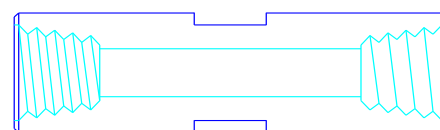
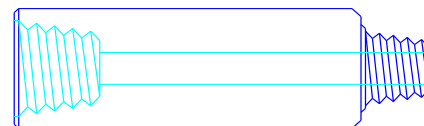
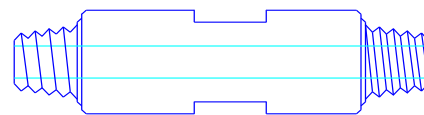
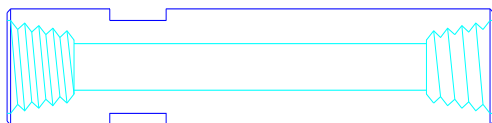
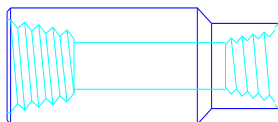
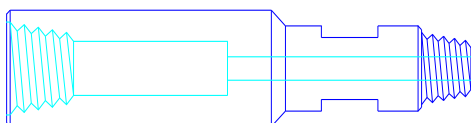


Mills Machine Rotary Substitute Adapters (Subs) are made from 4142 heat-treated alloy steel. They are made to any length, outside diameter, inside diameter or thread combination. We do inventory the most common subs in stock. We carry a large inventory of steel stock and are able to custom manufacture any sub to meet your specific requirements at competitive prices and with a quick turn around.

Subs can be made with a breakout configuration for any rig. Unless otherwise specified our standard flat is 2" long and 3/8 deep per side. We manufacture single flats, double depth flats, extra long flats, beveled flats, or flats to meet your specific needs. Breakout lugs are also available. Flats or lugs normally add to the length of the sub.

The outside and inside diameter of the sub should match up to the drill rod that you are using. We should always be aware of the largest O.D. and at the smallest I.D in your drill string.



When going from a large connection to a smaller connection, a bottleneck may be furnished to reduce the weight of the sub and make it easier to breakout. The bottleneck is normally cut on a 45° angle and may add length to the sub.

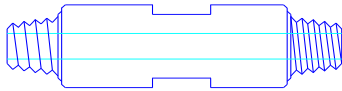
Any box thread can be bored out to accept a float (check) valve. The valve will add length to the sub depending on the length of the valve. The valves are sized to the box thread and can be seen in the last section of this catalog (Misc. Drilling Accessories). The bored out sub can be furnished with a float valve installed. We also stock float valve repair parts, prices on request.

Please use the application questionnaire for Subs at the back of this section.

"PLEASE CALL FOR CUSTOM OPTIONS AND OTHER ACCESSORIES"

Sub Variations

Mills Machine will furnish you any variation of the sub needed to complete your drill string or job requirements. Some of the variations that we normally find are the breakout flats, special flats, breakout lugs, extra length, bottle necks, knurling and float valves. These are listed in the following price sheets. Some of the other sub configurations are:

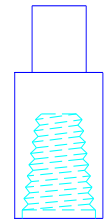


Kelly Subs or Kelly Adapters or Kelly Saver.

This terminology refers to a sub used between the Kelly or top head drive and the drill pipe. It is usually a pin sub that takes the wear abuse to protect the drill pipe and the drive connection. **Mills can furnish the subs along with the fluted, hex or square Kelly Bar drive itself.**

Weld-on or Thread-on Tool Joint Subs.

These subs are designed with one end to shrink fit or screw on the end of your drill tube and then be welded. The opposite end is the pin or box of your choice.



Pin or Box to Blank Subs. Similar in use to the above subs, these have a blank face either solid or with an ID on the end opposite the pin or box.

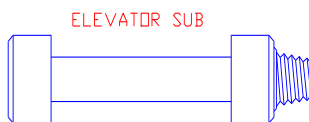
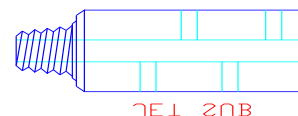


Shock Subs. These are specialized subs designed to absorb the shock vibrations created by a down-hole hammer and prevent damage to the drill string and the top head drive.

Floating or Cushion Subs. These subs absorb shock vibrations transmitted up through the drill string built to protect the pipe, the construction is simpler with more vertical movement in the sub.

