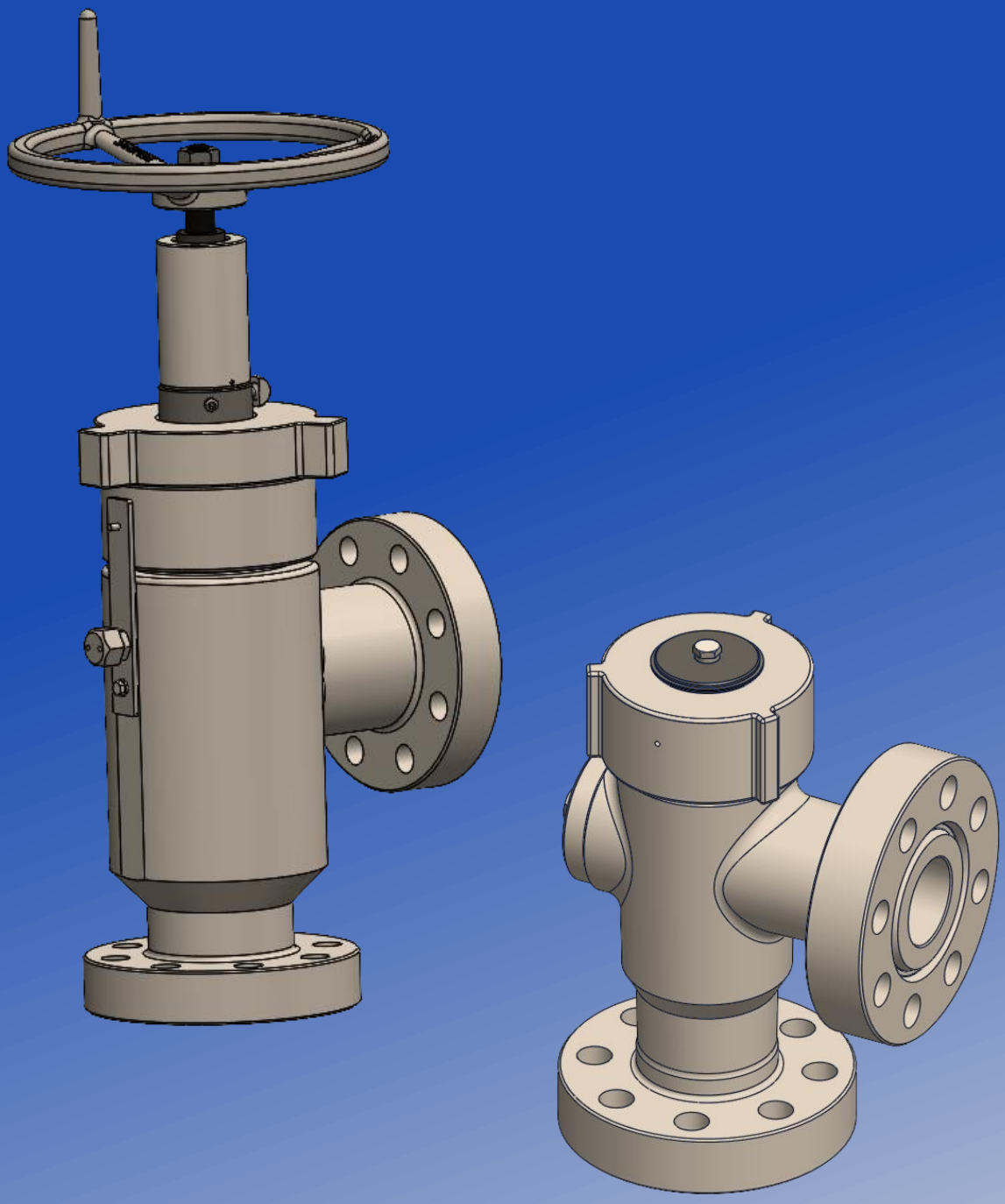
VERSA™ CHOKE VALVES



API 6A LICENSE
LICENSE NO. 6A-0541

Issued 210723

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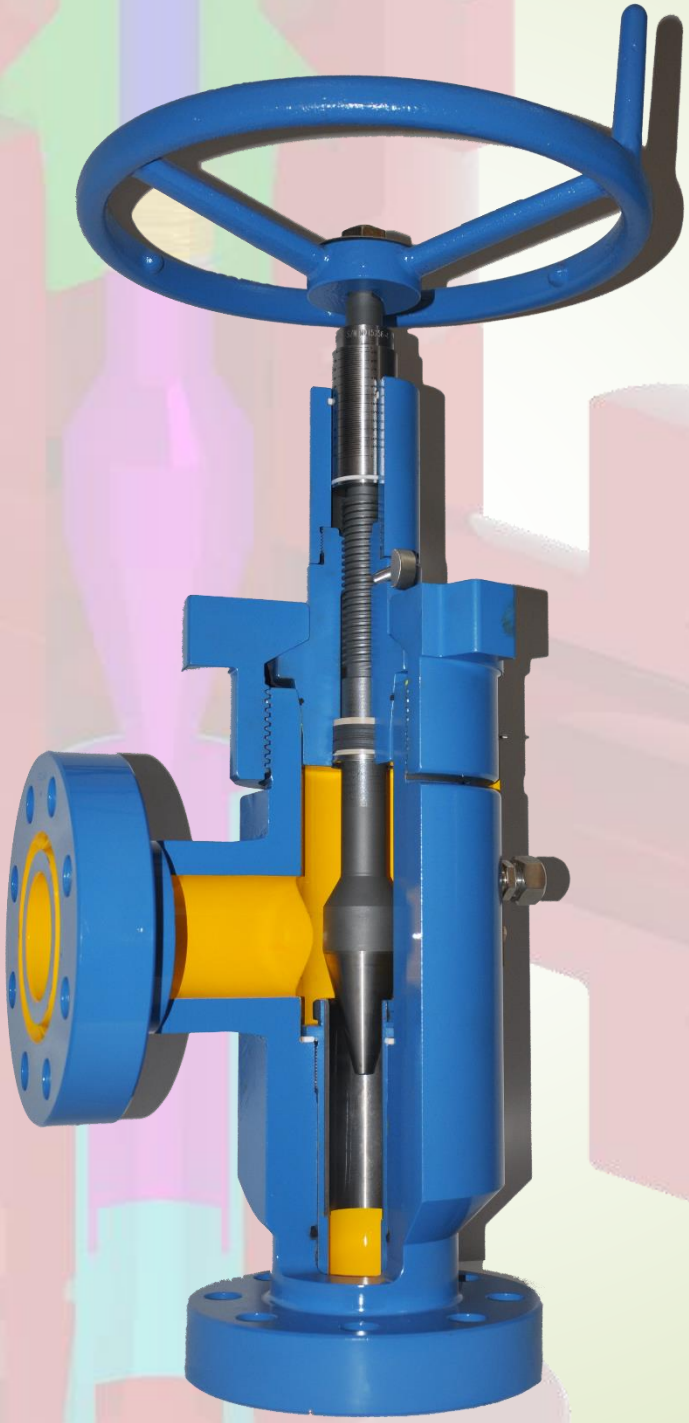
VERSA™ CHOKE VALVE SERIES



API 6A LICENSE
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SOURCE®

SV-03 R00

Advantages of the SOURCE Design

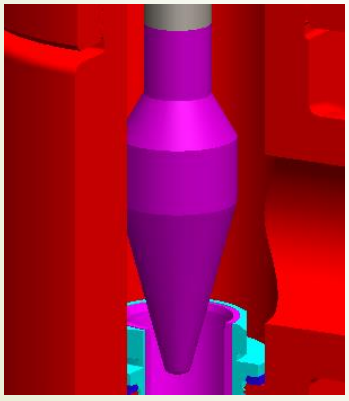
The **VERSA CHOKE VALVE** is used for well testing, precision flow control and production on Christmas Tree and Manifold, Gas Lift and Water Injection applications. The choke can be easily converted from a Positive Choke to Adjustable Choke. These Choke Valves are designed, manufactured and tested in accordance to API Spec. 6A requirement.

