GEAR MOTOR FLOW DIVIDER

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GRH POWER

齿轮马达 齿轮分流器

国瑞液压

COMPANY INTRODUCTION 公司简介

GRH is specialized in providing hydraulic components and solutions for hydraulic systems. With continuous improvement and enthusiasm over the past 30 years, GRH has developed into an emerging power in the fluid power industry since it was established in 1986.
Research and development are the driving force that facilitates GRH's ability to create new products. Standards of TS16949 and ISO14000 are our guiding principles. Employees' capabilities and creativity are major factors that differentiate GRH from our competitors.
GRH designs and produces Hydraulic Gear Pumps & Motors, Monoblock Valves, Sectional Stack Valves, Proportional Valves and Flow Dividers. These products are used on industrial machinery, construction equipment, agricultural equipment and material handling applications. GRH is also willing to work with our customers to develop specialized products for their special needs. Our customers can count on GRH's extensive system design and application experience when they are designing their hydraulic systems. GRH has designed and developed a series of load sensing proportional stackable valves which provides an improvement in valve operating performance and system efficiency.

持续的改进和对液压领域的专注，超过三十年的设计及制造经验，GRH从1986年至今取得了引人注目的成就。产品的研发和技术创新是GRH前进的动力。TS16949和 ISO14000的标准是GRH遵守的程序化准则。员工的能力和创造性是GRH不同于竞争对手的主要因素。

GRH设计并生产：液压齿轮泵/片式多路阀/整体多路阀/比例多路阀（带负载敏感及压力补偿）/液压马达/液压分流马达；这些零部件主要应用于工业机械、物料搬运、工程机械、农业和工业领域。GRH充分意识到客户在设计阶段作出的贡献及其产品设计输入的重要性。除了供应GRH目录上的产品，GRH还与客户密切协作提供液压技术的系统解决方案。客户可以依靠GRH在液压元件及系统设计方面的经验及GRH技术专家去实现他们的设想。GRH已关注到电子控制与液压系统集成的重要性，为了优化设计及节约能源，GRH在系统的电子控制及集成化方面正在做出自己的努力。

Contents 目 录

Introduction of GRH Gear Motor 齿轮马达简介

Gear motors from GRH Hydraulic have a floating bushing feature with automatic axial clearance compensation. The bushings are made with special abrasion resistant material providing improved service life. Precisely machined gears ensure our units provide excellent low noise characteristics. Our cold extrusion motor bodies can endure pressures above 30Mpa. High strength cast iron front & rear covers also enhance our reliability. Our units are widely used in the industrial, mobile, marine and aerospace industries.

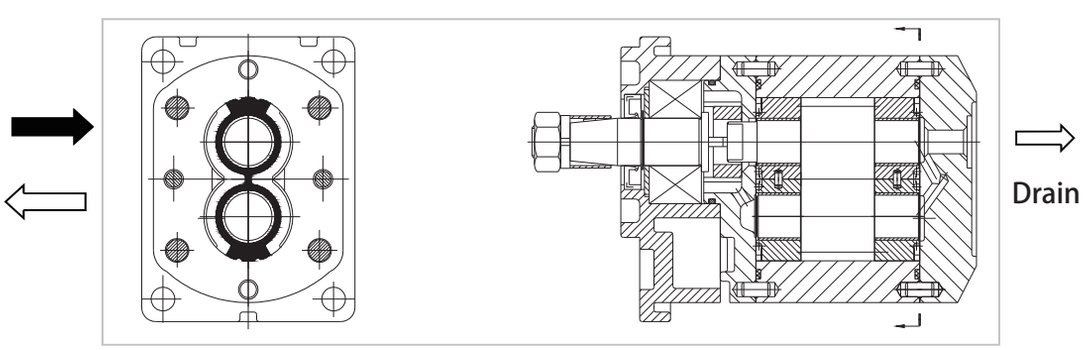
GRH has 5 series of gear motors-group 1、2、2.5、3 and 3.5. They can be divided into two types. One is the single direction gear motor, the other is the bi-direction gear motors. Normally the design of the single direction gear motor is similar to that of the single direction gear pump with some slight design differences. Therefore, all GRH pumps have a corresponding single direction gear motor. When placing your order, please refer to the ordering code.

We now focus on the bi-direction gear motors. This motor has a different sealing structure to the single direction motor. The symmetrical sealing (refer to the bottom drawings) separate high pressure from low pressure thus allowing bi-direction operation. The oil from internal leakage returns to tank through the drain port. Normal case drain pressure is limited to 2 bar but 5 bar is allowed for intermittent operation. High quality of the bushings, bearings and seals adds to the outstanding performance of GRH bi-direction gear motors.

齿轮马达是液压系统中的常用执行元件，它的特点是抗液压系统污染能力强，结构简单，可靠性高。GRH的齿轮马达均具有轴向间隙自动补偿功能，轴套独特的耐磨损配方，提供了长期的使用寿命，精心加工的齿轮保证了在低噪音条件下的使用，冷挤压型材泵体能承受超过30Mpa的压力。可广泛用于工业液压系统、工程机械液压系统、航空航天液压系统、船舶液压系统、海洋工程液压系统。

GRH有五个系列齿轮马达：1组、2组、2.5组、3组、3.5组,按照它的旋转方向，分为两个大类，一个大类是单向齿轮马达，另一个大类是双向齿轮马达，通常单向齿轮马达的结构与单向齿轮泵是类似的，只是在某些方面略有不同，因此，GRH所拥有的齿轮泵都有对应的单向齿轮马达，订货时请参见订单编码。

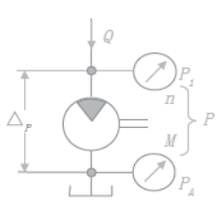
在此我们重点介绍的是双向齿轮马达，双向齿轮马达的密封结构与单向马达不同，如下图所示，对称的密封结构将高低压分开，因而保证了齿轮马达双向工作的可能性，内部泄漏的的油液经一个泄油口返回油箱，这个泄油口的压力通常是2~3bar，这意味着轴油封可以承受2~3bar的压力，短时间内可以承受5bar。GRH双向齿轮马达高质量的轴套、轴承、密封件，保证了优异的马达性能。



Specification 性能参数

Series 系列号	Displacement 排量(ml/r)	Pressure 压力(bar)			Speed/转速 (r/min)		Total Efficiency 总体效率 (T>%)	Volumetric Efficiency 容积效率 (V>%)	Mechanical Efficiency 机械效率 (M>%)	Output Torque 输出扭矩 (N.m)
		P1 Rated 额定	P2 Intermittent 间断	P3 Peak 峰值	MAX 最高	Min 最低				
1MF/1AMF	1.1 to 5.1	200	230	250	4000	650	78	92	85	Refer to Below Formula 参考以下公式
1MF/1AMF	5.1 to 8. 5	200	230	250	3600	650				
2MF	4 to 8	200	230	250	4000	600	80	94	85	
2MF	8 to 15	200	250	280	3500	600				
2MF	15 to 20	200	250	280	3000	600				
2MF	20 to 26	200	250	280	2500	500				
2MF	26 to 30	200	250	280	2000	500				
2.5MF	10 to 20	200	230	250	3600	500	80	94	85	
2.5MF	20 to 30	200	230	250	3600	500				
2.5MF	30 to 40	180	230	250	3000	500				
3MF	22 to 43	200	230	250	3000	400	82	95	86	
3MF	43 to 70	200	230	250	2500	400				
3MF	70 to 89	200	230	250	2200	400				
3.5MF	52 to 73	170	200	210	3600	500	82	95	86	
3.5MF	73 to 100	150	165	180	3000	500				
3.5MF	100 to 115	120	130	140	2500	500				

Formula 马达计算公式



$Q = V.n \cdot 10^3/\eta v$

$M = P \cdot V \cdot \eta m / 62.83$

$P = P.V.n.\eta t / 600 \cdot 1000$

V [cm³/r] Q [l/min] p [bar] n [r/min] P [kW] M [Nm]

Characteristics 使用特性

Direction of rotation: bi-direction and single-direction 旋转方向：双向和单向
Permissible ambient temperature range: min = -20 °C - max = + 60 °C 环境温度：min = -20 °C - max = + 60 °C
Operating pressures: input side P1 max = refer above data; outlet side P2 max =3 bar 操作压力：进油参考以上；出油P2 max =3 bar
Drain pressure: pd max= 2 bar, Short time: pd max= 5bar 泄油口压力：pd max= 2 bar 短时间：pd max= 5bar
Fluid temperature range: max=90 °C for NBR rotary shaft lip-type seal, 100 °C for FKM rotary shaft lip-type seal 液体温度范围：90 °C相对于丁晴橡胶轴油封，100 °C相对于氟橡胶轴油封
Viscosity range: min=10 mm²/s-max=600 mm²/s 粘度范围：min=10 mm²/s-max=600 mm²/s
Filtration 过滤：
Recommended: Viscosity range: V=30...45mm2/s 推荐粘度范围：V=30...45mm2/s
Recommended hydraulic fluids use: GB11118-94：L-HM46 or equate NFE-603/DIN515524 II-85 推荐液体：GB11118-94：L-HM46 or equate NFE-603/DIN515524 II-85
Characteristic curves refer to pages: page 4 to 7 特性曲线参考页：4到7页

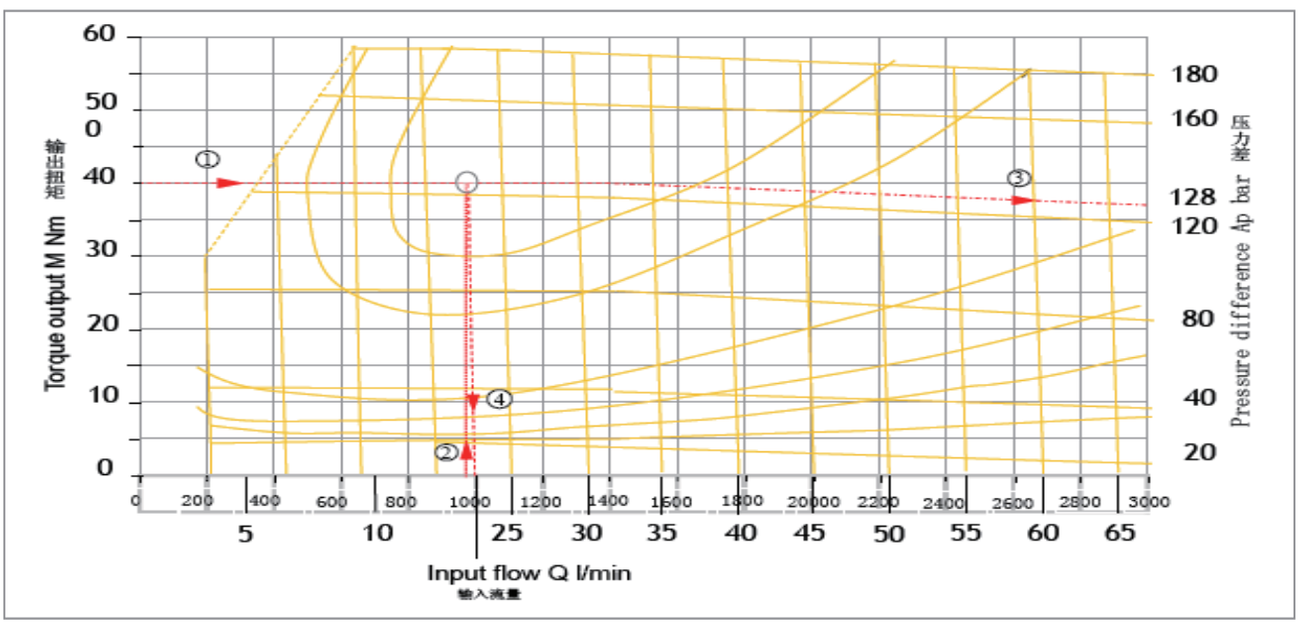
Characteristics 使用特性

标准	P<2000PSI(14MPa)	2000PSI(14MPa)<P<3050PSI(21MPa)	P>3050PSI(21MPa)
NAS1638	10	9	8
ISO4406	19/16	18/15	17/14
FILTER	25um	20um	10um

