

Hytorch “TA” Tunnel Applications actuator

For use in conjunction with Tunnel Transit Damper which exceeds a test to operate safely at 250°/482°F for a minimum of two hours

“Tunnel Applications”

In modern traffic tunnels the venting system that removes or blocks toxic gasses and blinding smoke, is required to function in support of a safety window in time and operate for a number of cycles, both during and after a fire.

During such a fire, relative high temperatures may be reached around the venting system and systems must have the ability to continue operating during this critical safety window. These venting systems combine a louvred damper driven by a pneumatic actuator that vents or blocks the air flow in a tunnel and is constructed to operate safely at temperatures of up to 250°C ~ 482°F for a minimum of two hours.

The Hytorch TA Solution

Emerson has developed a Hytorch brand spring return actuator for these kinds of high demanding “Tunnel Applications” that can cope with these requirements. The actuator is equipped with special seals, bearings and grease to accommodate these temperatures.

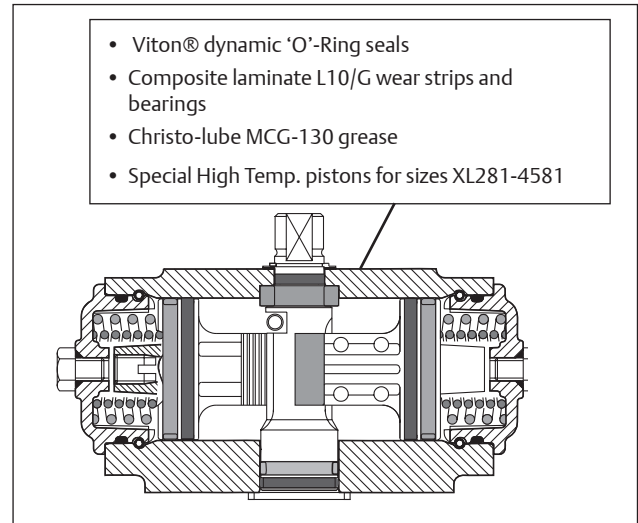
Under normal conditions the actuator functions as a normal Spring Return actuator, and in the case of a fire the actuator will be able to function a number of times under the below mentioned conditions.

Conformance Test Procedure:

Test actuators have been subjected to a specific high temperature / functional test as follows;

Step	Description
1.	Measure Torque output before test.
2.	Actuator put in oven, which is already at 250°C/ 482°F.
3.	Cycle Actuator at beginning of 2 hour period.
4.	Cycle Actuator every 15 minutes in oven at 250°C/ 482°F.
5.	Cycle Actuator several times at end of 2 hour period.
6.	Measure Torque output After test.

The test report is available on request.



Specifications:

Temperature range

Normal operation : -20°C to +120°C

(No fire) : -4°F to + 248°F

Tunnel Application : -20°C to +250°C
(Under fire) for 2 hours minimum

: -4°F to +482°F
for 2 hours minimum

Dynamic O-ring seals : Fluorocarbon Rubber 9775 (Viton®).

Static O-ring seals : Nitrile Rubber (Buna-N)

Bearing material : High temperature composite laminate L10/G

Grease : Christo-lube MCG-130

High temperature effects on output torque.

Spring stroke

Due to the high temperatures occurring during a fire, the spring torque will reduce due to the annealing affect of the heat, causing a drop in output torque of about 10% on the spring stroke. The attached torque table reflects the torque output of a standard actuator with 10% torque loss on the spring stroke after a fire.

Air stroke

The table shows also the torque output of the air stroke. Note that these torque values are in some cases much higher (compared to a standard actuator) depending on the supply pressure and the chosen spring set.

Sizing instructions

To select the right size of the actuator for a tunnel application two things have to be checked:

1 Sizing

- a Choose the smallest actuator size for **normal operation (no fire)**. Use the torque figures as per data sheet
Imperial data D67 (see web site).
Metric data D66 (see web site).
- b Choose the smallest actuator size **operation under fire**. Use the attached output torque table on page 3 and 4.
Use normal sizing procedure to define smallest actuator. Note that the air stroke torque output values are always higher than the spring torque values.
- c Select the largest actuator from “a” or “b”.

