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## Technical Report No.24

### Coronet Load Indicators — load/gap relationship on unloading and loading

#### Introduction

When tightening a group of bolts in a joint, the tightening of the later bolts may cause flexure of the plies with consequent relaxation of tension in the bolts initially tightened. It is customary to minimize this effect by tightening in a pattern from the center of the joint outwards and if necessary, repeating the sequence to obtain even tension in all bolts. These tests investigate whether load relaxation in a high strength bolt results in a measurable increase in Load Indicator gap.

#### Summary

It was found that Coronet Load Indicators would show loss of load by a gap increased from the original full load measurement. Re-tightening until the gap was slightly less than the original full load measurement restored the tension.

#### Procedure

A  $\frac{1}{2}$ " diameter A325 High Strength Bolt was fitted with a Coronet Load Indicator under the head and tightened in a Norbar load meter to an average indicator gap of 0.015" then untightened at approximately 4 $\frac{1}{2}$  kip steps, average gap noted, and finally re-tightened back to the original load.

The test was repeated on two further bolts.

#### Results

##### Test 1

Load Kips	Gap Inches
Down	
37.4	0.015
34.2	0.0152
28.7	0.0154
24.2	0.0158
18.8	0.0164
14.4	0.0166
5.8	0.0184
Up	
36.8	0.0148
37.7	0.0144

##### Test 2

Load Kips	Gap Inches
Down	
39.6	0.015
35.2	0.0154
29.4	0.0158
25.6	0.0162
21.1	0.0166
16.4	0.017
12.1	0.0174
2.5	0.0194
Up	
37.4	0.015
40.0	0.014

##### Test 3

Load Kips	Gap Inches
Down	
38.0	0.015
25.8	0.016
21.3	0.016
15.7	0.0168
11.2	0.0176
5.2	0.0188
Up	
34.8	0.015
37.8	0.0136

N.B.—The Coronet Load Indicators used in these tests were calibrated to give a minimum bolt tension of 36.05 kips at 0.015" average gap. ASTM A325 has since increased the required tension to 39.25 kips. Coronet Load Indicators have been modified accordingly.