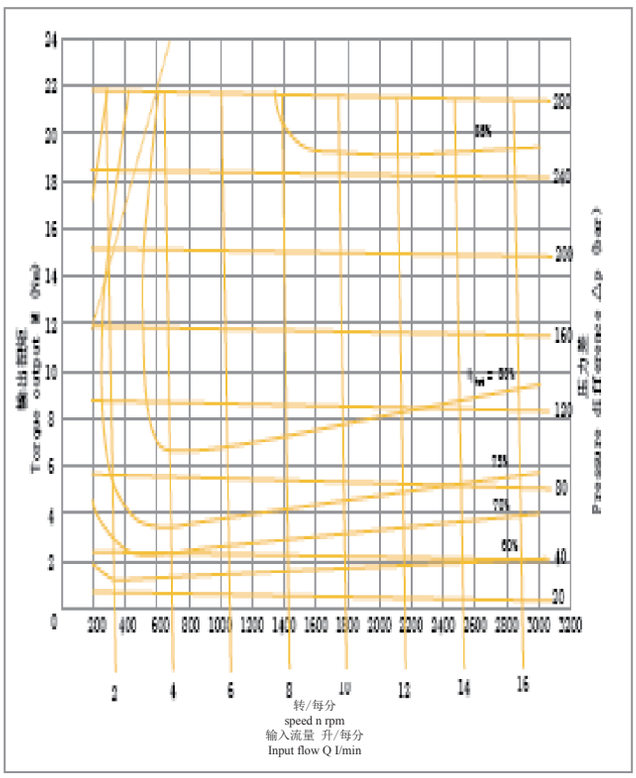
All motor can be combined with relief valve, proportional valve, thermostatic valve.
所有马达均可以集成溢流阀，比例阀，速度调节阀。

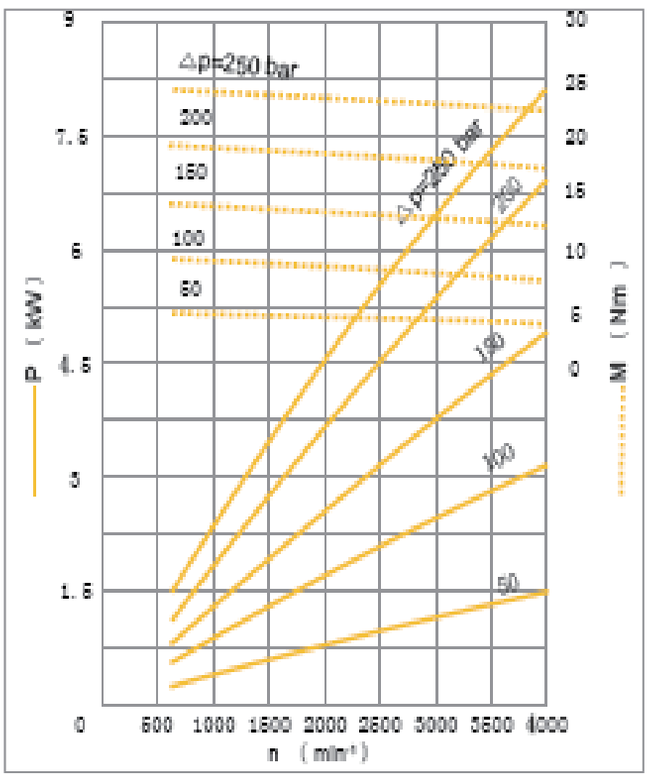
Guidance for Use of the Curves 曲线使用指南

In most cases, known: torque output M at speed n, unknown: pressure difference Δp and the required
Input flow ; example: ①M = 40 Nm ; ②n = 1000 RPM ; the intersection of ① and ② is the motor operating point with: Δp = 123 bar ③Q = 21.3l min ④
大多数应用场合,已知要得到的马达转速和相应输出扭矩M，求压力差Δp和要求的输入流量Q
举例: 已知 ①M = 40 Nm ; ②n = 1000 RPM ; ①和②的交点O是马达运行点: Δp=123 bar ③Q = 21.3 l/min④