Note:

We recommend that the valve (or louver) manufacturer supplies the maximum required torque values, including any adjustments or suggested safety factors for valve or louver service conditions or application.

Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counter Clock Wise or Clock Wise) these maximum requirements occur.

2 Check the maximum valve stem torque

Check the maximum valve stem torque for the chosen smallest actuator size. The maximum valve stem torque should be lower than the output torque on the air stroke.

For venting louvres, the drive mechanism should be capable to cope with the maximum air stroke torque output torque of the chosen actuator.

Important: Use the maximum available plant pressure to define the maximum torque output on the air stroke of the actuator.

High temperature effects on actuator components

A high temperature operation as indicated under “Test Procedure” has influence on the:

- Springs; spring forces decreased.
- Grease; will dry out and might get hard.
- Soft parts; will lose their original shape and or strength.

Therefore we strongly recommend replacing the actuator after a high temperature operation as indicated under “Conformance Test Procedure”.

WARNING : Use only Spring Return (fail safe) models – Do not use Double Acting models, where the air needs to be driven in both directions.

At high temperatures of 250°C / 482°F, there is a risk that the plastic head and the rubber ‘o’ ring of the metal SafeKey could melt. This will cause complete torque loss on the inward stroke of double acting models.

We therefore advise to use only Spring Return models for these “Tunnel Applications”.

This problem does not occur on Spring Return models because the end cap chambers on Spring Return are normally not pressurized.

High temperature pistons

Hytork XL actuator sizes XL26 up to XL221 suitable for Tunnel Applications, do not require special pistons.

Hytork XL actuator sizes XL281 up to XL4581 suitable for Tunnel Applications, require special pistons to keep the high temperature gear rack wear strip in place.

- In case of repair of a Tunnel Applications actuator, which will have the special pistons, only a repair kit is available. The repair kit contains all the necessary O-ring seals, bearings, washers and clip. Grease is not included.
- In case of a conversion from a standard temperature actuator to a Tunnel Applications actuator, which requires special pistons, the High Temperature conversion kits are available. The Conversion kit contains the special pistons and all the necessary O-ring seals, bearings, washers and clip. Grease is not included.

