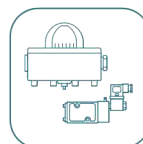
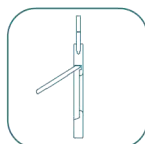
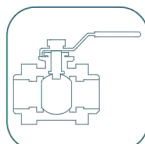
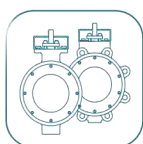
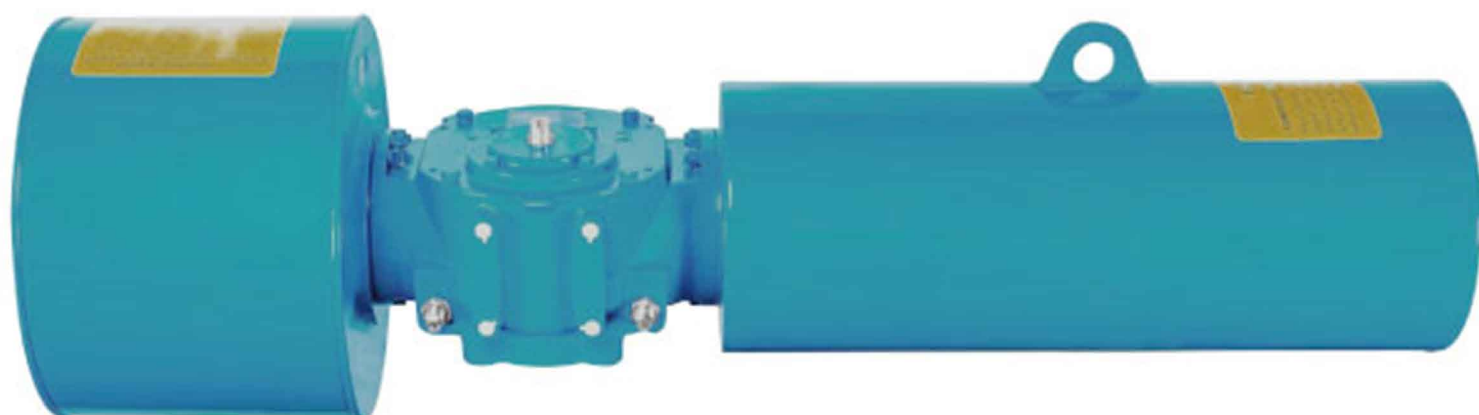
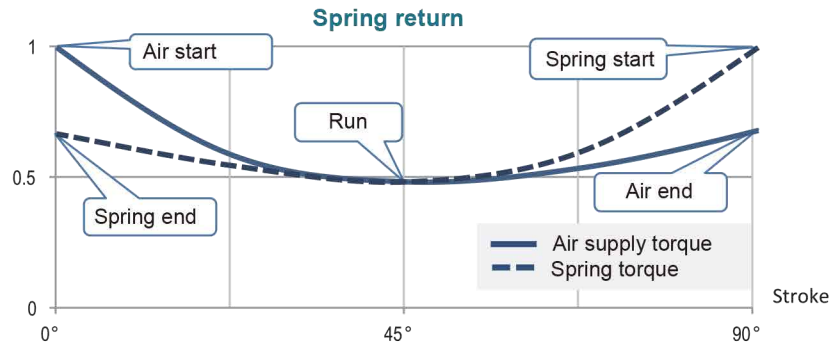


