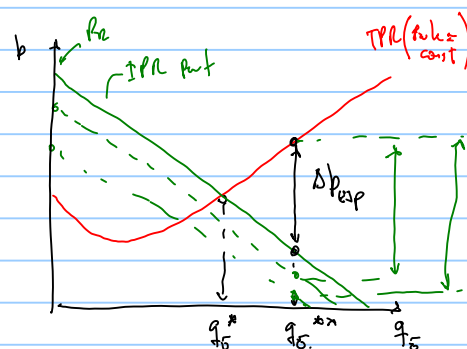
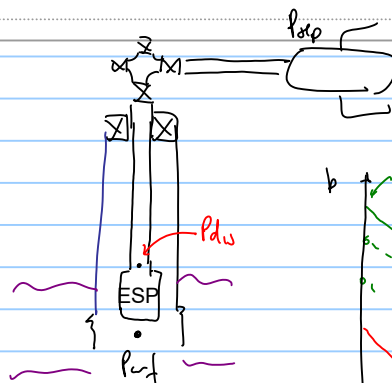
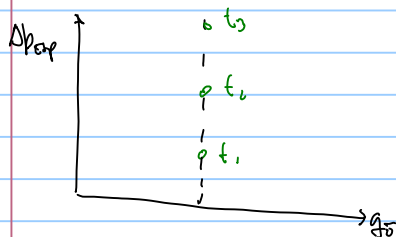
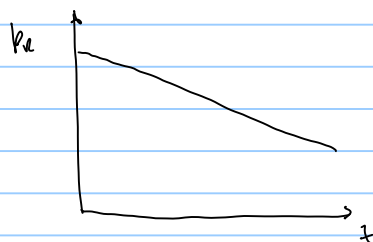


Note Title

ESP electric submersible pump



Depletion



the pump has operational constraints

- limited available motor capacity (maximum power)
- operational map (envelope)
- $P_{0,ESP} \geq P_b(T_R)$

↳ bubble point pressure (no gas is allowed in the pump)

onshore



offshore



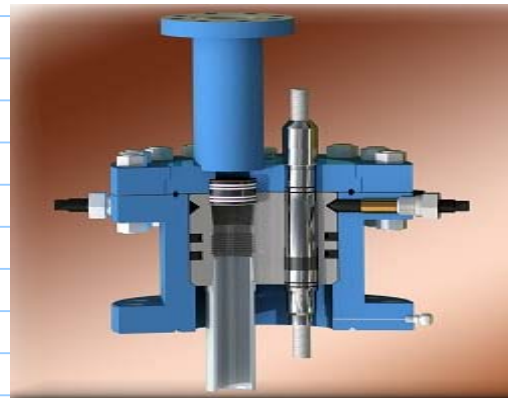
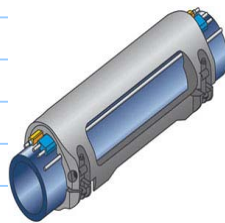
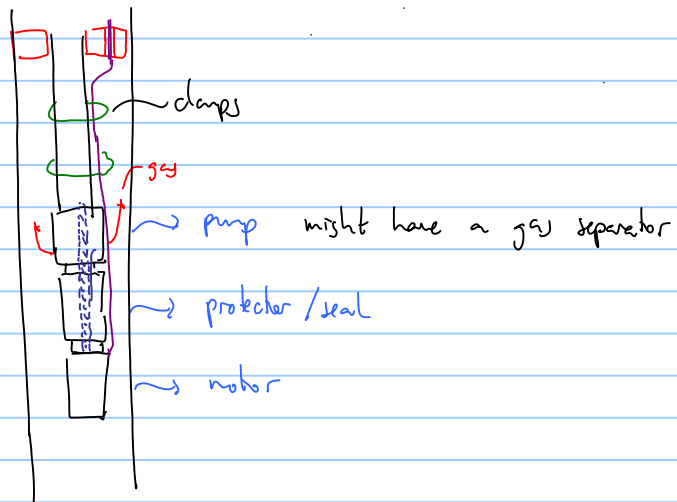
typical gas tolerance in ESP is $GVF = 10\%$
gas volume fraction

$$GVF = \frac{q_g}{q_L + q_g} \times 100\%$$

$$= \frac{q_g}{q_o + q_w}$$

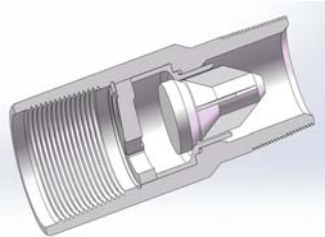
Armais Arutunoff



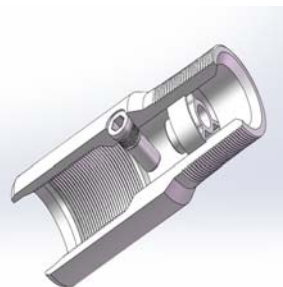


Other important components:

- other gas-handling equipment (after the gas separator)
- Check valve (above the pump)
- Bleeder valve (above the check valve)

