FRONTIER™

- Frontier Sonde Inc. based on high-efficiency permanent magnet motors.

- The R&D, design, manufacturing, and technical application team of the world's leading artificial lift company with more than ten years of experience

- Top scientific research cooperation institutions

- Internationally advanced R&D and design technology for permanent magnet submersible motors

- Rich experience in artificial lifting applications

Provide you with--

Professional, efficient and energy-saving artificial lifting solution

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Permanent magnet motor submersible electric pump system

The permanent magnet motor submersible electric pump (PMMESP) adopts the third-generation permanent magnet technology. Based on the current conventional submersible electric pump system, the downhole drive motor is upgraded from an ordinary induction motor to a permanent magnet motor, which is a smaller volume, A more efficient, energy-saving, stable and reliable rodless oil production system has a wider application range and better application benefits than conventional electric submersible pump systems.

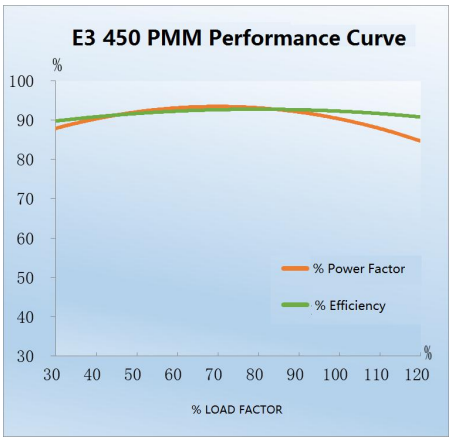
- Patented technology products
- Four-pole permanent magnet motor, nominal 3000RPM@100Hz
- The third-generation rare earth permanent magnet-neodymium iron boron
- G40EH high-grade magnetic steel, temperature resistance class 204°C
- Energy saving above 20%～30%
- Full torque start, small starting impact, low running current
- Small size, strong adaptability to dog legs
- Small torque pulsation, small vibration of the whole machine
- Universal unit interface size in the industry, compatible with conventional submersible electric pump ground frequency conversion equipment
- Single motor has high power, no need to connect in series, stable and reliable to achieve high power demand.
- protector can be connected to the motor factory, and the factory is pre-filled with oil, which saves on-site work time.
- In addition to conventional well conditions, it is also more suitable for application environments with poor motor heat dissipation such as high gas-to-liquid ratio, heavy oil, low liquid production, and perforation sections below.

Parameter	Permanent magnet motor	Ordinary Motor	Permanent magnet
Motor efficiency	85% ~ 93%	< 0.84	Motor energy saving 20% ～ 30% or more
Power factor	0.9 ~ 1.0	< 0.85	Low reactive power and heat loss, low temperature rise, electricity, voltage, and current level reduced
Power density	High	Low	The length is shortened by 1/2 or 2/3 to adapt to larger well deviation. And dog legs, reduce the risk of work
Motor temperature rise	Low	High	The lower the temperature rise, the longer the expected motor life
No-load current	Low	High	Facilitate operation control under light load and high gas content
Starting torque	Large	Low	Facilitate pump start, jam release and operation under severe well conditions

E3 450 series permanent magnet motor technical specifications

- Nominal: 3000RPM, 100HZ
- Outer diameter 4.5" (114mm)
- Temperature resistance class 399°F
- The maximum power of a single section is 261KW
- Winding or plug-in motor lead cable
- Industry common connection flange and serial amount