Scotch yoke pneumatic actuator

Fig.545



Output torque - Spring return

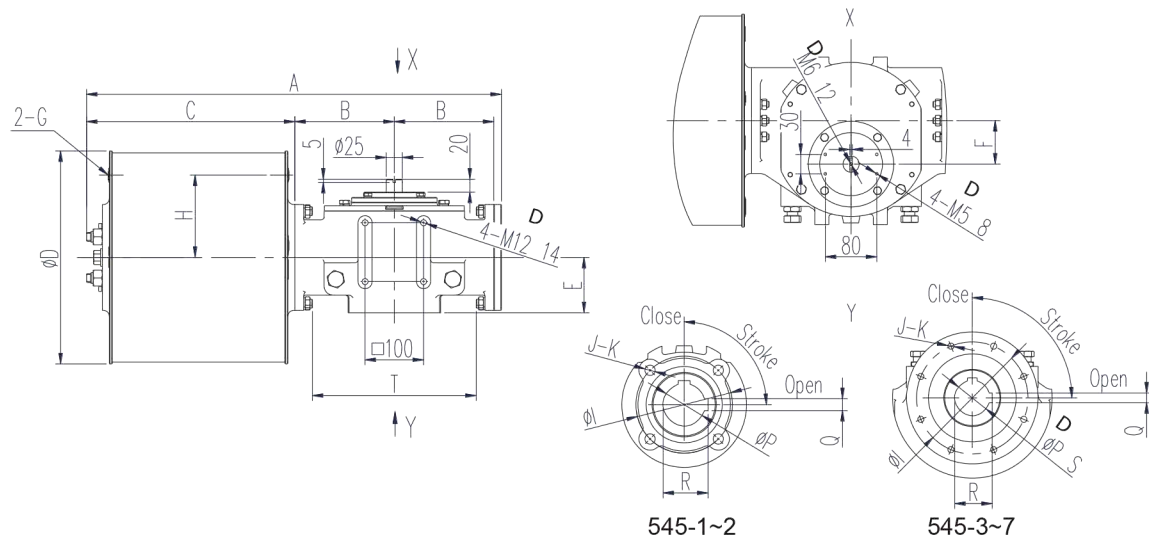


Output torque - Spring return

Model	Spring Torque [Nm]			Output torque - Spring return [Nm]												Weight [kg]
				3 Bar			4 Bar			5 Bar			6 Bar			
	Start	Run	End	Start	Run	End	Start	Run	End	Start	Run	End	Start	Run	End	
545-5-500-SR4	17538	7557	11100										16572	6887	9527	762.3
545-5-600-SR4	17538	7557	11100				15562	6354	8517	22489	10010	15444	29416	13666	22371	830.3
545-5-700-SR4	17538	7557	11100	17742	7505	10697	27705	12763	20660	37668	18021	30623				1010.3
545-5-500-SR3	21048	9017	13124										14357	5289	5686	776
545-5-600-SR3	21048	9017	13124				13347	4756	4676	20274	8412	11603	27202	12068	18530	844
545-5-700-SR3	21048	9017	13124	15528	5907	6857	25491	11165	16819	35453	16423	26782				1024
545-5-600-SR2	25892	10899	15411										24699	10009	13230	882.34
545-5-700-SR2	25892	10899	15411				22988	9106	11519	32951	14364	21482	42913	19622	31445	1062.3
545-5-600-SR1	28823	12400	18168										21681	8366	10022	879.4
545-5-700-SR1	28823	12400	18168				19970	7463	8311	29933	12721	18274	39896	17980	28237	1059.4
545-6-700-SR4	34600	14762	21341				25323	9536	10814	37492	15959	22983	49661	22381	35152	1740
545-6-800-SR4	34600	14762	21341	23978	8826	9468	39754	17153	25245	55531	25479	41021	71308	33806	56798	1870
545-6-900-SR4	34600	14762	21341	37440	15931	22930	57704	26626	43194	77968	37321	63459	98232	48016	83723	2007
545-6-700-SR3	41067	17451	25062							33420	13016	15906	45589	19439	28075	1790
545-6-800-SR3	41067	17451	25062				35682	14210	18168	51459	22537	33945	67236	30864	49721	1920
545-6-900-SR3	41067	17451	25062	33368	12989	15853	53632	23684	36118	73896	34379	56382	94160	45074	76646	2057
545-6-700-SR2	49840	21098	30110										40065	15448	18475	1864
545-6-800-SR2	49840	21098	30110				30158	10220	8568	45935	18546	24345	61712	26873	40122	1994
545-6-900-SR2	49840	21098	30110				48108	19693	26518	68372	30388	46782	88636	41083	67046	2131
545-6-700-SR1	56307	23787	33832										35993	12506	11398	1914
545-6-800-SR1	56307	23787	33832							41863	15604	17268	57639	23931	33045	2044
545-6-900-SR1	56307	23787	33832				44036	16751	19441	64300	27446	39705	84564	38141	59970	2181
545-7-800-SR3	57016	25792	40721				30356	11316	12525	49085	21201	31254	67814	31086	49984	
545-7-900-SR3	57016	25792	40721				51665	22562	33834	75721	35259	57890	99777	47955	81947	
545-7-1000-SR3	57016	25792	40721	43021	18000	25191	72215	33408	54384	101409	48816	83578	130603	64224	112772	
545-7-800-SR2	67109	30339	47859							41274	16225	20210	60003	26110	38939	
545-7-900-SR2	67109	30339	47859				43854	17587	22790	67910	30283	46846	91966	42979	70902	
545-7-1000-SR2	67109	30339	47859	35210	13025	14146	64404	28433	43340	93598	43840	72534	122792	59248	101728	
545-7-800-SR1	83319	36871	56401										50656	18962	21200	
545-7-900-SR1	83319	36871	56401							58563	23135	29107	82619	35832	53163	
545-7-1000-SR1	83319	36871	56401				55057	21285	25601	84251	36693	54795	113445	52101	83989	

