2.2

HSP series

Orbital hydraulic motor

The HSP motor is a product with improved reliability at the same pressure flow rate as the HSD, designed for all kinds of tough applications with small installation space. Stronger internal spline design, patented axial clearance adjustment design and enhanced bearing design improves reliability of HSP series motor.

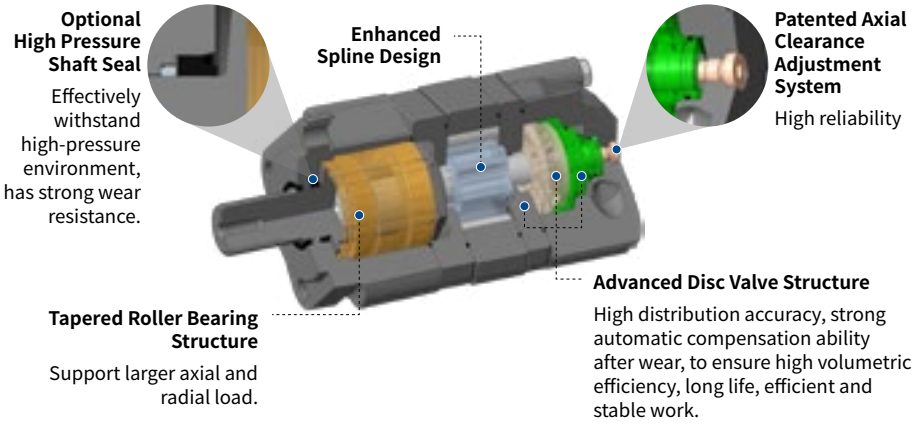
Contents

Overview

The HSP motor is a product with improved reliability at the same pressure flow rate as the HSD, designed for all kinds of tough applications with small installation space. Stronger internal spline design, patented axial clearance adjustment design and enhanced bearing design improves reliability of HSP series motor. Designed for some classic tough applications like Cane-harvester, Auger rigs, Mobile crusher and Wheel loader etc.

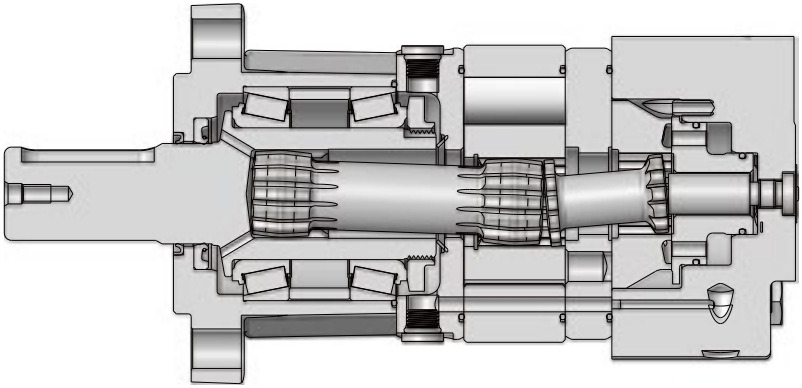
Advantages

- Using tapered roller bearing structure, can support larger axial and radial load.
- HengLi's patented axial clearance adjustment design can improve the wearing of drive.
- The motor's improved spline strength, shaft strengh and bearing side load capability make sure high reliability comparing competitors, also passed endurance test with more than 1000Nm torque to prove the robust design.
- Compared with market competitors,the HSP motor delivers superior drive, seal, bearing life and full displacements from 80cc to 500cc,which means that our customers do not have to sacrifice reliability in a cost-effective solution.
- Optional relief valve, speed sensor.



Standard structure

HSP Orbital hydraulic motor



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Specification

Type		80	100	125	160	200	230	250	315	400	500
Displacement (cm^3/rev.)		80.2	99.6	124.9	159.2	199.4	232.1	249.3	314.0	391.9	488.3
Max.speed (rpm)	Continuous	773	739	592	465	372	318	298	236	188	153
	Intermittent	982	892	714	562	447	385	359	284	229	187
Max.torque (N·m)	Continuous	241	297	370	473	610	658	760	874	897	847
	Intermittent	316	390	485	580	727	812	855	987	1056	986
Max.output (kW)	Continuous	15.5	18.0	18.0	16.5	16.5	13.8	14.5	15.0	11.0	9
	Intermittent	19.5	22.5	22.5	23.0	22.0	17.2	18.0	17.0	12.5	10.5
Max. differential pressure (bar)	Continuous	225	225	225	225	225	225	225	225	175	120
	Intermittent	275	275	275	260	250	250	250	240	190	140
	Peak	295	295	295	280	270	270	270	260	210	160
Max.flow (L/min)	Continuous	65	75	75	75	75	75	75	75	75	75
	Intermittent	80	90	90	90	90	90	90	90	90	90
Max.no-load starting pressure (bar)		12	10	10	8	8	8	8	8	8	8
Min.starting torque (N·m)	Max.continuous differential pressure	145	215	283	359	460	530	554	734	796	781
	Max.Intermittent differential pressure	188	281	371	440	557	633	697	858	925	925
Weight(Standard/Wheeled) (kg)		11.7	11.9	12.1	12.5	12.9	13.3	13.5	14.2	15	15

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- Intermittent working condition: The working time should be less than 6 seconds per minute under the intermittent working condition.
- Peak differential pressure: At peak differential pressure, the operating time is less than 0.6 seconds per minute.
- It is not recommended for the motor to work at simultaneous maximum torque and maximum speed.
- The filtration standard of ISO 4406 cleaning standard 20/18/15 is recommended.
- High quality anti-wear hydraulic fluids are recommended.
- When the temperature is 50° , the minimum viscosity of the oil is recommended to be $20mm^2/s$.
- The recommended maximum operating temperature is 82°C .
- To assure best motor life, run motor 10-15 minutes in low speed high torque mode at approximately 50% of continuous pressure and 50% of continuous flow.

