Flow-Line Heaters

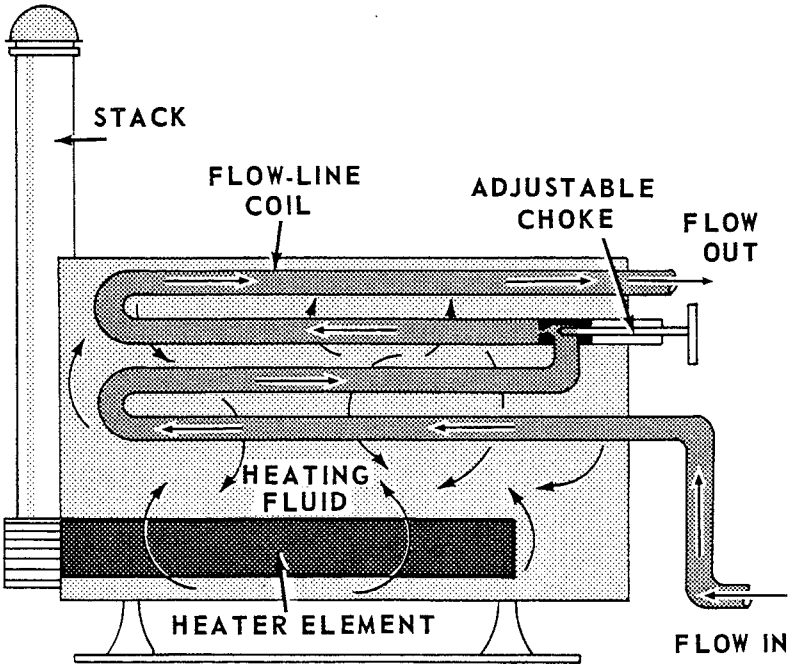
135. In many wells, surface chokes are protected by a *line heater.*

The heater increases the _____ of the fluid in the line.

136. The pressure drop across a choke cools the fluid and may cause hydrates or paraffin to deposit out.

Line heaters help prevent _____ and _____ from plugging the choke.

137. Here is a diagram of a line heater.



The heater is a tank filled with hot _____ that circulates.

138. A gas burner keeps the fluid (usually water) _____.

139. Fluid from the well is carried through a _____ of piping.

140. The choke is installed at the _____.

141. Well fluid is heated (before/after/both before and after) it flows through the choke.

142. The *upstream* heating helps prevent _____ and _____ from forming at the choke.

143. The *downstream* heating helps _____ any solids that do form at the choke.

144. Line heaters must be periodically inspected and maintained.

The burner must be supplied with _____.

145. The heater must be filled with _____.

146. The pressure gage at the heater must be checked.

If pressure is rising, the _____ is probably plugging up.

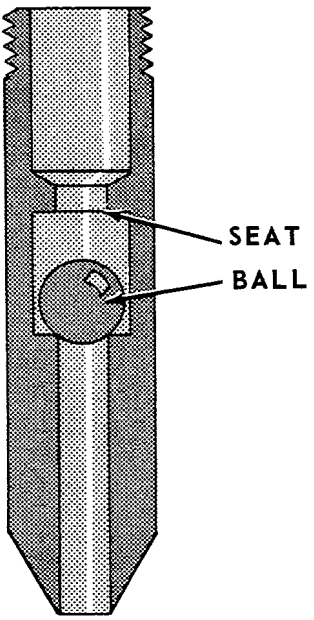
Tubing Valves and Tubing Plugs

147. To install or repair a master valve, flow must be blocked _____ from the valve.

148. A *tubing valve* screws into a mandrel or hanger in the tubing head.

The tubing valve may be used when a _____ valve is installed or replaced.

149. A tubing valve may be a ball-and-seat valve.

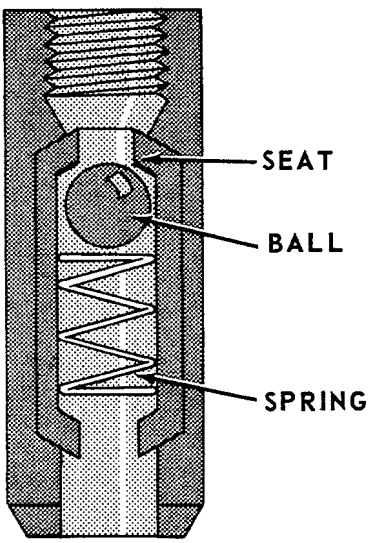


So that tubing pressures will close the valve, the seat must be (above/below) the ball when the valve is installed.

