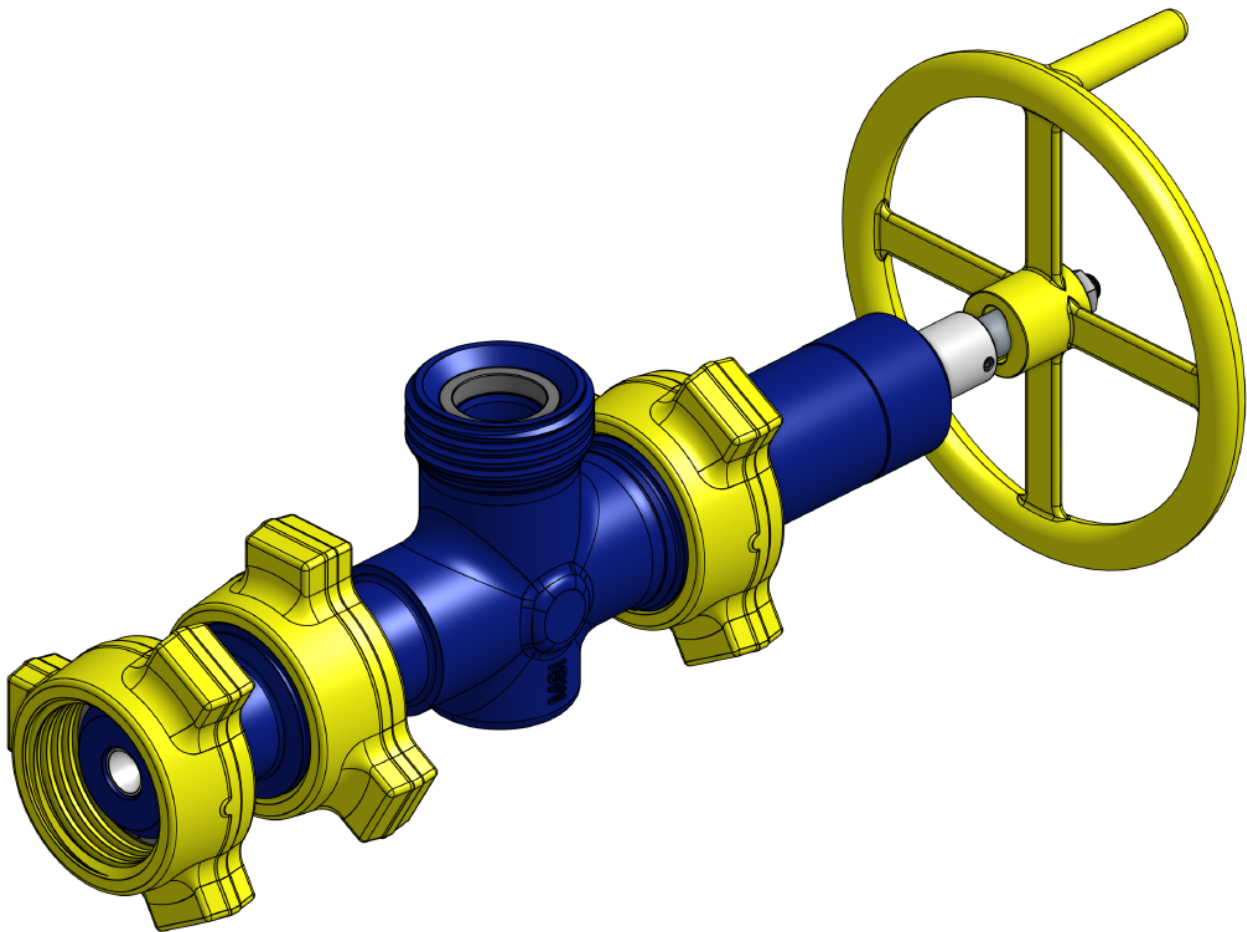




Technical Manual

MSI Manually Adjustable Choke



MSI – A Division of Dixie Iron Works, Ltd.

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SECTION 1 WARNINGS

The MSI Adjustable Choke is used in high-pressure and high flow well service applications. High pressure equipment, if not used and maintained properly, can cause serious injury or death and damage to equipment and property. Not taking proper precautions and failing to perform routine maintenance and inspections can also contribute to loss of well control, and such loss could cause serious injury or death and damage to equipment and property.

The MSI adjustable choke is designed to decrease pressure in a fluid flow situation, as a result, the velocity of the fluid stream increases drastically. Abrasive particles in the high velocity flow stream can cause excessive and premature erosion to the choke components. The choke trim utilizes tungsten-carbide in key areas to manage erosive wear. It is critical for safety and performance to ensure the choke is installed such that the direction of flow is away from the bonnet on adjustable chokes. Reverse flowing through the choke may cause damage and void the warranty.

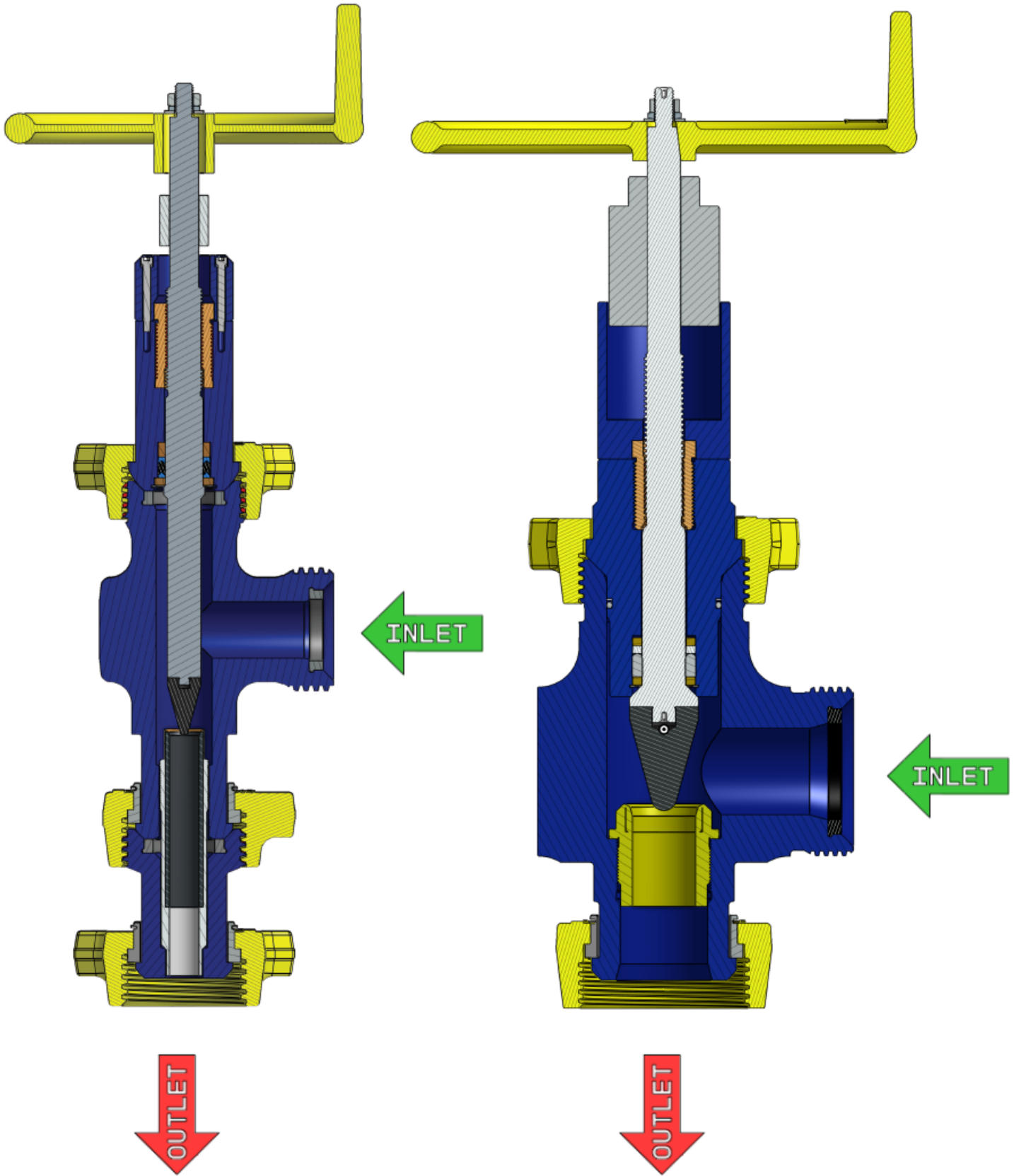
ALL OPERATORS AND MAINTENANCE PERSONNEL SHOULD BE THOROUGHLY TRAINED IN THE SAFE OPERATION, MAINTENANCE, AND INSPECTION OF THIS EQUIPMENT.