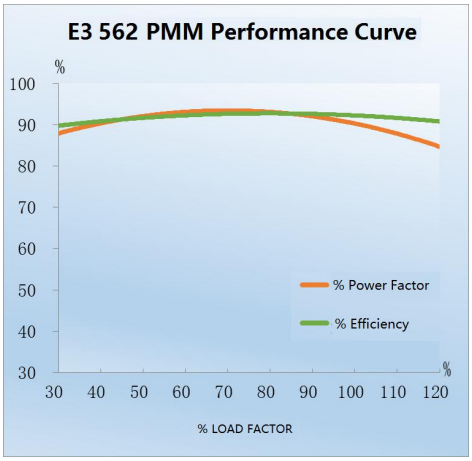
Frontier E3 submersible permanent magnet motor 450 series (114 mm)										
Power		Length		Weight		Voltage (V)				
HP	KW	Ft	M	Lb	Kg	72A	59A	50A	42A	32A
33.3	24.8	5.51	1.68	183	83			367	417	534
50.0	37.2	6.79	2.07	243	110			542	638	800
66.6	49.6	8.07	2.46	302	137			717	838	1067
83.3	62.1	9.35	2.85	362	164			892	1038	1317
100.0	74.5	10.63	3.24	421	191		880	1067	1213	1542
116.6	87.0	11.91	3.63	481	218		1025	1242	1409	1788
133.3	99.4	13.16	4.01	540	245		1171	1417	1600	2042
150.0	111.8	14.47	4.41	600	272		1317	1592	1800	2292
166.6	124.3	15.72	4.79	659	299		1463	1767	2000	2542
183.3	136.7	16.99	5.18	719	326		1609	1938	2209	2792
216.6	161.5	19.55	5.96	838	380		1900	2288	2667	
250.0	186.5	22.11	6.74	957	434	1767	2192	2634		
283.3	211.3	24.67	7.52	1076	488	2000	2459			
316.6	236.1	27.26	8.31	1191	540	2234	2763			
350.0	261.0	29.82	9.09	1310	594	2463	3035			



E3 562 series permanent magnet motor technical specifications

- Nominal: 3000RPM, 100HZ
- Outer diameter 5.62" (143mm)
- Temperature resistance class 399°F
- The maximum power of a single section is 722KW
- Winding or plug-in motor lead cable
- Industry common connection flange and serial amount

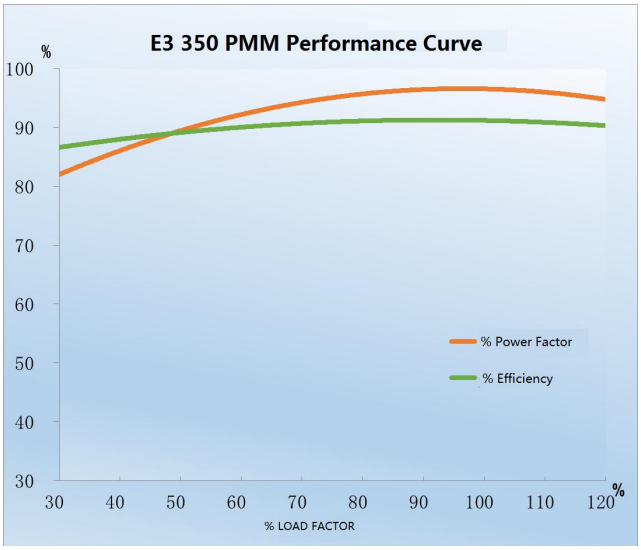
Frontier E3 submersible permanent magnet motor 450 series (114 mm)										
Power		Length		Weight		Voltage (V)				
HP	KW	Ft	M	Lb	Kg	72A	59A	50A	42A	32A
88	65.6	6.50	1.98	238	108					910
132	98.5	7.91	2.41	362	164					1364
176	131.3	9.35	2.85	505	229					1818
220	164.1	10.76	3.28	608	276				1894	2273
264	196.9	12.20	3.72	732	332				2273	2728
308	229.8	13.62	4.15	855	388			2121	2651	
352	262.6	15.39	4.69	979	444			2424	3030	
396	295.4	16.50	5.03	1102	500		2045	2727		
440	328.2	17.91	5.46	1226	556		2272	3028		
484	361.1	19.36	5.90	1349	612		2498	3330		
528	393.9	20.77	6.33	1473	668	1817	2725			
572	426.7	20.77	6.33	1596	724	1968	2952			
616	459.5	23.62	7.20	1720	780	2120	3180			
660	492.4	25.07	7.64	1843	836	2271	3407			
704	525.2	26.48	8.07	1967	892	2422				



E3 350 series permanent magnet motor technical specifications

- Nominal 3000RPM, 100HZ
- The outer diameter of the motor is 3.5 “(89mm, the smallest in China)
- The maximum projection outer diameter of the whole system is as small as 95mm
- Applicable to the minimum 4-1/2" casing / liner combined production or 7" casing separate production
- Four-pole permanent magnet motor design, efficiency up to 92%
- The maximum power of a single motor is 150KW (length <9 meters)
- Temperature resistance class 399 ° F
- General interface size

