UNIT 1
CHOKE SELECTION AND ADJUSTMENT

USING CHOKE SELECTION CHARTS

Exhibits 1 through 4 are placed in the center of the book so that they may be removed easily for reference. Please remove them now so that you will have them available when needed.

1. The rate of flow from a well is controlled by surface and bottom-hole _____.

2. Usually, the rate is changed by adjusting a (surface/subsurface) choke.

3. For a higher flow rate, a choke with a (larger/smaller) orifice is installed.

4. To reduce the rate, use a (larger/smaller) choke size.

5. Petroleum companies and laws set *allowables* for flowing wells.

   The allowable is the volume of _____ that can be sold in a given length of time.

6. Although actual production may exceed the allowable by some small percentage, any oil produced beyond the allowable (can/cannot) be sold.

7. Production rates are controlled to maintain flow as close to the _____ as possible.

8. The allowable is set for:

   ____ gas and oil.
   ____ oil only.

9. But most flowing wells produce a volume of _____ along with the oil.

10. The Gas-Oil Ratio indicates the volume of _____ produced with every barrel of oil.

11. At the well, the choke controls the flow rate of:

    ____ oil only.
    ____ all the produced fluid.

12. Different GOR's require (the same/a different) choke size to produce a given allowable.

Look at Exhibit 1, which is a chart for finding dry gas production for a given oil production.

13. Look at scale O-1.

    Scale O-1 is a scale for the desired _____ production in _____/day.

14. The lowest production shown on the scale is _____ bbl./day.

15. The highest production shown on the scale is _____ bbl./day.

16. Look at the distance between 1 bbl./day and 50 bbl./day on the scale.

    This distance is (greater than/less than/equal to) the distance between 50 bbl./day and 100 bbl./day.

17. Scale O-1 is a scale with (equal/graduated) distances between numbers.

18. As the numbers get larger, the distances between them get (larger/smaller).

19. Find a desired production of 200 bbl./day on the scale.

20. Now find a production of 900 bbl./day on the scale.

21. Look at scale GOR-1.

    This is a scale for the Gas-Oil _____ of the well in _____/bbl.

22. The lowest GOR shown on the scale is _____ CF/bbl.

23. The highest GOR shown is _____ CF/bbl.

24. Scale GOR-1 (is also/is not) a *graduated* scale.

25. Suppose you are producing 100 bbl./day with a GOR of 5000 CF/bbl.

    Find 5000 CF/bbl. on scale GOR-1.

26. Find 100 bbl./day on scale O-1.

27. Now lay a straightedge all the way across the page, touching 100 bbl./day and 5000 CF/bbl.

    The straightedge (crosses/does not cross) the third scale on the exhibit.

28. Read the number that the straightedge crosses on the third scale.

    The number is _____.

29. Now look at scale G-1.

    This is a scale for finding _____ production in _____/day.

30. MCF stands for:

    ____ cubic feet.
    ____ thousand cubic feet.

31. With a GOR of 5000 CF/bbl. and an oil production of 100 bbl./day, gas production is _____ MCF/day.

Now look at Exhibit 2.

32. In choke selection charts, it is important to have *one* number that will stand for the total volume of fluid produced from a well.

    In actual practice, oil volume and gas volume are measured in (the same unit/different units).

33. Oil is measured in (cubic feet/barrels).

34. Gas is measured in MCF, or thousands of _____ _____.

35. There are 5.6 cubic feet in a standard barrel.

    So, one barrel of oil is *equivalent* in volume to _____ CF of gas.

36. Look at scale E-2.

    This is a scale for finding _____ dry gas production in _____/day.

37. Scale E-2 includes dry gas production, plus oil production measured in the units ordinarily used for measuring dry _____.

38. This is done so that:

    ____ only the volume of oil can be measured.
    ____ only the volume of gas can be measured.
    ____ the total volume of produced fluid can be measured.

39. *Equivalent* dry gas production stands for the total _____ of fluid produced from the well, measured in _____/day.

40. Look at the other two scales on Exhibit 2.

    Scale GOR-2 is a scale for the _____ measured in _____/bbl.

41. It measures (the same/a different) ratio as scale GOR-1 on Exhibit 1.

42. Scale G-2 is a scale for actual _____ production in _____/day.

43. To find equivalent dry gas production, you need to know the _____ in CF/bbl. and the actual volume of _____ produced in MCF/day.

