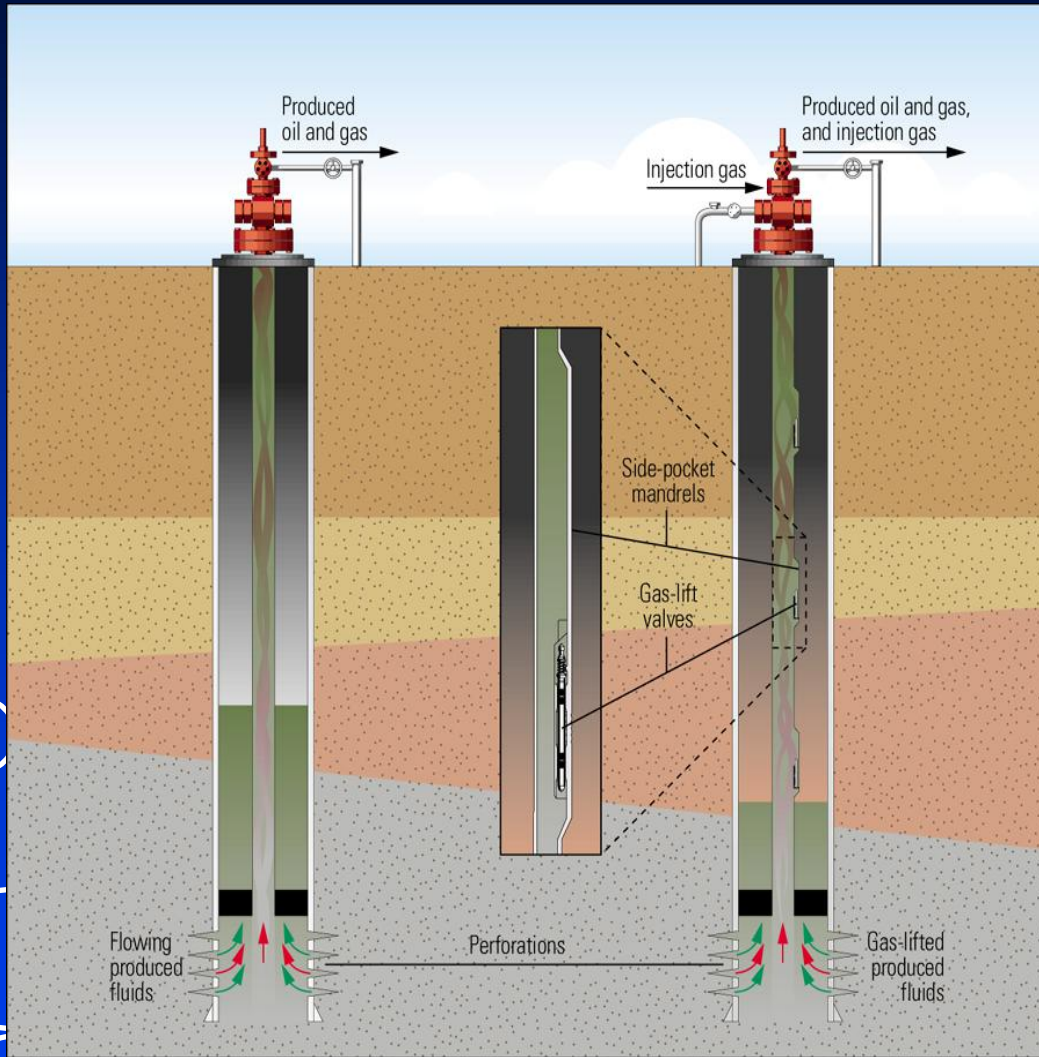


SCHLUMBERGER

GAS LIFT

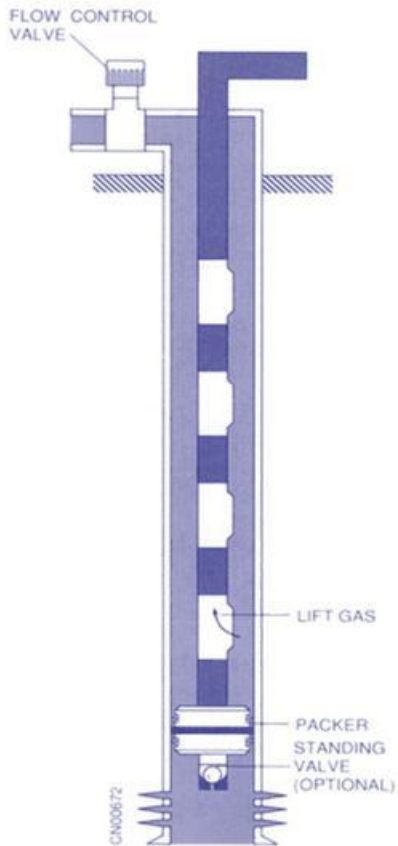
DESIGN & TECHNOLOGY

Gas Lift

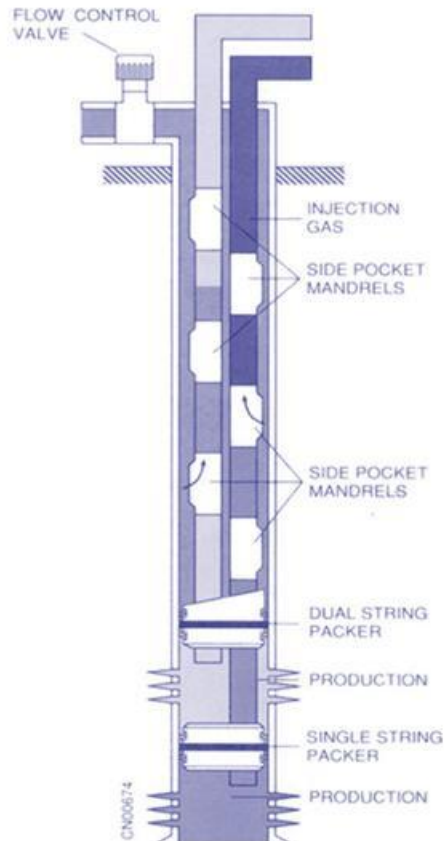


Gas Lift uses additional high pressure gas to supplement formation gas. Produced fluids are lifted by reducing fluid density in wellbore to lighten the hydrostatic column, or back pressure, load on formations.

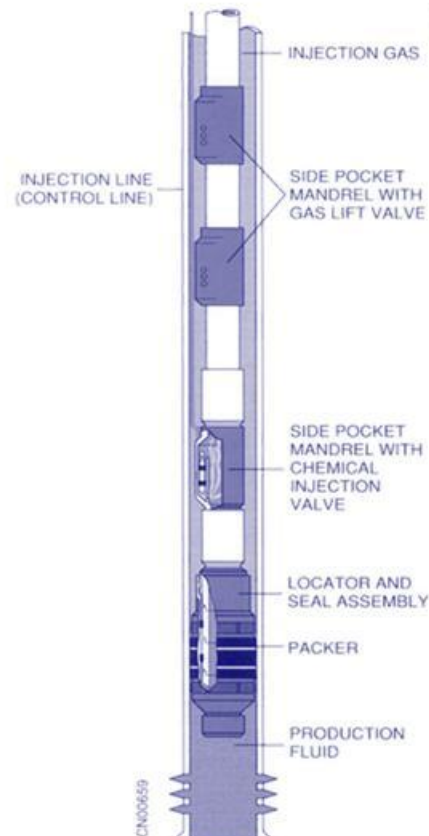
Continuous Flow Options



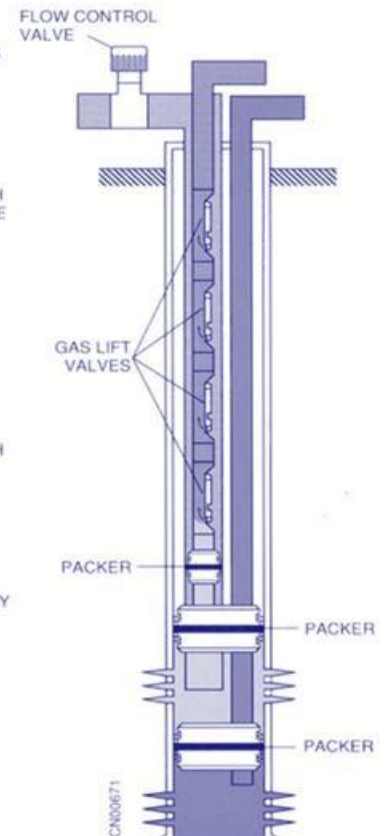
Schematic 1
Single Zone Gas Lift Installation



Schematic 2
Dual-String Gas Lift Installation



Schematic 4
Chemical Injection/Gas Lift Installation

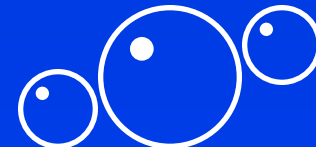
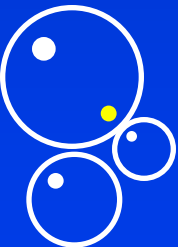


Schematic 5
Macaroni Installation




APPLICATIONS OF CONTINUOUS FLOW GAS LIFT

- To enable wells that will not flow naturally to produce
- To increase production rates in flowing wells
- To unload a well that will later flow naturally
- To remove or unload fluid in gas wells
- To back flow salt water disposal wells
- To lift aquifer wells






ADVANTAGES OF GAS LIFT

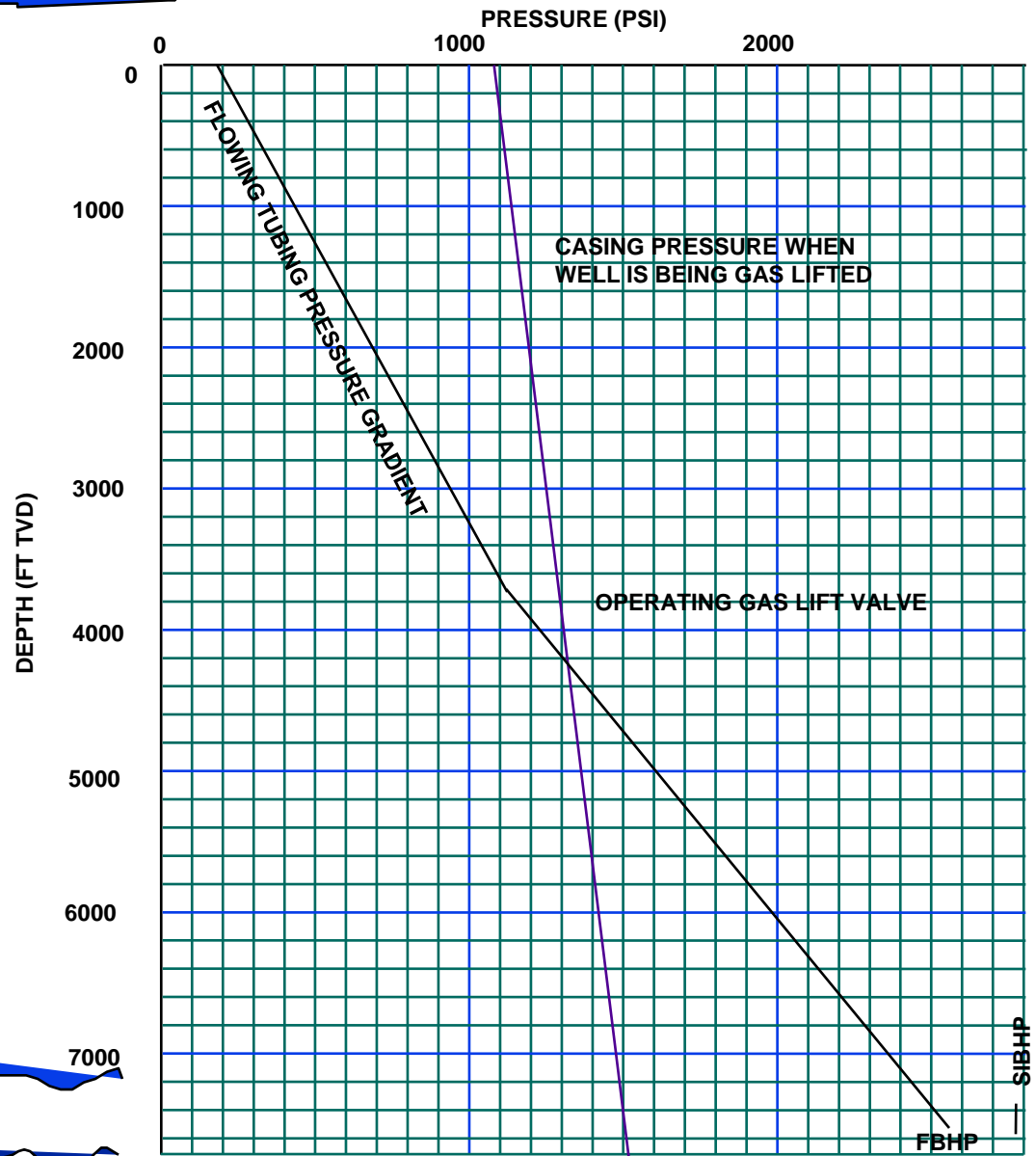
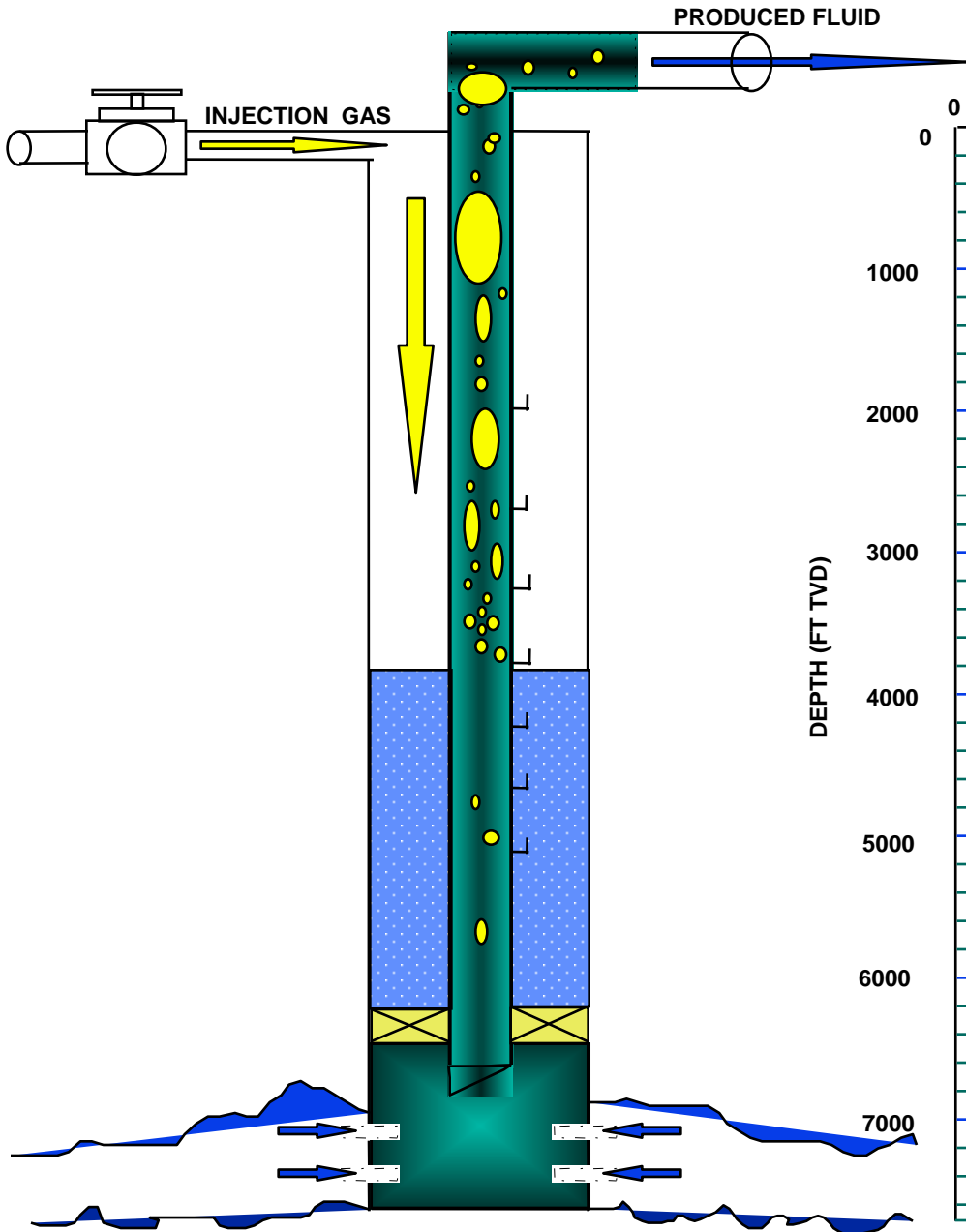
- **Initial downhole equipment costs lower**
 - **Low operational and maintenance cost**
 - Valves may be retrieved by slickline or tubing
 - **Simplified well completions**
 - **Flexibility - rates from 10 to 80000 bpd**
 - **Can best handle sand / gas / well deviation**
 - **Intervention relatively less expensive**
- 