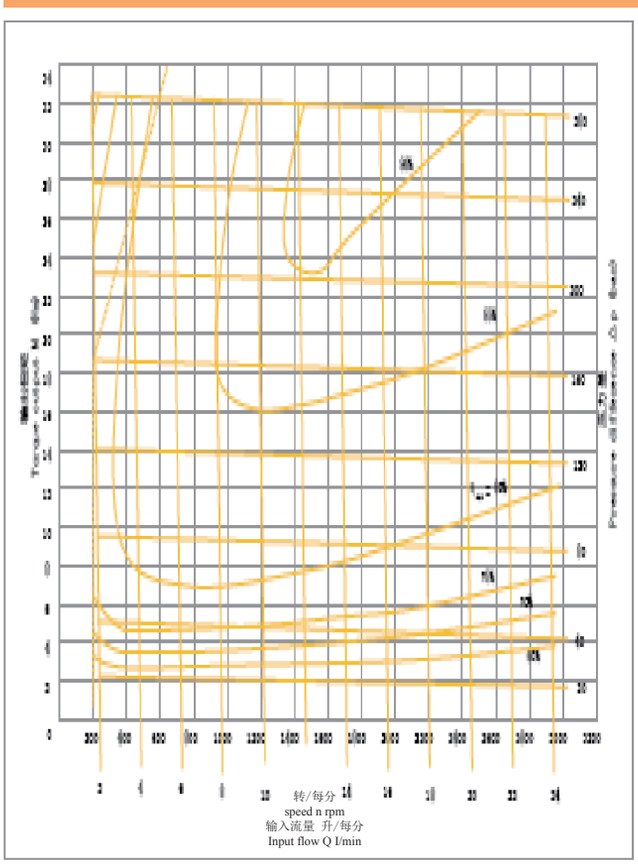


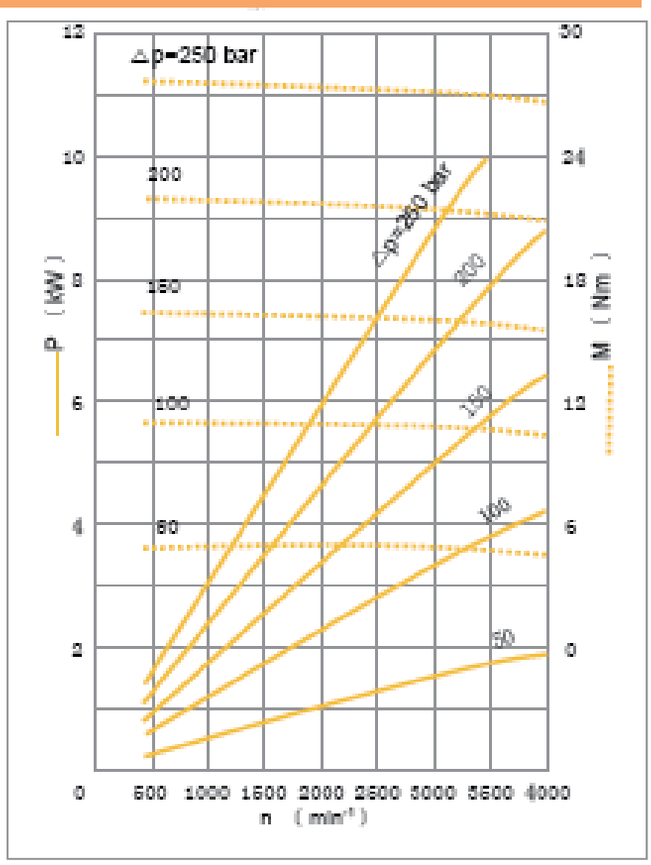
2MF6 Performance Curve 2MF6性能曲线



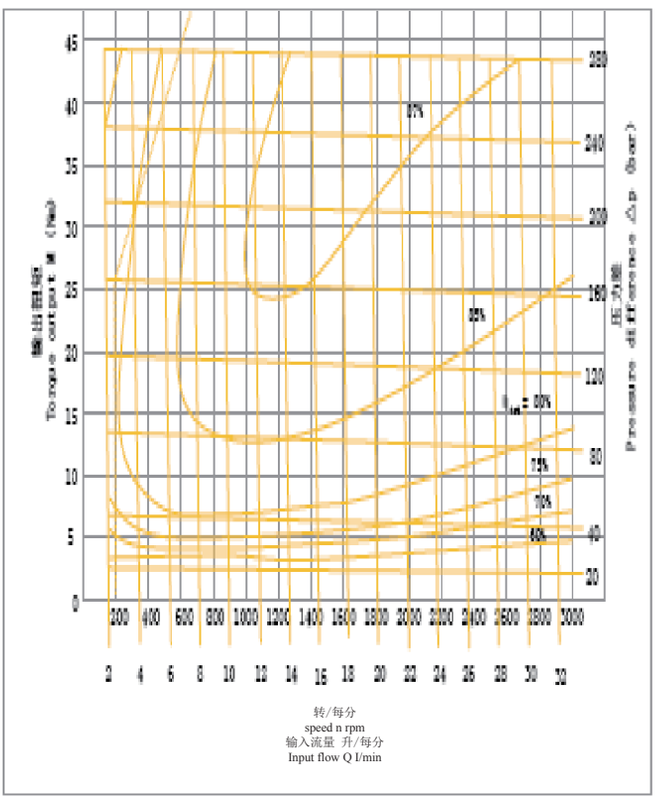


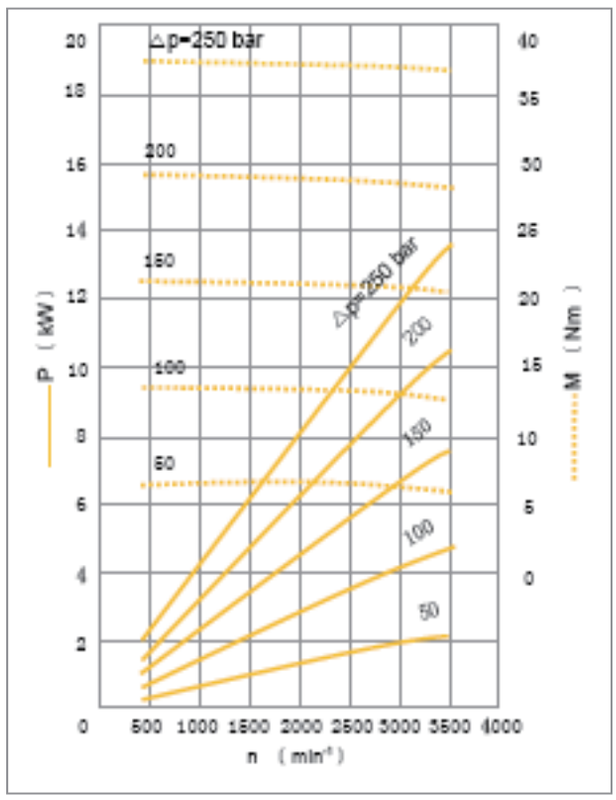
2MF8 Performance Curve 2MF8性能曲线



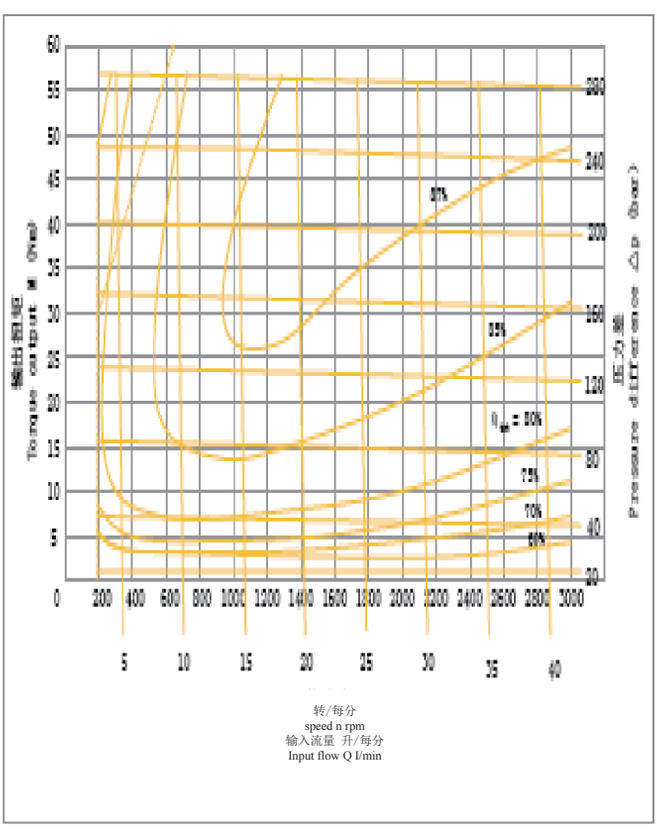


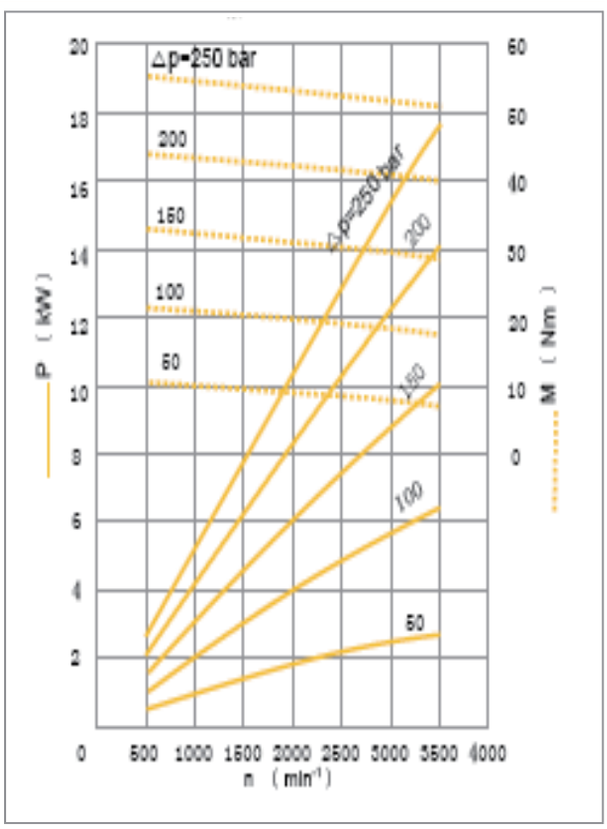
2MF11 Performance Curve 2MF11性能曲线



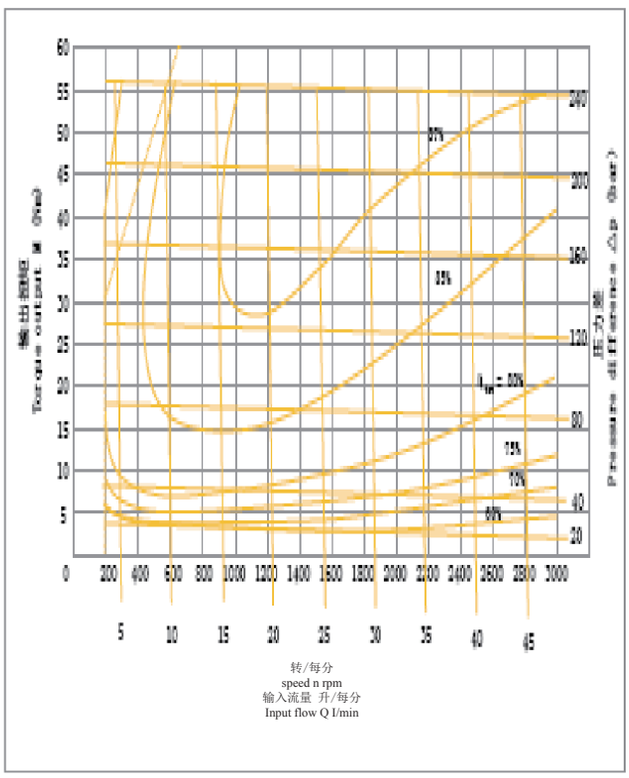


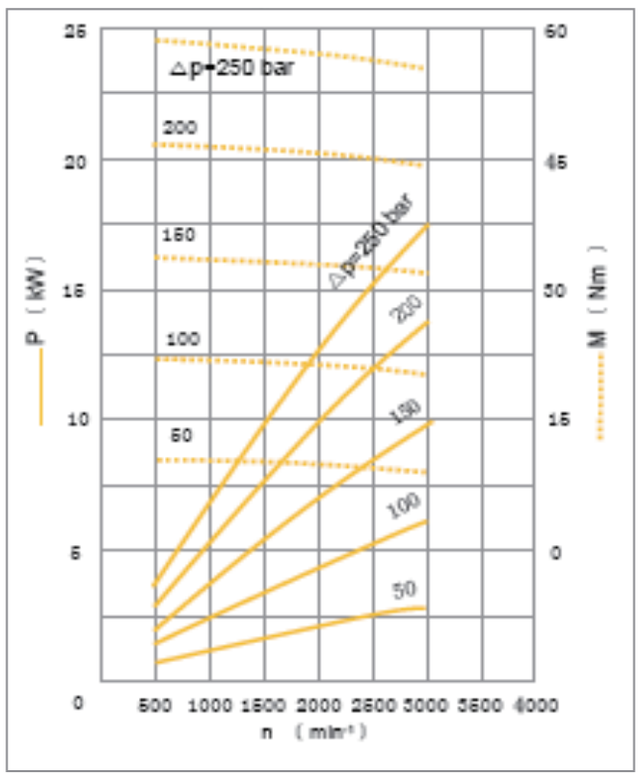
2MF14 Performance Curve 2MF14性能曲线



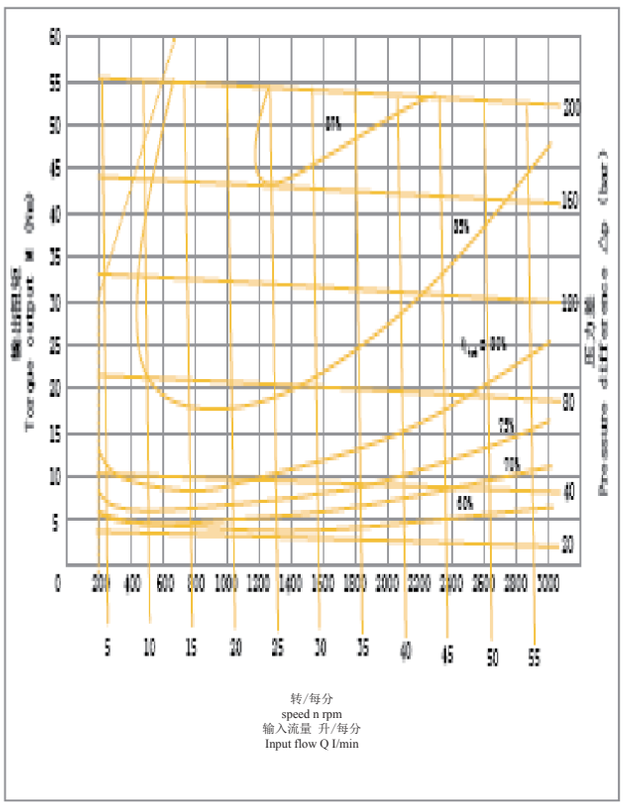


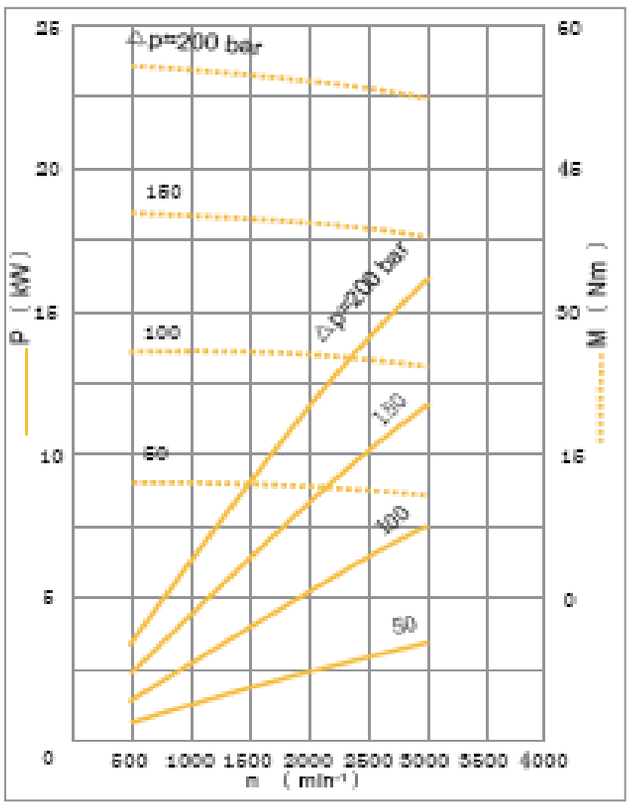
2MF16 Performance Curve 2MF16性能曲线





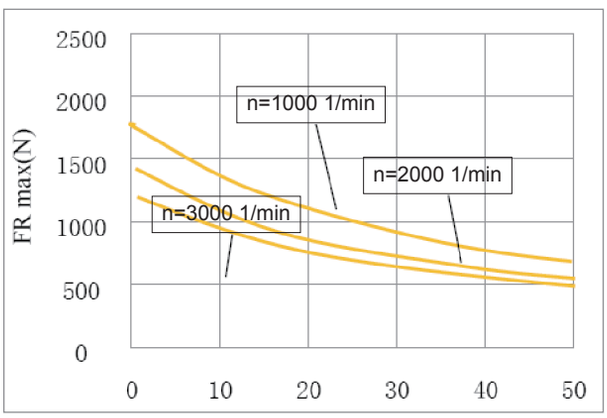
2MF19 Performance Curve 2MF19性能曲线





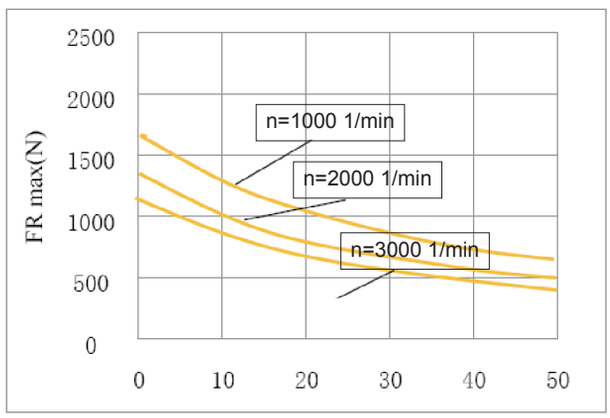
Permissible Load of Outboard Bearing 外支承允许外负荷