This product is not designed to be used for fully stopping the flow of fluids. In systems where this is required isolation equipment, such as plug valves, should be used in conjunction with the choke.

FLUID DIRECTION THROUGH CHOKE

3/4" & 1" MAXIMUM ORIFICE (2" IRON)

2" MAXIMUM ORIFICE (3" IRON)



SECTION 2 GENERAL DESCRIPTION

2.1 Choke Description

Adjustable chokes are used in many oilfield applications to control flowrate and/or pressure. Usually an adjustable choke is used as part of a manifold installed downstream of the wellhead or as a flow restrictor to create back-pressure for pump testing purposes. The MSI adjustable choke consists of three main sub-assemblies: the bonnet, tee, and nipple assemblies (for 2" iron only).

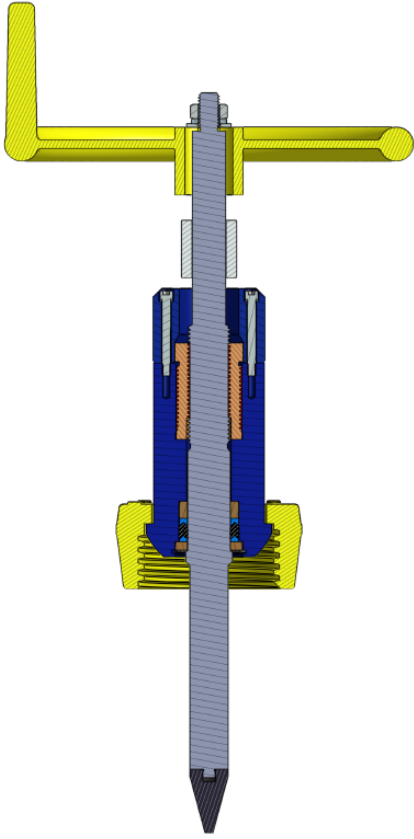
2.2 Choke Specifications

MSI chokes are available in ¾", 1", and 2" maximum orifice sizes. The bonnet, tee, and nipple are made from forged alloy steel. The stem is manufactured from stainless steel and utilizes a solid tungsten-carbide tip. The choke seat is also made from stainless steel that has been fitted with a tungsten-carbide liner.

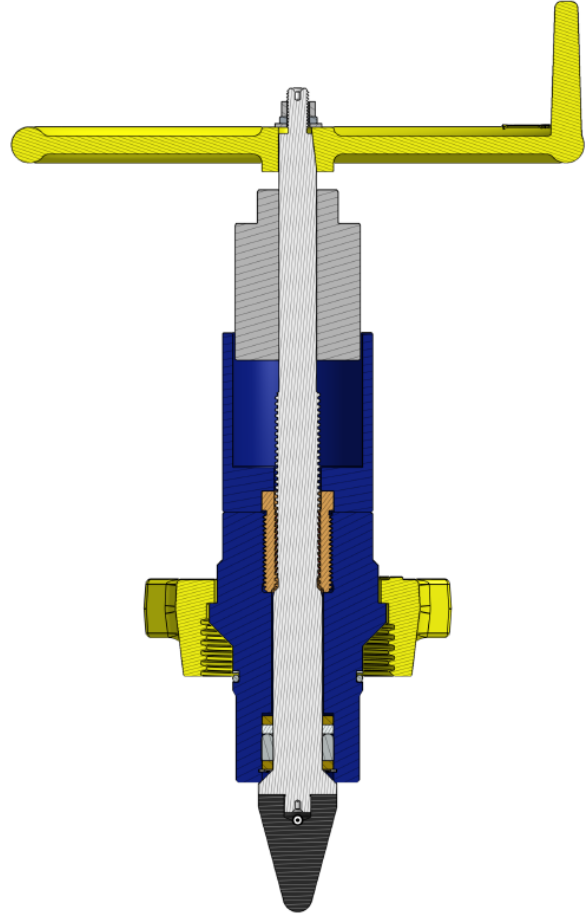
CHOKE MAIN SUB-ASSEMBLIES

3/4" & 1" MAXIMUM ORIFICE (2" IRON)

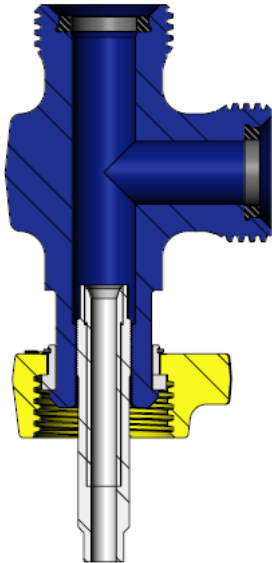
2" MAXIMUM ORIFICE (3" IRON)



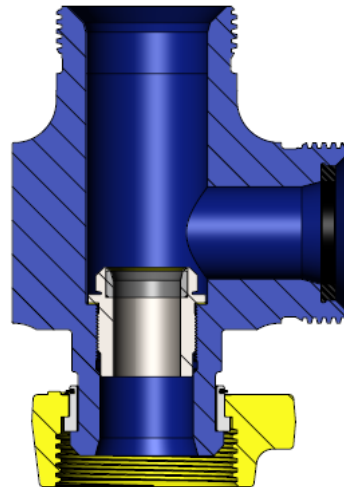
BONNET ASSEMBLY



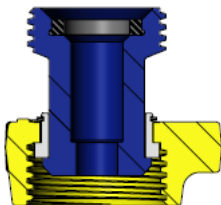
BONNET ASSEMBLY



TEE ASSEMBLY



TEE ASSEMBLY



NIPPLE ASSEMBLY

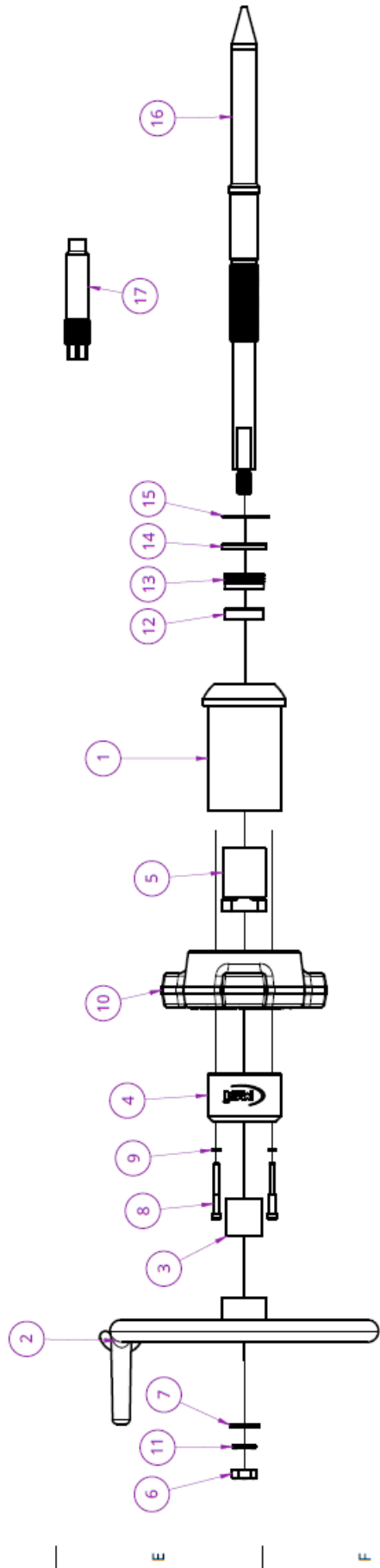
SECTION 3 PARTS

3.1 Exploded View

See the following drawings and bills of materials for replacement parts.