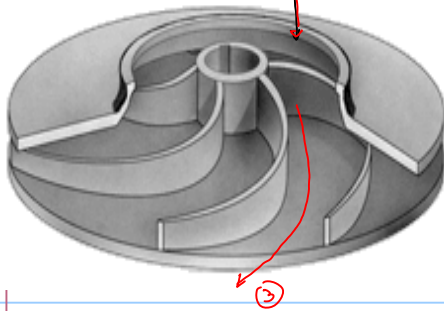


<http://www.orisun.asia/Products.asp?dl=111&xl=165>

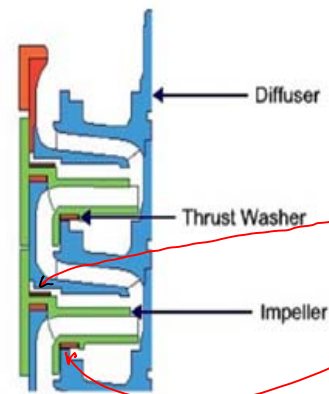


<http://www.orisun.asia/Products.asp?dl=111&xl=164>

Stage: impeller+diffuser

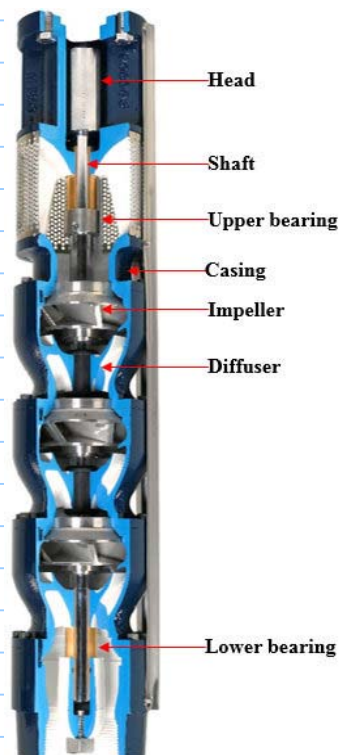
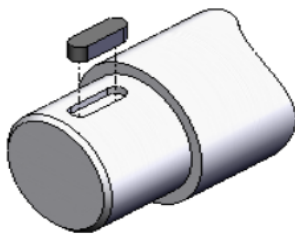

 P_i — P_e

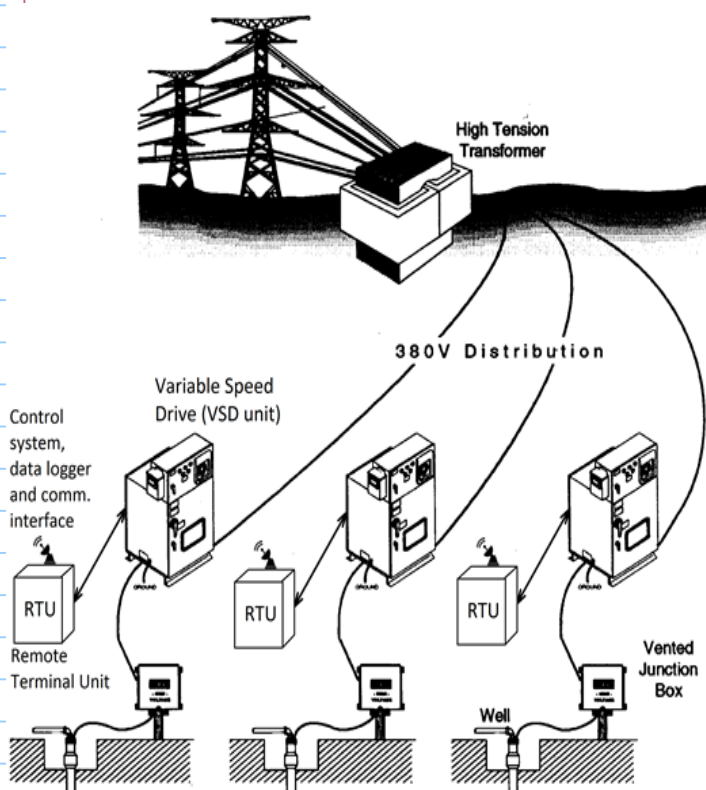
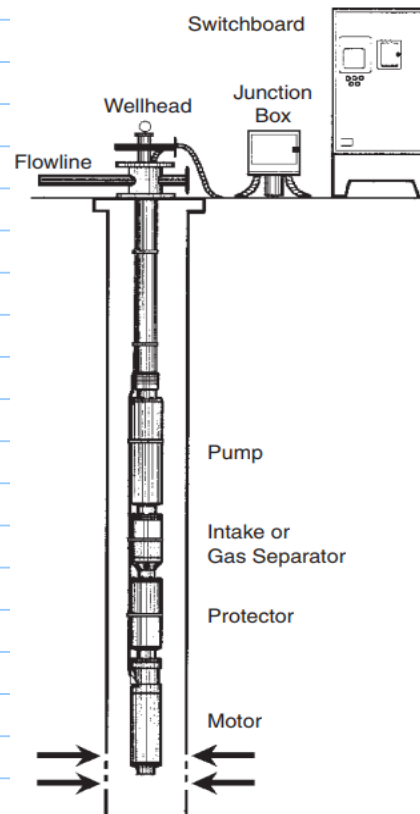
50 - 100 "stages"



-Upthrust
-Downthrust

Q is high
 Q is low





pump frequency

$$f = 30 - 70 \text{ Hz}$$

gas impeller and diffuser more
tolerant to gas