Special ID. We will furnish subs bored to a special ID, either smaller or larger than standard or for special cases with no ID bore.

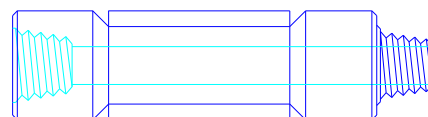
Jet Subs. These subs are designed with the water flow to jet out the sides of the sub to assist cleaning the perforated pipe or screen.



ELEVATOR SUB

Elevator Lift Subs. These narrow-necked subs provide a lifting area for use with standard pipe elevators. They are commonly used with internal flush (IF) pipe.

Break Out Lugs. Lugs are sometimes used instead of flats to give extra purchase for disconnecting subs.

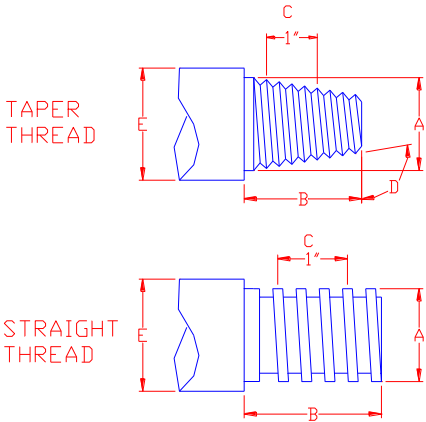


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Sub Measurement

Often we come across undefined tool joints. The thread identification is normally stamped on the tool joint. If that stamp is worn or is not present you need specific information to determine the tool joint identification. The way to define the pin tool joint (The box tool joint is hard to measure and measurement has often lead to errors) is to measure:

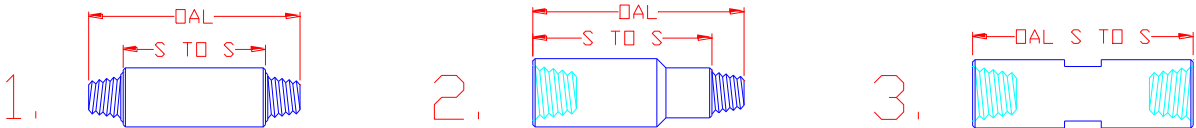
- A. The diameter of the base of the pin where it meets the sub body (shoulder).
- B. The thread length. Measured from shoulder to the end of the tool joint.
- C. The number of threads per inch - put the 0 mark of a ruler on the center of the first thread, don't count that thread, then count the threads to the one inch mark (see sketch).
- D. The thread form (taper, square, acme, special, etc.)
- E. The material OD - this may differ within threads, but is a cross check.



Your free thread ruler is at the beginning of this catalog. It will assist you in determining the thread. If you need additional copies, please contact your sales representative.

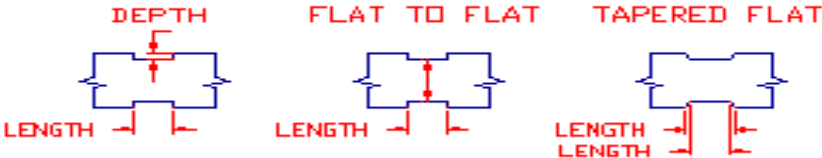
If there are problems measuring the part, send it to our engineers who can match the tool joint with one of over 600 thread gages we have in stock or in the API reference books.

Subs have two length measurements. The first is the over-all-length (OAL), this is the length from the tip to tip of the sub - the longest dimension of the sub. The second is the shoulder-to-shoulder or working length (S to S), the working dimension of the sub in the drill string. It is measured from the shoulder face of the pin to the shoulder face of a pin on pin to pin subs (1.). On a pin to box sub it is measured from the shoulder face of the pin end to the end of the box end (2). On a box to box sub the OAL and S to S are the same (3).



Flats depths on subs may be measured in two different ways. The first, and most common, is by the depth

of the flat from the diameter of the sub (1), how much material is removed. The second method of measurement is to measure the distance between the flat surface to flat surface (2), or the opening of the pipe-handling tool. If the flat has a taper, please give us the length at the top and again at the bottom of the flat (see sketch).