44. If you know the GOR and the desired *oil* production, you can find the actual volume of gas that would be produced along with the oil by using Exhibit (1/2).

45. If you know the actual gas production and the GOR, you can find the *equivalent* dry gas production from Exhibit _____.

46. In these charts, *equivalent* dry gas production is an index figure that helps you find the choke size.

    An *index* is something that you use to _____ something else.

    Look at Exhibit 3.

47. Exhibit 3 is the chart used for finding the _____ size needed at the well.

48. On the exhibit, choke sizes are given in _____ of an inch.

49. Look at scale P-3.

    Scale P-3 is a scale for flowing _____ pressure, measured in _____.

50. The lowest pressure shown on the scale is _____ PSIG.

51. The highest pressure shown on the scale is _____ PSIG.

52. Like the other scales on these charts, scale P-3 is a scale with (equal/graduated) distances between numbers.

53. To select a choke, you (need/do not need) to know the tubing pressure at the well.

54. With different tubing pressures, the same size choke will produce (the same/a different) rate of flow from the well.

55. To use the charts, tubing pressure is measured while the well is (shut in/flowing).

56. Because of back pressure, a shut-in well has a much (higher/lower) tubing pressure than the same well has when it is flowing.

57. For accurate use of the charts, the operator first needs to take an accurate tubing _____ reading at the well head, while the well is _____.

58. Look at scale E-3.

    Scale E-3 is the scale for _____ dry gas production in _____/day.

59. It refers to (the same/a different) index as scale E-2 on Exhibit 2.

60. You can find the equivalent dry gas production figure for a flowing well by using Exhibits _____ and _____.

61. Then Exhibit 3 can be used to find the _____ size needed at the well.

62. For dry gas wells, *equivalent* dry gas production is the same as *actual* dry gas production, and you do not need the other two exhibits to find the choke size.

    You need all three exhibits to find the choke size when you are producing (a dry gas/an oil) well.

63. For a dry gas well, you need only Exhibit (1/2/3).

64. Suppose you are producing a dry gas well, and the desired gas production is 1000 MCF/day.

    Find 1000 MCF/day on scale E-3.

65. Flowing tubing pressure is 1800 PSIG.

    Find 1800 PSIG on the tubing pressure scale.

66. Now lay a straightedge across 1000 MCF/day and 1800 PSIG.

    Read the number that the straightedge crosses on scale C-3.

    The number is _____.

67. On scale C-3, chokes are sized in _____ of an inch.

68. To produce dry gas at 1000 MCF/day with a flowing tubing pressure of 1800 PSIG takes a choke size at _____/64ths of an inch.

69. Here's another gas well problem.

    Desired production is 95 MCF/day and flowing tubing pressure is 600 PSIG.

    The choke size to use is _____/64ths of an inch.

70. To use Exhibit 3 you need to:

    know the total production desired in _____/day; and

    have an accurate measure of the flowing _____ pressure in _____.

71. From Exhibit 3 you can read the _____ _____ needed to maintain the desired flow rate.

    The choke size is given in _____ of an inch.

72. In producing an oil well, you need to know the *equivalent* dry gas production.

    If you know the equivalent dry gas production in MCF/day, and the flowing tubing pressure, you can use Exhibit _____ to find choke size.

73. Exhibit 2 is used to find (choke size/equivalent dry gas production).

74. (Exhibit 1/Exhibit 2) is used to find actual gas production for a given allowable.

75. To use these charts, you start with the GOR and the allowable.

    If you know the GOR and the desired oil production in bbl./day, you can find the _____ _____ production from Exhibit 1.

76. If you know the actual gas production, you can find the _____ _____ _____ production from Exhibit 2.

77. And, if you know the equivalent dry gas production, you can find the choke size from Exhibit (1/2/3).

78. Suppose you want to produce 175 bbl./day from a well with a GOR of 4500 CF/bbl. and a flowing tubing pressure of 900 PSIG.

    Using Exhibit 1 and a straightedge, find the actual gas production for an allowable of 175 bbl./day with a GOR of 4500 CF/bbl.

    Actual gas production is _____ MCF/day.