Ordering information

HSP	080	A3	1	S3	A	N	A
①	②	③	④	⑤	⑥	⑦	⑧

Orbital Hydraulic Series

①	Orbital Hydraulic Motor	HSP

Type

②	Type	080	100	125	160	200	230	250	315	400	500

Mount

③	SAE Type A 2×Ø13.5 mount Ø106.4, pilot Ø82.5×6.1	A3
	SAE Type A 4×Ø13.5 mount Ø106.4, pilot Ø82.5×6.1	A2
	4×M12×1 Square mount Ø82.55, pilot Ø44.4×3	F6
	6×Ø13.5 Magneto mount Ø106.4, pilot Ø82.5×2.6	M0
	Wheeled 4×Ø13.5 mount Ø147.6, pilot Ø107.9×6.4	W1
	Wheeled 4×Ø13.5 mount Ø147.6, pilot Ø107.9×6.4, rotate 45°C	W4

Port

④	Port G1/2, drain port G1/4	1
	Port 7/8-14UNF, drain port 7/16-20UNF	2
	Port M22×1.5, drain port M14×1.5	4
	Port G1/2, drain port G1/4, flat seal	H
	Port M22×1.5, drain port M14×1.5, O-ring seal	3
	Port 1 1/16-12UNF, drain port 7/16-20UNF, O-ring seal, side oil port	6
	Rear port, port 7/8-14UNF, drain port 7/16-20UNF	D
	Port 7/8-14UNF, drain port 7/16-20UNF, rear speed sensor	N
	Port glossy hole Ø12.7, drain port G1/4(ED-ring seal), with threaded 2×M10,interchangeable oil port positions	Q

Output Shaft

⑤	Ø32 straight, parallel key 10×8×45	S3
	Ø25.4 shaft, spline SAE 6B	R1
	Ø31.75 spline 14-DP12/24	R5
	Ø25.4 straight, parallel key 6.35×6.35×31.75, center hole 1/4-20UNC	S1
	Ø31.75 straight, parallel key 7.96×7.96×31.75, center hole 3/8-16UNC	S5
	Ø31.75 spline 14-DP12/24, center hole 3/8-16UNC, with retracting groove	RA
	Ø30 6B spline, lengthening	RN
	Ø31.75 tapered shaft, parallel key 7.96×7×22.6(keyed parallel to tapered shaft)	TN
	Ø31.75 tapered shaft, parallel key 7.96×7.96×31.75(keyed parallel to tapered shaft)	T4

Ordering information

Rotation Direction

⑥	CW	A
	CCW	R

Paint Option

⑦	No Paint	N
	Black	B
	Hengli blue	C

Special Features

		F6/M0/W1	A2/A3/W4	Code
⑧	Standard	●	●	A
	Free running	●	●	F
	High temperature	●	●	V
	Low temperature	●	●	S
	High pressure shaft seal	○	●	C
	High pressure shaft seal + Dust cover	○	●	DC
	Mount rotation 90°	●	●	R
	Speed sensor, DT04-4P connector	●	●	S2

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Note: ● =Available; ○ =Available on request; When using the order information, the user can select the motor series, displacement, installation flange, port, shaft and other information. If the selected specification is not in the table or has special requirements, please contact us.

Displacement performance

Flow (L/min)	Pressure(bar)						Max.Cont		Max.Inter
80	30	70	105	140	175	210	225	250	275
80cm³/rev.	Torque(N·m), **Speed(rpm)**								
5	26	59	92	117	147				
	60	**57**	**54**	**52**	**51**				
10	33	72	110	146	183	218	233	254	
	121	**118**	**115**	**111**	**105**	**98**	**93**	**86**	
20	33	74	116	155	195	236	259	278	304
	243	**239**	**235**	**231**	**225**	**217**	**204**	**203**	**186**
30	29	76	118	159	199	241	268	287	316
	367	**362**	**357**	**352**	**345**	**335**	**330**	**319**	**303**
40	25	72	113	154	195	235	262	280	311
	489	**483**	**479**	**473**	**465**	**455**	**434**	**438**	**421**
50		67	108	150	190	232	260		
		608	**602**	**595**	**586**	**574**	**550**		
Max.Cont 65		66	105	146	189	230	259		
		773	**766**	**758**	**747**	**733**	**696**		
Max.Inter 80		62	102	143	185				
		982	**974**	**964**	**953**				

Overall Efficiency: 70-100% 40-69% 0-39%

T-0125

Flow (L/min)	Pressure(bar))						Max.Cont		Max.Inter
100	35	70	105	140	175	210	225	250	275
100cm³/rev.	Torque(N·m), **Speed(rpm)**								
5	36	80	121	159	197	232	257		
	48	**47**	**46**	**44**	**42**	**38**	**34**		
10	37	82	125	166	227	257	276	306	337
	97	**95**	**93**	**91**	**85**	**84**	**82**	**74**	**69**
20	39	90	139	187	235	280	299	326	352
	196	**194**	**191**	**189**	**185**	**180**	**176**	**168**	**157**
30	41	93	143	193	244	292	316	352	383
	295	**292**	**288**	**284**	**280**	**276**	**269**	**260**	**249**
40	41	92	143	193	245	297	320	356	390
	393	**390**	**386**	**382**	**376**	**369**	**366**	**355**	**342**
50	37	88	140	192	241	293	316		
	494	**488**	**485**	**481**	**474**	**466**	**463**		
60	33	80	133	185	235	288	310		
	592	**588**	**584**	**577**	**571**	**562**	**556**		
Max.Cont 75	30	78	130	180	230	283	304		
	739	**731**	**725**	**719**	**709**	**697**	**690**		
Max.Inter 90		71	123	172	223				
		892	**885**	**876**	**867**				