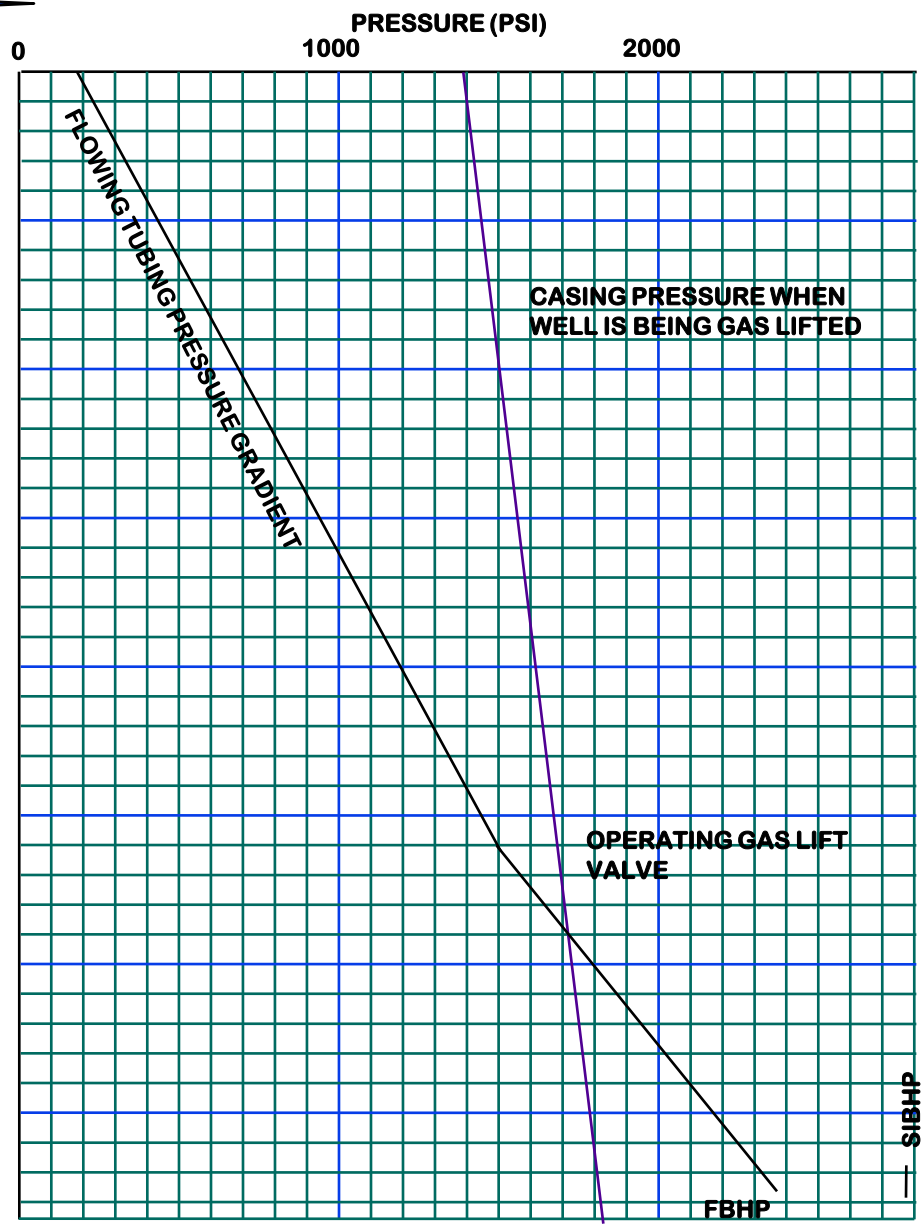
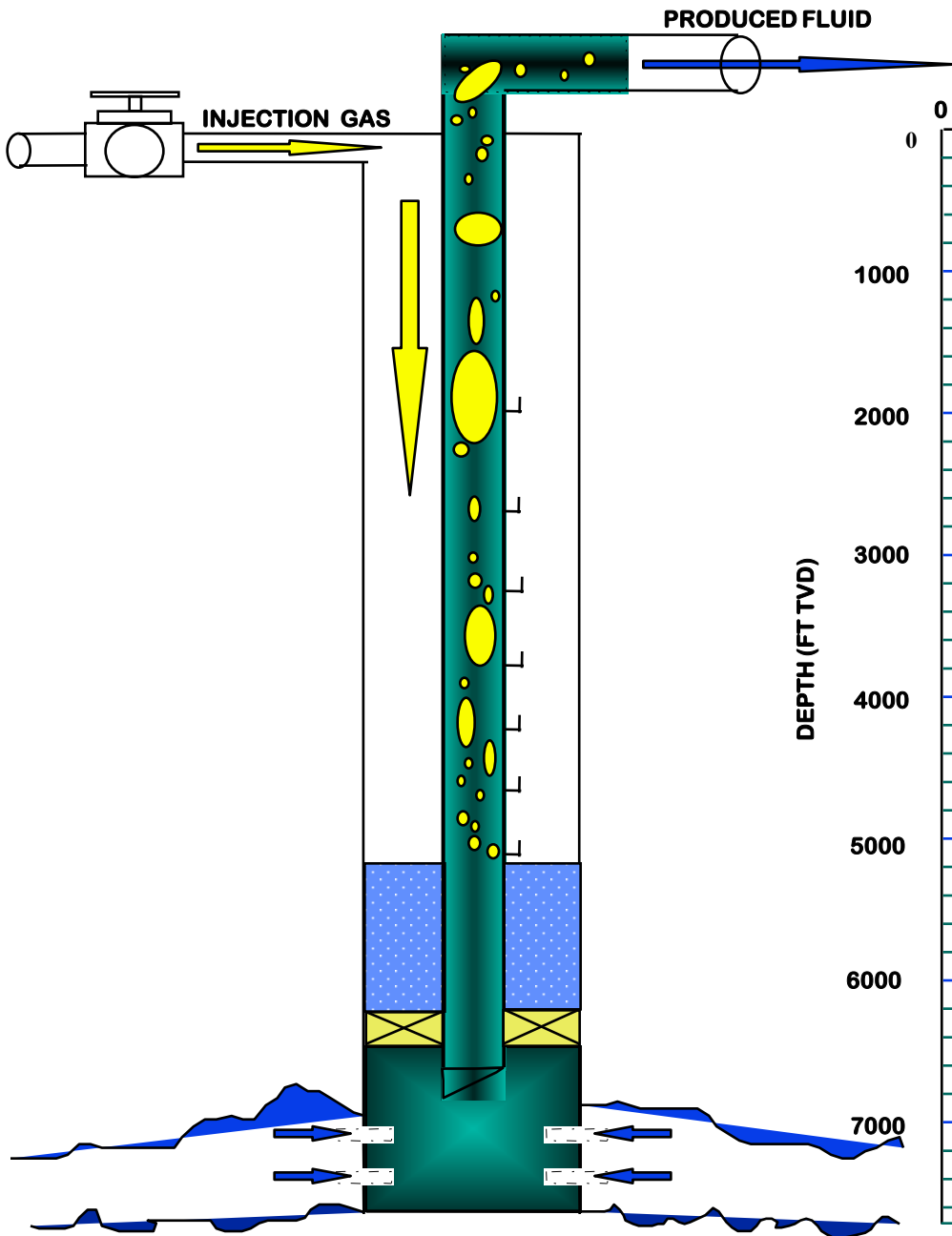
DISADVANTAGES OF GAS LIFT

- **Must have a source of gas**
 - Imported from other fields
 - Produced gas - may result in start up problems
 - **Possible high installation cost**
 - Top sides modifications to existing platforms
 - Compressor installation
 - **Possibility of freezing problems**
 - **Limited by available reservoir pressure and bottom hole flowing pressure**
- 

CONSTANT FLOW GAS LIFT WELL




CONSTANT FLOW GAS LIFT WELL





TYPES OF GAS LIFT

- **Continuous flow gas lift**
 - **Intermittent gas lift**
 - **Plunger lift, Chamber lift ...**
- 




INTERMITTENT FLOW GAS LIFT

LOW PRODUCTION WELLS (TYPICALLY <500 BFPD)

API GUIDELINES :



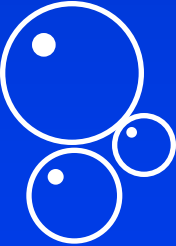

- 2-3/8” TUBING - 100 TO 150 BFPD
 - 2-7/8” TUBING - 200 TO 300 BFPD
 - 3-1/2” TUBING - 300 TO 400 BFPD
- 

3 CATEGORIES

- INTERMITTENT GAS LIFT
 - CHAMBER LIFT
 - PLUNGER LIFT
- 

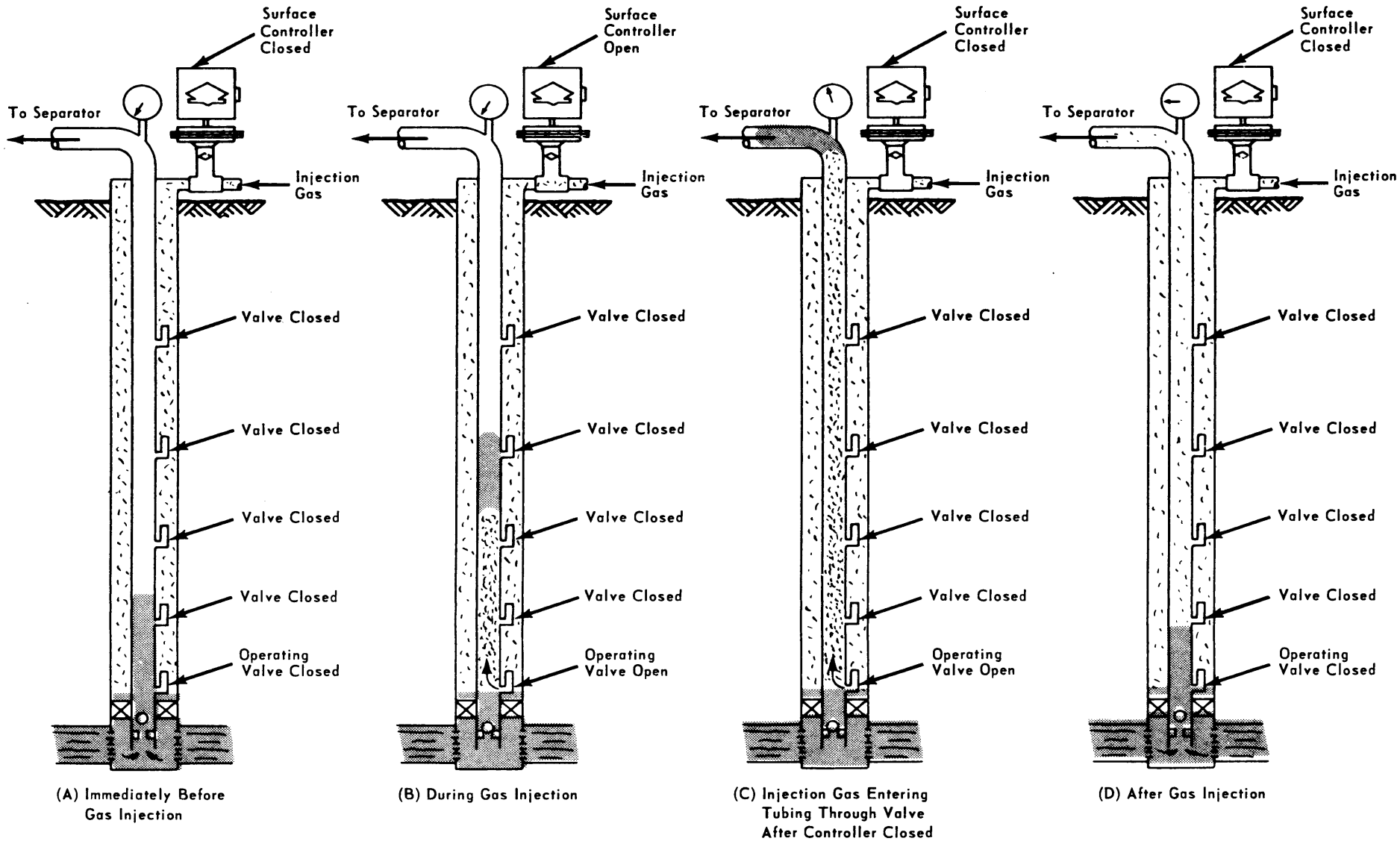


INTERMITTENT GAS LIFT

- **INTERMITTENT INJECTION INTO THE TUBING**
 - **LOW BHFP**
 - **CHOKE CONTROLLED UTILISING A PILOT OPERATED VALVE OR MOTOR CONTROLLED**
 - **3 TYPES OF COMPLETION : OPEN, SEMI-CLOSED OR CLOSED**
 - **FALLBACK LOSSES TYPICALLY 5 - 7% PER 1 000 FT OF TUBING**
 - **REQUIRE RAPID INJECTION OF GAS = PILOT OPERATED GAS LIFT VALVE**
- 
- 
- 
- 

