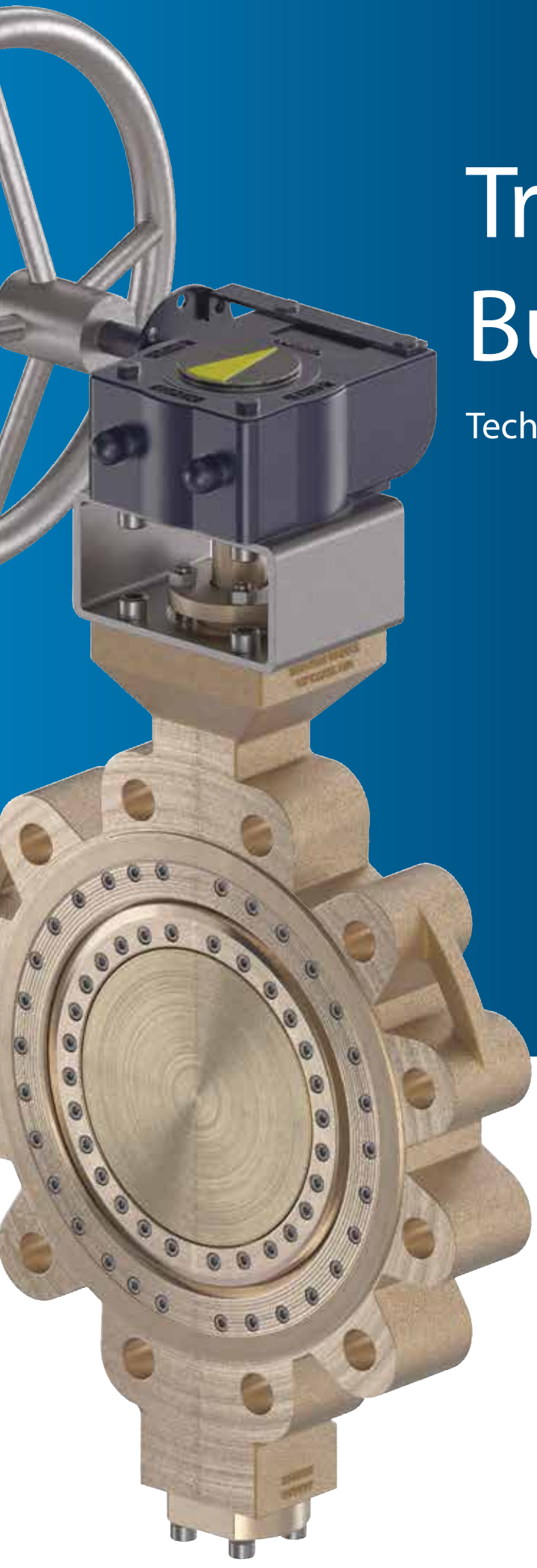

Triple-Offset Butterfly Valve

Technical Product Information

The world's preferred partner, delivering expert, corrosion-resistant, valve solutions.

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Contents

Headlines

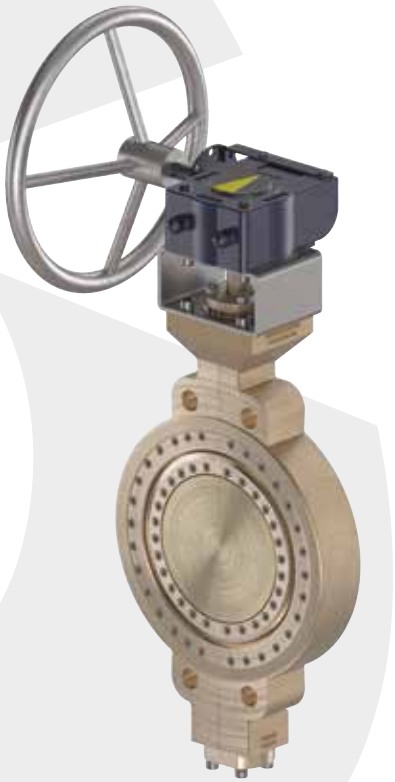
Your Comprehensive Triple-Offset Butterfly Valve Technical Manual

Shipham Valves has developed a high-quality Triple-Offset Butterfly Valve range that reflects our technical expertise in valve design, product engineering and market knowledge. This range possesses multiple design features which reflect the wide range of applications these valves support.

Technical Information At Your Fingertips

This technical manual provides a comprehensive overview of our range, illustrated by detailed 3D models and cutaway imagery combined with in-depth product descriptions and technical information such as:

- Unique design features
- User benefits
- Technical specifications
- Valve components and construction
- Varied applications supported by the triple-offset range
- Reference standards and certifications



This range also delivers a robust and effective through-life isolation valve, provides weight and space savings and is an alternative solution to gate and ball valves.

User Requirements

This high-quality triple-offset range has benefited from our valve design and materials expertise, unparalleled understanding of user needs and design feature requirements plus extensive market knowledge. This has resulted in a range that delivers proven performance and supports various severe-service and process-critical applications.

By choosing to work with Shipham Valves, we remove any concerns and provide total confidence that you have selected the right partner to help you navigate your way through the complex world of valve selection and project execution.

1 Introduction

Triple-Offset Butterfly Valves (TOBV), where the use of a metal-seated valve is advantageous, are a type of butterfly valve largely used for isolation and flow control on severe-service applications. Triple-Offset valves use three offsets to create a high performance, low friction seal. See image 1 below for further details.

- The valve shaft is offset from the centre line in both the X and Y axis, which makes up the first two offsets.
- The third offset consists of a conical angle on the sealing faces meaning the sealing faces only come into contact at the point of sealing.

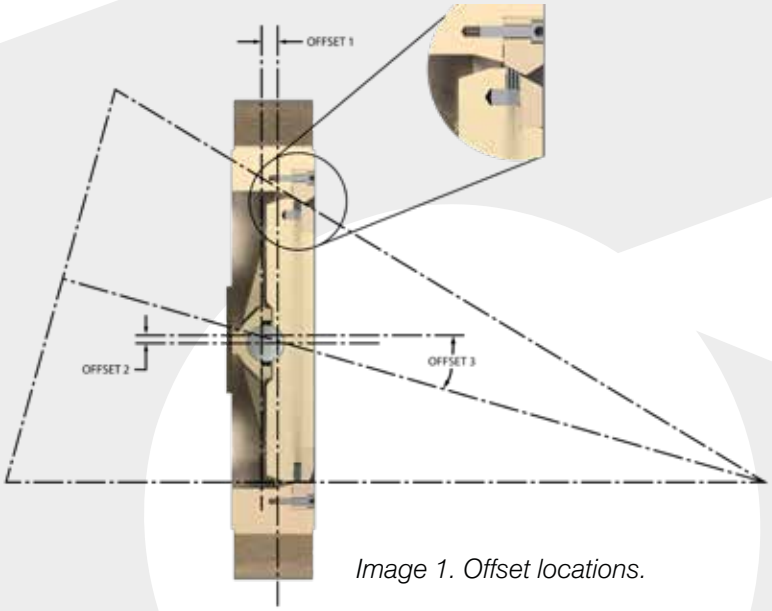


Image 1. Offset locations.

