

BELL SYSTEM PRACTICES
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PRESSURE TESTING REGULATORS

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1. GENERAL

1.01 This section describes the standard pressure testing regulator (two-stage type), and outlines the methods of testing it as well as the superseded single-stage regulator. The section also covers the devices which may be used to prevent tampering with regulators.

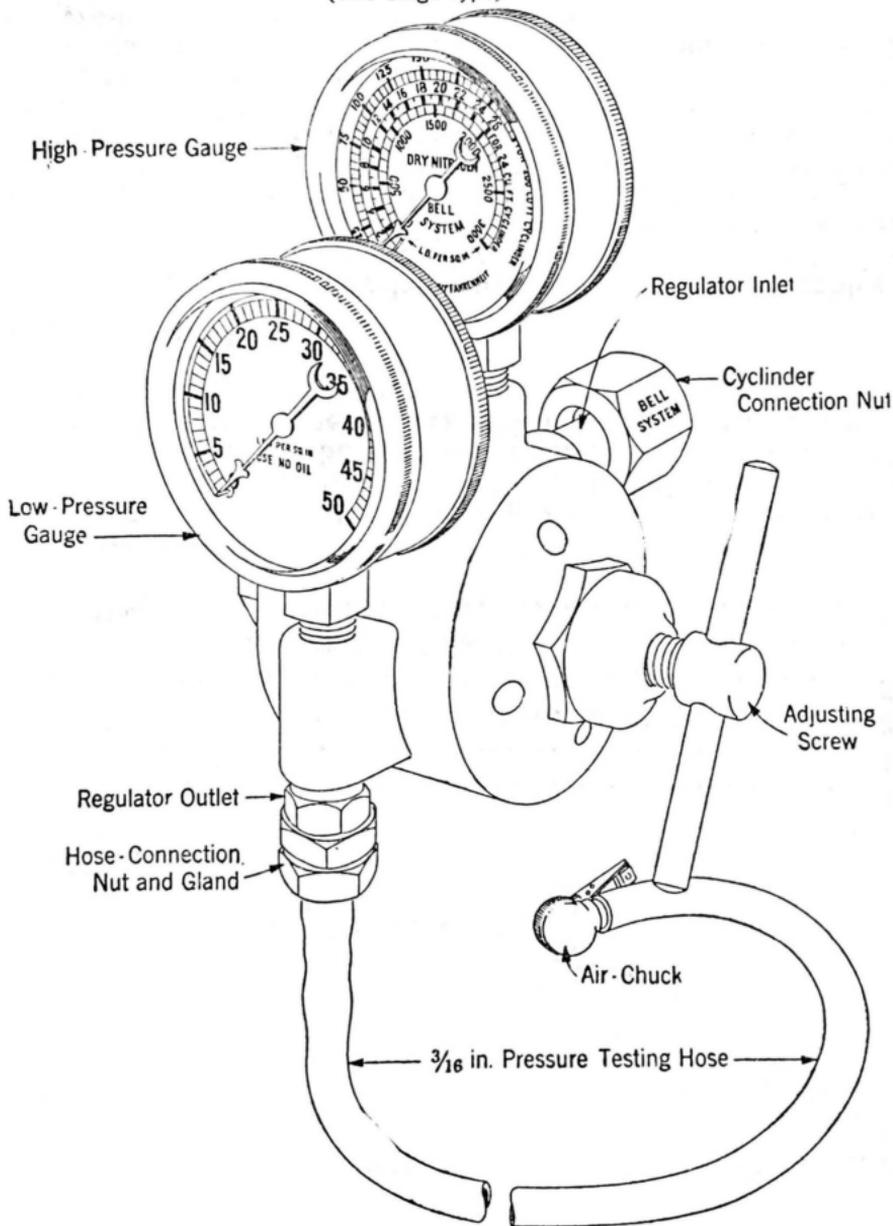
2. DESCRIPTION

2.01 The pressure regulator used to admit gas to cables is an assembly of reducing valves under control of an adjusting screw, together with a safety valve and two gauges. The high pressure gauge indicates the pressure of the gas in the cylinder and the volume of gas (at atmospheric pressure). The low pressure gauge indicates the pressure at which the gas is delivered to the regulator outlet. The standard two-stage regulator can be obtained equipped with a valve instead of the low pressure gauge, to permit reading the outlet pressure with a 3-1/2-inch gauge or mercury manometer.

2.02 There are two types of regulators in general use, which are known as the single-stage and two-stage regulators. In the single-stage regulator, reduction from cylinder pressure to regulator outlet pressure is accomplished by a single reducing valve while in the two-stage regulator the reduction is accomplished in two steps through the medium of two reducing valves.

The standard two-stage regulator is illustrated below. While superseded types of single-stage regulators differ somewhat in appearance, their operation is similar to that of the two-stage regulator.