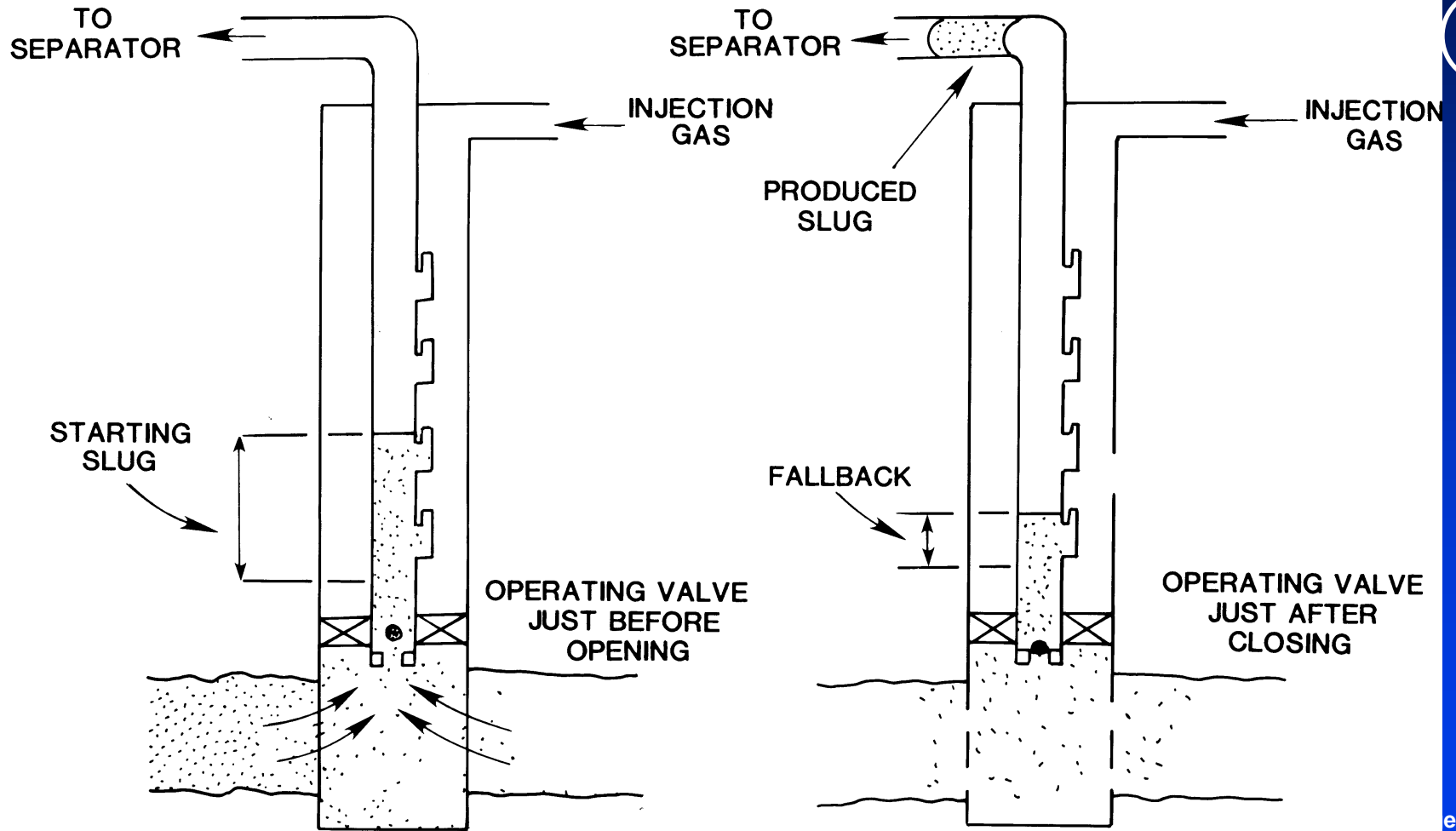


INTERMITTENT GAS LIFT



INTERMITTENT GAS LIFT

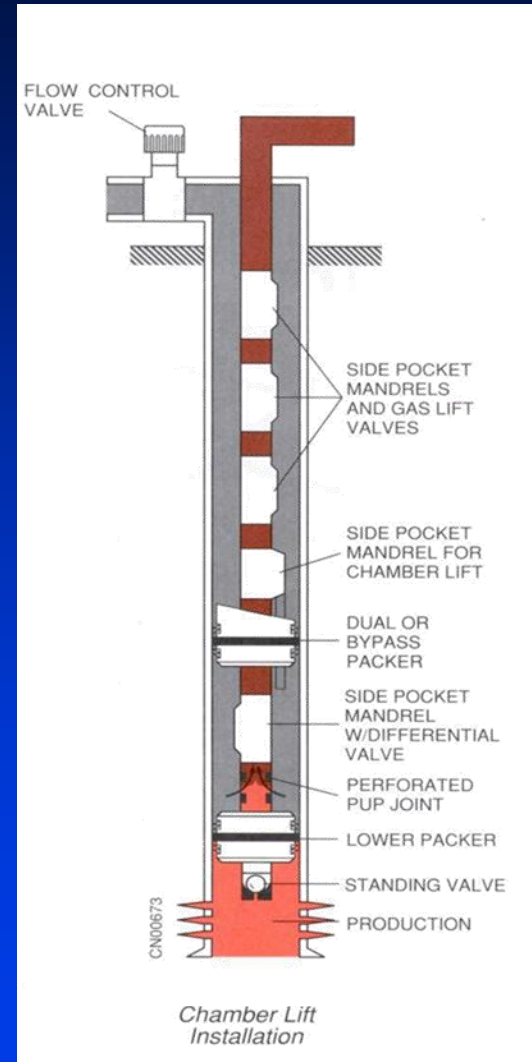
STARTING LIQUID SLUG AND FALLBACK



$$\text{FALLBACK} = \text{STARTING SLUG} - \text{PRODUCED SLUG}$$

CHAMBER LIFT GAS LIFT

- NORMALLY FOR LOW BHP APPLICATIONS
- FACILITATES LARGE SLUGS (MORE PRODUCTION) - USE OF ANNULAR VOLUME
- DUAL PACKER OR CHAMBER DESIGN
- REQUIRES BLEED PORT TO ENABLE CHAMBER TO FILL



CHAMBER LIFT GAS LIFT

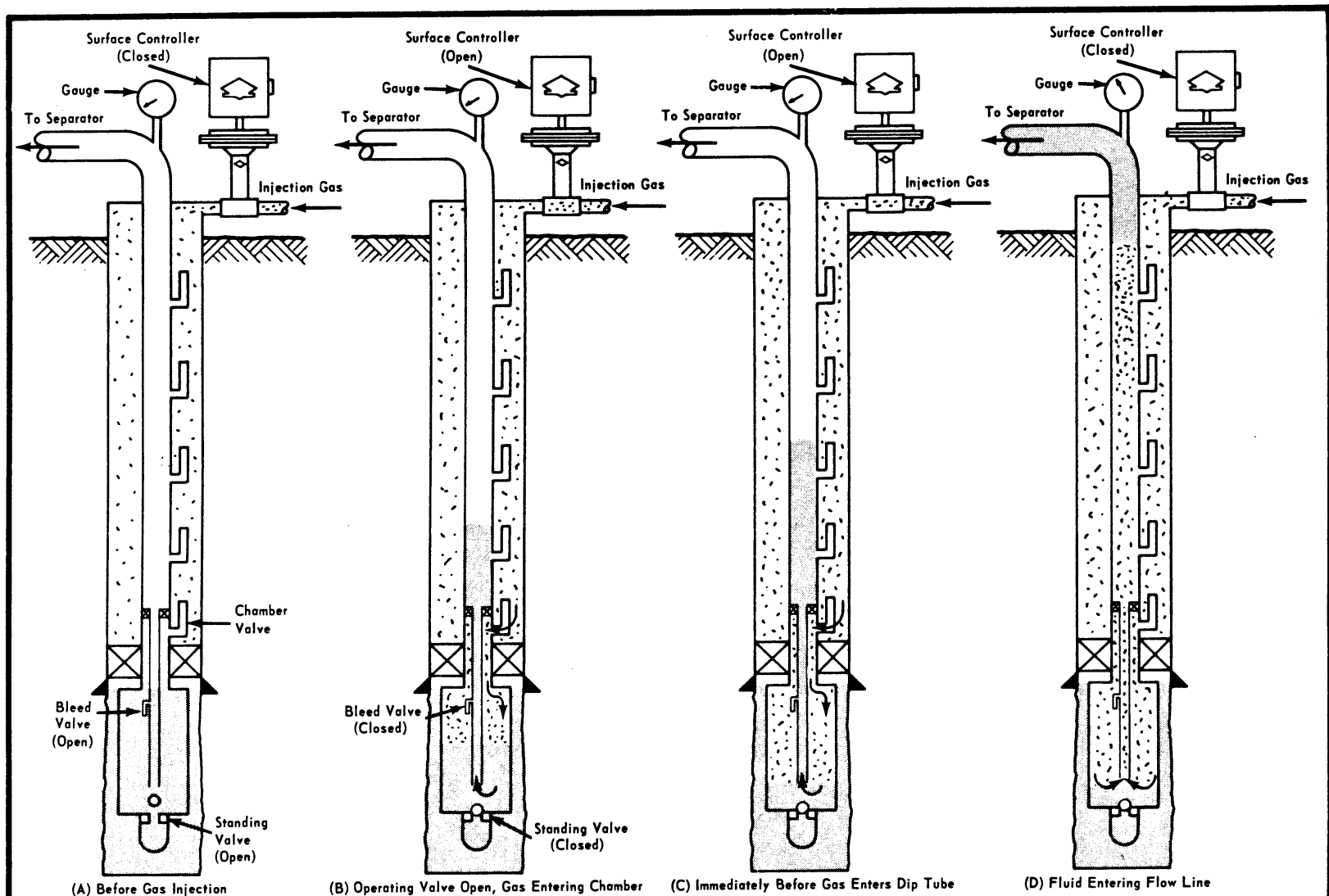
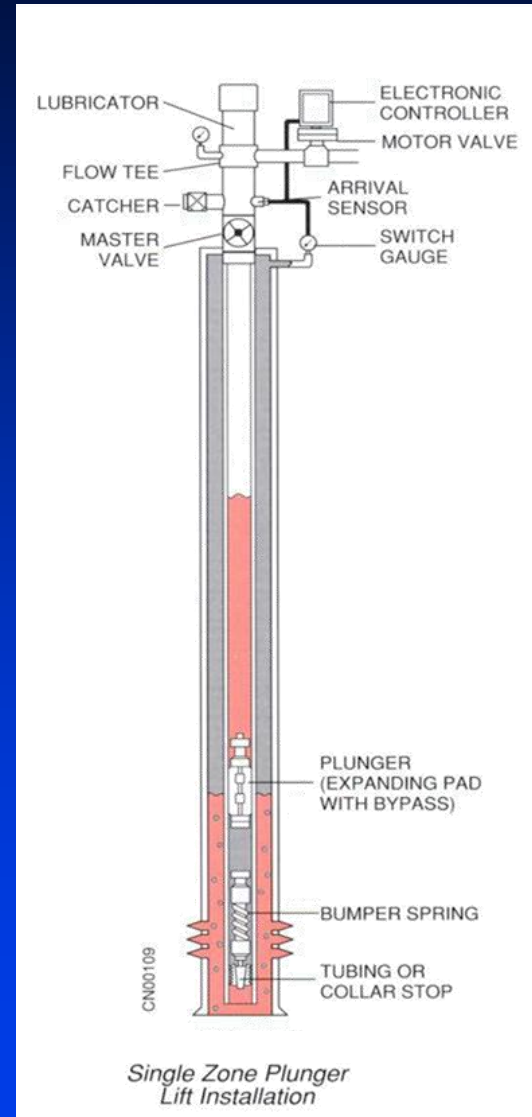