Dimensions - Double acting

Double acting



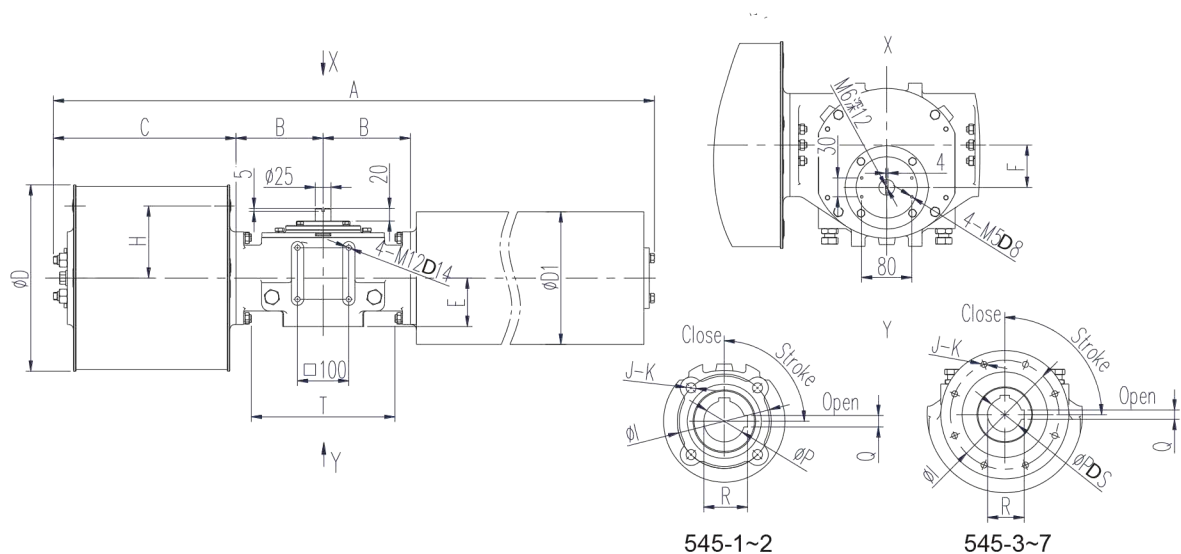
Dimensions - Double acting

Unit: mm

Model	A	B	C	D	E	F	G	H	I	J-K	P	S	Q	R	T
545-1-200	658	145	356	223	88	60	RC1/2	80	140	4-M16	60	145	18	64.4	235
545-1-250	658	145	356	280	88	60	RC 1/2	110	140	4-M16	60	145	18	64.4	235
545-1-300	658	145	356	332	88	60	RC 1/2	124	140	4-M16	60	145	18	64.4	235
545-1-350	658	145	356	362	88	60	RC 1/2	132	140	4-M16	60	145	18	64.4	235
545-2-300	709	170	356	332	94	74	RC 1/2	124	165	4-M20	72	155	20	76.9	285
545-2-350	709	170	356	362	94	74	RC 1/2	132	165	4-M20	72	155	20	76.9	285
545-2-400	725	170	372	413	94	74	RC 3/4	158	165	4-M20	72	155	20	76.9	285
545-3-350	828	195	423	362	98	89	RC 1/2	132	254	8-M16	80	175	22	85.4	320
545-3-400	828	195	423	413	98	89	RC 3/4	158	254	8-M16	80	175	22	85.4	320
545-3-500	828	195	423	514	98	89	RC 3/4	202	254	8-M16	80	175	22	85.4	320
545-4-400	982	238	492	413	115	108	RC 3/4	158	298	8-M20	100	200	28	106.4	396
545-4-500	982	238	492	514	115	108	RC 3/4	202	298	8-M20	100	200	28	106.4	396
545-4-600	982	238	492	616	115	108	RC 3/4	244	298	8-M20	100	200	28	106.4	396
545-5-500	1217	298	606	514	163	140	RC 3/4	202	356	8-M30	160	295	40	169.4	505
545-5-600	1217	298	606	616	163	140	RC 3/4	244	356	8-M30	160	295	40	169.4	505
545-5-700	1217	298	606	739	163	140	RC 1	305	356	8-M30	160	295	40	169.4	505
545-6-700	1536	370	766	739	203	171	RC 1	305	406	8-M36	180	360	45	190.4	620
545-6-800	1536	370	766	839	203	171	RC 1-1/2	355	406	8-M36	180	360	45	190.4	620
545-6-900	1536	370	766	947	203	171	RC 1-1/2	402	406	8-M36	180	360	45	190.4	620
545-7-800	1760	425	880	839	214	203	RC 1-1/2	355	483	12-M36	220	380	50	231.4	690
545-7-900	1760	425	880	947	214	203	RC 1-1/2	402	483	12-M36	220	380	50	231.4	690
545-7-1000	1760	425	880	1048	214	203	RC 2	456	483	12-M36	220	380	50	231.4	690