1.1 Valve Design Series

- BU04 - Wafer-Type Raised Face and Flat Face availability
- BU05 - Lug-Type Raised Face and Flat Face availability
- BU06 - Double-Flanged Raised Face and Flat Face availability

BU04 - Wafer-Type

BU05 - Lug-Type

BU06 - Double-Flanged

1.2 Reference Standards

Valve Design

API 609 Cat. B - Butterfly Valves: Double-Flanged, Lug and Wafer-Type and Buttweld
ASME B16.34 - Valves - Flanged, Threaded and Buttweld

Face to Face

API 609 - Lug and Wafer-Type and Double-Flanged Short Pattern
ASME B16.10 - Valves - Flanged, Threaded and Buttweld

Pressure Testing

API 598 - Valve Inspection and Testing

Shut Off Class

API 598 (Zero Leakage) - Valve Inspection and Testing
ISO 5208 Rate A - Industrial Valves - Pressure Testing of Metallic Valves

Fire Testing

API 607- Industrial Valves - Pressure Testing of Metallic Valves
BS EN ISO 10497 - Testing of Valves - Fire Type Testing Requirements

Fugitive Emissions

API 641

Accreditations

PED 2014 / 68 / EU
PE(S)R

2 Applications

Factors such as increased energy consumption, power generation, industrialisation and smart city initiatives have resulted in demand for high-quality Triple-Offset Butterfly Valves.

Diverse Industry-Specific Applications

The primary Triple-Offset application is isolation services, where a metal-seated valve with zero-leakage seat performance is desirable.

The range supports diverse industries, including:

- Chemical and processing industries
- Energy and power generation
- LNG storage and transportation
- Marine
- Oil and gas
- Petrochemical
- Pharmaceutical
- Pulp and paper
- Refining
- Steam shut-off
- Water industry and waste water treatment

Supporting applications such as:

- Carbon capture and storage
- Chemical solvents
- Cooling water systems
- Cryogenic liquids
- Desalination
- Hot gases
- Hydrocarbon and chemical isolation
- Hydrogen processing
- Isolation of reservoirs
- Thermal fluids
- Upstream applications

Suitable For Applications

The Triple-Offset range is ideal for applications with:

- High temperature
- Severe service
- Isolation requirements

It is becoming increasingly important for butterfly valve solutions to provide tight shut-off capabilities, lightweight solutions and lower installation costs. Shipham Valves' Triple-Offset Butterfly valve range addresses all of these end-user requirements.

Speciality materials and alloy steel with increased strength and corrosion-resistance characteristics are contributing to increased demand for Triple-Offset Butterfly Valves.

3 Design Features

3.1 Die-Formed Graphite Seals

- Die-formed graphite seals are made from graphite tape which is wound around a mandrel, then formed by a die into the seal shape. When installed in the valve this creates a high-density graphite ring which acts as a high integrity firesafe seal.
- Graphite can be used in a wide range of temperatures making it a suitable sealing material for a vast number of applications including firesafe designs.
- As well as having a wide temperature range, graphite is chemically compatible with almost all fluid types (line media) making them the ideal solution.
- The Triple-Offset range use graphite gaskets and packing rings as standard and, with the addition of a graphite seal at the end cover, it becomes a certified firesafe design, conforming to API 607 and ISO 10497. A fitted graphite fire-seal is shown below in image 2.

General Material	Component	Min. Temp	Max. Temp
Graphite	Gasket	-250°C	+600°C
	Packing Ring	-196°C	+400°C

Table 1. Graphite gasket and packing ring materials.

Image 2. Graphite fireseal used on Shipham Valves' Triple-Offset design.

3.2 Conical Seat Geometry

- Shipham Valves' Triple-Offset design employs a uniform profile around the conical sealing face to ensure effective sealing is achieved.
- Conical sealing, along with metal to metal seating, between the laminated disc seat and the body seat (shown below in image 3), ensures a lower friction operation with consistently high performance sealing over a long service life.

Image 3. Conical, metal to metal seating design.

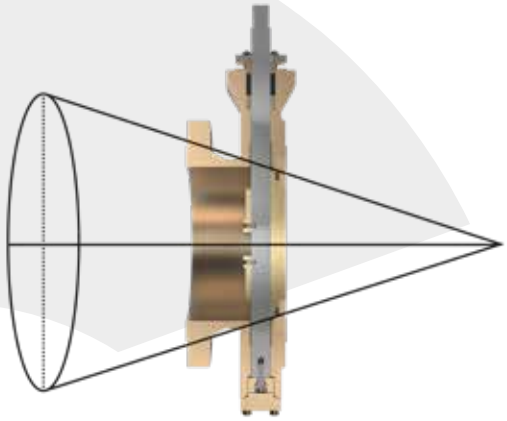


Image 4. Conical seating design profile.

3.3 Laminated Seat

- Industry-proven metallic and graphite laminated disc seat design.
- Consistent bi-directional sealing ability even at higher pressures.
- Suitable for use on critical service applications.
- Zero leakage sealing performance in accordance with API 598.
- Low friction design resulting in an extended seal service life.

Image 5. Laminated disc seat design.

3.4 Anti-Rotational Seat

- Anti-rotational laminated seat design to ensure no movement in service which maintains consistent sealing when compared to a clamped design. This is achieved by an anti-rotational pin (see image 6 below).
- Simplified build regime - prevents incorrect seat orientation on assembly.

Image 6. Laminated disc seat with anti-rotational pin.

3.5 Fugitive Emissions

- The entire Triple-Offset series can be offered on 'Hazardous Services' with fugitive emissions testing.
- Fugitive emissions testing ensures any leakages through all the seals are kept to an absolute minimum providing joint integrity across the entire valve range.
- Joint integrity is achieved with all-bolted joint designs in accordance with ASME 16.34, ASME BPVC VIII Division 1 and ASME PCC-1 recommended practice.
- A two-piece adjustable gland enables in-service packing consolidation to be followed up whilst maintaining even Radial sealing load on each packing ring.

See footnote in section 3.7 - Operations about Drivetrain in operation.

Image 7. Triple-Offset gland packing assembly.

3.6 Anti-Blowout Design

- This Triple-Offset butterfly valve range is designed with anti-blowout features included as standard to help prevent the valve shaft from being ejected from the valve in the unlikely event of a failure, when the valve is pressurised.
- The anti-blowout device is located at the bottom end of the shaft. It is bolted to the end of the stem and prevents stem blowout from the top of the valve due to the step in the rear of the body.
- Anti-blowout ring surface area and bolting size are calculated to counteract the shaft ejection force.
- In accordance with API 609 requirements, the valve endcap is bolted to the bottom end of the valve and prevents stem blowout from the bottom of the valve, in addition to sealing against the fluid pressure.

Image 8. Triple-Offset stem and anti-blowout detail.

3.7 Operation

- Torque seated valve - therefore all valves supplied as gear operated as standard.
- Standard mounting interface to allow for off the shelf actuation. Designed in accordance to ISO 5211.
- The weakest point of the drivetrain is located externally. In accordance with API 609 requirements the internal is a minimum of 10% stronger.
- Enables fast opening / closing quarter turn operation.
- Accurate and efficient actuation sizing made possible due to low operating torques.

Image 9. Triple-Offset Double-Flanged C/W gearbox and handwheel.