ADJUSTABLE CHOKE VALVE FEATURES:

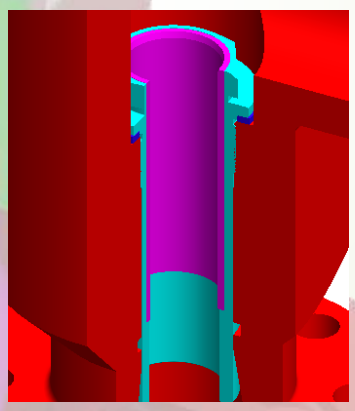
- 2000 to 5000 psi WP
- 2-1/16″ to 3-1/8″
- Orifice 3/4″-2″
- Not intended for shut off operation
- Non elastomeric stem packing
- Low operating torque
- Tested to requirement of API 6A

POSITIVE CHOKE VALVE FEATURES:

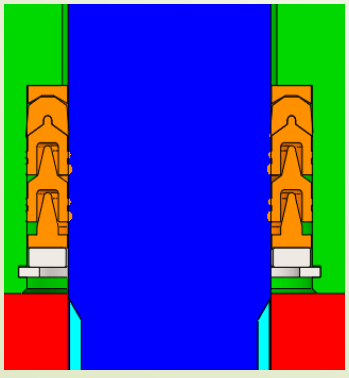
- 2000 to 5000 psi WP
- 2-1/16″ to 3-1/8″
- Orifice 1/8″-2″
- Tested to requirement of API 6A



Tip of stem has tungsten carbide hard face or stellite hard face overlay.



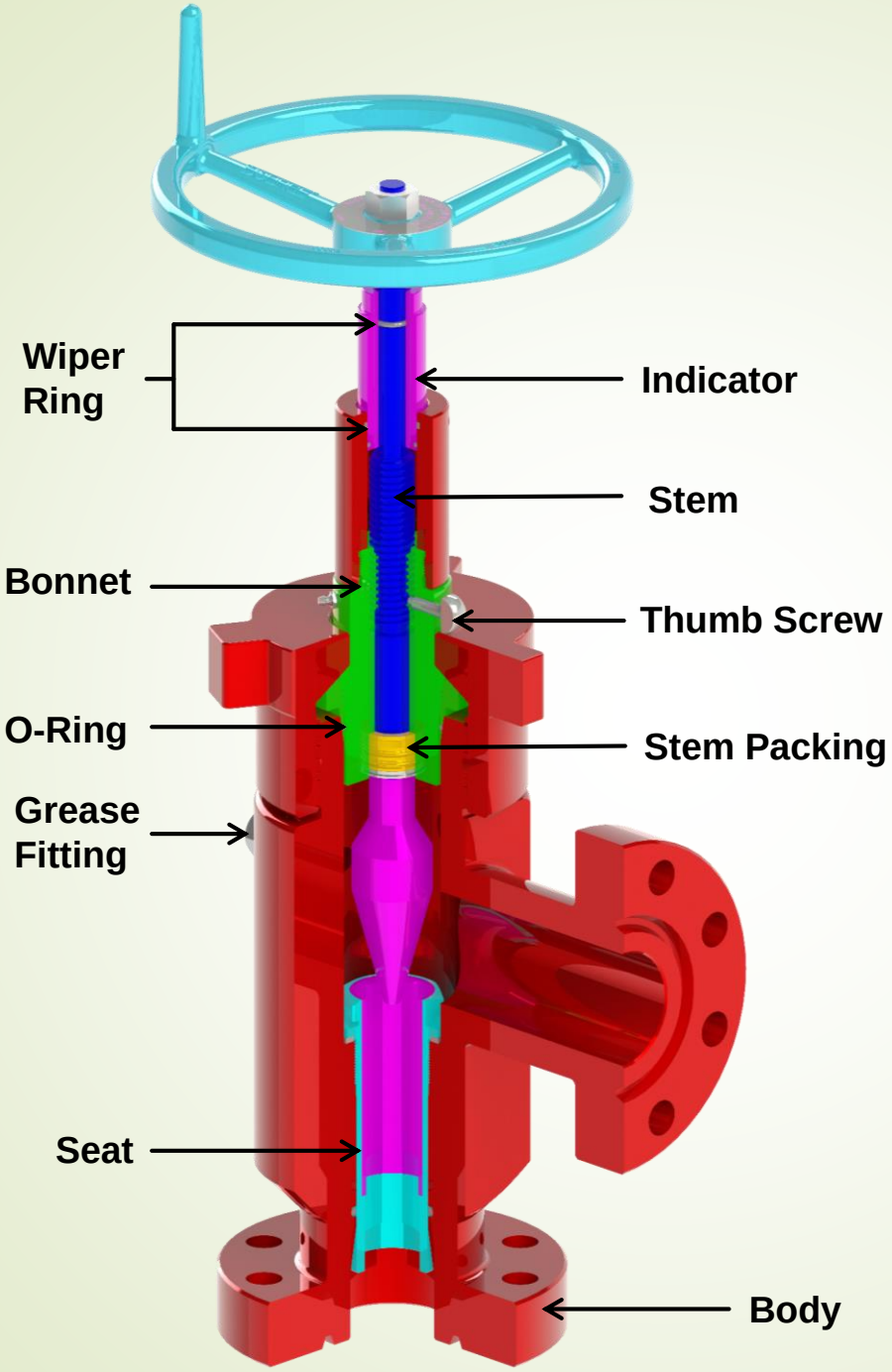
Adjustable and positive choke share the same type of seat. The seat is fitted with tungsten-cobalt alloy liner to prolong service life.