Dimensions - Spring return

Spring return



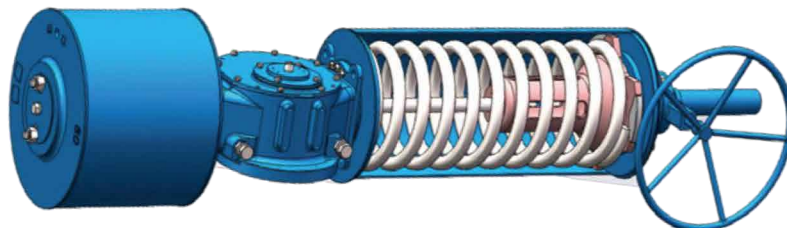
Dimensions - Spring return

Unit: mm

Model	A	B	C	D	D1	E	F	G	H	I	J-K	P	S	Q	R	T
545-1-200-SR	1370	145	356	223	220	88	60	RC 1/2	80	140	4-M16	60	145	18	64.4	235
545-1-250-SR	1370	145	356	280	220	88	60	RC 1/2	110	140	4-M16	60	145	18	64.4	235
545-1-300-SR	1370	145	356	332	220	88	60	RC 1/2	124	140	4-M16	60	145	18	64.4	235
545-1-350-SR	1370	145	356	362	220	88	60	RC 1/2	132	140	4-M16	60	145	18	64.4	235
545-2-300-SR	1440	170	356	332	274	94	74	RC 1/2	124	165	4-M20	72	155	20	76.9	285
545-2-350-SR	1440	170	356	362	274	94	74	RC 1/2	132	165	4-M20	72	155	20	76.9	285
545-2-400-SR	1456	170	372	413	274	94	74	RC 3/4	158	165	4-M20	72	155	20	76.9	285
545-3-350-SR	1600	195	423	362	327	98	89	RC 1/2	132	254	8-M16	80	175	22	85.4	320
545-3-400-SR	1600	195	423	413	327	98	89	RC 3/4	158	254	8-M16	80	175	22	85.4	320
545-3-500-SR	1600	195	423	514	327	98	89	RC 3/4	202	254	8-M16	80	175	22	85.4	320
545-4-400-SR	1932	238	492	413	408	115	108	RC 3/4	158	298	8-M20	100	200	28	106.4	396
545-4-500-SR	1932	238	492	514	408	115	108	RC 3/4	202	298	8-M20	100	200	28	106.4	396
545-4-600-SR	1932	238	492	616	408	115	108	RC 3/4	244	298	8-M20	100	200	28	106.4	396
545-5-500-SR	2275	298	606	514	508	163	140	RC 3/4	202	356	8-M30	160	295	40	169.4	505
545-5-600-SR	2275	298	606	616	508	163	140	RC 3/4	244	356	8-M30	160	295	40	169.4	505
545-5-700-SR	2275	298	606	739	508	163	140	RC 1	305	356	8-M30	160	295	40	169.4	505
545-6-700-SR	2702	370	766	739	682	203	171	RC 1	305	406	8-M36	180	360	45	190.4	620
545-6-800-SR	2702	370	766	839	682	203	171	RC 1-1/2	355	406	8-M36	180	360	45	190.4	620
545-6-900-SR	2702	370	766	947	682	203	171	RC 1-1/2	402	406	8-M36	180	360	45	190.4	620
545-7-800-SR	3590	425	880	839	682	214	203	RC 1-1/2	355	483	12-M36	220	380	50	231.4	690
545-7-900-SR	3590	425	880	947	682	214	203	RC 1-1/2	402	483	12-M36	220	380	50	231.4	690
545-7-1000-SR	3590	425	880	1048	682	214	203	RC 2	456	483	12-M36	220	380	50	231.4	690

Specifications

both ends of the stroke, available for all 90° rotation valves. The actuator is designed to provide long and efficient service with minimum maintenance.

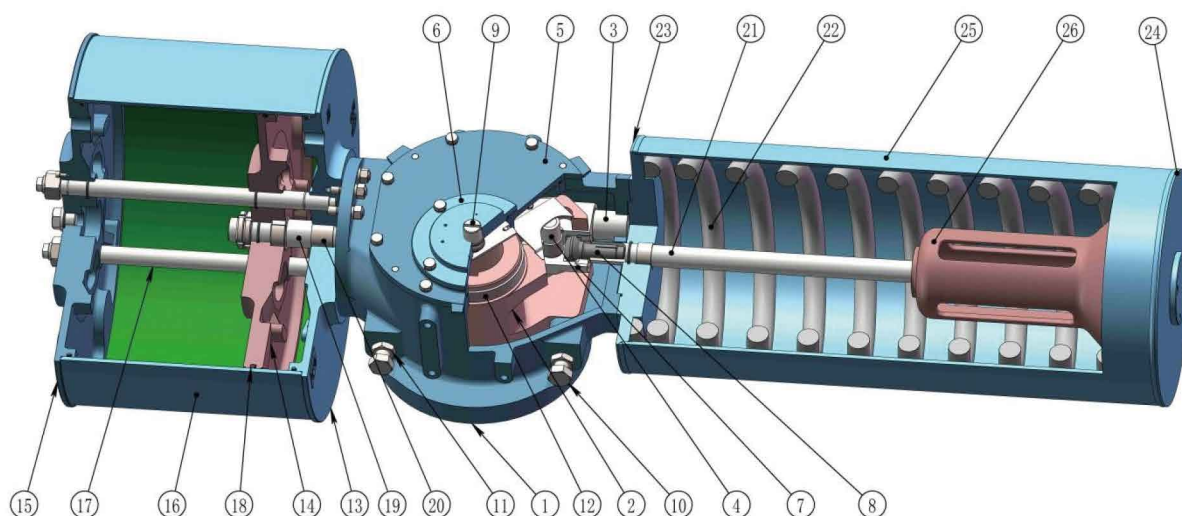


Operating media:	Dry or lubricated air, non-corrosive gas
Operating temperature:	−40°C~+80°C : Standard High temperature type is available on request.
Travel adjustment:	Adjustable +5°/-5° by 0° and 90° position
Air supply pressure:	3bar~6bar

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page 11	Dimensions - Double acting
page 12	Dimensions - Spring return

