Standards for Oil and Gas Wells

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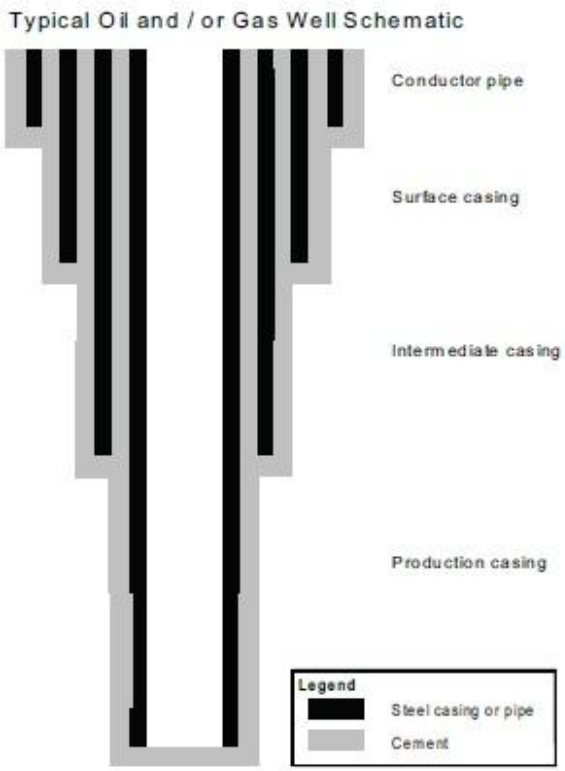
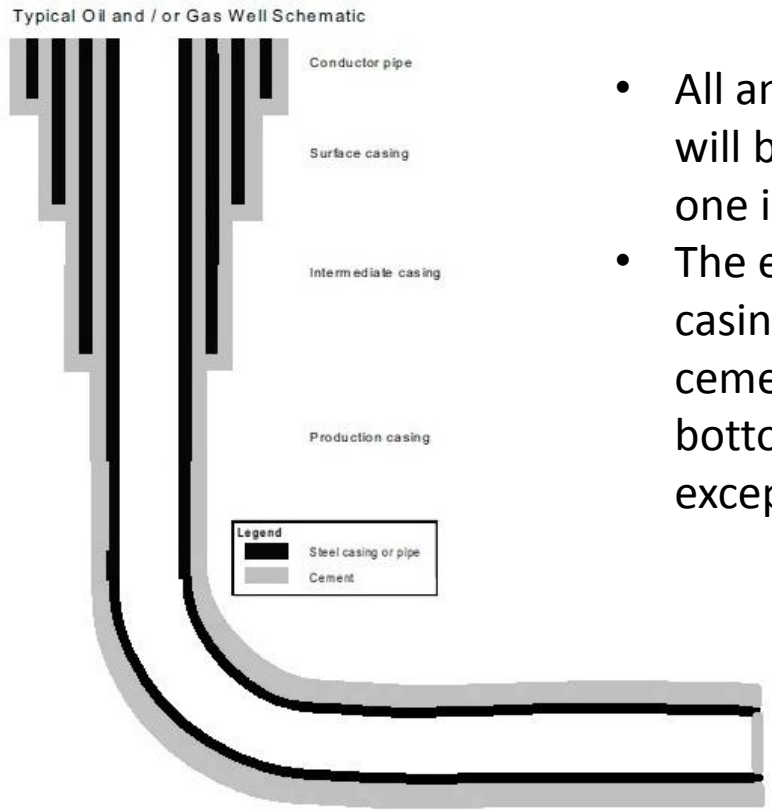
Well Construction Analysis

- Ohio
- Colorado
- Pennsylvania
- North Carolina (15A NCAC 05D rules)
- API Standards

Well Construction





- All annular spaces will be a minimum of one inch.
- The exterior of all casing will be cemented from bottom to surface, except for screens

(Diagrams modified from API Guidance Document HF-1, 2009)

<u>Conductor Casing</u>: 80 ft or auger refusal, whichever is less.
<u>Surface Casing</u>: 100 ft below deepest freshwater zone or 650 ft, whichever is deeper.
<u>Intermediate Casing</u>: Set at depth to stabilize borehole, 200 ft below deepest potable aquifer, or to 1,000 ft bgs, whichever is greater.
<u>Production Casing</u>: Extends from Intermediate casing into the production zone.
<u>Perforated Production Liner</u>: May be affixed to the production casing for oil wells.