79. Now use Exhibit 2 to find the *equivalent dry gas production* index figure for this well.

    The GOR is _____ CF/bbl.

    The actual gas production is _____ MCF/day.

    Equivalent dry gas production is _____ MCF/day.

86. To use these charts for an oil well producing some gas, you need to know:

the allowable, or desired oil production, measured in _____ per _____;

the GOR for the well in _____ _____ per _____; and

the flowing _____ pressure in _____.

87. In these charts, gas volume is given under standard conditions of 60°F and atmospheric pressure (14.7 PSIA).

If your company uses a different standard for measuring gas, these charts will give (an accurate/only an approximate) choke size.

88. Under different conditions of pressure and temperature used for measuring gas, the GOR figure needed for Exhibit 1 will be (the same/a different) number.

89. Since different companies use different standard conditions, many companies have tables available for converting gas volume from one set of _____ to another.

Look at Exhibit 4.

90. Some chokes are sized in decimal fractions of an inch.

Look at scale C-4 on Exhibit 4.

Scale C-4 has two sets of choke sizes; the scale on the left is sized in _____ _____ of an inch.

91. Exhibit 4 can be used instead of Exhibit (1/2/3) for finding chokes sized in both 64ths and decimal fractions of an inch.

92. Compare the numbers on the scales in C-4.

A choke size of 6/64ths of an inch is a choke size of _____ sized in decimal fractions of an inch.

93. These charts may be used with both surface and sub-surface chokes.

You (could/could not) use these charts to calculate the size for a bottom-hole choke.

94. Sometimes, factors such as high viscosity are important enough to prevent the choke size given on the chart from producing the desired rate of flow.

    If production is too low after flow with a new choke size has stabilized, the next (larger/smaller) choke size should be tried.

95. If production is too high with the choke size given on the chart, the next (larger/smaller) size should be installed.

96. As flowing tubing pressure changes, the choke size needed to maintain the same rate of flow (also changes/is not affected).

97. A changing GOR (affects/does not affect) production through a choke.

98. When the allowable, the GOR, or the _____ _____ pressure changes in a well, the lease operator can check these charts to find the _____ size needed to meet new well conditions.

ADJUSTING A SURFACE CHOKE

99. A well that is being tested, or that is underproducing or overproducing, may require a different size _____.

100. If the well has an adjustable choke, the choke size is changed by turning the _____ that moves the tip in or out.

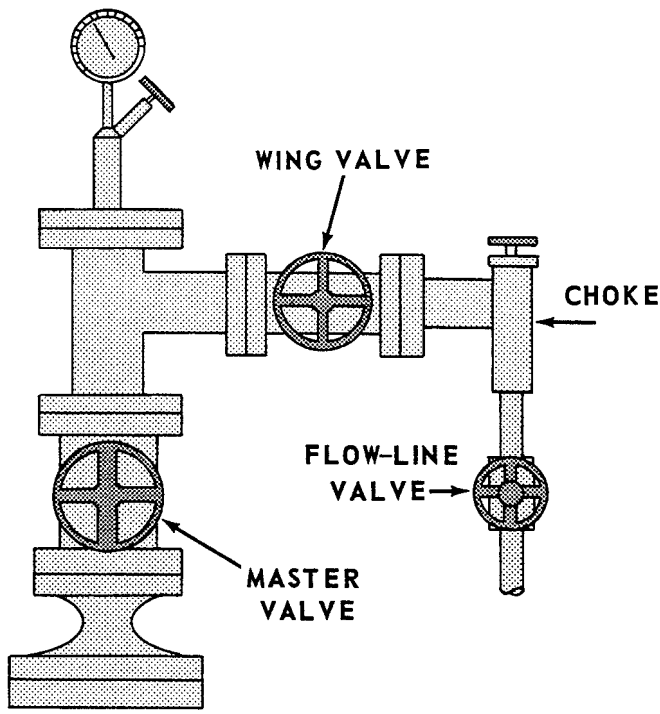
101. If the well has a positive choke, the flow bean or insert must be removed and _____ by another flow or proration bean.

102. The well (must/need not) be shut in to change the size of an adjustable choke.

103. To change the size of a positive choke, flow through the choke must be _____ before the bean or insert can be replaced.

104. Before the bean can be removed, pressure inside a positive choke must be _____ to the level of atmospheric pressure.