Mills Machine stocks the thread gages for over **600 different tool joint** connections for use in the water well, construction, mining, utility, horizontal and environmental drilling

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Stock Subs

industries. The threads are manufactured to meet the specifications of the American Petroleum Industry or the Diamond Core Drilling Manufacturers Association.

Subs (Rotary Adapters or Substitutes)

The Subs listed below are what we consider to be stock standard sizes and the working length will accept standard break out flats.

All of our subs are manufactured from 4142 heat treated alloy steel on computerized lathes enabling us to offer better pricing and availability.

Many other sizes are available in a multitude of configurations from the over 600 thread gages we have in stock. For quantities of ten or more please call us for special pricing.

Part Number	Box to Box	Dimensions	Working
		O.D x I. D.	Length
PSBBMJR238R	MJR to 2 3/8 Regular	2 3/4 - 3 1/8 BN x 1 1/2	10"
PSBBMJR278R	MJR to 2 7/8 Regular	2 3/4 - 3 3/4 BN x 1 1/2	10"
PSBBMJR312R	MJR to 3 1/2 Regular	2 3/4 - 4 1/2 BN x 1 1/2	10"
PSBBMJR412R	MJR to 4 1/2 Regular	2 3/4 - 5 1/2 BN x 1 1/2	12"
PSBBMR238R	MR to 2 3/8 Regular	3 1/4 x 1 1/2	10"
PSBBMR278R	MR to 2 7/8 Regular	3 1/4 - 3 3/4 BN x 2"	10"
PSBBMR312R	MR to 3 1/2 Regular	3 1/4 - 4 1/2 BN x 2"	10"
PSBBMR412R	MR to 4 1/2 Regular	3 1/4 - 5 1/2 BN x 2"	12"
PSBB238IF238R	2 3/8 IF to 2 3/8 Reg	3 1/2 x 1 1/2	10"
PSBB238IF278R	2 3/8 IF to 2 7/8 Reg	3 1/2 - 3 3/4 BN x 2"	10"
PSBB238IF312R	2 3/8 IF to 3 1/2 Reg	3 1/2 - 4 1/2 BN x 2"	10"
PSBB238IF412R	2 3/8 IF to 4 1/2 Reg	3 1/2 - 5 1/2 BN x 2"	10"
PSBB278IF312R	2 7/8 IF to 3 1/2 Reg	4 1/2 x 2"	10"
PSBB278IF412R	2 7/8 IF to 4 1/2 Reg	4 1/2 - 5 1/2 BN x 2"	10"
	Pin to Box		
PSBB312R412R	3 1/2 Reg to 4 1/2 Reg	4 1/2 - 5 1/2 BN x 1 1/2	9"

BN - Bottleneck for Break-out Flats

We also stock smaller quantities of 2 3/8 & 2 7/8 FEDP and Mayhew FH Box-Regular Box, MR & 2 3/8 IF Pin-Pin and 4 1/2 Reg Pin to 6 5/8 Reg Box.

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5a-4

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Stock Subs

Custom threads and other configurations (breakout flats, float valve bore, etc.) are available from over 600 thread gages in Stock!

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0504

5a-4

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Tool Joint Thread Chart

The thread dimensions shown in the following chart are those that may be used to determine a thread type in the field. For specific details of the threads, please contact Mills Machine Co., Inc. or refer to the DCDMA Standards book.

Tool Joint Name and Nominal Size	Material		Pin Dimensions			Box Dimensions		Taper	Thread	
	O. D.	Make to Dia.	Pin Length	Pin ID	Pin Dia. At Base	Box Length	Box Max ID		Thread /Inch	Thread Form

Section 1 - Popular Sizes

API REGULAR (Reg.)

2 3/8 REG	3 1/8		3"	1"	2.625	3 1/4	1 3/4	3	5	TAPER
2 7/8 REG	3 3/4		3 1/2	1 1/4	2.990	3 3/4	2"	3	5	TAPER
3 1/2 REG	4 1/4	4 1/2	3 3/4	1 1/2	3.490	4"	2 7/16	3	5	TAPER
4 1/2 REG	5 1/2		4 1/4	2 1/4	4.600	4 1/2	3 1/4	3	5	TAPER
5 1/2 REG	6 3/4		4 3/4	2 3/4	5.515	5"	3 3/8	3	4	TAPER
6 5/8 REG	7 3/4	8"	5"	3 1/2	5.975	5 1/4	4 3/4	2	4	TAPER
7 5/8 REG	8 7/8	9"	5 1/4	3 1/2	6.975	5 1/2	5 1/4	3	4	TAPER
8 5/8 REG	10"		5 3/8	4"	7.951	6 1/4	6 5/8	3	4	TAPER