Shipham Valves Triple-Offset Butterfly Valve with Double-Flanged Body (BU06) - Exploded View

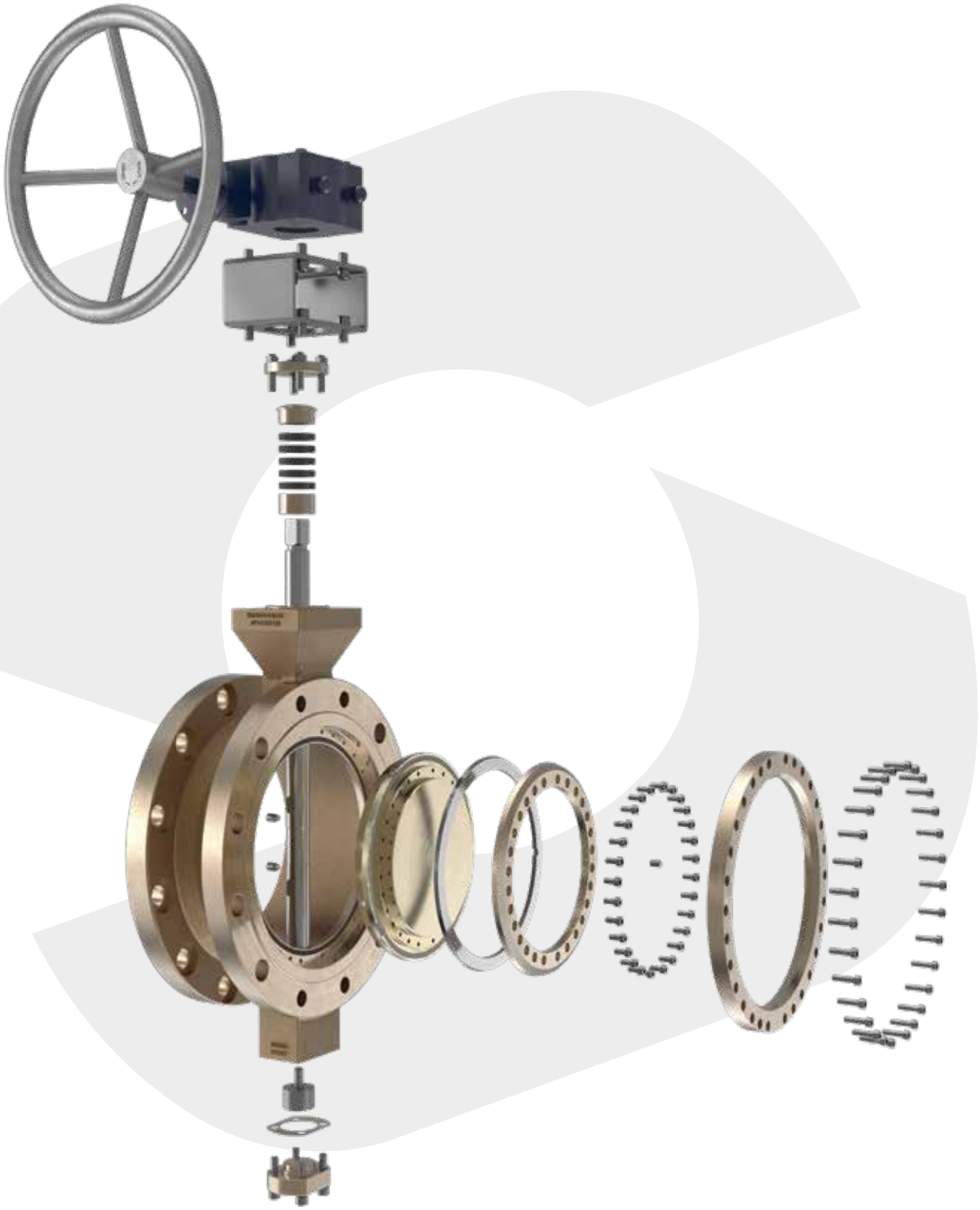


Image 10. Triple-Offset Butterfly Valve with Double-Flanged body - exploded view

4 Benefits

The standard design of our Triple-Offset Butterfly Valve range is compatible with various actuation solutions and is designed to meet a wide range of user requirements.

Benefits
With three body style designs and extensive design features, our Triple-Offset Butterfly Valve range delivers several user benefits including:

Performance
- High performance across a diverse range of applications
- Prolonged valve service longevity with the triple-offset design removing seat wear
- Laminated metal seat arrangements provide zero-leakage bi-directional sealing

Design
- Designed fully in accordance with API 609 Cat. B
- Firesafe design
- Compact design – when compared to other metal seated isolation valves such as Gate Valves
- Peace of mind - multiple anti-blowout devices integrated into the product to ensure stem retention under all future conditions

Certification and Accreditation
- Firesafe certification in accordance with API 607

Actuation
- Standard mounting interfaces enable easy actuation

Sizes and specialist materials of construction
Our range can be manufactured in a variety of specialist materials including Nickel Aluminium Bronze, Bronze, Duplex Stainless Steel, Super Duplex Stainless Steel, Hastelloy®, Monel®, Titanium, Inconel® and Zirconium in sizes ranging from 3” – 24”, with additional sizes available upon customer request.

5 Product Range

5.1 BU04

Triple-Offset Butterfly Valve, Wafer-Type Body,
Designed in accordance with API 609 Cat. B.

5.2 BU05

Triple-Offset Butterfly Valve, Lug-Type Body,
Designed in accordance with API 609 Cat. B.

5.3 BU06

Triple-Offset Butterfly Valve, Double-Flanged Body,
Designed in accordance with API 609 Cat. B.

5.4 Body Configurations – Flanges

- The triple offset design is available in the three main body configurations shown previously in section (1.1 Valve Design Series). Each valve can be offered with either flat-face or raised-face flanges.
- Flat-face flange – Gasket face is flat and on the same face as the bolting face (see image 11 below).
- Raised-face flange – Gasket surface is raised above the bolting face (see image 12 below).
- All gasket faces are provided with serrations in accordance with ASME B16.5 as standard.

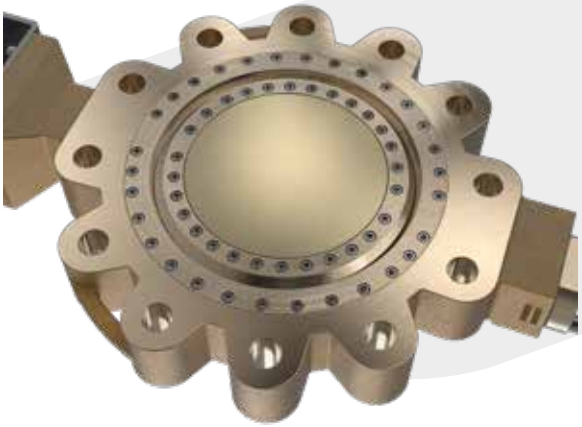


Image 11. Lug-Type body with flat-face flanges.

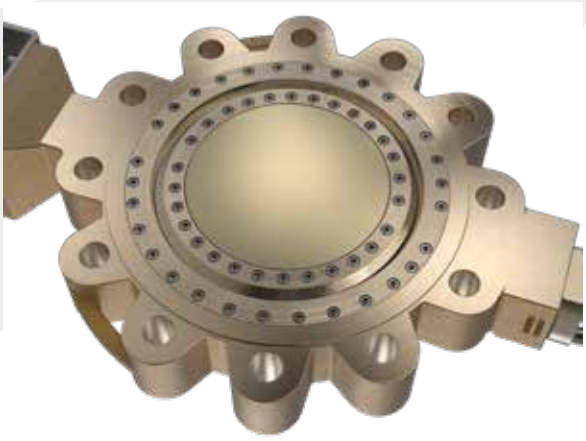


Image 12. Lug-Type body with raised-face flanges.

5.5 Series Availability

- This range is available in sizes from 3” up to 24” with further size options.

The table below shows the product range for the Shipham Valves’ Triple-Offset.
Further options are available upon customer request.

Size	3"		4"		6"		8"		10"		12”	
Class	Cl 150	Cl 300	Cl 150	Cl 300	Cl 150	Cl 300	Cl 150	Cl 300	Cl 150	Cl 300	Cl 150	Cl 300
Wafer-Type (BU04)	●	●	●	●	●	●	●	●	●	●	●	●
Lug-Type (BU05)	●	●	●	●	●	●	●	●	●	●	●	●
Double-Flanged (BU06)	●	●	●	●	●	●	●	●	●	●	●	●

Table 2. Triple-Offset range options 3” – 12”.