Torque output values for use on Tunnel applications

Spring Return Actuators (Nm), XL26 to XL426

Model Number	Spring Rating	Torque from Springs		Torques from air stroke (Nm) at given operating air pressure (bar)													
		Start	End	3.0 bar(g)		4.0 bar(g)		5.0 bar(g)		5.5 bar(g)		6.0 bar(g)		7.0 bar(g)		8.0 bar(g)	
				Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
XL26	S40	5	3	7	5	11	8	14	12	16	14	17	15	21	19	24	22
	S50	7	4	6	4	10	7	13	11	15	12	17	14	20	17	24	21
	S60	8	5	6	2	9	6	12	9	14	11	16	13	19	16	23	20
	S70	9	6	-	-	8	4	12	8	13	10	15	11	18	15	22	18
	S80	11	6	-	-	7	3	11	7	13	8	14	10	18	13	21	17
	S90	12	7	-	-	7	2	10	5	12	7	13	9	17	12	20	16
S1C	13	8	-	-	-	-	9	4	11	6	13	7	16	11	20	14	
XL71	S40	13	8	18	12	26	21	35	30	39	34	44	38	52	47	61	55
	S50	17	10	16	9	24	18	33	26	37	31	42	35	50	44	59	52
	S60	20	12	14	6	22	14	31	23	35	27	40	32	48	40	57	49
	S70	23	14	-	-	20	11	29	20	33	24	38	28	46	37	55	45
	S80	27	16	-	-	18	8	27	16	31	21	36	25	44	34	53	42
	S90	30	18	-	-	16	4	25	13	29	17	34	22	42	30	51	39
S1C	33	20	-	-	-	-	23	10	27	14	32	18	40	27	49	35	
XL131	S40	25	15	33	23	50	40	66	56	74	64	82	72	98	88	114	104
	S50	31	19	30	17	46	33	62	50	70	58	78	66	94	82	111	98
	S60	38	23	26	11	42	27	58	43	66	51	75	59	91	76	107	92
	S70	44	26	-	-	38	21	55	37	63	45	71	53	87	69	103	86
	S80	50	30	-	-	35	15	51	31	59	39	67	47	83	63	99	79
	S90	56	34	-	-	31	8	47	24	55	33	63	41	79	57	96	73
S1C	63	38	-	-	-	-	43	18	51	26	59	34	76	51	92	67	
XL186	S40	34	20	45	32	67	53	89	75	100	86	110	97	132	119	154	140
	S50	42	25	40	23	62	45	84	67	94	78	105	89	127	110	149	132
	S60	50	30	35	15	57	37	79	58	89	69	100	80	122	102	144	124
	S70	59	35	-	-	52	28	74	50	84	61	95	72	117	94	139	115
	S80	67	40	-	-	47	20	68	42	79	52	90	63	112	85	134	107
	S90	76	45	-	-	42	11	63	33	74	44	85	55	107	77	129	98
S1C	84	50	-	-	-	-	58	25	69	36	80	47	102	68	124	90	
XL221	S40	47	28	63	44	93	74	123	105	139	120	154	135	184	165	214	196
	S50	59	35	56	32	86	62	116	93	131	108	147	123	177	153	207	184
	S60	71	42	49	20	79	51	109	81	124	96	140	111	170	142	200	172
	S70	82	49	-	-	72	39	102	69	117	84	133	100	163	130	193	160
	S80	94	56	-	-	65	27	95	58	110	73	125	88	156	118	186	148
	S90	106	63	-	-	58	15	88	46	103	61	118	76	149	106	179	137
S1C	118	71	-	-	-	-	81	34	96	49	111	64	142	95	172	125	
XL281	S40	58	34	75	51	111	87	148	124	166	142	184	160	220	196	256	233
	S50	72	42	67	37	103	73	139	109	157	127	176	146	212	182	248	218
	S60	86	51	58	22	95	59	131	95	149	113	167	131	203	167	240	204
	S70	101	59	-	-	86	44	122	80	141	99	159	117	195	153	231	189
	S80	115	67	-	-	78	30	114	66	132	84	150	102	187	139	223	175
	S90	130	76	-	-	-	-	106	52	124	70	142	88	178	124	214	160
S1C	144	84	-	-	-	-	97	37	115	55	133	74	170	110	206	146	
XL426	S40	85	51	108	74	161	127	214	180	240	206	267	233	320	286	372	339
	S50	106	63	95	53	148	106	201	159	228	185	254	212	307	265	360	318
	S60	127	76	83	32	136	85	188	138	215	164	241	191	294	244	347	296
	S70	148	89	-	-	123	64	176	117	202	143	229	169	282	222	334	275
	S80	169	101	-	-	110	43	163	95	190	122	216	148	269	201	322	254
	S90	190	114	-	-	-	-	150	74	177	101	203	127	256	180	309	233
S1C	211	127	-	-	-	-	138	53	164	80	191	106	244	159	296	212	

Note:

We recommend that the valve (or louvre) manufacturer supplies the maximum required torque values (including any adjustments or suggested safety factors for valve or louvre service conditions or application). Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counter Clock Wise or Clock Wise) these maximum requirements occur.