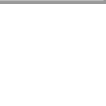
1		2		3		4		5		6	
ITEM NO.	QTY	PART NO.	DESCRIPTION	ITEM NO.	QTY	PART NO.	DESCRIPTION	ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	CC0016	BONNET, 2" H2S 15M MSI MANUAL	1	1	CC0016	BONNET, 2" H2S 15M MSI MANUAL				
2	1	CC0014	HANDWHEEL, 2" ADJ CHOKE "MSI"	2	1	CC0014	HANDWHEEL, 2" ADJ CHOKE "MSI"				
3	1	CC0013	CHOKE INDICATOR, 3/4" (FOR 2" CHOKE)	3	1	CC0013	CHOKE INDICATOR, 3/4" (FOR 2" CHOKE)				
4	1	CC0278	BONNET EXTENSION, 2" MSI MANUAL	4	1	CC0278	BONNET EXTENSION, 2" MSI MANUAL				
5	1	CC0281	BONNET THREAD BUSHING, 2" CHOKE	5	1	CC0281	BONNET THREAD BUSHING, 2" CHOKE				
6	1	HC0012	HEX NUT, 5/8"-11 HEAVY HEX 2H	6	1	HC0012	HEX NUT, 5/8"-11 HEAVY HEX 2H				
7	1	HC0014	FENDER WASHER, 5/8"	7	1	HC0014	FENDER WASHER, 5/8"				
8	2	HC0176	SOC HD, 1/4"-20 x 2.25"	8	2	HC0176	SOC HD, 1/4"-20 x 2.25"				
9	2	HC0111	LOCK WASHER, 1/4" HIGH COLLAR	9	2	HC0111	LOCK WASHER, 1/4" HIGH COLLAR				
10	1	UC0002	WINGNUT, 2"1502 STD	10	1	UC0131	WINGNUT, 2"1502 H2S				
11	1	HC0209F	LOCK WASHER, 5/8" STANDARD	11	1	HC0209F	LOCK WASHER, 5/8" STANDARD				
12	1	CC0029	CHOKE STEM GUIDE, 2" CHOKE	12	1	CC0029	CHOKE STEM GUIDE, 2" CHOKE				
13	1	CC0028	CHOKE PACKING, 2" CHEVRON TYPE	13	1	CC0028	CHOKE PACKING, 2" CHEVRON TYPE				
14	1	CC0030	CHOKE PACKING RETAINER, 2" CHOKE	14	1	CC0030	CHOKE PACKING RETAINER, 2" CHOKE				
15	1	CC0044	SNAP RING, 2" CHOKE BONNET	15	1	CC0044	SNAP RING, 2" CHOKE BONNET				
16	1	CC0022	CHOKE STEM, 3/4"-1" MAX 15M LONG	16	1	CC0022	CHOKE STEM, 3/4"-1" MAX 15M LONG				

17	1	CC0037	CHOKE SEAT, 3/4" FC-140 6"LINED CARBIDE
		CC0196	CHOKE SEAT, 1" FC-140 6"LINED CARBIDE

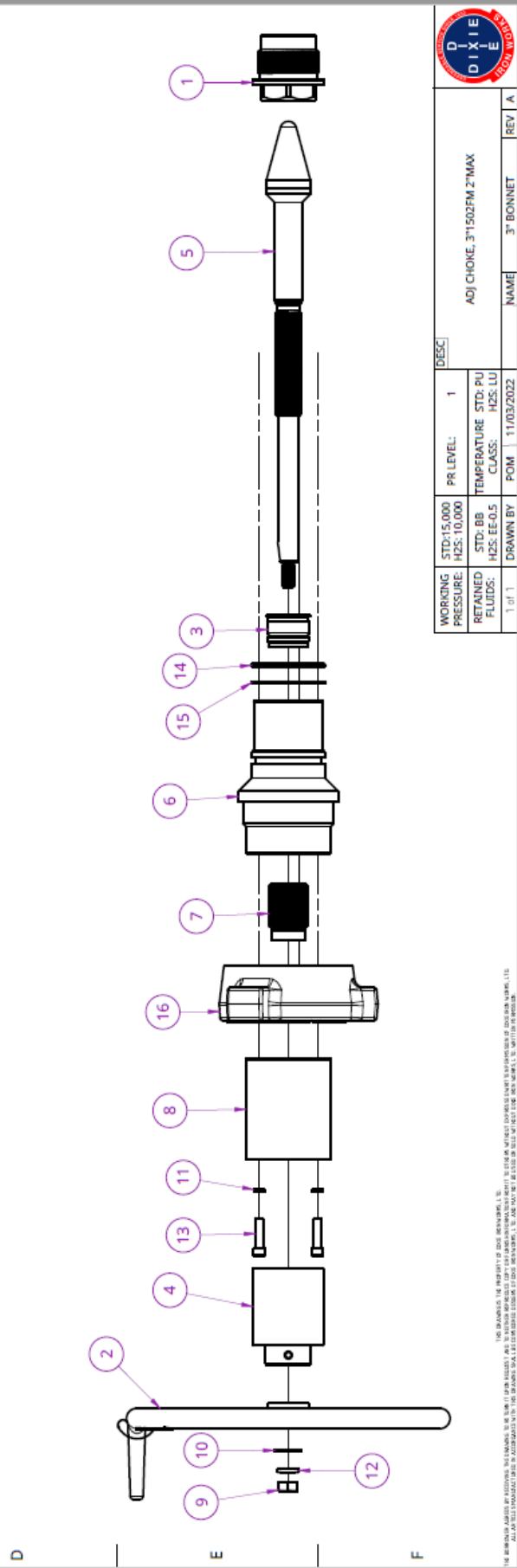


WORKING PRESSURE:		PR LEVEL:		DESC	
STD: 15,000	H2S: 10,000	1		ADJ CHOKE, 2"1502FM	
RETAINED FLUIDS:		TEMPERATURE CLASS:		NAME	
STD: BB	H2S: EE-0.5	STD: PU	H2S: LU	2" BONNET	REV A
1 of 1	DRAWN BY	POM	11/03/2022		

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1		2		3		4		5		6	
ITEM NO.	QTY	PART NO.	DESCRIPTION	ITEM NO.	QTY	PART NO.	DESCRIPTION	ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	CC0007	CHOKE SEAT, 2" MAX CARBIDE H-2	1	1	CC0007	CHOKE SEAT, 2" MAX CARBIDE H-2	1	1	CC0007	CHOKE SEAT, 2" MAX CARBIDE H-2
2	1	CC0008	HANDWHEEL, 3" ADJ CHOKE 2" MAX	2	1	CC0008	HANDWHEEL, 3" ADJ CHOKE 2" MAX	2	1	CC0008	HANDWHEEL, 3" ADJ CHOKE 2" MAX
3	1	CC0027	CHOKE PACKING, H2 COMPLETE (2" MAX)	3	1	CC0027	CHOKE PACKING, H2 COMPLETE (2" MAX)	3	1	CC0027	CHOKE PACKING, H2 COMPLETE (2" MAX)
4	1	CC0034	CHOKE INDICATOR, 2" MAX CARBIDE H-2	4	1	CC0034	CHOKE INDICATOR, 2" MAX CARBIDE H-2	4	1	CC0034	CHOKE INDICATOR, 2" MAX CARBIDE H-2
5	1	CC0059	CHOKE STEM, 2" MAX TUNGSTEN CARBIDE H-2	5	1	CC0059	CHOKE STEM, 2" MAX TUNGSTEN CARBIDE H-2	5	1	CC0059	CHOKE STEM, 2" MAX TUNGSTEN CARBIDE H-2
6	1	CC0284	BONNET, 3" STD 15M H-2 (HAMMER)	6	1	CC0006	BONNET, 3" H2S 15M H-2 (HAMMER)	6	1	CC0006	BONNET, 3" H2S 15M H-2 (HAMMER)
7	1	CC0285	BONNET THREAD BUSHING, 3" CHOKE	7	1	CC0285	BONNET THREAD BUSHING, 3" CHOKE	7	1	CC0285	BONNET THREAD BUSHING, 3" CHOKE
8	1	CC0286	BONNET EXTENSION, 3" MSI MANUAL	8	1	CC0286	BONNET EXTENSION, 3" MSI MANUAL	8	1	CC0286	BONNET EXTENSION, 3" MSI MANUAL
9	1	HC0012	HEX NUT, 5/8"-11 HEAVY HEX 2H	9	1	HC0012	HEX NUT, 5/8"-11 HEAVY HEX 2H	9	1	HC0012	HEX NUT, 5/8"-11 HEAVY HEX 2H
10	1	HC0014	FENDER WASHER, 5/8"	10	1	HC0014	FENDER WASHER, 5/8"	10	1	HC0014	FENDER WASHER, 5/8"
11	2	HC0025	LOCK WASHER, 3/8" HIGH COLLAR	11	2	HC0025	LOCK WASHER, 3/8" HIGH COLLAR	11	2	HC0025	LOCK WASHER, 3/8" HIGH COLLAR
12	1	HC0209	LOCK WASHER, 5/8" STANDARD	12	1	HC0209	LOCK WASHER, 5/8" STANDARD	12	1	HC0209	LOCK WASHER, 5/8" STANDARD
13	2	HC3009	SOC HD, 3/8"-24 x 1.50"	13	2	HC3009	SOC HD, 3/8"-24 x 1.50"	13	2	HC3009	SOC HD, 3/8"-24 x 1.50"
14	1	OC0023	O-RING, 3" BONNET H2S (2-339)	14	1	OC0023	O-RING, 3" BONNET H2S (2-339)	14	1	OC0023	O-RING, 3" BONNET H2S (2-339)
15	1	OC0024	PAR-BACK, 3" BONNET H2S (8-339)	15	1	OC0024	PAR-BACK, 3" BONNET H2S (8-339)	15	1	OC0024	PAR-BACK, 3" BONNET H2S (8-339)
16	1	UC0009	WINGNUT, 3"1502 STD	16	1	UC0005	WINGNUT, 3"1502 H2S	16	1	UC0005	WINGNUT, 3"1502 H2S



