Torque-Thru Knuckle Joint

MAN-TTT-900 (R01)

Thru-Tubing Technology

A Division of Owen Oil Tools LP

402 Machine Loop

Scott, Louisiana, 70583, USA

Phone: +1 (337) 984-1181

Fax: +1 (337) 984-3044

www.corelab.com/owen

Description

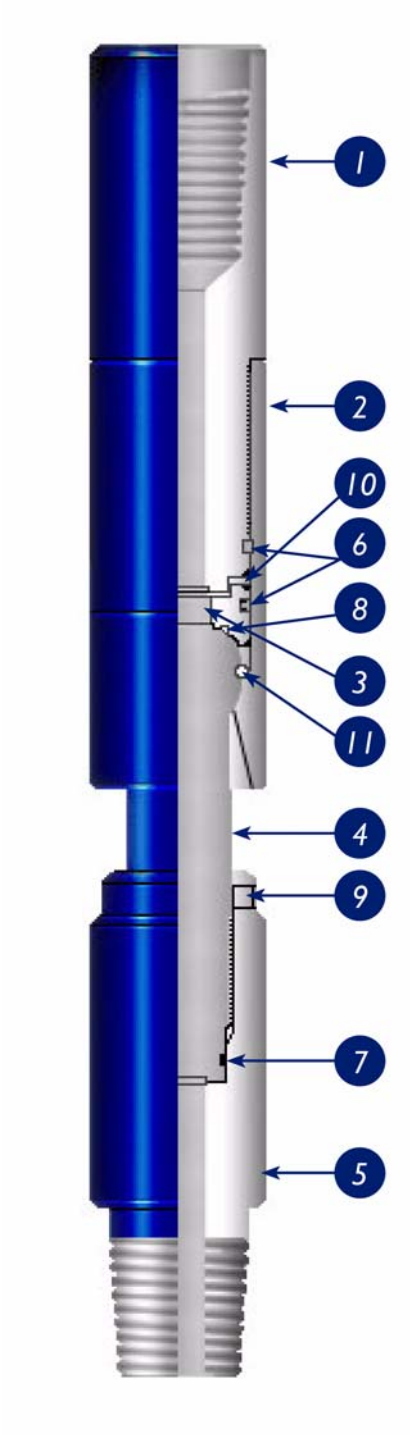
The Torque-Thru Knuckle Joint is used in a deviated well to aid in centralization with running a centralizer, stabilizer or mud motor for a few examples. The Torque-Thru Knuckle Joint will function the same way as a sealed knuckle joint, but it will additionally transmit torque. It can be placed above and below the mud motor, preventing any unnecessary side loads that may reduce the motor's life span or cause damages. The foot-pounds that can be transmitted is equivalent to if not greater than the mud motor. The knuckle joint is also sealed to allow for fluid to pass for washing or operating any hydraulic tools below it.

Operation

Simply install the tool in the tool string where the most flexibility is required. The tool will function automatically.

Note: Unless otherwise indicated, all the strength figures given in this manual, are the result of calculations based on the yield strength of the material used in the manufacture of this product. These strength calculations are considered accurate within plus or minus 20% and are to be used only as a guide. They do not constitute a guarantee, actual or implied. In use, appropriate allowance should be made as a safety factor.

TT0900-168A BOM, Schematic and Specs



ITEM	QTY	TOOL PARTS DESCRIPTION	PART NUMBER
1	1	Top Sub	TT0900-168A-001
2	1	Ball Housing	TT0900-168A-002
3	1	End Ring	TT0900-168A-003
4	1	Ball Sub	TT0900-168A-004
5	1	Bottom Sub	TT0900-168A-005
6	2	O-Rings 1 3/8" x 1 13/16" x 3/32" 2-123	PUR-TORV000-123
7	1	O-Ring 15/16" x 3/4" x 3/32" 2-116	PUR-TORV000-116
8	1	Teflon O-Ring 1 1/16" x 7/8" x 3/32" T-2-118	PUR-TORT000-118
9	6	Steel Allen Set Screws 10-32 x 5/16"	PUR-TSAS121-020
10	1	Steel Wave Spring SSB -0110	PUR-TWS0071-007
11	24	Steel Ball Bearings 1/8"	PUR-TSBC000-008

Tool Name: 1.688 in. OD Torque-Thru Knuckle Joint

Product Code: TT0900-168A **Tool OD:** 1.688 in. **Tool ID:** 0.531 in.

Material: AISI 4140 HT 285-341 BHN **Tool Length:** 11.38 in. w/ 1 in. MT Conn.

Minimum Yield: 100,000 psi.

Strength Properties of Tool:

Minimum Yield Point and Load to Yield: 51,600 lbs. Yield at the Ball Sub and Ball Socket.

Burst Point and Burst Pressure: 18,020 psi Burst at Ball Housing.