Torque output values for use on Tunnel applications

Spring Return Actuators (Nm), XL681 to XL4581

Model Number	Spring Rating	Torque from Springs		Torques from air stroke (Nm) at given operating air pressure (bar)													
				3.0 bar(g)		4.0 bar(g)		5.0 bar(g)		5.5 bar(g)		6.0 bar(g)		7.0 bar(g)		8.0 bar(g)	
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
XL681	S40	136	82	177	123	263	209	350	295	393	338	436	381	522	468	608	554
	S50	170	102	157	89	243	175	329	261	372	304	415	347	502	434	588	520
	S60	204	122	136	55	223	141	309	227	352	270	395	313	481	400	567	486
	S70	238	143	-	-	202	107	288	193	331	236	375	279	461	366	547	452
	S80	272	163	-	-	182	73	268	159	311	202	354	245	440	332	527	418
	S90	306	183	-	-	-	-	248	125	291	168	334	211	420	298	506	384
	S1C	340	204	-	-	-	-	227	91	270	134	313	178	400	264	486	350
XL1127	S40	223	133	300	210	444	355	588	499	661	571	733	644	877	788	1021	932
	S50	278	167	266	155	411	299	555	444	627	516	699	588	844	732	988	877
	S60	334	200	233	99	377	244	522	388	594	460	666	532	810	677	955	821
	S70	390	233	-	-	344	188	488	332	560	404	633	477	777	621	921	765
	S80	445	267	-	-	311	132	455	277	527	349	599	421	744	565	888	710
	S90	501	300	-	-	277	77	422	221	494	293	566	365	710	510	855	654
	S1C	556	334	-	-	-	-	388	165	460	237	533	310	677	454	821	598
XL1372	S40	274	164	365	255	541	431	717	608	805	696	894	784	1070	960	1246	1137
	S50	342	205	324	186	500	363	676	539	764	627	852	715	1029	892	1205	1068
	S60	411	246	282	118	459	294	635	471	723	559	811	647	988	823	1164	1000
	S70	479	288	-	-	418	226	594	402	682	490	770	578	947	755	1123	931
	S80	548	329	-	-	377	157	553	334	641	422	729	510	906	686	1082	863
	S90	616	370	-	-	336	89	512	265	600	353	688	441	864	618	1041	794
	S1C	685	411	-	-	-	-	471	197	559	285	647	373	823	549	1000	726
XL2586	S40	517	310	689	482	1022	815	1355	1148	1521	1315	1688	1481	2021	1814	2354	2147
	S50	646	388	611	353	944	686	1277	1019	1444	1185	1610	1352	1943	1685	2277	2018
	S60	776	465	534	224	867	557	1200	890	1366	1056	1533	1223	1866	1556	2199	1889
	S70	905	543	-	-	789	427	1122	760	1289	927	1455	1093	1788	1426	2121	1760
	S80	1034	620	-	-	712	298	1045	631	1211	798	1378	964	1711	1297	2044	1630
	S90	1163	698	-	-	634	169	967	502	1134	668	1300	835	1633	1168	1966	1501
	S1C	1293	776	-	-	-	-	890	373	1056	539	1223	706	1556	1039	1889	1372
XL4581	S40	915	549	1214	848	1802	1436	2390	2024	2683	2318	2977	2611	3565	3199	4153	3787
	S50	1144	686	1077	620	1665	1207	2252	1795	2546	2089	2840	2383	3428	2970	4016	3558
	S60	1372	823	940	391	1527	979	2115	1566	2409	1860	2703	2154	3291	2742	3878	3329
	S70	1601	961	-	-	1390	750	1978	1337	2272	1631	2566	1925	3153	2513	3741	3101
	S80	1830	1098	-	-	1253	521	1841	1109	2135	1403	2428	1696	3016	2284	3604	2872
	S90	2059	1235	-	-	1116	292	1703	880	1997	1174	2291	1468	2879	2055	3467	2643
	S1C	2287	1372	-	-	-	-	1566	651	1860	945	2154	1239	2742	1827	3329	2414

Note:

We recommend that the valve (or louvre) manufacturer supplies the maximum required torque values (Including any adjustments or suggested safety factors for valve or louvre service conditions or application). Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counter Clock Wise or Clock Wise) these maximum requirements occur.