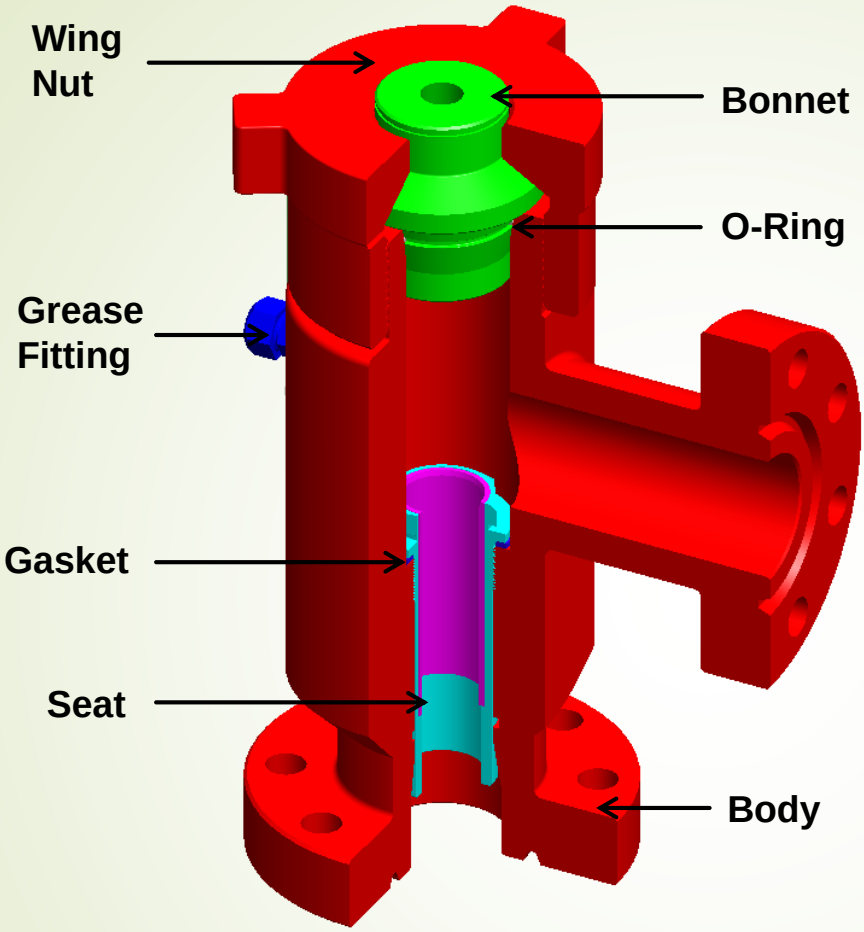
A unique design non-elastomeric stem packing to provide excellent resistance to chemicals and corrosive elements

Versa Choke Valve is designed and tested to API 6A PR2 requirements.

Adjustable Choke Valve



Positive Choke Valve



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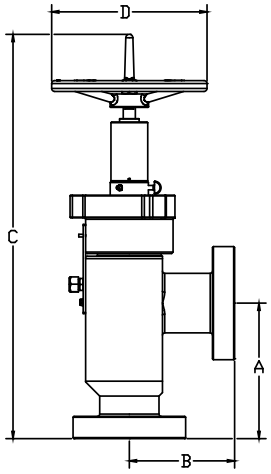
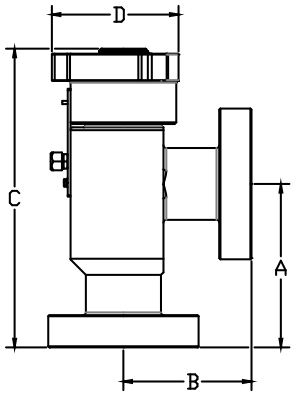
ADJUSTABLE CHOKE VALVE REFERENCE DIMENSIONS AND WEIGHTS



A Inlet Bore Centerline to outlet Flange
B Outlet Bore Centerline to Inlet Flange
C Overall Length of Choke
D Handwheel Diameter
WT Estimated Weight

Nominal Size	Working Pressure (psi)	A		B		C-Closed		C-Open		D		WT		Max. Orifice (in)	API Ring
		in	mm	in	mm	in	mm	in	mm	in	mm	lbs	kg		
2 1/16	2000	7.31	186	7.31	186	25.8	655	27.5	699	11	279	132	60	1	R-23
	3000-5000	9.38	238	7.5	191	27.03	687	28.26	718	13	330	154	70		R-24
3 1⁄8	2000	11.38	289	8.88	226	33.5	851	36.5	927	13	330	265	120	2	R-31
	3000	11.38	289	8.88	226	33.5	851	37.44	951	16	406	298	135		R-31
	5000	11.38	289	8.88	226	34.39	874	37.44	951	16	406	320	145		R-35

POSITIVE CHOKE VALVE REFERENCE DIMENSIONS AND WEIGHTS

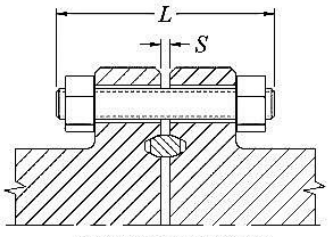


A Inlet Bore Centerline to outlet Flange
B Outlet Bore Centerline to Inlet Flange
C Overall Length of Choke
D Wing Nut Profile Dimension
WT Estimated Weight

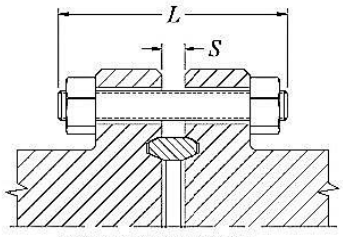
Nominal Size	Working Pressure (psi)	A		B		C		D		WT		Bean (in)	API Ring
		in	mm	in	mm	in	mm	in	mm	lbs	kg		
2 1/16	3000-5000	9.38	238	7.5	191	15.59	396	7.57	192	132	60	1	R-24
3 1⁄8	3000	11.38	289	8.88	226	20.5	521	8.85	225	256	116	2	R-31
	5000	11.38	289	8.88	226	20.5	521	8.85	225	278	126		R-35

RECOMMENDED FLANGE BOLT LENGTHS & RING GASKET TYPE

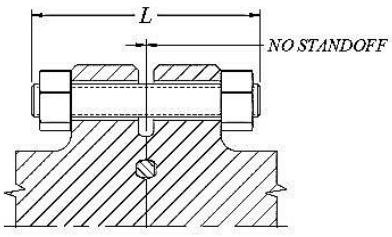
Recommended Bolt Lengths						
Nominal Size	Working Pressure (psi)	Stud			Nut	Ring Gasket
		Bolt Size and Thread	Length +0.125/−0	Qty	Qty	
2 1/16	2000	5/8-11 UNC	5	8	16	R23
	3000-5000	7/8-9 UNC	6.5	8	16	R24
	10000	3/4-10 UNC	5.5	8	16	BX-152
2 9⁄16	2000	3/4-10 UNC	5.5	8	16	R26
	3000-5000	1-8 UNC	7	8	16	R27
3 1⁄8	2000	3/4-10 UNC	5.75	8	16	R31
	3000	7/8-9 UNC	6.5	8	16	R31
	5000	1-1/8-8 UNC	7.75	8	16	R35
3 1/16	10000	1-8 UNC	7.25	8	16	BX-154
4 1⁄16	2000	7/8-9 UNC	6.5	8	16	R37
	3000	1-1/8-8 UN	7.5	8	16	R37
	5000	1-1/4-8 UN	8.5	8	16	R39
	10000	1-1/8-8 UN	8.5	8	16	BX-155
5 1⁄8	5000	1-1/2-8 UN	10.5	8	16	R44
	10000	1-1/8-8 UN	9.25	12	24	BX-169



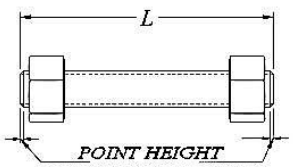
API TYPE 6B FLANGE WITH R GASKET



API TYPE 6B FLANGE WITH RX GASKET



API TYPE 6BX FLANGE



STUD BOLT WITH NUTS

LENGTH = 2(T + t + d) + S + 2(P)

T is total flange thickness;

t is plus tolerance for flange thickness;

d is heavy hex nut thickness;

S is flange face standoff (with “RX” gasket),S=0 for BX connection which has no standoff height;

P is point max. (1.5 x pitch).