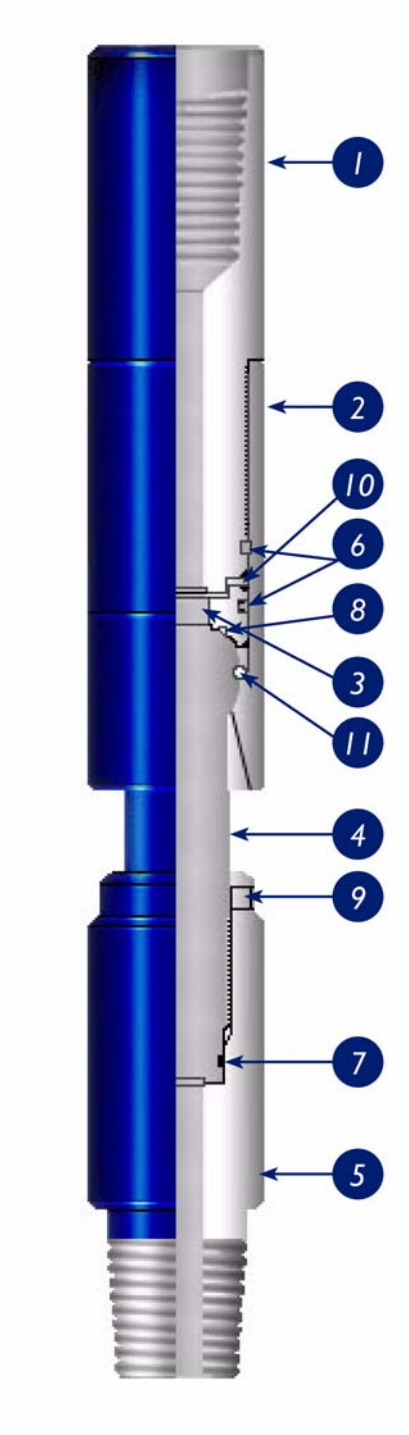
Torsional Weak Point and Ft-Lbs to Yield: 308 ft-lbs as a function of torsional yield of the 1/8 in. ball bearing torque drive connection of the Ball Sub.

Recommended Make Up Torque:

1st Connection: Top Sub and Ball Housing - 237 ft-lbs.

2nd Connection: Ball Sub and Bottom Sub - 118 ft-lbs, then tighten the 10-32 steel Allen set screws - 40 in-lbs.

TT0900-175A BOM, Schematic and Specs



ITEM	QTY	TOOL PARTS DESCRIPTION	PART NUMBER
1	1	Top Sub	TT0900-175A-001
2	1	Ball Housing	TT0900-175A-002
3	1	End Ring	TT0900-168A-003
4	1	Ball Sub	TT0900-168A-004
5	1	Bottom Sub	TT0900-175A-005
6	2	O-Rings 1 3/8" x 1 13/16" x 3/32" 2-123	PUR-TORV000-123
7	1	O-Ring 15/16" x 3/4" x 3/32" 2-116	PUR-TORV000-116
8	1	Teflon O-Ring 1 1/16" x 7/8" x 3/32" T-2-118	PUR-TORT000-118
9	6	Steel Allen Set Screws 10-32 x 5/16"	PUR-TSAS121-020
10	1	Steel Wave Spring SSB-0110	PUR-TWS0071-007
11	24	Steel Ball Bearings 1/8"	PUR-TSBC000-008

Tool Name: 1.750 in. OD Torque-Thru Knuckle Joint

Product Code: TT0900-175A **Tool OD:** 1.750 in. **Tool ID:** 0.531 in.

Material: AISI 4140 HT 285-341 BHN **Tool Length:** 11.38 in. w/ 1 in. MT Conn.

Minimum Yield: 100,000 psi

Strength Properties of Tool:

Minimum Yield Point and Load to Yield: 51,600 lbs Yield at the Ball Sub and Ball Socket.

Burst Point and Burst Pressure: The O-ring groove of the End Ring, 21,500 psi.

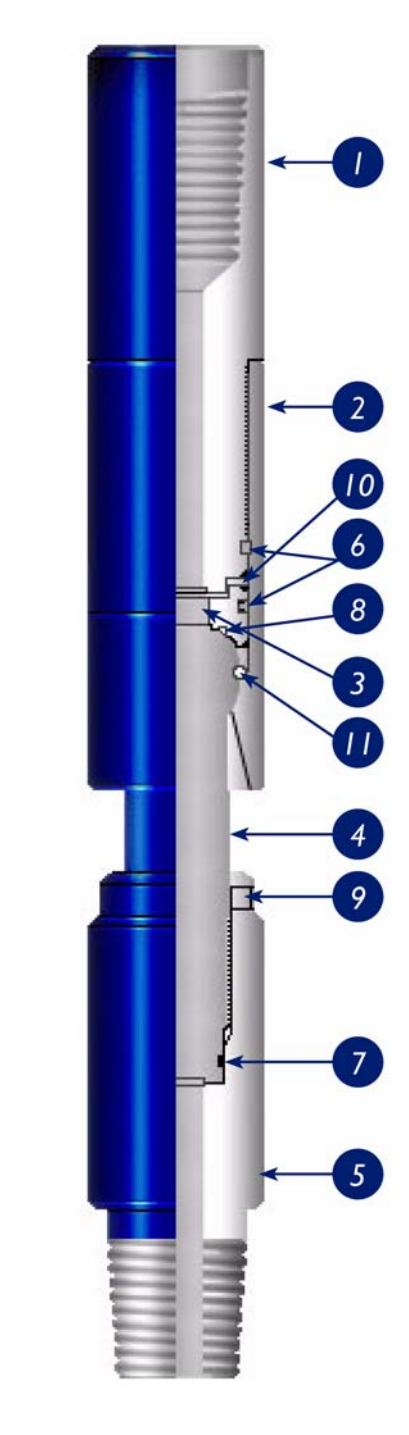
Torsional Weak Point and Ft-Lbs to Yield: 308 ft-lbs as a function of torsional yield of the 1/8 in. ball bearing torque drive connection of the Ball Sub.