Size	14"		16”		18"		20"		24"	
Class	Cl 150	Cl 300	Cl 150	Cl 300	Cl 150	Cl 300	Cl 150	Cl 300	Cl 150	Cl 300
Wafer-Type (BU04)	●	●	●	●	●	●	●	●	●	●
Lug-Type (BU05)	●	●	●	●	●	●	●	●	●	●
Double-Flanged (BU06)	●	●	●	●	●	●	●	●	●	●

Table 3. Triple-Offset range options 14” – 24”.

5.6 Face to Face

- Designed to standard face to face dimensions to API 609 and ASME B16.10

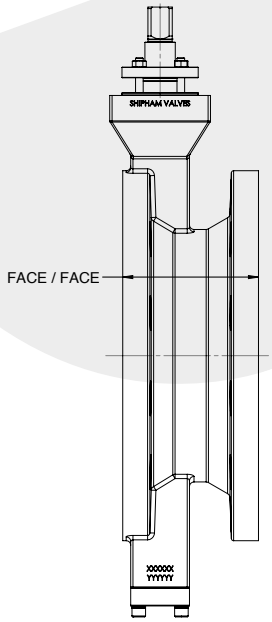


Image 13. Double Face to Face

5.7 Part Identification

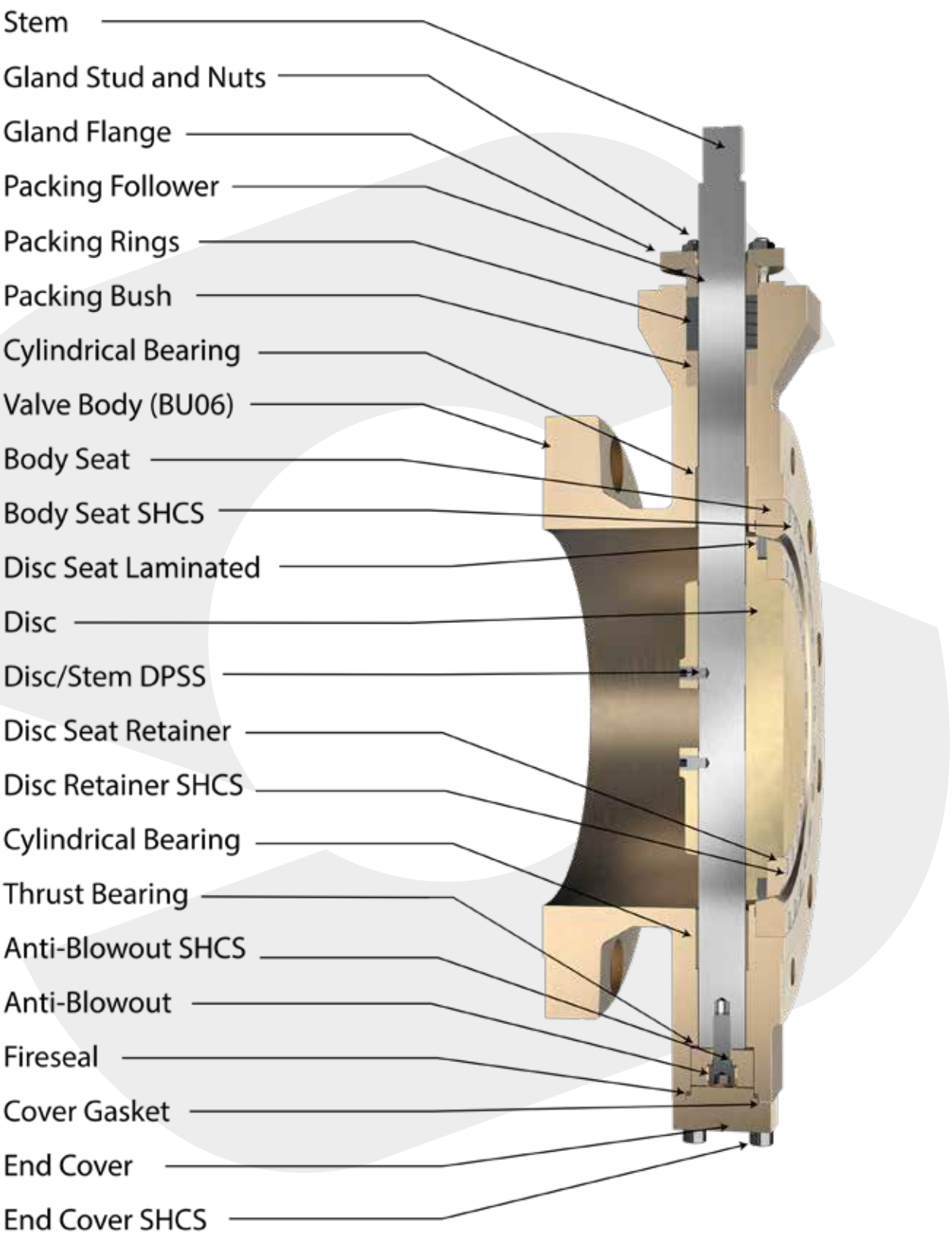


Image 14. Sectional view of Triple-Offset Double-Flanged flat-face (BU06).

6 Valve Dimensions

6.1 Envelope Dimensions

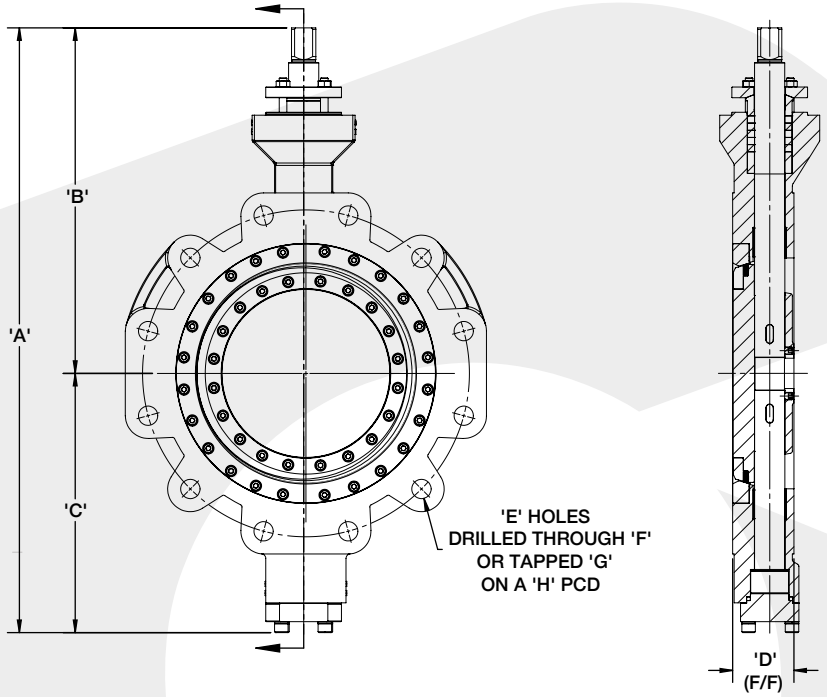


Image 15. Bare stemmed GA drawing, Triple-Offset Lug-Type flat-face (BU05).

