



Double & Triple Offset Butterfly Valve

## **Butterfly Valve**

**Triple Offset - Model 9000**  
**Double Offset - Model 9900**

API 609, API 607 / API 6FA  
Size - 2" to 160" ( 50mm to 4000mm)

Rating - Class 150 to Class 600

Class 900 & above on request

Wafer Design

Lug Design

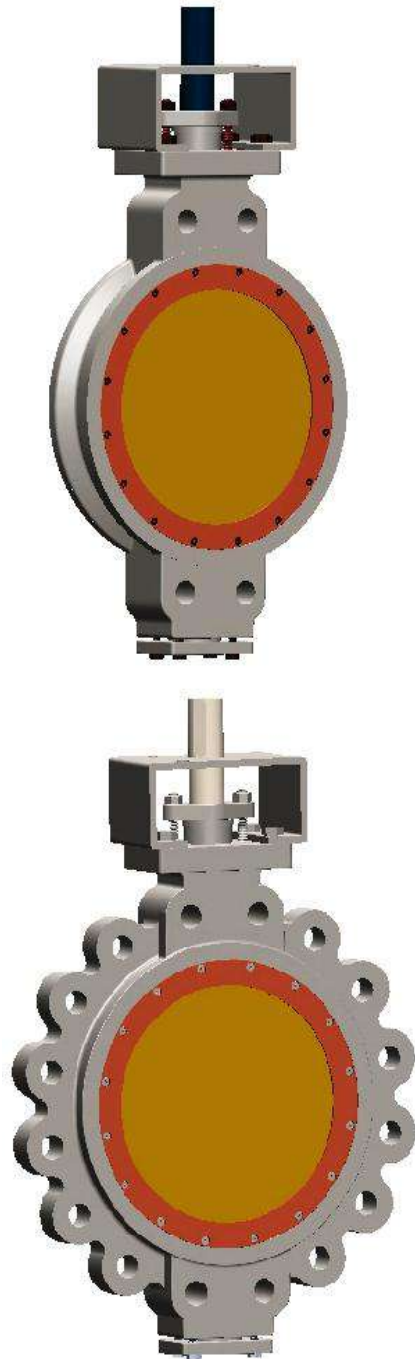
Flange Design

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# Triple Offset Butterfly Valve - Model 9000

# Double Offset Butterfly Valve - Model 9900



“INVACO” (Industrial Valve Company) founded and promoted by the technocrats having experience of 18 years in National and International valve industry. INVACO PRIVATE LIMITED (Industrial Valve Company) is registered experience company in Design, Development, Fabrication & Manufacturing of Industrial Valves. Our mission is to produce high quality and reliable Valves to our national & international clients / customers. Our proactive approach to technical issues enables to understand and implement cost-effective solutions to our valuable customers.

“INVACO” (Industrial Valve Company) committed to excellence by manufacturing top quality valves to exceed customer’s needs with low cost, on-time delivery & providing finest service in industry. “INVACO” manufacture Ball valves (Floating & Trunnion Mounted), Butterfly Valves (Damper, Sleeved, Double offset & Triple Offset), Gate Valves, Globe Valves , Check Valves, Strainers, Flap Valves, Dismantling Joints, Flange Adaptor, Flange Couplings & Sluice Gate / Penstock for Oil & Gas, Petrochemicals, Refineries, Power Plants, Water Treatment Plants, Chemical, Paper & Pulp, Sugar, Steel, Pharma, Pipeline Transmission and other process industries.

“INVACO” (Industrial Valve Company) is specialized in design, manufacturing & testing of Cast & Fabricated Butterfly Valves. All valves are designed as per API 609, ASME B16.34, AWWA C504, AWWA C207 and fire safe as per API 607 / API 6FA follows ISO 9001:2015 Quality Management Systems. INVACO manufacture butterfly valve size from 2” to 160” (50mm to 4000mm) with pressure range from Class 150 to Class 600 (Customized or Class 900 & above valves manufactured on request) and equivalent EN pressure ratings. Butterfly valves produced from CASTING materials like Cast Iron, Ductile Iron, WCB, WCC, WC6, LCB, LCC, CA15, CF8, CF8M, CF3M, A890 (4A, 5A, 6A), Aluminum Bronze, Alloy20, Hast Alloy, Inconel, Monel and other special materials.



INVACO (Industrial Valve Company) aims to produced a zero defect valves for long life and reliable services. Making continual improvements aims towards to minimize the Total Ownership Cost for valued customers. Also aims to established sales and services of valves & actuators worldwide.

This catalog provides basic information of High Performance Butterfly Ball valves (Double & Triple Offset). Every effort has been made to maintain technical accuracies however INVACO has reserve rights to make any change in design and materials without prior notice.

At “INVACO”, we established this comprehensive Quality Management System to implement a strategy of continual improvement and compliance with the requirements of the ISO 9001:2015 Quality Assurance standard and other industrial valves standards by:

**Customer Focused:**

- Make commitments we fully understand and believe we can meet and deliver.
- Meet all commitments to customers on time.
- Satisfy our customer’s needs and exceed their expectations.

**Performance Driven:**

- Verify that our products and services meet customer requirements.
- Monitor benchmark and continuously improve our business, products, and services, organization and employee’s performance.

Entire “INVACO” stick to the spirit and intent of this policy to ensure customer satisfaction is achieved at all respects and times.



## Quality Standards for Butterfly Valve:

### American Petroleum Institute (API)

|         |             |
|---------|-------------|
| API 609 | API Spec Q1 |
| API 598 | API 6FA     |
| API 607 |             |

### American Society of Mechanical Engineers (ASME)

|             |             |
|-------------|-------------|
| ASME B16.34 | ASME B16.5  |
| ASME B16.47 | ASME B16.10 |
| ASME B16.25 |             |

### British / European Standards

|             |             |
|-------------|-------------|
| BS 5155     | BS 6755     |
| BS 4504     | BS EN 558   |
| BS EN 1092  | BS EN 12266 |
| BS EN 10204 | BS EN 6364  |

### International Organization for Standardization (ISO)

|               |           |
|---------------|-----------|
| ISO 9001:2015 | ISO 5208  |
| ISO 5211      | ISO 14723 |

### Manufacturers Standardization Society (MSS - SP)

|           |           |
|-----------|-----------|
| MSS SP-6  | MSS SP-25 |
| MSS SP 44 | MSS SP 61 |
| MSS SP 67 | MSS SP 68 |

### National Association of Corrosion Engineers (NACE)

|               |               |
|---------------|---------------|
| NACE MR 01-75 | NACE TM 01-77 |
| NACE TM 02-84 | NACE MR 01-03 |

### Materials and Equipment Standards and Code (MESC)

|                 |                 |                 |                 |
|-----------------|-----------------|-----------------|-----------------|
| MESC SPE 77/106 | MESC SPE 77/134 | MESC SPE 77/211 | MESC SPE 77/200 |
| MESC SPE 77/300 | MESC SPE 77/302 | MESC SPE 77/312 |                 |

### American Water Work Association (AWWA)

|           |           |          |
|-----------|-----------|----------|
| AWWA C504 | AWWA C207 | AWWA M49 |
|-----------|-----------|----------|

## Testing & Inspection for Butterfly Valve:

| Test   | Applicable Standards   | Extent of Test        |
|--|--|-----------------------|
| Visual Inspection  | MSS SP - 55  | 100%                  |
| Marking Inspection   | MSS SP - 25  | 100%                  |
| Chemical, Physical & Heat Treatment                        | Relevant ASTM Standards  | 100%                  |
| Alloy Verification / Positive Material Identification(PMI) | INVACO Procedure   | Upon Customer Request |
| Hardness Requirement                                       | NACE MR 01 - 75  | Upon Customer Request |
| Radiographic Testing (RT) ( X-Ray & Gamma Ray)             | ASME B16.34 (Annex B) , ASTM E94 , E142 , E446 , E186 , E280, BPVC Sec V-Art 7 & 22, ASME Sec VIII - Div-1 | Upon Customer Request |
| Ultrasonic Testing (UT)                                    | ASME B16.34 , ASTM A388 , A609 , A578 , BPVC Sec V - Art 4 & 23, ASME VIII Div-1                           | Upon Customer Request |
| Magnetic Particle Inspection(MPI)- (Dry & Wet)             | ASME B16.34 Annex C , ASTM E709 , ASTM A275 , E1444, ASME Sec VIII Div-2, BPVC Sec V - Art 7 & 23          | Upon Customer Request |
| Liquid / Dye Penetrant Inspection ( LP / DP )              | ASME B16.34 Annex D ,ASTM E 165 , E1417 , ASME Sec VIII Div 1,BPVC Sec V - Art 6 & 24.                     | Upon Customer Request |
| Impact Test  | ASTM A 370   | Upon Customer Request |
| Microstructural & Ferrite Content                          | ASTM E 562   | Upon Customer Request |
| Microscopic / inclusion Count Test                         | ASTM E 45  | Upon Customer Request |