Recommended Make Up Torque:

1st Connection: Top Sub and Ball Housing - 239 ft-lbs.

2nd Connection: Ball Sub and Bottom Sub - 118 ft-lbs, then tighten the 10-32 steel Allen set screws - 40 in-lbs.

TT0900-181A BOM, Schematic and Specs



ITEM	QTY	TOOL PARTS DESCRIPTION	PART NUMBER
1	1	Top Sub	TT0900-181A-001
2	1	Ball Housing	TT0900-181A-002
3	1	End Ring	TT0900-168A-003
4	1	Ball Sub	TT0900-168A-004
5	1	Bottom Sub	TT0900-181A-005
6	2	O-Rings 1 3/8" x 1 13/16" x 3/32" 2-123	PUR-TORV000-123
7	1	O-Ring 15/16" x 3/4" x 3/32" 2-116	PUR-TORV000-116
8	1	Teflon O-Ring 1 1/16" x 7/8" x 3/32" T-2-118	PUR-TORT000-118
9	6	Steel Allen Set Screws 10-32 x 5/16"	PUR-TSAS121-020
10	1	Steel Wave Spring SSB-0110	PUR-TWS0071-007
11	24	Steel Ball Bearings 1/8"	PUR-TSBC000-008

Tool Name: 1.813 in. OD Torque-Thru Knuckle Joint

Product Code: TT0900-181A **Tool OD:** 1.813 in. **Tool ID:** 0.531 in.

Material: AISI 4140 HT **Tool Length:** 11.38 in. w/ 1 in. MT Conn.

Minimum Yield: 100,000 psi

Strength Properties of Tool:

Minimum Yield Point and Load to Yield: 51,600 lbs Yield at the Ball Sub and Ball Socket.

Burst Point and Burst Pressure: 24,700 psi Burst at Ball Housing.

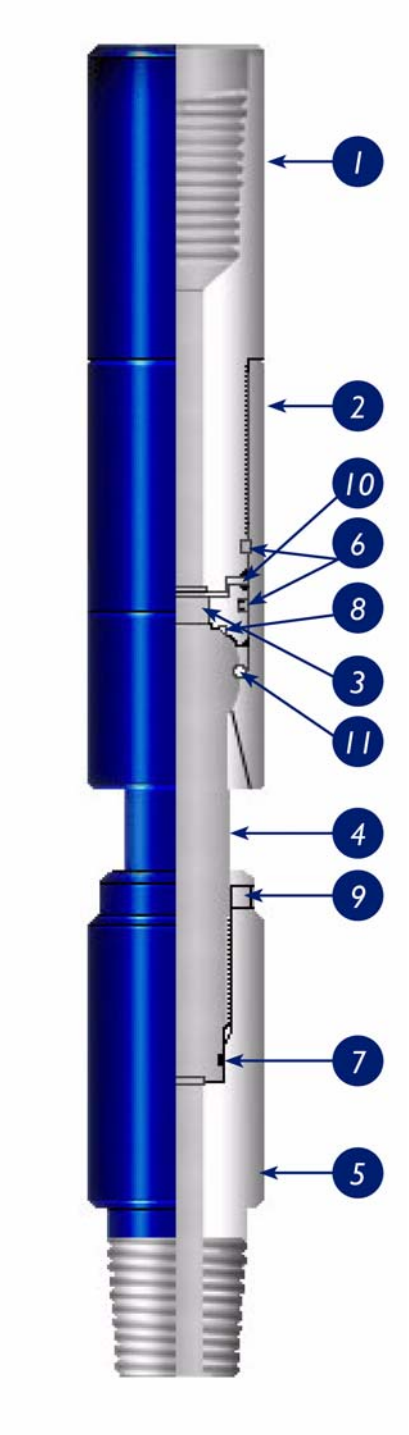
Torsional Weak Point and Ft-Lbs to Yield: 308 ft-lbs as a function of torsional yield of the 1/8 in. ball bearing torque drive connection of the Ball Sub.

Recommended Make Up Torque:

1st Connection: The Top Sub - Ball Housing Stub Acme connection - 241 ft-lbs.

2nd Connection: Ball Sub and Bottom Sub - 118 ft-lbs, then tighten the 10-32 steel Allen set screws - 40 in-lbs.

