A. P. I. STANDARDS FOR ROTARY TOOL JOINTS

Following the discussion of API standards for cable-tool joints in the last issue, we continue with a summary of the standards for rotary tool joints. Rotary tool joints are the threaded connections on the swivel, kelly, drill pipe, drill collar, and drilling bit which are the elements that make up the "drilling string" of a rotary drilling machine.

Rotary tool joints must withstand twisting strains, primarily, and must transmit heavy torque. At the same time, the joints must be designed to permit coupling and uncoupling the drill pipe readily. These requirements are in contrast to those for cable-tool joints which must withstand heavy impact and jarring.

The API specifications for rotary tool joints are of the same general character as those for cable-tool joints. The licensing of manufacturers, regulations on the use of the API monogram, and rules for use and care of gages are similar to those described in the previous article on cable-tool standards so will not be repeated here.

The specifications for rotary tool joints were originally adopted in 1926 and have been revised from time to time as experience showed the need for changes. The latest revision was issued in June, 1951.

Specifications for Tool Joints

There are three styles of API joints for rotary tools, as follows:

Regular	(REG)
Full-hole	(FH)
Internal-flush	(IF)

The thread form for all styles is the 60-degree V-form with the points flattened parallel to the taper of the joint. The roots of the regular (REG) and full-hole (FH) tool joints are rounded, but the roots for internal-flush (IF) joints are flat.

On drill pipe, the tool joints must be straight and concentric with the pipe so that any joint will be in line within ½-inch in a length of 20 feet.

Table I shows the sizes and types of API rotary tool joints, together with the thread form for each, threads per inch, and taper of the pin and box. Complete details of the thread dimensions are given in the API specification, but these are not of primary interest to drillers so are not reproduced here.

Table II gives the general dimensions of API rotary tool joints. Diagrams of the joints are shown with Table II to indicate where the various dimensions are measured. The column headings in Table II refer to the respective elements of the joints shown in the diagram.

Gaging of Rotary Tool Joints

Rotary tool joints are gaged in the same general manner as cable-tool joints. The stand-off of the gage is measured when screwed to the pin or box being checked and must be within the prescribed tolerance on a properly manufactured joint. When gaging the pin, the stand-off of the gage from the joint shoulder must be between 0.620″ and 0.635″. When gaging the box, the stand-off must be between zero and 0.010″. It will be noted that these are a little greater than the corresponding tolerances for cable-tool joints.

Substitute Joints

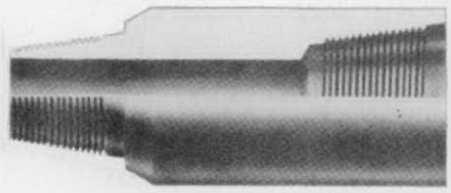
Substitute joints or "subs" are used when it is necessary to change from one size or style of tool joint to another size or style at some point in the "drilling string." The accompanying illustration shows typical subs. API pins or boxes on subs have dimensions and threads corresponding to the tool-joint standards described above.

TABLE I

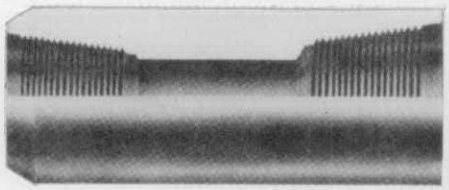
API ROTARY TOOL JOINTS

Details of Threads

Size and Style of Joint	Thread Form	No. of Thds. Per Inch	Pitch p	Taper In. Per Ft.
2⅜ REG	V.-.040 Flat	5	.2000	3
2⅜ IF	V-.065 Flat	4	.2500	2
2⅞ REG	V-.040 Flat	5	.2000	3
2⅞ IF	V-.065 Flat	4	.2500	2
3½ REG	V-.040 Flat	5	.2000	3
3½ FH	V-.040 Flat	5	.2000	3
3½ IF	V-.065 Flat	4	.2500	2
4 IF	V-.065 Flat	4	.2500	2
4½ REG	V-.040 Flat	5	.2000	3
4½ FH	V-.040 Flat	5	.2000	3
4½ IF	V-.065 Flat	4	.2500	2
5½ REG	V-.050 Flat	4	.2500	3
5½ FH	V-.050 Flat	4	.2500	2
5½ IF	V-.065 Flat	4	.2500	2
6⅝ REG	V-.050 Flat	4	.2500	2
6⅝ FH	V-.050 Flat	4	.2500	2



PIN TO BOX



BOX TO BOX

Typical API full-hole substitute joints.