Overall Efficiency: 70-100% 40-69% 0-39%

T-0126

Displacement performance

	Pressure(bar)						Max.Cont	Max.Inter
125	35	70	105	140	175	210	225	250	275
125cm³/rev.	Torque(N·m), **Speed(rpm)**								
5	51	109	166	226	281	333			
	39	**38**	**38**	**36**	**35**	**34**			
10	57	120	182	244	301	353	373	405	
	78	**77**	**76**	**74**	**73**	**69**	**67**	**62**	
20	54	119	179	244	306	367	395	437	473
	158	**156**	**155**	**153**	**150**	**145**	**143**	**135**	**123**
30	50	115	177	243	306	370	396	441	483
	237	**235**	**234**	**231**	**214**	**209**	**206**	**198**	**189**
40	44	109	174	238	303	367	395	441	485
	318	**315**	**313**	**310**	**305**	**299**	**296**	**288**	**277**
50	41	106	170	234	298	364	392		
	394	**396**	**392**	**389**	**384**	**377**	**373**		
60	38	96	168	232	297	363	390		
	480	**476**	**472**	**468**	**463**	**454**	**452**		
Max.Cont 75	29	96	161	227	291	355	383		
	592	**592**	**588**	**583**	**578**	**570**	**564**		
Max.Inter 90		91	156	221	286				
		714	**709**	**703**	**694**				

Flow (L/min)

T-0127

Overall Efficiency: 70-100% 40-69% 0-39%

	Pressure(bar)							Max.Cont	Max.Inter
160	35	70	105	140	160	175	210	225	260
159cm³/rev.	Torque(N·m), **Speed(rpm)**								
5	63	131	200	291	332	358			
	31	**29**	**28**	**28**	**28**	**27**			
10	70	151	229	306	343	368	437	466	
	61	**60**	**59**	**58**	**56**	**57**	**56**	**54**	
20	67	145	226	308	355	388	467	498	
	123	**122**	**120**	**119**	**118**	**117**	**113**	**109**	
30	65	147	229	311	357	391	473	506	580
	185	**184**	**182**	**180**	**179**	**178**	**173**	**171**	**169**
40	61	143	224	306	353	386	467	501	579
	247	**245**	**243**	**241**	**240**	**238**	**233**	**229**	**219**
50	52	136	218	298	345	379	461	496	
	310	**307**	**305**	**302**	**301**	**299**	**293**	**289**	
60	46	127	208	289	335	369	450	486	
	373	**370**	**367**	**347**	**361**	**359**	**353**	**347**	
Max.Cont 75	39	113	193	275	321	356	439	473	
	465	**458**	**455**	**451**	**448**	**446**	**438**	**433**	
Max.Inter 90	26	103	183	265	312				
	560	**562**	**558**	**552**	**549**				

Flow (L/min)

T-0128

Overall Efficiency: 70-100% 40-69% 0-39%

Displacement performance

	Pressure(bar)							Max.Cont	Max.Inter
200	35	70	105	140	160	175	210	225	260
199cm³/rev.	Torque(N·m), **Speed(rpm)**								
5	71	163	257	368					
	24	**24**	**23**	**23**					
10	78	178	276	371	432	469	573		
	49	**49**	**48**	**47**	**47**	**46**	**43**		
20	85	188	291	396	459	501	604	646	713
	98	**96**	**95**	**93**	**90**	**89**	**82**	**76**	**68**
30	88	192	297	401	462	505	610	656	727
	147	**146**	**144**	**142**	**140**	**139**	**133**	**129**	**111**
40	75	181	285	390	451	494	600	644	716
	197	**194**	**192**	**190**	**188**	**187**	**181**	**176**	**169**
50	65	170	273	379	438	484	588	633	
	246	**244**	**242**	**240**	**238**	**236**	**230**	**226**	
60	53	159	262	368	426	472	576	622	
	297	**294**	**291**	**289**	**287**	**285**	**279**	**276**	
Max.Cont 75	44	150	254	359	420	464	569	612	
	372	**369**	**366**	**363**	**361**	**359**	**353**	**349**	
Max.Inter 90		138	254	343	401				
		447	**442**	**438**	**435**				

Flow (L/min)

T-0129

Overall Efficiency: 70-100% 40-69% 0-39%

	Pressure(bar)								Max.Cont	Max.Inter
230	35	70	95	125	140	155	175	200	225	250
232cm³/rev.	Torque(N·m), **Speed(rpm)**									
5	88	187	258							
	21	**20**	**18**							
10	101	215	303	397	441	491				
	42	**41**	**40**	**38**	**37**	**35**				
20	102	219	305	407	450	509	577	658	736	812
	84	**82**	**80**	**79**	**79**	**77**	**76**	**74**	**71**	**66**
30	104	225	334	415	459	519	588	675	744	
	127	**125**	**119**	**123**	**122**	**121**	**120**	**118**	**114**	
40	102	226	333	413	459	518	588	648	732	
	169	**167**	**159**	**165**	**165**	**164**	**162**	**160**	**157**	
50	100	217	324	408	451	512	581			
	212	**211**	**200**	**208**	**207**	**206**	**205**			
60	85	205	310	395	439	499	568			
	255	**253**	**241**	**251**	**250**	**248**	**247**			
Max.Cont 75	76	197	300	387	430	488	498			
	256	**318**	**302**	**315**	**314**	**312**	**310**			
Max.Inter 90		185	289	391	425					
		385	**365**	**364**	**372**					

Flow (L/min)