TT0900-206A BOM, Schematic and Specs



ITEM	QTY	TOOL PARTS DESCRIPTION	PART NUMBER
1	1	Top Sub	TT0900-206A-001
2	1	Ball Housing	TT0900-206A-002
3	1	End Ring	TT0900-213A-003
4	1	Ball Sub	TT0900-213A-004
5	1	Bottom Sub	TT0900-206A-005
6	2	O-Rings 1 1/2" X 1 11/16" X 3/32" 2-128	PUR-TORV000-128
7	1	O-Ring 1 1/8" x 15/16" x 3/32" 2-119	PUR-TORV000-119
8	1	Teflon O-Ring 1 1/4" x 1 1/16" x 3/32" T-2-121	PUR-TORT000-121
9	6	Steel Allen Set Screws 1/4-20 x 5/16"	PUR-TSAS160-020
10	1	Steel Wave Spring SSR-0150	PUR-TWS0096-011
11	24	Steel Ball Bearings 5/32"	PUR-TSBC000-010

Tool Name: 2.063 in. OD Torque-Thru Knuckle Joint

Product Code: TT0900-206A **Tool OD:** 2.063 in. **Tool ID:** 0.594 in.

Material: AISI 4140 HT 285-341 BHN **Tool Length:** 13.81 in. w/ 1-1/2 in. MT

Minimum Yield: 100,000 psi.

Strength Properties of Tool:

Minimum Yield Point and Load to Yield: 83,130 lbs. Yield at the Ball Sub and Ball Socket.

Burst Point and Burst Pressure: 19,700 psi Burst at Ball Housing.

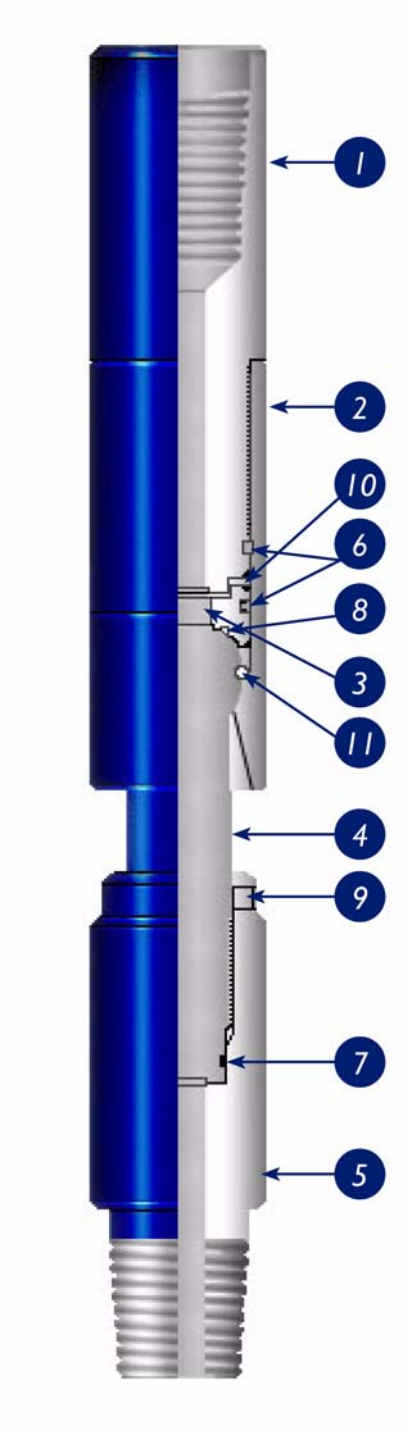
Torsional Weak Point and Ft-Lbs to Yield: 578 ft-lbs as a function of torsional yield of the 5/32 in. ball bearing torque drive connection of the Ball Sub.

Recommended Make Up Torque:

1st Connection: Top Sub and Ball Housing - 438 ft-lbs.

2nd Connection: Ball Sub and Bottom Sub - 257 ft-lbs. then tighten the 1/4 in.- 20 steel Allen set screws – 85 in-lbs.

TT0900-213A BOM, Schematic and Specs



ITEM	QTY	TOOL PARTS DESCRIPTION	PART NUMBER
1	1	Top Sub	TT0900-213A-001
2	1	Ball Housing	TT0900-213A-002
3	1	End Ring	TT0900-213A-003
4	1	Ball Sub	TT0900-213A-004
5	1	Bottom Sub	TT0900-213A-005
6	2	2-128 O-Rings 1 1/2" x 1 11/16" x 3/32"	PUR-TORV000-128
7	1	2-119 O-Ring 1 1/8" x 15/16" x 3/32"	PUR-TORV000-119
8	1	2-121 Teflon O-Ring 1 1/4" x 1 1/16" x 3/32"	PUR-TORT000-121
9	6	Steel Allen Set Screws 1/4-20 x 5/16"	PUR-TSAS160-020
10	1	Steel Wave Spring SSR-0150	PUR-TWS0096-011
11	24	Steel Ball Bearings 5/32"	PUR-TSBC000-010

Tool Name: 2.125 in. OD Torque-Thru Knuckle Joint

Product Code: TT0900-213A **Tool OD:** 2.125 in. **Tool ID:** 0.594 in.