DIXIE 1502		DESC: ADJ CHOKE, 3"1502FM 2" MAX	REV: A
WORKING PRESSURE: H2S: 10,000	PR LEVEL: 1	DATE: 11/03/2022	NAME: 3" BONNET
RETAINED FLUIDS: H2S: EE-0.5	TEMPERATURE CLASS: H2S: LU		
1 of 1	DRAWN BY: POM		

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SECTION 4 OPERATION

4.1 Choke Adjustment

The equivalent orifice size of MSI manually operated chokes can be easily determined and adjusted. To adjust the choke, turn the handwheel either clockwise to throttle the choke closed, or counter-clockwise to throttle the choke open until the desired rate is achieved. All MSI manually adjustable chokes come with an indicator. Each number on the indicator represents the equivalent orifice diameter in 1/64ths of an inch. Determining the flow bean size needed for a positive choke can be determined by reading the number shown on the indicator at the indicator line located on the bonnet extension. The orifice size can be determined by using orifice indicator bean sizing table, or you can multiply the indicator number by 1/64 and that will give you the orifice size for the flow bean needed.

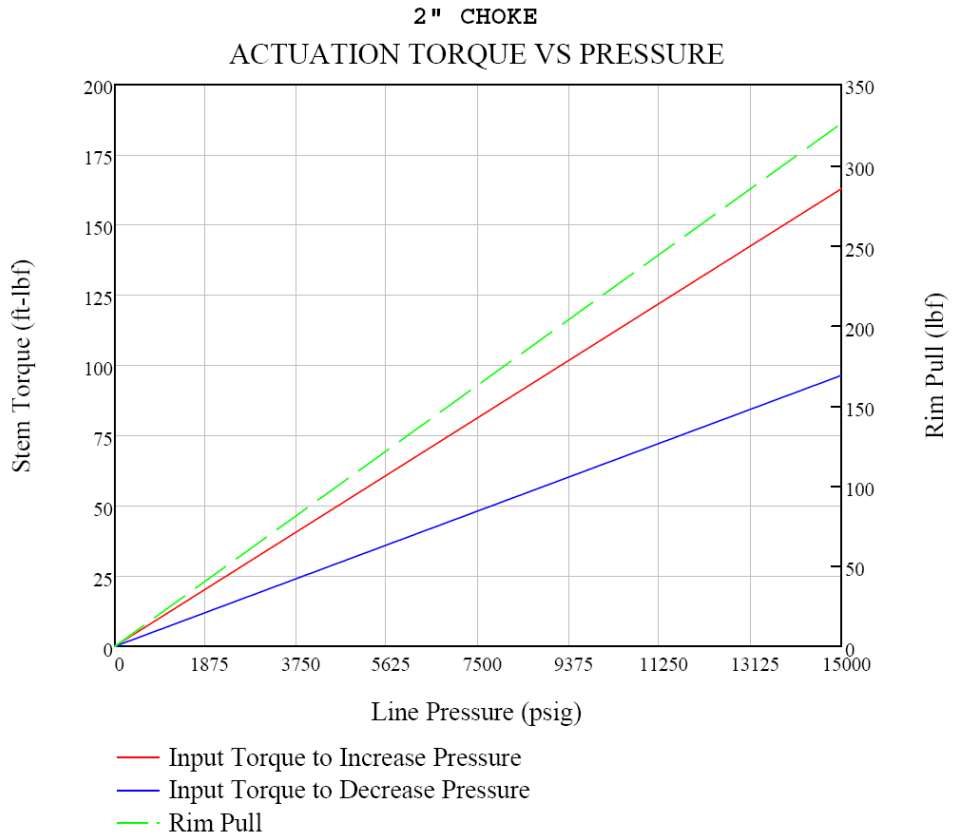
Example: the indicator in the picture below is at 42 this would be equivalent to an orifice bean size of 42/64.