6A GATE VALVE TRIM CHART

TRIM		SERVICE CONDITION	BODY	BONNET	GATE	SEAT	STEM[*3]
AA	Non-sour Service	Standard Trim, Non Corrosive	A487 4C /4130LA	4130LA	4130LA	4130LA	17-4PH
BB		Stainless Trim, Slightly Corrosive	A487 4C /4130LA	4130LA	410SS	410SS	17-4PH
CC		Full Stainless Trim, Moderately Corrosive	410SS	410SS	410SS	410SS	17-4PH
DD-0.5	Sour Service	Standard Trim, Non Corrosive	A487 4C /4130LA	4130LA	4130LA	4130LA	17-4PH
DD-NL		Standard Trim, Non Corrosive	A487 4C /4130LA	4130LA	4130LA	4130LA	4130LA
EE-0.5		Stainless Trim, Slightly Corrosive	4130LA	4130LA	410SS	410SS	17-4PH
EE-1.5		Stainless Trim, Highly Corrosive	4130LA	4130LA	410SS	410SS	410SS
EE-NL		Stainless Trim, Highly Corrosive	4130LA	4130LA	410SS	410SS	Inconel 718[*4]
FF-0.5		Full Stainless Trim Highly Corrosive	410SS	410SS	410SS	410SS	17-4PH
FF-1.5		Full Stainless Trim Highly Corrosive	410SS	410SS	410SS	410SS	410SS
FF-NL		Full Stainless Trim Highly Corrosive	410SS	410SS	410SS[*3]	410SS[*3]	Inconel 718[*4]
HH-NL[*5]		Highly Corrosive Extreme Service	4130 W/625 Inlay[*5]	4130 W/625 Inlay[*5]	Inconel 718[*4]	Inconel 718[*4]	Inconel 718[*4]

NOTES:

1.This trim chart provides information on materials included in standard valves offered by Array. Special materials, trims and configurations are available upon customer request.

2.Standard trim parts are QPQ nitrided. Tungsten Carbide HVOF, Hardfaced gates and seats are available for any TRIM upon request.

3.Materials for sour service trims conform to latest edition of NACE MR0175/ISO15156. Explanation for suffixes used for sour trims:

a) 0.5 = 0.5 psi maximum partial pressure of hydrogen sulfide(H2S)

b) 1.5 = 1.5 psi maximum partial pressure of hydrogen sulfide(H2S)

c) NL = No limit to hydrogen sulfide (H2S) exposure.

4.Inconel 718 is an alternative material for upgrade.

5.Inconel 718 is only "NL" for temperatures K thru U. Inconel 725 can be used up to temp. X.

6.CRA material is not available for temp. Y service.

7.Source reserves the right to use material class ZZ when customers request materials of construction that do not comply with current NACE MR0175/ISO standards

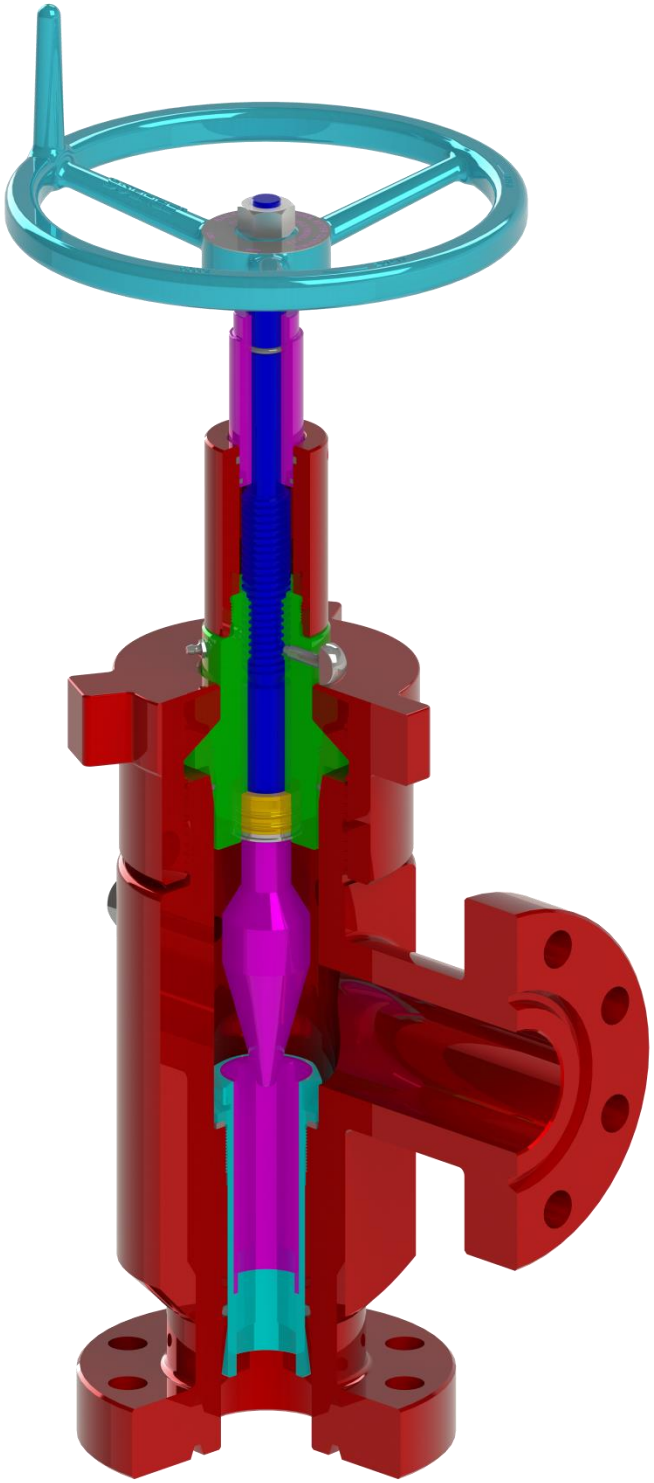
Temp. Class	Temperature Range			
	℃		°F	
	min.	max.	min.	max.
K	–60	82	–75	180
L	–46	82	–50	180
N	–46	60	–50	140
P	–29	82	–20	180
S	–18	60	0	140
T	–18	82	0	180
U	–18	121	0	250
V	2	121	35	250
X	–18	180	0	350
Y	-18	350	0	650

NOTE

Minimum temperature is the lowest ambient temperature to which the equipment can be subjected. Maximum temperature is the highest temperature of the fluid that can directly contact the equipment.