Torque output values for use on Tunnel applications

Spring Return Actuators (In.lbs), XL26 to XL426

Model Number	Spring Rating	Torque from Springs		Torques from air stroke (in.lbs) at given operating air pressure (PSI)															
				40 PSI		50 PSI		60 PSI		70 PSI		80 PSI		90 PSI		100 PSI		120 PSI	
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
XL26	S40	47	28	55	36	76	57	97	78	118	99	139	120	159	141	180	161	222	203
	S50	59	35	48	24	69	45	90	66	111	87	131	108	152	129	173	150	215	191
	S60	71	43	41	13	62	33	83	54	104	75	124	96	145	117	166	138	208	179
	S70	83	50	-	-	55	22	76	42	96	63	117	84	138	105	159	126	201	168
	S80	95	57	-	-	-	-	68	31	89	52	110	72	131	93	152	114	194	156
	S90	106	64	-	-	-	-	61	19	82	40	103	61	124	81	145	102	187	144
S1C	118	71	-	-	-	-	-	-	75	28	96	49	117	70	138	90	179	132	
XL71	S40	118	71	138	90	190	143	242	195	294	247	346	299	399	351	451	403	555	508
	S50	148	89	120	61	172	113	224	165	276	217	329	270	381	322	433	374	537	478
	S60	177	106	102	31	154	84	207	136	259	188	311	240	363	292	415	344	520	449
	S70	207	124	-	-	137	54	189	106	241	158	293	211	345	263	398	315	502	419
	S80	236	142	-	-	-	-	171	77	223	129	275	181	328	233	380	285	484	390
	S90	266	159	-	-	-	-	153	47	206	99	258	151	310	204	362	256	466	360
S1C	295	177	-	-	-	-	-	-	188	70	240	122	292	174	344	226	449	331	
XL131	S40	222	133	259	170	357	268	455	366	553	465	651	563	750	661	848	759	1044	955
	S50	278	167	226	115	324	213	422	311	520	409	618	507	716	605	814	703	1011	899
	S60	333	200	192	59	291	157	389	255	487	353	585	452	683	550	781	648	977	844
	S70	389	233	-	-	257	102	355	200	453	298	552	396	650	494	748	592	944	788
	S80	444	267	-	-	-	-	322	144	420	242	518	340	616	439	714	537	911	733
	S90	500	300	-	-	-	-	289	89	387	187	485	285	583	383	681	481	877	677
S1C	555	333	-	-	-	-	-	-	353	131	452	229	550	327	648	426	844	622	
XL186	S40	297	178	349	230	481	362	613	494	745	626	877	758	1009	890	1141	1022	1405	1286
	S50	372	223	304	156	436	288	568	420	700	552	832	684	964	816	1096	948	1360	1211
	S60	446	268	260	82	392	214	523	346	655	478	787	610	919	741	1051	873	1315	1137