Material: AISI 4140 HT 285-341 BHN **Tool Length:** 13.81 in. w/ 1-1/2 in. MT

Minimum Yield: 100,000 psi.

Strength Properties of Tool:

Minimum Yield Point and Load to Yield: 83,130 lbs. Yield at the Ball Sub and Ball Socket.

Burst Point and Burst Pressure: 22,600 psi Burst at Ball Housing.

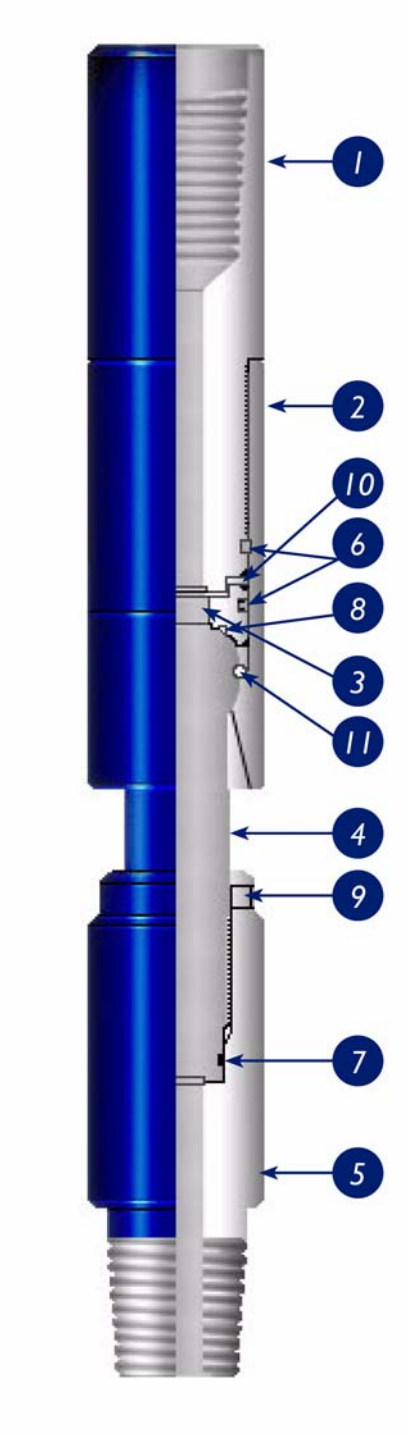
Torsional Weak Point and Ft-Lbs to Yield: 578 ft-lbs as a function of torsional yield of the 5/32 in. ball bearing torque drive connection of the Ball Sub.

Recommended Make Up Torque:

1st Connection: Top Sub and Ball Housing - 440 ft-lbs.

2nd Connection: Ball Sub and Bottom Sub - 257 ft-lbs. then tighten the 1/4 in.- 20 steel Allen set screws – 85 in-lbs.

TT0900-225A BOM, Schematic and Specs



ITEM	QTY	TOOL PARTS DESCRIPTION	PART NUMBER
1	1	Top Sub	TT0900-225A-001
2	1	Ball Housing	TT0900-225A-002
3	1	End Ring	TT0900-225A-003
4	1	Ball Sub	TT0900-225A-004
5	1	Bottom Sub	TT0900-225A-005
6	2	O-Rings 1 7/8" x 1 11/16" x 3/32" 2-131	PUR-TORV000-131
7	1	O-Ring 1 1/4" x 1 1/16" x 3/32" 2-121	PUR-TORV000-121
8	1	Teflon O-Ring 1 3/8" x 1 13/16" x 3/32" T-2-123	PUR-TORT000-123
9	6	Steel Allen Set Screws 1/4-20 x 5/16"	PUR-TSAS160-020
10	1	Steel Wave Spring SSR-0175	PUR-TWS2112-009
11	24	Steel Ball Bearings 5/32"	PUR-TSBC000-010

Tool Name: 2.250 in. OD Torque-Thru Knuckle Joint

Product Code: TT0900-225A **Tool OD:** 2.250 in. **Tool ID:** 0.625 in.

Material: AISI 4140 HT 285-341 BHN **Tool Length:** 15.4 in. w/ 1-1/2 in. MT Conn.

Minimum Yield: 100,000 psi

Strength Properties of Tool:

Minimum Yield Point and Load to Yield: The spherical face of the ball on the mating face and bore on the ID of the Ball Housing, 58,400 lbs; the thread recess of the Stub Acme box connection of the Ball Housing, 86,500 lbs.

Burst Point and Burst Pressure: The O-ring bore of the Ball Housing, 18,030 psi.