105. To bleed off pressure in the choke, the choke must be isolated from flow-line pressure.



To isolate the choke, the _____ _____ is closed upstream from the choke.

106. Then, a _____-_____ valve is closed downstream from the choke.

107. Some operators loosen the choke cap while the choke is still under pressure.

Choke caps are always tight enough so that they must be loosened by striking a lug on the cap with a _____.

108. As the cap is loosened, fluid escapes through bleeder vents or around the threads, releasing the high _____.

109. When the pressure has been released, there is no longer a sound of escaping fluid, and the cap may then be _____ by hand.

110. Although this method is quick, it may be dangerous.

It is safer to loosen the choke cap (before/after) pressure is bled off.

111. Hammering the choke cap while the tubing pressure gage is in place is also hard on the gage.

Jarring the gage may ruin its calibration and cause it to give a _____ reading of tubing pressure.

112. It is better practice, after isolating the choke, to close the master valve.

Then, the needle valve is closed and the tubing _____ _____ above the needle valve is removed.

113. With the pressure gage removed, the needle valve may be opened to the air.

High pressure is reduced as fluid flows out through the _____ valve from the space between the closed wing valve and the closed _____ valve.

114. When no more fluid hisses out, the needle valve is opened wide.

Then the wing valve is slowly opened.

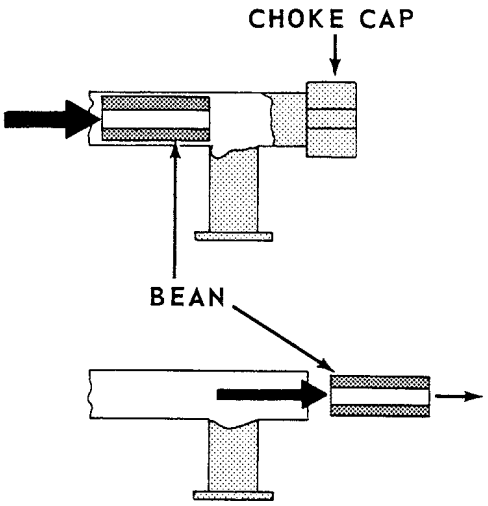
As the wing valve is opened, the high pressure is released from the whole space between the master valve and the _____-_____ valve.

115. Unless the choke is plugged, all pressure at the choke is now bled off.

If the choke is plugged, there may still be some pressure between the _____ and the flow-line valve.

116. The operator should be especially careful in replacing a bean that is _____ with solids.

117. Suppose an operator tries to replace an *upstream*-mounted bean without first bleeding off pressure.



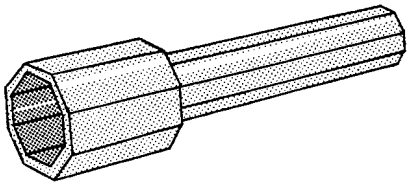
When the choke cap is removed, the _____ will shoot out of the tee.

118. High pressure between the master valve and the _____ will force the bean out of the tee.

119. The safer mounting for a positive choke bean is (upstream/downstream) from the tee.

120. With any mounting of the choke, choke adjustment is safer when the _____ is bled off through the needle valve before the choke cap is loosened.

121. When pressure has been released and the cap has been removed, a bean wrench is used to loosen the bean from the choke body.



A bean wrench has (the same/different) size ends.

122. The large end of the wrench fits into the socket in a (flow/proration) bean.

123. The small end of the wrench fits into the socket in an _____.

124. With one end of the bean wrench in the choke, the other end may be turned by any common _____.

125. When the choke has a master bean and an insert, only the _____ is removed to change the choke size.

126. When a choke has a flow bean in a cage nipple, the cage nipple is not disturbed.

The _____ is removed from the cage nipple.

127. The bean is pulled out on the end of the _____ _____.

128. When the bean has been removed, the cage nipple is washed out with a solvent to remove any solids that might plug the choke or let fluid _____ around the threads.

129. Lubricant is usually brushed on the threads of a new bean.

The lubricant makes the bean easier to install and also provides a better seal between the bean and the _____ nipple or _____ bean.

