eight would be

614
00:34:07,849 --> 00:34:01,940
the first one that you would test and

615
00:34:10,099 --> 00:34:07,859
put it at crank it up to 85% of tensile

616
00:34:11,750 --> 00:34:10,109
element for a minimum of a 70 to 72

617
00:34:14,000 --> 00:34:11,760
hours and you shouldn't have heads

618
00:34:18,609 --> 00:34:14,010
popping off if you have heads popping

619
00:34:23,629 --> 00:34:21,500
now the sample size and rejection

620
00:34:25,490 --> 00:34:23,639
criteria

621
00:34:31,640 --> 00:34:25,500
normally you pick a bunch of random

622
00:34:39,500 --> 00:34:36,110
the ASTM f 788 has a table which will

623
00:34:41,360 --> 00:34:39,510
show later that gives you the number of

624
00:34:45,710 --> 00:34:41,370
samples that you should take for a given

625
00:34:49,250 --> 00:34:45,720
production lot another one is given in

626
00:34:52,370 --> 00:34:49,260
this aunt cas qcz 1.4

627
00:34:55,700 --> 00:34:52,380
which superseded mil standard one 105

628
00:35:00,670 --> 00:34:55,710
and then we have aunt suspect be

629
00:35:04,370 --> 00:35:00,680
eighteen eighteen point one that gives

630
00:35:08,180 --> 00:35:04,380
some sampling techniques the basis of

631
00:35:11,470 --> 00:35:08,190
all of these is to randomly pick a small

632
00:35:17,750 --> 00:35:11,480
sample and any failure of the samples

633
00:35:21,890 --> 00:35:17,760
rejects the whole life here is one from

634
00:35:24,110 --> 00:35:21,900
ASTM f 788 which shows you the sample

635
00:35:30,440 --> 00:35:24,120
size that you should take for a given

636
00:35:32,900 --> 00:35:30,450
lot size and you check it for all of

637
00:35:35,990 --> 00:35:32,910
these different tests that you want to

638
00:35:37,910 --> 00:35:36,000

run and once again the amount of testing

639
00:35:43,700 --> 00:35:37,920
that you do depends on the criticality

640
00:35:46,850 --> 00:35:43,710
of the design so if you find that there

641
00:35:49,550 --> 00:35:46,860
okay you can proceed and accept the

642
00:35:51,770 --> 00:35:49,560
quantity of fasteners that you have if

643
00:35:54,460 --> 00:35:51,780
you find problems and you could go ahead

644
00:35:57,380 --> 00:35:54,470
and insist on more testing to verify

645
00:36:01,510 --> 00:35:57,390
that it's not as serious as it appears

646
00:36:03,650 --> 00:36:01,520
on the surface now for macroscopic

647
00:36:07,780 --> 00:36:03,660
examination of predix with seam

648
00:36:13,760 --> 00:36:07,790
indications here is a sample table from

649
00:36:15,770 --> 00:36:13,770
ASTM f 788 and you can take them a look

650
00:36:19,880 --> 00:36:15,780
at them according to this sampling

651
00:36:24,410 --> 00:36:19,890
technique and if they are not judged

652
00:36:31,240 --> 00:36:24,420
acceptable then you can either conduct

653
00:36:37,329 --> 00:36:34,609
there's been a lot of talk on the lot

654
00:36:40,099 --> 00:36:37,339
traceability and commingling and

655
00:36:42,440 --> 00:36:40,109
certifications and so on

656
00:36:45,309 --> 00:36:42,450
concerning the fastener quality act

657
00:36:51,589 --> 00:36:45,319
which is also known as public law 101

658
00:36:54,559 --> 00:36:51,599
amended its 101 592 as amended by 104 -

659
00:36:56,660 --> 00:36:54,569
113 and of course one of the things that

660
00:37:00,410 --> 00:36:56,670
is covered in that law is lot

661
00:37:02,569 --> 00:37:00,420
traceability of fasteners the customer

662
00:37:05,540 --> 00:37:02,579