Frontier E3 Submersible Permanent Magnet Motor 350 Series (89mm)						
Power		Length		Weight		Voltage (V)
Hp	KW	Ft	M	Lb	Kg	34A
33. 3	24. 8	7. 81	2. 38	198	90	475
50. 0	37. 2	10. 37	3. 16	258	117	717
66. 6	49. 6	12. 89	3. 93	328	149	954
83. 3	62. 1	15. 45	4. 71	390	177	1192
100. 0	74. 5	18. 01	5. 49	452	205	1429
116. 6	87. 0	20. 57	6. 27	522	237	1673
133. 3	99. 4	23. 10	7. 04	586	266	1900
150. 0	111. 8	25. 66	7. 82	655	297	2142
166. 6	124. 3	28. 05	8. 55	723	328	2375



Permanent magnet motor submersible electric pump system

Frontier Sonde Inc., in addition to independent research and development, design and production of permanent magnet submersible motors with regular speed and low speed, selects partners and suppliers, and has the current potential in the industry. Based on products such as oil motor protectors, suction ports, gas-liquid separators, gas processors, submersible centrifugal pumps, etc., optimized, and updated designs are mainly carried out from various aspects of structural design, material, and process to provide more efficient and reliable the solution of the electric submersible pump lifting system with more optimized well conditions.

- submersible motor protector, 325 / 350, 400 / 450, 540 altogether. 3 series, protection MODULAR
- suction port, 338, 400, 540, 675, 862 a total of 5 different series
- Gas-liquid separators, 338, 400, 540 total 3 series
- Gas processor, 400, 513, 538 total 3 series
- submersible centrifugal pump, 338, 400, 513, 538, 675, 862, 950 altogether. 7 series, 42 is Species type pump, the displacement can cover the range of 75 to 45,000 barrels / day, lift the range 0 to 5000 yards.

• Standard pump outlet connector, currently there are 2-3 / 8”, 2-7/8", 3-1 / 2", 5-1 / 2 ", 7", a total of 5 different sizes and buckle types, customizable

Submersible motor protector

- 2~6 cavity module combined protector
- Standard protector
- Sand control protector - tungsten carbide bearing bush
- Anti-corrosion protector- 9Cr1Mo shell, stainless steel head seat, polymer thrust bearing
- enhanced sand protection (for specific well conditions) - sand control cover, sand discharge hole design, the radial double ceramic bearings, special seal design
- It can be combined with permanent magnet submersible motor, pre-filled with oil, saving time on site

Series	Standard	Antiseptic	Sand control	Enhanced sand control	Pre-filled oil
325/350	★	★	★		★
400/450	★	★	★	★	★
540	★	★	★	★	★

Part	Types of
Machinery Seal	AILift、JohnCrane
Thrust bearing	AILift、High Load、Super High Load
Rubber parts	F26D、HSN、AFLAS
Motor oil	BH180、 BH6# Synthetic Oil
Spline bushing	45、MONEL K-500、INCONEI718
Headstock	45、2Cr13、304、316L、Duplex
case	45、9Cr1Mo、304、316L
axis	MONEL K-500、HS MONEL、 INCONEL 625、INCONEL 718
Spraying	Coating、Monel Coating

*** *For more detailed information, please see the product catalog.**

Permanent magnet motor submersible electric pump system

Suction point

- Standard suction port, separate configuration, flange connection, conventional material, and structure
- Integrated suction port, no flange connection with pump, suitable for large displacement
- Sand control suction port, two-stage radial bearing support, upgraded shaft sleeve and bearing shell material, special design of the liquid inlet

Gas processing equipment

- RGS separator, which uses the different centrifugal force generated by gas-liquid rotation at high speed for separation, is suitable for well conditions with low gas-liquid ratio, and can be used in series according to the situation
- Vortex separator, designed with inducer and multi-stage turbine generator to improve separation efficiency
- GasPro gas processor, multi-stage axial flow structure, rotating stirring generates high pressure, breaks large bubbles, and compresses the gas, so that the bubbles are uniform and reduced, and the lifting performance of the centrifugal pump is improved, avoiding air lock, and can handle up to 45% of the gas content.