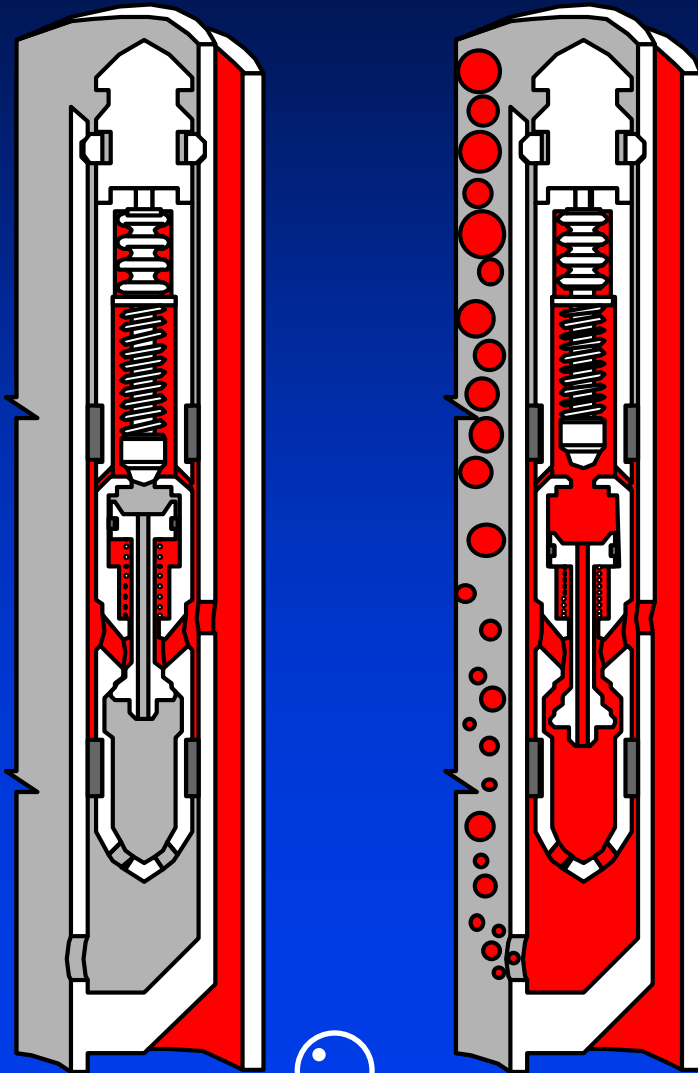
FIGURE 7-2: INTERMITTENT LIFT CYCLE OF OPERATION FOR CHAMBER INSTALLATION

PLUNGER LIFT

- **MECHANICAL BARRIER AT THE INTERFACE REDUCES FALLBACK**
- **NEED WELLHEAD MODIFICATIONS AND BY-PASS THROUGH PLUNGER**
- **NO TAPERS IN THE WELL = NO SAFETY VALVES**



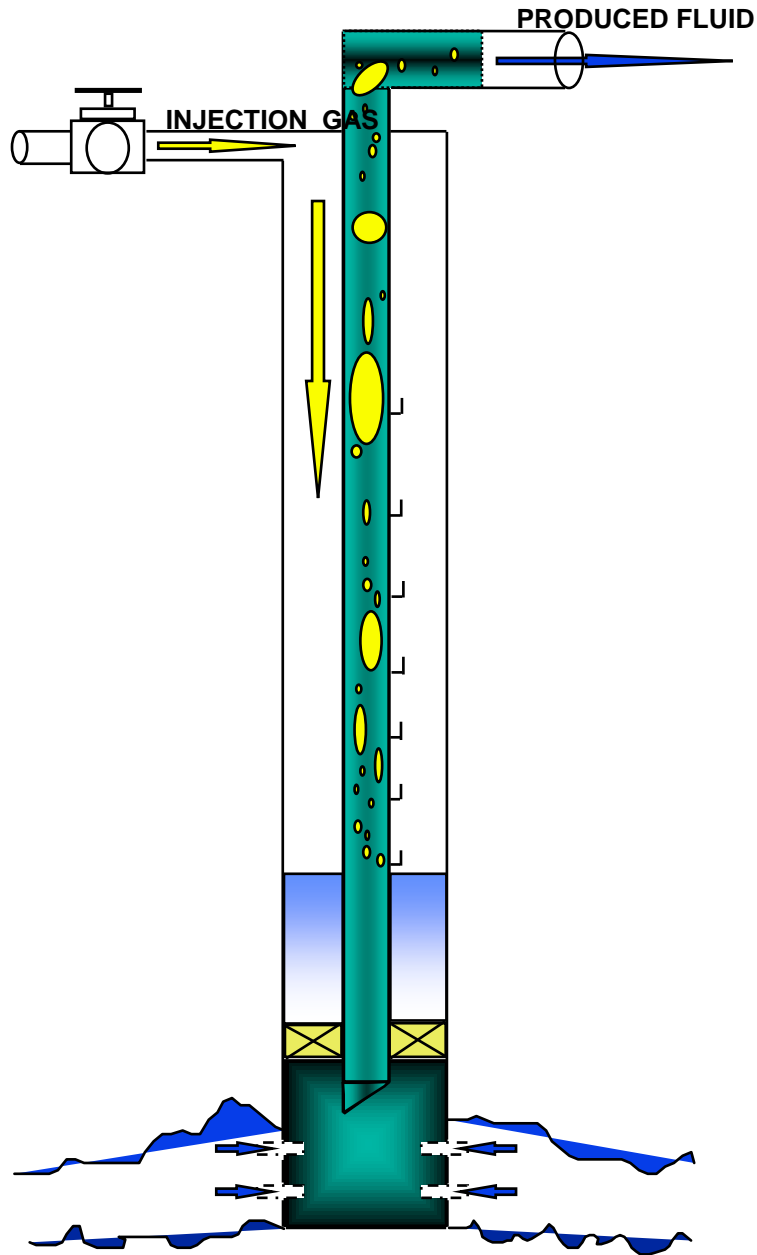
INTERMITTENT GAS LIFT – PILOT VALVE

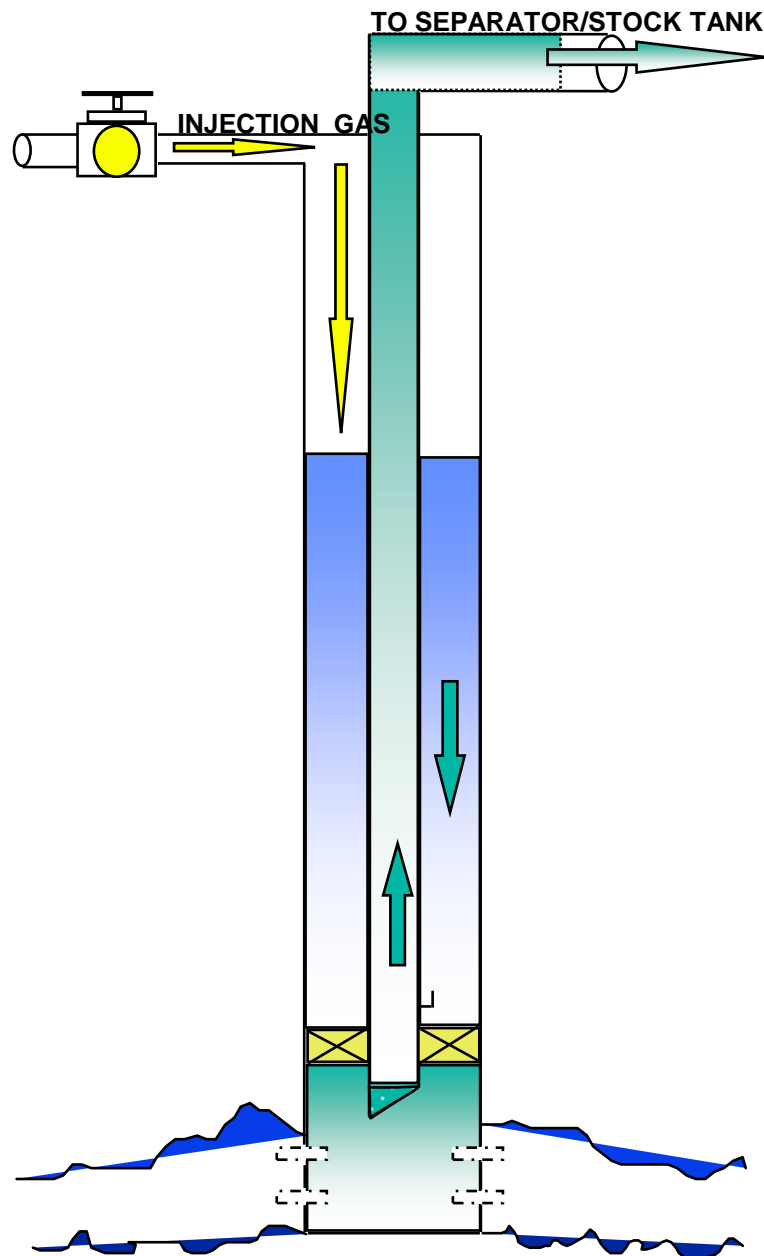
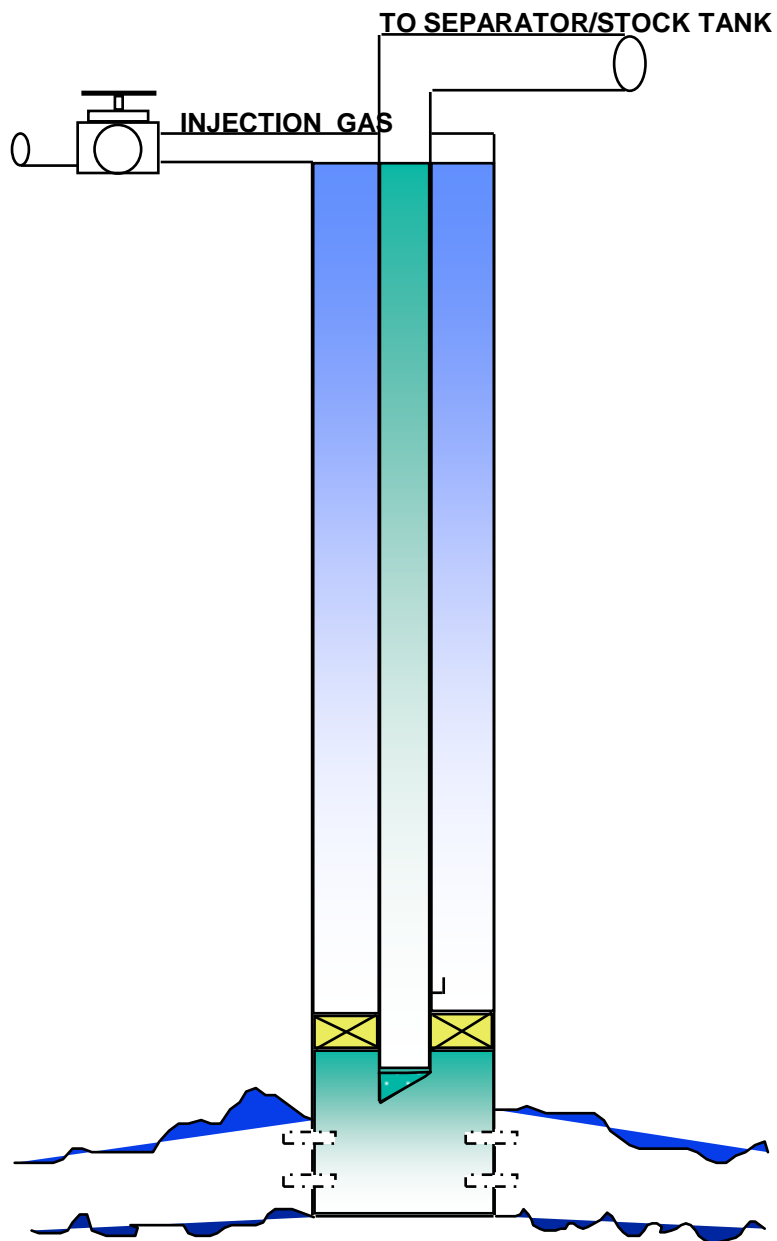


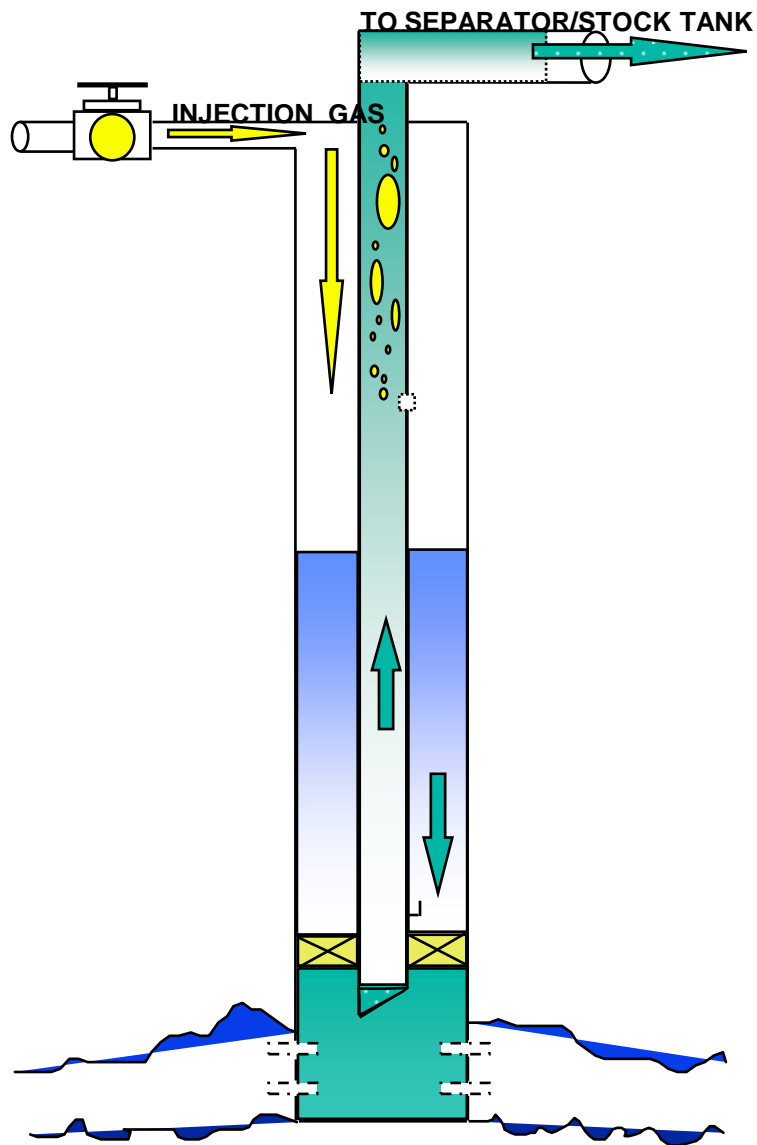
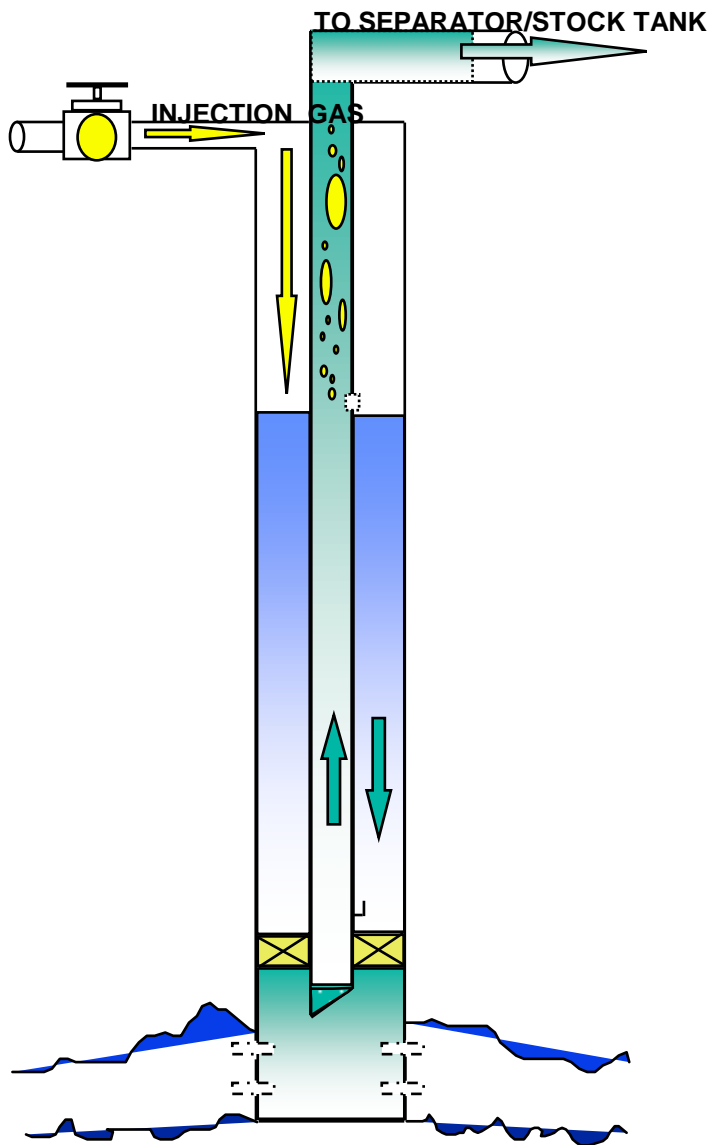
PILOT OPERATED ARE MOST APPLICABLE :