T-0130

Overall Efficiency: 70-100% 40-69% 0-39%

Displacement performance

Flow (L/min)	250 (249cm³/rev.) Pressure(bar) 35	70	95	125	140	155	175	200	Max.Cont 225	Max.Inter 250
	Torque(N·m), **Speed(rpm)**									
5	87									
	20									
10	101	208	288	364	421	506				
	39	**37**	**36**	**33**	**30**	**28**				
20	103	229	315	417	463	513				
	78	**76**	**74**	**73**	**72**	**70**				
30	95	223	313	421	473	538	603	675	749	855
	118	**116**	**115**	**113**	**112**	**111**	**108**	**91**	**85**	**70**
40	83	213	304	414	467	538	608	676	760	
	157	**155**	**154**	**152**	**151**	**149**	**147**	**142**	**135**	
50	68	199	290	401	460	541	613			
	197	**195**	**194**	**192**	**191**	**189**	**187**			
60	51	180	273	384	439	529	600			
	238	**235**	**234**	**232**	**230**	**229**	**226**			
Max.Cont 75	21	150	241	353	408	519				
	298	**296**	**294**	**295**	**290**	**288**				
Max.Inter 90		110	203	321	369					
		359	**356**	**358**	**350**					

T-0131

Overall Efficiency: 70-100% 40-69% 0-39%

Flow (L/min)	315 (314cm³/rev.) Pressure(bar) 35	70	100	120	140	160	175	200	Max.Cont 225	Max.Inter 250
	Torque(N·m), **Speed(rpm)**									
5	127	254	339							
	15	**14**	**14**							
10	133	272	393	465	547	609				
	31	**30**	**28**	**26**	**24**	**22**				
20	141	305	441	528	613	669				
	62	**61**	**59**	**58**	**55**	**50**				
30	144	310	453	545	635	721	783	874	969	987
	93	**92**	**91**	**89**	**87**	**81**	**74**	**66**	**53**	**50**
40	134	297	440	535	627	719	785	873	949	
	125	**123**	**122**	**121**	**119**	**116**	**113**	**102**	**95**	
50	129	291	434	529	623	717	784			
	156	**155**	**153**	**152**	**151**	**148**	**145**			
60	108	272	414	509	604	697	767			
	188	**186**	**185**	**184**	**182**	**180**	**177**			
Max.Cont 75	85	254	395	490	585	679				
	236	**234**	**232**	**231**	**229**	**226**				
Max.Inter 90	60	228	370	464	559					
	284	**283**	**281**	**279**	**277**					

T-0132

Overall Efficiency: 70-100% 40-69% 0-39%

Displacement performance

	Pressure(bar)							Max.Cont	Max.Inter
400	30	60	80	105	120	140	160	175	190
392cm³/rev.	Torque(N·m), **Speed(rpm)**								
5	142	293							
	11	**10**							
10	153	306	414	558					
	25	**24**	**23**	**22**					
20	152	328	448	590	677	791	897	979	
	50	**49**	**48**	**47**	**46**	**45**	**39**	**36**	
30	163	342	460	608	697	815	931	997	1056
	75	**74**	**73**	**72**	**71**	**70**	**68**	**65**	**60**
40	153	331	451	599	688	810	923	978	
	100	**99**	**98**	**97**	**96**	**95**	**93**	**91**	
50	136	330	454	590	688	776			
	125	**124**	**123**	**122**	**121**	**121**			
60	123	298	417	566	657	775			
	150	**150**	**149**	**148**	**147**	**145**			
Max.Cont 75	96	278	399	544	635				
	188	**188**	**187**	**185**	**185**				
Max.Inter 90	68	248	367	517					
	225	**229**	**227**	**224**					

Flow (L/min)

T-0133

Overall Efficiency: 70-100% 40-69% 0-39%

	Pressure(bar)					Max.Cont	Max.Inter
500	25	50	80	90	105	120	140
488cm³/rev.	Torque(N·m), **Speed(rpm)**						
10	160	329					
	20	**20**					
20	152	333	547	616	722		
	41	**40**	**40**	**39**	**34**		
30	160	342	561	633	740	847	986
	57	**57**	**56**	**56**	**56**	**55**	**54**
40	153	337	557	629	736	842	
	81	**81**	**80**	**80**	**79**	**79**	
50	132	316	538	613	723	835	
	102	**101**	**100**	**100**	**100**	**99**	
60	121	304	526	597	708		
	122	**122**	**121**	**121**	**135**		
Max.Cont 75	92	260	478	552	664		
	153	**153**	**152**	**151**	**151**		
Max.Inter 90	56	223	447	518			
	177	**186**	**184**	**184**			

Flow (L/min)