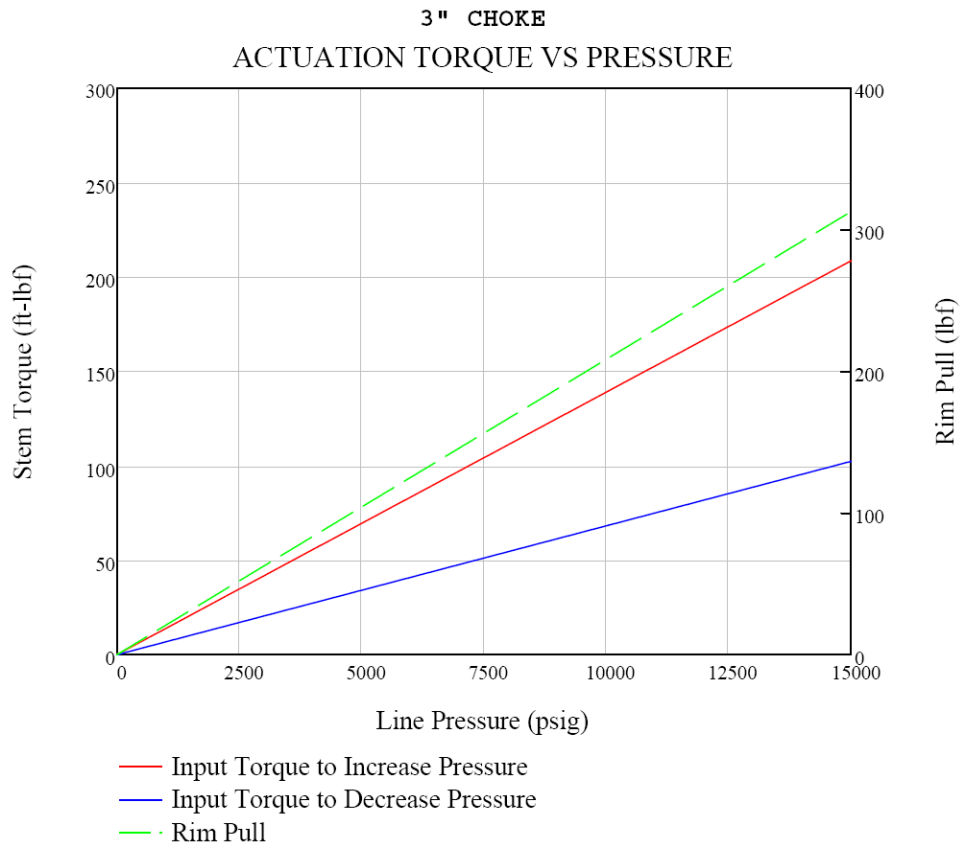
4.2 Orifice Indicator Bean Sizing Table

Indicator #	Orifice Size	Indicator #	Orifice Size	Indicator #	Orifice Size	Indicator #	Orifice Size
1	1/64	33	33/64	65	1 1/64	97	1 33/64
2	2/64	34	34/64	66	1 2/64	98	1 34/64
3	3/64	35	35/64	67	1 3/64	99	1 35/64
4	4/64	36	36/64	68	1 4/64	100	1 36/64
5	5/64	37	37/64	69	1 5/64	101	1 37/64
6	6/64	38	38/64	70	1 6/64	102	1 38/64
7	7/64	39	39/64	71	1 7/64	103	1 39/64
8	8/64	40	40/64	72	1 8/64	104	1 40/64
9	9/64	41	41/64	73	1 9/64	105	1 41/64
10	10/64	42	42/64	74	1 10/64	106	1 42/64
11	11/64	43	43/64	75	1 11/64	107	1 43/64
12	12/64	44	44/64	76	1 12/64	108	1 44/64
13	13/64	45	45/64	77	1 13/64	109	1 45/64
14	14/64	46	46/64	78	1 14/64	110	1 46/64
15	15/64	47	47/64	79	1 15/64	111	1 47/64
16	16/64	48	48/64	80	1 16/64	112	1 48/64
17	17/64	49	49/64	81	1 17/64	113	1 49/64
18	18/64	50	50/64	82	1 18/64	114	1 50/64
19	19/64	51	51/64	83	1 19/64	115	1 51/64
20	20/64	52	52/64	84	1 20/64	116	1 52/64
21	21/64	53	53/64	85	1 21/64	117	1 53/64
22	22/64	54	54/64	86	1 22/64	118	1 54/64
23	23/64	55	55/64	87	1 23/64	119	1 55/64
24	24/64	56	56/64	88	1 24/64	120	1 56/64
25	25/64	57	57/64	89	1 25/64	121	1 57/64
26	26/64	58	58/64	90	1 26/64	122	1 58/64
27	27/64	59	59/64	91	1 27/64	123	1 59/64
28	28/64	60	60/64	92	1 28/64	124	1 60/64
29	29/64	61	61/64	93	1 29/64	125	1 61/64
30	30/64	62	62/64	94	1 30/64	126	1 62/64
31	31/64	63	63/64	95	1 31/64	127	1 63/64
32	32/64	64	1	96	1 32/64	128	2

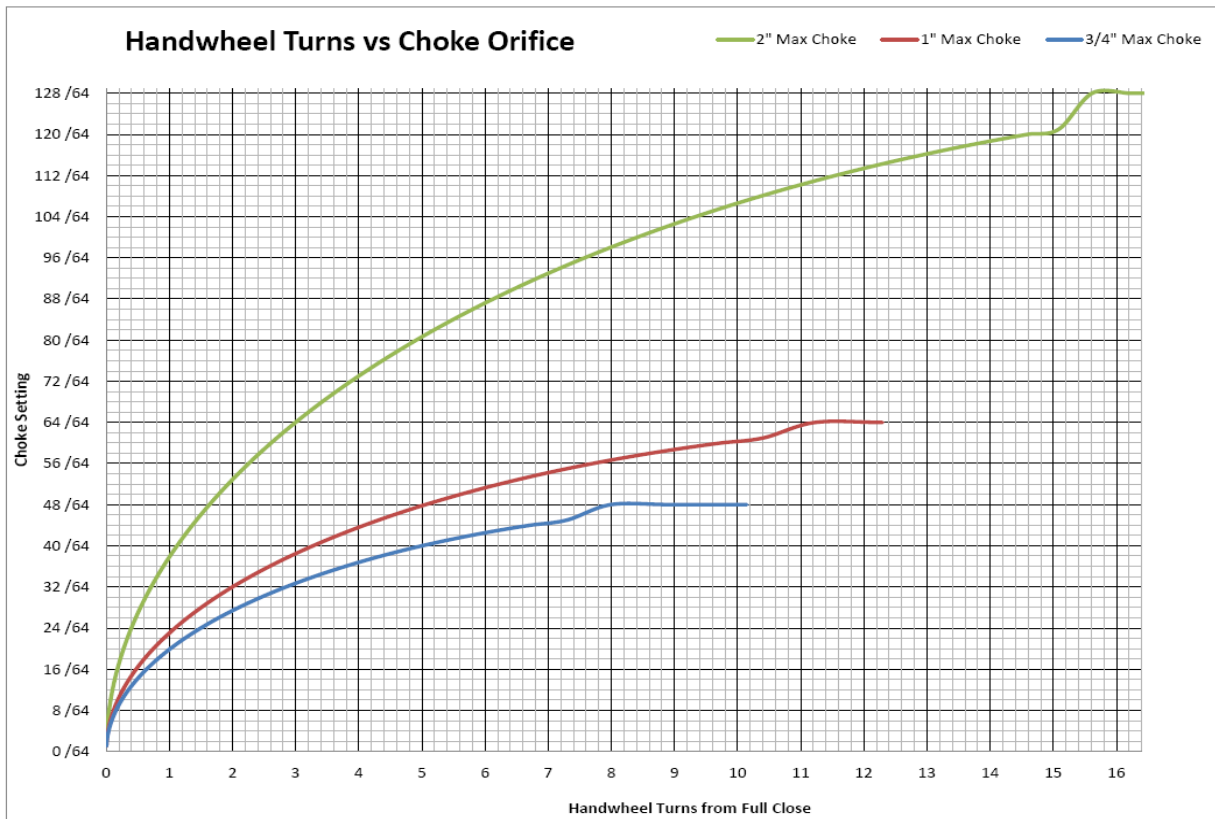
4.3 2" Choke Stem Actuation Torque vs Pressure



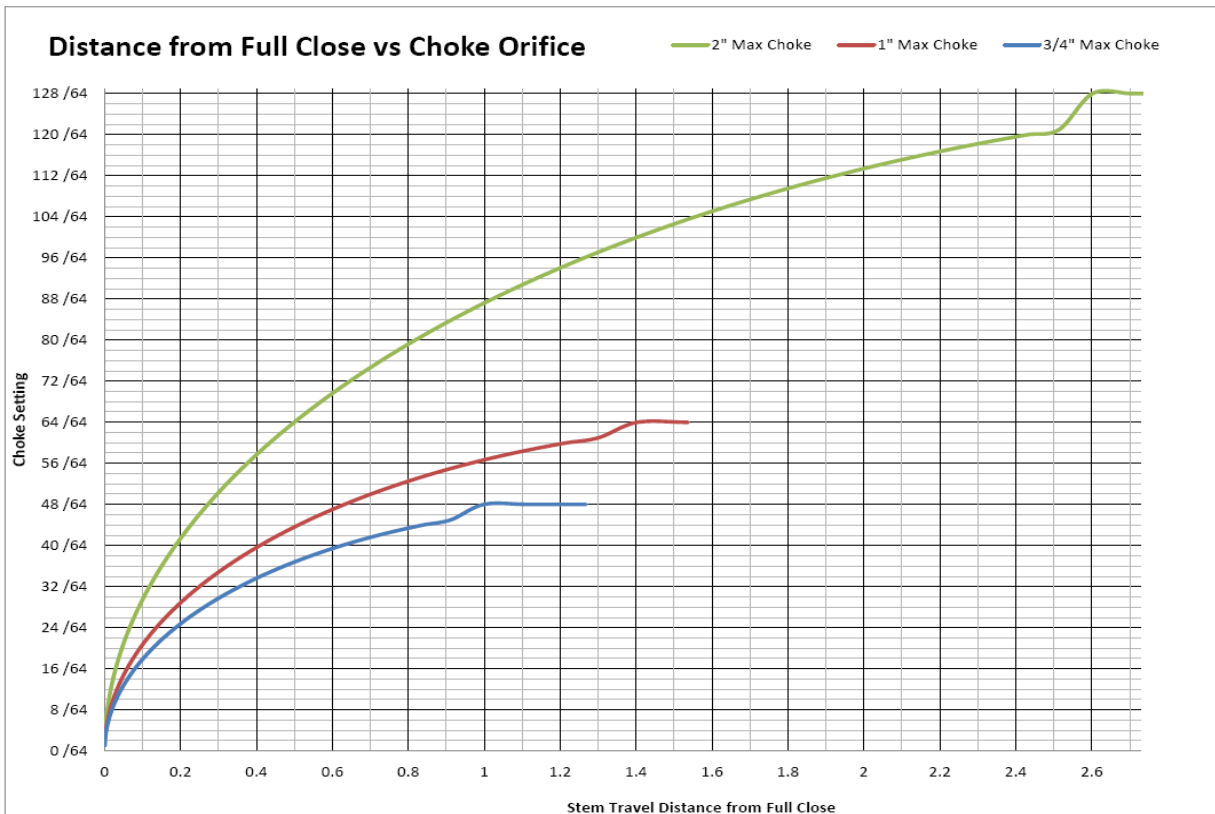
4.4 3" Choke Stem Actuation Torque vs Pressure



4.5 Handwheel Turns vs Choke Orifice



4.6 Distance from Full Close vs Choke Orifice



5. MAINTENANCE

5.1. Preventative

The choke stem should be thoroughly greased during assembly. This grease should be replaced at every rebuild. In the case that there is a need to lubricate the stem between rebuilds, deep penetrating oil can be used in the interim. Temporarily removing the handwheel, indicator, and bonnet extension will expose more of the choke stem if needed.