API INTERNAL FLUSH (IF)

2" IF	2 3/8		2 1/4	1 1/8	1.975	2 3/4	1 1/2	2	4	TAPER
2 3/8 IF	3 1/2		3"	1 5/8	2.860	3 1/4	2 1/8	2	4	TAPER
2 5/8 IF LH	3 3/4		3 1/4	1 3/4	3.128	3 5/8	2 1/4	2	4	TAPER
2 7/8 IF	4 1/8	4 1/2	3 1/2	2 1/8	3.385	3 3/4	2 1/2	2	4	TAPER
3 1/2 IF	4 3/4		4"	2 11/16	4.000	4 1/4	3 1/4	2	4	TAPER
4" IF (4 1/2 XH)	6"		4 1/2	3 1/4	4.828	4 3/4	3 1/2	2	4	TAPER
4 1/2 IF (5 XH)	6 1/8		4 1/2	3 3/4	5.250	4 3/4	4"	2	4	TAPER
5 1/2 IF	7 3/8		5"	4 13/16	6.390	5 1/2	5 1/16	2	4	TAPER
6 5/8 IF	9"		5"	3 3/4	7.459	5 5/8	6 1/4	2	4	TAPER

API FULL HOLE (FH)

2 7/8 FH	4 1/4	4 1/2	3 1/2	2 1/8		3 7/8	2 1/8	3	5	TAPER
3 1/2 FH	4 5/8		3 3/4	2 7/16	3.990	4"	2 7/8	3	5	TAPER
4" FH	5 1/4		4 1/2	2 13/16	4.270	4 3/4	3 1/4	2	4	TAPER
4 1/2 FH	5 3/4		4"	3"	4.782	4 1/4	3 1/4	3	5	TAPER
5 1/2 FH	7"		5"	4"	5.828	5 1/2	4 1/4	2	4	TAPER
6 5/8 FH	8"		5"	5"	6.740	5 1/2	5 1/2	2	4	TAPER

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5a-5

Tool Joint Thread Chart

Tool Joint Name and Nominal Size	Material		Pin Dimensions			Box Dimensions		Taper	Thread	
	O. D.	Make to Dia.	Pin Length	Pin ID	Pin Dia. At Base	Box Length	Box Max ID		Thread /Inch	Thread Form

MAYHEW

JUNIOR (MJ)	2 3/4		2 1/4	1 1/4	2.320	2 1/2	1 11/16	2	4	TAPER
REGULAR (MR)	3 1/4		3"	1 1/2	2.555	3 1/4	2"	1 1/2	4	TAPER
FULLHOLE (MFH)	3 3/4		3 3/8	2"	3.045	3 5/8	2 3/8	1 1/2	4	TAPER

FAILING EXPLORATION

2 3/8 FEDP	3 1/8		2 3/4	1 3/8	2.480	3"	1 3/4	2	4	TAPER
2 7/8 FEDP	3 3/4		3 1/4	1 7/8	3.100	3 1/2	2 1/4	2	4	TAPER

SQUARE THREAD & DCDMA THREADS

3 THREAD N ROD	2 3/8		2 3/4	1"	1.860	3"	1 5/8		3	SQUARE
4 THREAD N ROD	2 3/8		2 3/4	1"	1.865	3"	1 5/8		4	SQUARE
A ROD	1 5/8		1 7/8	9/16	1.260	2 1/8	1 1/16		3	SQUARE
AW ROD	1 3/4		1 7/8	5/8	1.365	2 1/8	1 1/4		3	SQUARE
AWJ (AWML)	1 3/4		1 3/4	5/8	1.425	1 7/8	1"	2	5	TAPER
E ROD	1.305		1 3/4	7/16	0.996	2"	7/8		3	SQUARE
B W	2 3/8		2 1/4	3/4	1.680	2 5/8	1 3/8		3	SQUARE
BQ	2 3/16		4 3/4	1 13/16		2"	1 13/16	1/2	3	TAPER
HW	3 1/2		3 1/4	2 1/4		3 1/2	2 13/16		3	SQUARE
EW	1 3/8		1 9/16	7/16	1.050	1 3/4	7/8		3	SQUARE
NW	2 5/8		2 3/4	1 3/8	2.210	3"	2"		3	SQUARE
NWJ (NWML)	2 5/8		2 3/8	1 1/4	2.240	2 3/4	1 1/2	2	4	TAPER