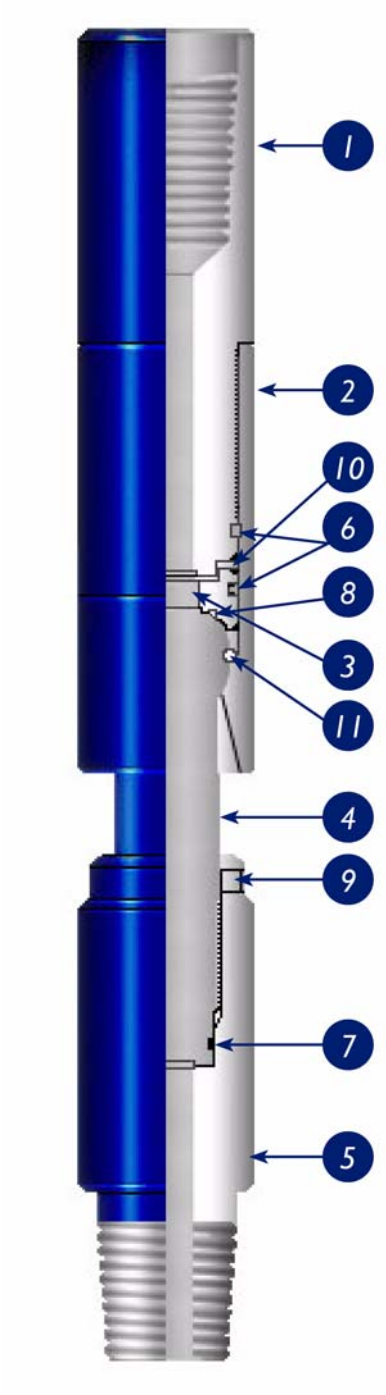
Torsional Weak Point and Ft-Lbs to Yield: 645 ft-lbs as a function of torsional yield of the 5/32 in. ball bearing torque drive connection of the Ball Sub.

Recommended Make Up Torque:

1st Connection: The Top Sub - Ball Housing Stub Acme connection - 510 ft-lbs.

2nd Connection: The Ball - Bottom Sub Stub Acme connection - 194 ft-lbs and then tighten the six (6) 1/4 in.-20 Steel Allen set screws - 85 in-lbs.

TT0900-288A BOM, Schematic and Specs



ITEM	QTY	TOOL PARTS DESCRIPTION	PART NUMBER
1	1	Top Sub	TT0900-288A-001
2	1	Ball Housing	TT0900-288A-002
3	1	End Ring	TT0900-288A-003
4	1	Ball Sub	TT0900-288A-004
5	1	Bottom Sub	TT0900-288A-005
6	2	O-Rings 2 1/16" x 2 1/8" x 1/8" 2-227	PUR-TORV000-227
7	1	O-Ring 1 1/4" x 1 1/2" x 1/8" 2-218	PUR-TORV000-218
8	1	Teflon O-Ring 1 5/16" x 1 9/16" x 1/8" T-2-219	PUR-TORT000-219
9	6	Steel Allen Set Screws 5/16-18 x 5/16"	PUR-TSAS200-020
10	1	Steel Wave Spring SSR-0200	PUR-TWS2128-009
11	24	Steel Ball Bearings 3/16"	PUR-TSBC000-012

Tool Name: 2.875 in. OD Torque-Thru Knuckle Joint

Product Code: TT0900-288A **Tool OD:** 2.875 in. **Tool ID:** 0.78 in.

Material: AISI 4140 HT 285-341 BHN **Tool Length:** 20 in. w/ 2-3/8 in. PAC DSI

Minimum Yield: 100,000 psi

Strength Properties of Tool:

Minimum Yield Point and Load to Yield: Shaft of Ball Sub - 144,090 lbs.

Burst Point and Burst Pressure: Ball Sub Housing - 18,870 psi

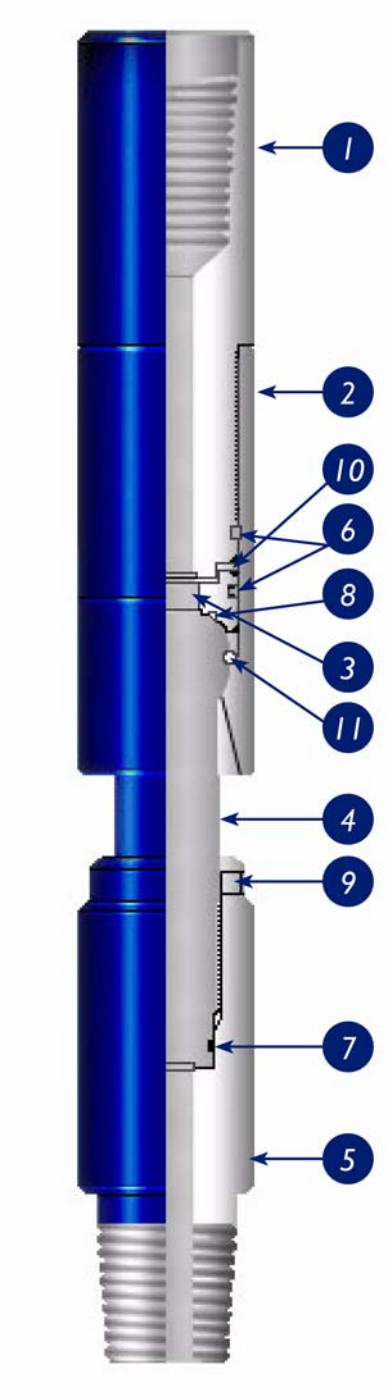
Torsional Weak Point and Ft-Lbs to Yield: 1140 ft-lbs as a function of torsional yield of the 3/16 in. ball bearing torque drive connection of the Ball Sub.