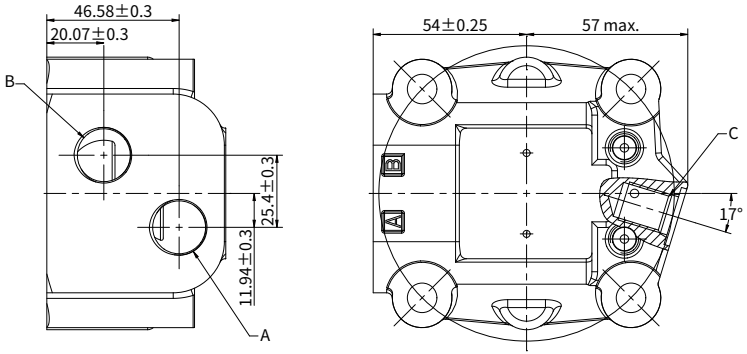
Torque(N·m):835
Speed(rpm): 99

Overall Efficiency: 70-100% 40-69% 0-39%

T-0134

Installation size

Port size



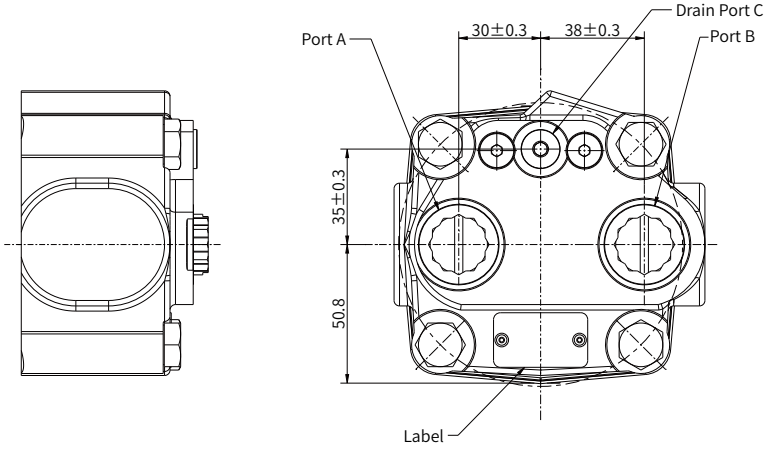
P - 0167

Code	Port A/B	Drain port C
1	G1/2	G1/4
2	7/8-14UNF	7/16-20UNF
4	M22x1.5	M14x1.5
H	G1/2	G1/4
3	M22x1.5	M14x1.5
6	1-1/16-12UNF	7/16-20UNF
N	7/8-14UNF	7/16-20UNF
Q	Ø12.7	G1/4

