**The Lease Pumper's Handbook**

**Chapter 14**
**Well Testing**

**Section D**

# GAUGES AND GAUGE CALIBRATION

## D-1. Quality of Pressure Gauges.

Pressure gauges are available in many different sizes, price ranges, and styles (Figure 1). They can vary from very cheap to very expensive. The most important considerations when purchasing a new gauge are what level of accuracy is needed, how much vibration and shock the gauge be subjected to, and what will be done with the reading after it is obtained.

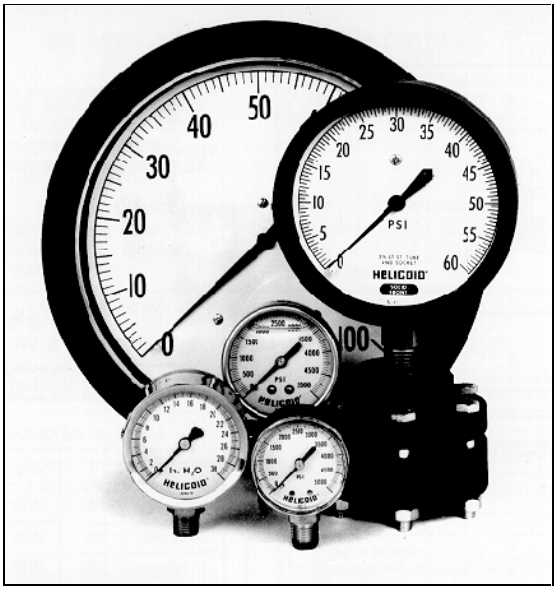


**Figure 1. Typical gauge assortment.**
*(courtesy of Helicoid Instruments)*

Simply glancing at a gauge when it is in service to determine the approximate pressure on a line is not particularly critical. Even inexpensive gauges can provide an approximation. However, more accurate and, thus, expensive gauges are required for. well tests where pressure will be reviewed closely to determine if the reservoir has had any pressure drop in the past year and accurately know how many pounds of pressure are involved. This is an instance when the pumper should use the most accurate gauge available—a test gauge that can be calibrated. If a pressure gauge is subjected to pounding by a high-pressure pump, such as a triplex, where the hand of the gauge fluctuates rapidly back and forth, an adjustable vibration dampener can be installed ahead of it to reduce the shock and extend the life of the gauge.

## D-2. Gauge Construction.

Historically, the most common style of gauges in the oil fields had a bourdon tube on the inside to transmit the pressure to the hand. The second style is operated by exerting pressure against a spring.

The bourdon tube (Figure 2) is a long, curved, flat tube that extends about two-thirds to three-fourths of the distance on the inside of the gauge. It has a pivot point in the center of the gauge for attaching the hand, and the end of the bourdon tube is connected to the pivot with a lever. The inside of the tube is shorter than the outside and, as pressure is applied to the inside, the tube moves to the outside at the end. This action moves the hand of the gauge in a ratio to the amount of pressure applied.

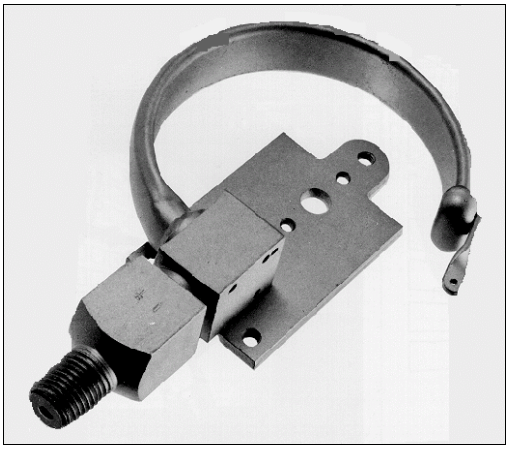

**Figure 2. A bourdon tube.**
*(courtesy of Helicoid Instruments)*

## D-3. Safety Gauges.

When working with high pressure, the pumper should use a gauge with safety provisions and possibly improved glass in the face. A good quality safety gauge will have a rubber plug mounted in the back that can blow out if the tube should rupture. Also, safety glasses should be worn when opening a gauge to eliminate the possibility of blowing broken glass into the face and eyes. The pumper should stand slightly to one side, never directly in front of a gauge when opening it.

**Liquid-filled gauges.** The liquid-filled gauge is a sealed gauge filled with transparent liquid behind the glass or plastic face. Corrosion and oxidation cause serious damage to a gauge that is not sealed. Gauges that are not liquid filled may become hard to read and inaccurate with time.

## D-4. Adjustable Test Gauges.

The pressure gauge used for testing a well is usually a test gauge (Figure 3). This is simply a better quality of gauge that can be calibrated for accuracy.

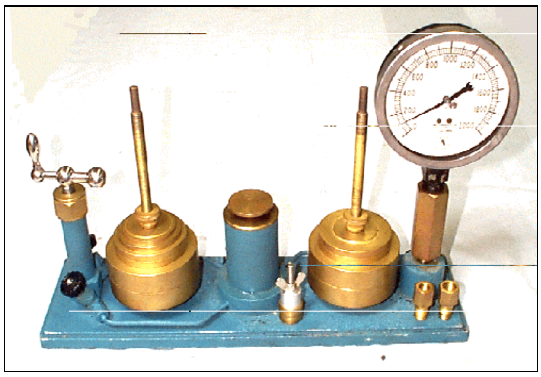

**Figure 3. Gauge and dead weight tester.**

Test gauges have an adjustment screw on the face, side, or back. By pressurizing the gauge to a specific known pressure with a dead weight tester, the adjustment screw can be used to correct any error in the reading. Economy gauges do not have calibration or adjustment capabilities.

Most pumpers carry their test gauges wrapped in a clean soft cloth stored safely in the vehicle. This will be in a specific section of the tool box or even in the glove compartment. It may be necessary to have the gauge re-calibrated by the factory or a laboratory occasionally if the pressure on the test must be exact. The cam and roller geared gauge is a good test gauge because of its proven long life and accuracy.

When purchasing new gauges, it is best to select a gauge with a pressure range where the hand turns to an approximately vertical position or the center of the measurable pressure range. They are usually more dependable when they are correctly selected.

## D-5. Calibrating Gauges and the Dead Weight Tester.

Figure 3 illustrates a gauge tester. To operate the dead weight tester and calibrate the gauge, the procedure on the next page should be followed:

1. Remove the tester cover and loosen the plug that is screwed in where the gauge is mounted on the right side.
2. On the left, close the back black valve.
3. Open the front valve and crank the handle upward. This pulls hydraulic fluid from the center reservoir to the space under the plunger of the crank.
4. Close the front valve and open the back one.
5. Crank the handle downward so that fluid begins to move to the center pedestal stem.
6. Remove the right-hand plug and, when it fills with oil, tighten the gauge into place.
7. Place the correct amount of weight on the center pedestal as the left-hand screw is screwed down so that the weights are lifted to the correct height, and the gauge is then visually checked for accuracy.
8. Use a screwdriver to adjust the hand on the gauge.

**Testing the pressure of the well directly.** A high-pressure hose several feet long with a small diameter is available that will permit connection directly from the dead weight tester to the wellhead. Pressure of the tubing or casing can then be accurately determined directly from the tester without using a gauge in the system. In situations where extremely accurate pressure measurements are needed, this is an accurate method.