5.2. Inspection

Clean and degrease the parts then inspect for abnormal wear, corrosion, erosion, or other physical damage. Replace parts as needed to restore the choke to working condition.

5.3. Assembly

5.3.1. Assembling the Tee subassembly

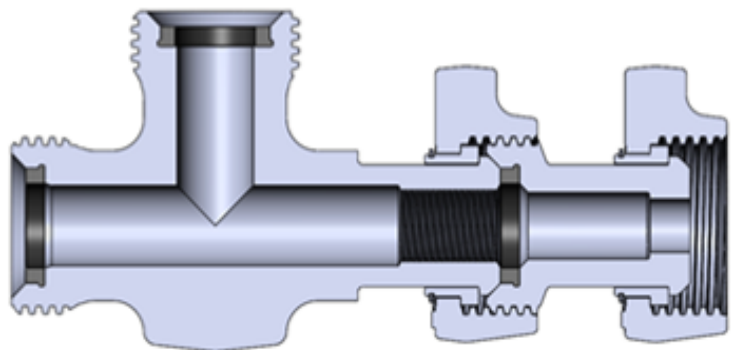
NOTE - ALWAYS USE HIGH QUALITY GRAPHITE GREASE OR ANTI-SEIZE DURING ASSEMBLY. LUBRICATE ALL PARTS THOROUGHLY, ESPECIALLY THREADS.



Apply anti-seize to the choke seat threads on male end connection



For a 2" choke assembly only: assemble the choke nipple with the choke tee subassembly:



Insert the choke seat through the female end connection of the Tee fitting with a choke seat wrench.

Choke Size	Wrench PN
2"	CC0071
3"	CC0282



Using a torque wrench, fully tighten the choke seat to the recommended torque:

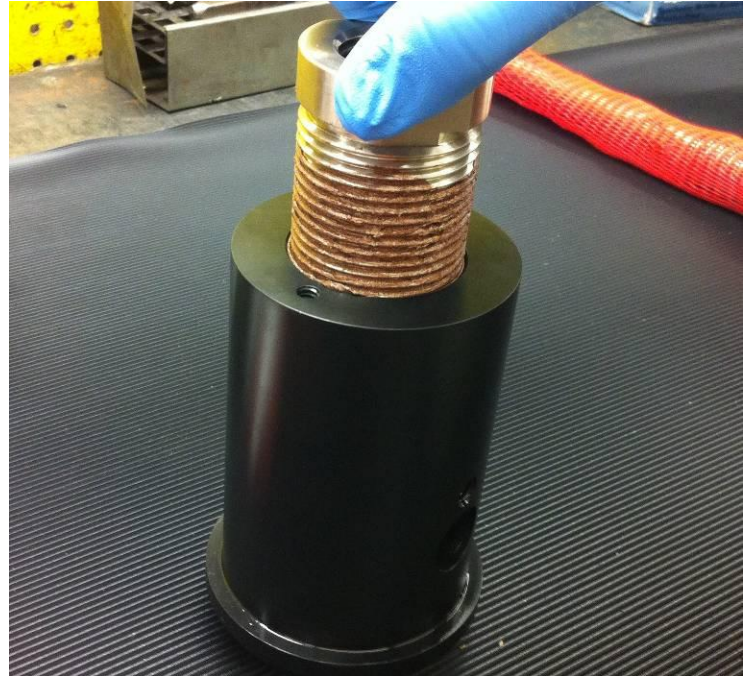
Choke Size	Torque (ft*lbs)
2"	100
3"	125



5.3.2. 2" Bonnet Subassembly

NOTE - ALWAYS USE HIGH QUALITY GRAPHITE GREASE OR ANTI-SEIZE DURING ASSEMBLY. LUBRICATE ALL PARTS THOROUGHLY, ESPECIALLY THREADS.

Lubricate the internal and external threads on the bushing then screw the thread bushing into the bonnet and tighten snug with a wrench.



Position bonnet extension over bonnet, aligning holes accordingly.

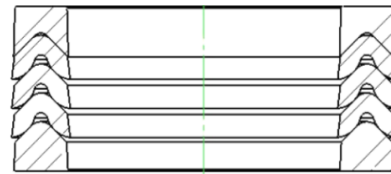


Install lock washers on socket head cap screws and torque to 10 ft-lbs, attaching the bonnet extension to the bonnet.



Lubricate the packing gland of the bonnet and choke stem threads with light general purpose grease to prevent damage to packing during installation.

Install choke packing retainer, new packing, and stem guide bushing on stem in orientation shown.

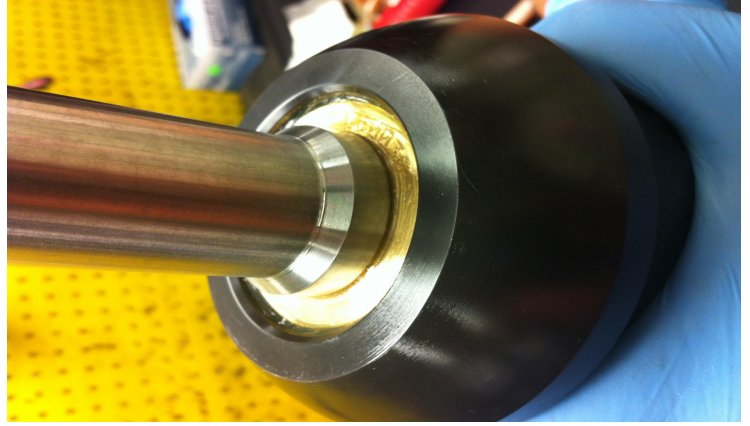


INSERT THIS END ON STEM FIRST

Insert the threaded end of the stem with packing into the bonnet and engage the threads on the bonnet bushing.



Thread the choke stem clockwise by hand until the choke packing is fully seated then install the retaining ring. Do not use tools to turn the stem.



Slide wing nut over bonnet body.

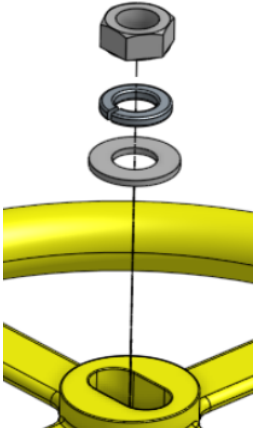


Slide the indicator onto the stem. Do not tighten the set screw.