can ask for the steel manufacturers name

663
00:37:07,400 --> 00:37:05,550

the lot number chemical analysis of the

664
00:37:10,520 --> 00:37:07,410
wire from the which the fasteners were

665
00:37:13,099 --> 00:37:10,530
made and of course from domestic

666
00:37:16,010 --> 00:37:13,109
suppliers this information is readily

667
00:37:18,920 --> 00:37:16,020
available because most companies when

668
00:37:21,890 --> 00:37:18,930
they make fasteners they get a bill of

669
00:37:24,770 --> 00:37:21,900
lading with the coil material that gives

670
00:37:27,380 --> 00:37:24,780
all this information on it and but on

671
00:37:29,270 --> 00:37:27,390
imported fasteners then it's a bit of a

672
00:37:32,870 --> 00:37:29,280
problem to get it because you have to

673
00:37:36,740 --> 00:37:32,880
get the certification from the person

674
00:37:39,890 --> 00:37:36,750
who made it in the foreign country now

675
00:37:44,420 --> 00:37:39,900
on co-mingling this is something that's

676
00:37:48,970 --> 00:37:44,430
kind of a new word but what it is in the

677
00:37:51,470 --> 00:37:48,980
past the fastener distributors would get

678
00:37:55,370 --> 00:37:51,480
fasteners from all different suppliers

679
00:37:57,109 --> 00:37:55,380
put them together in a barrel and when

680
00:37:59,150 --> 00:37:57,119
someone ordered some they get a bunch

681
00:38:01,280 --> 00:37:59,160
out of the barrel so you it would be

682
00:38:04,520 --> 00:38:01,290
theoretically possible for you to get a

683
00:38:08,420 --> 00:38:04,530
hundred fasteners made by 25 or 30

684
00:38:13,309 --> 00:38:08,430
different manufacturers under this this

685
00:38:15,559 --> 00:38:13,319
part of the law the commingling would be

686
00:38:18,559 --> 00:38:15,569
cut way down to where you can only have

687
00:38:20,809 --> 00:38:18,569
the fasteners from two different

688
00:38:23,359 --> 00:38:20,819

manufacturers in the same lot because

689
00:38:26,390 --> 00:38:23,369
each each manufacturer must register his

690
00:38:28,130 --> 00:38:26,400
trademark with asme then he has a stamp

691
00:38:31,190 --> 00:38:28,140
his trademark on all the fasteners

692
00:38:34,609 --> 00:38:31,200
covered by the law now the the minimum

693
00:38:36,730 --> 00:38:34,619
size is covered are quarter inch in the

694
00:38:40,970 --> 00:38:36,740
inch system and five millimeter

695
00:38:43,609 --> 00:38:40,980
diameters in the metric of course that

696
00:38:44,690 --> 00:38:43,619
is not altogether true - because if the

697
00:38:47,030 --> 00:38:44,700
fastener is three

698
00:38:48,950 --> 00:38:47,040
hardened in other words if it's a

699
00:38:51,440 --> 00:38:48,960
heat-treated fastener then smaller sizes

700
00:38:54,500 --> 00:38:51,450
are covered but nearly all the small

701
00:38:56,300 --> 00:38:54,510
sizes are excluded from the law because

702
00:38:58,760 --> 00:38:56,310
they're not heat treated that much

703
00:39:01,370 --> 00:38:58,770
now if the fasteners haven't been

704
00:39:05,540 --> 00:39:01,380
exempted they're now restricted by this

705
00:39:07,490 --> 00:39:05,550
commingling rule and of course you can't

706
00:39:10,490 --> 00:39:07,500
have more than two locks in the same

707
00:39:13,220 --> 00:39:10,500
container at least this way you have a

708
00:39:15,109 --> 00:39:13,230
better idea of who the manufacturer was

709
00:39:22,400 --> 00:39:15,119
on your lot of fasteners that you're