|   |   |                              |
|---|---|------------------------------|
| Pitting Corrosion   | ASTM G 48                               | Upon Customer Request        |
| Crevice Corrosion   | ASTM G 48                               | Upon Customer Request        |
| Hydrogen Induced Cracking Test (HIC)  | NACE TM 02 - 84                         | Upon Customer Request        |
| Ferric Chloride Corrosion Test  | ASTM A 923                              | Upon Customer Request        |
| Hardness Test   | ASTM E 18 , ASTM E 92, NACE MR 01 - 75  | Upon Customer Request        |
| Intergranular Corrosion Cracking (IGC)  | ASTM A 262                              | Upon Customer Request        |
| Chloride Stress Corrosion Cracking Test (CSCC)  | NACE TM 01 - 75                         | Upon Customer Request        |
| Size / Dimension Check  | INVACO Approved Drawings                | 100%                         |
| Functional Check  | INVACO Approved Drawings                | 100%                         |
| Shell Test ( Hydro Test)  | API 598, API6D,<br>Approved GA Drawings | 100%                         |
| Seat Test ( Hydro Test)   | API 598, API6D,<br>Approved GA Drawings | 100%                         |
| Backseat Test ( Hydro Test)   | API 598, API6D,<br>Approved GA Drawings | 100%                         |
| Seat Test (Air/Pneumatic Test)  | API 598, API6D,<br>Approved GA Drawings | 100%                         |
| Helium Leak / Fugitive Emission Test  | ISO 15848, MESC 77 / 312                | Upon Customer Request        |
| Torque Test   | API 6D , INVACO Procedure               | 10% or Upon Customer Request |
| Blasting Report   | INVACO Procedure                        | 10% or Upon Customer Request |
| Surface Finish Report   | INVACO Procedure                        | 10% or Upon Customer Request |
| Painting / Dry Film Thickness Report  | INVACO Procedure                        | 10% or Upon Customer Request |
| Tag No, Serial No, Name Plate   | INVACO Procedure                        | 100%                         |
| Note: - 1) Backseat test is applicable to Gate & Globe Valve.<br>2) Above Test available upon customer request with extra cost.<br>3) For more information kindly contact "INVACO". |   |                              |

### Manufacturing Range for Butterfly Valve:

| Design         | ASME CLASS / Size - in ( mm) |                          |                          |            |            |            |
|----------------|------------------------------|--------------------------|--------------------------|------------|------------|------------|
|                | 150                          | 300                      | 600                      | 900        | 1500       | 2500       |
| Triple Off-Set | 3" - 56"<br>(80 - 1400 )     | 3" - 56"<br>(80 - 1400 ) | 3" - 40"<br>(80 - 1000 ) | On Request | On Request | On Request |
| Double Off-Set | 2" - 160"<br>(50 - 4000 )    | 2" - 64"<br>(50 - 1600 ) | 2" - 40"<br>(50 - 1000 ) | On Request | On Request | -----      |
| Sleeve         | 2" - 48"<br>(50 -1200 )      | ----                     | ----                     | ----       | ----       | ----       |
| Damper         | 2" - 160"<br>(50 - 4000 )    | 2" - 64"<br>(50 - 1600 ) | 2" - 40"<br>(50 - 1000 ) | ----       | ----       | ----       |



**Features for Butterfly Valve (Model – 9000 & 9900):**

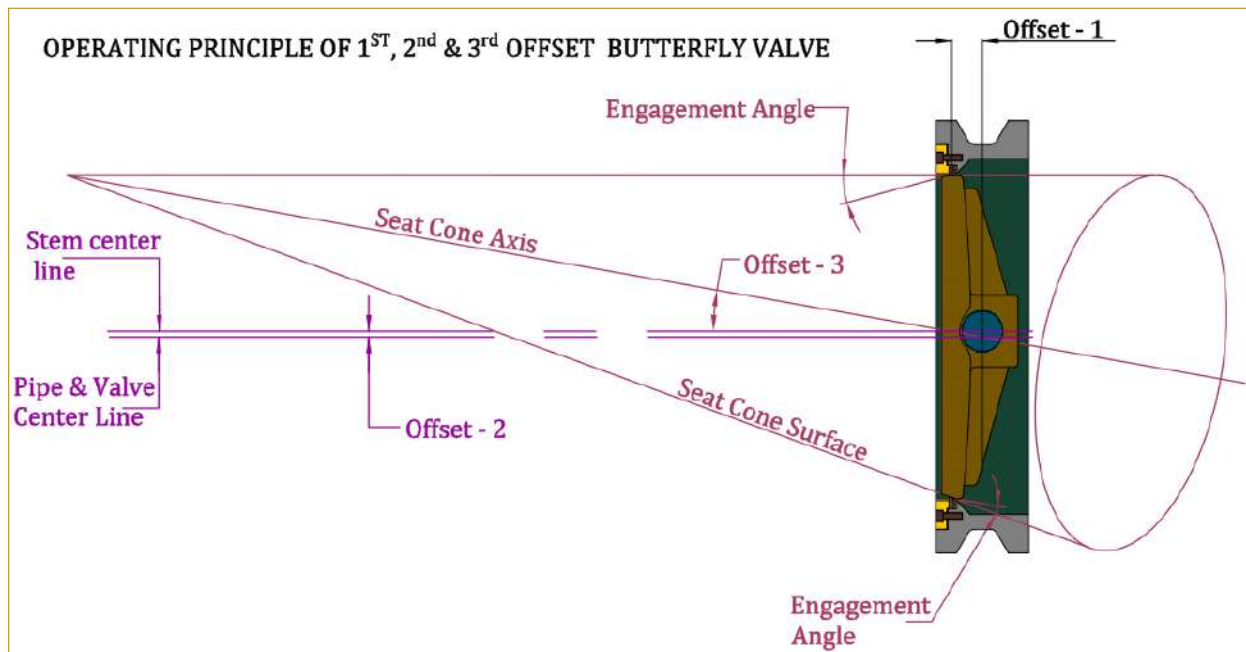
**Operating Principle:**

**\*\*First Offset:-**

The Stem centre line or axis is positioned or designed behind seat centre line to form first off-set. The sealing surface of seat remains completely in contact with the disc.

**\*\* Second Offset:-**

The Stem centre line or axis is offset from the pipeline and valve centre line or axis to form second offset (Double Off-Set Designed). Advantage of double offset designed is valve operate (Open & Close) interference free. Friction between seal and disc is drastically reduced to allow the combination of soft seat and flexible metal seat to form a fire safe design. There are three type of seat variant available in double offset design i.e. soft seat, metal seat (Leakage Class IV) and combination of both (soft and metal).



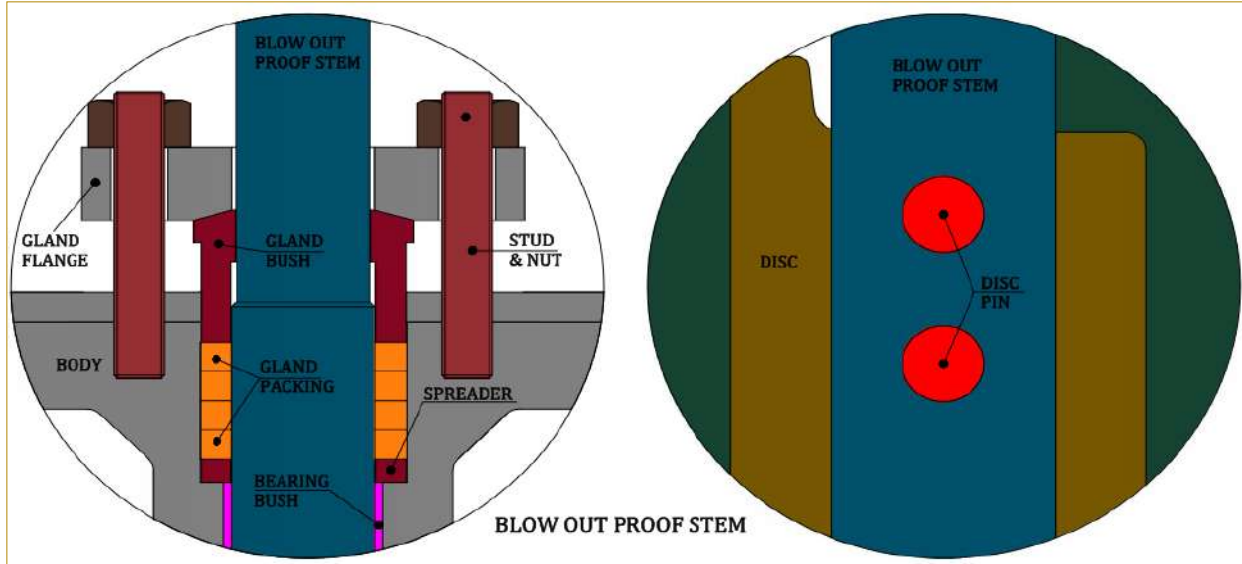
**\*\* Third Offset:-**

The seat cone centerline or axis form an angle with shaft centre line or axis to make third offset (Triple Off-Set Designed). The conical geometry of seat with stem centre line or triple offset designed further exceed to eliminate the friction during opening n closing of valve. Sealing surface of seat and disc achieve uniform compressive sealing. Tripe Offset design is suitable for high temperature & abrasive application. There are two types of variant available i.e. laminated (combination of graphite & flexible metal sheet) and second is solid metal seat.

**\*\* Double Sealing Blow Out Proof Stem:-**

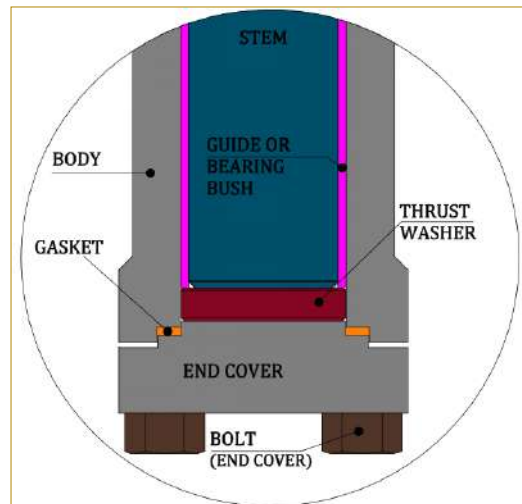
One piece stem with large diameter is assembled with disc through tapered disc pin to form first internal blow out proof stem.