150. A tubing valve is run through the open master valve on an *installing tool.*

The installing tool is used to screw the valve into the mandrel or hanger in the _____ head.

151. A *tubing plug* is set in the tubing.

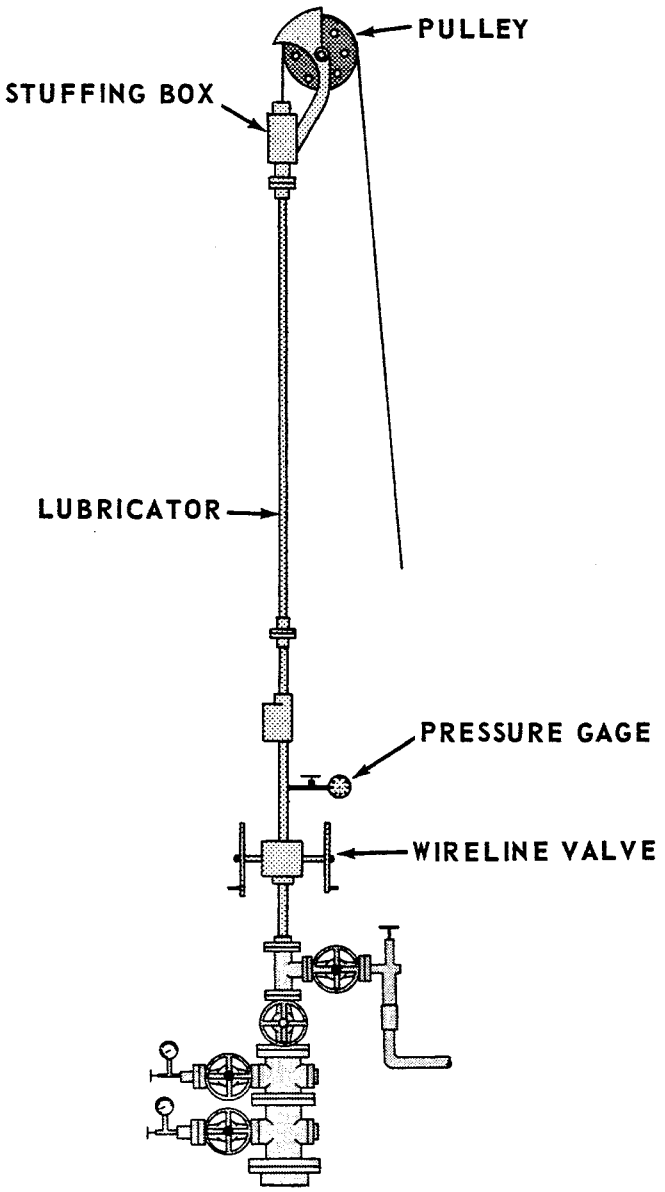


The tubing plug blocks flow (above/below) the tubing head.

152. Like the tubing valve, the tubing plug may use a _____-and-seat to block flow.

153. High tubing pressures force the ball (up/down) on its seat to plug the tubing.

154. Subsurface equipment may be run into the well-bore on a *wire line.*



The wire line is run from a pulley down through a lubricator set on the _____ _____.

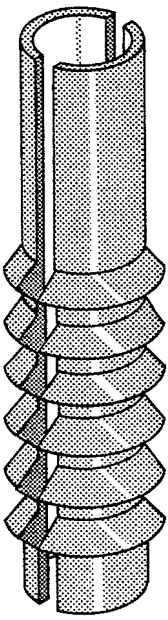
155. The lubricator is made up of short sections of tubing.

To prevent leakage, there is a stuffing box at the top of the _____.

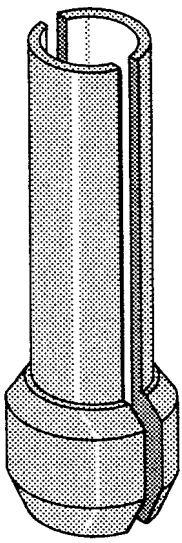
156. Equipment is run into the lubricator while the master valve is closed.

Then, with the lubricator sealed at the top around the wire line, the master valve is _____, and the equipment is lowered into the _____.

