Electrical Submersible Pump

24 pulse Variable Frequency Drive

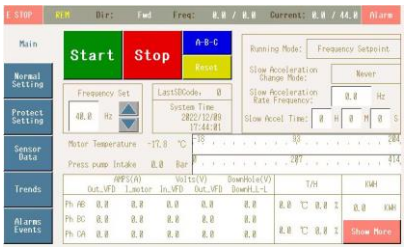
Voltage rating: 380V to 480V, 50/60Hz

DCUS

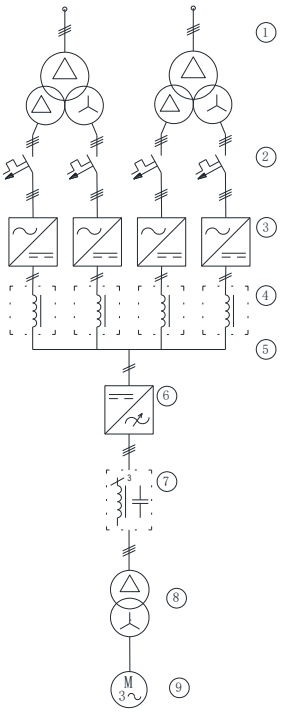
EVR 3 Series 24 pulse Variable Frequency Drive

Industry Power & Control for Artificial Lift Application

Modular design, IEEE 519, Easy-to-use and Easy-to-maintain Variable frequency drive



Input power supply	3 phase 380V to 480V ±10%, 50/60Hz ±5%
Converter type	24 pulse diode front end
Inverter type	IGBTs
Input current protection	Circuit breaker
Input surge suppression	IEC test classification / EN type: II/T2 Maximum continuous voltage: 350V(L-PE) I_{SCCR}: 50kA (max.200A gG) Voltage protection level: 1500V I_n: 20kA 8/20 µs I_{max}: 40kA 8/20 µs
Input power balance	Standard input DC reactors
Output voltage	The same as power supply
Output frequency	0.1Hz to 120Hz
Output waveform	High performance Sinewave
Motor control	Constant or Variable Torque (V/F)
Motor technology	Induction motor (IM) or Permanent Magnet Motor (PMM)
Efficiency	~96% at full load
Power factor	0.98 across entire speed range
Overload rating	120% for 1min/5min
Certifications	ISO9001, ISO14001
Enclosure rating	Junction box & main power section: IP66 [equivalent to NEMA4] 24 pulse front end section： IP55 [equivalent to NEMA3] Magnetics section: IP24 [equivalent to NEMA3R]
Cooling system	IP66: air-conditioning unit, heat sink IP24 & IP55 : forced air cooling
Altitude	0 to 1000m without derating
Ambient operating Temp.	-30 degC to 55 degC
Relative humidity	20% to 95% maximum(noncondensing)
H_2S protection	Conformal-coated PCBs & bus bars
Material	Carbon steel, the thickness is 2.5mm
Line-side termination	Circuit breaker's lugs in power junction box
Load-side termination	Lugs in power junction box
Control termination	Mounting plate on the dedicated swing door
Safety features	Emergency stop button Electronic interlocks Separated power and control sections Backspin indication LED on the front door Prewired IO junction box
Analog inputs (AI)	Qty 2: 4-20mA, resolution 12 bits
Digital inputs (DI)	Qty 5: DC24V, sink wiring
Digital outputs (DO)	Qty 4: relay output, NO, up to 5A
Serial communication	Qty 1: RS485 Modbus Master (for DHS) Qty 1: RS485 Modbus Slave (for SCADA)



24 Pulse Variable Frequency Drive – The principle of the 24 pulse rectifier has two 12 pulse rectifiers in parallel with two three-winding transformers having a 15° phase shift. The benefit is that practically all low frequency harmonics are eliminated and the harmonic distortion is less than 5%, 24 pulse VFD is IEEE 519 product

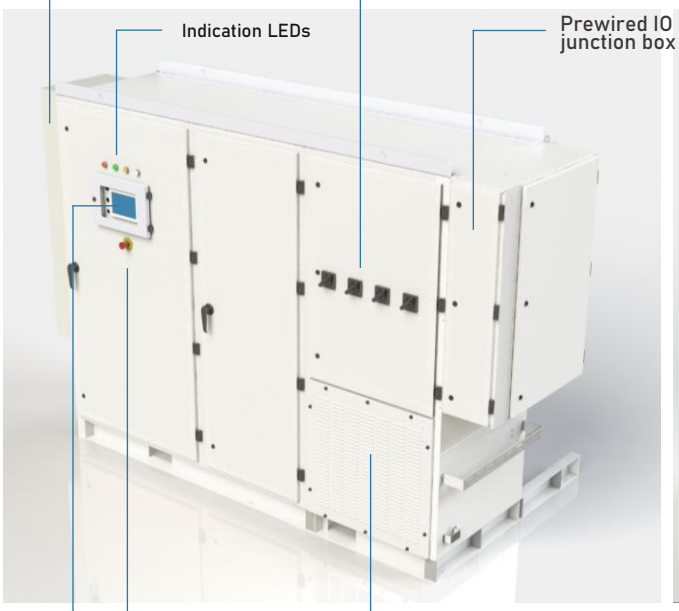
① 24 pulse phase shifting transformer
② 24 pulse main breakers
③ 6 pulse diode bridges
④ DC chokes
⑤ DC bus
⑥ Inverter
⑦ Output sine wave filter
⑧ Step-up transformer
⑨ Electrical Submersible Motor