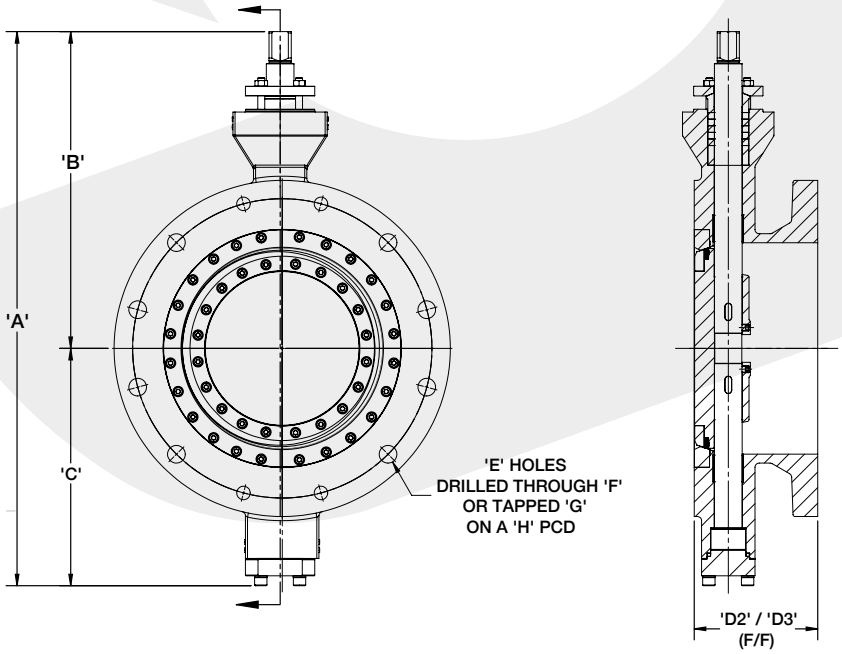


Image 16. Bare stemmed GA drawing, Triple-Offset Double-Flanged flat-face (BU06).

Class 150														
Valve Size (Inch)		A (mm)	B (mm)	C (mm)	D (mm)	D2 (DFSP)	D3 (DFLP)	E	F	G	H	Wafer (Kg)	Lugged (Kg)	Double Flanged (Kg)
DN	NPS													
80	3	415	263	152	48	114	203	4	3/4"	5/8"	152.4	*	12	17
100	4	437	259	178	54	127	229	8	3/4"	5/8"	190.5	*	16	22
150	6	518	308	210	57	140	267	8	7/8"	3/4"	241.3	*	24	33
200	8	610	362	248	64	152	292	8	7/8"	3/4"	298.5	*	41	55
250	10	681	394	287	71	165	330	12	1"	7/8"	362	*	60	80
300	12	799	457	342	80	178	356	12	1"	7/8"	431.8	*	93	118
350	14	883	511	372	92	190	381	12	1.1/8"	1"	476.3	*	124	158
400	16	961	555	406	102	216	406	16	1.1/8"	1"	539.8	*	176	208
450	18	1019	577	442	114	222	432	16	1.1/4"	1.1/8"	577.9	*	220	251
500	20	1201	726	475	127	229	457	20	1.1/4"	1.1/8"	635	*	315	348
600	24	1351	797	554	154	267	508	20	1.3/8"	1.1/4"	749.3	*	484	523

** Consult Factory*
DFSP – Double-Flanged short pattern / DFLP – Double-Flanged long pattern.

Table 4. Class 150 valve envelope dimensions and approximate series weights.

Class 300														
Valve Size (Inch)		A (mm)	B (mm)	C (mm)	D (mm)	D2 (DFSP)	D3 (DFLP)	E	F	G	H	Wafer (Kg)	Lugged (Kg)	Double Flanged (Kg)
DN	NPS													
80	3	TBC	TBC	TBC	48	180	282	TBC	TBC	TBC	TBC	*	*	*
100	4	TBC	TBC	TBC	54	190	305	TBC	TBC	TBC	TBC	*	*	*
150	6	TBC	TBC	TBC	59	210	403	TBC	TBC	TBC	TBC	*	*	*
200	8	TBC	TBC	TBC	73	230	419	TBC	TBC	TBC	TBC	*	*	*
250	10	TBC	TBC	TBC	83	250	457	TBC	TBC	TBC	TBC	*	*	*
300	12	TBC	TBC	TBC	92	270	502	TBC	TBC	TBC	TBC	*	*	*
350	14	TBC	TBC	TBC	117	290	762	TBC	TBC	TBC	TBC	*	*	*
400	16	TBC	TBC	TBC	133	310	838	TBC	TBC	TBC	TBC	*	*	*
450	18	TBC	TBC	TBC	149	330	914	TBC	TBC	TBC	TBC	*	*	*
500	20	TBC	TBC	TBC	159	350	991	TBC	TBC	TBC	TBC	*	*	*
600	24	TBC	TBC	TBC	181	390	1143	TBC	TBC	TBC	TBC	*	*	*

** Consult Factory*
DFSP – Double-Flanged short pattern / DFLP – Double-Flanged long pattern.

Table 5. Class 300 valve envelope dimensions and approximate series weights.

6.2 Topworks Dimensions (Class 150)

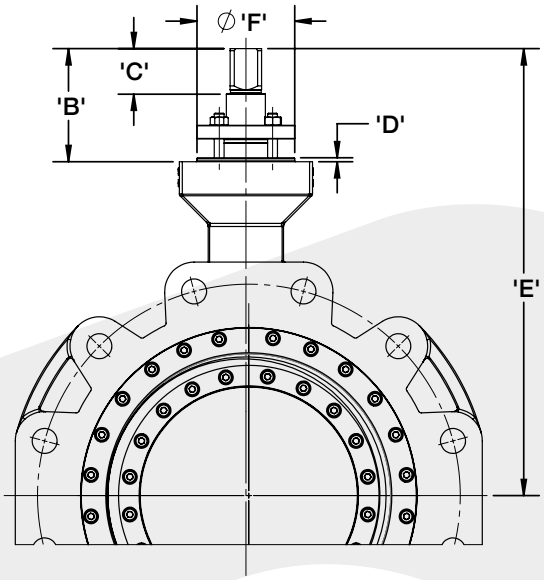


Image 17. Topworks details - Triple-Offset Lug-Type flat-face (BU05).

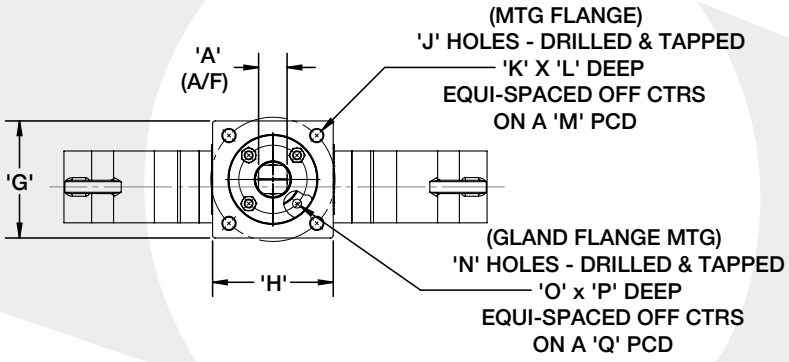


Image 18. Topworks details – mounting bracket and gland mounting detail - Triple-Offset Lug-Type flat-face (BU05).

Valve Size		A (A/F)		B		C		D		E		F (Ø)		G	
DN	NPS	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
80	3	14	0.55	102	4.03	29	1.14	6.4	0.25	263	10.35	70	2.75	94	3.70
100	4	16	0.63	102	4.03	29	1.14	6.4	0.25	259	10.20	70	2.75	94	3.70
150	6	18	0.71	102	4.03	29	1.14	2.9	0.11	309	12.15	70	2.75	94	3.70
200	8	23	0.91	107	4.23	34	1.34	2.9	0.11	363	14.27	85	3.34	114	4.49
250	10	26	1.02	107	4.23	37	1.46	2.9	0.11	394	15.49	85	3.34	114	4.49
300	12	32	1.26	115	4.53	46	1.81	4	0.16	457	17.99	100	3.94	132	5.20
350	14	36	1.42	146	5.75	56	2.20	4.9	0.19	511	20.12	130	5.12	158	6.22
400	16	44	1.73	146	5.75	58	2.28	7.4	0.29	556	21.87	130	5.12	158	6.22
450	18	48	1.89	146	5.75	58	2.28	7.4	0.29	577	22.70	130	5.12	158	6.22
500	20	52	2.05	254	10.00	67	2.64	11	0.45	726	28.56	200	7.87	268	10.55
600	24	64	2.52	254	10.00	67	2.64	11	0.45	797	31.36	200	7.87	268	10.55

** Consult Factory*

Table 6. Triple-Offset topworks dimensions (Class 150).