157. Subsurface equipment may be set in the tubing by *slips* or *dogs*.



SLIPS



DOGS

Ridged slips hold the equipment by biting into the _____ wall.

158. Dogs fit into seating shoes or nipples in the tubing.

Equipment with (slips/dogs) can be set at any depth.

159. Equipment with dogs must be set where there is a _____ shoe or nipple in the tubing.

160. Subsurface equipment may also be *sealed* with rubber cups to prevent _____ around the equipment.

161. A tubing plug is run in on a wire line.

The tubing plug is set by _____ or _____ on the plug.

162. A tubing *valve* is _____ into the tubing head.

163. Wireline-running equipment is not needed to install the tubing (valve/plug).

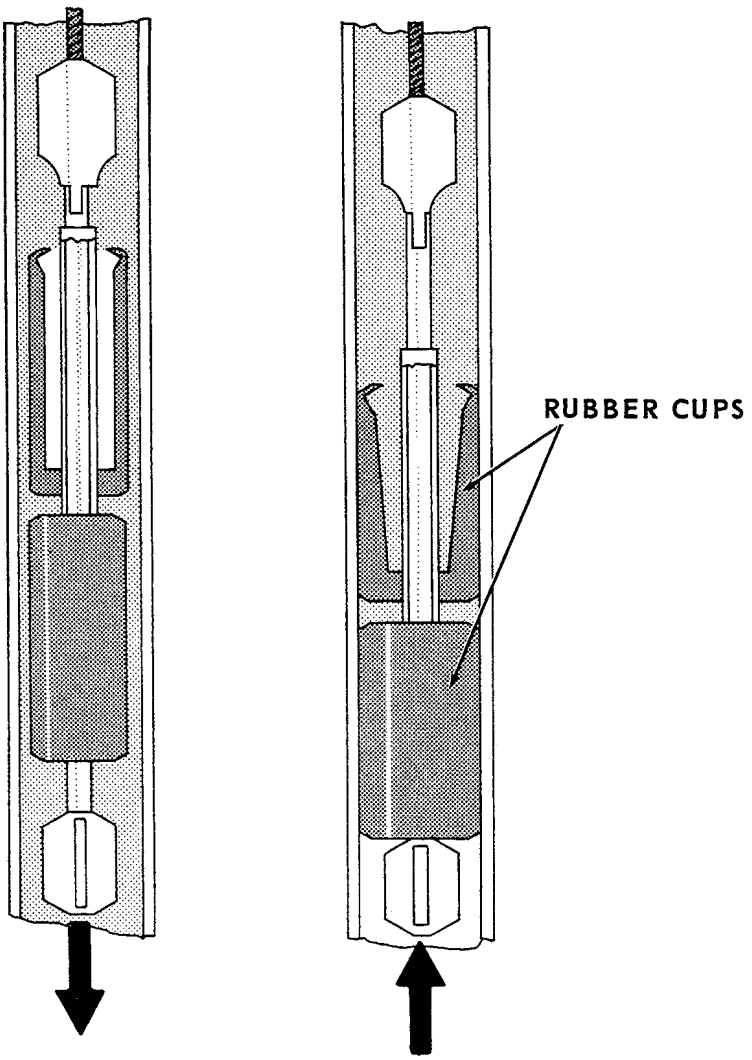
Swabbing Tools

164. To run or pull tubing, the well must be *killed* by filling the tubing and annulus with heavy muds or fluids.

High-density fluids prevent flow from the reservoir by (increasing/decreasing) hydrostatic bottom-hole pressures.

165. Before the well can flow again, these dense fluids must be _____.

166. A *swabbing tool* is run on a wire line through the Christmas tree.



While the tool is being run, the cups are (retracted/expanded).

167. When the tool is pulled up, the cups fill and _____ the fluid upward.

168. When tubing is being run or retrieved, the well must be (shut in/plugged/killed).

169. In wireline operations, flow is blocked by the stuffing box on the _____.

170. The well (must/need not) be killed to run or retrieve wireline equipment.

PACKERS

171. Suppose you are running a packer into a well-bore.

The OD of the packer must be (larger/smaller) than the casing ID.

172. But the packer ID must be as large as the _____ ID.

173. A packer (can/cannot) be run into the well-bore inside the tubing.

174. A packer must be set in place _____ tubing is run, or tubing must be _____ to install a packer in the well.

175. Or, the packer can be run in *on* the tubing string.

A wireline-run packer is run in (before/after) tubing is installed.

