Planning A Wellhead for A Parallel String Multiple Completion

By LEONARD E. WILLIAMS, J
Cameron Iron Works

In planning a parallel string multiple completion wellhead, certain information must be known, and advanced planning on the type of tree required should be done. The tubing combinations that can be run in different sizes and weights of casing are almost unlimited, and the required information governs the type of tubing hanger and valves that can be used. Thus, when planning a multiple string hook-up for completing inside casing or tubingless completions the following information is required:

1. What are the size and weight of casing?
2. What are the size and type of all strings of tubing?
3. a. Will tubing be run clamped or independently?
   b. If independently, can either string be pulled selectively?
4. Are there any special features? For example,
   a. Are any tools or adapters in string larger than collar?
   b. If strings are different size or thread, in what order will strings be run?
5. What is the working pressure of tree?

The first thing that is always checked is whether the tubing pass in the casing. When the tubing is run clamped, clearance is checked by adding joint or coupling outside diameter plus the opposite tubing diameter subtracted from casing inside drift diameter. However, if run independently, one must have clearance to pass joint or coupling diameters. After the type run is decided, the next step is to check to see if the tubing can be landed in the tubing head by using standard center-to-center distances for duals or standard radius on triples and quadruples.

To find the maximum center-to-center distance of any tubing strings in any size and weight of casing, the procedure is as follows:

One divides the nominal inside diameter of the casing by two and, with the outside diameter of the tubing in contact with the inside wall of the casing, calculates the distance from the center of the casing to the center of the tubing. For strings of tubing the same size, the maximum center-to-center distance for duals will be the results multiplied by 2, and for triples and quadruples the results will be the radius centers.

Examples:

Find the maximum center-to-center of two strings of 2 3/8 in. O.D. tubing in 7 in. O.D. - 39 lb casing.

Inside diameter of 7 in. - 39 lb casing (5.920 divided by 2	2.960 in.
Outside diameter of 2-3/8 in. O.D. tubing divided by 2	1.187 in.
Subtracting 1.187 from 2.960 leaves	1.773 in.

1.773 multiplied by 2 equals 3.546 or 3-35/64 max. center-to-center

Note: 3-35/64 in. is a standard center-to-center distance for 2-3/8 O.D. X 2-3/8 O.D. tubing.

Find the maximum center-to-center of 2-3/8 in. O.D. tubing and 2-7/8 in. tubing in 7-5/8 in. - 39 lb. casing.

Inside diameter of 7-5/8 in. - 39 lb casing (6.625 divided by 2	3.312
Outside diameter of 2-7/8 tubing divided by 2	1.437
Outside diameter of 2-3/8 tubing divided by 2	1.187

3.312 minus 1.437 leaves 1.875

3.312 minus 1.187 leaves 2.125

Adding 1.875 and 2.125 gives 4.00 max. center-to-center

Note: 4.00 in. is a standard center-to-center distance for 2-3/8 O.D. X 2-7/8 O.D. tubing.

If it is found that the tubing cannot be hung on standard centers, it is possible to suspend some strings eccentric with the run of the upper section of the tree and still have the full opening into the tubing. Also it is sometimes possible to use eccentric flanged spools to center the tubing over the casing. This latter procedure is usually done where the string being hung has a considerably smaller inside diameter than does the run of the components used above.

To hang multi-strings, there are, depending upon what tools are run into the hole, a number of ways, such as gas lift valves that may be larger than collar diameter. However, the best type of hanger suited for this job would be a segmented hype hanger, which would give maximum opening through the tubing head. But if nothing larger than collar diameter is run on the strings, a mandrel type suspension with a smaller through bore is satisfactory. Then, if it is desired to suspend the tubing in tension, a ram type or a special tension type hanger is required. But here again, where the tubing must be in tension, the casing size is a factor determining the type of suspension that may be used. On a ram type tubing head the hanger suspending member may be run directly below the point of suspension and into the casing, and pulled back up and suspended on the rams. On a special clover leaf type tension hanger, the mandrel or supporting member is run below the point of suspension, pulled back up, and pulled over to one side of a bowl, which supports the tubing. When using this suspension system, instead of ram type, the casing diameter must be larger to give room for pulling the tubing to one side and suspending.

On a multiple tubingless completion, the two methods now used for running tubing are simultaneously and independently. Where all strings are run together at one time, there is no problem in passing scratchers and centralizers through the head and into the surface casing

because there is full opening. But where the strings are run independently, there must be clearance in the suspension hanger for passing centralizers on the second, third, or fourth strings. Once all of the strings have been landed, it is the general practice to pick up one or more strings for scratching the hole while cementing. Then there is always a chance of sticking the tubing while suspended some point above the suspension head. In this case a slip type hanger and pack-off are required. The upper section of the tree may be assembled directly onto the tubing, or if a flanged type tree is desired for higher pressures, a seal or pack-off flange is installed over the tubing. With a seal flange installed, the pack-off around each string may be tested to the working pressure of the tree.

On a multiple completion there may be installed three types of trees: block, fabricated, and independent valve type construction. On independent valve type construction, upper section such as 5-bolt and triple cap, it is possible to remove one run without distrubing the others. This construction is also helpful in the future when it would be possible for one side to go on the pump, and this valve can be removed and used elsewhere

On the valve construction of multiple trees, for duals the lower zone is the lower most valve. For triples the valves should spiral upward in the same direction as the tubing is stabbed in the packers and in the same relative position from bottom to top.

Blowout preventers are generally used on most completions. On some specific types of hangers one set of offset tubing rams can be installed before running the first string of tubing. The, offset bore in the ram is positioned over the last hanger to be run.

Standard Centers Now in Use for Multiple Completions

Dual Completion:

Tubing Size. O.D.	Center-to-Center	Min Casing
1.900 x 1.900	2-25/32 in	5-1/2 in.-20 lbs
2-1/16 x 2-1/16	2-25/32 in	5-1/2 in.-17 lbs
2-3/8 x 2-3/8	3-35/64 in	6-5/8 in.-24 lbs
2-3/8 x 2-7/8	4 in	7-5/8 in.-39 lbs
2-7/8 x 2-7/8	4-1/2 in	8-5/8 in.-44 lbs
3-1/2 x 3-1/2	5-3/64 in	9-5/8 in.-53.5 lbs

Triple Completion:

Tubing Size. O.D.	Radius Centers	Min. Casing
1.900x1.900x1.900	1-7/8 in	6-5/8 in.-32 lbs
2-1/16x2-1/16x2-1/16	1-7/8 in	6-5/8 in.-24 lbs
2-3/8x2-3/8x2-3/8	1-15/16	7 in.-26 lbs
2-3/8x2-3/8x2-3/8	2-1/8	7-5/8 in.-39 lbs
2-7/8x2-7/8x2-7/8	2-13/16	9-5/8 in.-53.5 lbs

Quadruple Completion:

Tubing Size, O.D.	Radius Centers	Min Casing
2-3/8x2-3/8x2-3/8x2-3/8	3-1/16 in	9-5/8 in-53.5 lbs
2-7/8x2-7/8x2-7/8x2-7/8	3-7/16 in	10-3/4 in-55 lbs
2-7/8x2-7/8x2-7/8x2-7/8	4 in	11-3/4 in-54 lbs (Tubingless with Independent Valves)