

**Additional Materials**

**Table S1** The Likely Specific Causes of Electrical Failures.

<b>Electrical Failures</b>	
<b>Specific Failure Mode</b>	<b>Likely Cause</b>
Power Fail	Electrical issues with the power supply.
Under-Voltage	Intermittent under-voltages and over-voltages are caused by a poorly controlled primary power supply or wiring problem.
Over-Voltage	
Phase Unbalance	Unbalanced power input
	Over/undervoltage
	Excess flow
Overcurrent	Bad bearings
	Foreign material in the pump
	Jammed pump

**Table S2** The Likely Specific Causes of Motor Failures.

<b>Motor Failure</b>	
<b>Specific Failure Mode</b>	<b>Likely Cause</b>
Voltage/Current	Unbalanced power input results in overheating and reduced motor life
Unbalanced	
	Loads exceed the motor design
	Mechanical failure of the downhole equipment
Motor Overload	An increase in the density of the fluid being pumped.
	A change in the supply voltage
	Debris creates impeller drag in the pump (locked rotor)
Low Speed	High torque
	When the motor has more load on it than it is designed for, it can no longer supply enough torque to keep it spinning.
Motor Stall	Therefore, the speed is automatically reduced.
Overheat	Motor's rotor overheating due to improper cooling
High $T_m$	High Motor Winding Temperature

**Table S3** The Likely Specific Causes of Gas Effect Failure.

<b>Gas Effects</b>	
<b>Specific Failure Mode</b>	<b>Likely Cause</b>
Motor Undercurrent/Underload	Restricted flow
	Lack of liquid to pump (reduced load on the motor).
	Broken shaft coupling or belt
Intake pressure fluctuation	Gas locking causes underload shutdown
	High gas production from Reservoir

**Table S4** The Descriptions of the Other ESP Specific Failures.

<b>Others</b>	
<b>Specific Failure Mode</b>	<b>Description</b>
Broken Shaft	A broken ESP pump shaft is categorized as Mechanical Failure
High $T_i$	High pump suction temperature due to the fluid temperature entering the pump
High MTR Temp (cable)	The MTR sensor detects a high temperature in the electrical cable.
Plugged with sand	External substances (sand) interference with the ESP assembly
Sensor Failure	Downhole sensor failure which results in no sensor readings at the surface.