130. After the flow bean or insert is secure, the choke _____ is replaced, screwed into place, and hammered tight.

131. The operator closes the _____ valve and replaces the tubing _____ _____.

132. Then the well is ready to _____.

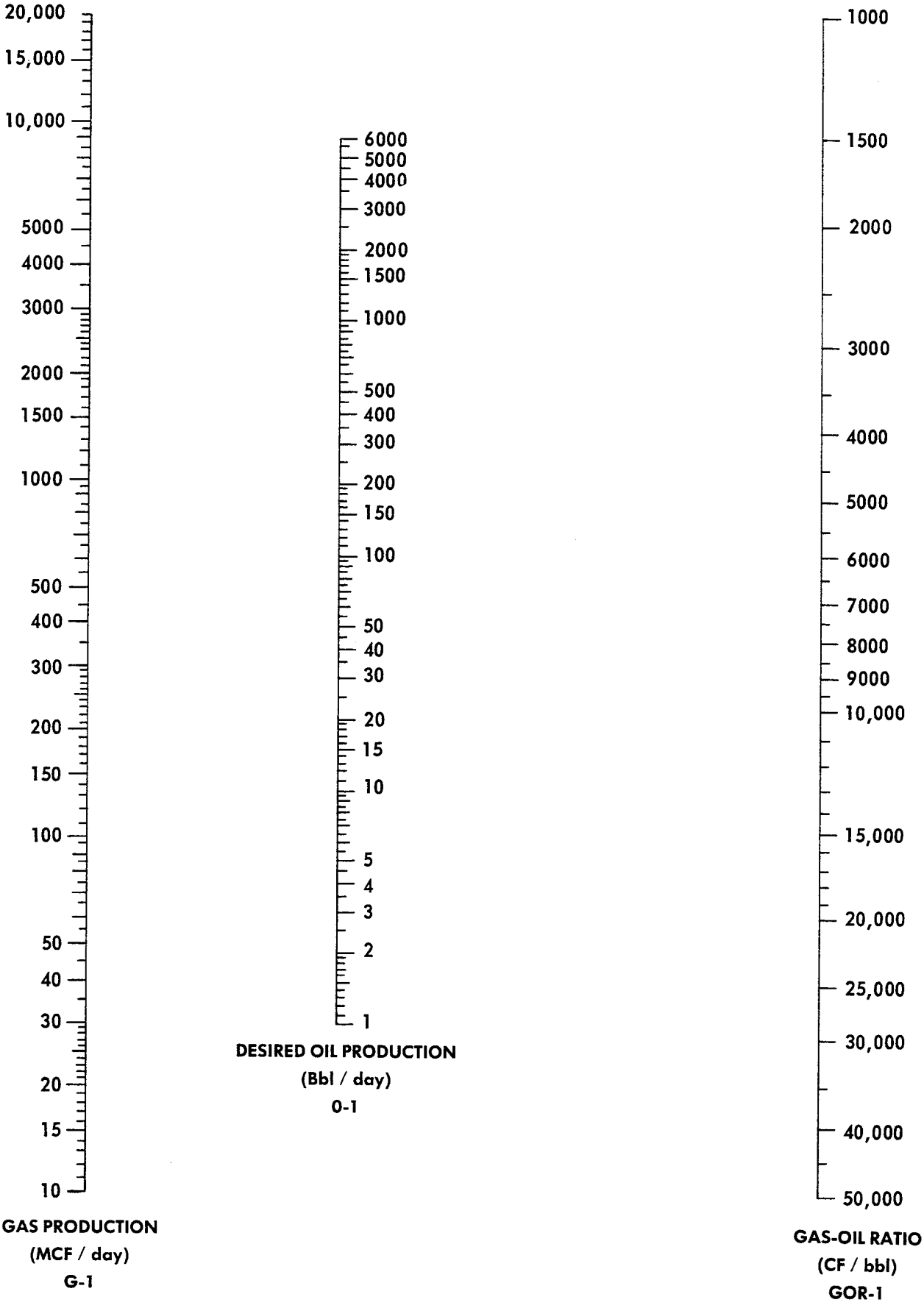
133. Sometimes the lease operator changes a positive choke to an adjustable choke.

To make this change, the flow bean is replaced by an adjustable choke seat.

A socket wrench is used to insert the _____ for the adjustable choke in the cage nipple.