710
00:39:25,430 --> 00:39:22,410
getting for your usage a customer can

711
00:39:27,650 --> 00:39:25,440
demand certifications such as the

712
00:39:31,000 --> 00:39:27,660
material lot numbers chemical analysis

713
00:39:36,020 --> 00:39:31,010

reports in tensile test data and this

714
00:39:39,079 --> 00:39:36,030
documentation is notarized and legally

715
00:39:41,240 --> 00:39:39,089
binding on the suppliers part now in the

716
00:39:46,339 --> 00:39:41,250
past we could get certifications with

717
00:39:48,130 --> 00:39:46,349
fasteners but they normally were a sheet

718
00:39:51,710 --> 00:39:48,140
that the clerk who filled the order

719
00:39:54,109 --> 00:39:51,720
initialed and said these are certified

720
00:39:58,430 --> 00:39:54,119
to be good and that was it and so nobody

721
00:40:01,490 --> 00:39:58,440
was legally responsible so if it is done

722
00:40:04,370 --> 00:40:01,500
this way with the certification then the

723
00:40:08,780 --> 00:40:04,380
supplier is legally responsible for the

724
00:40:10,700 --> 00:40:08,790
fastener so one of the gimmicks that

725
00:40:13,940 --> 00:40:10,710
some of the distributors distributors

726
00:40:16,160 --> 00:40:13,950
are using is they're saying okay you

727
00:40:17,900 --> 00:40:16,170
want certified fasteners it'll cost you

728
00:40:18,800 --> 00:40:17,910
three times as much for certified

729
00:40:28,640 --> 00:40:18,810
fasteners

730
00:40:32,109 --> 00:40:28,650
that's one of the loopholes if the

731
00:40:34,250 --> 00:40:32,119
distributor is not required to provide

732
00:40:38,240 --> 00:40:34,260
certifications he's not responsible for

733
00:40:42,230 --> 00:40:38,250
fasteners anymore the other thing that

734
00:40:48,410 --> 00:40:42,240
is in that law which is a real big

735
00:40:53,030 --> 00:40:48,420
loophole is agreement between customer

736
00:40:55,069 --> 00:40:53,040
and manufacturer now if the customer is

737
00:40:58,550 --> 00:40:55,079
a clerk who knows nothing about

738
00:41:00,110 --> 00:40:58,560

fasteners they can make all sorts of

739
00:41:03,140 --> 00:41:00,120
agreement with the manufacturer without

740
00:41:07,700 --> 00:41:03,150
even knowing it so that so in other

741
00:41:10,400 --> 00:41:07,710
words it's don't-ask don't-tell type

742
00:41:12,800 --> 00:41:10,410
thing with these fastener certifications

743
00:41:14,780 --> 00:41:12,810
if you don't ask for them and insist

744
00:41:16,880 --> 00:41:14,790
that you get them and pay the surcharge

745
00:41:25,580 --> 00:41:16,890
forgetting them you're not going to get

746
00:41:30,800 --> 00:41:25,590
them so that's where the fastener

747
00:41:33,410 --> 00:41:30,810
quality act stands and I am although a

748
00:41:35,330 --> 00:41:33,420
lot of fastener manufacturers are scared

749
00:41:38,930 --> 00:41:35,340
and a lot of companies are scared on it

750
00:41:40,490 --> 00:41:38,940
I don't honestly think myself that it's

751
00:41:46,970 --> 00:41:40,500
going to amount to that much in the long

752
00:41:50,480 --> 00:41:46,980
run it is being handled by NIST and of

753
00:41:53,360 --> 00:41:50,490
course the the government will enforce

754
00:41:57,530 --> 00:41:53,370
the laws how much they enforce them

755
00:42:00,680 --> 00:41:57,540
nobody knows yet I went to the school

756
00:42:02,360 --> 00:42:00,690
that they taught on how it would be

757
00:42:05,420 --> 00:42:02,370