One piece stem designed with integral collar (T-Type) to provide blow out proof stem externally guided with gland assembly as per API609.



**\*\* Bearing Guided Stem:-**

Self lubricated heavy duty full length bearing bush press fitted in body and protected against solid entry. One piece stem assembled with disc, disc pin is centered with bearing bush or guide bush. This help to absorbed thrust or load to allow for differential expansion due to temperature.



**\*\* Bi-Directional Tight Shut-Off:-**

Sealing surface of disc and seat are evenly compressed across the circumference by the force applied give bi-directional tight shut-off (zero leakage) in both hydro and air test as per API598.

**\*\* Seat Options:-**

**1) Double Offset Soft Seat Butterfly Valve:-**

Rubber seats like NBR, EPDM and Viton are designed to increase sealing performance to provide bi-directional tight shut off under vacuum and positive applications.

PTFE or RPTFE seat designed to ensure tight shut off at low pressure. Working pressure pushes the seat against disc and become more reliable in high pressure.

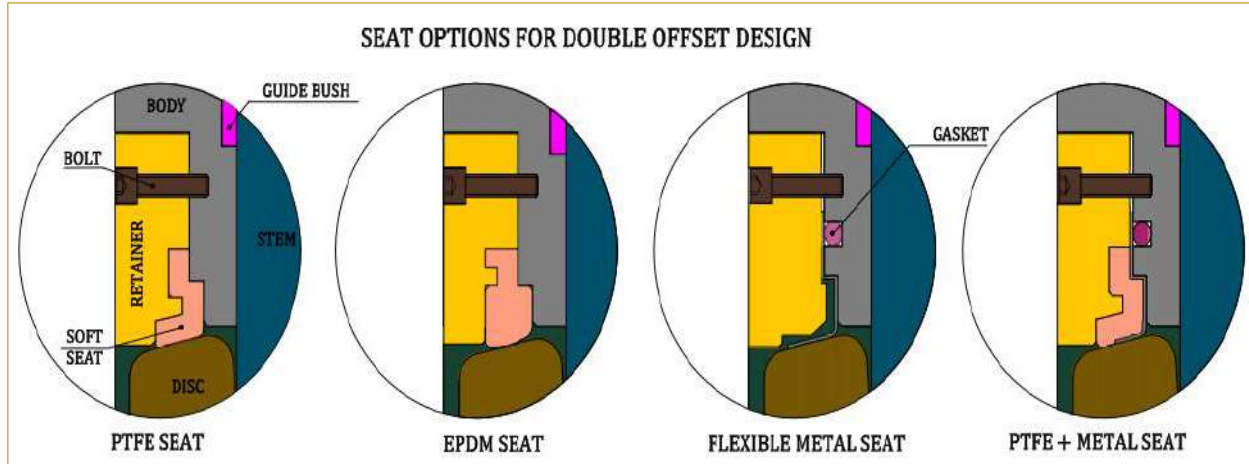
The sealing surface of seat is designed to reduced contact area, friction and easily replaceable.





**2) Double Offset Metal Seat Butterfly Valve:-**

Double offset metal seat butterfly valve typically used where the leakage is allowed, pressure is low and temperature is high. A flexible die pressed metal seat is designed for minimum torque requirement, give Class IV leakage, and used up to 600°C temperature. The metal seats are easily replaceable.

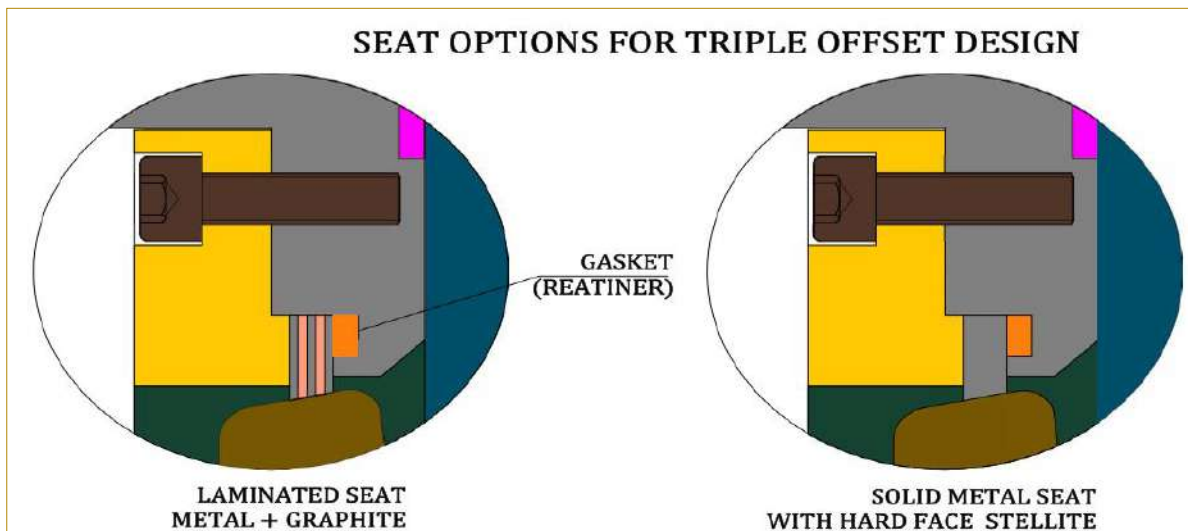


**3) Double Offset Fire Safe Butterfly Valve:-**

This designed is the combination of primary PTFE seat and secondary die pressed flexible metal seat. In case of increasing temperature, primary PTFE seat is destroyed the secondary metal seat provide internal leakage. The seats are easily replaceable.

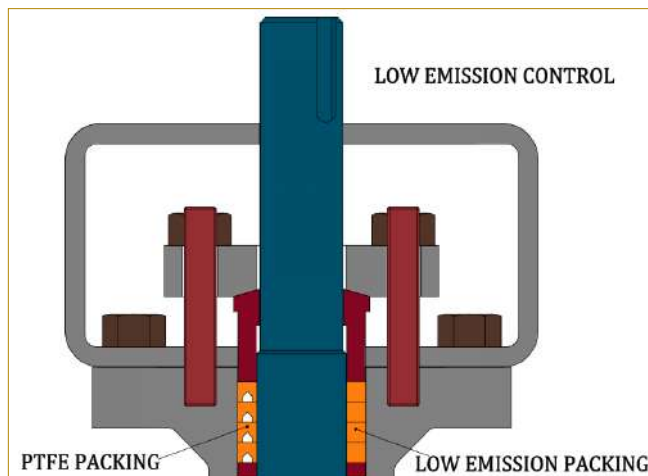
**4) Triple Off-Set Laminated or Solid Seat Butterfly Valve:-**

Laminated or solid cone centre line or axis with stem centre line formed third offset (Triple Offset). In laminated seat layer of graphite and flexible metal seats are carefully bonded with phenolic resin bond and used up to 450°C. Solid seat ring are also available for high temperature requirements up to 900°C and abrasive services.

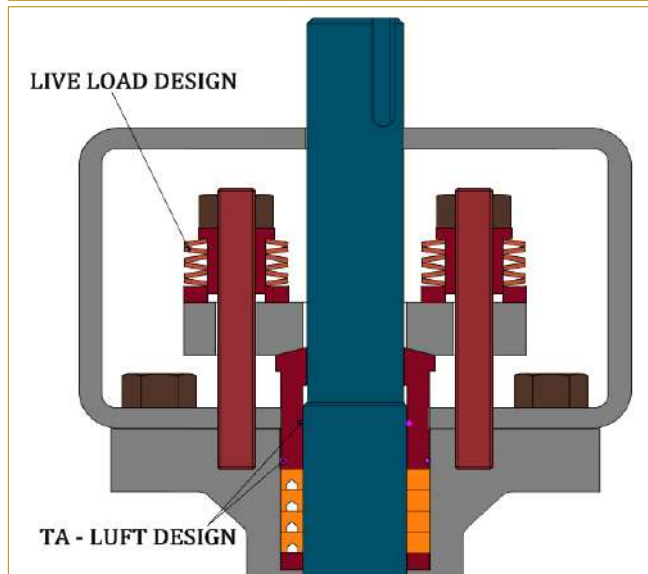


**\*\*Low Emission Packing & Double Packing:-**

Finish machining of stem & stuffing box plays an important role in sealing. The stem is made cold rolling with surface finish of Ra=0.4 reduced friction and ensure sealing. Surface finish of stuffing box within Ra=1.6 results in better sealing effect. In frequently operated valves, normal graphite can be wear to cause leakage. INVACO designed low emission packing to prevent leakage. Graphite packing with cone designed in die-formed rings has low creep, less stress relaxation and provide better sealing performance & long life cycle. V-Shaped PTFE packing is used for emission control.