EXHIBIT 1

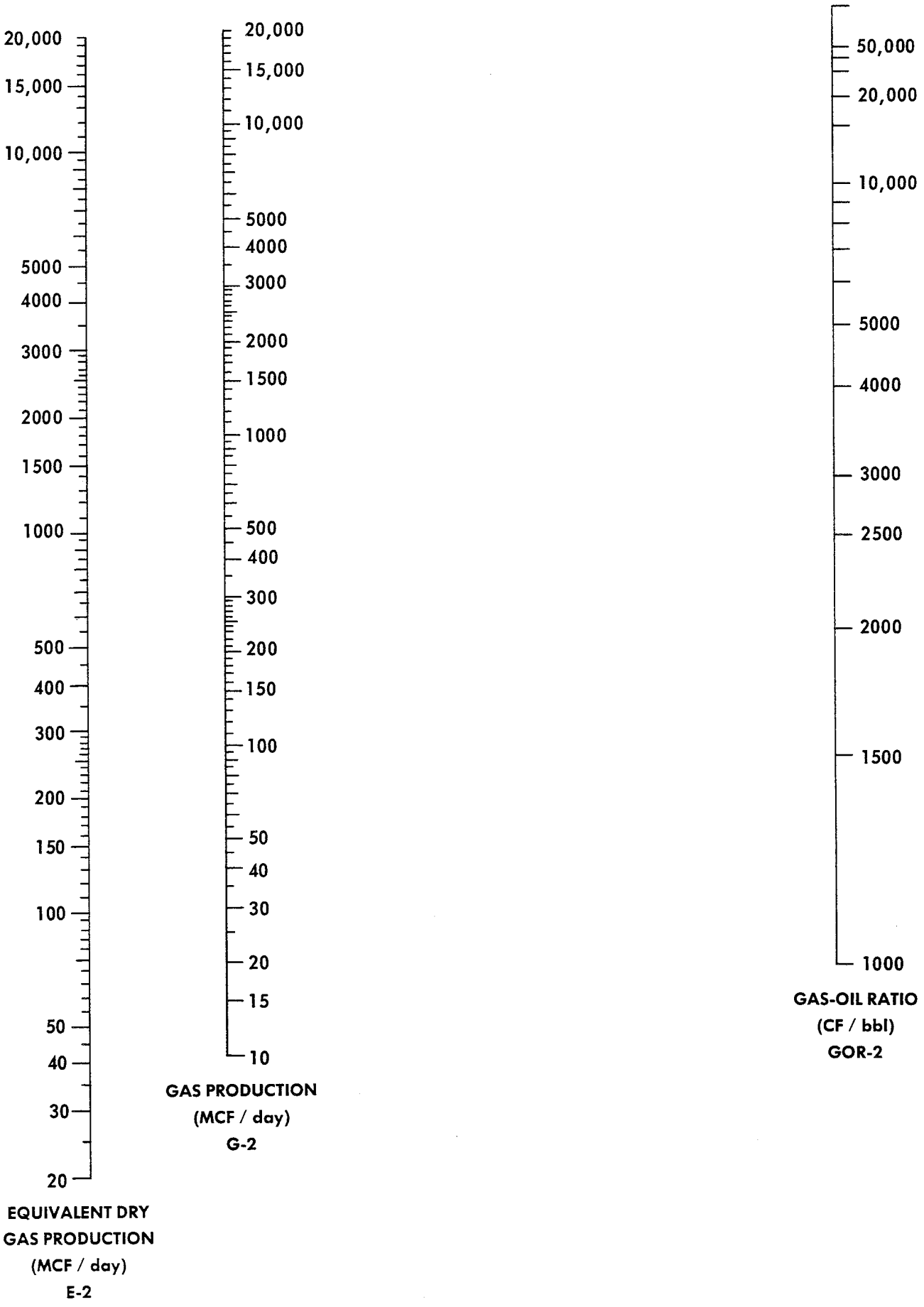
GAS PRODUCTION



(adapted with permission from materials developed by Oil Center Tool Co.)