Adjustable Choke Assembly

Operating & Service Manual



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Operating & Service Procedure

Manual Adjustable Choke

Date: Sept. 2014

OPS-803 Rev.01

Information provided in this Recommended Procedure is of general nature based on accepted operating practices. Source Manufacturing or its agents makes no representation, warranty or guarantee in connection with this recommended procedure and expressly disclaims any liability or responsibilities when any part of this recommended procedure is adopted. The user is the best judge when applying this procedure base on specific equipment installation and the operating conditions.

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Table Of Content

Section 1 Warnings

The 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 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 downstream side of the choke is protected by Tungsten-cobalt alloy liner to reduce this wear. Therefore 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. Improperly flowing through the choke may cause damage and void the warranty. It is not recommended.

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 proper isolation valves should be used in conjunction with the choke.

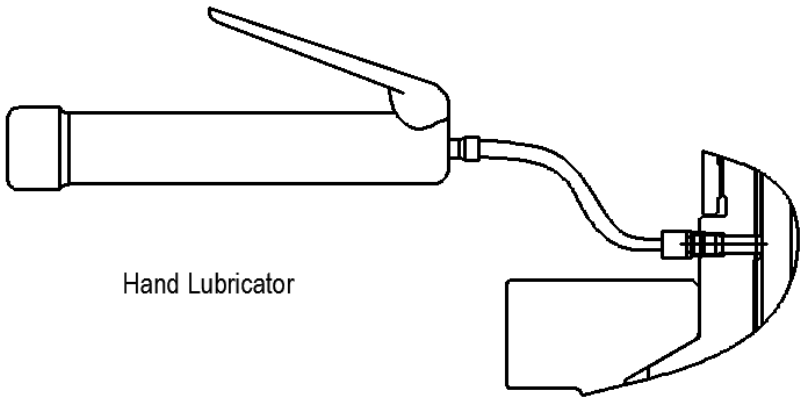
Section 2 General

2.1 Choke Description

Adjustable choke valves are used in many oilfield applications to control the rate of flow. The choke is operated by adjusting throttling height of stem.

2.2 Choke Structure (See Assembly Drawing)

1) The choke valve is equipped with injection fitting to add grease during regular maintenance.



Lubrication of Stem Bearing

2) Rotate stem clockwise to "close", counterclockwise to "open".

2.3 Characteristic

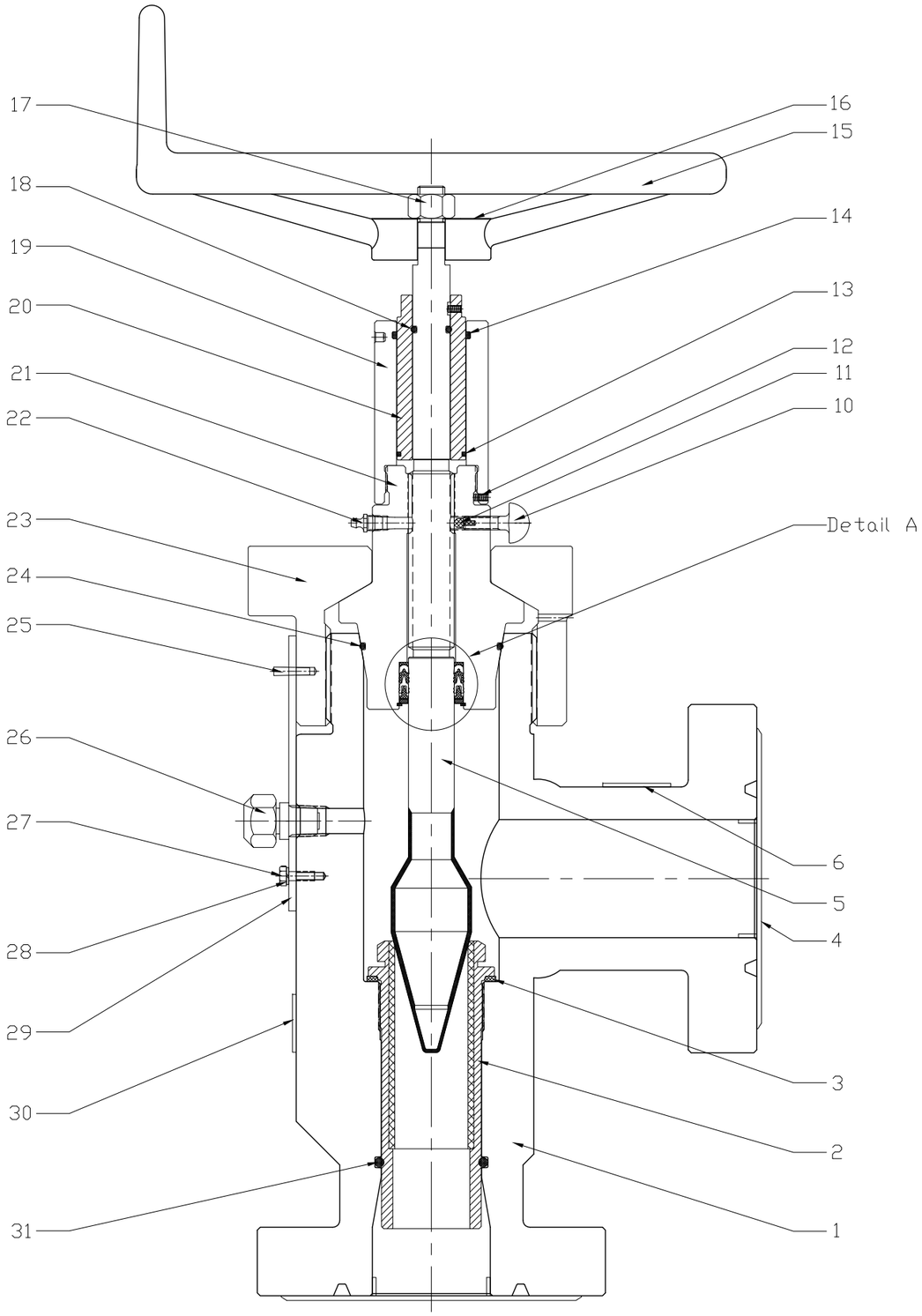
1) Structure is simple, easy to install, operate and maintain.

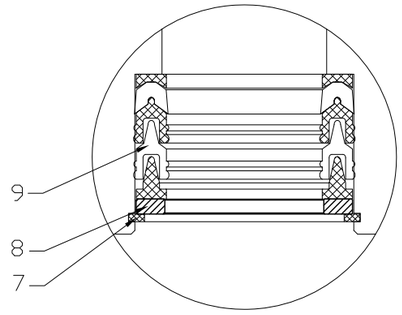
2) The choke is designed for throttling operation and not intended for shut off operation.