Drill Collars and Kellys

Drill collars and kellys are specified to have standard rotary tool joints. Additional requirements for the API design of drill collars and kellys are given which are applicable primarily to equipment manufactured for oil-well drilling. Most manufacturers of rotary drilling machines for water-well drilling depart from the API standards in the manufacture of these items.

Conclusion

Continued study is being made by the American Petroleum Institute and by various manufacturers which will result in further improvements of standards. The present practice has done much to promote interchangeability and to eliminate confusion and joint trouble.

While the tolerances allowed may result in small but noticeable differences in the fit of occasional joints, the result is generally a very satisfactory fit, if the joints have been properly checked against the gages after manufacture. The widespread adoption of API standard joints has eliminated most of the trouble with drilling tool joints, and the remaining troubles can usually be traced to improper handling and care.

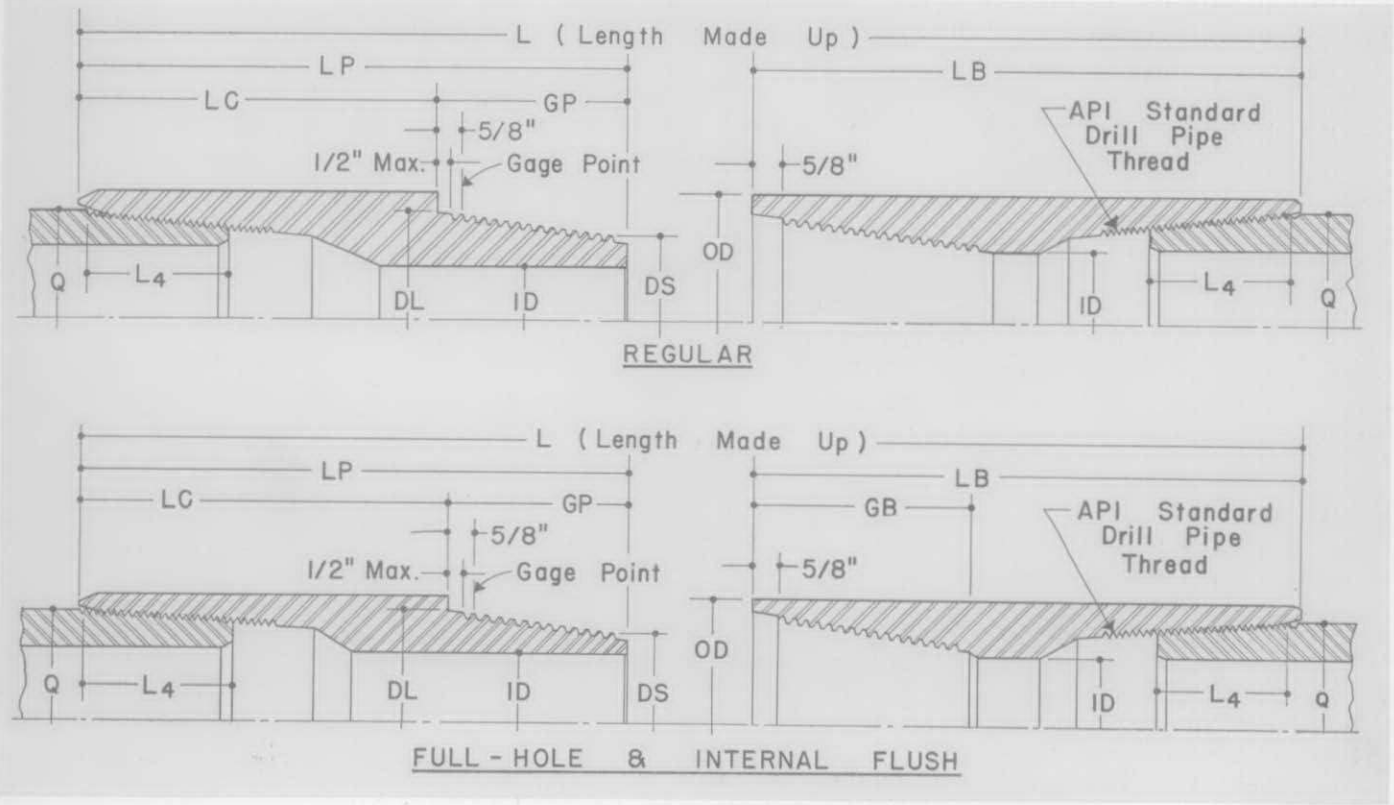
(Continued on Page 13)