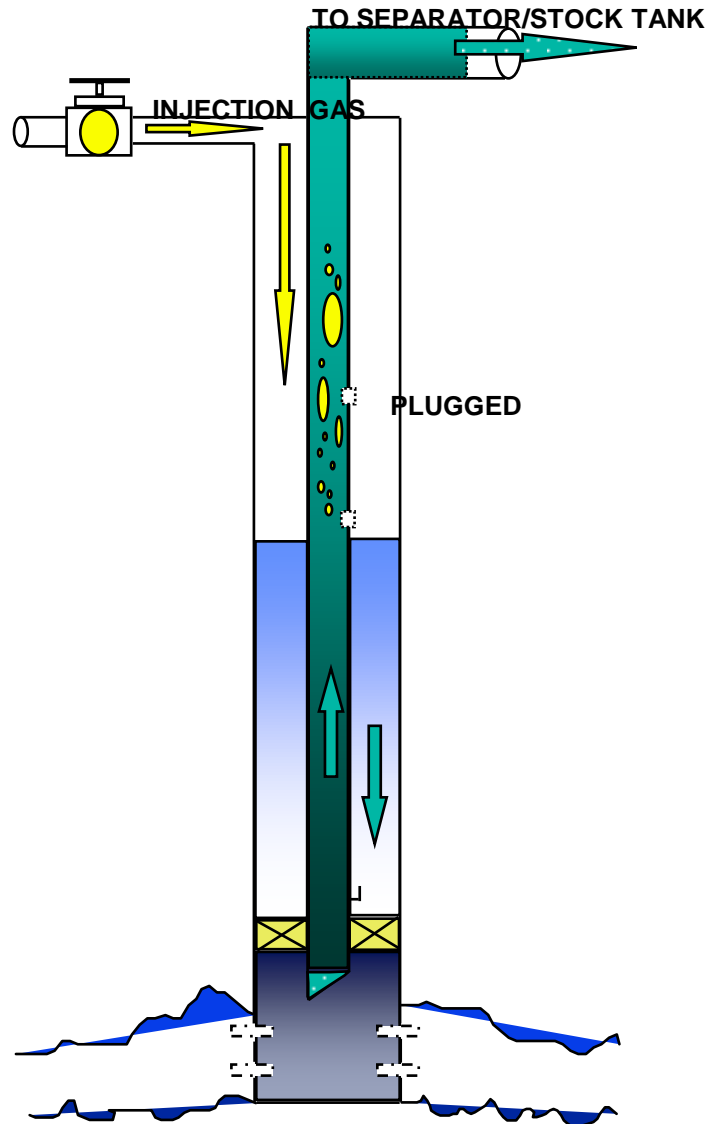
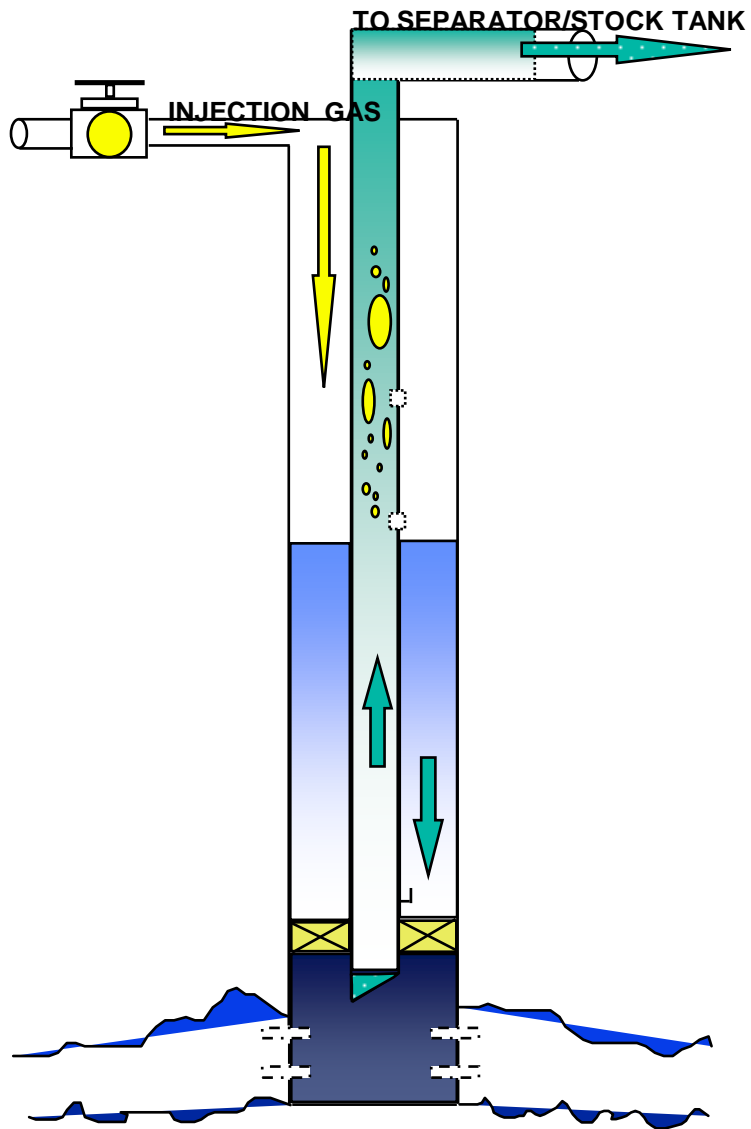
- **Controlled opening**
- **Yet large port for maximum quick gas passage**

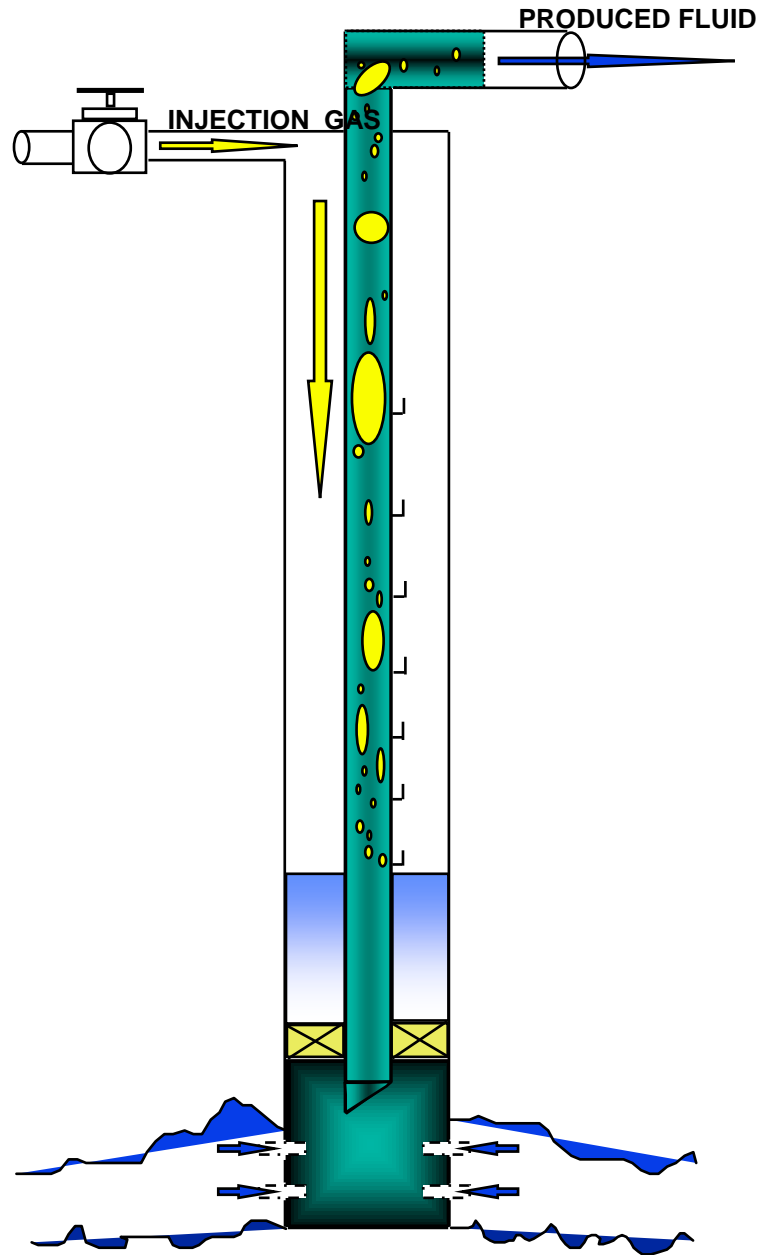
CONTINUOUS FLOW UNLOADING SEQUENCE

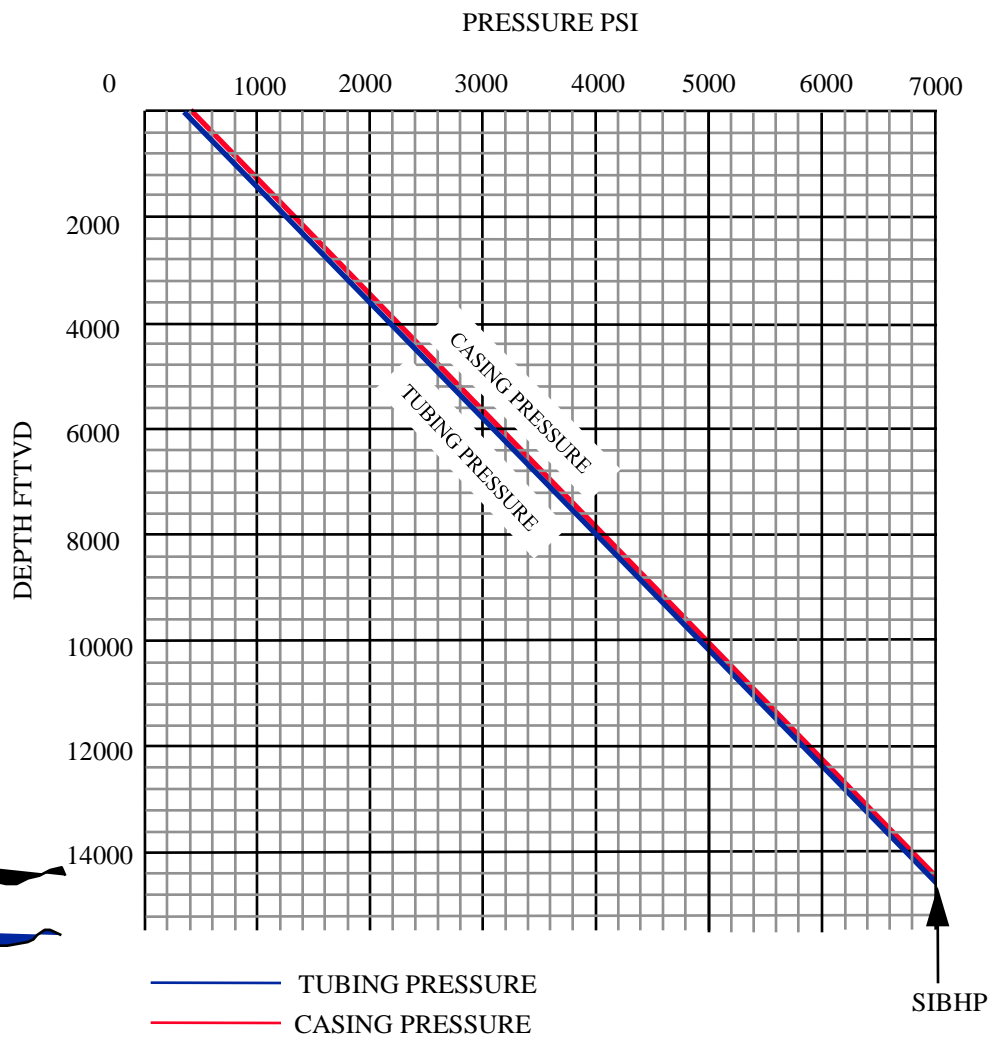
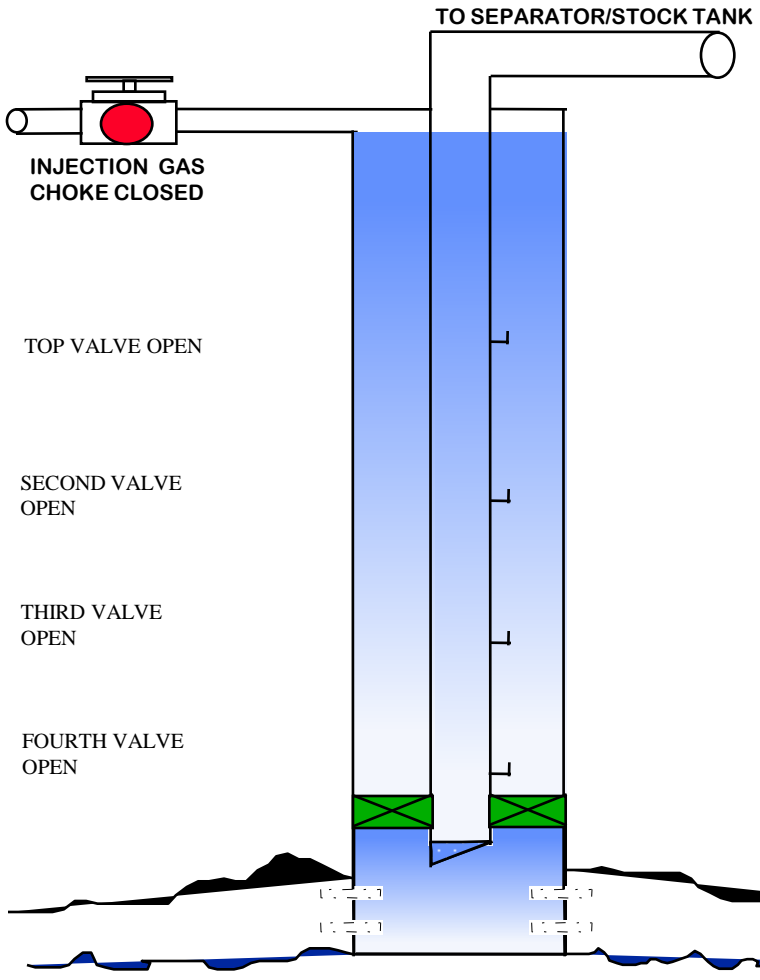