Material part list



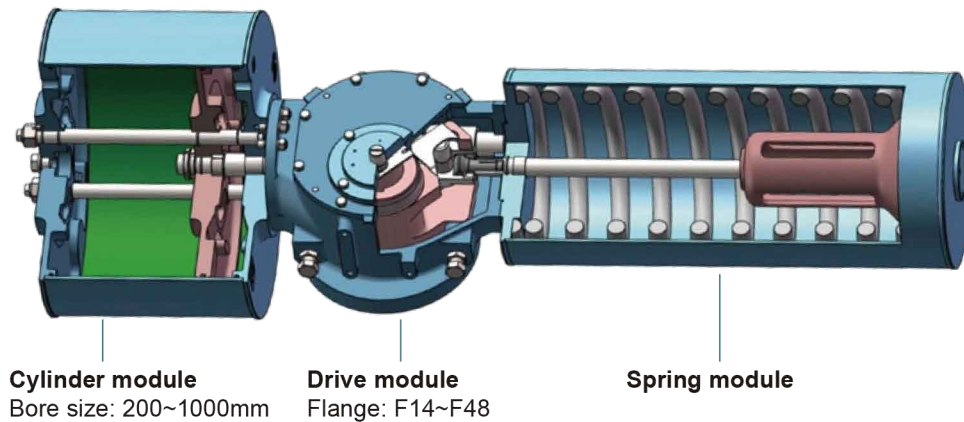
Material part list

No.	Part name	Material
1	Body	Ductile iron
2	Yoke	Ductile iron
3	Guide bar	Alloy steel
4	Pin	Alloy steel
5	Body cover	Ductile iron
6	Cover	Carbon steel
7	Guide block	Ductile iron
8	Connector	Alloy steel
9	Drive shaft	Stainless steel
10	Adjust bolt	Stainless steel
11	Nut	Stainless steel
12	Yoke bearing	DU bearing
13	Inlylinder cover	Ductile iron
14	Piston	Ductile iron
15	Cylinder cover	Ductile iron
16	Cylinder	Carbon steel
17	Cylinder tension rod	Alloy steel
18	Sealing ring	NBR
19	Piston rod	Alloy steel
20	Piston rod bearing	DU bearing
21	Tension rod	Alloy steel
22	Spring	Alloy steel
23	Spring cover	Carbon steel
24	Spring cover	Carbon steel
25	Spring cylinder	Carbon steel
26	Spring seat	Ductile iron

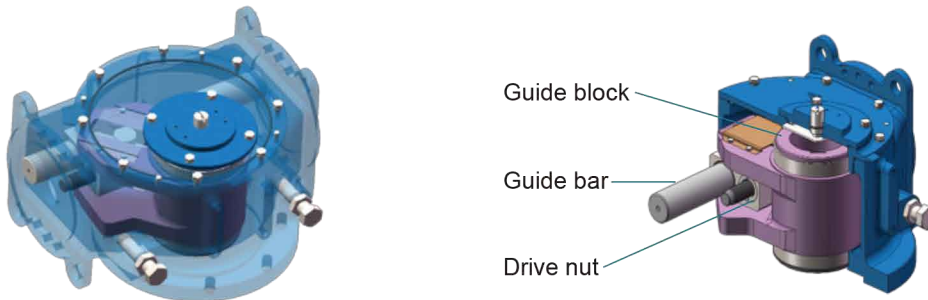
Modular construction design

Fig.545 scotch yoke pneumatic actuator has an efficient and interchangeable modular construction design. Each body module can choose different cylinder modules and spring modules to meet the different requirements for torque. Modular construction and stocking of modules can not only offer quick delivery time, but also make the maintenance more convenient.

- The cylinder is separated from the drive module which can effectively protect the transmission components;
- Flexible combination: one drive module can be equipped with different cylinders to meet the torque requirements under different conditions;
- Easy to upgrade and maintenance, e.g., the spring module can be added on site to upgrade an actuator from double acting to be spring return; easier to change to another size of cylinder on site if the working condition has changed.

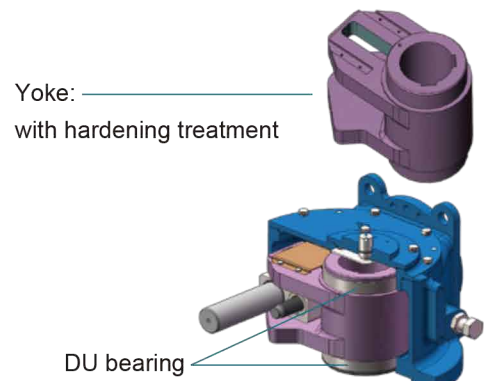


Drive module design



Yoke design

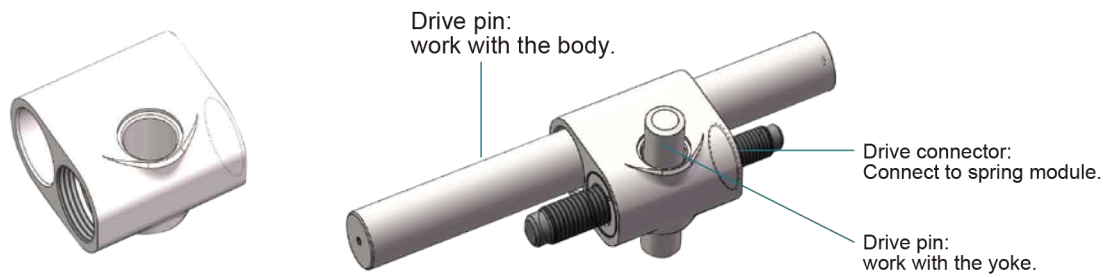
- The yoke is made of integral casting, and the inner surface of the groove is with quenching treatment to reach above HRC50;
- The inner hole of the yoke output shaft is connected by a key, and the two key grooves of the left and right symmetry can be flexibly selected to be installed;
- The yoke and the body cover are connected by self-lubricating DU bearings, which can reduce the friction during the rotation



Drive module design

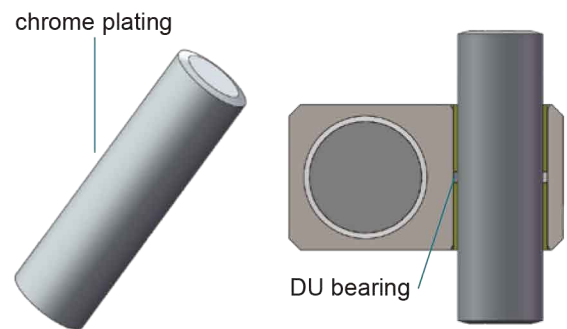
Guide rod design

The guide block is a hub connecting cylinder, springs, guide bar and yoke.