FO=0 N



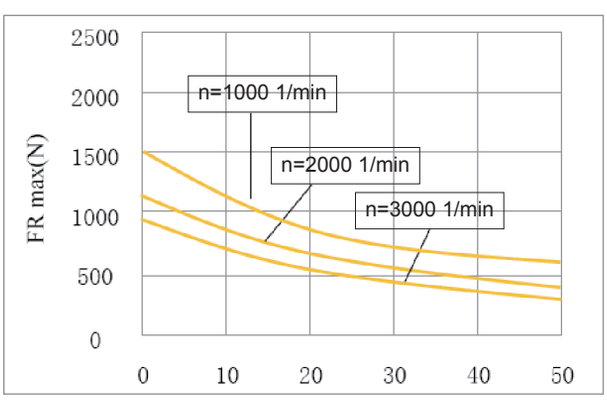
L:mm

FO=200 N



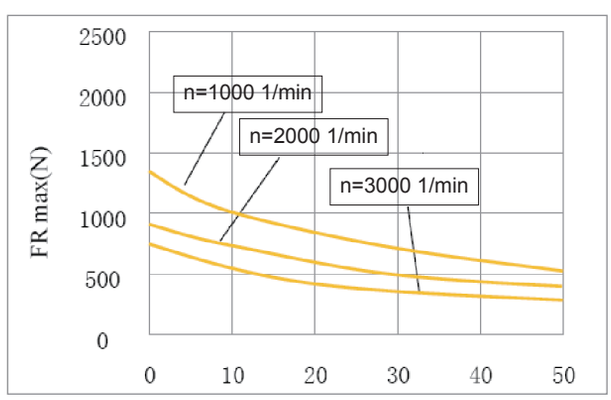
L:mm

FO=400 N



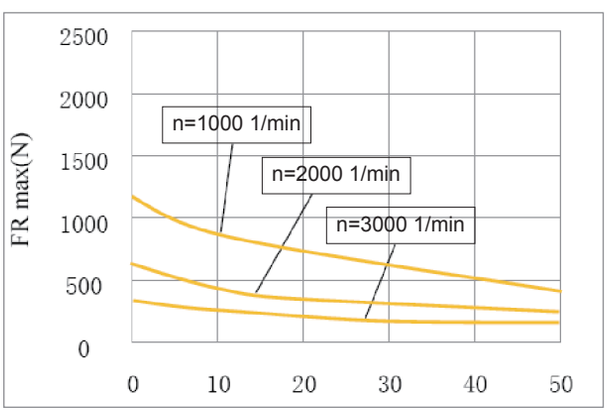
L:mm

FO=600 N



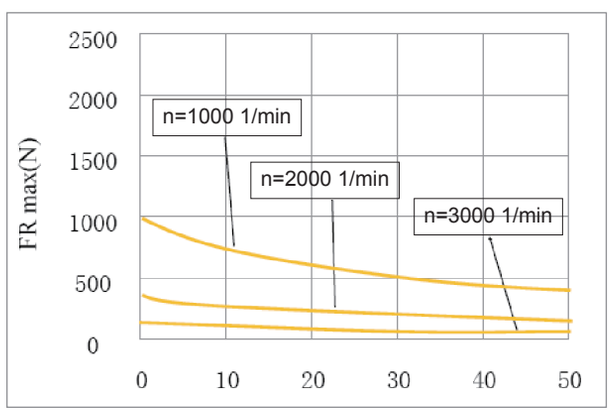
L:mm

FO=800 N



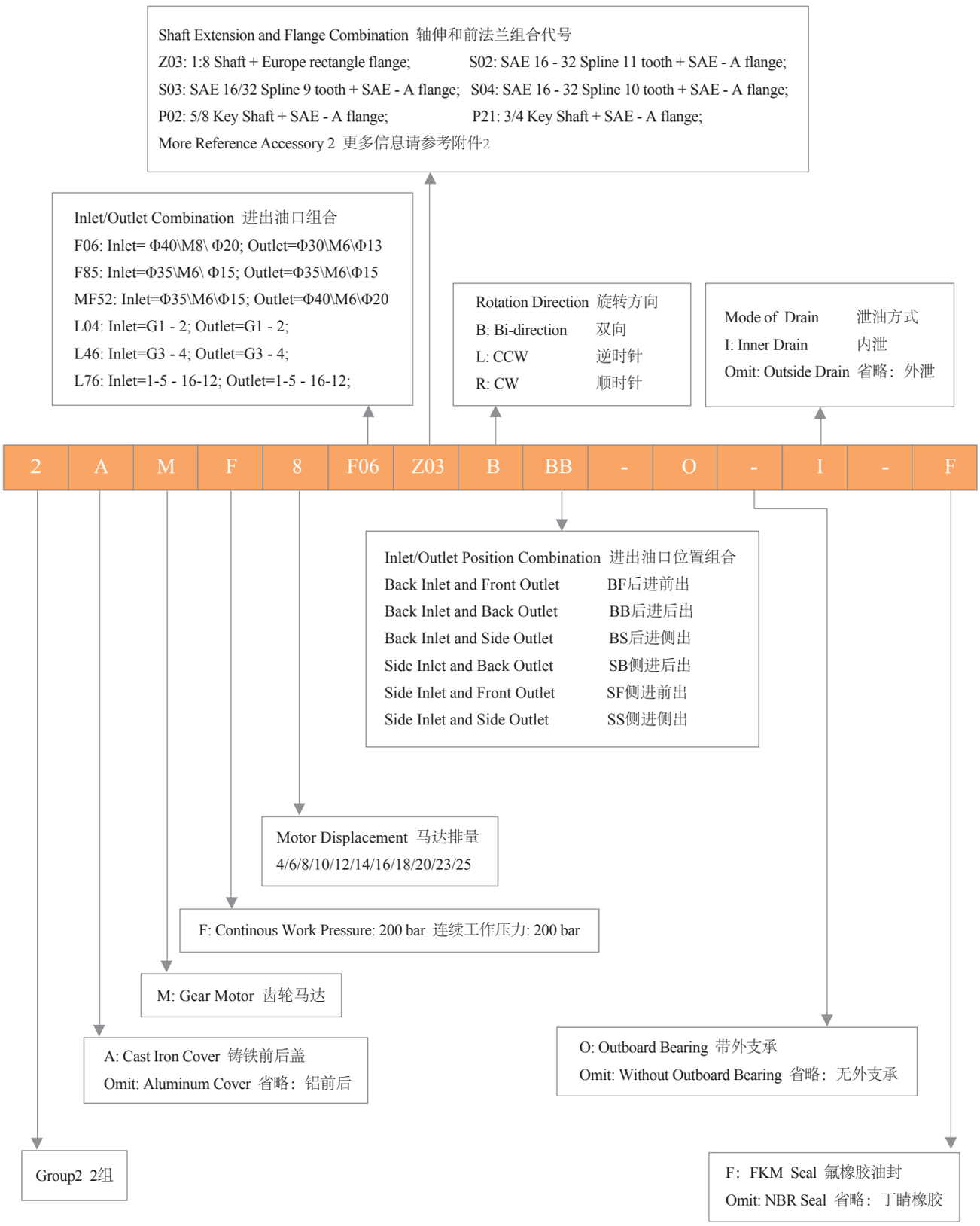
L:mm

FO=900 N

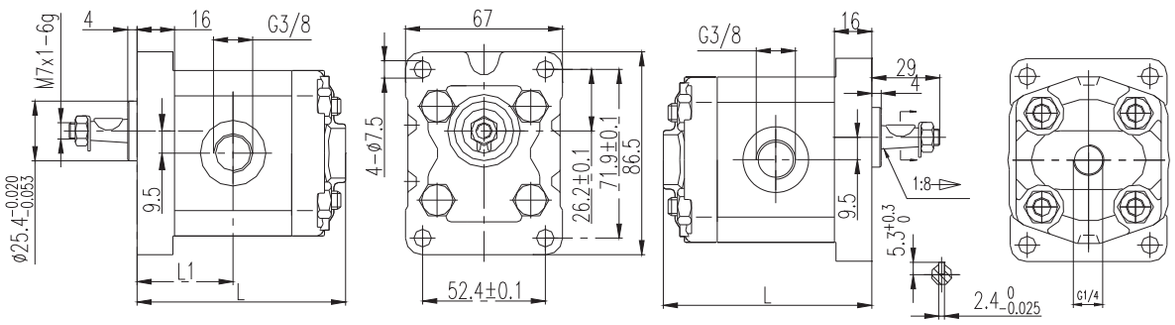


L:mm

Ordering Code 订单编码

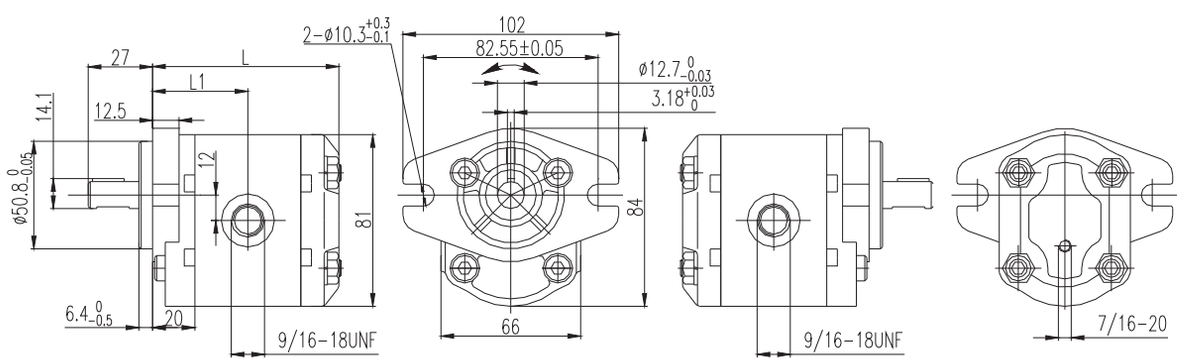


1MF**L69Z02BB



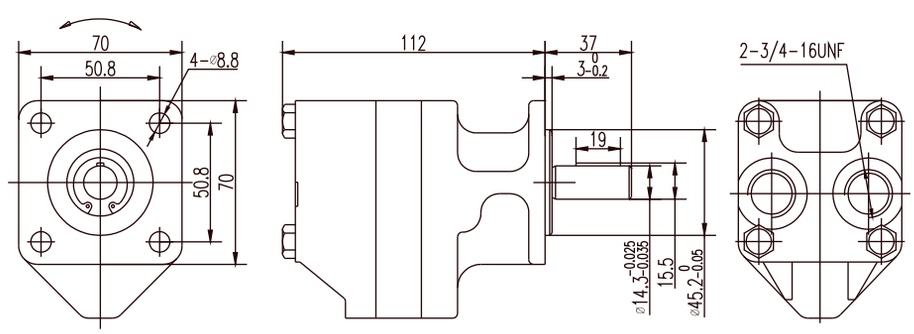
Displacement 排量(ml/r)	1.1	1.6	2.1	2.7	3.2	3.7	4.2	4.8	5.8	6.5	8.0
L1	33	35	36	37	38	39	40	41	43	44	47
L	75	78	79	81	83	85	87	89	93	95	101

1AMF**L**P01BB



Displacement 排量(ml/r)	1.3	2.0	2.7	3.4	4.1	5.1	6.1	6.5	7.0	7.5	8.5
L1	42	43	43	45	46	47.5	49	49.5	50	50.5	52
L	82	84	86	88	90	93	96	98	100	102	103