PRESSURE TESTING REGULATOR
(Two Stage Type)



2.03 Single-stage regulators are satisfactory for flash testing, accelerated charging, and for other operations in which moderate changes in outlet pressure are not objectionable.

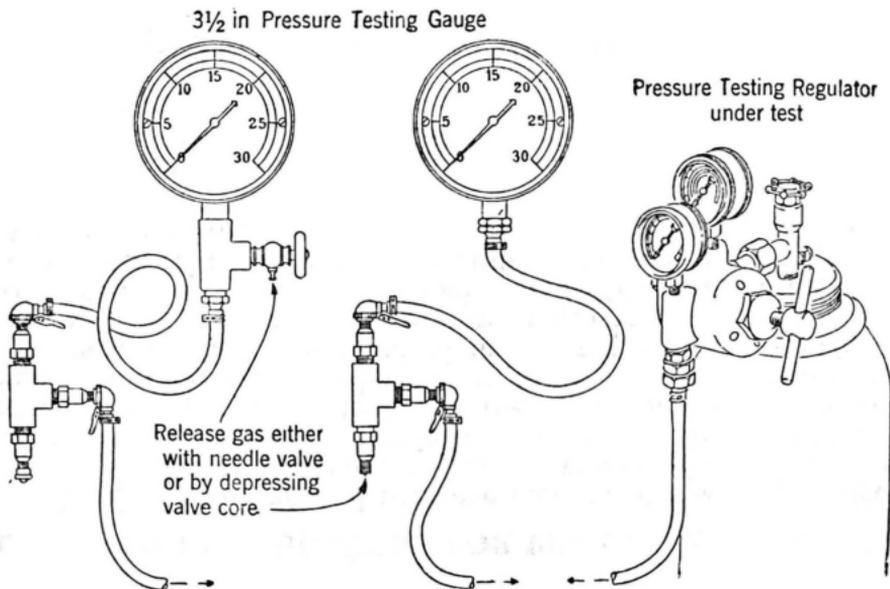
2.04 The two-stage regulator is less subject to pressure creepage and should be used for charging purposes whenever the gas cylinder may remain connected to a cable unattended for a considerable period of time.

2.05 Before attaching the regulator to a cylinder, open the valve on the cylinder slightly to blow out any moisture or foreign matter which may have collected in the gas outlet. Then close the valve. Turn the regulator adjusting screw in a counterclockwise direction until it turns freely in its socket, and then attach the regulator to the cylinder outlet. Attach the pressure testing hose to the regulator hose connection, and to the cable. Open the valve on the cylinder slowly. The high pressure gauge should then register the pressure in the cylinder. Failure of the high pressure gauge to register or the registration of pressure by the low pressure gauge is an indication that the regulator is defective. Such a regulator should be replaced immediately by one in good condition.

2.06 The flow of gas through the regulator, and the outlet pressure are controlled by the regulator adjusting screw. To start the flow, turn the regulator adjusting screw very slowly in a clockwise direction until the low pressure gauge shows the desired pressure. To shut off the gas, turn the regulator adjusting screw in a counterclockwise direction until it turns freely.

3. TESTING REGULATORS FOR PRESSURE CREEPAGE

3.01 When the normal pressure method of charging is used (formerly referred to as overnight charging), it is important to employ a regulator that is free from excessive pressure creepage, and to adjust the regulator pressure before connecting the gas cylinder to the cable. The two-stage regulator is inherently better suited to this purpose and should be used whenever possible. Before any regulator is left connected to a cable unattended it should be tested and adjusted in accordance with the procedure outlined below, to ensure satisfactory operation.



- (1) Connect a 3-1/2-inch pressure testing gauge to the regulator as illustrated above, using the arrangement suited to the apparatus available.
- (2) To make sure that all connections are gas-tight, adjust the regulator to an outlet pressure of 9 pounds, then turn off the gas at the regulator adjusting screw and observe the pressure on the 3-1/2-inch pressure testing gauge for about a half minute. The regulator may then be tested to determine the degree of pressure creepage.
- (3) Turn the regulator adjusting screw until the 3-1/2-inch gauge indicates the approximate charging pressure and observe the gauge to determine whether the pressure rises or "creeps" to a higher value than the original setting. Observe the regulator for a period of about five minutes and if the pressure creepage is found to be in excess of .5 pound during this time the regulator should not be used for normal pressure charging of cables.
- (4) If excessive pressure creepage occurs, the regulator may be defective and should be tested as outlined in Paragraph 4.01 or 4.02, depending on its type.

(5) If the regulator operates satisfactorily from the starting point of pressure creepage, note the reading of the 3-1/2-inch gauge and then open the gas release valve for two or three seconds and close it, noting the change in pressure reading. Repeat this test three or four times. If on closing the valve the pressure does not consistently return to within .5 pound of its original value, the regulator should not be used for normal pressure charging.

