

ACL® Clamp Life

Introduction

All common sanitary clamp unions utilise similar parts. The majority of the component parts do not experience the usual types of degradation that other engineered systems experience. The majority of the degradation is experienced by the threaded fasteners and their contact points.

The removal and thus retightening of threaded fasteners results in a detrimental effect on the achievable bolt pre-load. As the bolt pre-load is the determining

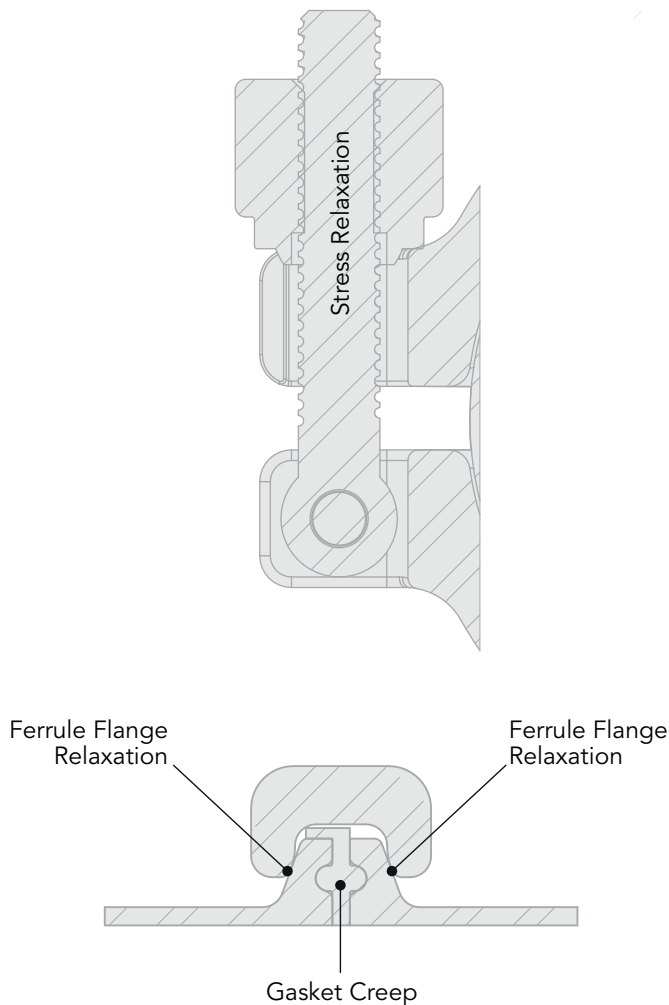
factor in the sealing integrity of the sanitary union, it should be considered as the critical component in the assembly. The bolt pre-load is the force that clamps the union together and prevents gasket blow out and movement of the constituent parts.

In the sanitary union, there exists a balance between the gasket sealing, maintaining the gasket intrusion limit, avoiding galling and clamp longevity. Elastomeric gaskets are the most

commonly used gasket in the sanitary union; they are also the most susceptible to degradation due to their molecular structure. As a result of this, it is a requirement that they are frequently changed. This means that the clamp has to be removed and re-assembled.

It is a well known fact that the achievable clamping force (pre-load) for a threaded component is reduced after the first tensioning (utilising the same torque value).

Typical Areas of Stress Relaxation in a Sanitary Clamp



Calculation of Bolt Preload of ACL® Clamps*

$$T = K \cdot F \cdot D$$

where,

K = estimated nut friction factor
 T = bolt torque
 D = nominal bolt diameter

Then,

$$F = T / (K \cdot D)$$

* Source: ACL® Clamp Nut Torque Guide)

Coefficients of Friction for ACL® Fasteners

Stainless on stainless:	0.3
General sanitary lubricant:	0.2

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Table 1. ACL® Clamp Bolt Preload Values for Elastomeric Seals (Dry Assembly - No Lubrication)

Nominal Size (inches)	Flange Size	SH		SSH		ASME VIII		S-Type	
		Torque (Nm)	Bolt Preload (N)	Torque (Nm)	Bolt Preload (N)	Torque (Nm)	Bolt Preload (N)	Torque (Nm)	Bolt Preload (N)
0.5	25	2	849	2	818			2	849
DN10	34	2	849	2	818			2	849
1.5	50.5	2	849	2	654	2	515	2	849
2	64	2	849	2	654	2	515	2	849
2.5	77.5	2	849	2	654			2	849
3	91	3	1274	3	981	3	772	3	1274
3.5	106	3	1274	3	981			3	1274
4	119	3	1274	3	981	3	772	3	1274
4.5	130	4	1699	4	1308			4	1699
5	144.4	4	1699	4	1090	4	1030		
5.5	155	4	1308	4	1090				
6	167	5	1635	4	1090	4	1030	4	1699
6.625	183	5	1635	5	1363	5	1287		
8	217.4	5	1635	6	1635	6	1545		
8.625	233.5	6	1962	6	1635	6	1545		
10	268	8	2616			8	2060		
10.625	286.1	8	2616						
12	319	10	3270			10	2575		
12.625	338	10	3270						

Table 2. ACL® Clamp Bolt Preload Values for Polymeric Seals (Lubricated Assembly - FDA Lubricant)