Well Borehole & Casing Standards

- Wellbore must be consistent with manufacturer's recommendations for float equipment, centralizers, packers, cement baskets, and all other equipment used in the wellbore (Ohio).
- “Casing shall be so centralized and the annulus of such size that cement can be injected to fill the entire annular space behind the casing back to the surface” (15A NCAC 05D).
- Drilling fluids, additives, or other fluids which geochemically degrade source rock or reservoir shall not be used. Refer to published work by N.C. Geological Survey.

Casing Standards

- Casing and casing couplers (must have API stamp)
  - Steel or other approved API material.
  - Manufactured and tested to comply with most recent and relevant API standards (currently specification 5T and 5B).
  - Internal pressure rating 20 percent greater than the maximum anticipated pressure to which the casing will exposed (includes fracturing pressures too).
  - Casing connections: torqued to manufacture's specifications and meet API's most recent and relevant standards, specifications, and practices.
  - New casing requirements or just meet standards?

Centralizer & Hardware Standards

- Ensure centered casing and effective cement circulation.
- Must ensure a minimum cement thickness of one inch around each casing run.
- Must meet most recent and relevant API recommended practices, specifications, and standards.
- Current standards: API RP 10D-2 and API TR 10TR-4.
- Other casing hardware (float equipment, centralizers, cement baskets, wiper plugs, stage tools) shall meet well design objectives and the most recent and relevant API recommended practices or standards.

Cement Standards

- Cement and cement use must comply with all relevant and most recent API and ATSM standards.
- Casing must set undisturbed following cementing for at least eight hours or for the period recommended by API for the specific cement formulation, whichever is greater.
- 15A NCAC 05D .0107 requires cement to set for at least 24 hours, if drilling is to continue. (?)
- Colorado sets compressive strength standards for surface/intermediate and for production casing. (?)
- Ohio: cement to reach compressive strength of 500 lbs/in^2, before drilling plug or initiating a test. (?)

Casing Pressure Testing

- Casing must meet well design & construction requirements
- (Ohio + Colorado) All pressure testing to be done according to relevant and most recent API standards (i.e. API 5CT) and consistent with well design parameters and appropriate to site geological conditions.
- (15A NCAC 05D .0107) Pressure raised equal to casing length (ft) * 0.2, not to exceed 1,500 psi. Check for pressure reduction within 30 minutes.
- Recommend pressure testing for surface, intermediate, and production casing.
- Keep NC language or adopt “generic” language?

Formation Pressure Integrity Test (Mud Weight Determination)

- Performed after the casing pressure test.
- Performed within borehole, at a sufficient depth beneath the casing.
- Performed consistent with well design and site geology
- Performed with a safety margin 20 percent greater than anticipated pressure.
- In accordance with most current and relevant API standards or practices (i.e. API RP 65-2).