T - 0232

02

Rear Port Size



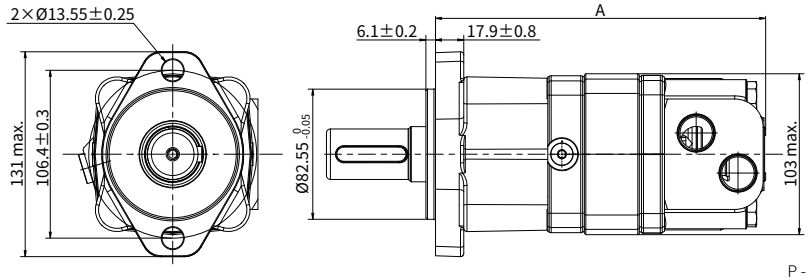
P - 0313

Code	Port A/B	Drain port C
D	7/8-14UNF	7/16-20UNF

T - 0233

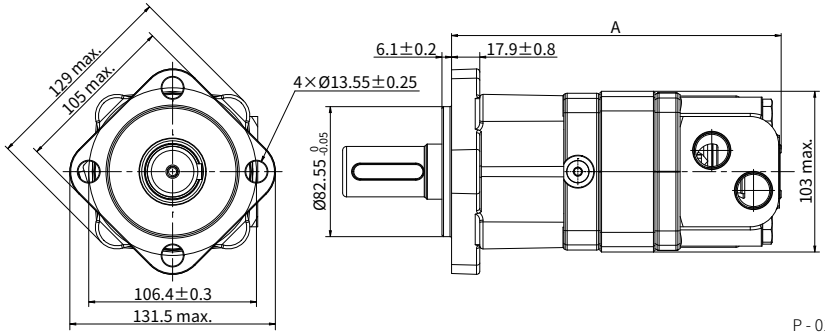
Installation size

A3 2-HOLE, SAE A MOUNT



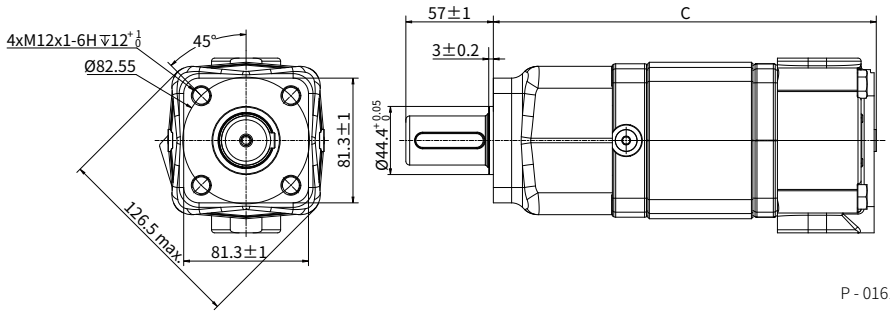
P - 0157

A2 4-HOLE, SAE A MOUNT



P - 0158

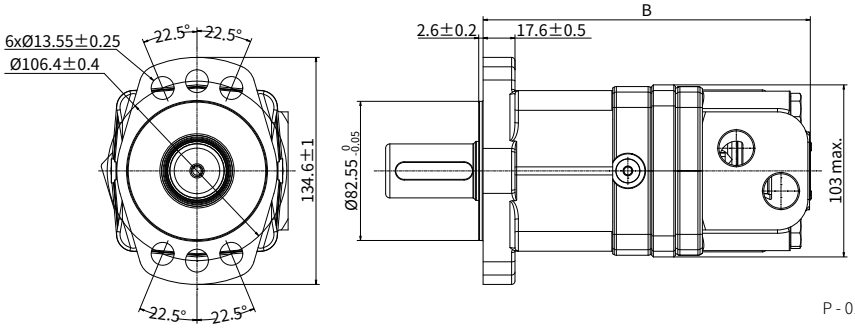
F6 FOUR-THREADED HOLE SQUARE FLANGE



P - 0161

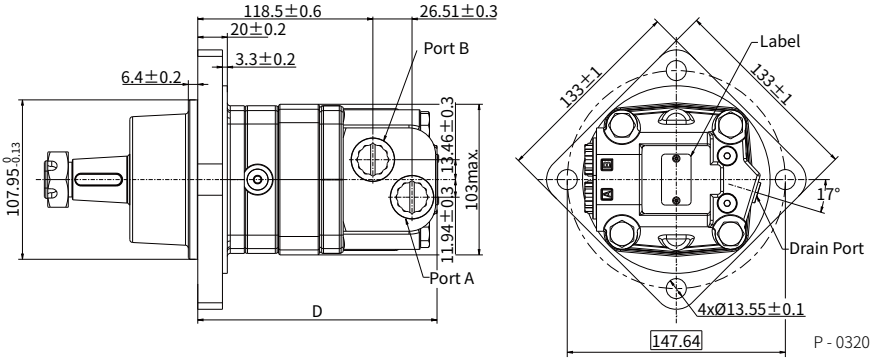
Installation size

M0 6-HOLE, MAGNETO MOUNT



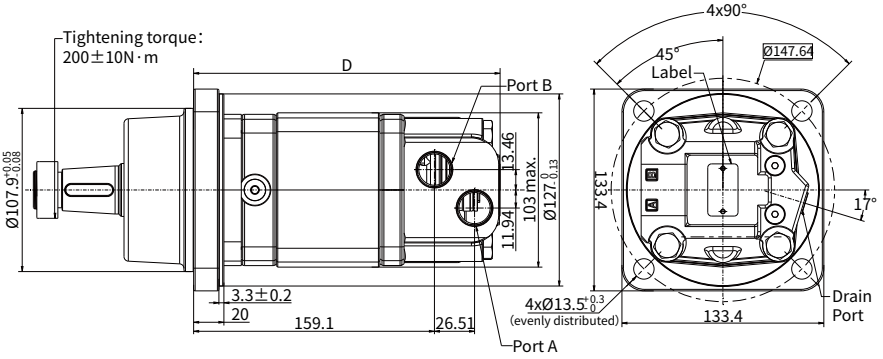
P - 0159

W1 4-HOLE, WHEELED MOUNT



P - 0320

W4 4-HOLE, WHEELED MOUNT



P - 0321

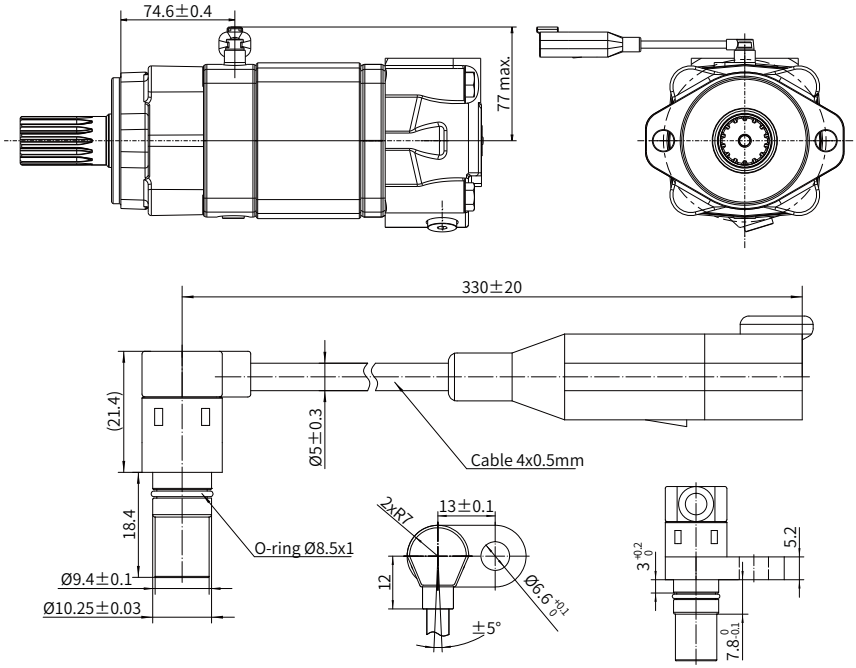
Length and weight

Type	A mm	B mm	C mm
80	188.0	192.1	194.7
100	191.4	195.5	198.1
125	195.8	199.9	202.5
160	201.8	205.9	208.5
200	208.8	212.9	215.5
230	214.5	218.6	221.2
250	217.5	221.6.	224.2
315	228.8	232.9	235.5
400	242.4	246.5	249.1
500	242.4	246.5	249.1

T-0136

Note: Dimensions A, B,C are the length from the flange mounting surface to the rear end of the motor, and the tolerance is ±0.61mm.

Speed sensor



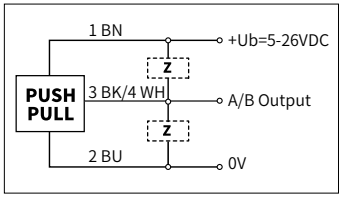
P - 0305

Speed sensor

Dimensions	Ø10.25 /L=18.4mm
Voltage	5-26VDC
Input Current	<15mA
Sensing distance	0.2~1.7mm
Power reverse protection（Y/N）	Yes
Power input overcurrent and overvoltage protection (Y/N)	Yes
Maximum output current	40mA
Voltage drop	⩽ 2VDC
Working frequency	0-20KHz
Output signal	A, B
Operating temperature	-40°C ~ +125°C
Protection	IP69K
Shell material	Stainless steel/plastic
Pressure resistance of measuring surface	500bar
Connector	Cable 0.33m, Injection 4-core DEUTSCH DT04-4P-EP04 plug

T - 0236

■ WIRING DIAGRAM



P - 0306

■ TERMINAL ASSIGNMENT

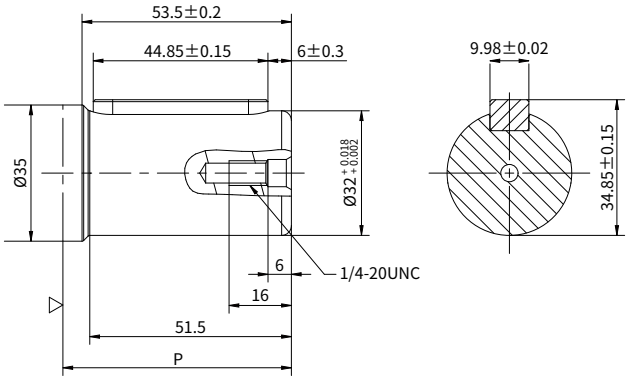
Signal		+Ub	0V	A	B
Color		BN	BU	BK	WH
4 core plug DT04		1	2	3	4