176. A tubing-run packer is run in _____ the tubing.

177. After the packer is run, it must be *set,* or locked in place.

A wireline-run packer is set on the wall of the _____ _____ before tubing is run.

178. Wireline-run packers are usually set with a *permanent* seal to the casing walls.

Wireline-run packers are designed to be (permanent/ retrievable) packers.

179. A tubing-run packer is made up as part of the _____ string.

180. Many tubing-run packers can be pulled by pulling the _____.

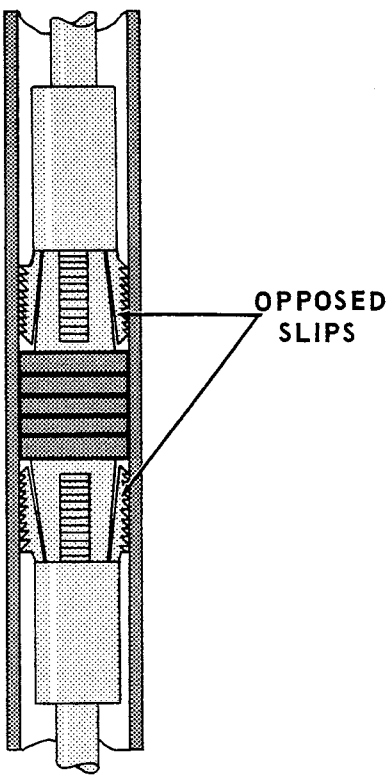
181. Tubing-run packers may be permanent, or they may be *retrievable* packers.

A retrievable packer is usually run on (a wire line/ tubing).

182. Packers run on a wire line are almost always _____ packers.

183. Packers run on tubing may be either _____ packers or _____ packers.

184. Here is one way a permanent packer may be set.



This packer is set by forcing opposed _____ over two wedges.

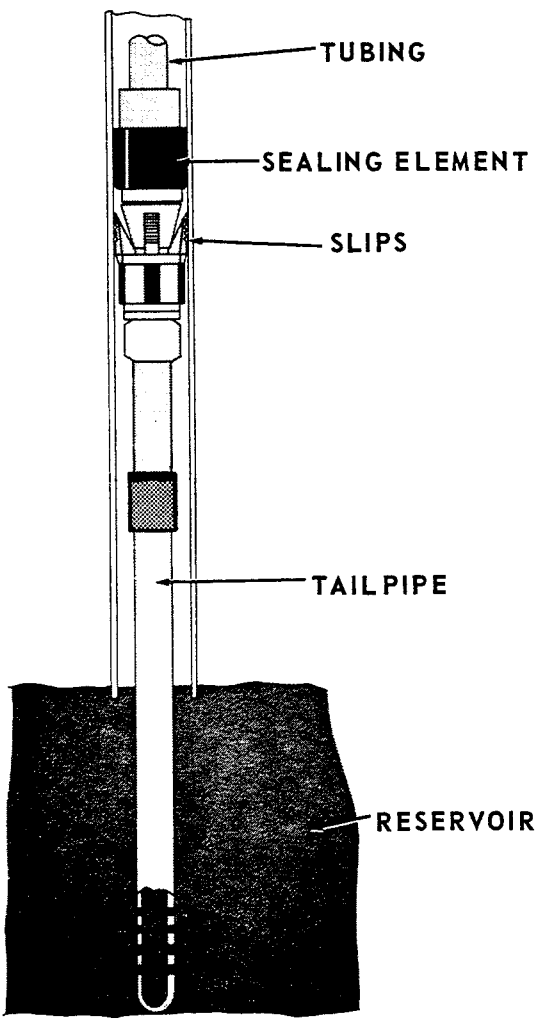
185. The upper slips help keep the packer from being pushed up by bottom-hole pressures.

The lower slips help keep the packer from moving (up/down).

186. While the packer is being run, the slips are (pushed out/held in).

187. The packer is set when the slips are forced to bite into the wall of the _____ _____.

188. Or, the packer can be set on a *tailpipe*.



This tailpipe extends down to the _____ of the well.

189. So that fluid can enter the tubing, the tailpipe has _____.

190. The weight of the _____ on the packer helps to hold the packer in place.

191. Some wells are completed with a casing that does not extend all the way down through the reservoir formation.

In these "open-hole" completions, a tailpipe on the _____ helps to protect the well-bore.