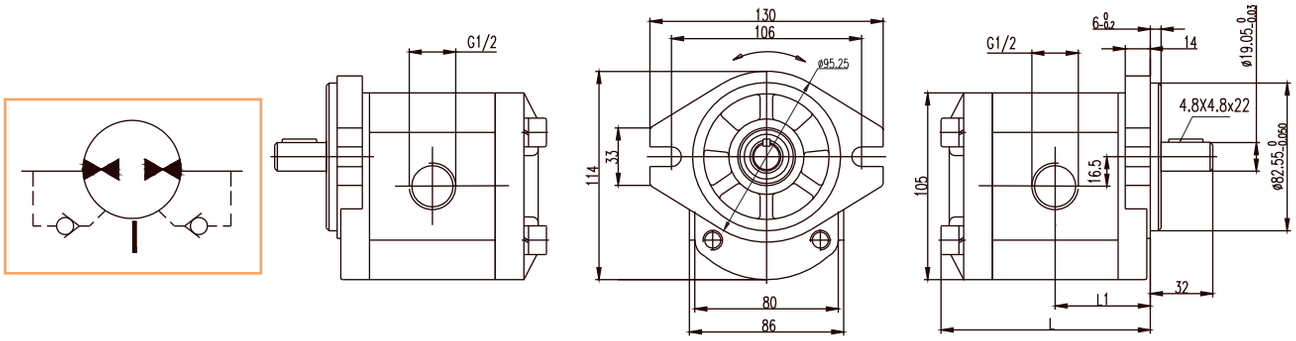
1DMF6.1LJ86P68B-BB



Displacement 排量(ml/r)	Working Pressure 工作压力(bar)	Max Speed 最高转速(rpm)	Torque 扭矩(N. m)	Direction 方向
6.2	70	5000	5.78	Bi-direction

2MF**L04P02-B-I

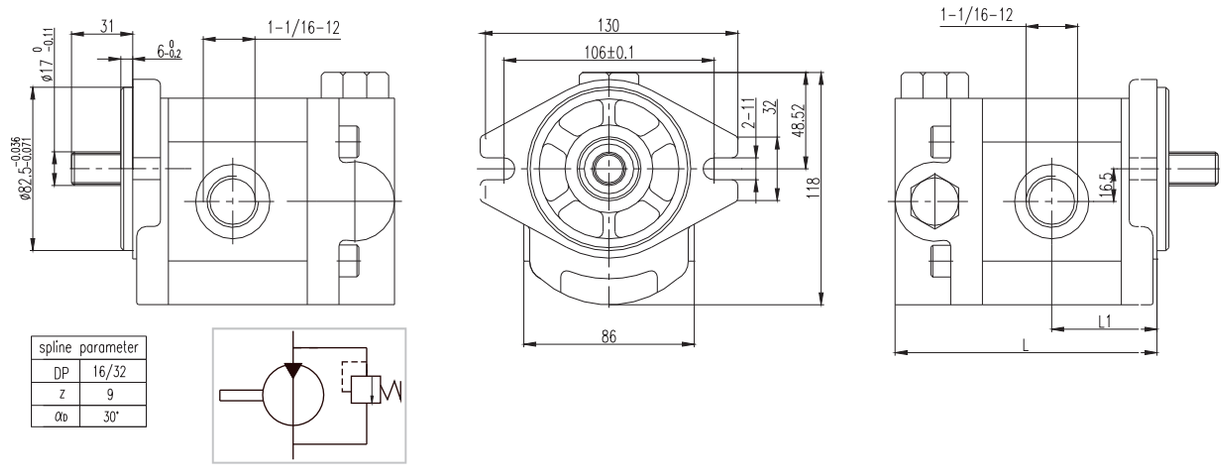
This motor is of internal drainage port structure. Two check valves guarantee its bi-directional fuction and have the oil of internal leakage return to inlet port. The function symbols are as follows:
这个马达为内泄油口结构，两个单向阀保证了马达的双向使用功能，并使内部泄漏的油回到进油口。机能符号如下图：



Displacement 排量(ml/r)	4	6	8	10	12	14	16	18	20	23	25
L1	44	45	47	48	50	51	53	55	56	58	60
L	96	98	102	104	108	108	114	117	120	123	128

2MF**F**Z11-R-V

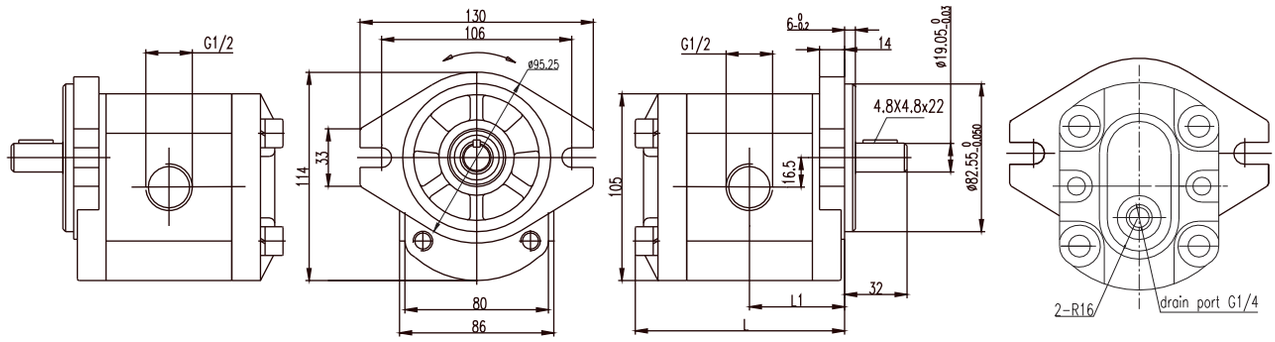
The motor has with it the relief valve of which the highest working pressure is same as that of the motor inlet port. The function symbols are as follows:
这个马达带有溢流阀，溢流阀压力为马达进油腔的最高工作压力。机能符号如下图：



spline parameter	
DP	16/32
z	9
αD	30°

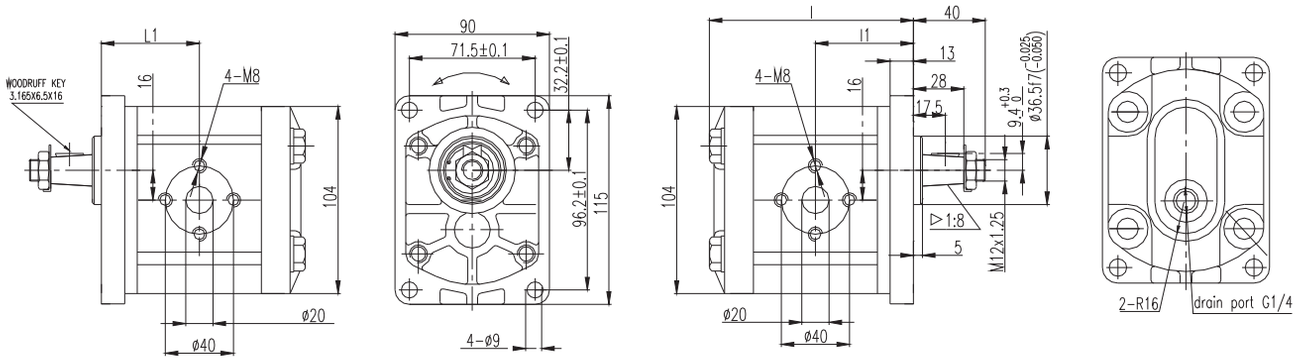
Displacement 排量(ml/r)	4	6	8	10	12	14	16	18	20	23	25
L1	39	40	41	43	44	46	48	49	51	54	57
L	111	112	115	118	120	125	128	132	137	139	141

2MF**L04P02B



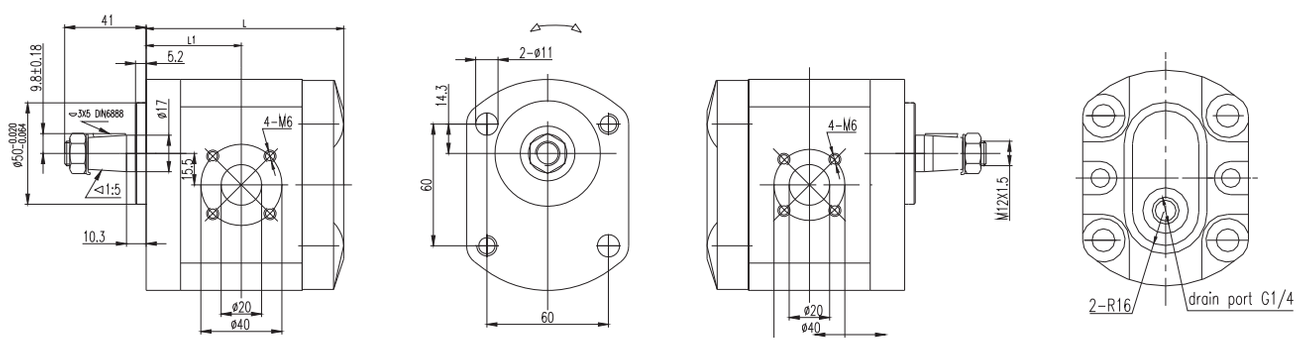
Displacement 排量(ml/r)	4	6	8	10	12	14	16	18	20	23	25
L1	44	45	47	48	50	51	53	55	56	58	60
L	96	98	102	104	108	108	114	117	120	123	128

2MF**F**Z03B



Displacement 排量(ml/r)	4	6	8	10	12	14	16	18	20	23	25
L1	46	47	49	50	52	53	55	57	58	60	62
L	98	100	104	106	110	112	116	119	122	125	130

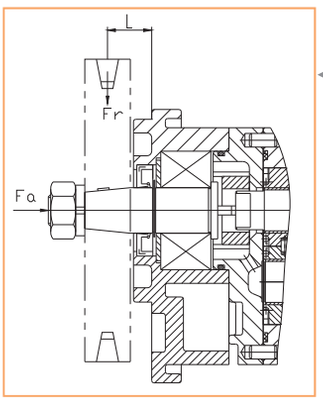
2MF**F**Z11B

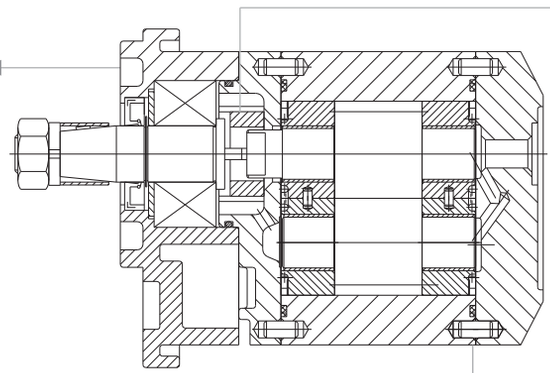


Displacement 排量(ml/r)	4	6	8	10	12	14	16	18	20	23	25
L1	39	40	41	43	44	46	48	49	51	54	57
L	90	91	94	96.5	98.5	103.5	107	111	116	118	120

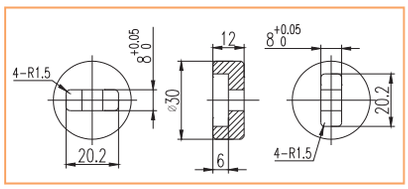
2MF-B-0 Gear Motor With Outboard Bearing 带外支承齿轮马达

Outboard Bearing 外支承 2MF**F**Z**B-O





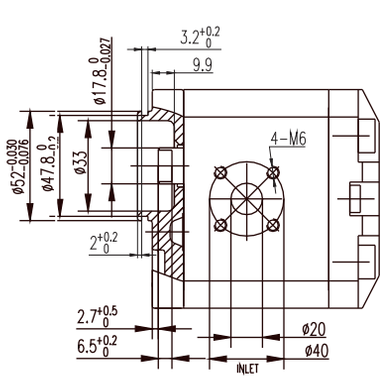
Coupling 联轴结 2MF-C1

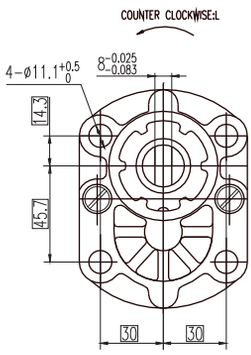


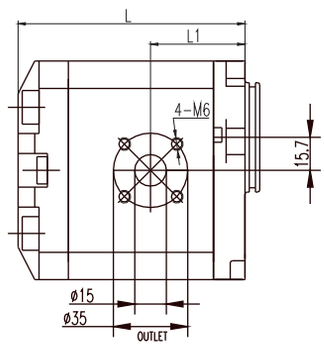
Permissible Load 允许外负荷 : Fr

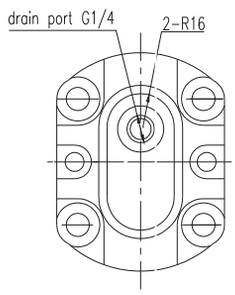
Please to look curves on page7 请看第七页负荷曲线