TABLE II

API ROTARY TOOL JOINTS

All Dimensions in Inches

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Size and Style of Tool Joint	Outside Diameter of Tool Joint Tolerance ±1/32		Bore of Tool Joint Pin Tolerance +1/64 —1/32		Small Diameter of Pin	Large Diameter of Pin	Length, Small End of Pin to Shoulder Tolerance +0.000—⅛	Length, Pipe End of Pin to Shoulder (*)	Total Length Tool Joint Pin, Tolerance +⅛—½	Combined Length, Pin and Box, Made-Up Tolerance +⅝—1	Total Depth of Box Tolerance +0—⅜	Total Length of Tool Joint Box Tolerance +⅛—½	Diam. of Counterbore in Drill Pipe Ends	Total Length Drill Pipe Threads
	Std. OD	Opt. OD	Std. ID	Opt. ID	DS	DL	GP	LC	LP	L	GB	LB	Q	L_4
2⅜ REG	3⅛	.....	1	.....	1.875	2.625	3.000	6½	9½	16	.....	9½	2½	2.125
2⅜ IF	3⅜	.....	1¾	.....	2.376	2.876	3.000	6½	9½	16	3⅝	9½	$2\frac{25}{32}$	2.125
2⅞ REG	3¾	.....	1¼	.....	2.125	3.000	3.500	6¾	10¼	17	.....	10¼	3	2.625
2⅞ IF	4⅛	.....	2⅛	.....	2.808	3.391	3.500	6¾	10¼	17	4⅛	10¼	$3\frac{11}{32}$	2.625
3½ REG	4¼	4½	1½	.....	2.562	3.500	3.750	7⅛	10⅞	18	.....	10⅞	3⅝	2.625
3½ FH	4⅝	.....	$2\frac{7}{16}$	.....	3.056	3.994	3.750	7⅛	10⅞	18	4⅜	10⅞	3⅝	2.625
3½ IF	4¾	.....	$2\frac{11}{16}$	.....	3.349	4.016	4.000	7	11	18	4⅝	11	$3\frac{15}{16}$	2.625
4 IF	5¾	6	3¼	$3\frac{5}{16}$	4.084	4.834	4.500	7¾	12¼	20	5⅛	12¼	4⅝	3.375
4½ REG	5½	5¾	2¼	.....	3.562	4.625	4.250	7⅞	12⅛	20	.....	12⅛	4⅝	3.375
4½ FH	5¾	.....	$3\frac{3}{32}$	3	3.792	4.792	4.000	7⅞	11⅞	20⅜	4⅝	12½	4⅝	3.375
4½ IF	6⅛	.....	3¾	.....	4.500	5.250	4.500	7¾	12¼	20	5⅛	12¼	5⅛	3.375
5½ REG	6¾	.....	2¾	.....	4.333	5.520	4.750	8⅝	13⅜	22	.....	13⅜	$5\frac{11}{16}$	3.625
5½ FH	7	6¾	4	.....	4.992	5.825	5.000	8⅜	13⅜	22⅛	5⅝	13¾	$5\frac{11}{16}$	3.625
5½ IF*	.....	.....	.....	.....	5.564	6.397	5.000	.....	.....	.....	.....	.....	.....	.....
6⅝ REG	7¾	.....	3½	.....	5.159	5.992	5.000	9½	14½	24	.....	14½	6¾	3.875
6⅝ FH	8	7¾	5	.....	5.920	6.753	5.000	9½	14½	24	5⅝	14½	6¾	3.875



with excellent entertainment which climaxed the convention.

