

CIRP completion insertion and removal under pressure equipment

Insert and retrieve long perforating gun strings under well pressure when surface pressure control equipment is shorter than the gun string

- Measure:**
Engineered perforating gun sizes from 2 in to 4.5 in
- Temperature:**
Rated to 400 degF and for H₂S environments
- Pressure:**
Designed for controlled underbalance
- Mechanical:**
Deployed with snubbing, wireline, slickline, or coiled tubing

Applications

- Performs rigless perforating or reperforating, which typically involves short lubricators, limiting the length of gun string deployed
- Perforates long intervals with controlled underbalance
- Completes multiple perforating runs without killing the well between runs
- Deploys all Schlumberger hollow carrier perforating guns measuring 2 to 4½ in

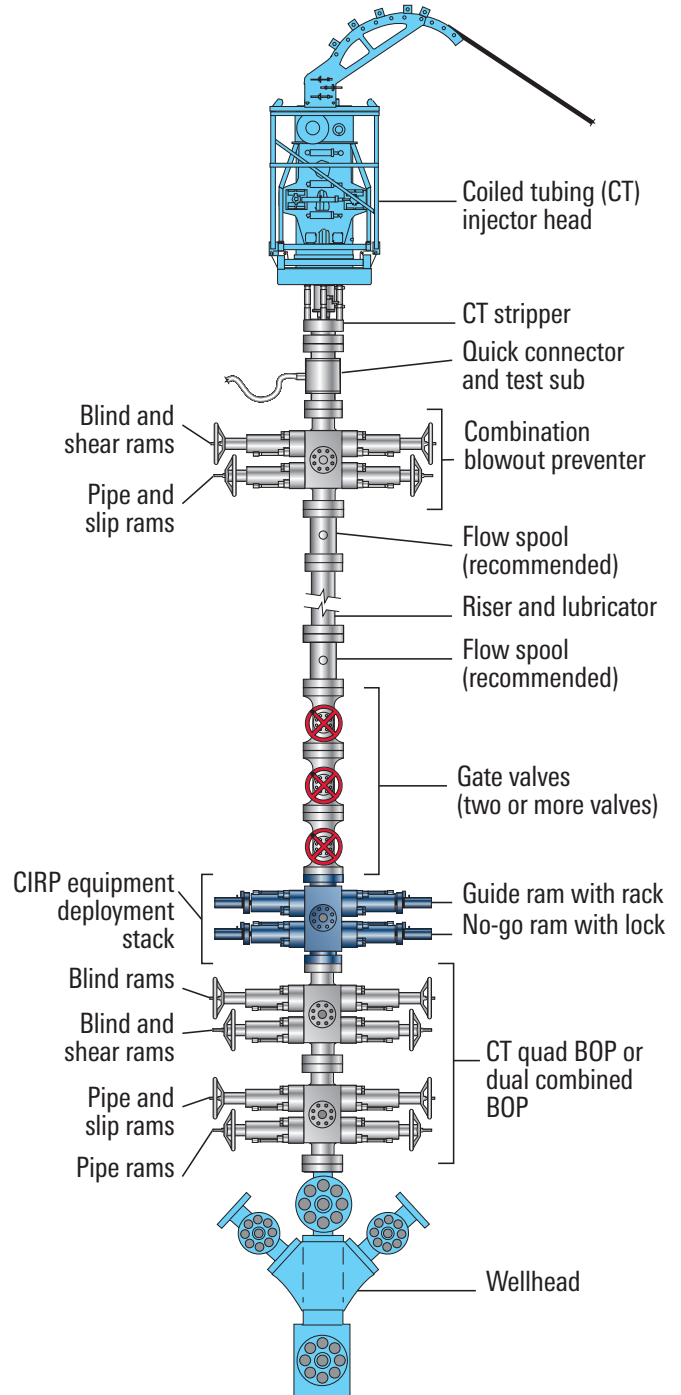
How it improves perforations in well completions

- Creates safer operations due to separately deployed firing head not attached to a perforating gun
- Leaves no formation damage from kill fluids
- Minimizes production loss when reperforating
- Reduces personnel exposure with remote operation

How it works

The CIRP* completion insertion and removal under pressure equipment is used to insert and retrieve long gun strings under wellhead pressure when the surface pressure control equipment, or lubricator, is shorter than the gun string. With CIRP equipment, a long interval can be perforated under the optimum underbalance condition, and then the perforating guns can be retrieved without exposing the formation to damaging kill fluids.