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Tool Joint Thread Chart

Tool Joint Name and Nominal Size	Material		Pin Dimensions			Box Dimensions		Taper	Thread	
	O. D.	Make to Dia.	Pin Length	Pin ID	Pin Dia. At Base	Box Length	Box Max ID		Thread /Inch	Thread Form

Section 2 - Other Sizes

API X-HOLE (XH)

3 1/2 XH	4 7/8		3 1/2	2 7/16	3.800	3 7/8	2 7/8	2	4	TAPER
4 1/2 XH Same as 4 IF. Use those dimensions.										
5" XH Same as 4 1/2 IF. Use those dimensions.										

HACKER

JUNIOR	3 1/8		2 1/4	1 7/8	2.685	2 3/4	2 1/8	1 3/4	5	TAPER
SENIOR	3 1/2		2 1/2	1 3/4	2.895	2 3/4	2 1/4	1 1/2	4	TAPER
4" HACKER	5 7/8		3 5/8	3 3/4	5.215	4"	4 3/8	1 1/2	4	TAPER
6 5/8 HACKER	7 1/2		3 1/16	6"	6.935	3 1/2	6 1/4	1 1/2	4	TAPER
8 5/8 HACKER	10 1/2		4 1/2	7 1/2	9.460	5"	8"	2	4	TAPER

BECO

3 1/2 BECO	4 3/4		3 3/4	1 1/2	3.970	4 1/4	2 1/4	3	2	TAPER
4 1/2 BECO	5 3/4 or 6 1/2		4 1/4	2 1/4	5.000	5"	3 1/4	3	2	TAPER
5 1/4 BECO	7"		5 3/4	2 13/16	5.750	5 1/2	3 3/4	3	2	TAPER
6" BECO	7 5/8 or 8 3/4		6 1/2	3"	6.500	5 1/2+	4 1/2	3	2	TAPER
8" BECO	10 3/4 or 12 3/4		4 7/8	5"	8.500	5 1/2+	6 1/4	3	2	TAPER

CA-21 (DEEP ROCK)

CA 21	2 1/4		1 1/4	1 1/8	1.765	1 1/2	1 1/2	1 1/2	6	TAPER
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E U E

Nominal Size	API Size										
3/4	1.050	1.560		1 1/8	1.315	0.825	1 3/8		3/4	10	TAPER
1	1.315	1.900		1 1/4	1.469	1.049	1 1/2		3/4	10	TAPER
1 1/4	1.660	2.200		1 3/8	1.825	1.380	1 3/4	1 1/2	3/4	10	TAPER
1 1/2	1.900	2.500		1 7/16	2.093	1.610	1 7/8	1 3/4	3/4	10	TAPER
2"	2 3/8	3.063		1 15/16	2.625	1.995	2 3/8	2 1/4	3/4	8	TAPER
2 1/2	2 7/8	3.668		2 1/8	3.113	2.441	2 1/2	2 1/2	3/4	8	TAPER
3"	3 1/2	4.500		2 3/8	3.795	2.992	2 3/4	3 5/16	3/4	8	TAPER
3 1/2	4"	5.000		2 1/2	4.250	3.476	2 7/8		3/4	8	TAPER
4"	4 1/2	5.563		2 5/8	4.790	3.958	3"		3/4	8	TAPER

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5a-7

Tool Joint Thread Chart

Tool Joint Name and Nominal Size	Material		Pin Dimensions			Box Dimensions		Taper	Thread	
	O. D.	Make to Dia.	Pin Length	Pin ID	Pin Dia. At Base	Box Length	Box Max ID		Thread /Inch	Thread Form

HACKER FAILING

6 5/8 HF	8"		3 1/2	6"	7.310	4 1/2	6 1/2	1.5	4	TAPER
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*Also, known as 7" Hacker

MOBILE

2 5/8 MOBILE	2 5/8		2 1/2	1 1/4	2.240	2 7/8	1 3/4	2	5	TAPER
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NATIONAL PIPE THREAD