	S70	520	313	-	-	347	139	479	271	611	403	743	535	875	667	1007	799	1271	1063
	S80	595	357	-	-	-	-	435	197	566	328	698	460	830	592	962	724	1226	988
	S90	670	401	-	-	-	-	390	122	522	254	654	386	786	518	918	650	1182	914
S1C	744	446	-	-	-	-	-	-	478	179	610	311	741	443	873	575	1137	839	
XL221	S40	416	250	485	319	669	503	853	686	1037	870	1221	1054	1404	1238	1588	1422	1956	1789
	S50	520	312	423	215	607	399	791	582	974	766	1158	950	1342	1134	1526	1318	1893	1685
	S60	624	375	361	111	544	295	728	478	912	662	1096	846	1279	1030	1463	1213	1831	1581
	S70	728	437	-	-	482	190	666	374	849	558	1033	742	1217	926	1401	1109	1768	1477
	S80	833	500	-	-	-	-	603	270	787	454	971	638	1155	822	1338	1005	1706	1373
	S90	937	562	-	-	-	-	541	166	725	350	908	534	1092	717	1276	901	1643	1269
S1C	1041	624	-	-	-	-	-	-	662	246	846	430	1030	613	1213	797	1581	1165	
XL281	S40	510	298	581	369	801	589	1021	809	1241	1029	1461	1249	1681	1469	1901	1689	2340	2128
	S50	638	373	507	242	727	462	947	681	1166	901	1386	1121	1606	1341	1826	1561	2266	2001
	S60	765	447	432	114	652	334	872	554	1092	774	1312	994	1532	1214	1751	1433	2191	1873
	S70	893	522	-	-	578	207	797	426	1017	646	1237	866	1457	1086	1677	1306	2117	1746
	S80	1020	596	-	-	-	-	723	299	943	519	1163	739	1383	958	1602	1178	2042	1618
	S90	1148	671	-	-	-	-	648	171	868	391	1088	611	1308	831	1528	1051	1968	1491
S1C	1276	745	-	-	-	-	-	-	794	264	1014	483	1233	703	1453	923	1893	1363	
XL426	S40	748	449	834	535	1155	855	1475	1176	1796	1497	2116	1817	2437	2138	2758	2458	3399	3100
	S50	935	561	722	348	1042	668	1363	989	1684	1310	2004	1630	2325	1951	2645	2271	3287	2913
	S60	1122	673	610	161	930	481	1251	802	1571	1123	1892	1443	2213	1764	2533	2084	3175	2726
	S70	1309	785	-	-	818	294	1139	615	1459	936	1780	1256	2101	1577	2421	1898	3062	2539
	S80	1496	897	-	-	-	-	1027	428	1347	749	1668	1069	1988	1390	2309	1711	2950	2352
	S90	1683	1009	-	-	-	-	914	241	1235	562	1556	882	1876	1203	2197	1524	2838	2165
S1C	1870	1122	-	-	-	-	-	-	1123	375	1443	695	1764	1016	2085	1337	2726	1978	