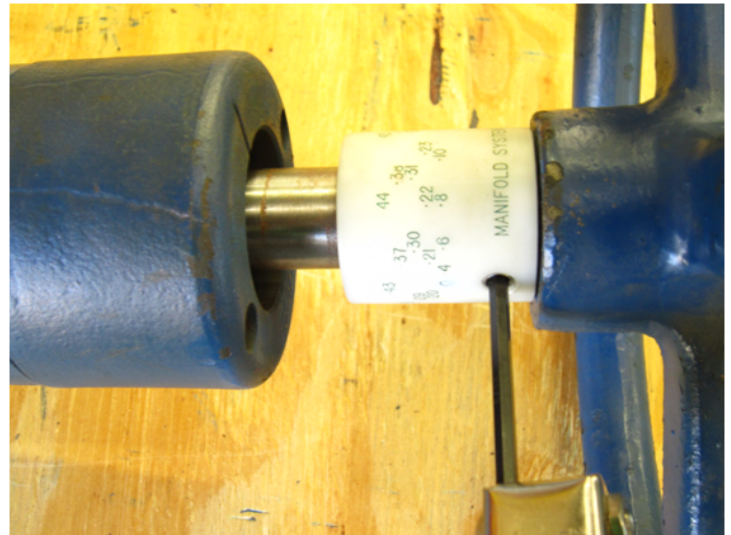
NOTE: THE END OF THE INDICATOR WITH THE SET SCREW MUST BE INSTALLED AWAY FROM THE BONNET.



Install hand wheel, washer, lock washer, and hex nut.



Temporarily position the indicator against the hand wheel and tighten the set screw.



5.3.3. 3" Bonnet Subassembly

NOTE - ALWAYS USE HIGH QUALITY GRAPHITE GREASE OR ANTI-SEIZE DURING ASSEMBLY. LUBRICATE ALL PARTS THOROUGHLY, ESPECIALLY THREADS.

Lubricate the internal and external threads on the bushing then screw the thread bushing into the bonnet and tighten snug with a wrench.



Position bonnet extension on bonnet. Align mounting holes between parts



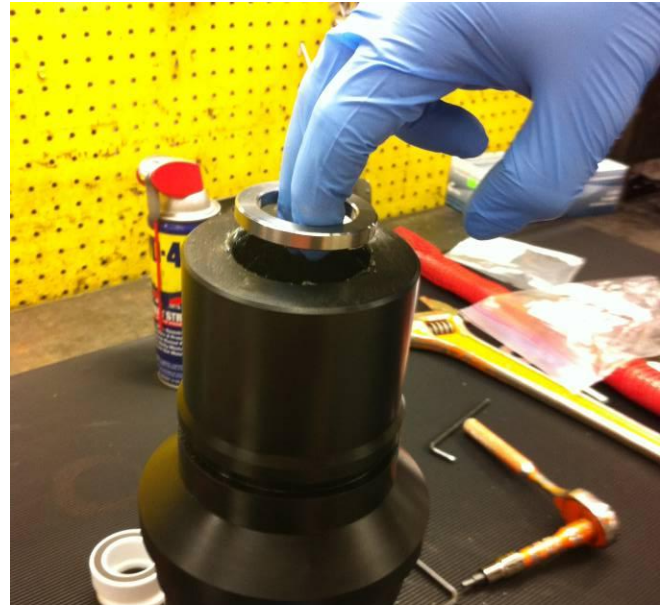
Install lock washers on socket head cap screws and torque per table below, attaching the bonnet extension to the bonnet.

Nominal Dia	Torque
1/4" screws	10 ft-lbs
3/8" screws	38 ft-lbs

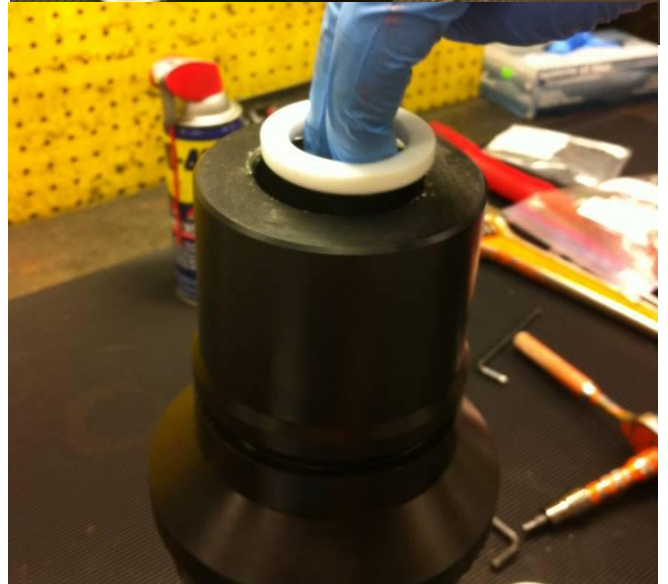


Lubricate the packing gland of the bonnet with light general purpose grease

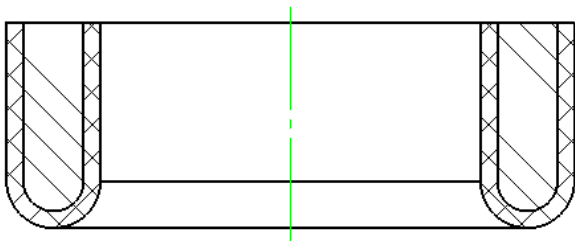
Install first choke packing retainer in bonnet



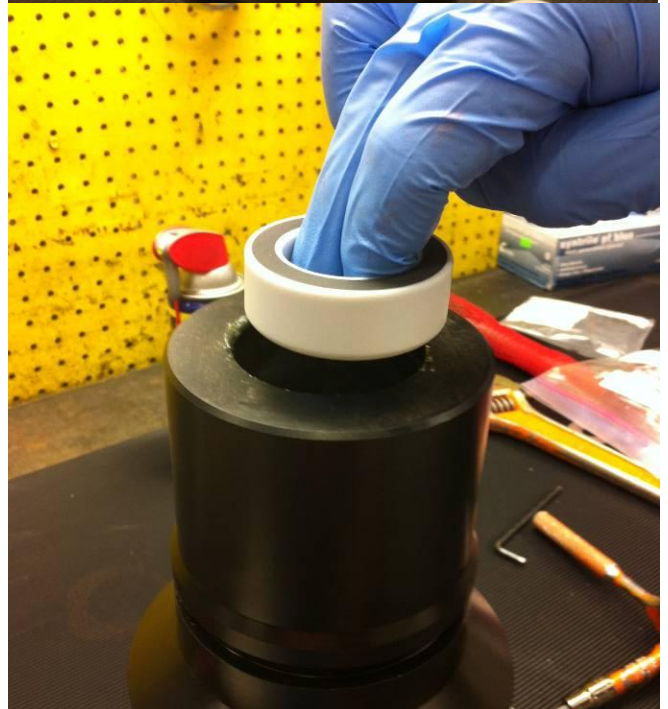
Install choke packing bushing in bonnet



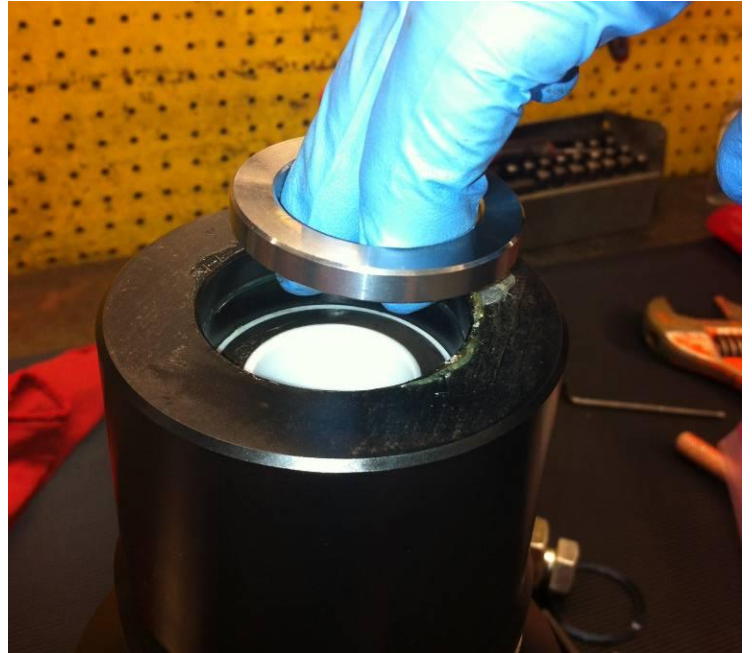
Install new packing in bonnet gland and press in with a soft-faced rod. Verify the orientation is correct.