Recommended Make Up Torque:

1st Connection: Top Sub - Ball Housing Connection - 1030 ft-lbs at 25% of connection torsional yield strength.

2nd Connection: Ball Sub - Bottom Sub Connection - 640 ft-lbs and then tighten the six (6) 5/16 in.-18 steel Allen Set Screws to 167 in-lbs.

TT0900-313A BOM, Schematic and Specs



ITEM	QTY	TOOL PARTS DESCRIPTION	PART NUMBER
1	1	Top Sub	TT0900-313A-001
2	1	Ball Housing	TT0900-313A-002
3	1	End Ring	TT0900-313A-003
4	1	Ball Sub	TT0900-313A-004
5	1	Bottom Sub	TT0900-313A-005
6	2	2-228 O-Rings 2 1/4" x 2 1/2" x 1/8"	PUR-TORV000-228
7	1	2-221 O-Ring 1 7/16" x 1 11/16" x 1/8"	PUR-TORV000-221
8	1	2-223 Teflon O-Ring 1 5/8" x 1 7/8" x 1/8"	PUR-TORT000-223
9	8	Steel Allen Set Screws 3/8-16 x 7/16"	PUR-TSAS240-028
10	1	Steel Wave Spring SSR-0200	PUR-TWS2128-009
11	24	Steel Ball Bearings 1/4"	PUR-TSBC000-016

Tool Name: 3.125 in. OD Torque-Thru Knuckle Joint

Product Code: TT0900-313A **Tool OD:** 3.125in. **Tool ID:** 0.88 in.

Material: AISI 4140 HT 285-341 Bhn **Tool Length:** 22.84 in. w/ 2-3/8 in. API Reg Connections

Minimum Yield: 100,000 psi

Strength Properties of Tool:

Minimum Yield Point and Load to Yield: Shaft of Ball Sub - 171,900 lbs.

Burst Point and Burst Pressure: Ball Sub Housing - 19,500 psi

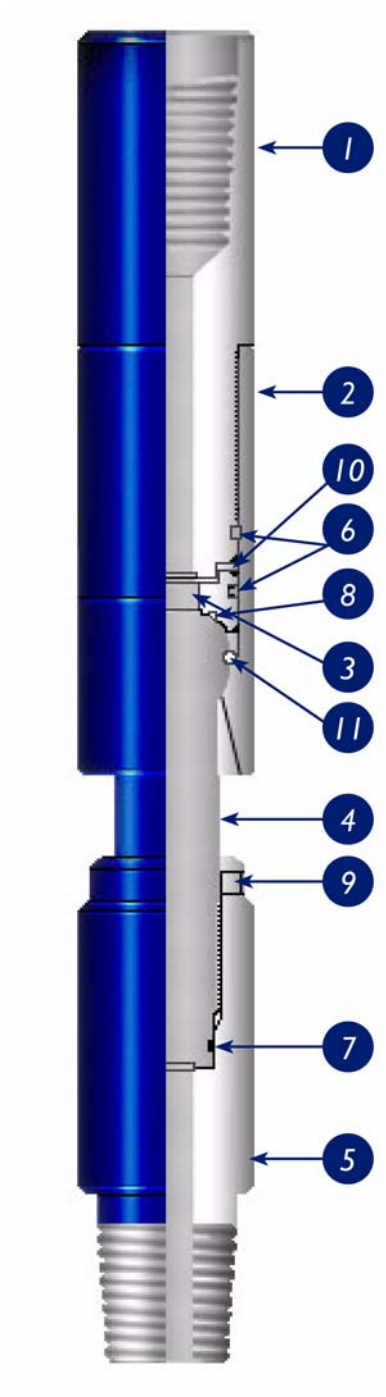
Torsional Weak Point and Ft-Lbs to Yield: 868 ft-lbs as a function of torsional yield of the ¼ in. ball bearing torque drive connection of the Ball Sub.

Recommended Make Up Torque:

1st Connection: Top Sub - Ball Housing Connection - 925 ft-lbs at 25% of connection torsional yield strength.

2nd Connection: Ball Sub - Bottom Sub Connection - 734 ft-lbs and then tighten the six 3/8 in.-16 Allen Set Screws to 273 in-lbs.