In extended-reach wells, for example, the perforated interval may be longer than the maximum gun string that can be conveyed, mandating multiple runs. The length of the surface lubricator determines the length of the gun string interval between the equipment's two connectors.



CIRP equipment system for CT operations.

CIRP equipment consists of three main components:

- connectors, which tie the gun sections together and provide sealed ballistic transfer
- deployment stack, which locks and unlocks connectors under pressure and supports the disconnected string
- two gate valves, which isolate the lubricator from well pressure to contain well pressure when short gun sections are being picked up or laid down.

CIRP equipment comprises conventional lubricators, two or more gate valves, and a deployment stack with dual actuators. The lower actuator is a no-go ram with a lock to position the connector. The upper actuator is a guide ram with a rack to operate the locking mechanism on the connector. The connector is the mechanical and ballistic link between the gun sections deployed in the lubricator. The rack and lock allow

connection or disconnection of the connectors under pressure inside the lubricator assembly. Gun string segments matching the lubricator length can be installed or removed using the gate valve to close in the well before bleeding off and opening the lubricator during each step of the operation. Closing the gate valve allows the pressure in the lubricator to be bled off. It can then be disconnected for insertion or removal of gun sections. The sealed ballistic transfers seal the loaded guns before they are shot.

The firing head is usually deployed separately, not attached to a perforating gun, when pressure is equalized in the riser. Afterward, it is connected to the gun string with the connector.

Specifications				
Perforating gun size, in	2, 2.25, 2.50	2.50, 2.88, 3.38, 3.50	3.38, 3.50, 4.50	2.88, 3.38, 3.50
Connectors				
OD, in [mm]	2.25 [57]	2.80 [71]	4.0 [102]	2.80 [71] [†]
Temperature rating, [‡] degF [degC]	400 [204]	400 [204]	400 [204]	400 [204]
Collapse pressure, [§] psi [MPa]	20,000 [138]	20,000 [138]	20,000 [138]	20,000 [138]
Shot-to-shot distance, ^{††} in [cm]	46 [117]	46 [117]	47 [119]	51 [129.5]
Makeup length, in [cm]	33.94 [86.2]	33.70 [85.6]	35.33 [89.7]	36.33 [92.3]
Slick joint length, in [cm]	12.0 [30.5]	11.84 [30.1]	12.0 [30.5]	12.0 [30.5]
Tensile strength, [§] lbf [kN]	60,000 [267]	145,000 [645]	245,000 [1,090]	60,000 [267] [†]
Compressive strength, [§] lbf [kN]	19,000 [85]	51,000 [227]	195,000 [867]	20,000 [89] [†]
Nominal rotation of lock sleeve, [°]	15	15	15	15
Rack and lock				
Deployment stack ID, in [mm]	4.06 [103]	4.06 [103]	5.125 [130]	7.06 [179]
Working pressure, psi [MPa]	10,000 [69]	10,000 [69]	10,000 [69] or 15,000 [103]	10,000 [69]
Ram space out, center to center, in [cm]	11.5 [29.2]	11.5 [29.2]	11.5 [29.2]	14.5 [36.8]

[†] NACE MR0175 qualified for H₂S.

[‡] For 100 h, temperature rating can be increased with special seals.

[§] Collapse pressure rating is at 67% of yield strength; tensile and compressive strengths are at yield strength.

^{††} Nominal shot-to-shot distance; exact distance depends on shot density and phasing option of gun.