Nominal Size (inches)	Flange Size	SH		SSH		ASME VIII		S-Type	
		Torque (Nm)	Bolt Preload (N)	Torque (Nm)	Bolt Preload (N)	Torque (Nm)	Bolt Preload (N)	Torque (Nm)	Bolt Preload (N)
0.5	25	6	3822	6	3697			6	3822
DN10	34	6	3822	6	3697			6	3822
1.5	50.5	6	3822	6	2943	10	3862	6	3822
2	64	6	3822	6	2943	10	3862	6	3822
2.5	77.5	6	3822	6	2943			6	3822
3	91	9	5733	9	4415	15	5793	9	5733
3.5	106	9	5733	9	4415			9	5733
4	119	9	5733	9	4415	15	5793	9	5733
4.5	130	10	6370	12	5886			10	6370
5	144.4	10	6370	20	8175	20	7724		
5.5	155	16	7848	20	8175				
6	167	20	9810	20	8175	20	7724	10	6370
6.625	183	20	9810	25	10219	25	9656		
8	217.4	20	9810	30	12263	24	9269		
8.625	233.5	24	11772	30	12263	24	9269		
10	268	32	15696			32	12359		
10.625	286.1	32	15696						
12	319	37.5	18394			40	15449		
12.625	338	37.5	18394						

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Lubrication

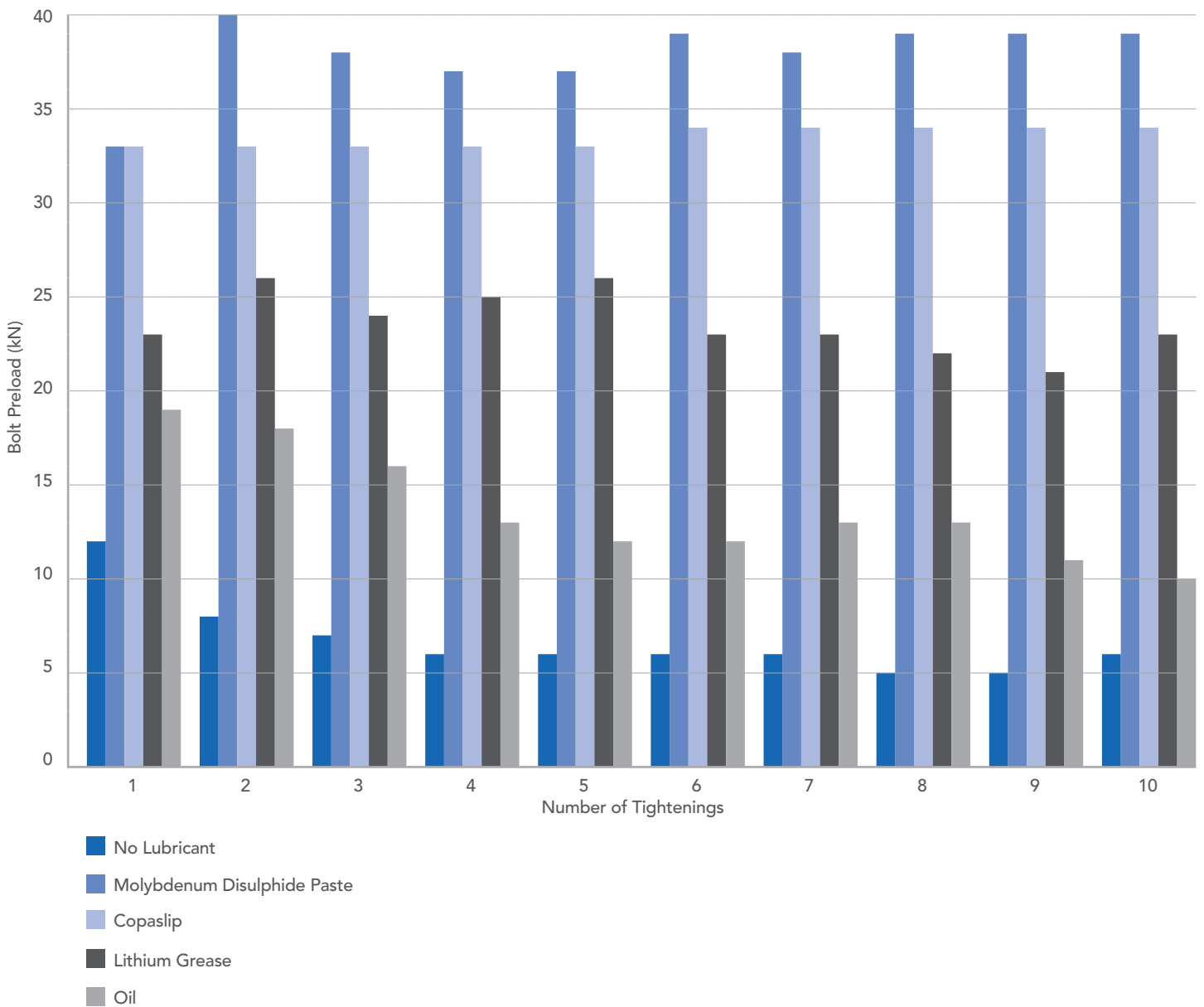
As can be seen in the chart below, repeated use of lubricated or unlubricated fasteners will usually result in a reduction of achievable bolt preload. This is an important consideration for the sanitary union as it will affect the intrusion of the gasket and the sealing reliability.

In order to maintain the performance of your hygienic processing system, it is recommended that the clamps are replaced after a maximum of ten assembly cycles. This can of course be extended if the operator is happy with the condition and performance of the clamp.

References

Eccles, W., Sherrington, I. and Arnell, R., 2010. *Frictional changes during repeated tightening of zinc plated threaded fasteners*. Tribology International, 43(4), pp.700-707.

The Effect of Lubrication on the Repeated Tightening of EZP Fasteners*



* Source: Eccles, Sherrington and Arnell, 2010

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