implemented it's something like a

758
00:42:07,730 --> 00:42:05,430
hundred page document even the lawyers

759
00:42:11,480 --> 00:42:07,740
can't agree on how it should be

760
00:42:16,610 --> 00:42:11,490
interpreted so they'll probably ask for

761
00:42:19,820 --> 00:42:16,620
another delay in 98 now as far as

762
00:42:23,030 --> 00:42:19,830
inspection and test standards there are

763
00:42:25,490 --> 00:42:23,040

all kinds of specifications for testing

764
00:42:30,050 --> 00:42:25,500
inspection methods and what we have done

765
00:42:33,470 --> 00:42:30,060
is listed as many of those as we can in

766
00:42:35,870 --> 00:42:33,480
the appendices we also have general

767
00:42:38,030 --> 00:42:35,880
references in the appendices for where

768
00:42:40,280 --> 00:42:38,040
some of this material came from and

769
00:42:44,000 --> 00:42:40,290
additional references in case you'd want

770
00:42:47,350 --> 00:42:44,010
to check further since so many fastener

771
00:42:50,390 --> 00:42:47,360
tests are done per mil standard 13 12

772
00:42:57,230 --> 00:42:50,400
will give a summary of its contents here

773
00:42:59,600 --> 00:42:57,240
just kind of go over it it establishes

774
00:43:04,100 --> 00:42:59,610
standard methods for testing fasteners

775
00:43:07,450 --> 00:43:04,110
in both the metric and the inch pound

776
00:43:11,660 --> 00:43:07,460
system and the standard test methods

777
00:43:14,539 --> 00:43:11,670
yield data and design allowables

778
00:43:18,859 --> 00:43:14,549
that are safe to use in fact mil

779
00:43:21,559 --> 00:43:18,869
handbook five uses mil standard 1312 for

780
00:43:24,170 --> 00:43:21,569
running their tests on both materials

781
00:43:26,660 --> 00:43:24,180
and fasteners that they publish in the

782
00:43:32,559 --> 00:43:26,670
book and also fastener allowables in the

783
00:43:42,289 --> 00:43:37,280
each test has a standard method spelled

784
00:43:44,870 --> 00:43:42,299
out and each and if their book forms for

785
00:43:48,910 --> 00:43:44,880
each one of them so you have a - -

786
00:43:52,339 --> 00:43:48,920
number for it that gives you a

787
00:43:56,900 --> 00:43:52,349
standalone document if you will so if

788
00:43:59,000 --> 00:43:56,910

you turn over to the next page here are

789
00:44:01,010 --> 00:43:59,010
the different categories the salt spray

790
00:44:04,280 --> 00:44:01,020
test that we've covered the interaction

791
00:44:06,890 --> 00:44:04,290
tests humidity lap shear test stress

792
00:44:10,030 --> 00:44:06,900
durability hardness testing tensile

793
00:44:13,069 --> 00:44:10,040
strength stress corrosion stress rupture

794
00:44:20,539 --> 00:44:13,079
fatigue the thickness of metallic

795
00:44:25,030 --> 00:44:20,549
coatings and doubles your testing and on

796
00:44:28,670 --> 00:44:25,040
the then we go to torque tension

797
00:44:30,349 --> 00:44:28,680
clamping forces for installed or

798
00:44:33,589 --> 00:44:30,359
installation for fasteners stress

799
00:44:37,250 --> 00:44:33,599
relaxation elevated temperature tensile

800
00:44:41,180 --> 00:44:37,260
tests sealing single shear sure joint

801
00:44:44,299 --> 00:44:41,190
fatigue receptacle push out panel

802
00:44:46,490 --> 00:44:44,309
fasteners for electrical tensile

803
00:44:53,750 --> 00:44:46,500
strength - panel fasteners and and

804
00:44:56,930 --> 00:44:53,760
receptacle torque out fasteners then you

805
00:44:59,539 --> 00:44:56,940