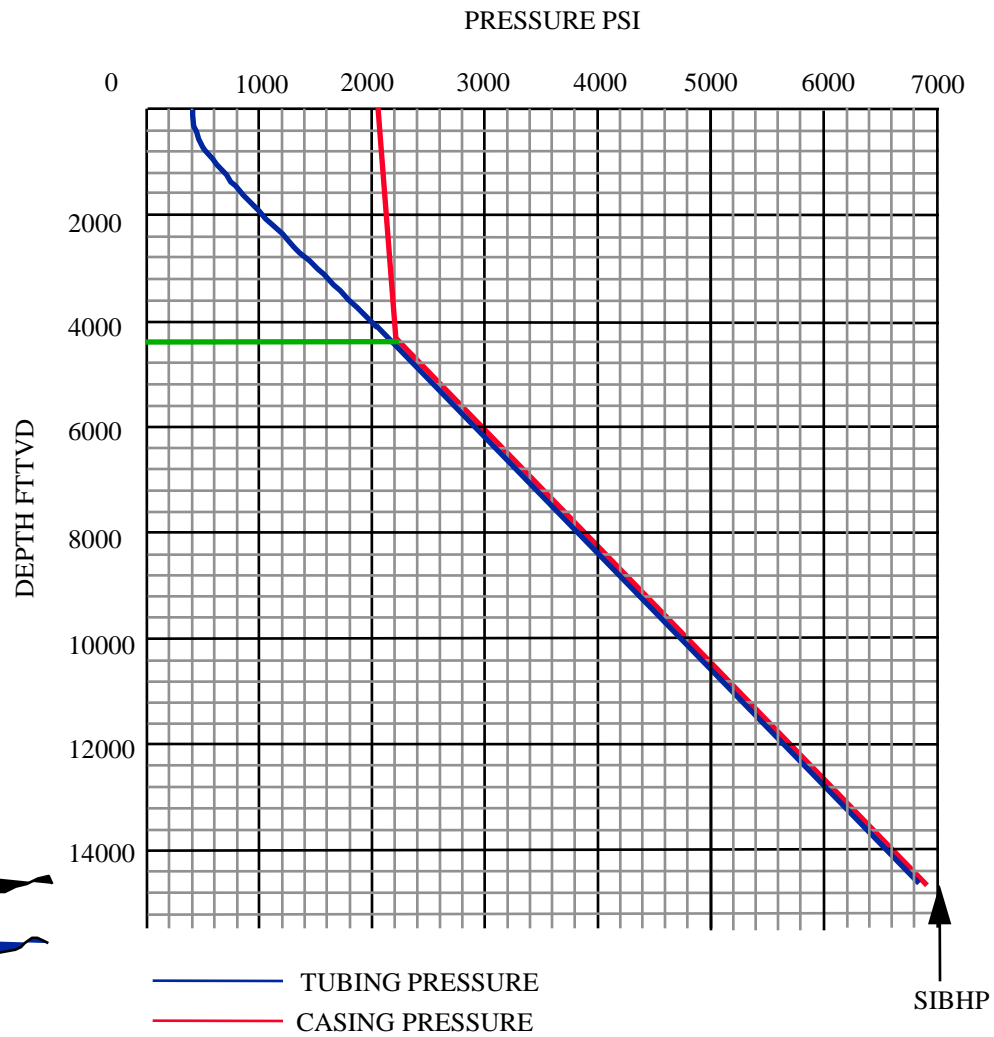
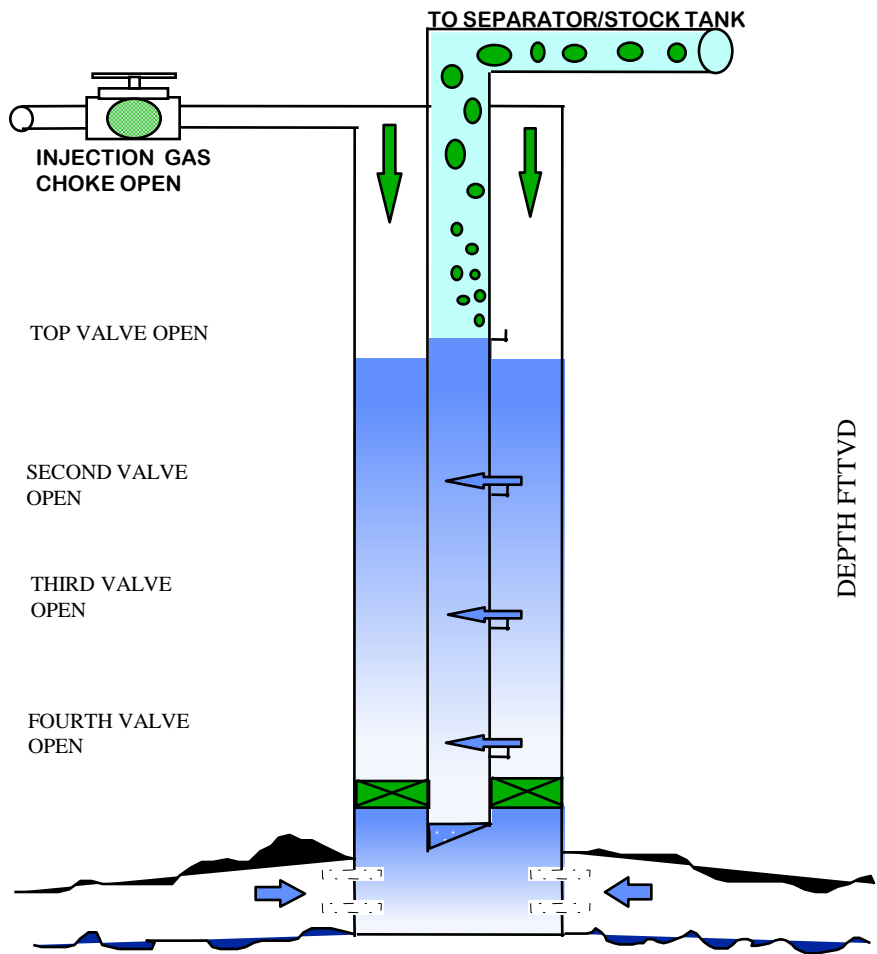


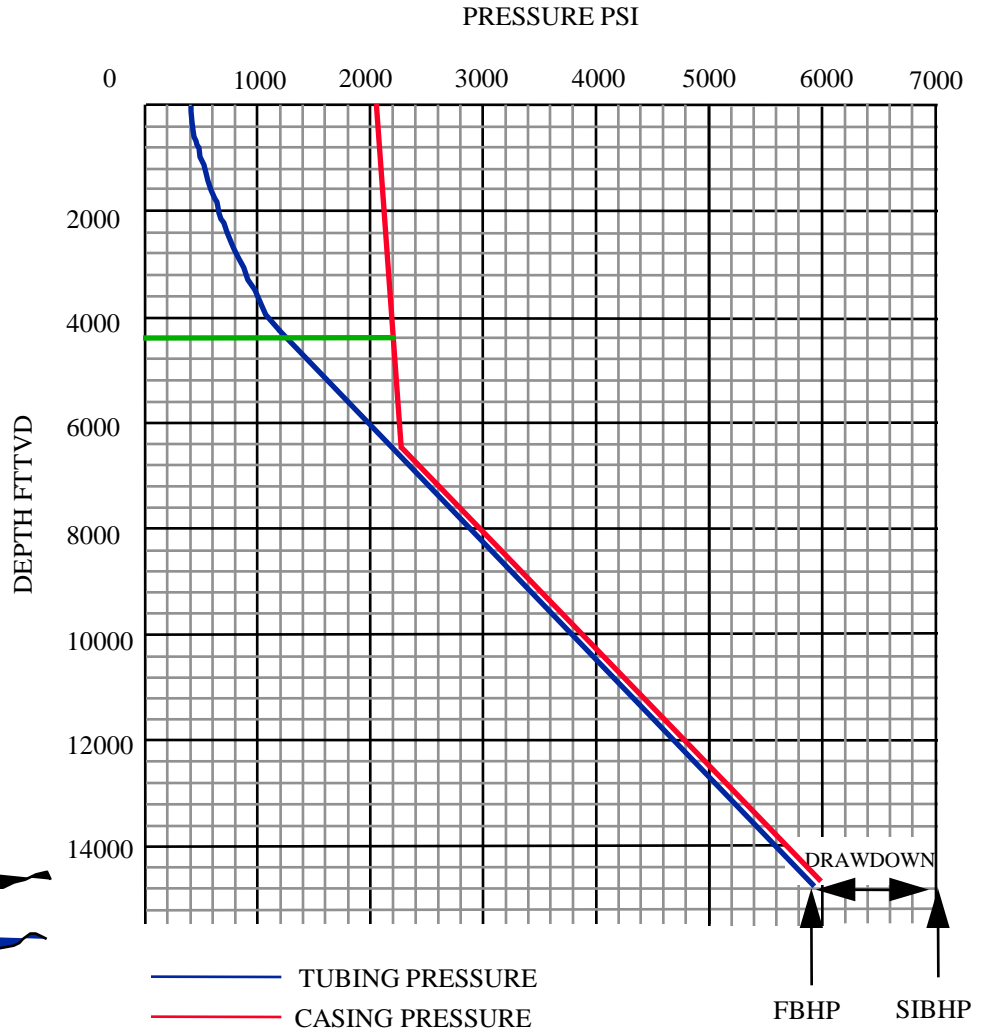
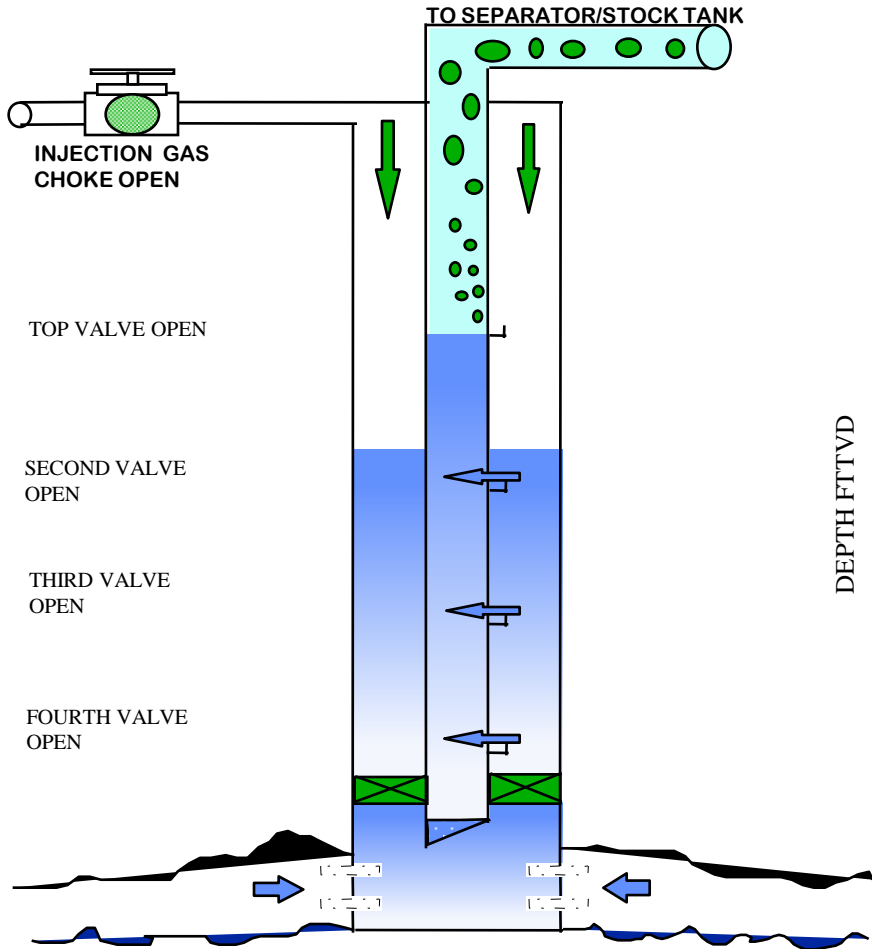