Series	RGS separator	Vortex separator	GasPro gas processor
338	★		
400	★	★	★
513/540	★		★
538		★	★

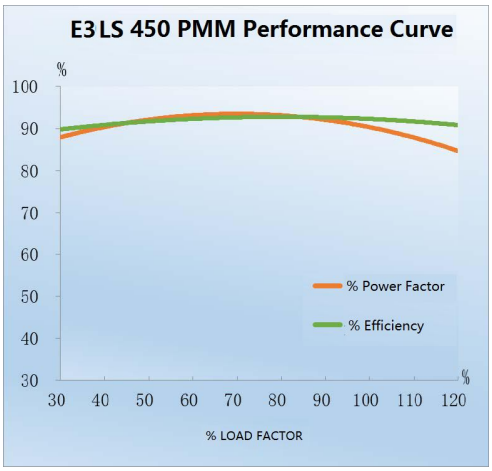
Submersible centrifugal pump

- 338, 400, 513, 538, 675, 862, 950 altogether. 7 series, 42 is Species type pump, the displacement can cover the range of 75 to 45,000 barrels / day, lift the range 0 to 5000 yards.
- Radial flow or mixed flow impeller
- Floating or compressed structure
- Standard configuration, carbon steel shell, head/base, Monel K500 shaft, nickel cast iron impeller and guide shell

- Sand control configuration, high-strength wear-resistant bearings, increased number of bearings (depending on demand), compression structure
- Anti-corrosion configuration, 9Cr1Mo shell, 2Cr13 or 416 stainless steel head/base, INCONEL shaft
- Enhanced sand control and anti-corrosion configuration (special design, suitable for special well conditions), mixed flow impeller, compression structure, shell of 13Cr or more, alloy steel impeller and guide shell, full bearing design, pump stage with coating or Boron treatment

***For more detailed information, please see the product catalog.**

Permanent magnet motor submersible screw pump system



The submersible screw pump (ESPCP) combines the advantages of the electric submersible pump and the screw pump. The screw pump is upgraded from the ground rod drive to the downhole rodless drive, which fundamentally solves the common tripping, broken rod and deviation of the ground rod drive. Problems such as grinding, ground oil leakage, frequent maintenance, and production safety. It is more suitable for the exploitation of highly deviated wells, horizontal wells, heavy oil wells, high sand content and high gas content wells. It has the advantages of wide discharge range, deep pumping depth, reliable operation, long repair-free period, and large starting torque. Permanent magnet motor submersible screw pumps were lifting the basis of conventional submersible screw pump on the formation of a more efficient, energy-saving, environmental protection, safe reliable and secure artificial lift solution.

Or in the industry initiative to develop an exceptionally low rotational speed of the largest number (50 ~ 500RPM) submersible permanent magnet motor. Through the combination of unique electromagnetic design and control theory, it has broken through the current control method of submersible permanent magnet motors in the industry and has become the only supplier of submersible permanent magnet screw pump technology compatible with V/F control and vector control in the industry.

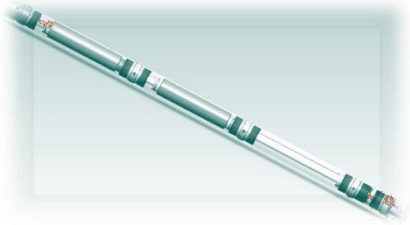
E3 LS series permanent magnet motor technical specifications

- Nominal: 300RPM, 40HZ
- Rotation speed: 50 ~ 500RPM
- Number of pole pairs: 16
- Outer diameter 4.5" (114mm)
- Temperature resistance class 302°F
- Maximum torque of single section in the industry 996N·m
- Winding or plug-in motor lead cable
- Excellent compatibility of inverters in the industry

Frontier Sonde Inc. E3 LS Screw Pump Submersible Permanent Magnet Motor 450 Series (114mm)									
Power		Torque		Length		Weight		Voltage	Current
Hp	KW	Ft	N	Ft	M	Lb	Kg	V	A
7	5.2	122	166	7.5	2.3	359	163	158	40
14	10.4	245	332	12.5	3.8	626	284	316	40
21	15.6	367	498	17.4	5.3	893	405	474	40
28	20.8	490	664	22.3	6.8	1160	526	632	40
35	26.1	612	830	27.2	8.3	1426	647	790	40
42	31.3	735	996	31.5	9.6	1693	768	948	40