have grabbing recessed torque for a

806
00:45:03,829 --> 00:44:59,549
quality conformance test structural

807
00:45:06,589 --> 00:45:03,839
panel lap shear sheet pull up now this

808
00:45:11,930 --> 00:45:06,599
is something that is important and some

809
00:45:14,390 --> 00:45:11,940
of the cherry rivet type manufacturers

810
00:45:19,940 --> 00:45:14,400
the pulls damn tape rivet manufacturers

811
00:45:22,670 --> 00:45:19,950
have had trouble meeting the this sheet

812
00:45:25,570 --> 00:45:22,680
pull up because if you have several

813
00:45:29,690 --> 00:45:25,580

sheets together maybe they're not

814
00:45:32,480 --> 00:45:29,700
exactly flat and you try to pull them up

815
00:45:34,730 --> 00:45:32,490
and clinched the rivet sometimes you

816
00:45:37,700 --> 00:45:34,740
have trouble passing this test with

817
00:45:40,100 --> 00:45:37,710
these pull stem rivets so a lot of the

818
00:45:42,200 --> 00:45:40,110
manufacturers have had to go back and

819
00:45:44,420 --> 00:45:42,210
revise things to get a little more pull

820
00:45:47,630 --> 00:45:44,430
in the system so that they can lock the

821
00:45:53,570 --> 00:45:47,640
rivets so that's what that one is

822
00:45:56,000 --> 00:45:53,580
is used for that one there would be for

823
00:45:59,840 --> 00:45:56,010
the blind fasteners then you have

824
00:46:02,660 --> 00:45:59,850
locking torque tests and this last one

825
00:46:05,240 --> 00:46:02,670
here has been I'm not sure whether the

826
00:46:09,470 --> 00:46:05,250
final copy of that one is even in the

827
00:46:11,120 --> 00:46:09,480
book yet but I don't the last committee

828
00:46:13,070 --> 00:46:11,130
meeting we had it was discussed that

829
00:46:16,160 --> 00:46:13,080
that one was being published barrel nut

830
00:46:24,170 --> 00:46:16,170
tension test which which we didn't have

831
00:46:28,070 --> 00:46:24,180
Dave and we did the CM 1b bans now for

832
00:46:30,050 --> 00:46:28,080
the the metric side you have these that

833
00:46:33,140 --> 00:46:30,060
are covered and they for some reason or

834
00:46:35,870 --> 00:46:33,150
rather they changed it to a DoD standard

835
00:46:39,610 --> 00:46:35,880
thirteen twelve for the metric in order

836
00:46:41,930 --> 00:46:39,620
to differentiate in the mil standard and

837
00:46:47,300 --> 00:46:41,940
these are the ones that they have for

838
00:46:50,300 --> 00:46:47,310

testing of metric fasteners now we go

839
00:46:54,730 --> 00:46:50,310
into the the do's and don'ts of fastener

840
00:46:57,710 --> 00:46:54,740
designs and I I kind of come up with a

841
00:47:00,560 --> 00:46:57,720
set of guidelines you're just common

842
00:47:02,900 --> 00:47:00,570
sense type guidelines that for you to

843
00:47:04,370 --> 00:47:02,910
use and it's not a complete list because

844
00:47:07,850 --> 00:47:04,380
you can always come up with an addition

845
00:47:12,170 --> 00:47:07,860
for a list but these at least could be

846
00:47:15,520 --> 00:47:12,180
used as a designer's checklist and one

847
00:47:18,110 --> 00:47:15,530
of the things that's a pet peeve of mine

848
00:47:21,470 --> 00:47:18,120
is a field that enough information

849
00:47:24,380 --> 00:47:21,480
should be given on a drawing to fully

850
00:47:26,420 --> 00:47:24,390
define the fasteners you want and I know

851
00:47:28,750 --> 00:47:26,430
in the past I've been disappointed in

852
00:47:36,950 --> 00:47:28,760