Note:

We recommend that the valve (or louvre) manufacturer supplies the maximum required torque values (Including any adjustments or suggested safety factors for valve or louvre service conditions or application). Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counter Clock Wise or Clock Wise) these maximum requirements occur.

Torque output values for use on Tunnel applications

Spring Return Actuators (In.lbs), XL681 to XL4581

Model Number	Spring Rating	Torque from Springs		Torques from air stroke (in.lbs) at given operating air pressure (PSI)															
		Start	End	40		50		60		70		80		90		100		120	
				Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
XL681	S40	1203	722	1369	888	1891	1410	2414	1933	2937	2455	3459	2978	3982	3501	4505	4023	5550	5069
	S50	1504	902	1188	587	1711	1110	2234	1632	2756	2155	3279	2677	3801	3200	4324	3723	5369	4768
	S60	1804	1083	1008	286	1531	809	2053	1331	2576	1854	3098	2377	3621	2899	4144	3422	5189	4467
	S70	2105	1263	-	-	1350	508	1873	1031	2395	1553	2918	2076	3441	2599	3963	3121	5008	4166
	S80	2406	1443	-	-	-	-	1692	730	2215	1253	2738	1775	3260	2298	3783	2820	4828	3866
	S90	2707	1624	-	-	-	-	1512	429	2034	952	2557	1474	3080	1997	3602	2520	4648	3565
	S1C	3007	1804	-	-	-	-	-	-	1854	651	2377	1174	2899	1696	3422	2219	4467	3264
XL1127	S40	1970	1181	2319	1530	3194	2405	4069	3280	4944	4155	5819	5030	6694	5905	7569	6780	9319	8530
	S50	2462	1476	2024	1038	2899	1913	3774	2788	4649	3663	5524	4538	6399	5413	7274	6288	9024	8038
	S60	2955	1771	1729	545	2604	1420	3479	2295	4354	3170	5229	4045	6104	4920	6979	5795	8729	7545
	S70	3447	2066	-	-	2309	928	3184	1803	4059	2678	4934	3553	5809	4428	6684	5303	8434	7053
	S80	3940	2361	-	-	-	-	2889	1310	3764	2185	4639	3060	5514	3935	6389	4810	8139	6560
	S90	4432	2657	-	-	-	-	2593	818	3468	1693	4343	2568	5218	3443	6093	4318	7843	6068
	S1C	4925	2952	-	-	-	-	-	-	3173	1200	4048	2075	4923	2950	5798	3825	7548	5575
XL1372	S40	2425	1454	2821	1850	3889	2919	4958	3988	6027	5056	7096	6125	8164	7194	9233	8263	11372	10400
	S50	3031	1818	2457	1244	3526	2313	4595	3381	5663	4450	6732	5519	7801	6588	8870	7656	11007	9794
	S60	3637	2181	2094	638	3162	1707	4231	2775	5300	3844	6369	4913	7437	5982	8506	7050	10644	9188
	S70	4243	2545	-	-	2799	1100	3867	2169	4936	3238	6005	4307	7074	5375	8142	6444	10280	8582
	S80	4850	2909	-	-	-	-	3504	1563	4573	2632	5641	3700	6710	4769	7779	5838	9916	7975
	S90	5456	3272	-	-	-	-	3140	957	4209	2025	5278	3094	6347	4163	7415	5232	9553	7369
	S1C	6062	3636	-	-	-	-	-	-	3845	1419	4914	2488	5983	3557	7052	4625	9189	6763
XL2586	S40	4576	2746	5329	3499	7348	5518	9367	7537	11386	9556	13404	11574	15423	13593	17442	15612	21479	19649
	S50	5720	3432	4643	2355	6662	4374	8681	6393	10699	8412	12718	10430	14737	12449	16756	14468	20793	18505
	S60	6863	4118	3957	1212	5975	3230	7994	5249	10013	7268	12032	9287	14050	11305	16069	13324	20107	17362
	S70	8007	4805	-	-	5289	2086	7308	4105	9327	6124	11345	8143	13364	10161	15383	12180	19420	16218
	S80	9151	5491	-	-	-	-	6621	2961	8640	4980	10659	6999	12678	9018	14696	11036	18734	15074
	S90	10295	6177	-	-	-	-	5935	1817	7954	3836	9973	5855	11991	7874	14010	9892	18048	13930
	S1C	11439	6864	-	-	-	-	-	-	7267	2692	9286	4711	11305	6730	13324	8748	17361	12786
XL4581	S40	8097	4858	9392	6153	12955	9716	16517	13278	20080	16841	23642	20403	27205	23966	30767	27528	37892	34653
	S50	10121	6072	8178	4129	11740	7692	15303	11254	18865	14817	22428	18379	25990	21942	29553	25504	36678	32629
	S60	12145	7287	6963	2105	10526	5667	14088	9230	17651	12792	21213	16355	24776	19917	28338	23480	35463	30605
	S70	14169	8501	-	-	9311	3643	12874	7206	16436	10768	19999	14331	23561	17893	27124	21456	34249	28581
	S80	16194	9716	-	-	-	-	11659	5181	15222	8744	18784	12306	22347	15869	25909	19431	33034	26556
	S90	18218	10930	-	-	-	-	10445	3157	14007	6720	17570	10282	21132	13845	24695	17407	31820	24532
	S1C	20242	12145	-	-	-	-	-	-	-	-	16355	8258	19918	11821	23480	15383	30605	22508

Note:
 We recommend that the valve (or louvre) manufacturer supplies the maximum required torque values (Including any adjustments or suggested safety factors for valve or louvre service conditions or application). Additionally, the valve manufacturer must identify at which position(s) and direction(s) of rotation (Counter Clock Wise or Clock Wise) these maximum requirements occur.