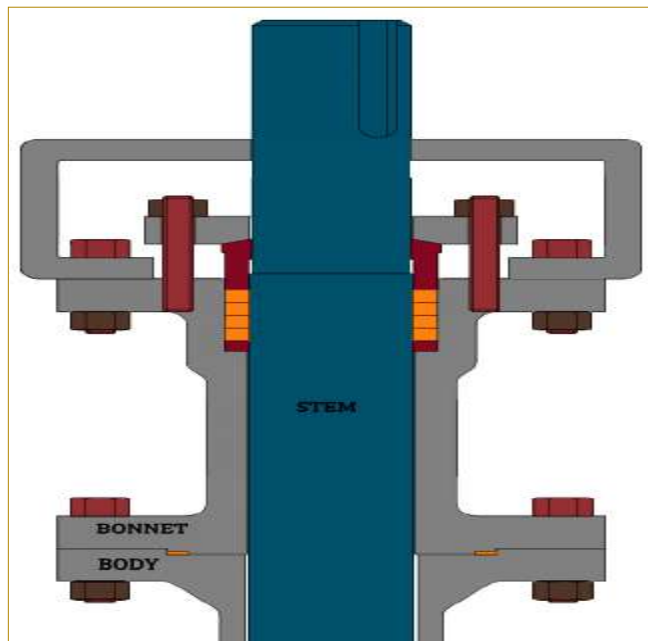


Designed is also available in double packing with lantern ring. Two sets of packing ring are separated with lantern ring. A lantern ring and leak off port is provided for removal of leakage if any from bottom packing.



**\*\*Live Loaded Design and TA - LUFT:-**

In standard valve assembly, gland packing is tightened through gland and gland stud & nuts. During the service & continuous working pressure, gland load reduced to loosen loads at gland packing thus results in gland leakage. INVACO designed for low emission valves used sets of Belleville springs installed in gland stud provide continuous compressive force on gland packing to avoid leakage.



Assembly of stem, body and gland prevent wobbling and packing leakage due to thrust on stem. In TA-LUFT, two O-Ring are use in gland bush to provide additional stem sealing.

**\*\*Extended Bonnet & Stem:-**

Options of extended bonnet designed are available for extreme temperature requirements. Extended bonnets are recommended for cryogenic service (below -50 °C temperature) and high temperature service (above 220 °C temperature). INVACO offers standard bonnet, extended bonnet & finned bonnet according to BS 6364, Shell GSI MESC and MSS SP-134.



**Design Features for Butterfly Valve (Model – 9000 & 9900)**



**Quality Standards:-**

|                           |  |
|---------------------------|--|
| Design Standards          | - API 609 / ASME B16.34 / AWWA C 504/ MESC SPE 77-106,134,211,300,302. |
| Testing Standards         | - API 598 / EN 12266 / ISO 5208 / BS 6755                              |
| End to End Standards      | - API 609 / ASME B 16.10 / EN 558                                      |
| Flange Drilling Standards | - ASME B16.5 / ASME B 16.47 / BS EN 1092/ AWWA C 207                   |
| Butt-Weld                 | - ASME B 16.25   |
| Actuator Mounting         | - ISO 5211   |
| Fire Testing              | - API 607 / API 6FA / ISO 10497  |
| Fugitive Emission Test    | - MESC SPE 77 - 312 / ISO 15848  |
| Cryogenic Services        | - BS 6364, MSS SP 134  |
| Valve Marking             | - MSS SP 25 / ASME B 16.34   |
| Visual Inspection         | - MSS SP 55  |
| Material Testing          | - NDE / NACE MR 01- 75 / NACE MR 01- 03 Compliance available.          |

**Key Features:-**

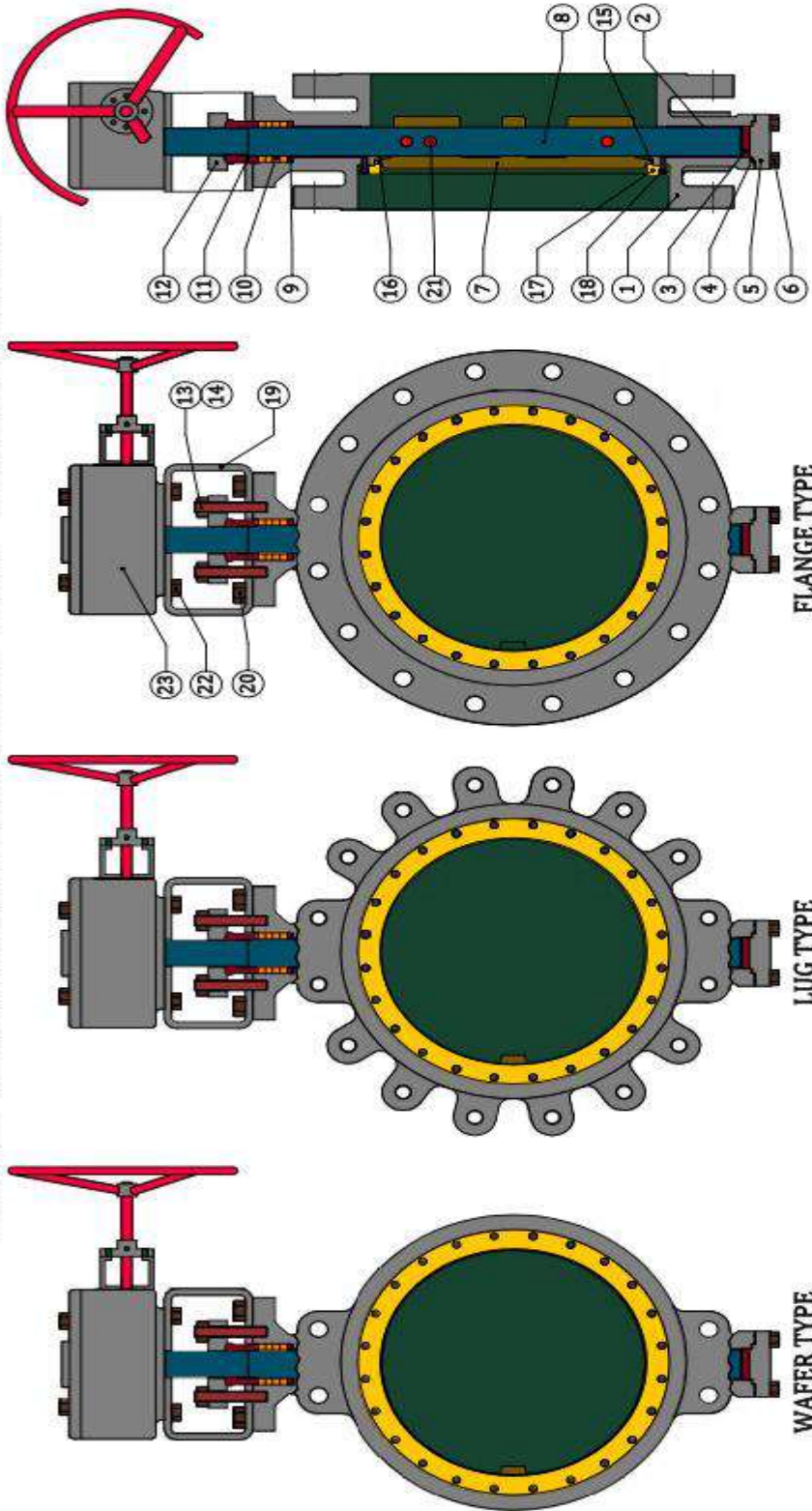
- Size :-2” to 160” (50mm to 4000mm)-Model-9900
- Size :-3” to 56” (80mm to 1400mm)-Model-9000
- Soft , Metal & Fire Safe Design
- Extended Bonnet
- Extended Stem
- Wafer , Lug, Flange & Butt-weld End
- Rating:- 150# to 600# & Equiv. DIN Rating
- Class 900 & above available on request.
- Blow Out Proof Stem
- Bi-direction Tight Shut Off
- Casting / Forging Body.
- Bare Stem, Manual & Actuation.

**Materials** - Carbon Steel, Low Temperature Carbon Steel, Stainless Steel, Duplex, Super Duplex, Incoloy, Inconel, Monel, Aluminum Bronze, Hastalloy, Titanium and other materials.

**Applications** - Offshore / Onshore Oil & Gas, Chemical, Petrochemical & Allied Process, Power Plant, Water Treatment Plant, Liquefied Natural Gas, Sugar, Paper & Pulp, Steel, Piping & Process Industries.

GA Drawing for Butterfly Valve (Model - 9000 & 9900)

DOUBLE & TRIPLE OFFSET BUTTERFLY VALVE - MODEL 9900 & 9000



| RECOMMENDED SPARE PARTS FOR MAINTENANCE |                      |
|---|----------------------|
| FOR START UP                            | 16 SEAT RING         |
| 4                                       | GASKET ( END COVER ) |
| 10                                      | GLAND PACKING        |
| 15                                      | GASKET ( RETAINER )  |

| Sr. No. | PARTS                  | Sr. No. | PARTS            | Sr. No. | PARTS               |
|---------|------------------------|---------|------------------|---------|---------------------|
| 1       | BODY                   | 7       | DISC             | 13      | STUD                |
| 2       | GUIDE / BEARING BUSH   | 8       | STEM             | 14      | NUT                 |
| 3       | THRUST WASHER          | 9       | SPREADER         | 15      | GASKET ( RETAINER ) |
| 4       | GASKET ( END COVER )   | 10      | GLAND PACKING    | 16      | SEAT RING           |
| 5       | END COVER              | 11      | GLAND BUSH       | 17      | RETINER             |
| 6       | BOLT ( END COVER )     | 12      | GLAND FLANGE     | 18      | BOLT ( RETAINER )   |
| 19      | BRACKET                | 20      | BOLT ( BRACKET ) | 21      | DISC PIN            |
| 22      | BOLT ( GEAR OPERATOR ) | 23      | GEAR OPERATOR    |         |                     |