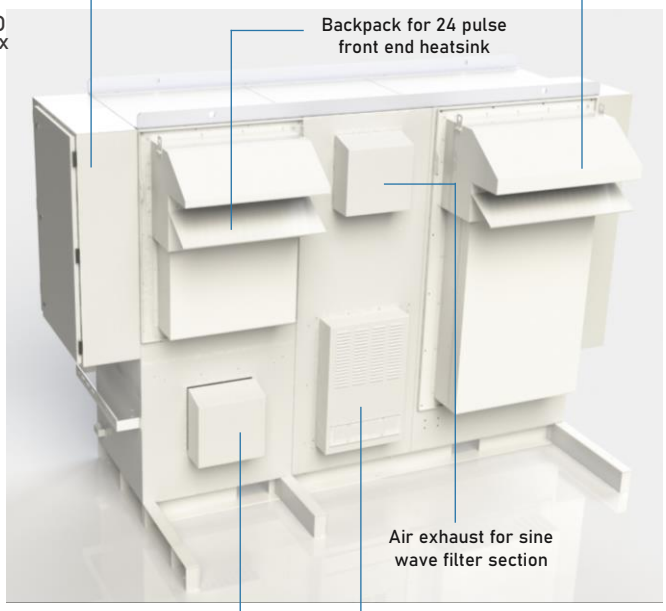
+ Single drive – there is only one drive module. The diode rectifier and inverter are sealed in a same enclosure.
+ Four separate, parallel 6-pulse diode bridges compose to 24 pulse rectifier in the input. Four input DC chokes are used to balance power supply.
+ Compared to two parallel 12 pulse VFD solution or four parallel 6 pulse VFD solution, there is one inverter and one output sine wave filter. Smaller footprint, lower cost and higher reliability.

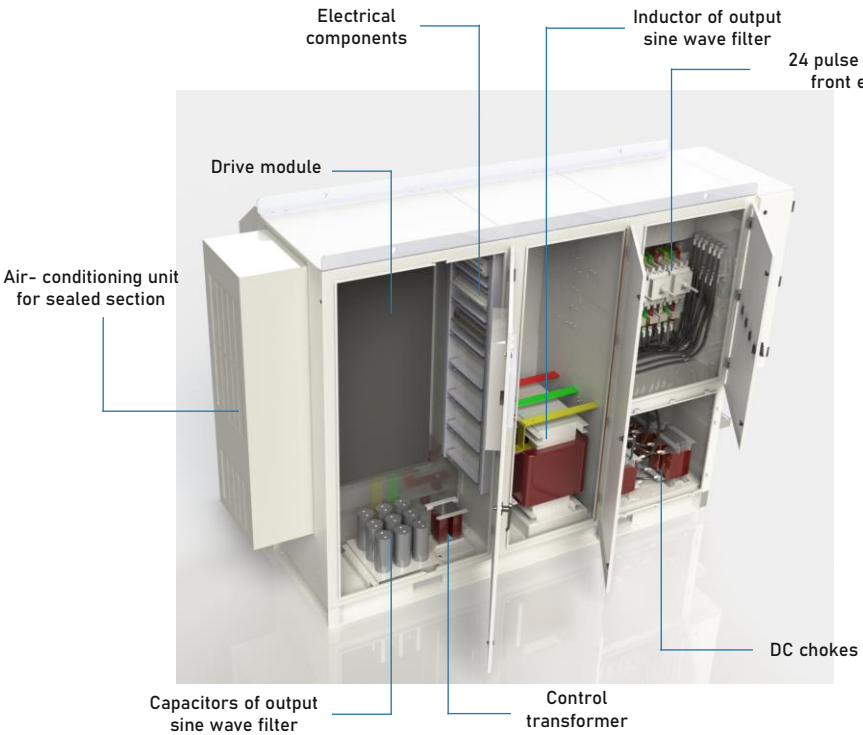
Comparison of 24 pulse VFD solution

	Parallel 6 pulse or 12 pulse solution	Multi-drive solution	DCUS-24 pulse front end solution
Configuration	4 pcs parallel 6 pulse VFD or 2 parallel 12 pulse VFD compose of 24 pulse VFD.	4 pcs parallel 6 pulse diode rectifier modules with one or several inverters compose of 24 pulse VFD	4 parallel 6 pulse diode bridges with one inverter compose of 24 pulse VFD
Output sine filter	The number of sine wave filters is the same as the number of the 6 pulse single drives in order to balance the output power	The number of sine wave filters is the same as the number of the inverters. More than one inverter need the same number sine wave filters to balance the output power.	One inverter, one output sine wave filter.
Output power rating	High horse power requirement	Wide output power range	Wide output power range
Inverter control	Parallel control	Single or parallel control	Single control
Simplicity of the installation	Four or two VFDs	Converter units and inverter unit(s)	One enclosure
Installation footprint	150%	120%	100%
Equipment cost	140%	120%	100%
Solution flexibility	Fully the same 6 pulse VFD to parallel connect	Power matched between converters and inverters	24 pulse front end has more flexible adaptability

VFD Introduction







- 24 pulse front end is a separate power supply unit. It is composed of diode bridges, heatsink, breakers, DC chokes, pre-charge circuit and cooling fans.
- Different rating 24 pulse diode front end units can be matched with the existing EVR3 series VFDs to form 24 pulse VFDs and drive the induction motor and permanent magnet motor. The output power ratings are the same as the existing EVR3 series VFD's,
- The DC bus of 24 pulse front end which act as a supply unit connect the DC bus of drive module integrated in the exist EVR3 VFD, that is 24 pulse front end replaces the exist 6 pulse rectifier, only the inverter of the drive module is activated, 24 pulse VFD's hardware is ready.
- 24 pulse VFD is custom designed product

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