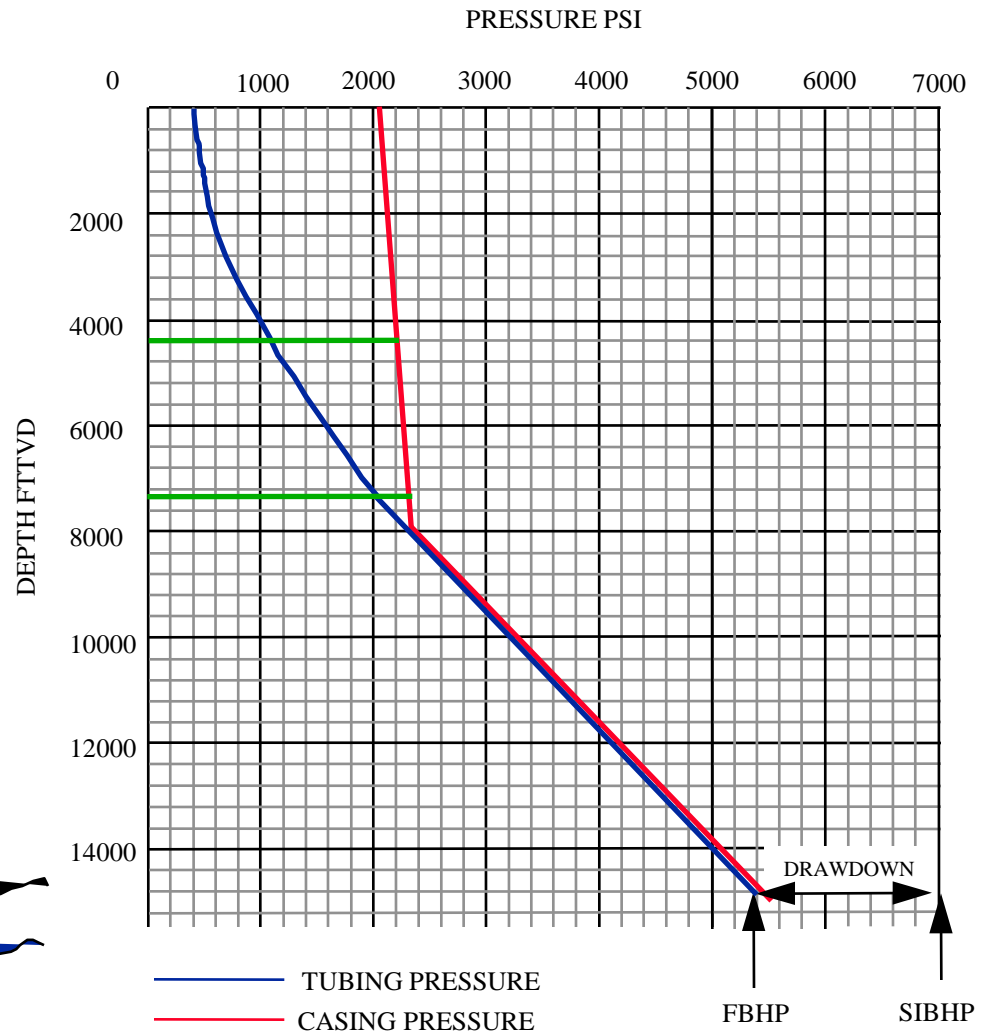
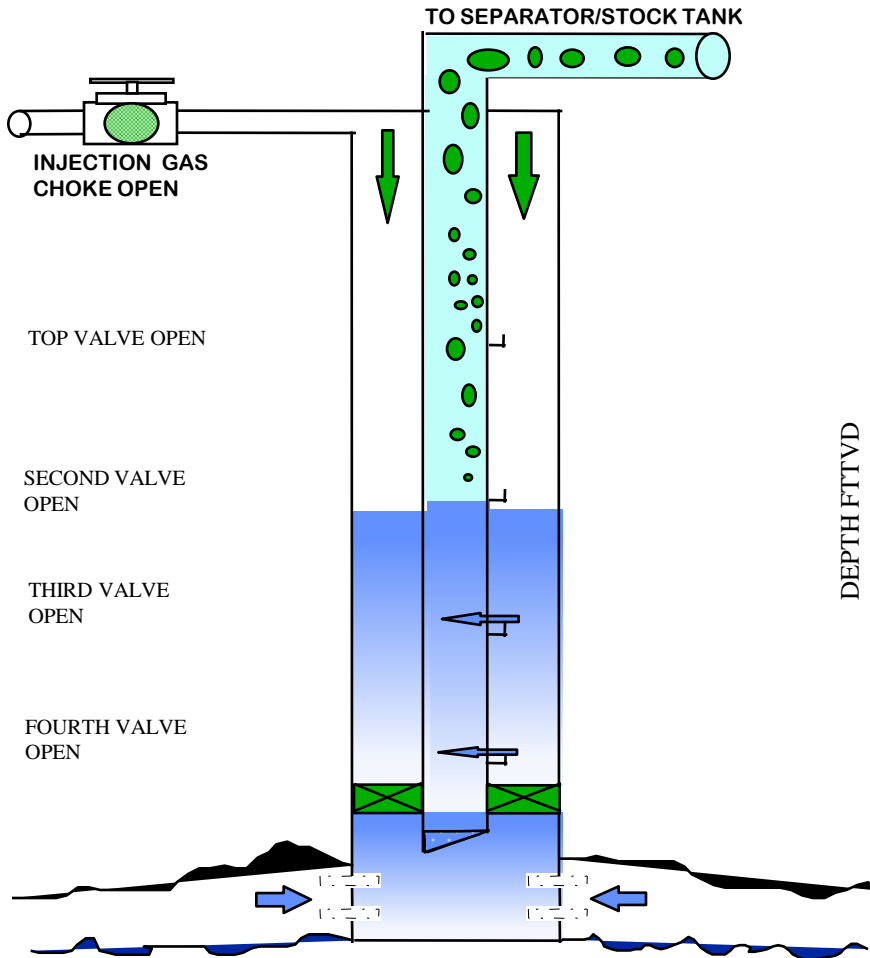


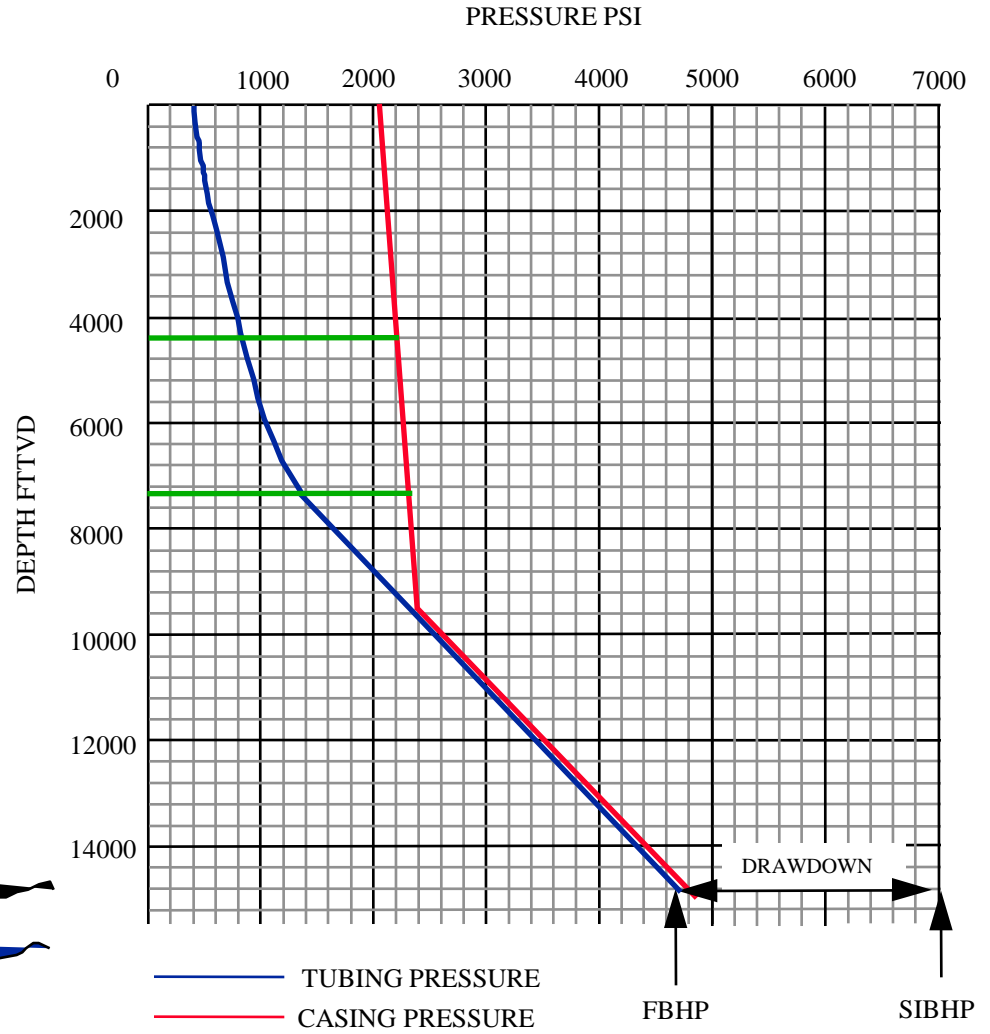
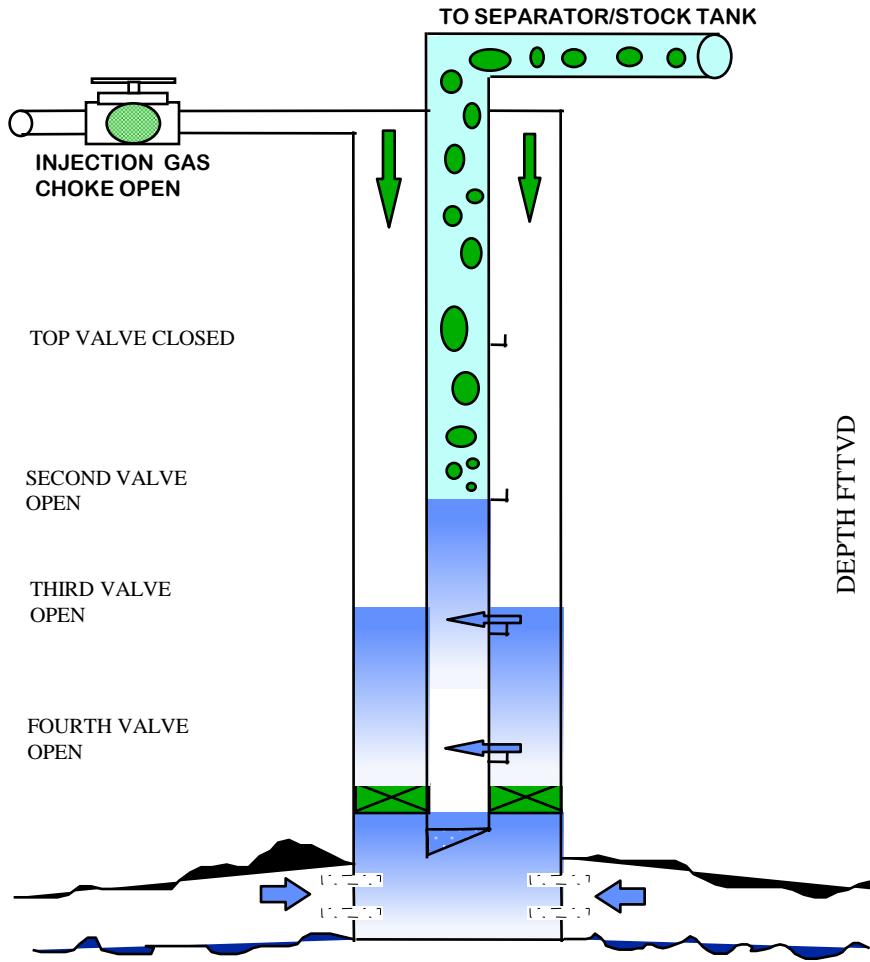