NOTE: \*\* ABOVE DESIGN IS FOR 8" (203mm) & ABOVE. 10" (254mm) & ABOVE. 12" (305mm) & ABOVE. 14" (356mm) & ABOVE. 16" (406mm) & ABOVE. 18" (457mm) & ABOVE. 20" (508mm) & ABOVE. 24" (609mm) & ABOVE. 30" (762mm) & ABOVE. 36" (914mm) & ABOVE. 42" (1067mm) & ABOVE. 48" (1219mm) & ABOVE. 54" (1372mm) & ABOVE. 60" (1524mm) & ABOVE. 66" (1676mm) & ABOVE. 72" (1829mm) & ABOVE. 78" (1981mm) & ABOVE. 84" (2134mm) & ABOVE. 90" (2286mm) & ABOVE. 96" (2438mm) & ABOVE. 102" (2591mm) & ABOVE. 108" (2744mm) & ABOVE. 114" (2897mm) & ABOVE. 120" (3050mm) & ABOVE. 126" (3203mm) & ABOVE. 132" (3356mm) & ABOVE. 138" (3510mm) & ABOVE. 144" (3663mm) & ABOVE. 150" (3816mm) & ABOVE. 156" (3969mm) & ABOVE. 162" (4122mm) & ABOVE. 168" (4275mm) & ABOVE. 174" (4428mm) & ABOVE. 180" (4581mm) & ABOVE. 186" (4684mm) & ABOVE. 192" (4887mm) & ABOVE. 198" (5090mm) & ABOVE. 204" (5193mm) & ABOVE. 210" (5296mm) & ABOVE. 216" (5400mm) & ABOVE. 222" (5553mm) & ABOVE. 228" (5656mm) & ABOVE. 234" (5759mm) & ABOVE. 240" (5862mm) & ABOVE. 246" (5965mm) & ABOVE. 252" (6068mm) & ABOVE. 258" (6171mm) & ABOVE. 264" (6274mm) & ABOVE. 270" (6377mm) & ABOVE. 276" (6480mm) & ABOVE. 282" (6583mm) & ABOVE. 288" (6686mm) & ABOVE. 294" (6791mm) & ABOVE. 300" (6894mm) & ABOVE. 306" (6997mm) & ABOVE. 312" (7100mm) & ABOVE. 318" (7203mm) & ABOVE. 324" (7306mm) & ABOVE. 330" (7409mm) & ABOVE. 336" (7512mm) & ABOVE. 342" (7615mm) & ABOVE. 348" (7718mm) & ABOVE. 354" (7821mm) & ABOVE. 360" (7924mm) & ABOVE. 366" (8027mm) & ABOVE. 372" (8130mm) & ABOVE. 378" (8233mm) & ABOVE. 384" (8336mm) & ABOVE. 390" (8439mm) & ABOVE. 396" (8542mm) & ABOVE. 402" (8645mm) & ABOVE. 408" (8748mm) & ABOVE. 414" (8851mm) & ABOVE. 420" (8954mm) & ABOVE. 426" (9057mm) & ABOVE. 432" (9160mm) & ABOVE. 438" (9263mm) & ABOVE. 444" (9366mm) & ABOVE. 450" (9469mm) & ABOVE. 456" (9572mm) & ABOVE. 462" (9675mm) & ABOVE. 468" (9778mm) & ABOVE. 474" (9881mm) & ABOVE. 480" (9984mm) & ABOVE. 486" (10087mm) & ABOVE. 492" (10190mm) & ABOVE. 498" (10293mm) & ABOVE. 504" (10396mm) & ABOVE. 510" (10499mm) & ABOVE. 516" (10602mm) & ABOVE. 522" (10705mm) & ABOVE. 528" (10808mm) & ABOVE. 534" (10911mm) & ABOVE. 540" (11014mm) & ABOVE. 546" (11117mm) & ABOVE. 552" (11220mm) & ABOVE. 558" (11323mm) & ABOVE. 564" (11426mm) & ABOVE. 570" (11529mm) & ABOVE. 576" (11632mm) & ABOVE. 582" (11735mm) & ABOVE. 588" (11838mm) & ABOVE. 594" (11941mm) & ABOVE. 600" (12044mm) & ABOVE. 606" (12147mm) & ABOVE. 612" (12250mm) & ABOVE. 618" (12353mm) & ABOVE. 624" (12456mm) & ABOVE. 630" (12559mm) & ABOVE. 636" (12662mm) & ABOVE. 642" (12765mm) & ABOVE. 648" (12868mm) & ABOVE. 654" (12971mm) & ABOVE. 660" (13074mm) & ABOVE. 666" (13177mm) & ABOVE. 672" (13280mm) & ABOVE. 678" (13383mm) & ABOVE. 684" (13486mm) & ABOVE. 690" (13589mm) & ABOVE. 696" (13692mm) & ABOVE. 702" (13795mm) & ABOVE. 708" (13898mm) & ABOVE. 714" (14001mm) & ABOVE. 720" (14104mm) & ABOVE. 726" (14207mm) & ABOVE. 732" (14310mm) & ABOVE. 738" (14413mm) & ABOVE. 744" (14516mm) & ABOVE. 750" 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ABOVE. 1242" (23065mm) & ABOVE. 1248" (23168mm) & ABOVE. 1254" (23271mm) & ABOVE. 1260" (23374mm) & ABOVE. 1266" (23477mm) & ABOVE. 1272" (23580mm) & ABOVE. 1278" (23683mm) & ABOVE. 1284" (23786mm) & ABOVE. 1290" (23889mm) & ABOVE. 1296" (23992mm) & ABOVE. 1302" (24095mm) & ABOVE. 1308" (24198mm) & ABOVE. 1314" (24301mm) & ABOVE. 1320" (24404mm) & ABOVE. 1326" (24507mm) & ABOVE. 1332" (24610mm) & ABOVE. 1338" (24713mm) & ABOVE. 1344" (24816mm) & ABOVE. 1350" (24919mm) & ABOVE. 1356" (25022mm) & ABOVE. 1362" (25125mm) & ABOVE. 1368" (25228mm) & ABOVE. 1374" (25331mm) & ABOVE. 1380" (25434mm) & ABOVE. 1386" (25537mm) & ABOVE. 1392" (25640mm) & ABOVE. 1398" (25743mm) & ABOVE. 1404" (25846mm) & ABOVE. 1410" (25949mm) & ABOVE. 1416" (26052mm) & ABOVE. 1422" (26155mm) & ABOVE. 1428" (26258mm) & ABOVE. 1434" (26361mm) & ABOVE. 1440" (26464mm) & ABOVE. 1446" (26567mm) & ABOVE. 1452" (26670mm) & ABOVE. 1458" (26773mm) & ABOVE. 1464" (26876mm) & ABOVE. 1470" (26979mm) & ABOVE. 1476" (27082mm) & ABOVE. 1482" (27185mm) & ABOVE. 1488" (27288mm) & ABOVE. 1494" (27391mm) & ABOVE. 1500" (27494mm) & ABOVE. 1506" (27597mm) & ABOVE. 1512" (27700mm) & ABOVE. 1518" (27803mm) & ABOVE. 1524" (27906mm) & ABOVE. 1530" (28009mm) & ABOVE. 1536" (28112mm) & ABOVE. 1542" (28215mm) & ABOVE. 1548" (28318mm) & ABOVE. 1554" (28421mm) & ABOVE. 1560" (28524mm) & ABOVE. 1566" (28627mm) & ABOVE. 1572" (28730mm) & ABOVE. 1578" (28833mm) & ABOVE. 1584" (28936mm) & ABOVE. 1590" (29039mm) & ABOVE. 1596" (29142mm) & ABOVE. 1602" (29245mm) & ABOVE. 1608" (29348mm) & ABOVE. 1614" (29451mm) & ABOVE. 1620" (29554mm) & ABOVE. 1626" (29657mm) & ABOVE. 1632" (29760mm) & ABOVE. 1638" (29863mm) & ABOVE. 1644" (29966mm) & ABOVE. 1650" (30069mm) & ABOVE. 1656" (30172mm) & ABOVE. 1662" (30275mm) & ABOVE. 1668" (30378mm) & ABOVE. 1674" (30481mm) & ABOVE. 1680" (30584mm) & ABOVE. 1686" (30687mm) & ABOVE. 1692" (30790mm) & ABOVE. 1698" (30893mm) & ABOVE. 1704" (30996mm) & ABOVE. 1710" (31099mm) & ABOVE. 1716" (31202mm) & 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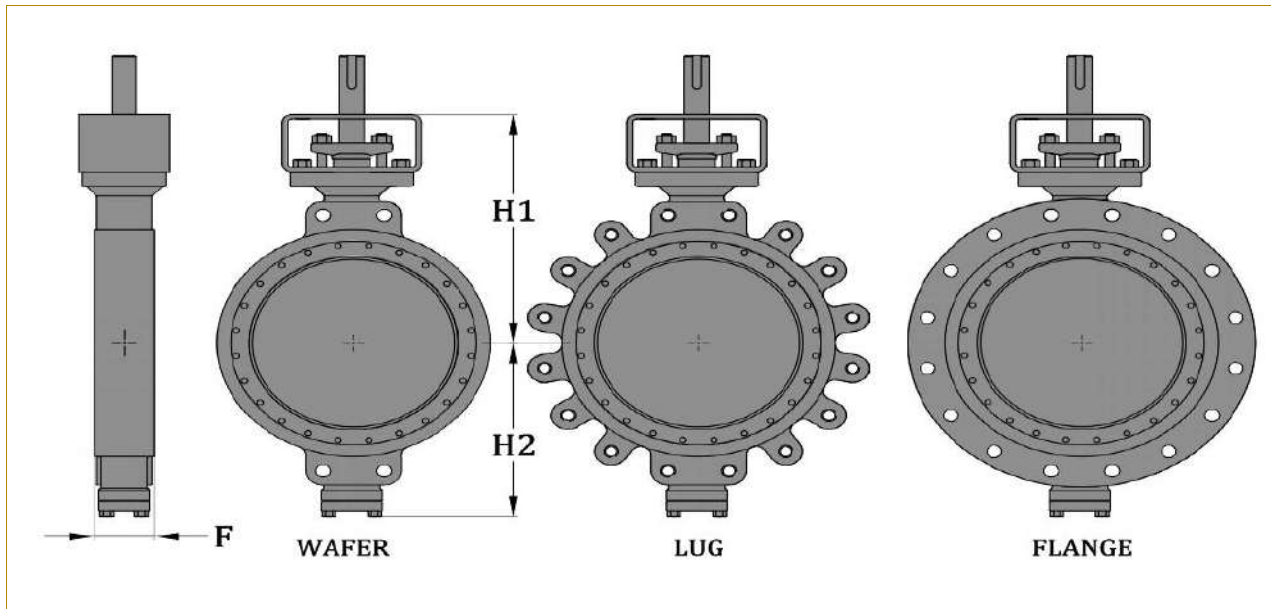
### Material of Construction for Butterfly Valve (Model – 9900 & 9000)