2MF**F**B11B







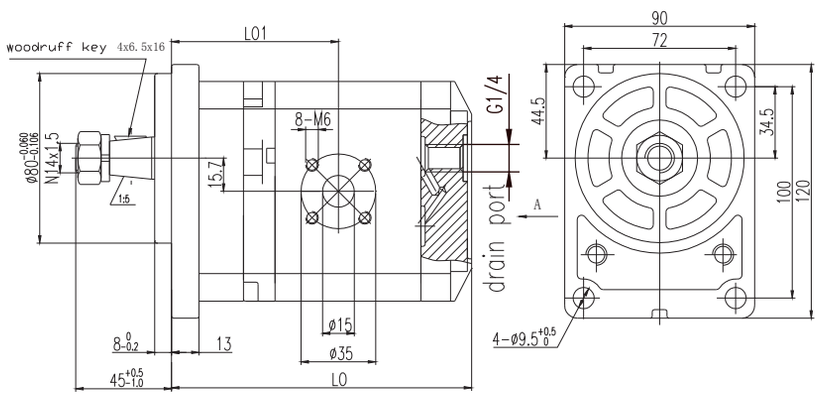


2MF**F**Z18B-O

Note 注解

O: Outboard bearing 外支承

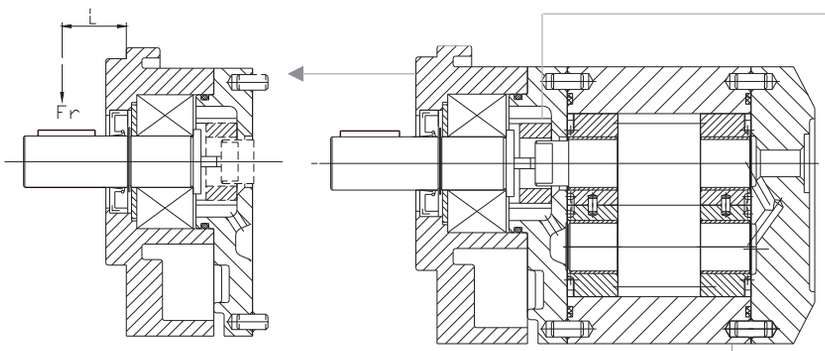
B: Bi– direction 双向



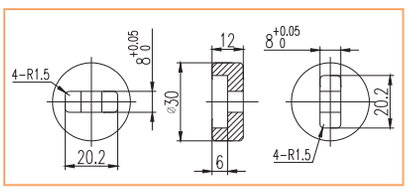
Displacement 排量(ml/r)	4	6	8	10	12	14	16	18	20	23	25
LO1	73	74	75	77	79	80	82	83	86	89	92
LO	123	124	127	130	133	137	141	143	147	153	157
L1	39	40	41	43	44	46	48	49	51	54	57
L	90	91	94	96.5	98.5	103.5	107	111	116	118	120

2MF–B-O Gear Motor With Outboard Bearing 带外支承齿轮马达

Outboard Bearing 外支承 2MF**L**P21B-O



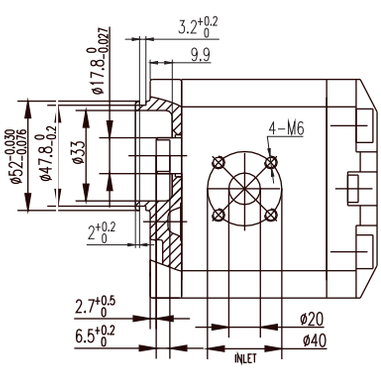
Coupling 联轴结 2MF-C1

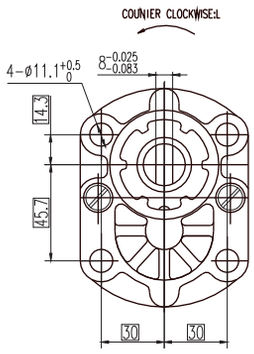


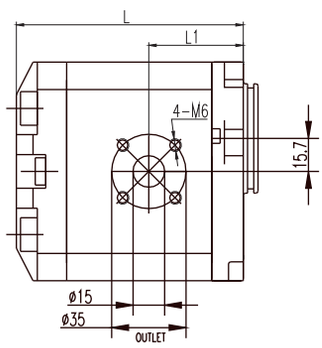
Permissible Load 允许外负荷 : Fr

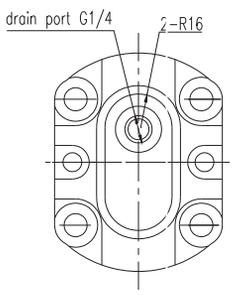
Pleas to look curves on page7 请看第七页负荷曲线

2MF**F**B11B







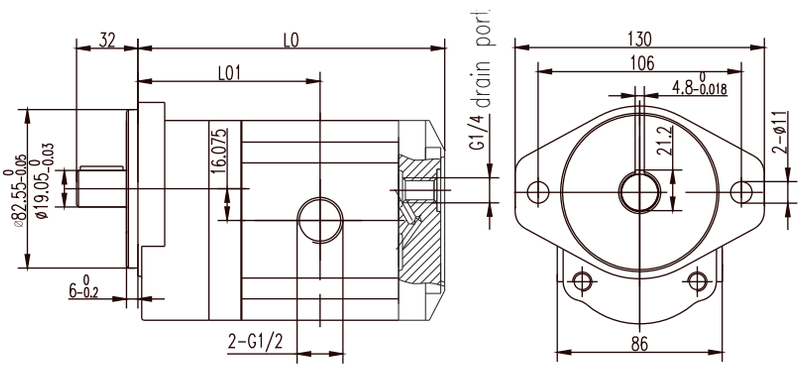


2MF**L**P21B-O

Note 注解:

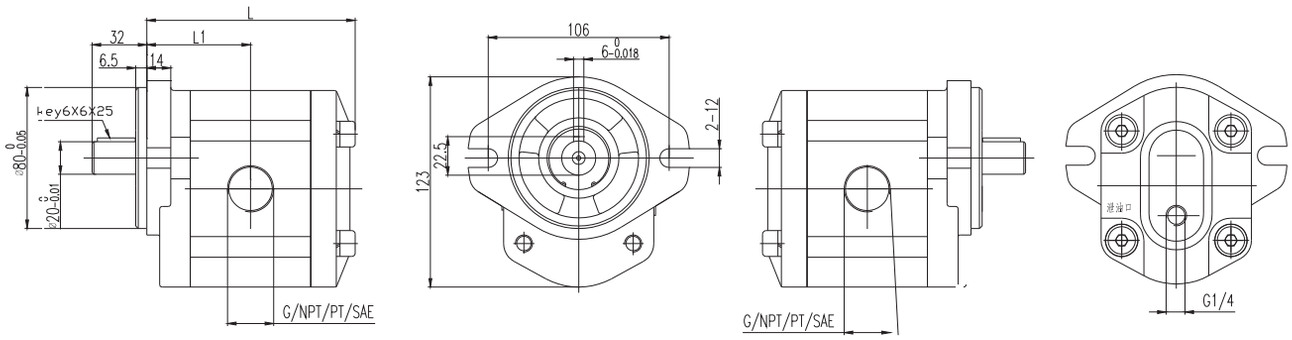
O: Outboard bearing 外支承

B: Bi– direction 双向



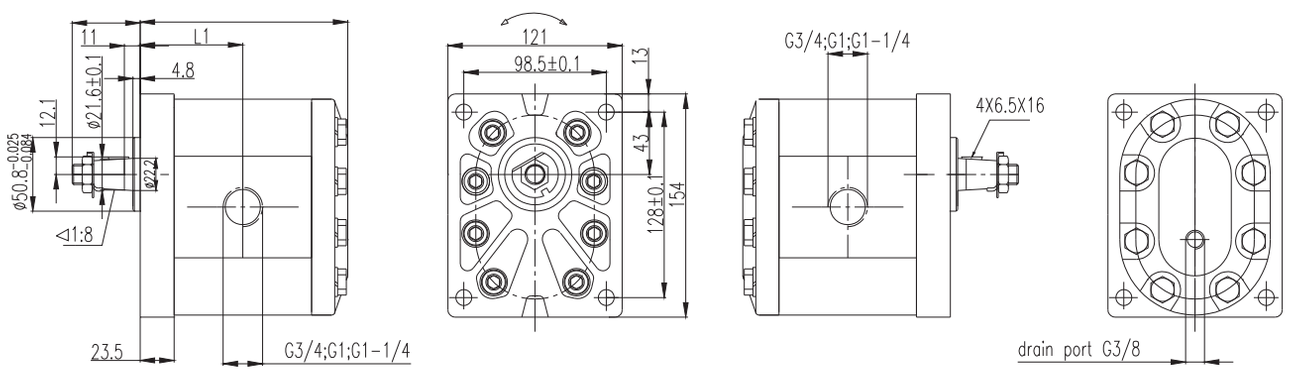
Displacement 排量(ml/r)	4	6	8	10	12	14	16	18	20	23	25
LO1	79	80.5	82	84	86	80	88	90	91	94	95
LO	131	134	137	140	144	137	150	153	156	160	163
L1	39	40	41	43	44	46	48	49	51	54	57
L	90	91	94	96.5	98.5	103.5	107	111	116	118	120

2.5MF**L**P61B



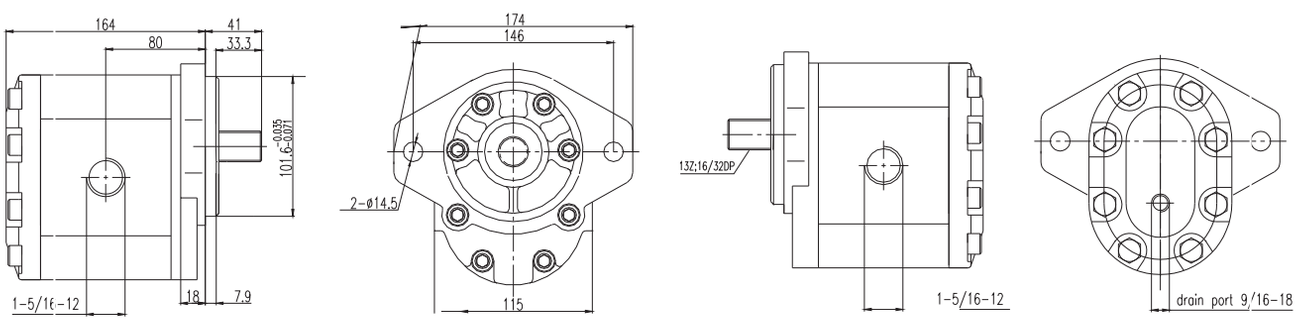
Displacement 排量(ml/r)	10	16	20	25	27	30	32	36	40
L1	44	45	60	62	63	65	66	68	70
L	96	98	125	130	132	137	139	144	148