Valve Size		H		J	K	L		M		N	O	P		Q	
DN	NPS	mm	inch	Mtg Holes (No.)	Thread	mm	inch	mm	inch	Gland Holes (No.)	Thread	mm	inch	mm	inch
80	3	100	3.94	4	M10	15	0.59	102	4.02	4	M8	10	0.39	45	1.77
100	4	100	3.94	4	M10	16	0.63	102	4.02	4	M8	10	0.39	46	1.81
150	6	100	3.94	4	M10	18	0.71	102	4.02	4	M8	10	0.39	48	1.87
200	8	136	5.35	4	M12	18	0.71	125	4.92	4	M10	13	0.51	60	2.36
250	10	136	5.35	4	M12	18	0.71	125	4.92	4	M10	13	0.51	65	2.56
300	12	136	5.35	4	M16	30	1.18	140	5.51	4	M10	13	0.51	77	3.03
350	14	176	6.93	4	M20	30	1.18	165	6.50	4	M10	13	0.51	85	3.35
400	16	176	6.93	4	M20	30	1.18	165	6.50	4	M12	18	0.71	99	3.90
450	18	176	6.93	4	M20	30	1.18	165	6.50	6	M12	18	0.71	102	4.02
500	20	268	10.55	8	M16	27	1.06	254	10.0	4	M20	25	0.98	120	4.72
600	24	268	10.55	8	M16	27	1.06	254	10.0	4	M24	30	1.18	140	5.51

Table 7. Triple-Offset topworks dimensions (Class 150).

6.3 Operating Torques & MAST (Class 150)

The Triple-Offset range has a normal operating torque and maximum allowable stem torques (MAST) on four stem materials which are highlighted in the table below.

Valve Size		Operating Torque (Nm)	MAST (Nm)						
DN	NPS	Cl 150	Mon. K-500	Inc. 718	17-4pH	Ti Gr5	S.Dup 6A	Inc. 625	Hast
80	3”	83	55	186	163	186	123	77	63
100	4”	143	262	314	276	315	209	131	108
150	6”	227	378	453	397	453	301	189	155
200	8”	430	802	962	843	963	640	401	329
250	10”	729	1168	1400	1227	1402	931	584	479
300	12”	1150	2202	2639	2314	2642	1755	1101	903
350	14”	1482	3152	3778	3312	3782	2512	1576	1293
400	16”	2210	5799	6950	6093	6959	4622	2899	2378
450	18”	2990	7550	9049	7933	9060	6018	3775	3097
500	20”	3912	9623	11533	10111	11547	7670	4811	3947
600	24”	6426	18039	21620	18954	21646	14379	9019	7398

Operating Torque = Torque required to close the valve.

Table 8. Operating torques and MAST values (Class 150).

6.4 Topworks Dimensions (Class 300)

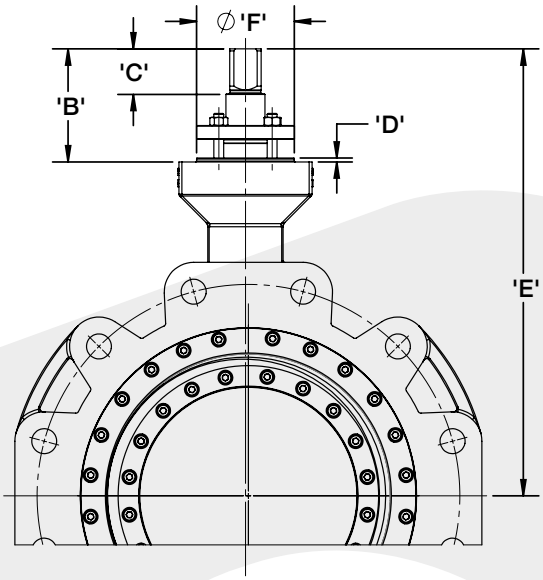


Image 19. Topworks details - Triple-Offset Lug-Type flat-face (BU05) (Class 300).

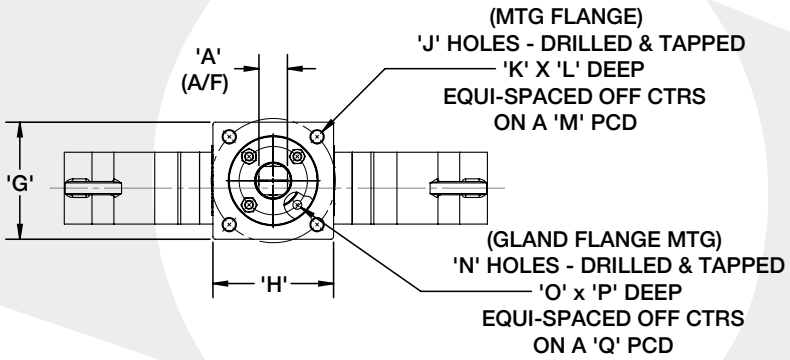


Image 20. Topworks details – mounting bracket and gland mounting detail - Triple-Offset Lug-Type flat-face (BU05).

Valve Size		A (A/F)		B		C		D		E		F (Ø)		G	
DN	NPS	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
80	3	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
100	4	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
150	6	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
200	8	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
250	10	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
300	12	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
350	14	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
400	16	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
450	18	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
500	20	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
600	24	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC

Table 9. Triple-Offset topworks dimensions (Class 300).

Valve Size		A (A/F)		B		C		D		E		F (Ø)		G	
DN	NPS	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
80	3	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
100	4	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
150	6	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
200	8	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
250	10	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
300	12	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
350	14	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
400	16	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
450	18	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
500	20	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
600	24	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC

Table 10. Triple-Offset topworks dimensions (Class 300).

6.5 Operating Torques & MAST (Class 300)

The Triple-Offset range has a normal operating torque and maximum allowable stem torques (MAST) on four stem materials as highlighted in the table below.

Valve Size		Operating Torque (Nm)	MAST (Nm)						
DN	NPS	Cl 300	Mon. K-500	Inc. 718	17-4pH	Ti Gr5	S.Dup 6A	Inc. 625	Hast
80	3”	83	55	186	163	186	123	77	63
100	4”	143	262	314	276	315	209	131	108
150	6”	227	378	453	397	453	301	189	155
200	8”	430	802	962	843	963	640	401	329
250	10”	729	1168	1400	1227	1402	931	584	479
300	12”	1150	2202	2639	2314	2642	1755	1101	903
350	14”	1482	3152	3778	3312	3782	2512	1576	1293
400	16”	2210	5799	6950	6093	6959	4622	2899	2378
450	18”	2990	7550	9049	7933	9060	6018	3775	3097
500	20”	3912	9623	11533	10111	11547	7670	4811	3947
600	24”	6426	18039	21620	18954	21646	14379	9019	7398

Operating Torque = Torque required to close the valve.

Table 11. Operating torques and MAST Values (Class 300).

7 Valve Flow Coefficient

The Triple-Offset range theoretical flow capabilities shown below are based on assumption that the valve is in the fully open position and pressure drop will be negligible.