(6) If the regulator passes these tests, it should be adjusted to the desired charging pressure before being connected to the cable. On being connected to the cable the outlet pressure will fall slightly, but as the charging progresses the flow of gas through the regulator will diminish and the charging pressure will gradually rise to the original value.

3.02 Because of inherent operating limitations single-stage regulators may not meet the above requirements, and, therefore, they are not recommended for use in connection with the normal pressure method of charging cables. They are, however, satisfactory for flash testing, accelerated charging of cables, and for other purposes in which moderate changes in outlet pressure are not objectionable.

3.03 Before removing a regulator from a gas cylinder, make sure that the cylinder valve is closed and that the regulator adjusting screw is backed out until it turns freely. The diaphragm of the regulator will be weakened if the adjusting screw presses against it when the regulator is not in use.

3.04 All nuts and unions on the regulators should be turned with the special wrench provided for this purpose.

4. MAINTENANCE OF REGULATORS

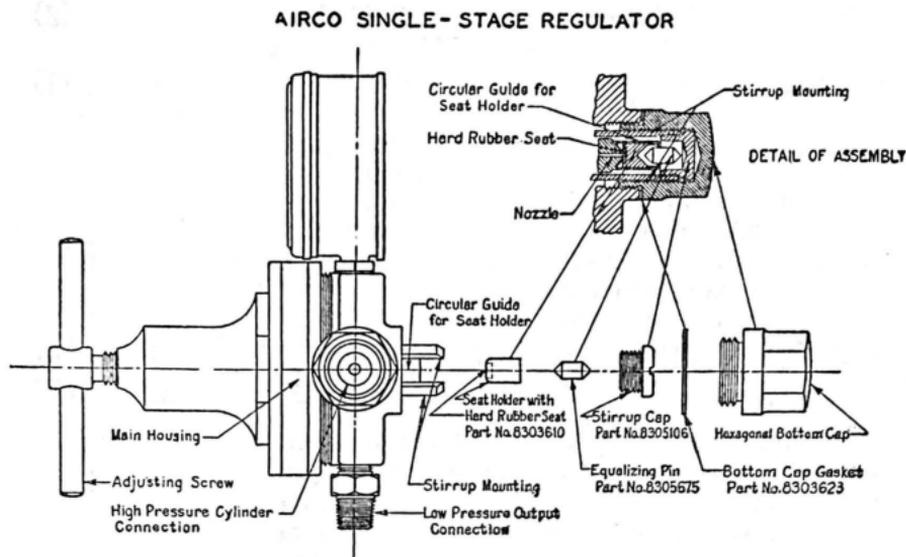
4.01 **Single-Stage Regulator:** The presence of grooves due to wear, scratches or other irregularities on the valve seat of the regulator may cause excessive pressure creepage. When the pressure creepage of an Airco single-stage regulator materially exceeds .6 pound in a period of four to five minutes the valve seat should be replaced as outlined below. To avoid possible damage, these replacements should be made by one familiar with the regulator mechanism and equipped with the necessary tools.

(1) Tighten the adjusting screw by turning it as far as practicable in a clockwise direction.

(2) Unscrew and remove the hexagonal bottom cap and its gasket; then remove the stirrup cap with a large screwdriver.

(3) Turn the regulator over so that the equalizing pin and seat holder drop out of the circular guide.

- (4) Clean the nozzle with a pencil eraser, substitute a new seat and holder, and reassemble the parts in the order illustrated below.



- (5) After the regulator has been reassembled, turn back the adjusting screw until it turns freely in its socket; then connect the regulator to a gas cylinder.

(6) Close the opening in the low pressure outlet connection with the thumb and set the regulator to an outlet pressure of 10 pounds. Then open and close the low pressure outlet with the thumb eight or ten times in succession. This operation will allow the new seat to adjust itself to the high pressure nozzle and thereby minimize the possibility of pressure creepage from this source.

(7) The regulator should now be tested for pressure creepage as outlined previously. If it still shows a creepage appreciably in excess of .6 pound in a period of four to five minutes, it should be returned for repair.

4.02 Two-Stage Regulators: The mechanism of the two-stage regulator is more intricate than that of the single-stage regulator and, therefore, defective two-stage regulators should be returned to the Western Electric Company for repair. A faulty two-stage regulator can generally be recognized as follows:

- (1) Pressure creepage, which results from a leaky low pressure valve.

(2) Projection of the red signal button out of the body of the regulator, which is due to a leaky high pressure valve. If the leak continues the pressure in the intermediate pressure chamber may rise high enough to operate the safety valve, which will close automatically as soon as the pressure has returned to normal.