3MF**L**Z05B



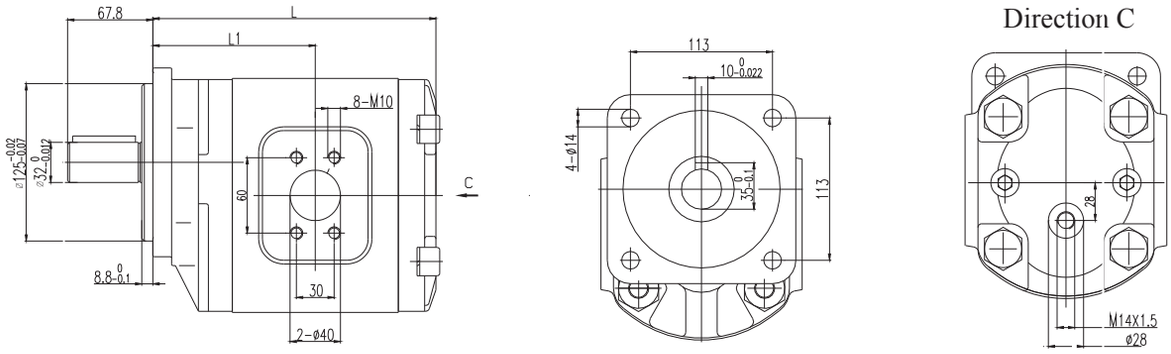
Displacement 排量(ml/r)	22	26	34	39	43	51	60	70	78	89
L1	64	66	68	70	71	74	77	81	83	87
L	129	132	137	141	144	150	156	163	168	174

3MF**L**S05B



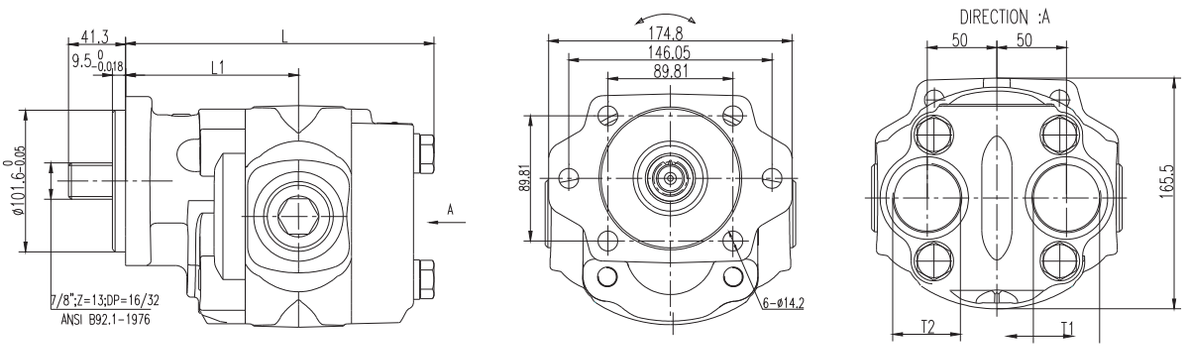
Displacement 排量(ml/r)	22	26	34	39	43	51	60	70	78	89
L1	66	67	69	71	73	76	79	82	85	88
L	131	134	139	143	147	152	158	166	171	176

3.5BMF**F108P64B



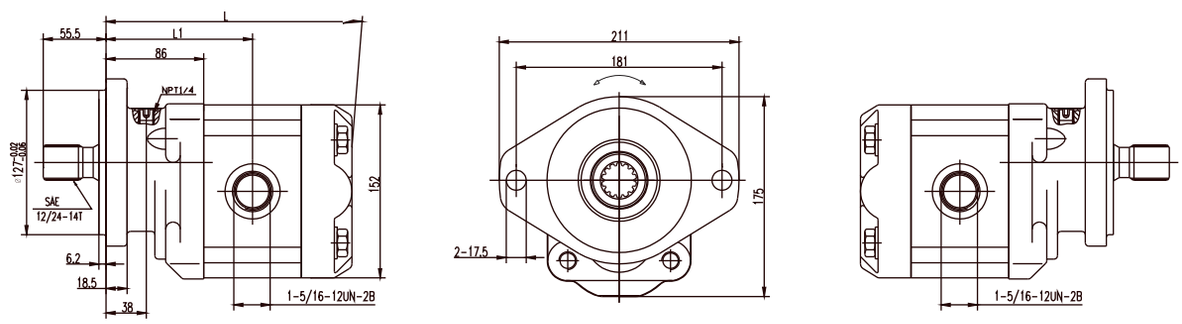
Displacement 排量(ml/r)	63	80	100
L1	119	125	132
L	215	221	228

3.5MF**L**S12B



Displacement 排量(ml/r)	52	63	73	85	93	104	115
L1	181	188	194	200	207	213	219
L	207	216	225	235	244	255	264

3.5MF**L**S34B



Displacement 排量(ml/r)	52	63	73	85	93	104	115
L1	181	188	194	200	207	213	219
L	207	216	225	235	244	255	264

Introduction of Flow Divider 分流器简介

Two or several gear motors can be combined to flow divider after being connected by coupling.It guatantees synchronous operation and accuracy of power element like cylinder (Its principle drawing is as follows), hydraulic liquid from the pipe is input into the inlet port and the same amount liquid is distributed to the outlet port by the rotation of gears that with same specification. Obviously, accuracy of flow divider is up to accuracy of gears and relative spare parts.

GRH has two series for flow divider 1FDF and 2FDF. Flow accuracy and pressure loss are as follows:

两个或几个齿轮马达通过联轴器联接后可组成分流马达，它可以保证执行元件（如油缸）同步运行，并获得高的同步精度，它的原理如下图：从进油口输入来自管路的液压油，通过联结在一个轴上的相同规格尺寸的齿轮副的旋转运动分配给出油口相同的流量，显而易见，分流马达的精度取决于齿轮副以及与其相配零件的精度。

GRH有二个系列分流马达：1FDF、2FDF。分流精度及压力损失如下：

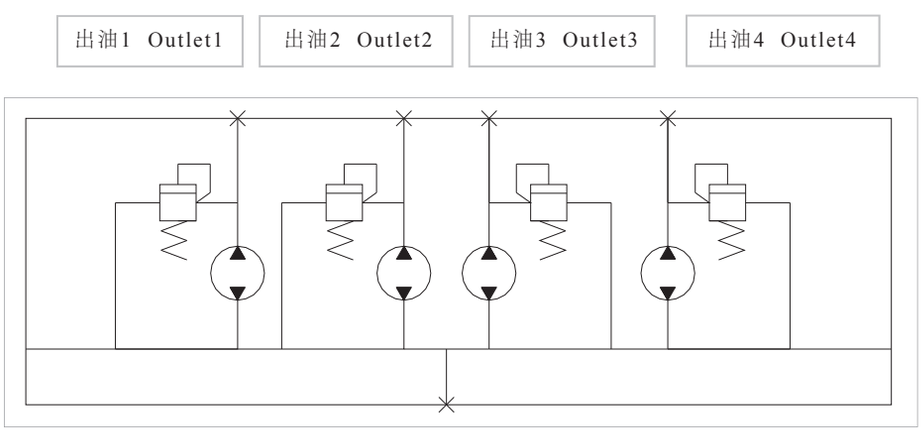
Type 型号	Flow Accuracy 分流精度	Pressure Drop 压力损失
1FDF	±1.5%—±2%	16-19bar
2FDF	±1.5%—±2%	11-14bar

It should be noted that flow accuracy is also related to the factors below: System pressure, viscosity of hydraulic liquid, load that each power unit bears and overall flow. These factors should be taken into account at time of application.

Flow divider can be integrated with relief valve, check valve and governor valve, protecting system pressure and filling the oil. For specific requirements, please contact GRH.

需要注意的是分流精度也和下面一些因素有关：系统压力、液压油的粘度、每个执行机构所承担的负载、总的流量等，在实际使用和设计时要考虑这几方面的影响。

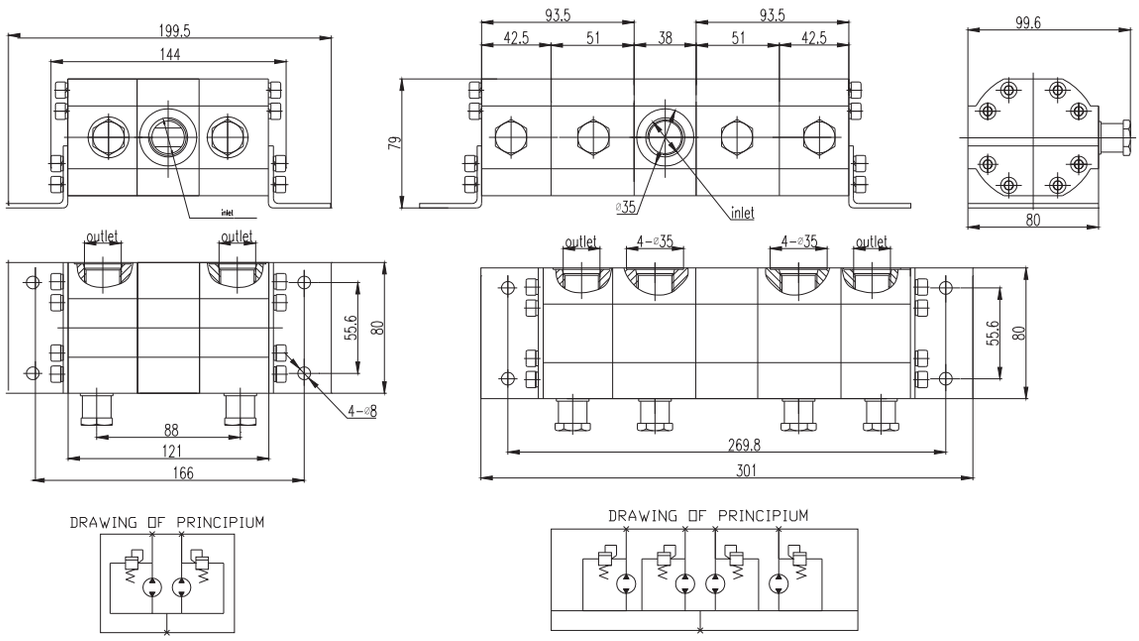
分流马达也可以和溢流阀、单向阀、调速阀集成，起到保护系统压力、补油等功能，具体要求请和GRH联系。



1FDF**L**-2/4 Flow Divider 分流马达

Specification Dimension 性能参数及外形尺寸

Displacement 排量		SAE Port SAE油口		Minimum Flow 最小流量/秒(sec)		Maximum Flow 最大流量/秒(sec)		Cont. Diff Between Pressure Inlet 进出油口压力差(outlet)		Maximum Outlet Pressure any Section 出油口最大压力	
in^3	cm^3	inlet	outlet	gpm	lpm	gpm	lpm	psi	bar	psi	bar
0.097	1.60	sae6	sae6	0.8	3.0	1.7	6.4	1800	124	3500	240
0.129	2.13	sae8	sae8	1.2	4.5	2.5	9.5	1800	124	3500	240
0.194	3.18	sae8	sae6	1.7	6.4	4.5	13.2	1800	124	3500	240
0.258	4.24	sae10	sae10	2.5	9.5	5	18.9	1800	124	3500	240
0.323	5.29	sae10	sae10	3.0	11.4	6.0	22.7	1800	124	3500	240
0.388	6.36	sae10	sae10	3.5	13.2	7.0	26.5	1600	110	3500	240
0.453	7.42	sae10	sae10	4.0	15.1	8.0	30.3	1300	90	3500	240
0.517	8.42	sae10	sae10	4.5	17.0	9.0	34.1	1200	83	3500	240