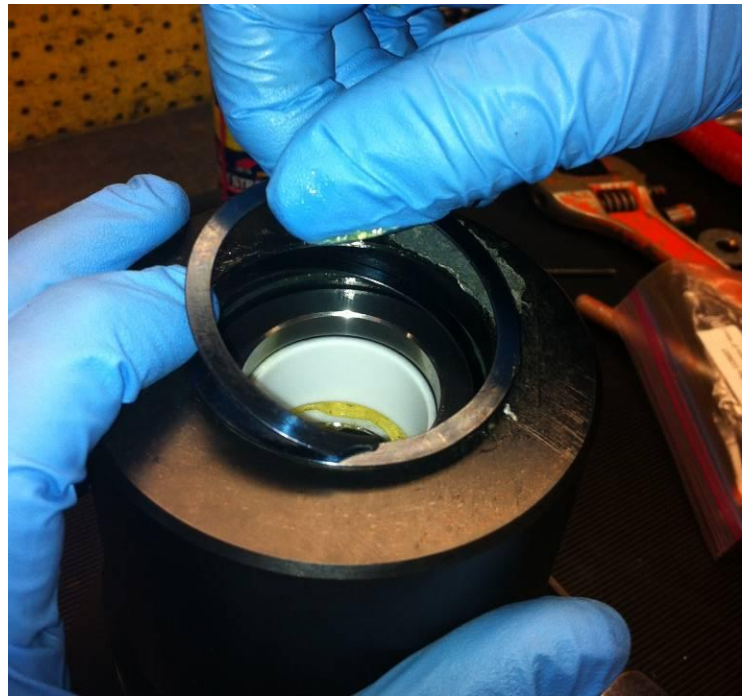
INSERT THIS END ON BONNET FIRST



Install second choke packing retainer in bonnet



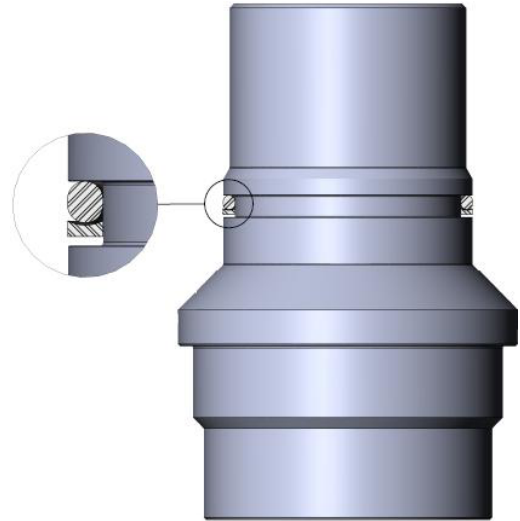
Secure choke packing with retaining ring



Lubricate inside of packing with light general purpose grease



Using light general purpose grease, install backup ring and o-ring on seal gland as shown.



Lubricate the choke stem with light general purpose grease and insert the threaded end through the bonnet. Screw choke stem by hand until resistance is felt.



Holding the bonnet in place as shown, temporarily position the hand wheel on the stem and use it to continue threading the stem until the stem shoulder contacts the bonnet.



Remove the hand wheel.

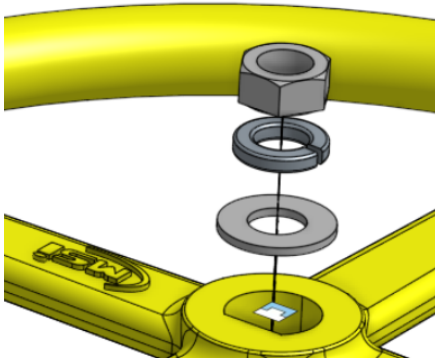
Slide wing nut over bonnet body.

Slide the indicator onto the stem. Do not tighten the set screw.

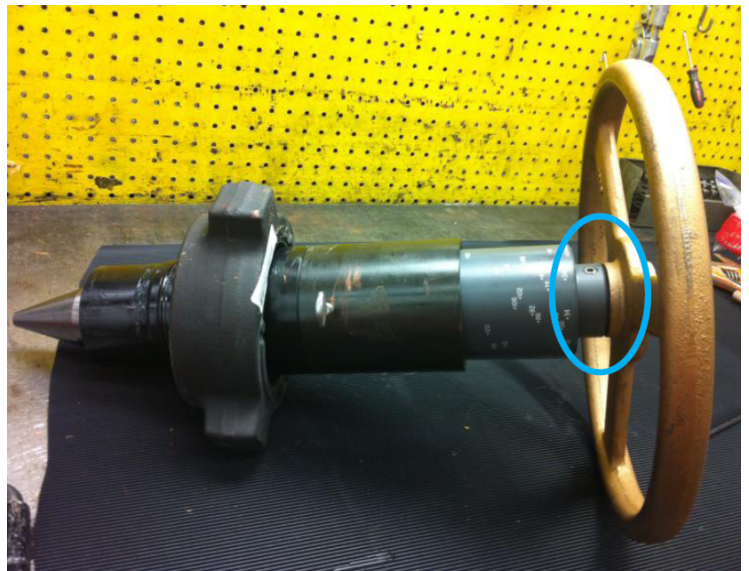
NOTE: THE END OF THE INDICATOR WITH THE SET SCREW MUST BE INSTALLED AWAY FROM THE BONNET.



Install hand wheel, washer, lock washer, and hex nut.



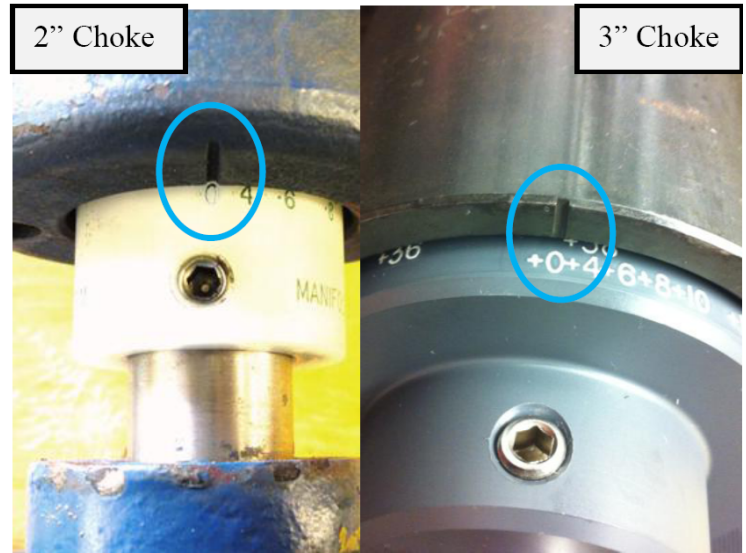
Temporarily position the indicator up against the hand wheel and tighten the set screw.



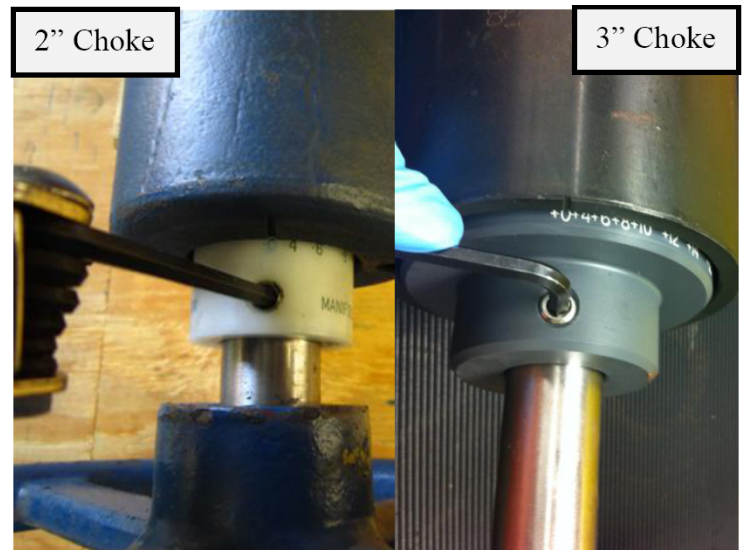
5.3.4. Choke Stem Synchronization Procedure

With the stem fully retracted mount the bonnet assembly to the choke tee assembly. Hammer the union connection ring tight. Rotate the hand wheel clockwise to shut the choke.

Loosen the indicator set screw. Rotate and slide the indicator into position, so that the “0” is aligned with the indicator groove on the bonnet extension.



Tighten the indicator set screw to synchronize the indicator to stem position.





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