		Class 150		Class 300		Class 600	
DN	NPS (In)	*Cv	*Kv	*Cv	*Kv	*Cv	*Kv
50	2	70	60	70	60	70	60
80	3	163	141	163	141	163	141
100	4	298	258	298	258	298	258
150	6	697	602	697	602	697	602
200	8	1271	1098	1271	1098	1228	1061
250	10	3052	2637	3052	2637	2896	2502
300	12	4464	3857	4464	3857	4274	3692
350	14	5490	4743	5490	4743	5165	4463
400	16	9722	8400	9722	8400	9070	7836
450	18	12568	10859	12188	10531	11454	9896
500	20	15793	13645	15366	13276	14133	12211
600	24	23395	20213	22870	19760	20850	18014

*Cv - Valve flow coefficient (imperial unit) - The number of US gallons per minute (gpm) of water at 60°F that can flow through a valve with a pressure drop across it of 1psi.

*Kv - Valve flow coefficient (metric unit) - The number of cubic metres per hour (m3/h) of water at 16°C that can flow through a valve with a pressure drop across it of 1bar.

Table 12. Theoretical Cv and Kv values for Triple-Offset (Class 150 - 600).

8 Materials of Construction

Materials of Construction			
Body & Disc	**Trim**	**Stem**	**Laminate Seat**
ASTM B148 C95800 - **A**	ASTM B150 C63200 - **A** ASTM B148 C95800 - **A** ASTM B164 N04400 - **B1**	ASTM B865 N05500 - **B2** ASTM B637 Gr. 718 - **I2** ASTM B865 N05500 - **B2** ASTM B637 Gr. 718 - **I2**	ASTM B443 N06625 (Inconel 625) / Graphite As standard for all
ASTM A494 M 35-1 - **B1**	ASTM A494 M 35-1 - **B1**	ASTM B865 N05500 - **B2** ASTM B637 Gr. 718 - **I2**	
ASTM A995 CD3MN - **F**	ASTM A995 CD3MN - **F** ASTM A479 S32760 - **F**	ASTM A479 S32760 - **E** ASTM A564 630 - **J** H1150D - **J** ASTM B637 Gr. 718 - **I2**	
ASTM A995 CD3MWCuN - **E**	ASTM A995 CD3MWCuN - **E** ASTM A479 S32760 - **E**	ASTM A479 S32760 - **E** ASTM A564 630 - **J** H1150D - **J** ASTM B637 Gr. 718 - **I2**	
ASTM B367 Gr. C-2 - **C1**	ASTM B367 Gr. C-2 - **C1** ASTM B348 GR. 5 - **C2** ASTM B381 F-2 - **C1**	ASTM B348 GR. 5 - **C2** ASTM B381 F-5 - **C2**	
ASTM A494 CW6MC - **I1**	ASTM A494 CW6MC - **I1** ASTM B564 N0662 - **I1**	ASTM B564 N06625 - **I1** ASTM B637 Gr. 718 - **I2**	
ASTM A351 CK3MCuN (6Mo) - **G**	ASTM A351 CK3MCuN (6Mo) 5 - **G**	ASTM B637 Gr. 718 - **I2**	
ASTM A351 CF8M - **D1**	ASTM A351 CF8M - **D1** ASTM A479 S32205 - **F** ASTM A182 F316 - **D2**	ASTM A564 630 - **J** H1150D - **J**	
ASTM A494 N12MV - **H1**	ASTM A494 N12MV - **H1**	ASTM B564 N10276 - **H2** ASTM B637 Gr. 718 - **I2**	
ASTM A494 CW12MW - **H2**	ASTM A494CW12MW - **H2**	ASTM B564 N10276 - **H2** ASTM B637 Gr. 718 - **I2**	

Table 13. Available materials of construction.

Bolting Materials		
ASTM B150 C63000 HR50 - **A**	ASTM A193 B7M - **K**	ASTM A320 L7 - **K**
ASTM B164 N04400 - **B1**	ASTM A193 B8 Cl.2 - **D1**	ASTM A320 L7M - **K**
ASTM A193 B7 - **M**	ASTM A193 B8M Cl.2 - **D2**	ASTM A276 Condition S - **E**

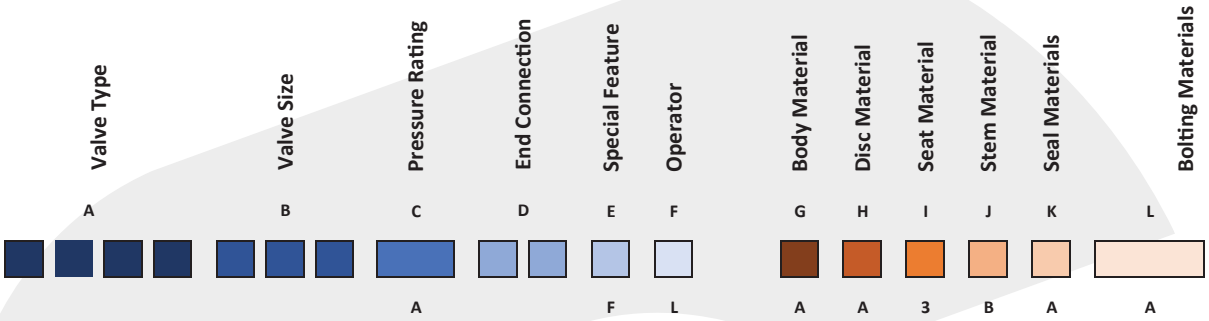
All bolting supplied in accordance with API 609/ASME B16.34 intermediate and high strength only.

Table 14. Bolting material standardised options.

Key:
A - Nickel Aluminium Bronze **B1** - Monel 400 **B2** - Monel K-500 **C1** - Titanium Gr.2 **C2** - Titanium Gr.5 **D1** - Austenitic (304) Stainless Steel **D2** - Austenitic (316) Stainless Steel **E** - Super Duplex - 6A **F** - Duplex - 4A **G** - 6 Mo Stainless Steel **H1** - Hastelloy B **H2** - Hastelloy C276 **I1** - Inconel 625 **I2** - Inconel 718 **J** - 17-4 Precipitation Hardened Steel & 17-4 Stainless Steel Bar **K** - Chromium Molybdenum Steel

9 Product Coding

Butterfly Valve Product Codification



A - Valve Type	
BU04	- Wafer-Type
BU05	- Lug-Type
BU06	- Double-Flanged

B - Valve Size			
030	- 3"	120	- 12"
040	- 4"	140	- 14"
060	- 6"	160	- 16"
080	- 8"	180	- 18"
100	- 10"	200	- 20"
		240	- 24"

C - Pressure Class	
A	- ASME Cl 150
B	- ASME Cl 300
Q	- PN16
S	- PN32
T	- PN40

D - End Connection	
FA	- ASME B16.5 Cl 150 RF
FB	- ASME B16.5 Cl 150 FF
FD	- ASME B16.5 Cl 300 RF
FE	- ASME B16.5 Cl 300 FF

E - Special Feature	
A	- None
F	- Firesafe Seat

F - Operator	
W	- Gearbox (Worm)
L	- Lever
B	- Bareshaft

G - Body Material	
A	- ASTM B148 C95800 (NI AL BRZ)
B	- ASTM A494 M 35-1 (MONEL® 400)
C	- ASTM B61 C92200 (BRONZE)
D	- ASTM B62 C83600 (BRONZE)
E	- ASTM A995 CD3MN (DUPLEX)
F	- ASTM A995 CD3MWCuN (S.DUPLEX)
H	- ASTM B367 Gr. C-2 (TITANIUM)
K	- ASTM A494 CW6MC (INCONEL® 625)
L	- ASTM A351 CK3MCuN (6Mo)
M	- ASTM A494 N12MV (HASTELLOY® B)
N	- ASTM A494 CW12MW (HASTELLOY® C)