TT0900-350A BOM, Schematic and Specs



ITEM	QTY	TOOL PARTS DESCRIPTION	PART NUMBER
1	1	Top Sub	TT0900-350A-001
2	1	Ball Housing	TT0900-350A-002
3	1	End Ring	TT0900-350A-003
4	1	Ball Sub	TT0900-350A-004
5	1	Bottom Sub	TT0900-350A-005
6	1	O-Ring 1 5/8" x 1 7/8" x 1/8" 2-223	PUR-TORV000-223
7	2	O-Rings 2 5/8" x 2 7/8" x 1/8" 2-231	PUR-TORV000-231
8	1	Teflon O-Ring 1 3/4" x 2" x 1/8" T-2-224	PUR-TORT000-224
9	6	Steel Allen Set Screws 3/8-16 x 1/2"	PUR-TSAS240-032
10	1	Steel Wave Spring SSR-0200	PUR-TWS2128-009
11	24	Steel Ball Bearings 5/16"	PUR-TSBC000-020

Tool Name: 3.500 in. OD Torque-Thru Knuckle Joint

Product Code: TT0900-350A **Tool OD:** 3.500 in. **Tool ID:** 1.00 in.

Material: AISI 4140 HT 285-341 Bhn **Tool Length:** 24.90 in. w/ 2-3/8 in. API Reg Connections

Minimum Yield: 100,000 psi

Strength Properties of Tool:

Minimum Yield Point and Load to Yield: Shaft of Ball Sub - 197,500 lbs.

Burst Point and Burst Pressure: Ball Sub Housing - 19,400 psi

Torsional Weak Point and Ft-Lbs to Yield: 1352 ft-lbs as a function of torsional yield of the 5/16 in. ball bearing torque drive connection of the Ball Sub.

Recommended Make Up Torque:

1st Connection: Top Sub - Ball Housing Connection - 2000 ft-lbs at 25% of connection torsional yield strength.

2nd Connection: Ball Sub - Bottom Sub Connection - 1065 ft-lbs and then tighten the six 3/8 in.-16 Allen Set Screws to 273 in-lbs.

1.0 Pre-Assembly

Warning: ***Make sure all tool parts and components have been thoroughly cleaned or serious damage and/or injury could occur!***

Note: Verify that the correct O-ring redress kit and quantities are used as specified on the Bill Of Materials (for example, 5 each etc.…). Lay out all redress kit components on a clean surface.

Note: Make sure to lubricate all O-rings and threaded surfaces.

Note: Visually inspect all parts for damage or wear. Thread parts together without the O-rings to check fit. Repair or replace damaged parts.

Caution: ***Always file wrench marks or burrs and clean off debris!***

Caution: ***This tool should always be disassembled, cleaned thoroughly, inspected and reassembled after each job!***

Important

This tool can be assembled to operate as a non-torque-thru Knuckle Joint, by eliminating the Steel Ball Bearings from the assembly process.

2.0 Assembly

2.1 Put an O-ring (item #6) onto the Top Sub (item #1) and grease the entire ID of the sub, the O-ring, the top of the pin thread end and the pin threads.

2.2 Put an O-ring (item #7) onto the Ball Sub (item #4). Liberally grease the "ball" of the Ball Sub, then place 2 Ball Bearings (item #11) into each one of the slots on the "ball" (24 in total).

Note: The grease should hold the Ball Bearings in place.

2.3 Grease the entire ID of the Ball Housing (item #2) and place on a work surface, threaded end up.

2.4 Place the Ball Sub into the Ball Housing, aligning the Bearing Balls with the slots inside the housing. Make sure that all of the bearings stay in place.

2.5 Put the housing into a vise and making sure that all of the bearings stay in place.

2.6 Put an O-ring (item #6) onto the OD of the End Ring (item #3) and the Teflon O-ring (item #8) in the ID of the End Ring. Grease the ring inside and out.

2.7 Place the End Ring, Teflon O-ring end first, into the Ball Housing and push it in 2-3 in. (5-8 cm) so that Top Sub can be screwed in.

2.8 Place the Wave Spring (item #10) on the top of the pin threaded end of the Top Sub.

2.9 Now put the Top Sub into the vise. Screw the Ball Housing onto the Top Sub by holding the Ball Sub with one hand and the Ball Housing with the other. Make wrench tight.

Note: A little back pressure should be applied to the Ball Sub to ensure that the bearings stay in place.

2.10 Grease the ID of the Ball Sub and its stem. Now grease the ID of the Bottom Sub (item #5), then screw it onto the Ball Sub wrench tight.

2.11 Finally, screw in the 6 Set Screws (item #9) into the Bottom Sub.

Note: The Knuckle Joint should have approximately 6° of bend between the top and bottom subs. The tool should sway smoothly from side to side with slight resistance.

2.12 This tool should be pressure tested before running in the well bore.

3.0 Disassembly

3.1 Put the tool in a vise on the Top Sub (item #1).

3.2 Unscrew the 6 Set Screws (item #9) from the Bottom Sub (item #5). Remove the Bottom Sub.

3.3 Unscrew the Ball Housing (item #2) from the Top Sub (item #1). Drop on a wood block to remove the Ball Sub (item #4), End Ring (item #3) and Wave Spring (item #10). Discard the Ball Bearings and spring.

3.4 Finally, remove the Top Sub from the vise

Note: Remove and discard all O-rings. Replace O-rings after each use. Thoroughly clean tool parts in a cleaner approved by state and/or local laws.

Note: Visually inspect tool for swelling after each use. Damaged or swelled components must be replaced.

Note: It is recommended that a Magnetic Particle Inspection (MPI) be completed on all components after each job.