192. A *hook-wall* packer is set by slips biting into the _____ _____.

193. When pressure differences in the well are great enough, efficient production can be obtained with a short *tubing* string.

Then a (packer and tailpipe/hook-wall packer) would be more practical.

194. Most packers in use today are _____-wall packers.

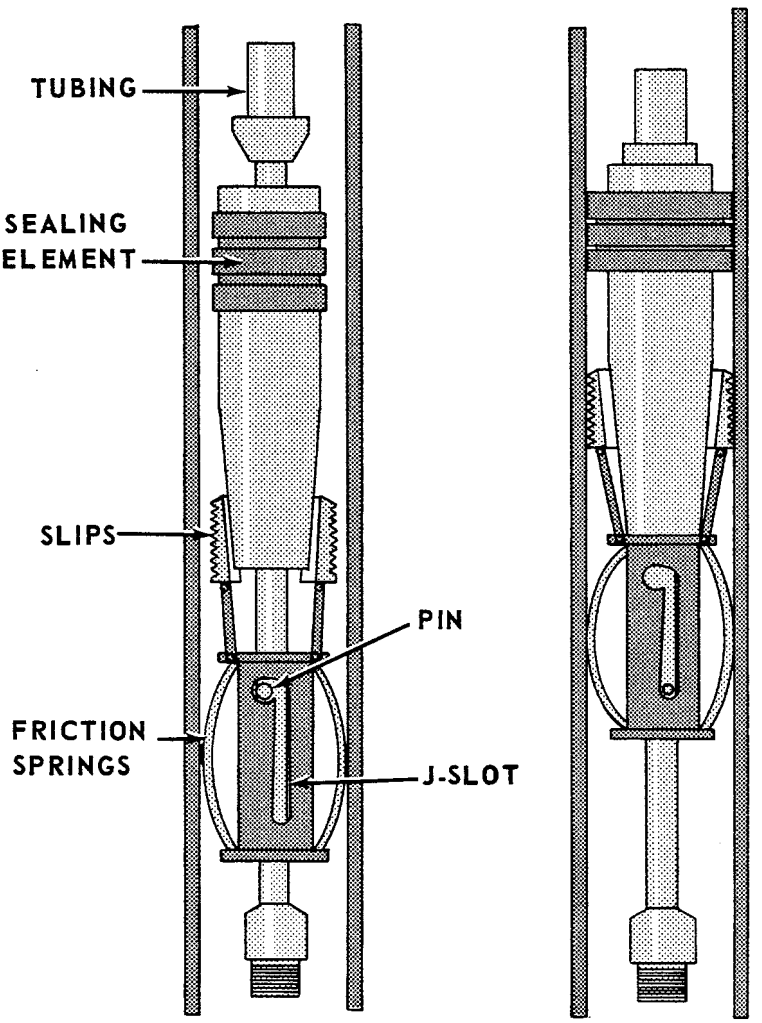
195. Most packers are also retrievable packers.

At different times, a retrievable packer (can/cannot) be used in different wells.

196. A retrievable packer also can be raised or lowered in the _____ as needed.

197. Since packers are expensive, most packers are designed to be _____.

198. Here is one kind of retrievable hook-wall packer.



This packer has a _____ element, a set of _____, and _____ springs.

199. The slips are used to hook the packer to the _____ of the casing.

200. While the packer is being run, the pin in the J-slot holds the slips in.

After the packer is run, the tubing is rotated to drop the _____ in the J-slot.

201. Then the _____ are free to move out against the casing.

202. In this packer, the slips are set by (raising/lowering) the tubing.

203. The weight of the _____ on the packer holds the packer set.

204. To set a packer with a tailpipe from the surface of the well, it is also the _____ that is pushed down.

205. A packer that is set by lowering the tubing is set in *compression.*

Pushing down on the tubing _____ the setting device in the packer.

206. Packers also have *sealing elements* to prevent _____ around the packer.

207. In a compression-set packer, the sealing element is also expanded when the tubing is _____.

208. Or, compression-set packers are both set and _____ by compressing the tubing.

209. When the packer is set and sealed, some of the weight of the tubing is supported by the _____ casing.

210. And, in some packers, the tubing is also supported at well bottom by the _____.

211. A wall packer is not supported at well bottom.

The wall packer is held by slips wedged between the _____ and the _____ _____.