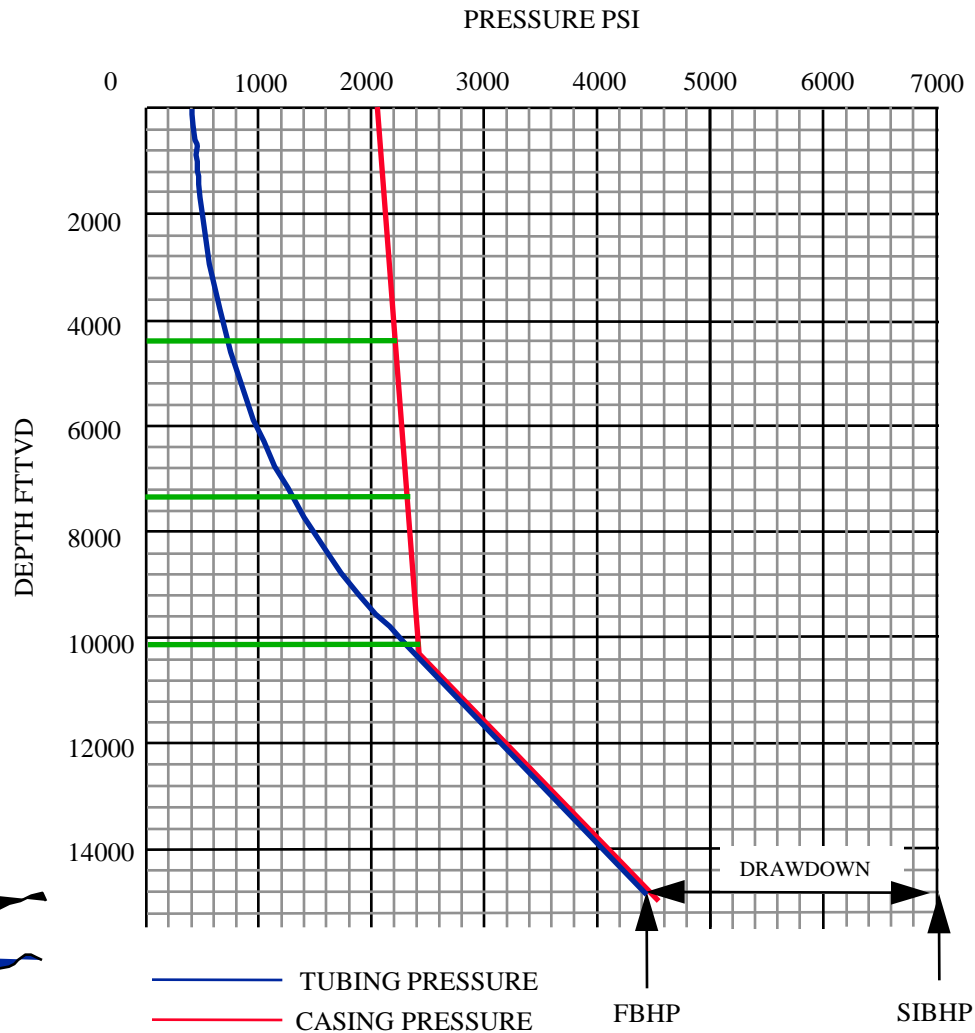
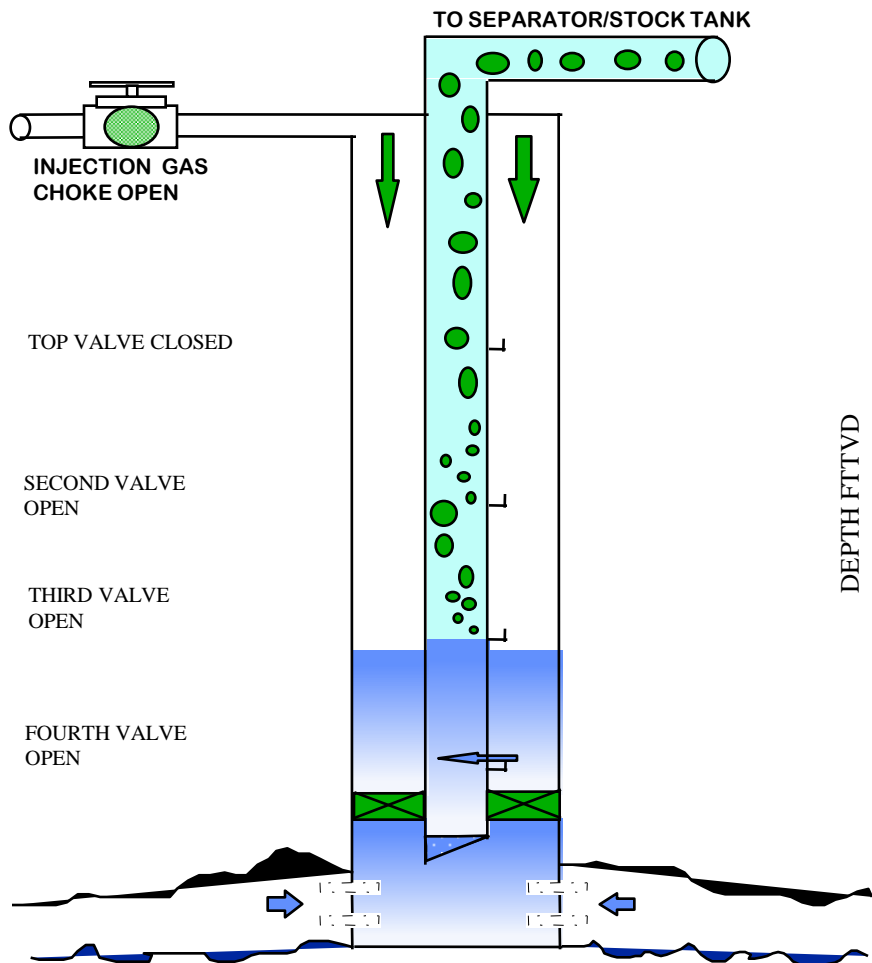


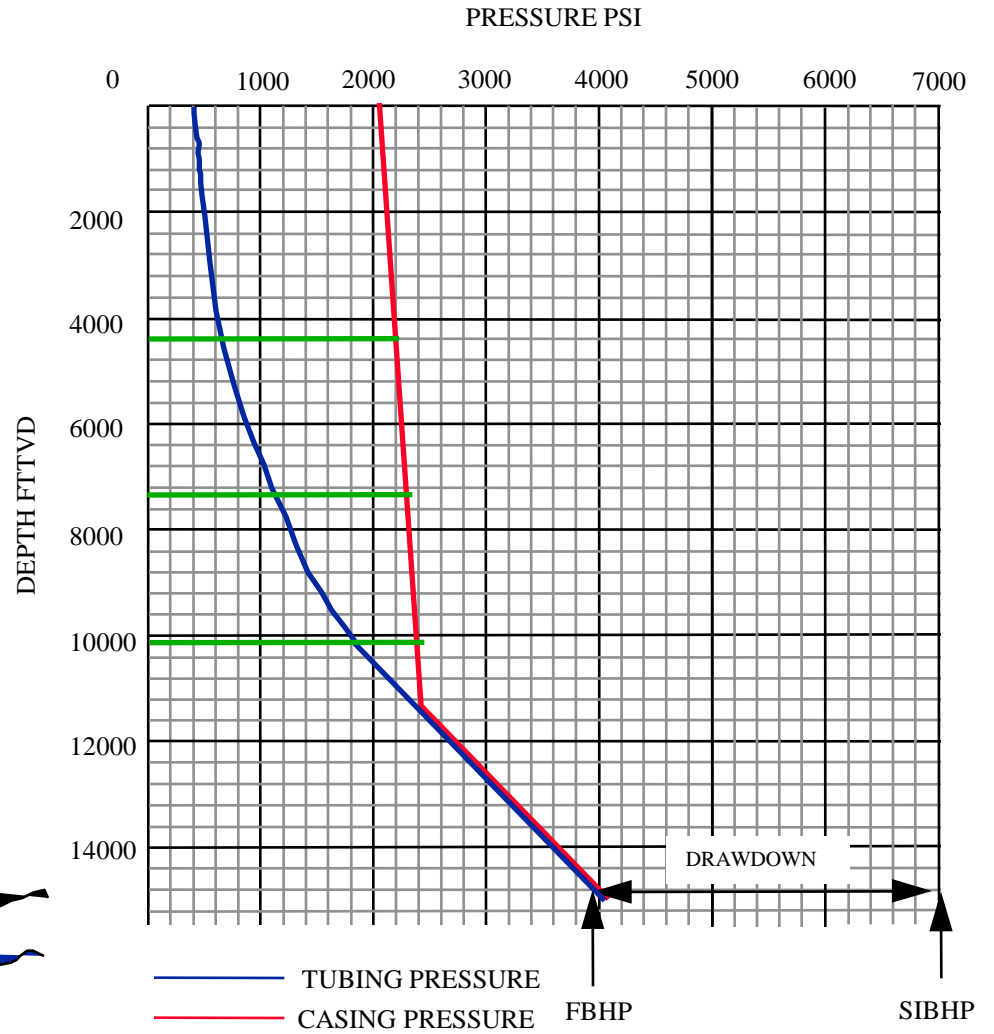
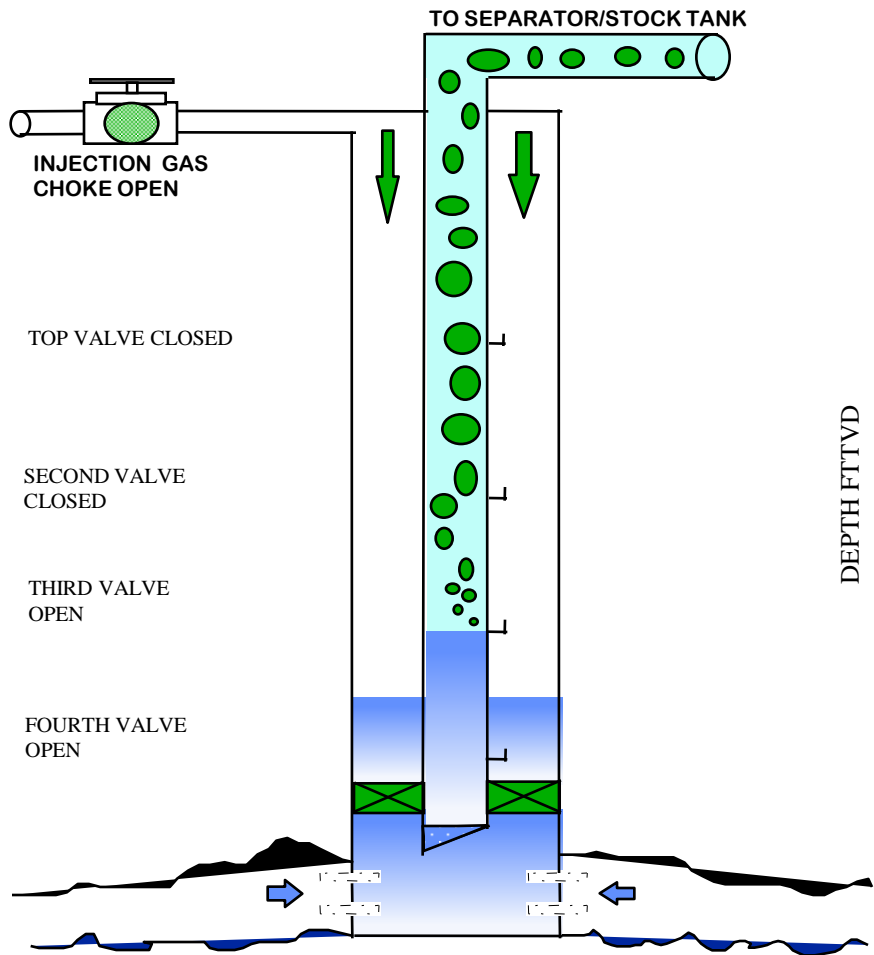




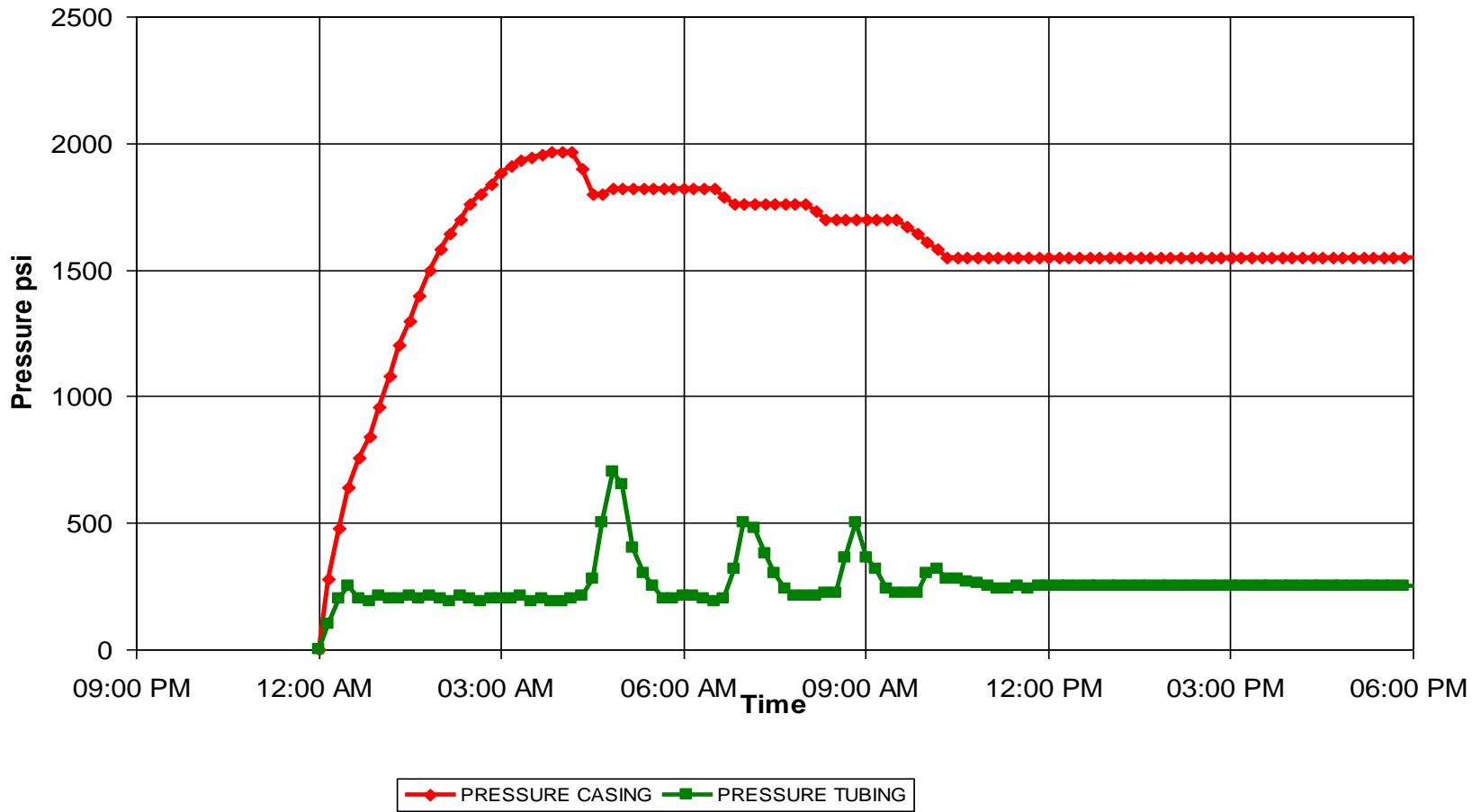








**FIGURE 1-21: Example of the Unloading Sequence
Casing Operated Valves and Choke Control of Injection Gas**



Gas Lift Well Kick-Off

- Note - when unloading all valves open
- Unload well carefully
 - 50 - 100 psi (3.5 bar) per 10 min
 - 1 - 2 bbl per min
- Maximize production choke opening
- Gradually increase gas injection rate
- Monitor well clean up and stability
- Get to target position
- Perform step rate production test
- Optimise gas injection rate