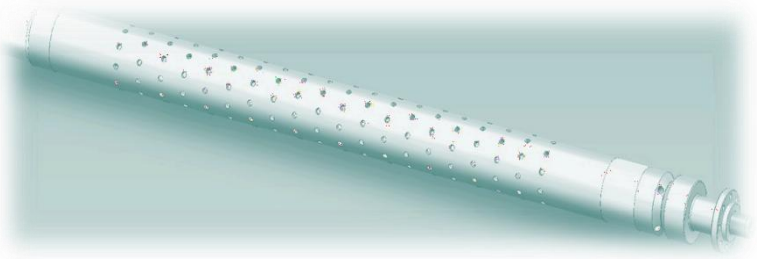
Screw pump motor protector screw pump torque shaft

- Undertake the isolation function, thrust unloading.
- Outer diameter: 101.6mm
- Double capsule single sedimentation cavity
- Super-strength thrust bearing.
- Bearing capacity: 8 tons.



Screw pump torque shaft

- Independent patented technology
- Outer diameter: 101.6mm
- Torque: 1500N·m
- Suitable for 2-7/8 and 3-1/2” two types of screw pumps
- Screw pump reverse rotation prevention design



Ground drive equipment

In pioneering liter Submersible Pump system ground voltage variable frequency drive apparatus by a control system or a step-up transformer and an isolation transformer (for boosting transformer without case) composition the system may provide reliable downhole electrical submersible pump system source Input, protection and control, frequency modulation and speed regulation functions.

The frequency conversion control system (PMD) of electric submersible pump independently designed by Frontier Sonde Inc. has the functions of motor characteristic identification, load adaptation, precise driving, motor protection, system working condition monitoring, real-time data transmission, and closed-loop control. Independent design matching high frequency sine wave filter, so that the output can be obtained as a perfect sine waveform, finish not only the United States and is suitable for permanent in liters initiative submersible pump systems can also be used as conventional submersible pump system ground Frequency The use of control equipment is cost-effective.

The compact variable frequency control equipment structure, suitable for indoor and outdoor environments installation and operation, the scene is set and intuitive, easy to operate, the use of advanced equipment and automatic control of Things technology to meet the optimization of production and intellectual submersible pump system of oil can control. The whole set of ground drive equipment is equipped with a broadband transformer, and the gear can be customized, suitable for operation in a wider frequency range.

Ground drive equipment selection table

Inverter 380V/50Hz input							Broadband step-up transformer 380V 120Hz	
model	Light load (2kHz carrier)			Heavy duty (5kHz carrier)			Model	Capacity
	Power (KW)	Input current(A)	Output current (A)	Power (KW)	Input current (A)	Output current (A)		KVA
PMD 26 LV YK1 5K	22	59.7	44	18.5	50.5	39	QYKB-30	30

PMD 30 LV YK1 5K	30	58.3	59.6	22	43.1	45	QYKB-50	50
PMD 39 LV YK1 5K	37	71.5	74.9	30	58.3	60	QYKB-50	50
PMD 49 LV YK1 5K	45	86.5	89.2	37	71.5	75	QYKB-63	63
PMD 60 LV YK1 5K	55	105	103	45	86.5	91	QYKB-80	80
PMD 74 LV YK1 5K	75	142	140	55	105	112	QYKB-100	100
PMD 99 LV YK1 5K	90	170	168	75	142	150	QYKB-125	125
PMD 118 LV YK1 5K	110	207	208	90	170	180	QYKB-160	160
PMD 142 LV YK1 5K	132	248	250	110	207	216	QYKB-200	200
PMD 171 LV YK1 5K	160	300	296	132	248	260	QYKB-250	250
PMD 200 LV YK1 5K	200	373	371	160	300	304	QYKB-315	315
PMD 244 LV YK1 5K	220	410	389	200	373	371	QYKB-315	315
PMD 272 LV YK1 5K	250	465	453	220	410	414	QYKB-400	400
PMD 298 LV YK1 5K	315	584	568	250	465	453	QYKB-500	500
PMD 398 LV YK1 5K	355	657	675	315	584	605	QYKB-500	500