| Bill of Material for Butterfly Valve ( Double & Triple Offset ) |                      |  |                        |                    |                   |                          |                                 |
|---|----------------------|--|------------------------|--------------------|-------------------|--------------------------|---------------------------------|
| Sr. No.   | Part                 | Carbon Steel   | Low Temp. Carbon Steel | Stainless Steel    | Duplex            | Aluminium Bronze         | Nickel Alloys                   |
| 1   | Body                 | A216 Gr WCB  | A325 Gr. LCB, LCC      | A351 Gr. CF8M, CF8 | A890 Gr. 4A,5A,6A | C95800, C95500, C63200   | CW6MC, CW12M, M53-1             |
| 2   | Bearing Bush         | ( F304 / F316 ) + PTFE   |                        |                    | Duplex + PTFE     | ( Monel / Brass ) + PTFE | ( Inconel/ Monel / Brass )+PTFE |
| 3   | Thrust Washer        | F304 / F316 / Brass  |                        |                    | Duplex / Brass    | Brass                    | Inconel / Monel / Brass         |
| 4   | Gasket ( End Cover ) | SPWG + SS ( 304 / 316 )  |                        |                    | SPWG + Duplex     | SPWG + Monel             | SPWG + (Monel,Inconel)          |
| 5   | End Cover            | A216 Gr WCB  | A325 Gr. LCB, LCC      | A351 Gr. CF8M, CF8 | A890 Gr. 4A,5A,6A | C95800, C95500, C63200   | CW6MC, CW12M, M53-1             |
| 6   | End Cover Bolt       | A193 Gr. B7 / B7M  | A320 Gr. L7 / L7M      | A193 Gr B8 / B8M   |                   |                          |                                 |
| 7   | Disc                 | A351 Gr. CF8M, CF8   |                        |                    | A890 Gr. 4A,5A,6A | C95800, C95500, C63200   | CW6MC, CW12M, M53-1             |
| 8   | Stem                 | AISI 410, F304 , F316, 17-4PH  | F304 , F316            |                    | F51, F53, F55     | Monel                    | Inconel 625, 750 , 825 / Monel  |
| 9   | Spreader             |  |                        |                    |                   |                          |                                 |
| 10  | Gland packing        | PTFE / RPTFE / Graphite  |                        |                    |                   |                          |                                 |
| 11  | Gland Bush           | F 304 / F316   |                        |                    | Duplex            | Brass                    | Inconel / Monel                 |
| 12  | Gland Flange         |  |                        |                    |                   |                          |                                 |
| 13  | Stud                 | A193 Gr. B7 / B7M  | A320 Gr. L7 / L7M      | A193 Gr B8 / B8M   |                   |                          |                                 |
| 14  | Nut                  | A194 Gr. 2H / 2HM  | A194 Gr. 4 / 7 / 7M    | A194 Gr. 8 / 8MA   |                   |                          |                                 |
| 15  | Gasket ( Retainer )  | Graphite   |                        |                    |                   |                          |                                 |
| 16  | Seat Ring            | PTFE / RPTFE / EPDM / Buna-N / ( Soft Seat + Metal Seat ) / Meat Seat / Laminated Seat |                        |                    |                   |                          |                                 |
| 17  | Retainer             | A216 Gr WCB  | A325 Gr. LCB, LCC      | A351 Gr. CF8M,CF8  | A890 Gr. 4A,5A,6A | C95800, C95500,C63200    | CW6MC, CW12M, M53-1             |
| 18  | Bolt(Retainer)       | A193 Gr. B7 / B7M  | A320 Gr. L7 / L7M      | A193 Gr B8 / B8M   |                   |                          |                                 |
| 19  | Bracket              | Carbon Steel   |                        |                    | Stainless Steel   |                          |                                 |
| 20  | Bracket Bolt         | A193 Gr. B7 / B7M  | A320 Gr. L7 / L7M      | A193 Gr B8 / B8M   |                   |                          |                                 |
| 21  | Disc Pin             | AISI 410, F304 , F316, 17-4PH  | F304 , F316            |                    | F51, F53, F55     | Monel                    | Inconel 625, 750 , 825 / Monel  |
| 22  | Bolt ( GO )          | A193 Gr. B7 / B7M  | A320 Gr. L7 / L7M      | A193 Gr B8 / B8M   |                   |                          |                                 |
| 23  | Operation            | Baer Stem, Manual ( Lever / Gear Operated ) , Actuator                                 |                        |                    |                   |                          |                                 |

Note:- "INVACO" reserve right to change Material & Design anytime without prior notice.



**Dimensions for Butterfly Valve (Model – 9900 & 9000)**



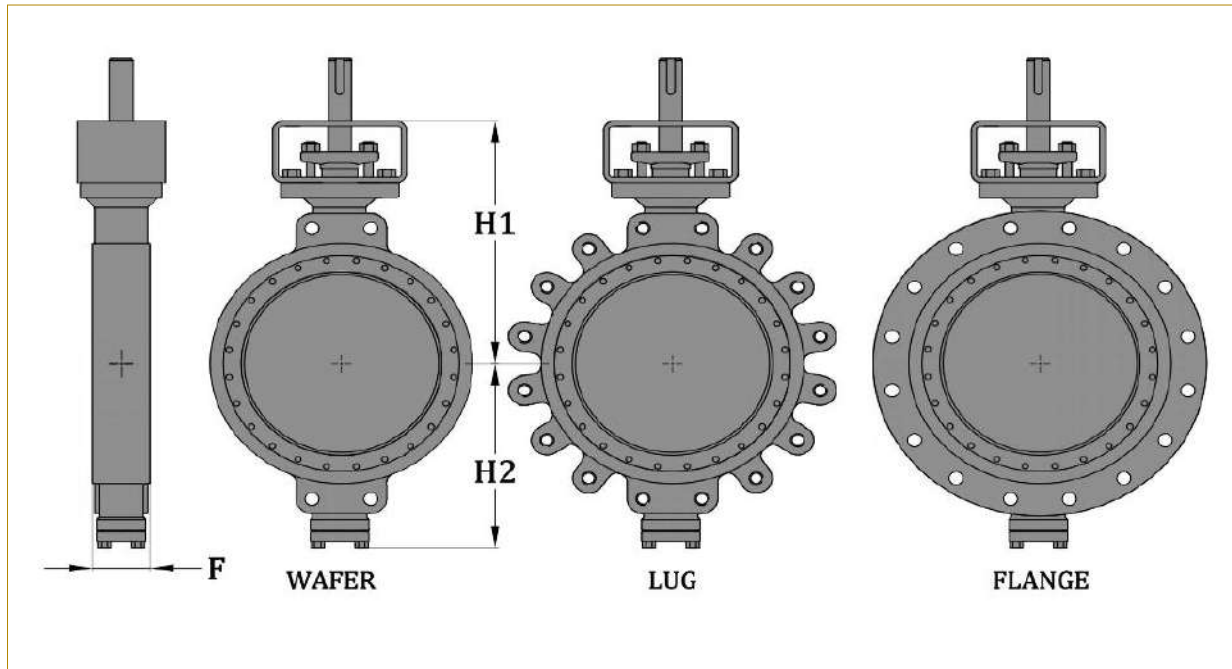
| ASME CLASS 150 |     |                     |     |        |     |     |         |
|----------------|-----|---------------------|-----|--------|-----|-----|---------|
| Size           |     | Face to Face ( mm ) |     |        | H1  | H2  | ISO Pad |
| in             | mm  | Wafer               | Lug | Flange | mm  | mm  |         |
| 2              | 50  | 43                  | 43  | 108    | 168 | 74  | F07     |
| 2½             | 65  | 46                  | 46  | 112    | 184 | 79  | F07     |
| 3              | 80  | 48                  | 48  | 114    | 205 | 94  | F07     |
| 4              | 100 | 54                  | 54  | 127    | 230 | 118 | F07     |
| 5              | 125 | 56                  | 56  | 140    | 241 | 136 | F07     |
| 6              | 150 | 57                  | 57  | 140    | 245 | 151 | F07     |
| 8              | 200 | 64                  | 64  | 152    | 290 | 218 | F10     |
| 10             | 250 | 71                  | 71  | 165    | 355 | 253 | F10     |
| 12             | 300 | 81                  | 81  | 178    | 407 | 295 | F12     |
| 14             | 350 | 92                  | 92  | 190    | 435 | 323 | F14     |
| 16             | 400 | 102                 | 102 | 216    | 474 | 368 | F14     |
| 18             | 450 | 114                 | 114 | 222    | 513 | 395 | F16     |
| 20             | 500 | 127                 | 127 | 229    | 582 | 439 | F16     |
| 22             | 550 | 127                 | 127 | 229    | 612 | 458 | F16     |
| 24             | 600 | 154                 | 154 | 267    | 632 | 475 | F25     |
| 26             | 650 | 154                 | 154 | 292    | 658 | 484 | F25     |
| 28             | 700 | 165                 | 165 | 292    | 677 | 509 | F25     |
| 30             | 750 | 165                 | 165 | 318    | 702 | 534 | F25     |
| 32             | 800 | 190                 | 190 | 318    | 762 | 584 | F25     |