some of the drawings in which they say

853
00:47:38,990 --> 00:47:36,960
all fasteners to be per ffs 86 or 85 now

854
00:47:42,500 --> 00:47:39,000
if you go look at that spec you can

855
00:47:46,210 --> 00:47:42,510
anything from alloy steel stainless

856
00:47:48,530 --> 00:47:46,220
steel down to even nylon fasteners on it

857
00:47:50,570 --> 00:47:48,540
so you're giving the guy a lot of leeway

858
00:47:53,930 --> 00:47:50,580
if you don't define it any further than

859
00:47:56,540 --> 00:47:53,940
that so this is why that I said fully

860
00:47:58,130 --> 00:47:56,550
defined fasteners you want in other

861
00:48:04,010 --> 00:47:58,140
words when you call them out for a

862
00:48:06,050 --> 00:48:04,020
specification give the paragraph of that

863
00:48:10,340 --> 00:48:06,060

specification that covers the fasteners

864
00:48:12,170 --> 00:48:10,350
that you want to use or if you are not

865
00:48:16,240 --> 00:48:12,180
satisfied with how its defined in the

866
00:48:21,560 --> 00:48:16,250
spec give the strength level required

867
00:48:25,280 --> 00:48:21,570
for example on drawings on materials I

868
00:48:27,860 --> 00:48:25,290
know I have seen on drawings where it is

869
00:48:30,290 --> 00:48:27,870
critical enough that you even specify

870
00:48:33,820 --> 00:48:30,300
the grain direction on the drawing

871
00:48:36,530 --> 00:48:33,830
because you know on materials you have a

872
00:48:41,090 --> 00:48:36,540
longitudinal transverse and short

873
00:48:44,360 --> 00:48:41,100
transverse directions on them the short

874
00:48:47,840 --> 00:48:44,370
transverse is usually the weak one so

875
00:48:50,900 --> 00:48:47,850
you specify on the drawing and the the

876
00:48:54,740 --> 00:48:50,910
area of major stress that you want that

877
00:48:57,640 --> 00:48:54,750
to be the longitudinal direction in

878
00:49:00,680 --> 00:48:57,650
order to get better properties so

879
00:49:04,790 --> 00:49:00,690
specify what you want on the face of the

880
00:49:07,880 --> 00:49:04,800
drawing now here I mentioned earlier in

881
00:49:10,070 --> 00:49:07,890
the course using up it's softer than the

882
00:49:12,170 --> 00:49:10,080
bolt that'll keep you out of trouble and

883
00:49:16,670 --> 00:49:12,180
that distributes the loads on the thread

884
00:49:19,640 --> 00:49:16,680
because usually if you torque a fastener

885
00:49:23,900 --> 00:49:19,650
to failure with a nut it will fail in

886
00:49:26,360 --> 00:49:23,910
the first two threads in the thread

887
00:49:31,760 --> 00:49:26,370
run-out area due to stress concentration

888
00:49:34,400 --> 00:49:31,770

so the nut will not fail usually it's

889
00:49:37,910 --> 00:49:34,410
the the bolt that fails and don't use

890
00:49:41,060 --> 00:49:37,920
feather edges on sheets in a joint match

891
00:49:43,310 --> 00:49:41,070
drill for counter sunk holes use

892
00:49:45,380 --> 00:49:43,320
floating nut plates for critical designs

893
00:49:49,640 --> 00:49:45,390
particularly for counter sunk fasteners

894
00:49:52,580 --> 00:49:49,650
so that the countersink can Center the

895
00:49:52,819 --> 00:49:52,590
fastener and the nut plate will not be

896
00:49:56,930 --> 00:49:52,829
try

897
00:49:59,269 --> 00:49:56,940
bend it determine the environmental

898
00:50:02,359 --> 00:49:59,279
conditions before selecting materials or

899
00:50:04,940 --> 00:50:02,369
coatings for fasteners because you want

900