A large number of drillers and their families attended. Exhibits in the Armory by manufacturers and jobbers were many and varied. Outdoor displays included drilling machines and submersible pumps in operation.

At the annual business meeting, the following officers were elected for the coming year:

Leo Riegler,
President ..... Muskegon
Owen Corsaut, Jr.,
Secy-treas. ..... Birmingham
Karl Geiger, Jr.,
1st Vice-pres. ..... Belding
Theron Brewer,
2nd Vice-pres. ..... Parma

The board of directors includes these officers plus the following:

S. H. Niedjelski ..... Pontiac
J. C. Newman ..... Kalamazoo
Howard Cribley ..... Dexter
Kenneth Lee ..... Linden
Felix Lemieux ..... Kawkawlin
Frank Vincent ..... Port Huron
Harold Gilbert ..... Lansing
Harold Armstrong ..... Battle Creek
Clyde Schimke ..... Manistee
Don Russell ..... Flint

The retiring Secretary, Harold Armstrong, and Mrs. Armstrong were presented with a boat and other gifts as an expression of appreciation by the Association for the fine work done during the past 14 years on this important job.

The attendance and enthusiasm as they celebrated their Silver Anniversary showed that the Michigan drillers have one of the best State drillers' organizations in the country.

Gus Beyer of Merton, Wisconsin, drilling 6-inch suburban well near Merton.

WASHINGTON

Another interesting regional meeting of the Washington State Drillers' Association was held on July 18, at the Davenport Hotel in Spokane. James B. Fishen, Water Engineer of Spokane, gave a talk on the wells and ground-water source that supply the city with plenty of water of good quality.

Harold O. Meyer of Kirkland, president, announces that the 1953 Convention of the Association will be held in Seattle on November 13 and 14. Details will be forthcoming a little later.

The State Division of Water Resources informs the Association that it is dropping the requirement that well logs be notarized. This change had been requested by many members. The Division also asks drillers to make special efforts to prepare well logs accurately and submit them promptly. The Association, in turn, urges cooperation on the part of drillers in reporting well logs.

Drilling machines exhibited at Silver Anniversary convention of Michigan Well Drillers' Association.

ROTARY TOOL JOINTS

(Continued from Page 6)

API tool joints are not used as universally on rotary drilling equipment for water-well and shot-hole drilling as they are in the oil-well drilling field. This is because the requirements for water-well and shot-hole drilling are considerably different. Rotary drilling equipment for these two applications is generally much lighter and must be more portable. Some manufacturers of this equipment supply drill pipe with coarse, square threads of the "Acme" type with slight taper. These joints give good service and find acceptance by drillers. Substitute joints are readily available to connect drill pipe with such threads to drill collars and drilling bits that have standard API joints.

Reference

Portions of this article and Figures 1, 2 and 3 are from API Standard 7-B (Tenth Edition) and Supplement 3, "Specification for Rotary Drilling Equipment" and are used by permission of the American Petroleum Institute, Dallas, Texas.

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WIRE ROPE

(Continued from Page 11)

it is highly important to handle and care for the cable properly. Many systems and methods of caring for wire lines have been devised. The best practice is to secure the advice of both the wire-rope manufacturer and the drilling machine manufacturer on the sizes of lines to use and the proper way to care for them. The rig designer cannot always meet the wire-rope makers' recommendations, which are pointed toward getting the longest use of the rope. Better rig performance, for example, may require the cable to be used under conditions that shorten its life and increase rope consumption, but the extra wire-rope cost may be more than offset by the economies resulting from improved operation of the machine as a whole.