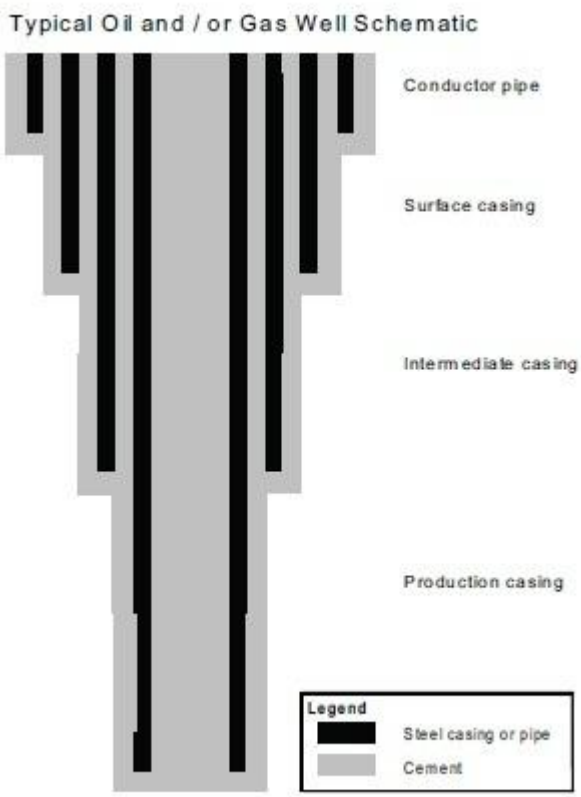
Tubing & Packer Standards

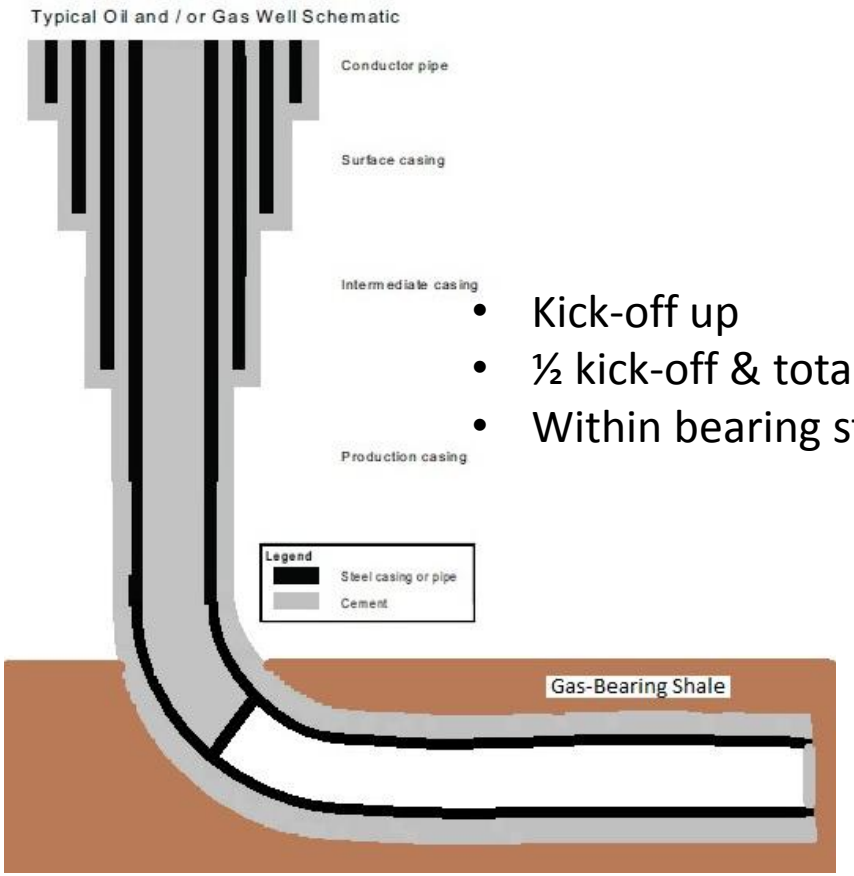
- All tubing and packers must be suitable for well design and site geological conditions.
- Tubing and packers must meet most recent and relevant API standards, specifications, or practices.
- Example: API Specification 5CT/ISO 11960.

Blowout Prevention Equipment

- The operator shall take all necessary precautions for keeping a well under control while being drilled. (Colorado)
- All drilling wells should be equipped with a master gate or equivalent, an adequate blowout preventer, and a properly sized flow line value. "Adequate" shall be taken to mean that consideration has been given to the depth of the test and pressures likely to be encountered at those depths. The entire control equipment shall be in good working condition at all times and shall have been tested to working pressures at least 50 percent above the hydrostatic pressures anticipated in the well. (15A NCAC 05D .0107)
- All equipment should have working pressures capable to handle anticipated pressures and be flame resistant. (Pennsylvania)
- Will require BOP pressure, with results posted at well site for review.
- BOPE compliance with most recent and relevant API recommended practices, specifications, or practices.

Abandonment





- Kick-off up
- ½ kick-off & total length
- Within bearing stratum

Vertical Wells: Cemented from the bottom to the surface.
Horizontal (stratigraphically parallel) Wells: Cemented from production stratum to surface.
Note: Removal of wellhead and casing to plow depth and abandoning.
DENR to receive written notification at least 48 prior.

(Diagrams modified from API Guidance Document HF-1, 2009)

Variance Authority

- Variance granted when:
  - Compelling reason provided
  - Construction of the well in accordance with the rules was not technically feasible.
  - The use of the well will not endanger human health or the environment.
  - Requested in writing.
  - Provided by Department or MEC in writing (?)
  - May require conditions for enhancement.

Dikes and Faults

- Are special provisions or rules needed to address drilling through dikes or faults?
- Will industry practice negate the need for specific rules regarding dikes or faults?

Source: Reinemund, 1955

Wellhead (Item #16)

- (15A NCAC 05D .0107 (i)): Christmas tree fittings or well head connections, flow lines and treating facilities, shall have a working pressure in keeping with anticipated working pressures generated by the well as determined from drillstem tests or other pressure testing procedures *acceptable to the director*.
- Alternate language: "…*in accordance with most current and relevant API standards or practices*."
- Steel well tag:
- Security, fencing:
- Permit on site?
- Requiring pressure gauges?