EXHIBIT 2

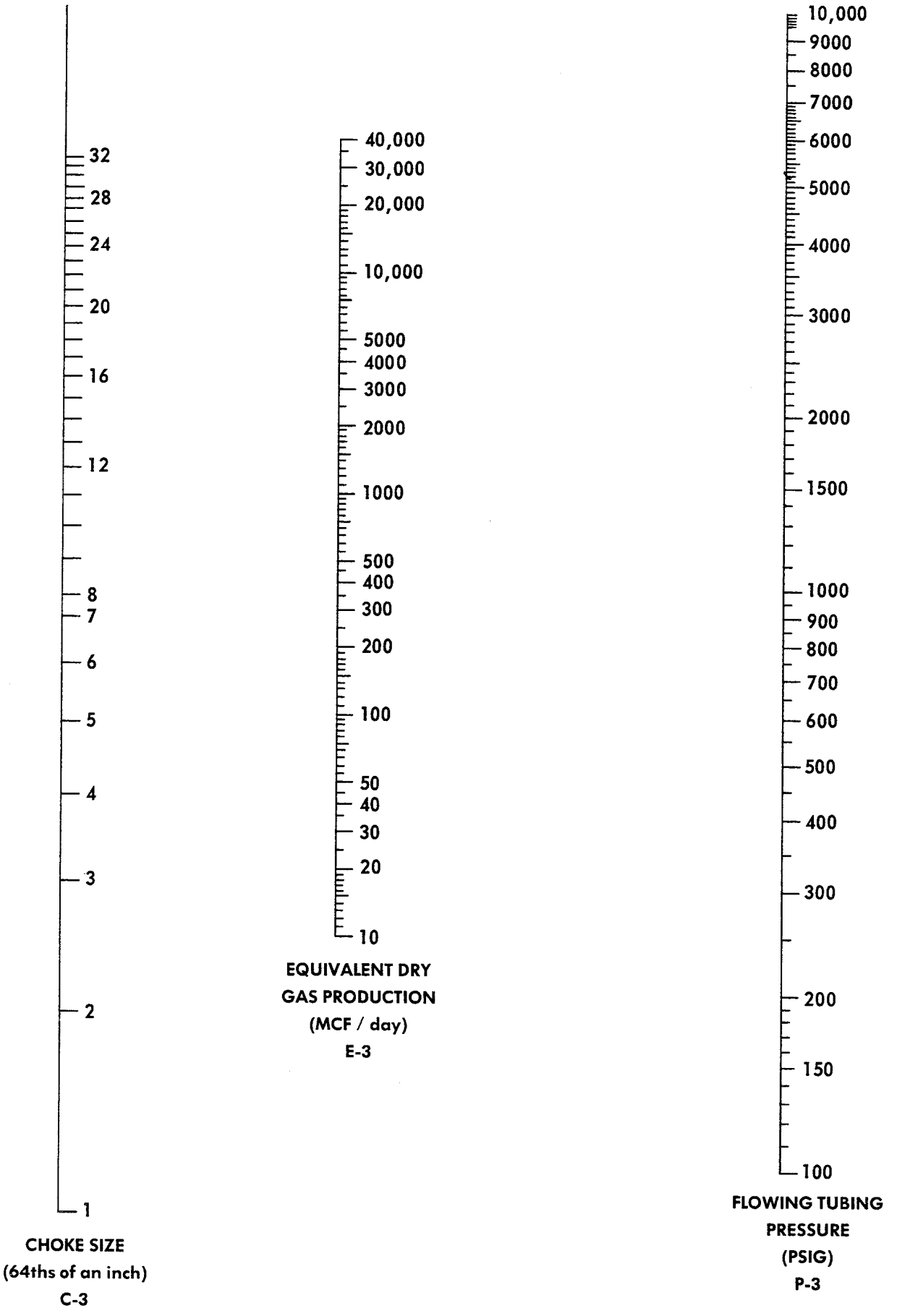
EQUIVALENT DRY GAS PRODUCTION



(adapted with permission from materials developed by Oil Center Tool Co.)