3) Tip of stem has tungsten carbide hard face and seat is fitted with tungsten-cobalt alloy liner to prolong service life.

Assembly Drawing:

--to be continued





Detail A

Item	Qty	Description
31	1	O-Ring
30	1	NamePlate
29	1	Safety Plate
28	1	Spring Washer
27	1	Bolt
26	1	Grease Fitting
25	1	Taper Pin
24	1	O-Ring
23	1	Wing Nut
22	1	Zerk Fitting
21	1	Bonnet
20	1	Indicator
19	1	Bonnet Cap
18	1	O-Ring
17	1	Lock Nut
16	1	Operating Disk
15	1	Handwheel
14	1	Support Ring
13	1	Support Ring
12	2	Set Screw
11	1	Nylon Ball
10	1	Thumb Screw
9	1	Packing
8	1	Support Ring
7	1	Retaining Ring
6	1	Flow Direction Plate
5	1	Stem
4	2	Protector
3	1	Gasket
2	1	Seat
1	1	Body

2.4 Choke Performance

The flow coefficient (C_v) graph is corresponding to different orifice sizes, as Figure 1 shown.

For liquid flow, the mathematical equation for determining C_v is:

$$C_v = q\left(\frac{\rho}{\Delta p}\right)^{1/2}$$

Where:

q=flow rate (gpm)

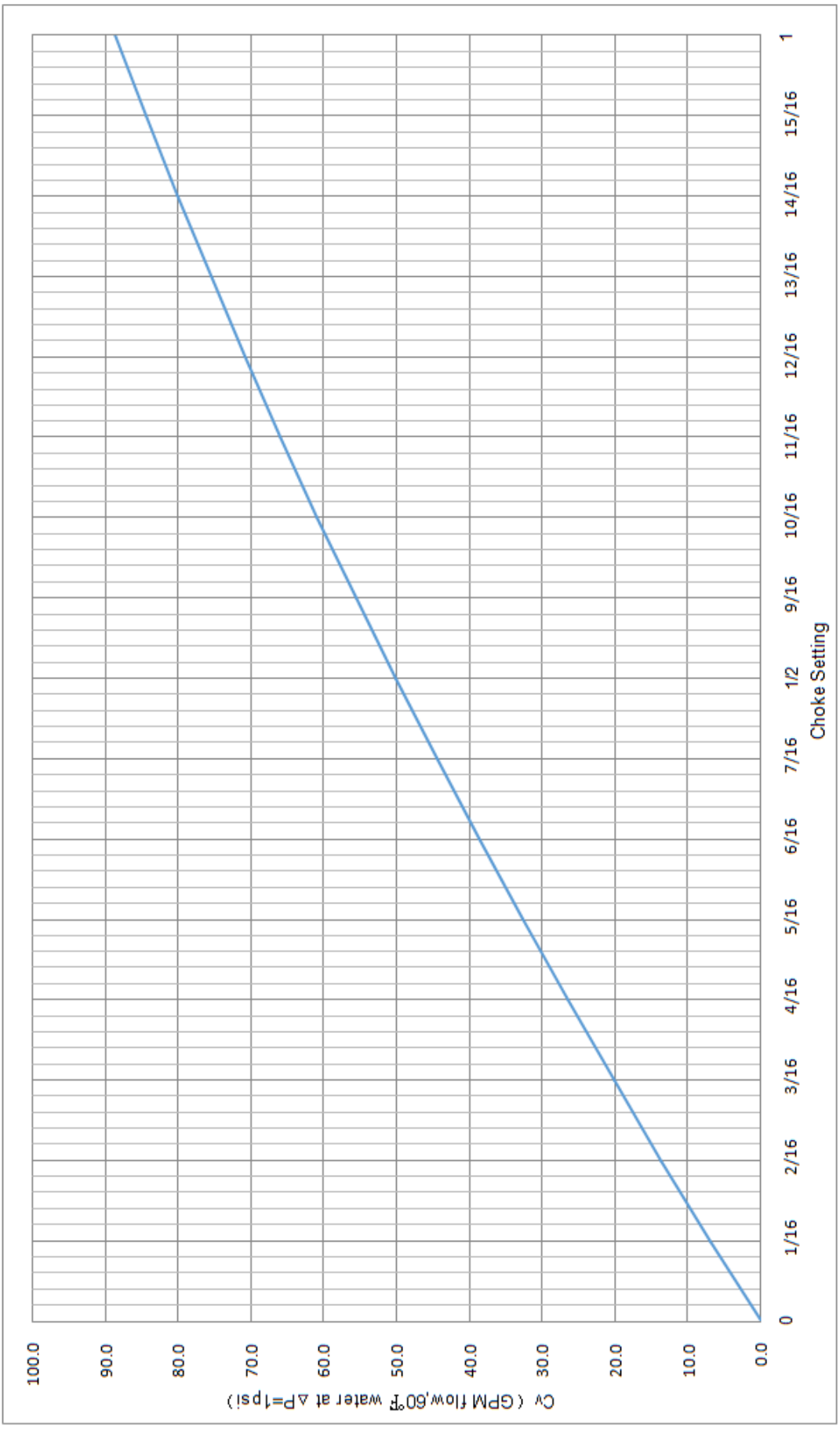
ρ=fluid specific gravity (1 for 60℉ water)

Δp=pressure drop across choke (psi)