212. A compression-set wall packer is held in place by pressure from (above/below) the packer.

213. But, in many wells, bottom-hole pressures may be _____ than the weight of the tubing can overcome.

214. Then a compression-set packer may be _____ out of place by bottom-hole pressures.

215. When the J-slot and other setting mechanisms of a compression-set wall packer are *reversed,* the packer can be set by applying pressure (under/above) the packer.

216. Then the packer would be set by (raising/lowering) the tubing.

217. A *tension-set* packer is set by tension or stretch between the packer and the tubing.

Or, to set a packer in tension, the tubing is _____ _____.

218. When a packer is set in tension, high bottom-hole pressures (can/cannot) release the packer.

219. Increased bottom-hole pressure sets the packer tighter in place if the packer is set in (compression/tension).

220. Suppose you pull tubing in a well that has a packer set in compression.

Pulling the tubing will probably (release/set) the packer.

221. The packer may need to be released *before* tubing can be pulled if the packer is set in tension.

Trying to pull tubing with a tension-set packer could just _____ the packer in more tightly.

222. A well-service operator must always be told whether the packer in a well is set in _____ or in _____ before he starts operations.

223. Packers set in tension or compression are *mechanical packers.*

They use _____ or dogs, and rubber _____ elements to hold the packer in place.

224. Slips hold a piece of equipment by (mechanical/hydraulic) force.

225. A packer can also be set by increasing fluid pressure inside an inflatable sealing element.

A packer that is set by high-pressure fluid is a (mechanical/hydraulic) packer.

226. Hydraulic packers are usually set by applying external pressure to the tubing string.

Applying external pressure to the tubing string causes the sealing element inside the packer to (expand / contract).

227. The sealing element in a hydraulic packer is easily contracted again.

Hydraulic packers (are / are not) retrievable packers.

228. Retrievable packers may be:

set with a tailpipe or sealed to the casing _____;

set in _____ or set in _____;

mechanical packers or _____ packers.

229. A packer is installed partly to keep casing pressures _____.

230. But bottom-hole pressure under the packer is usually very _____.

231. Since retrievable packers are made to be moved, they (may/cannot) be affected by pressure differences.

232. A *permanent* packer cannot be _____ once it is set.

233. When the packer is exposed to very great pressure differences, a (retrievable/permanent) packer is usually more practical.

234. Permanent packers are sealed between the walls of the tubing and the _____ _____.

235. Since the tubing string may need to be pulled, the seal between a packer and the tubing is always a (permanent/ retractable) seal.

236. All permanent seals are made to the wall of the _____ _____.

237. A permanent packer is set with a special mechanical, hydraulic, or electric *setting tool.*

The setting tool makes a permanent seal between the packer and the _____ _____.

238. Suppose a packer is run into the well-bore on a wire line.

The tubing (is already/is not yet) run.

239. Before tubing is run, the packer may be wireline-run and sealed to the casing walls with a setting tool.

The setting tool makes a (permanent/retractable) seal.

240. Most wireline-run packers are _____ packers.

241. But not all permanent packers are wireline-run.

Some permanent packers are run in on _____.

242. The permanent packer may be set with a retractable seal on the tubing string.

Then seals are run on the _____ to seal off the bore of the packer.

243. Permanent packers are also called *drillable* packers.

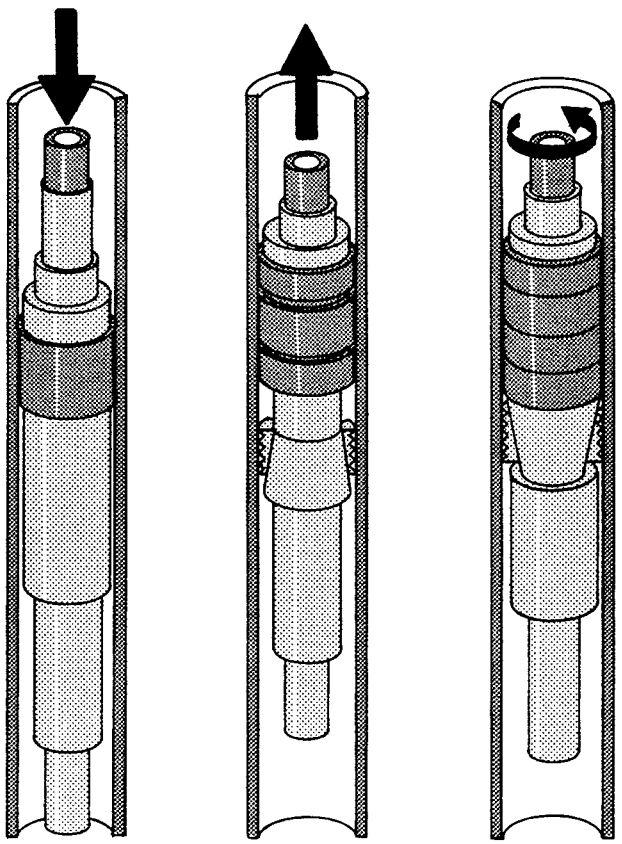
To remove a permanent packer from the casing, the packer is often _____ out.