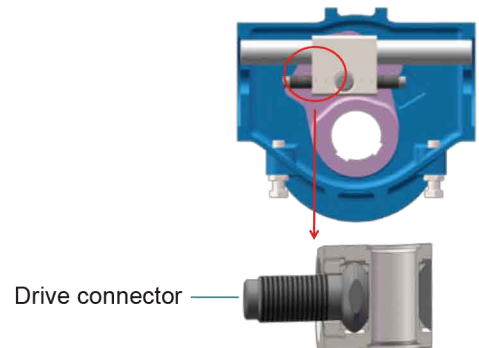
Drive pin

- By using drive pin design, the rolling contact with the yoke can greatly reduce the friction;
- The surface of the drive pin is chrome-plated and hardened to improve the life;
- The drive pin and the guide block are connected by DU bearing which to make the movement smoother - which can also greatly reduce the friction between the pin and the guide block.



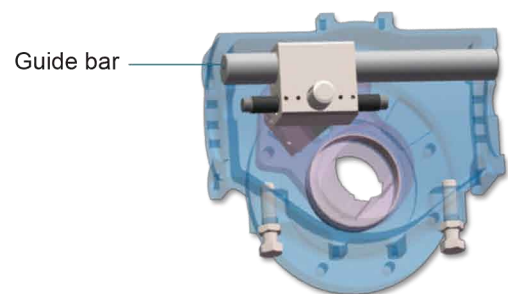
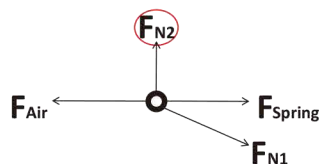
Drive nut

- The piston rod and the guide block are connected by an active joint, which can effectively resolve various radial forces caused by assembly deviations to the piston rod, thereby improving the cylinder output efficiency;
- The active joint is made of ultra-high strength material and the tensile strength reaches 1000MPa.



Drive guide rod

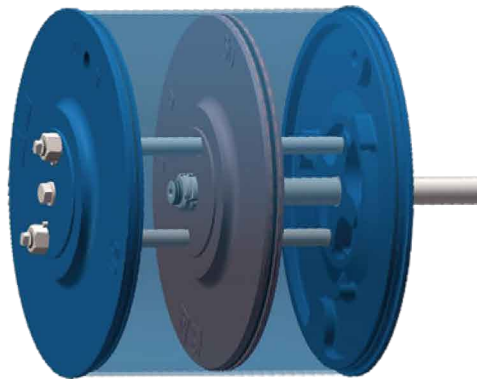
- Through the connection of the guiding block, the radial force originally acting on the cylinder piston is transferred to the guiding rod, so that the piston action is more stable, and the eccentric wear of the piston is effectively prevented.



D-ring design

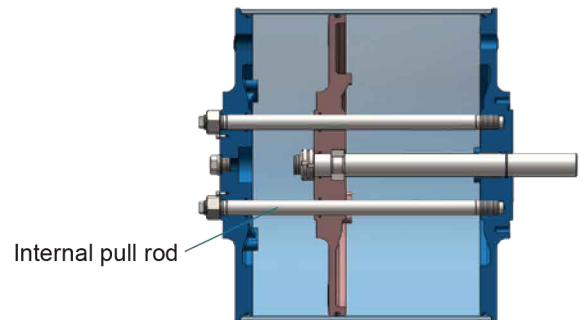
- Piston seal with D-ring to prevent seal rolling during movement and improve the reliability of sealing;
- The D-ring provides excellent sealing with a smaller compression amount, so the friction between the sealing ring and the cylinder wall is reduced, which provides better smoothness during moving, and the lifetime of the

Cylinder module design



Inner guide rod design

- Smaller cylinder diameter with internal pull rod design than those with external tie rods;
- The inner pull rod has a better guiding effect on the piston, and no eccentric wear occurs;
- The inner pull rod is made of high-strength material, and the tensile strength can achieve 1000MPa, which is 2~3 times than that of ordinary carbon steel.



Cylinder Surface treatment

- The inner surface of the cylinder is treated with fluorine, which can improve the smoothness of the inner surface. At the same time, the PTFE has self-lubricity which can also reduce the friction;
- Better anti-corrosion and anti-rust ability after sprayed with fluorine. When water comes into the cylinder, it can effectively prevent the rust of the inner surface so as not to affect the movement of the whole actuator.