| ASME CLASS 150 |      |                     |     |        |      |      |         |
|----------------|------|---------------------|-----|--------|------|------|---------|
| Size           |      | Face to Face ( mm ) |     |        | H1   | H2   | ISO Pad |
| in             | mm   | Wafer               | Lug | Flange | mm   | mm   |         |
| 36             | 900  | 200                 | 200 | 330    | 803  | 604  | F30     |
| 40             | 1000 | 216                 | 216 | 410    | 886  | 668  | F30     |
| 42             | 1050 | 216                 | 216 | 410    | 903  | 698  | F30     |
| 44             | 1100 | 251                 | 251 | 410    | 938  | 728  | F30     |
| 48             | 1200 | 276                 | 276 | 470    | 1030 | 795  | F35     |
| 52             | 1300 | 276                 | 276 | 470    | 1083 | 858  | F35     |
| 56             | 1400 | 279                 | 279 | 530    | 1175 | 900  | F35     |
| 60             | 1500 | 279                 | 279 | 530    | 1245 | 964  | F40     |
| 64             | 1600 | 318                 | 318 | 600    | 1315 | 1025 | F40     |
| 72             | 1800 | 356                 | 356 | 670    | 1429 | 1138 | F48     |
| 78             | 2000 | 406                 | 406 | 760    | 1538 | 1253 | F48     |
| 88             | 2200 | ---                 | --- | 790    | 1674 | 1386 | F48     |
| 96             | 2400 | ---                 | --- | 910    | 1749 | 1459 | F48     |
| 104            | 2600 | ---                 | --- | 990    | 1922 | 1576 | F48     |
| 112            | 2800 | ---                 | --- | 1070   | 2213 | 1691 | F48     |
| 120            | 3000 | ---                 | --- | 1150   | 2454 | 1845 | F48     |
| 140            | 3500 | ---                 | --- | 1350   | 2750 | 2685 | F60     |
| 160            | 4000 | ---                 | --- | 1350   | 3195 | 3004 | F60     |

**Note:** - 1) Triple Offset (Model – 9000) has range up to 56" (1400mm).

2) "INVACO" reserve the right to change the information anytime without prior notice.





| ASME CLASS 300 |     |                     |     |        |     |     |         |
|----------------|-----|---------------------|-----|--------|-----|-----|---------|
| Size           |     | Face to Face ( mm ) |     |        | H1  | H2  | ISO Pad |
| in             | mm  | Wafer               | Lug | Flange | mm  | mm  |         |
| 2              | 50  | 43                  | 43  | 108    | 168 | 74  | F07     |
| 2½             | 65  | 46                  | 46  | 112    | 184 | 79  | F07     |
| 3              | 80  | 48                  | 48  | 114    | 205 | 95  | F07     |
| 4              | 100 | 54                  | 54  | 127    | 230 | 118 | F07     |
| 6              | 150 | 59                  | 59  | 140    | 265 | 179 | F10     |
| 8              | 200 | 73                  | 73  | 152    | 313 | 238 | F10     |
| 10             | 250 | 83                  | 83  | 165    | 357 | 255 | F12     |
| 12             | 300 | 92                  | 92  | 178    | 405 | 304 | F12     |
| 14             | 350 | 117                 | 117 | 190    | 437 | 330 | F14     |
| 16             | 400 | 133                 | 133 | 216    | 545 | 391 | F14     |
| 18             | 450 | 149                 | 149 | 222    | 589 | 429 | F16     |
| 20             | 500 | 159                 | 159 | 229    | 652 | 463 | F16     |
| 22             | 550 | 159                 | 159 | 229    | 710 | 504 | F16     |
| 24             | 600 | 181                 | 181 | 267    | 772 | 542 | F30     |

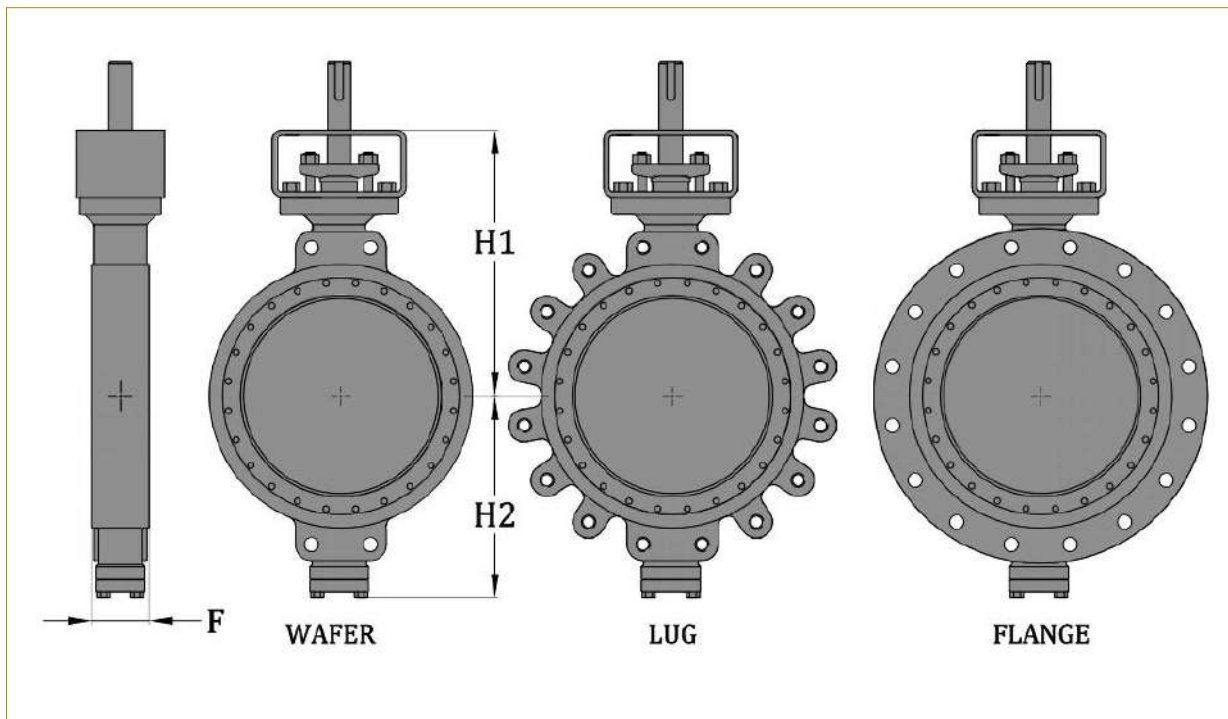
| ASME CLASS 300 |      |                     |     |        |      |      |         |
|----------------|------|---------------------|-----|--------|------|------|---------|
| Size           |      | Face to Face ( mm ) |     |        | H1   | H2   | ISO Pad |
| in             | mm   | Wafer               | Lug | Flange | mm   | mm   |         |
| 26             | 650  | 181                 | 181 | 292    | 738  | 529  | F30     |
| 28             | 700  | 229                 | 229 | 292    | 765  | 560  | F35     |
| 30             | 750  | 229                 | 229 | 318    | 805  | 595  | F35     |
| 32             | 800  | 241                 | 241 | 318    | 839  | 634  | F35     |
| 36             | 900  | 241                 | 241 | 330    | 925  | 698  | F35     |
| 40             | 1000 | 300                 | 300 | 410    | 994  | 749  | F40     |
| 42             | 1050 | 300                 | 300 | 410    | 1024 | 778  | F40     |
| 44             | 1100 | 300                 | 300 | 410    | 1048 | 803  | F40     |
| 48             | 1200 | 350                 | 350 | 470    | 1151 | 881  | F48     |
| 52             | 1300 | 350                 | 350 | 470    | 1198 | 933  | F48     |
| 56             | 1400 | 390                 | 390 | 710    | 1278 | 1018 | F48     |
| 60             | 1500 | 390                 | 390 | 710    | 1309 | 1049 | F60     |
| 64             | 1600 | 440                 | 440 | 790    | 1340 | 1080 | F60     |

**Note:-**

\*\*All dimensions are in "mm" unless & otherwise specified.