244. Packers set high in the well-bore may need to be moved.

Since permanent packers cannot be moved, they are usually set (high/deep) in the well-bore.

245. A packer set high in the well-bore is usually a (permanent/retrievable) packer.

246. Let's review by looking at three ways a packer might be set.

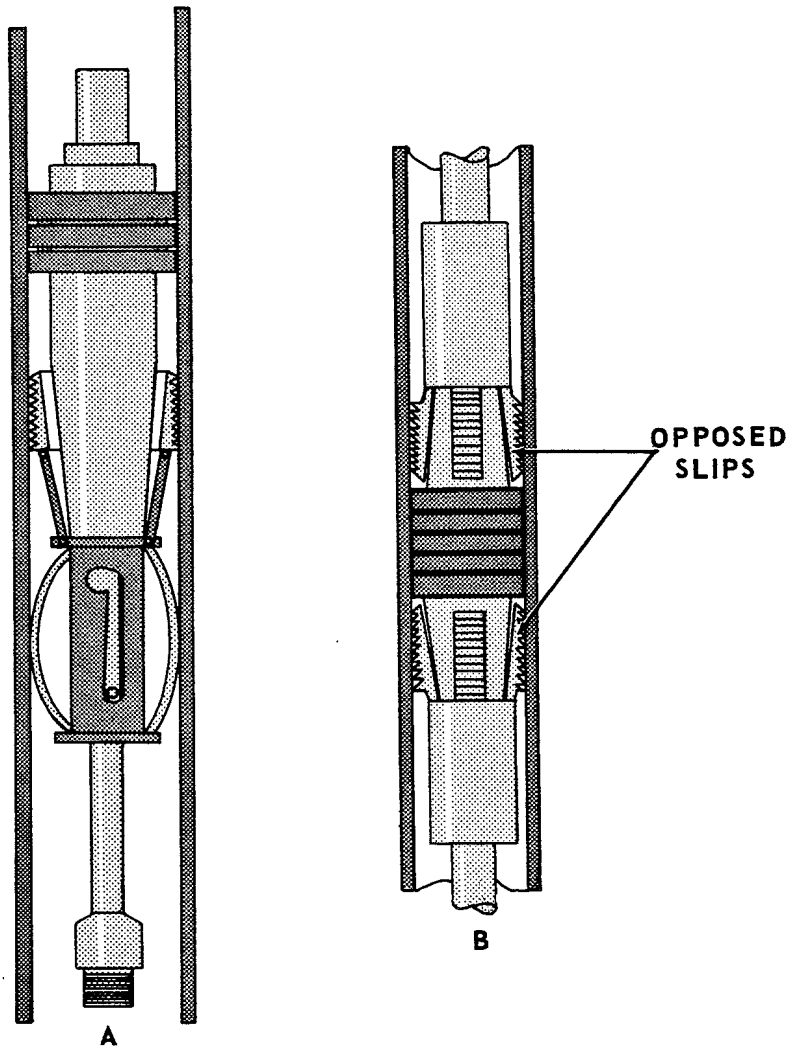


The packer in well A is set in _____.

247. The packer in well B is set in _____.

248. Since each of these packers can be set or released by moving the tubing, they are all _____ packers.

249. Here are two packers that were run in on tubing.



The retrievable packer is (A/B).

250. Much wireline-run equipment is retrievable.

But, wireline-run packers are usually _____.

251. Wireline-run packers are usually set with a permanent seal to the walls of the _____ _____.

The packer is run on the wire line (before/after) tubing is run.

252. Tubing-run packers may be either _____ or _____.

BOTTOM-HOLE CHOKES AND REGULATORS