00:50:08,059 --> 00:50:04,950
to make sure that you're covered with

901
00:50:10,039 --> 00:50:08,069
your temperature range and design sure

902
00:50:13,370 --> 00:50:10,049
fasteners to be critical and varying

903
00:50:16,009 --> 00:50:13,380
that means that the fastener is stronger

904
00:50:18,049 --> 00:50:16,019
in shear than the material so therefore

905
00:50:21,049 --> 00:50:18,059
you can elongate the hole and the

906
00:50:26,599 --> 00:50:21,059
material to allow your fasteners to pick

907
00:50:31,069 --> 00:50:26,609
up the load without failing the fastener

908
00:50:33,289 --> 00:50:31,079
don't use Jam nuts for locking check

909
00:50:36,739 --> 00:50:33,299
alignment of fasteners before final

910
00:50:38,930 --> 00:50:36,749
assembly and of course as a corollary of

911
00:50:41,499 --> 00:50:38,940
that avoid head bending because the

912
00:50:44,539 --> 00:50:41,509
fastener bending I think the SAE

913
00:50:47,329 --> 00:50:44,549

handbook says don't go more than plus or

914
00:50:51,079 --> 00:50:47,339
minus two degrees on misalignment on a

915
00:50:54,709 --> 00:50:51,089
fastener head to avoid trouble with

916
00:50:57,469 --> 00:50:54,719
bending and followed the edge distance

917
00:50:59,569 --> 00:50:57,479
and spacing guidelines on fasteners now

918
00:51:01,489 --> 00:50:59,579
you can temper this but one of the

919
00:51:04,489 --> 00:51:01,499
things that you don't do is put a

920
00:51:06,829 --> 00:51:04,499
fastener so close to the edge that if

921
00:51:09,229 --> 00:51:06,839
the tolerance goes against you when the

922
00:51:11,779 --> 00:51:09,239
hole is drilled you'll have it pushing

923
00:51:15,109 --> 00:51:11,789
out of the hitch and I've seen some that

924
00:51:17,479 --> 00:51:15,119
were almost that bad now don't use

925
00:51:20,390 --> 00:51:17,489
fasteners that look alike but are made

926
00:51:22,939 --> 00:51:20,400
of different materials they'll use 300

927
00:51:26,329 --> 00:51:22,949
stainless and 2a 286 stainless the same

928
00:51:27,349 --> 00:51:26,339
size same head everything that so that

929
00:51:29,989 --> 00:51:27,359
you can't tell the difference between

930
00:51:32,120 --> 00:51:29,999
them and don't use fine and coarse

931
00:51:33,589 --> 00:51:32,130
threads in the same assembly unless

932
00:51:37,670 --> 00:51:33,599
there's a big difference in the fastener

933
00:51:40,219 --> 00:51:37,680
diameter so it's not possible to get

934
00:51:42,680 --> 00:51:40,229
them in the wrong holes and here's

935
00:51:44,599 --> 00:51:42,690
something that you can get in trouble

936
00:51:48,170 --> 00:51:44,609
with although we did it on fittings on

937
00:51:51,380 --> 00:51:48,180
cm-1 don't mix metric and inch fasteners

938
00:51:55,039 --> 00:51:51,390

in a design that that'll get you in real

939
00:51:57,589 --> 00:51:55,049
trouble verify that you have the

940
00:52:00,349 --> 00:51:57,599
fasteners you specified and demand

941
00:52:02,120 --> 00:52:00,359
traceability if it is a critical design

942
00:52:05,209 --> 00:52:02,130
make sure that you get the proper

943
00:52:06,710 --> 00:52:05,219
traceability of the fasteners use

944
00:52:08,660 --> 00:52:06,720
inserts and soften

945
00:52:12,470 --> 00:52:08,670
cereals to avoid fastener pull out if

946
00:52:15,470 --> 00:52:12,480
you can't use through holes if the

947
00:52:17,300 --> 00:52:15,480
dominant fastener load is sheer don't