H -Disc Material	
A	- ASTM B148 C95800 (NI AL BRZ)
B	- ASTM A494 M 35-1 (MONEL® 400)
C	- ASTM B61 C92200 (BRONZE)
D	- ASTM B62 C83600 (BRONZE)
E	- ASTM A995 CD3MN (DUPLEX)
G	- ASTM A995 CD3MWCuN (S.DUPLEX)
K	- ASTM B367 Gr. C-2 (TITANIUM)
N	- ASTM A494 CW6MC (INCONEL® 625)
O	- ASTM A351 CK3MCuN (6Mo)
Q	- ASTM A494 N12MV (HASTELLOY® B)
R	- ASTM A494 CW12MW (HASTELLOY® C)

I - Seat Laminate Material	
5	- ASTM B433 N06625 (Inconel® 625)

J - Stem Material	
A	- ASTM B150 C63200 TQ 50 (NI AL BRZ)
B	- ASTM B865 N05500 (MONEL® K-500)
C	- API 6A CRA N07718 (INCONEL® 718)
D	- ASTM B381 Gr. F-5 (TITANIUM)
F	- ASTM B564 N06625 (INCONEL® 625)
J	- ASTM B564 N10276 (HASTELLOY®)
L	- ASTM A276 S32760 (S.DUPLEX)

K- Seal Material	
A	- Graphite / No Elastomer
P	- PTFE / No Elastomer

L- Bolting Material	
A	- ASTM B150 C63000 HR50 (NI AL BRZ)
B	- ASTM B164 N04400 (MONEL® 400)
E	- ASTM A193 B7/ A194 2H SCF2 (C.STEEL)
F	- ASTM A193 B7M/ A194 2HM SCF2(C.STEEL)
G	- ASTM A193 B8 CL.2 / A194 8 (S.STEEL)
H	- ASTM A193 B8 CL.2 / A194 8 SCF2 (S.STEEL)
K	- ASTM A193 B8M CL.2 / A194 8M (S.STEEL)
L	- ASTM A193 B8M CL.2 / A194 8M SCF2 (S.STEEL)
M	- ASTM A320 L7 / A194 Gr. 7 SCF2 (C.STEEL)
N	- ASTM A320 L7M / A194 Gr. 7M SCF2 (C.STEEL)
P	- ASTM A276 S32760 Cond. S (S.DUPLEX)

Finish Identifier	Extent	Code	Colour	Quality Identifier	Level Number	Percentage Modifier	Level Modifier
M	N	O	P	Q	R	S	T
F				Q			
F	A	N	N	Q	0	S	S

N - Extent	
A	ACTUATOR
N	NOT APPLICABLE
O	OPERATOR ONLY
V	VALVE ASSEMBLY

O -Code	
B	BS 4800
C	CUSTOM
F	FED STD
N	NOT APPLICABLE
R	RAL

P- Colour	
BS4800	
A	14-E-53 - Green (SC011)
B	04-D-45 - Russet
C	04-E-53 - Poppy Red SC010)
D	06-C-39 - Saddle Brown
E	06-E-51 - Mandarin Orange
F	08-C-35 - Butterscotch
G	22-D-45 - Deep Purple
H	20-E-51 - Cornflower Blue
I	00-E-53 - Black
J	08-E-55 - Orange & 04-D-45 Russet
K	10-E-53 - Canary Yellow
L	18-E-53 - Cobalt Blue
CUSTOM	
A	TBC
FED STD	
A	TBC
RAL	
A	RAL 3000 - Flame Red (SC002)
B	RAL 3001 - Signal Red (SC005)
C	RAL 3002 - Carmine Red
D	RAL 9003 - Signal White (SC006)
E	RAL 1028 - Melon Yellow
F	RAL 7042 - Traffic Grey
G	RAL 6002 - Leaf Green
H	RAL 9017 - Traffic Black (SC004)
I	RAL 7022 - Umbra Grey
J	RAL 7035 - Light Grey
K	RAL 2011 - Deep Orange
L	RAL 5011 - Steel Blue
M	RAL 5013 - Cobalt Blue (SC001)
O	RAL 7038 - Exxon Mobil Grey
P	RAL 9002 - Grey White
N- NOT APPLICABLE	

R - Level Number	
0	QSL 0
A	SQL 1
B	SQL 2
C	SQL 3

S -Percentage Modifier	
S	STD 10% MIN OF 2
A	25% PER LINE ITEM
B	50% PER LINE ITEM
C	100% PER LINE ITEM

T - Level Modifier	
B	3.2 CERT (BV BODY)
C	IMPACT TESTED (-196°C)
D	3.2 CERT (DNV BODY)
L	3.2 CERT (LLOYDS BODY)
S	STANDARD NO REQ
Z	SPECIAL

10 Technical Optional Extras

Added-value services include a wide range of technical options and cover everything your organisation needs, from optional design features that meet various bespoke applications to comprehensive testing services and coating options.

We provide effective technical solutions for valves that are often installed in challenging environments, hard-to-reach locations or areas with limited access.

Technical Optional Extras

Design features:
- Extended stem – ideal for pits and buried applications
- Actuation – hydraulic, pneumatic and electric
- Extended gearbox input shaft
- Gearbox orientation (through 90°)

Testing:
- Extended test durations
- Fugitive emissions testing
- Disc strength test
- Torque testing
- Functional testing

External coating
- Painting

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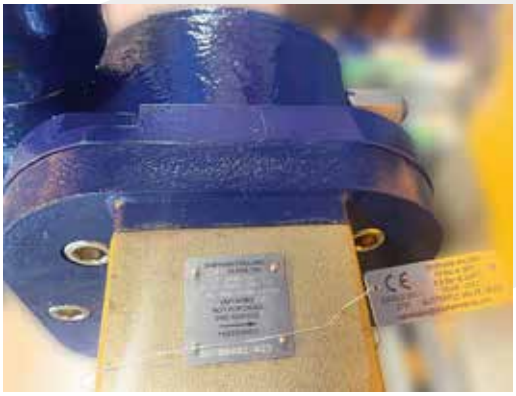
Commercial Optional Extras

Items	Cost
Certificate of Origin and Invoice Attested by Local Chamber of Commerce	TBC
EX1 Export Documentation	TBC
Project Documentation Pack (English language only) This contains GA Drawings, maintenance and operating instructions along with relevant procedures in PDF file format only (ITP and relevant procedures). One copy supplied six weeks after order placement. Any other documentation required will be subject to additional costs.	Costs will be provided as part of the overall costed proposal.
Witness Inspection (Charged at a day rate to P.O quantity)	Costs will be provided as part of the overall costed proposal.
Tagging (Optional) If tagging is required, please provide full details in-order for us to process the order.	TBC

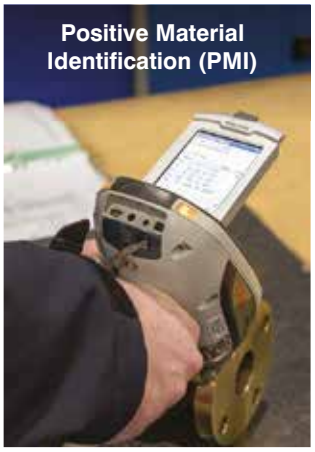
For further details on the complete range of Shipham Valves' commercial optional extra solutions, please contact the team today on valvesales@shiphamvalves.com or +44 (0)1482 323163.



Testing and Quality Verification

Faro Arm Dimensional Inspections

Verifies product quality by performing dimensional inspections.



Positive Material Identification (PMI)

Verification of metal and alloy chemical composition.

Dye Penetrant Testing

Testing exterior/interior surfaces for defects, cracks and conformity to ASME VIII.