1" NPT	1 3/4		1"	1"	1.325	1 1/4	1 1/8	3/4	11 1/2	TAPER
1" NPT LH	1 3/4		1"	1"	1.325	1 1/4	1 1/8	3/4	11 1/2	TAPER
1 1/4 NPT	2"		1"	1 1/4	1.660	1 1/4	1 3/8	3/4	11 1/2	TAPER
1 1/2 NPT	2 1/4		1 1/8	1 1/2	1.950	1 3/8	1 5/8	3/4	11 1/2	TAPER
2" NPT	2 3/4		1 1/8	2"	2.385	1 5/8	2 1/8	3/4	11 1/2	TAPER
2" NPT LH	2 3/4		1 1/8	2"	2.385	1 5/8	2 1/8	3/4	11 1/2	TAPER
2 1/2 NPT	3 1/4		1 9/16	2 1/2	2.875	1 3/4	2 5/8	3/4	8	TAPER
3" NPT	4"		1 5/8	3"	3.500	1 7/8	3 1/8	3/4	8	TAPER
3" NPT LH	4"		1 5/8	3"	3.500	1 7/8	3 1/8	3/4	8	TAPER
3 1/2 NPT	4 5/8		1 11/16	3 1/2	4.000	2 1/16	3 5/8	3/4	8	TAPER
3 1/2 NPT LH	4 5/8		1 11/16	3 1/2	4.000	2 1/16	3 5/8	3/4	8	TAPER
4" NPT	5 1/4		1 3/4	4"	4.510	2 1/4	4 1/8	3/4	8	TAPER
4" NPT LH	5 1/4		1 3/4	4"	4.510	2 1/4	4 1/8	3/4	8	TAPER
4 1/4 NPT				4 1/4	4.250			3/4	8	TAPER
5" NPT	6 5/16		2"	5"	5.563	2 1/2	5 1/4	3/4	8	TAPER
6" NPT	7 3/8		2"	6"	6.625	2 1/2	6 1/4	3/4	8	TAPER

P K RED DEVIL

P K Red Devil	2 7/8		3 7/8	1 3/8	2.300	4 1/4	1 7/8	3/4	8	TAPER
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ROCKMASTER

ROCKMASTER	2 3/4		3"	1 1/8	2.030	3 1/4	1 3/4		3	ACME
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WINTER WEISS

2 3/8 WW MOD.	3 1/4		3"	1 1/2	2.535	3 1/4	2"	1.5	4	TAPER
2 7/8 WW MOD.	3 7/16		3"	1 1/2	2.535	3 1/4	2"	1.5	4	TAPER

"PLEASE CALL FOR CUSTOM OPTIONS AND OTHER ACCESSORIES"

Tool Joint Thread Chart

SUB Application Questionnaire	
SUB Adapter	Rotary Substitute

Company _____

 Address _____

 City, State Zip _____
 Contact _____

Phone _____
 Fax _____
 E-mail _____

Quantity**: _____
 Top Connection**: _____ Pin Box
 Bottom Connection**: _____ Pin Box

Sketch:

****Must fill out these items. Fill out more if possible or custom product requested.**

Length: Shoulder to Shoulder _____
 OR Overall _____

Top Neck Dimensions: OD _____ ID _____
 Knurled Length _____

Bottom Neck Dimensions: OD _____ ID _____
 Knurled Length _____

Breakout Flats: Two Sided Four Sided
 Special _____
 Flat Length _____
 Dimensions: Flat to Flat _____
 OR Depth per Side _____
 Location _____

Lugs: Drill Pipe OD _____
 Hour Glass: Location _____ Dimensions _____

Float Valve: Bore Only Install: Customer Furnished

"PLEASE CALL FOR CUSTOM OPTIONS AND OTHER ACCESSORIES"

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Check our Web site:
www.MillsMachine.com

MILLS MACHINE CO. INC., P O BOX 1514, SHAWNEE, OK, 74802
 Phone: 800-654-2703 or 405-273-4900 Fax: 405-273-4956

Tool Joint Thread Chart

Mills Furnished
Brand _____ *Model & Size* _____

Special Requirements: _____

"PLEASE CALL FOR CUSTOM OPTIONS AND OTHER ACCESSORIES"

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