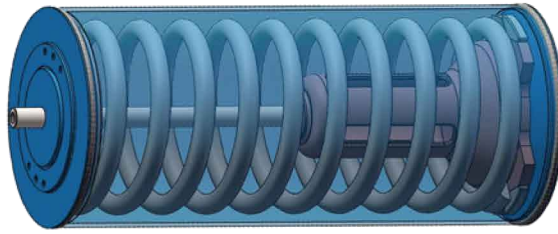
Corrosion resistant test

72-hour salt spray test on fluorine-spray cylinders and chrome-plated test bars.

Item	Start	24h	72h
Chrome-plated bar			
Fluorine-spray cylinder			

Result: There are still rust spots on the surface of the chrome-plated test bar; the fluorine-emitting cylinder shows a better anti-corrosion effect.

Spring module

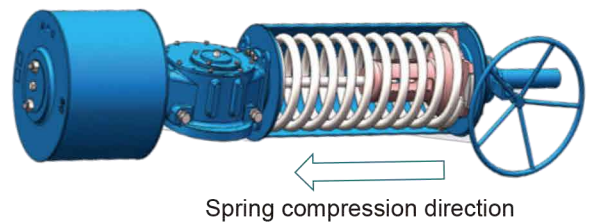


Single spring design

- Single spring design makes the output force more stable. But multiple springs design need to be the same height to achieve a stable output force, which makes it very difficult for the production;
- The shortcoming of the single spring design is that the spring tube is too long, and the space arrangement should be considered in the working application.

Cylinder Surface Treatment

- The compression direction of the spring is towards the drive module, so that the spring cylinder body is not subjected to the spring tension during the action of the actuator, and the bolt between the spring module and the drive module is only used as fixing connector and does not have to stand the spring force;
- The full-welded spring tube can further ensure that the spring does not bounce to the maximum extent, thus to avoid accident happens.



Torque rating

Model	Flange	Max torque [Nm]	Max torque [Nm]
		Double acting	Spring return
545-S1	F14	3600	1700
545-S2	F16	6400	3600
545-S3	F25	12000	6200
545-S4	F30	21000	12600
545-S5	F35	39800	28800
545-S6	F40	81000	56000
545-S7	F48	116700	83000

Cylinder volumn

Model	Cylinder effective volumn										
	200	250	300	350	400	500	600	700	800	900	1000
545-1	6.8	10.6	15.4	18.2							
545-2			15.4	18.2	21.3						
545-3				21.7	27.5	43					
545-4					33.7	53	76				
545-5						59	100	145			
545-6								180	234	296	
									275	353	430

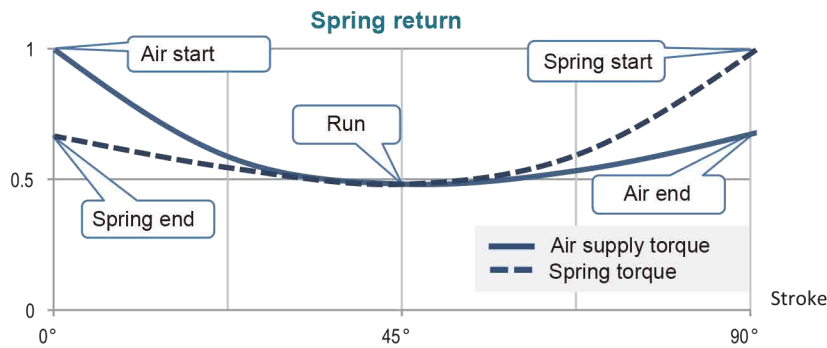
Output torque - Double acting



Output torque - Double acting

Model	Output torque - Double acting [Nm]												Weight [kg]
	3 Bar		3.5 Bar		4 Bar		5 Bar		5.5 Bar		6 Bar		
	Start/End	Run	Start/End	Run	Start/End	Run	Start/End	Run	Start/End	Run	Start/End	Run	
545-0-190	827	414	965	482	1103	551	1378	689					28
545-1-200	1066	563	1244	656	1421	750	1777	938	1954	1031	2132	1125	57
545-1-250	1701	898	1985	1048	2269	1197	2836	1497	3119	1646	3403	1796	67
545-1-300	2459	1298	2869	1514	3278	1730							76
545-1-350	2948	1556	3440	1815									84
545-2-250			2448	1292	2797	1477	3497	1845	3847	2030	4197	2216	80
545-2-300	3033	1600	3538	1867	4043	2134	5054	2667	5560	2934	6065	3201	89
545-2-350	3636	1919	4242	2239	4848	2559	6060	3198	6666	3518			97
545-2-400	4799	2533	5598	2955	6398	3377							120
545-3-350	4373	2308	5102	2693	5831	3077	7289	3847	8017	4231	8746	4616	127
545-3-400	5771	3046	6733	3554	7695	4061	9619	5077	10581	5584	11543	6092	150
545-3-500	9128	4818	10650	5621	12171	6424							197
545-4-400	7003	3696	8171	4312	9338	4928	11672	6160	12840	6776	14007	7392	188
545-4-500	11077	5846	12923	6821	14769	7795	18462	9744	20308	10718	22154	11692	235
545-4-600	16031	8461	18703	9871	21375	11281							303
545-5-500	14359	7578	16752	8842	19146	10105	23932	12631	26325	13894	28718	15157	356
545-5-600	20781	10968	24245	12796	27708	14624	34635	18280	38099	20108	41563	21936	424
545-5-700	29889	15775	34870	18404	39852	21033							604
545-6-700	36507	19267	42591	22479	48676	25690	60845	32112	66929	35324	73014	38535	795
545-6-800	47330	24980	55218	29143	63107	33306	78884	41633	86772	45796	94660	49960	925
545-6-900	60792	32085	70924	37432	81057	42780	101321	53475					1072
545-7-800	56187	29654	65552	34597	74916	39539	93645	49424	103010	54366	112374	59309	
545-7-900	72169	38089	84197	44437	96225	50785	120281	63482	132309	69830	144338	76178	
545-7-1000	87581	46224	102178	53927	116775	61631	145969	77039	160566	84743	175163	92447	