Ordering Code

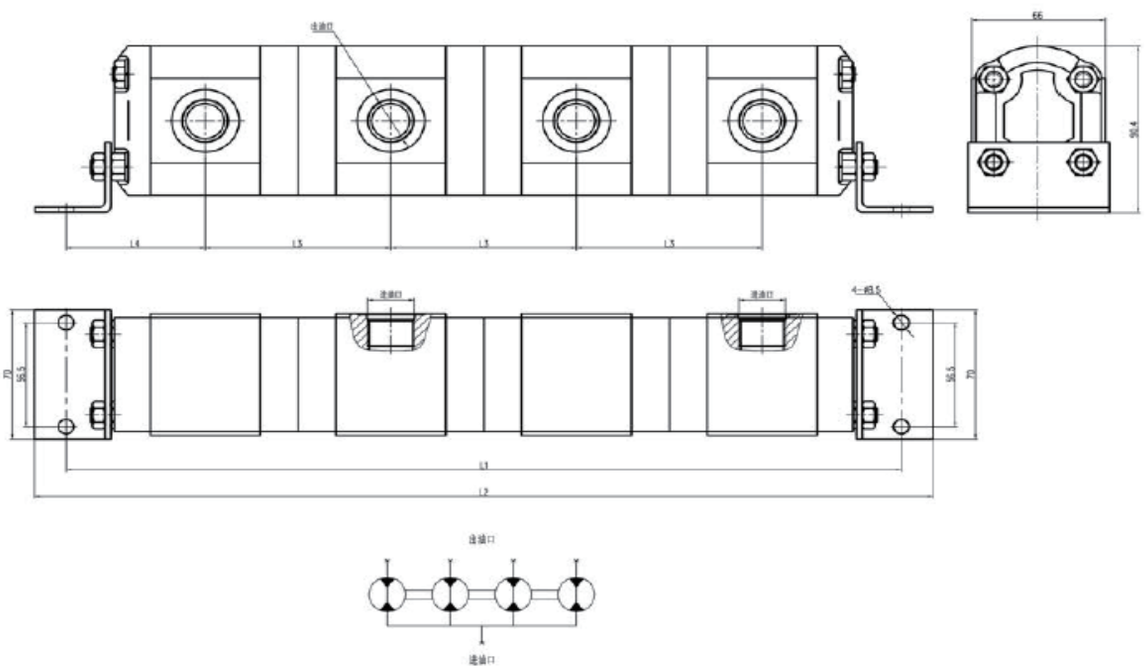
1	FD	F	04	L35	-2/4
Model1	Function	Pressure Level	Displacement	Inlet/Outlet Combination	Number of Section
Group 1	Flow Divider	16～25 Mpa	4ml/r	L35 etc. Reference Accessory 1	-2/4 Section

型号说明

1	FD	F	04	L35	-2/4
组号	功能代码	压力等级代码	排量	进出油口组合形式	出油口数
1组	齿轮式分流器	16～25 Mpa	4ml/r	L35 等，参见附录 1	-2/4 两个、四个出口

Specification Dimension 性能参数及外形尺寸

Displacement 排量	SAE Port SAE 油口	Minimum Flow 最小流量/秒(sec)	Maximum Flow 最大流量/秒(sec)	Cont. Diff Between Pressure Inlet/Outlet 进出油口压力差
2.0	382.8	414	84	65.2
3.0	394.8	426	87	66.7
4.1	406.8	438	90	68.2
5.1	418.8	450	93	69.7
6.1	430.8	462	96	71.2
7.0	442.8	474	99	72.7



Ordering Code

1	AFD	FD	F2	04	L04	-4	-1
Model	Function	Function	Pressure Level	Displacement	Inlet/Outlet Combination	Number of Section	Number of Inlet
Group1	Flow Divider	Flow Divider	16~25Mpa	2ml/r	Reference Accessory 1		

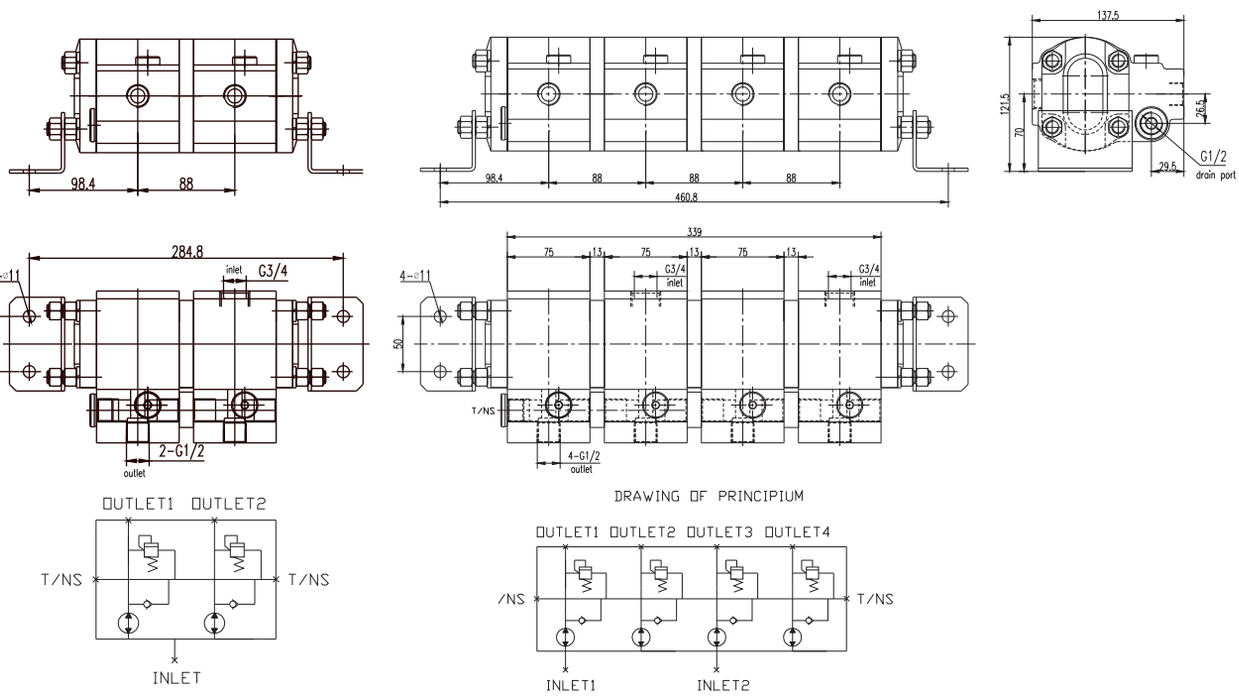
型号说明

1	AFD	FD	F2	04	L04	-4	-1
组号	功能代码	功能代码	压力等级代码	排量	进出油口组合形式	联数	进油口数
1组	齿轮式分流器	齿轮式分流器	16~25Mpa	2ml/r	参见附录 1		

2FDF**L**-2/4 Flow Divider 齿轮式分流器

Specification Dimension 性能参数及外形尺寸

Displacement 排量		SAE Port SAE 油口			Minimum Flow 最小流量/秒(sec)		Maximum Flow 最大流量/秒(sec)		Cont. Diff Between Pressure Inlet/Outlet 进出油口压力差		Maximum Outlet Pressure any Section 出油口最大压力	
in^3	cm^3	inlet	outlet	drain	GPM	LPM	GPM	LPM	PSI	BAR	PSI	BAR
0.366	6	G3/8	G1/2	G3/8	0.8-4.2	3.0-16	4.8	18	3142	220	3571	250
0.488	8	G3/8	G1/2	G3/8	1.1-5.0	4.0-19	5.8	22	3142	220	3571	250
0.671	11	G3/8	G1/2	G3/8	1.5-6.6	5.5-25	7.1	27	3142	220	3571	250
0.854	14	G3/8	G1/2	G3/8	1.8-8.4	7.0-32	9.0	34	2857	200	3142	220
1.037	17	G3/8	G1/2	G3/8	2.2-9.0	8.5-34	9.8	37	2857	200	3142	220
1.525	25	G3/8	G1/2	G3/8	3.1-12.7	12-48	14	53	2857	200	3142	220
1.891	31	G3/8	G1/2	G3/8	3.7-15.9	14-60	18.5	70	2286	160	2571	180



Ordering Code

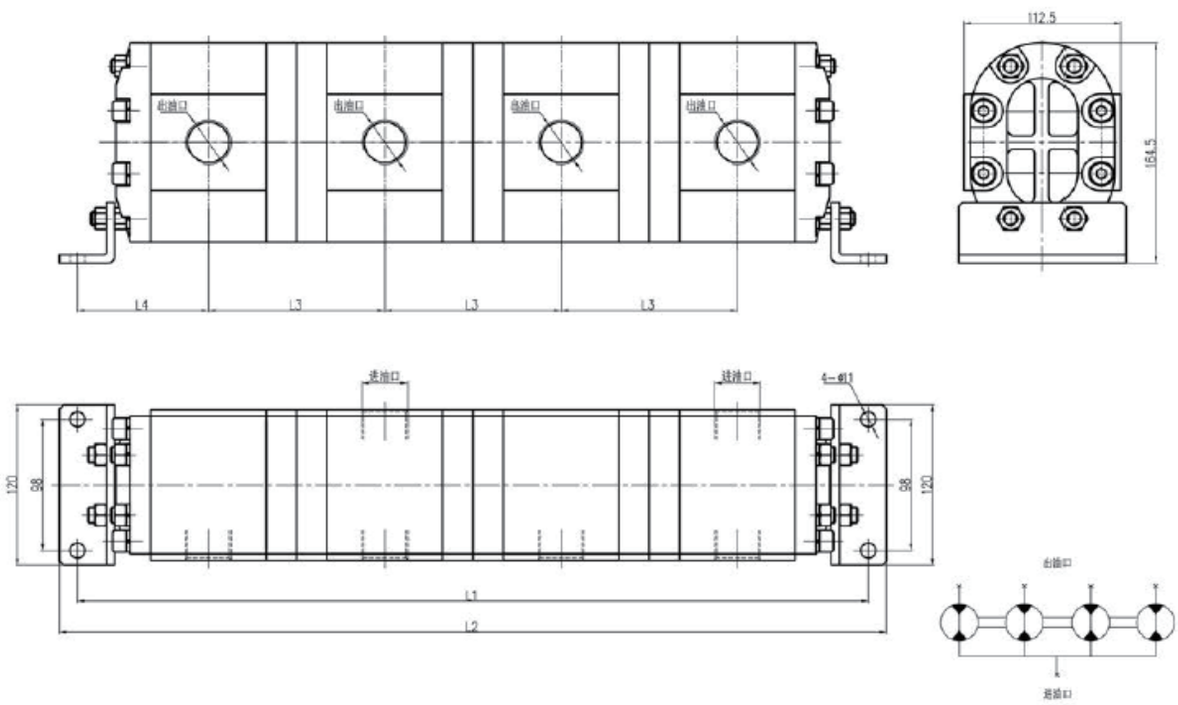
2	FD	F	04	L35	-2/4
Model	Function	Pressure Level Code	Displacement	Inlet/Outlet Combination	Number of Section
Group2	Flow Divider	16～25 Mpa	8 ml/r	L35 etc，Reference Accessory 1	-2/4 Section

型号说明

2	FD	F	04	L35	-2/4
组号	功能代码	压力等级代码	排量	进出油口组合形式	出油口数
2 组	齿轮式分流器	F:16～25 Mpa	8 ml/r	L35等，参见附录1	-2/4 两个、四个出口

Specification Dimensions 性能参数及外形尺寸

Displacement 排量（ml/r）	L1/mm	L2/mm	L3/mm	L4/mm
20	552.4	578.4	122.5	92.3
30	582.4	608.4	130.0	96.0
40	610.4	636.4	137.0	99.5
50	636.4	662.4	143.5	102.8
60	668.4	694.4	151.5	106.8
70	696.4	722.4	158.5	110.3



Ordering Code

3	FD	F	60	L71	-4	-1
Model	Function	Pressure Level	Displacment	Inlet/Outlet Combination	Number of Section	Number of Inlet
Group3	Flow Divider	16～25 Mpa	60 ml/r	Reference Accessory 1		

型号说明

3	FD	F	60	L71	-4	-1
组号	功能代码	压力等级代码	排量	进出油口组合形式	联数	进油口数
3 组	齿轮式分流器	16～25 Mpa	60 ml/r	参见附录 1		

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