P - 0307

Shaft end dimensions

S3

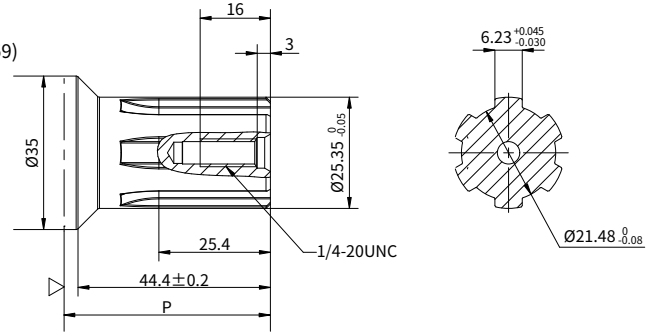
Ø32mm Straight
Parallel key: 10×8×45
Max. Torque: 881N·m



P-0163

R1

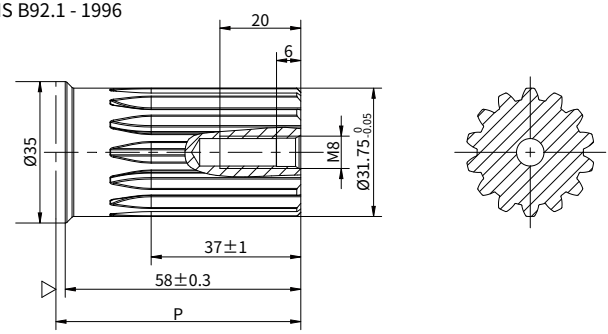
Ø25.4mm Straight
Spline: SAE 6B (B.S.2059)
Max. Torque: 678N·m



P-0166

R5

Ø31.75mm
Spline: 14-DP12/24，ANS B92.1 - 1996
Max. Torque: 881N·m

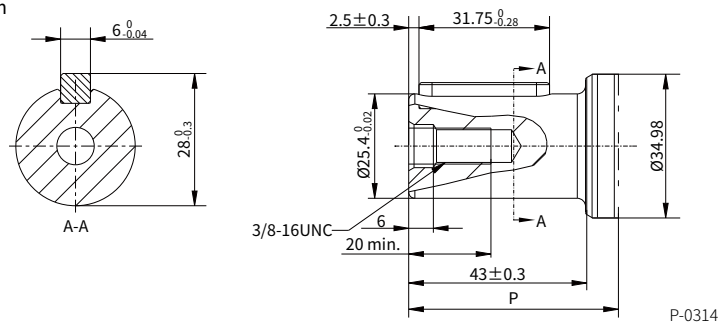


P-0165

Shaft end dimensions

S1

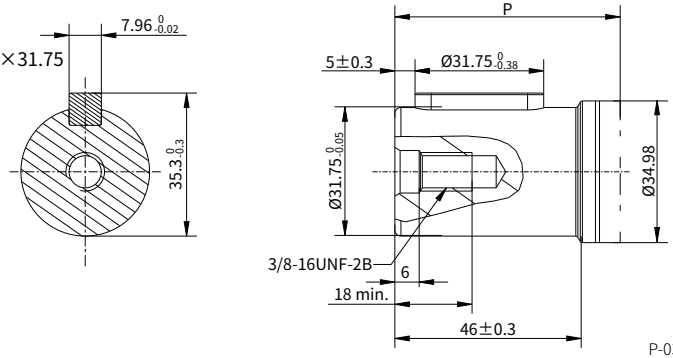
Ø25.4mm Straight
Parallel key: 6.35×6.35×31.75
Max. Torque: 678N·m



P-0314

S5

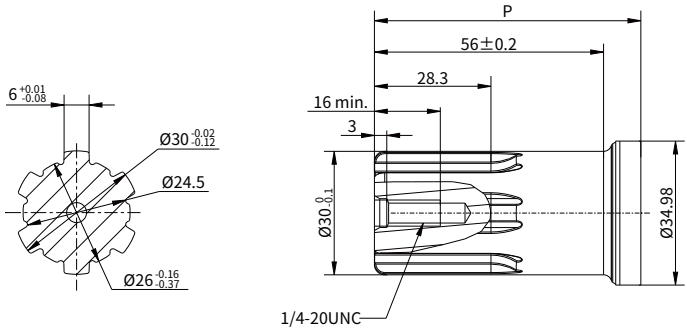
Ø31.75mm Straight
Parallel key: 7.96×7.96×31.75
Max. Torque: 881N·m



P-0315

RN

Ø30mm shaft
Spline: SAE 6B
Max. Torque: 768N·m

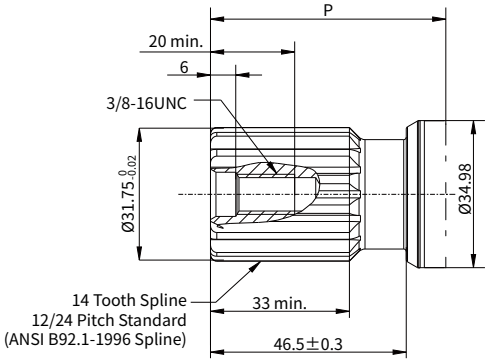


P-0316

Shaft end dimensions

RA

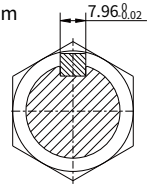
Ø31.75mm Shaft
Spline: 14-DP12/24，ANSI B92.1 - 1996
Max. Torque: 881N·m