948
00:52:20,210 --> 00:52:17,310
use a high torque on the fastener

949
00:52:23,450 --> 00:52:20,220
because you have to combine the fastener

950
00:52:25,190 --> 00:52:23,460
and shear loads to the total strength of

951
00:52:28,160 --> 00:52:25,200
the material so you don't want to use up

952
00:52:32,720 --> 00:52:28,170
all of it in tension if your primary

953
00:52:35,380 --> 00:52:32,730
load is shear avoid tap poles as much as

954
00:52:40,730 --> 00:52:35,390
possible because you can't inspect them

955
00:52:44,300 --> 00:52:40,740
you're not sure how good they are so if

956
00:52:46,960 --> 00:52:44,310
you can avoid them don't use them use

957
00:52:50,990 --> 00:52:46,970
harden washers under both the head and

958
00:52:54,080 --> 00:52:51,000
the nut on a bolded installation if

959
00:52:57,190 --> 00:52:54,090
possible don't Terk a fastener above its

960
00:53:01,520 --> 00:52:57,200
yield point stay below the yield point

961
00:53:03,740 --> 00:53:01,530
and don't get close to it unless you run

962
00:53:06,020 --> 00:53:03,750
sufficient tests to determine

963
00:53:09,010 --> 00:53:06,030

pretty much where it is then in a

964
00:53:11,780 --> 00:53:09,020
fatigue joint if you have to go up

965
00:53:13,849 --> 00:53:11,790
because of fatigue then you can go up to

966
00:53:18,020 --> 00:53:13,859
a near yield

967
00:53:19,820 --> 00:53:18,030
thou'rt the use of lubricants lowers the

968
00:53:23,320 --> 00:53:19,830
coefficient of friction so the Clerc

969
00:53:26,210 --> 00:53:23,330
values have to be adjusted accordingly

970
00:53:29,359 --> 00:53:26,220
one of the cases we had at the Cape of

971
00:53:31,400 --> 00:53:29,369
this using silver-plated nuts stainless

972
00:53:33,170 --> 00:53:31,410
steel nuts of course the silver

973
00:53:35,870 --> 00:53:33,180
tarnishes so if you have them in a

974
00:53:39,440 --> 00:53:35,880
barrel for a long time they look bad so

975
00:53:42,740 --> 00:53:39,450
some manufacturer decided he would stop

976
00:53:46,400 --> 00:53:42,750
that so he coated these silver plated

977
00:53:48,170 --> 00:53:46,410
nuts with wax from tarnishing they

978
00:53:50,180 --> 00:53:48,180
didn't tarnish but nobody told the guy

979
00:53:51,650 --> 00:53:50,190
using the torque wrench so they were

980
00:53:53,930 --> 00:53:51,660
yielding these things all over the place

981
00:53:56,240 --> 00:53:53,940
and couldn't figure out why they were

982
00:54:00,230 --> 00:53:56,250
yielding well somebody found out that

983
00:54:01,910 --> 00:54:00,240
because the wax actually reduced the

984
00:54:07,099 --> 00:54:01,920
coefficient of friction to about half of

985
00:54:10,460 --> 00:54:07,109
what it would normally be and Clerc

986
00:54:12,079 --> 00:54:10,470
tables are only guidelines the design

987
00:54:16,190 --> 00:54:12,089
engineer should determine the turqu

988
00:54:19,280 --> 00:54:16,200

values for his design because that's why

989
00:54:21,430 --> 00:54:19,290
you don't blindly use a turk table and

990
00:54:24,350 --> 00:54:21,440
will get you in trouble

991
00:54:25,880 --> 00:54:24,360
fasteners loaded in fatigues should be

992
00:54:31,670 --> 00:54:25,890
trucked the near yield values I

993
00:54:35,800 --> 00:54:31,680
mentioned that earlier and before we go

994
00:54:39,910 --> 00:54:35,810
into the frequently asked questions on

995
00:54:43,070 --> 00:54:39,920
for design we'll take a short break and