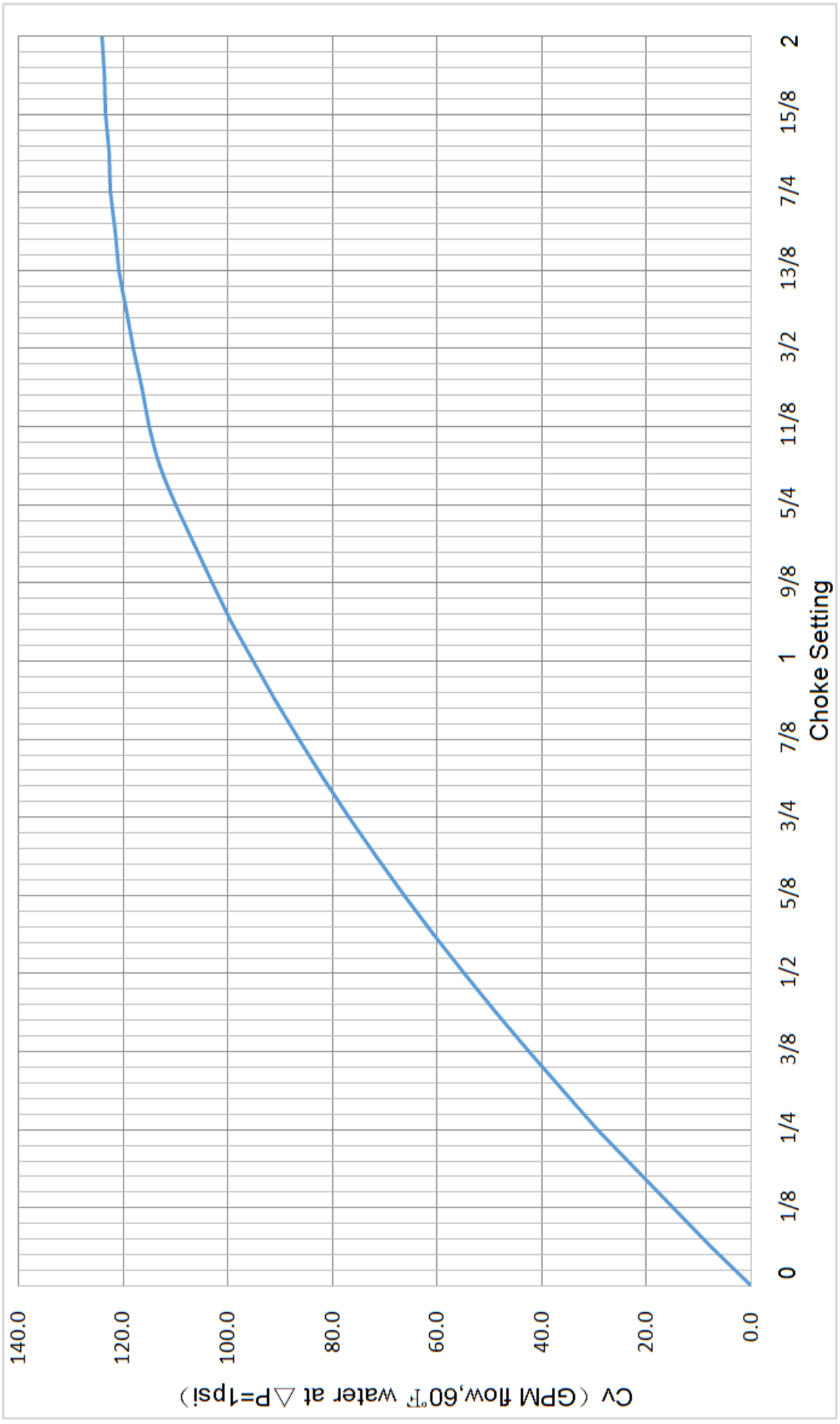
Flow Coefficient (C_v) Graph :

--to be continued

C_v (1" MAX ORIFICE)



C_v (2" MAX ORIFICE)



Section 3 Operation

3.1 Operation Procedure

The manual adjustable choke comes with an indicator which shows the equivalent orifice size of the choke and can be easily adjusted and set.

The choke can be adjusted according to the following steps:

1) Loosen the thumb screw, **BUT DO NOT REMOVE**;

2) Turn the handwheel either clockwise to throttle the choke closed, or counter-clockwise to throttle the choke open;

3) Tighten the thumb screw to lock down the stem once desired rate is achieved.

Caution:

Flow direction must be in accordance with arrow indication on flow direction plate(#6).

Section 4 Maintenance and Protection

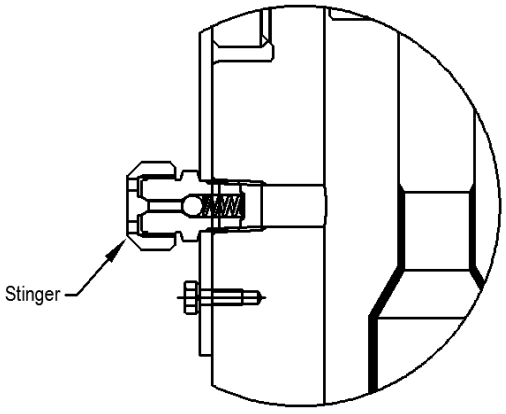
4.1 Preventative Protection

The choke shall be lubricated periodically with grease which can be injected from zerk fitting (#22).

4.2 Disassembly and Maintenance

WARNING: BLEED OFF ANY PRESSURE FROM CHOKE ASSEMBLY BEFORE ATTEMPTING REPAIR.

Note: Install a cap stinger to the injection fitting and slowly make up to depress the ball-check to bleed off any pressure trapped in the packing cavity of the bonnet.



Use Stinger to Open Ball-Check

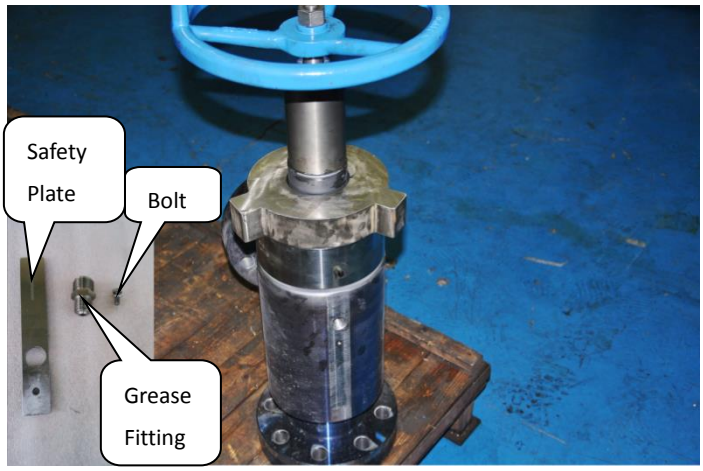
Disassembly of the choke as the following steps:

Step One:

a) Remove the Lock Nut (#17) and Handwheel (#15)

b) Loosen the Thumb Screw (#10) and Nylon Ball (#11)

c) Remove the Grease Fitting (#26), Bolt (#27), Spring Washer (#28) and Safety Plate (#29).



Note: Make sure any trapped pressure is completely bleed off before removing Grease Fitting.

Step Two:

a) Remove the Zerk Fitting (#22)

b) Remove the Wing Nut (#23) by hammering protection of the Nut counterclockwise

Step Three:

a) Remove the two Set Screws (#12)

b) Remove the Bonnet Cap (#19) and Indicator (#20)

Note: Indicator is not required to draw out from the Bonnet Cap if no damage is found on the two parts.

Step Four:

Remove sub-assembly of Bonnet and Stem

Step Five:

Remove the Stem（#5）from the Bonnet (#21) clockwise

Step Six:

a) Remove the Retaining Ring (#7) as per section **4.3**

b) Remove the Support Ring (#8) and Packing (#9)

Note: The packing is not intended to be re-used after removed from bonnet. Always, rebuild with new packing.

Step Seven:

Remove the Seat（#2）with 1-3/4" socket wrench Counterclockwise

Note: If part is found damaged during inspection, replacement or repair shall be carried out immediately.