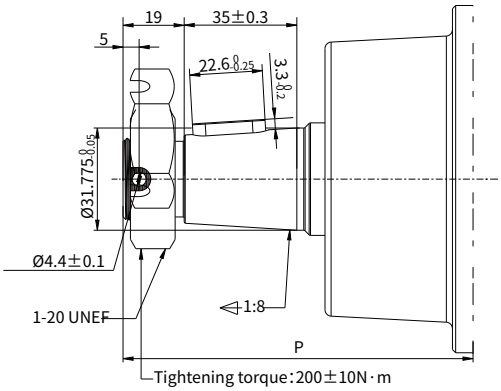


P-0317

TN

Ø31.75mm Tapered shaft
Parallel key: 7.96×7×22.6
Tightening torque: 200±10N·m
Max. Torque: 881N·m

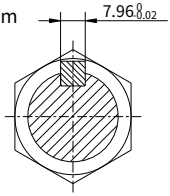


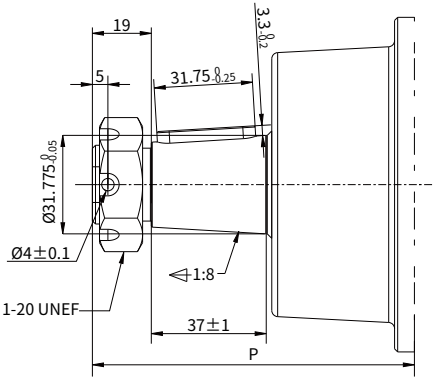


P-0318

T4

Ø31.75mm Tapered shaft
Parallel key: 7.96×7.96×31.75
Tightening torque: 200±10N·m
Max. Torque: 881N·m





P-0319

Shaft end dimensions

P mm	SAE Mount	Magneto Mount	Square Mount	Wheeled Mount
S3	63.2	57.8	51.1	-
R1	53.9	48.5	41.8	-
R5	66.0	60.6	53.9	-
S1	51	45.6	38.9	-
S5	55.6	50.2	43.5	-
RN	64.7	59.3	52.6	-
RA	55.9	50.5	43.8	-
TN	-	-	-	108.8
T4	-	-	-	104

T-0137

Note: Dimension P is the overall distance from the flange mounting surface to the end of the shaft, and the tolerance is ±0.97mm.

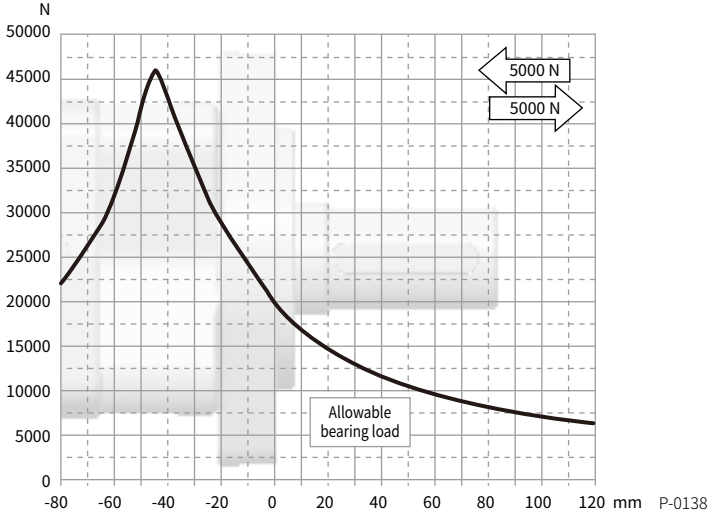
02

Allowable shaft load/bearing curve

As shown in the figure, when the axial load is 0, the radial allowable load of the output shaft is related to the distance from the flange mounting surface to the load action point.

The solid line shows the allowable radial load of the bearing.It is based on L_{10} bearing life 2000 hrs at 100 RPM with rated output torque.

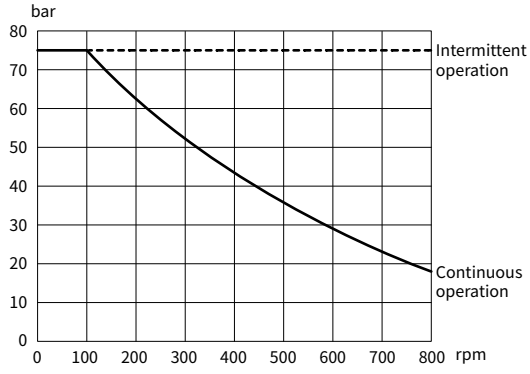
Any shaft load exceeding the values quoted in the curve will involve a risk of failure.



P-0138

Standard shaft seal pressure

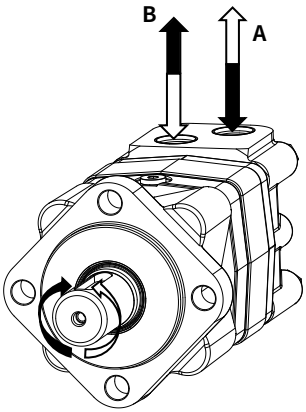
When case drain port is not working, the pressure on the output shaft seal is slightly higher than the pressure in the return line.
When using a drain line, the pressure on the shaft seal of the output shaft is the same as the pressure in the drain line.



P-0019

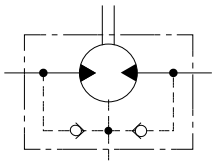
Rotation direction：CW

When facing the motor shaft extension direction, port A is high pressure oil, the output shaft rotates CW; Otherwise, it rotates CCW.



P-0028

Hydraulic diagram



P-0020