EXHIBIT 3

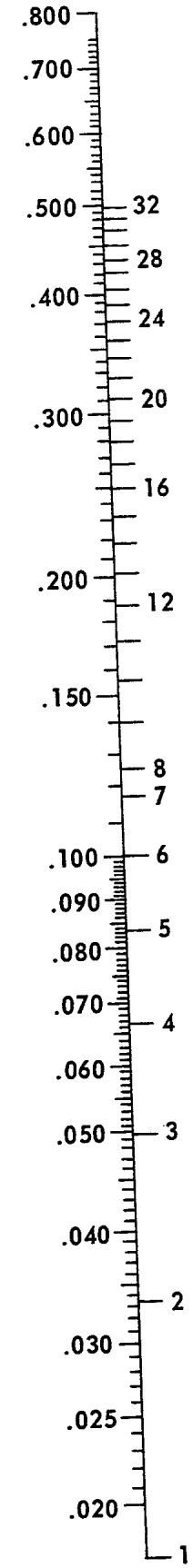
CHOKE SIZE IN 64ths OF AN INCH



(adapted with permission from materials developed by Oil Center Tool Co.)

EXHIBIT 4

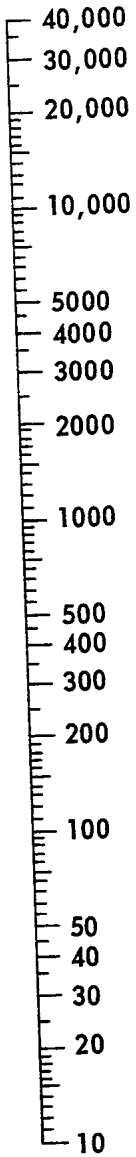
CHOKE SIZE IN INCHES AND 64ths OF AN INCH



CHOKE SIZE

Inches and 64ths of an inch

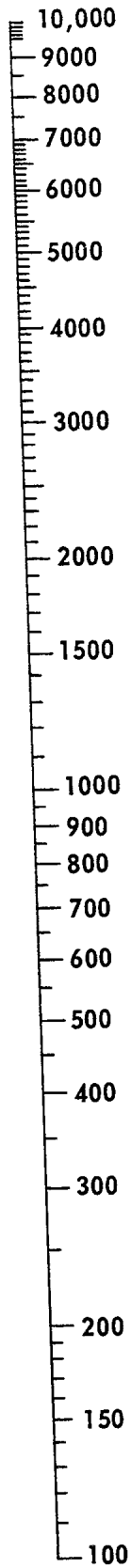
C-4



EQUIVALENT DRY GAS PRODUCTION

(MCF / day)

E-4



FLOWING TUBING PRESSURE

(PSIG)

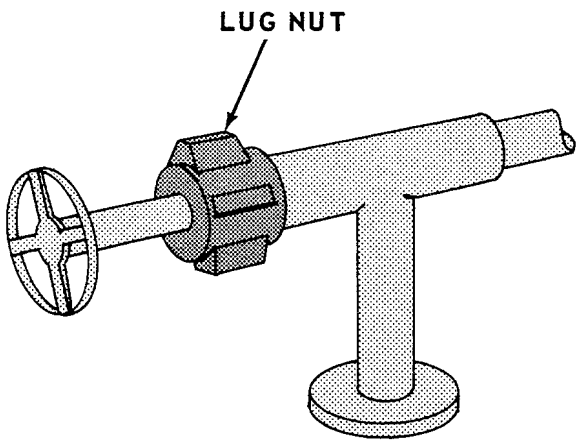
P-4

(adapted with permission from materials developed by Oil Center Tool Co.)

134. The stem tip assembly of the adjustable choke is cleaned and lubricated.

Sand and solid particles are removed from the threads so that they can be screwed tight enough to make a good _____ and prevent fluid from _____ through the cap.

135. A *lug nut* on the stem tip is used to secure the assembly.



The lug nut secures the stem tip to the end of the _____.

136. The lug is screwed and hammered up solidly so there are no _____ after the well has begun to flow.

137. Then the _____ is fitted on the stem tip assembly, so that the flow rate can be adjusted.

138. A retaining nut is used to fit the handwheel on the choke _____.

REVIEW AND SUMMARY

139. Bean wrenches are used to change (positive/adjustable) chokes.

140. Positive chokes can be changed to adjustable chokes by removing the _____ _____ and installing a seat and _____ _____ assembly.

141. Adjustable chokes can be changed to *positive* chokes by removing the *seat* from the choke body and inserting a flow _____.

142. To change a positive choke safely:

close the _____ valve and a downstream _____ valve;

then close the _____ valve;

remove the _____ _____, and open the _____ valve;

as pressure bleeds off, open the _____ valve;

then, remove the choke _____ and insert a _____ _____ to remove the bean.