Output torque - Spring return



Output torque - Spring return

Model	Spring Torque [Nm]			Output torque - Spring return [Nm]												Weight [kg]
				3 Bar			4 Bar			5 Bar			6 Bar			
	Start	Run	End	Start	Run	End	Start	Run	End	Start	Run	End	Start	Run	End	
545-0-190-SR	706	280	412				653	253	359	920	386	626	1186	519	892	56
545-1-200-SR4	718	353	619				735	359	627	1088	546	980	1441	732	1333	119
545-1-250-SR3	1313	645	1132				1030	491	832	1597	790	1399	2164	1090	1966	129
545-1-300-SR3	1313	645	1132	1220	592	1022	2039	1024	1842	2859	1457	2661				138
545-1-350-SR3	1313	645	1132	1709	850	1511	2692	1369	2494							150
545-1-250-SR2	1529	743	1288				859	384	595	1426	683	1163	1993	982	1730	130.57
545-1-300-SR2	1529	743	1288	1049	484	786	1869	917	1605	2689	1349	2425				139.57
545-1-350-SR2	1529	743	1288	1539	743	1275	2522	1261	2258							151.57
545-1-250-SR1	1743	847	1465				665	271	361	1232	570	928	1800	870	1496	132.97
545-1-300-SR1	1743	847	1465	856	371	552	1675	804	1371	2495	1236	2191	3314	1669	3010	141.97
545-1-350-SR1	1743	847	1465	1345	630	1041	2328	1148	2024	3310	1667	3006				153.97
545-2-250-SR3	2537	1182	1944							1370	552	722	2070	921	1421	165
545-2-300-SR3	2537	1182	1944				1916	840	1268	2927	1374	2278	3938	1907	3289	174
545-2-350-SR3	2537	1182	1944	1509	625	860	2721	1265	2072	3933	1905	3284	5145	2544	4496	182
545-2-400-SR3	2537	1182	1944	2671	1239	2023	4271	2083	3622	5871	2927	5222				205
545-2-300-SR2	2851	1344	2243				1589	663	924	2600	1197	1935	3611	1730	2946	179.7
545-2-350-SR2	2851	1344	2243				2394	1088	1729	3606	1727	2941	4818	2367	4153	187.7
545-2-400-SR2	2851	1344	2243	2344	1062	1679	3944	1906	3279	5543	2750	4878				210.7
545-2-300-SR1	3614	1687	2778							2014	822	1100	3025	1355	2111	194.53
545-2-350-SR1	3614	1687	2778				1808	713	894	3020	1353	2106	4232	1992	3318	202.53
545-2-400-SR1	3614	1687	2778	1759	687	844	3358	1531	2444	4958	2375	4043				225.53
545-3-350-SR3	4194	1955	3215				2313	938	1242	3771	1707	2699	5228	2477	4157	251
545-3-400-SR3	4194	1955	3215	2253	907	1182	4177	1922	3106	6101	2937	5030	8025	3953	6953	274
545-3-500-SR3	4194	1955	3215	5610	2678	4539	8653	4284	7582	11696	5890	10625				321
545-3-350-SR2	4795	2235	3675							3267	1401	2042	4725	2170	3499	244.4
545-3-400-SR2	4795	2235	3675				3673	1615	2448	5597	2631	4372	7521	3646	6296	267.4
545-3-500-SR2	4795	2235	3675	5107	2372	3881	8149	3978	6924	11192	5584	9967				314.4
545-3-350-SR1	6219	2899	4767							2072	674	483	3530	1444	1941	262.56
545-3-400-SR1	6219	2899	4767				2479	889	889	4402	1904	2813	6326	2919	4737	285.56
545-3-500-SR1	6219	2899	4767	3912	1645	2323	6955	3251	5365	9997	4857	8408				332.56
545-4-400-SR4	7842	3560	5648							5492	2265	3091	7826	3497	5425	400.55
545-4-500-SR4	7842	3560	5648	4897	1951	2495	8589	3899	6188	12281	5848	9880	15974	7797	13572	453.55
545-4-600-SR4	7842	3560	5648	9851	4565	7450	15195	7386	12793	20539	10206	18137				515.55
545-4-400-SR3	9336	4206	6603							4446	1558	1456	6781	2790	3791	434
545-4-500-SR3	9336	4206	6603				7543	3192	4554	11236	5141	8246	14928	7090	11938	487
545-4-600-SR3	9336	4206	6603	8805	3858	5815	14149	6679	11159	19493	9499	16503				549
545-4-500-SR2	11174	5029	7884				6142	2292	2542	9834	4240	6234	13527	6189	9927	473.93
					958	3804	12748	5778	9148	18091	8598	14492				535.93
										8406	3456	4689	12099	5404	8381	486.44
							11320	4993	7602	16663	7814					