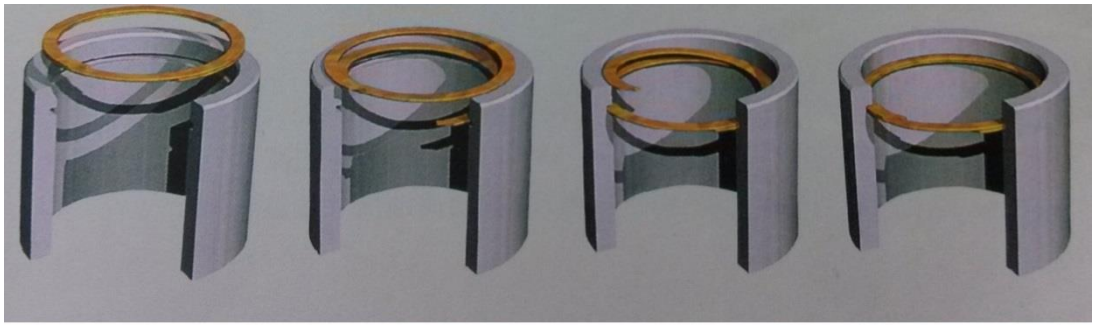
WARNING: SEALING SURFACES OF THE STEM SHOULD BE PROTECTED FROM DAMAGE.

4.3 Installation and Removal of Retaining Ring

a) Manual Installation

1. Separate the ring coils and insert one end of the ring into the groove.

2. Wind the ring by pressing down around the circumference until the entire ring in inserted into the groove.



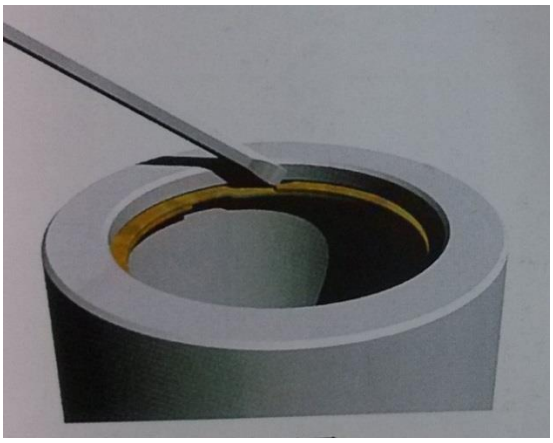
b) Remove

Smalley Retaining Ring are supplied standard with removal notches to enable easy extraction from a groove. The notch is provided to from a small gap between the ring end and the housing, permitting a blunt object to be inserted at the end of the ring to pry the free end out radially and up.

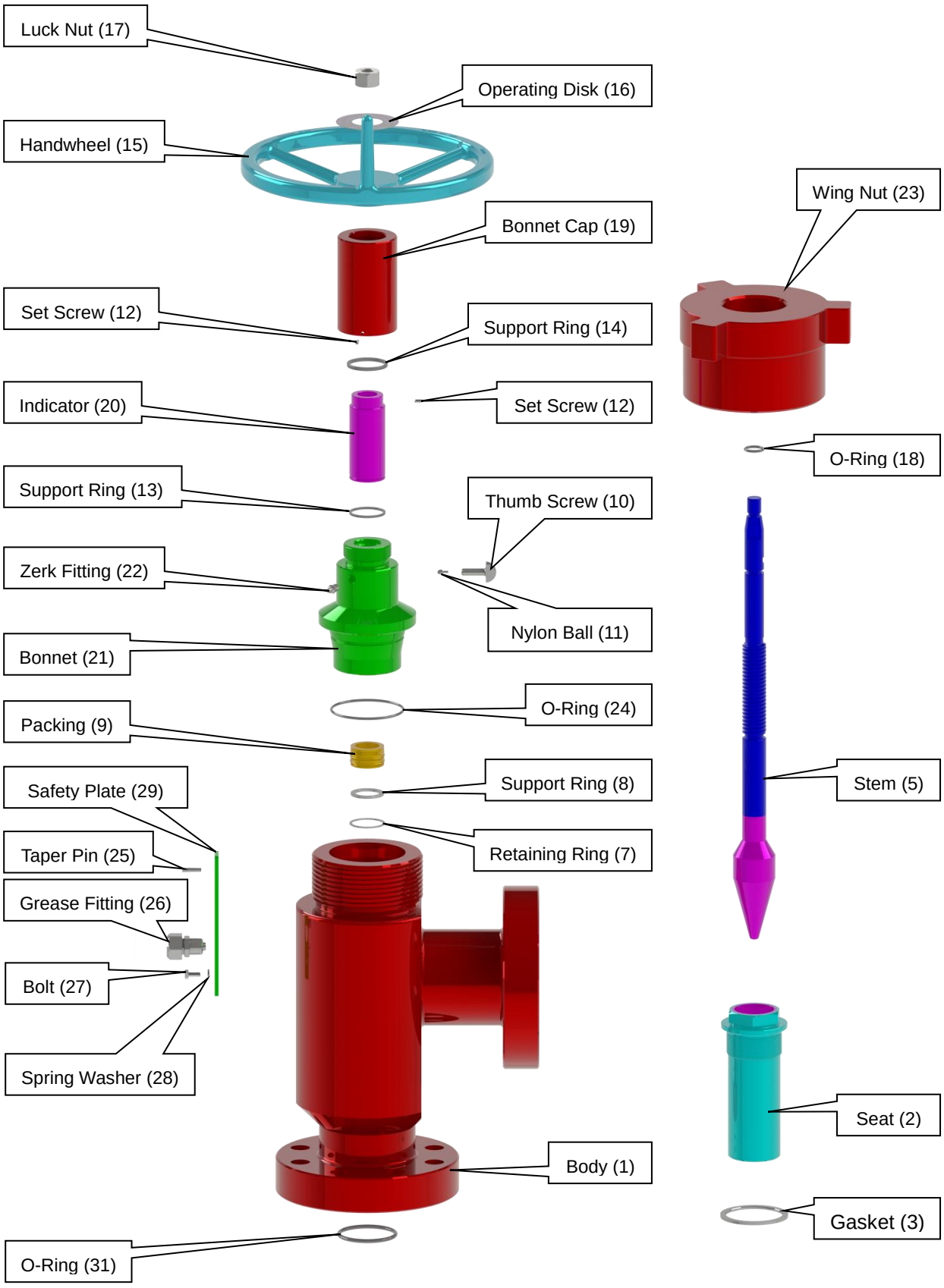
1. Insert a screwdriver or dental pick behind the removal notch.

2. Use the tool to pry out the first end of the ring.

3. Manually spiral the ring around until it is free from the groove.



Exploded View:



4.4 Common Breakdowns and Solutions

1) Unsteady Flow

When orifice size has been adjusted and choke was locked, sometimes unsteady flow can occur, particularly at condition of minimum stable flow. The main reasons are due to loosening of locking device, partial block of throttle and changes of media temperature.

Loosening of locking device is caused by mechanical vibration, which should be inspected periodically, to ensure locking device is tightened at all times. Partial block of throttle is caused by accumulation of debris on throttle edge which should be cleared to restore steady flow; Changes in media temperature will lead to changes in viscosity change of the fluid which will affect steady flow, so proper measures should be taken to stabilize media temperature.

2) Increasing of Internal leakage

When internal leakage is found increasing at “close” position, it is due to erosion of stem seal surface which may induce unstable minimum stable flow condition. To rectify this occurrence, the stem should be replaced as soon as possible.

Revision	Date	Record of Changes
00	2014/12/25	Initial Release
01	2015/04/20	Delete “Normative Reference”; Add Flow Coefficient (**Cv**) Graph for 2" Max Orifice;