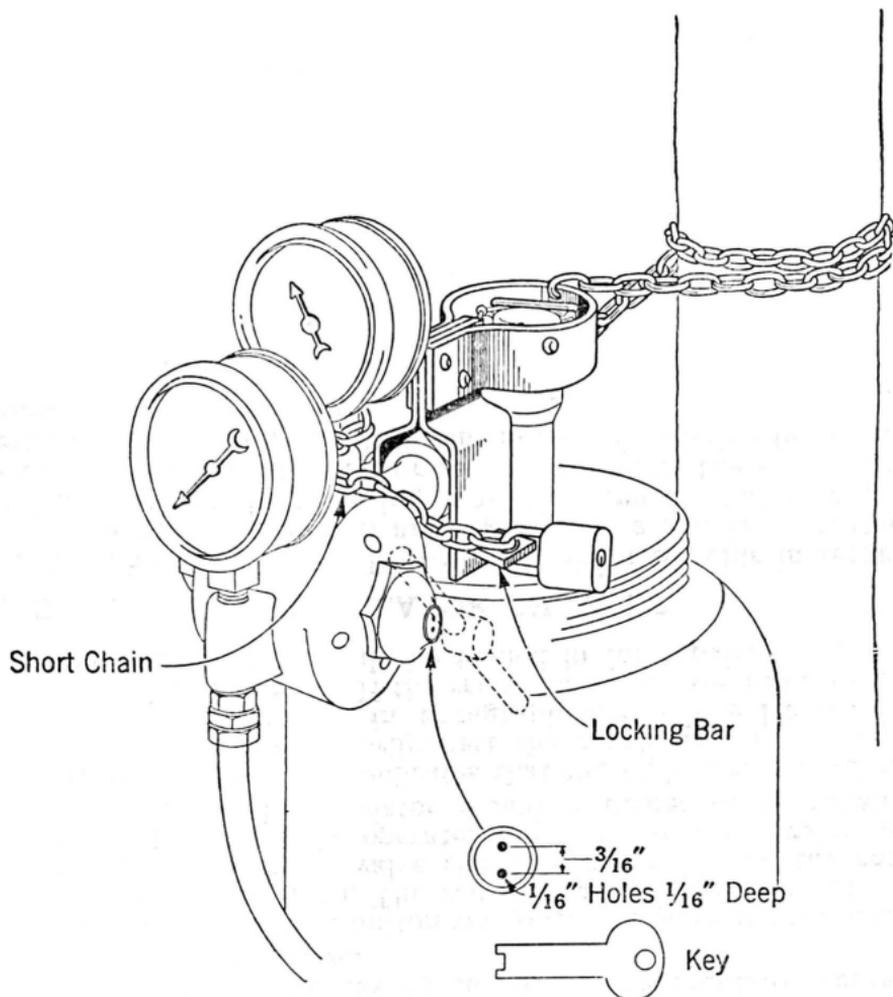
(3) When either condition occurs, disconnect the hose from the regulator and with the thumb held over the gas outlet set the outlet pressure at 10 pounds. Start and stop the flow of gas with the thumb 8 or 10 times in succession. This will cause the pressure reducing valves to open wide, allowing a relatively large volume of gas to flow through the regulator which should dislodge any small particle that may be interfering with the operation of the valves and allow the valve nozzles and seats to readjust themselves. Then turn off the gas by means of the regulator screw and replace the hose.

(4) If the red signal button was operated, push it back into position by hand. The red button will remain in place if the high pressure valve closes properly. Should the red signal button again operate, the high pressure valve is defective and the regulator should be turned in for repair.

(5) If the above test indicates that the high pressure valve operates satisfactorily, test the regulator for pressure creepage as outlined in Paragraph 3.01 before leaving it connected to a cable. If the regulator shows abnormal pressure creepage, it should be turned in for repair.

5. B PRESSURE REGULATOR SHACKLE

5.01 The use of the B Pressure Regulator Shackle in securing the gas cylinder and regulator to a pole is illustrated in the sketch on the following page. Covering the locked regulator with a rubber blanket or canvas will make the equipment less conspicuous and reduce the likelihood of its being tampered with.



8. REGULATOR ADJUSTING KEY

6.01 When it becomes necessary, as a means of discouraging tampering with the adjustment of regulators left in the field, the adjusting screw can be equipped for operation with a key as shown in the figure in Paragraph 5.01. The method of modifying the screw is as follows: Turn the adjusting screw into the regulator until the force required indicates that the end of the screw is in contact with the diaphragm. Then turn the screw outward (in a counterclockwise direction) about one revolution where it begins to turn freely in the socket. Mark the screw at a point flush with the socket, remove the screw and cut the screw at the mark. Drill two holes in the face of the screw, and file a key as illustrated, to fit the holes in the screw. Regulator delivery pressures can then be set by means of the key.