\*\* "INVACO" reserve the right to change the information anytime without prior notice.





| ASME CLASS 600 |      |                     |     |        |      |     |         |
|----------------|------|---------------------|-----|--------|------|-----|---------|
| Size           |      | Face to Face ( mm ) |     |        | H1   | H2  | ISO Pad |
| in             | mm   | Wafer               | Lug | Flange | mm   | mm  |         |
| 3              | 80   | 54                  | 54  | 180    | 223  | 155 | F07     |
| 4              | 100  | 64                  | 64  | 190    | 256  | 193 | F12     |
| 6              | 150  | 78                  | 78  | 210    | 292  | 210 | F12     |
| 8              | 200  | 102                 | 102 | 230    | 377  | 249 | F14     |
| 10             | 250  | 117                 | 117 | 250    | 451  | 342 | F14     |
| 12             | 300  | 140                 | 140 | 270    | 487  | 374 | F16     |
| 14             | 350  | 155                 | 155 | 290    | 513  | 403 | F25     |
| 16             | 400  | 178                 | 178 | 310    | 583  | 448 | F25     |
| 18             | 450  | 200                 | 200 | 330    | 623  | 483 | F30     |
| 20             | 500  | 216                 | 216 | 350    | 713  | 543 | F30     |
| 22             | 550  | 216                 | 216 | 350    | 794  | 596 | F35     |
| 24             | 600  | 232                 | 232 | 390    | 815  | 610 | F35     |
| 26             | 650  | 232                 | 232 | 390    | 790  | 590 | F35     |
| 28             | 700  | 292                 | 292 | 450    | 830  | 630 | F40     |
| 30             | 750  | 313                 | 313 | 480    | 869  | 671 | F40     |
| 32             | 800  | 318                 | 318 | 510    | 933  | 703 | F48     |
| 36             | 900  | 330                 | 330 | 540    | 1003 | 773 | F48     |
| 40             | 1000 | ---                 | --- | 570    | 1085 | 835 | F48     |



**Note:** - \*\*All dimensions are in "mm" unless & otherwise specified.  
 \*\* For Rating or ASME Class 900 & Above kindly contact INVACO.  
 \*\* "INVACO" reserve the right to change the information anytime without prior notice.



## Torque for Butterfly Valve

| <b>Butterfly Valve - Torque in N-m for ASME Class 150</b> |           |  |                       |                    |                     |                       |                    |                     |                       |                    |
|---|-----------|--|-----------------------|--------------------|---------------------|-----------------------|--------------------|---------------------|-----------------------|--------------------|
| <b>Size</b>   |           | <b>Pressure Difference - bar ( psi )</b> |                       |                    |                     |                       |                    |                     |                       |                    |
|   |           | <b>20 ( 290 )</b>                        |                       |                    | <b>15 ( 218 )</b>   |                       |                    | <b>7 ( 102 )</b>    |                       |                    |
| <b>in</b>   | <b>mm</b> | <b>Break Torque</b>                      | <b>Seating Torque</b> | <b>Open Torque</b> | <b>Break Torque</b> | <b>Seating Torque</b> | <b>Open Torque</b> | <b>Break Torque</b> | <b>Seating Torque</b> | <b>Open Torque</b> |
| 2   | 50        | 18                                       | 17                    | 7                  | 18                  | 17                    | 5                  | 17                  | 17                    | 4                  |
| 2.1/2   | 65        | 29                                       | 27                    | 7                  | 29                  | 27                    | 6                  | 27                  | 26                    | 3                  |
| 3   | 80        | 40                                       | 36                    | 13                 | 39                  | 36                    | 11                 | 37                  | 36                    | 6                  |
| 4   | 100       | 70                                       | 64                    | 23                 | 68                  | 64                    | 18                 | 65                  | 63                    | 9                  |
| 6   | 150       | 141                                      | 129                   | 45                 | 137                 | 128                   | 35                 | 130                 | 126                   | 19                 |
| 8   | 200       | 281                                      | 257                   | 100                | 271                 | 253                   | 77                 | 256                 | 248                   | 40                 |
| 10  | 250       | 481                                      | 439                   | 175                | 464                 | 433                   | 134                | 437                 | 422                   | 68                 |
| 12  | 300       | 685                                      | 627                   | 288                | 659                 | 616                   | 220                | 618                 | 597                   | 110                |
| 14  | 350       | 934                                      | 855                   | 339                | 896                 | 837                   | 259                | 835                 | 808                   | 131                |
| 16  | 400       | 1390                                     | 1276                  | 466                | 1331                | 1245                  | 357                | 1235                | 1195                  | 182                |
| 18  | 450       | 1953                                     | 1794                  | 646                | 1864                | 1745                  | 494                | 1723                | 1667                  | 250                |
| 20  | 500       | 2545                                     | 2344                  | 808                | 2418                | 2267                  | 619                | 2215                | 2144                  | 317                |
| 22  | 550       | 3335                                     | 2996                  | 970                | 3145                | 2891                  | 745                | 2842                | 2724                  | 386                |
| 24  | 600       | 3908                                     | 3606                  | 1210               | 3696                | 3469                  | 929                | 3356                | 3250                  | 479                |
| 26  | 650       | 4409                                     | 4067                  | 1412               | 4169                | 3913                  | 1080               | 3785                | 3665                  | 550                |
| 28  | 700       | 5335                                     | 4932                  | 1842               | 5022                | 4720                  | 1409               | 4522                | 4381                  | 718                |
| 30  | 750       | 6683                                     | 6015                  | 2228               | 6273                | 5772                  | 1699               | 5618                | 5384                  | 853                |
| 32  | 800       | 7591                                     | 6829                  | 2350               | 7124                | 6553                  | 1790               | 6377                | 6111                  | 895                |
| 34  | 850       | 8998                                     | 8141                  | 3025               | 8379                | 7736                  | 2312               | 7388                | 7088                  | 1173               |
| 36  | 900       | 10899                                    | 9860                  | 3866               | 10148               | 9368                  | 2951               | 8947                | 8583                  | 1486               |
| 40  | 1000      | 13997                                    | 12688                 | 4750               | 12980               | 11998                 | 3624               | 11352               | 10894                 | 1823               |
| 42  | 1050      | 15185                                    | 13780                 | 5297               | 14055               | 13001                 | 4040               | 12246               | 11754                 | 2020               |
| 44  | 1100      | 17605                                    | 15972                 | 5910               | 16292               | 15067                 | 4500               | 14189               | 13618                 | 2244               |
| 48  | 1200      | 20302                                    | 18490                 | 5321               | 18696               | 17338                 | 4089               | 16127               | 15493                 | 2119               |
| 52  | 1300      | 27184                                    | 24824                 | 8788               | 24898               | 23128                 | 6714               | 21241               | 20415                 | 3395               |
| 56  | 1400      | 32455                                    | 29625                 | 10540              | 29714               | 27591                 | 8028               | 25328               | 24337                 | 4008               |
| 60  | 1500      | 37641                                    | 34487                 | 12049              | 34327               | 31962                 | 9224               | 29025               | 27921                 | 4704               |
| 64  | 1600      | 56159                                    | 51622                 | 14640              | 50897               | 47494                 | 11216              | 375906              | 361855                | 5739               |
| 72  | 1800      | 76550                                    | 70520                 | 21456              | 69061               | 64538                 | 16398              | 57077               | 54967                 | 8304               |
| 76  | 1900      | 86494                                    | 79794                 | 25009              | 77807               | 72782                 | 19094              | 63908               | 61563                 | 9631               |
| 80  | 2000      | 96495                                    | 89071                 | 28591              | 86665               | 81096                 | 21797              | 70936               | 68338                 | 10928              |
| 88  | 2200      | 121709                                   | 112671                | 38200              | 108754              | 101975                | 29114              | 88024               | 84861                 | 14576              |

NOTES: -1) For Metal Seat, Fire Safe Design & Solid Metal Seat multiply above torque by 1.5.  
 2) For actuator selection or sizing, factor of safety of 1.3 - 1.5 is recommended.  
 3) INVACO reserves the right to change Design, Material or Specification or any information without prior notice.





**Butterfly Valve - Torque in N-m for ASME Class 300**

| Size |      | Pressure Difference - bar ( psi ) |                |             |              |                |             |              |                |             |              |                |             |
|------|------|-----------------------------------|----------------|-------------|--------------|----------------|-------------|--------------|----------------|-------------|--------------|----------------|-------------|
|      |      | 51 ( 740 )                        |                |             | 38 ( 551 )   |                |             | 20 ( 290 )   |                |             | 7 ( 102 )    |                |             |
| in   | mm   | Break Torque                      | Seating Torque | Open Torque | Break Torque | Seating Torque | Open Torque | Break Torque | Seating Torque | Open Torque | Break Torque | Seating Torque | Open Torque |
| 2    | 50   | 23                                | 19             | 6           | 22           | 19             | 5           | 21           | 19             | 4           | 19           | 19             | 3           |
| 2.½  | 65   | 59                                | 48             | 19          | 55           | 47             | 15          | 51           | 47             | 9           | 48           | 46             | 4           |
| 3    | 80   | 73                                | 59             | 22          | 68           | 59             | 17          | 63           | 57             | 11          | 58           | 57             | 6           |
| 4    | 100  | 114                               | 93             | 36          | 108          | 92             | 28          | 98           | 90             | 17          | 92           | 89             | 9           |
| 6    | 150  | 231                               | 191            | 81          | 216          | 185            | 63          | 194          | 178            | 39          | 179          | 173            | 21          |
| 8    | 200  | 425                               | 354            | 151         | 392          | 339            | 118         | 347          | 320            | 72          | 315          | 305            | 39          |
| 10   | 250  | 687                               | 571            | 230         | 634          | 548            | 179         | 561          | 515            | 108         | 508          | 492            | 56          |
| 12   | 300  | 1119                              | 939            | 381         | 1024         | 890            | 296         | 892          | 822            | 178         | 797          | 772            | 93          |
| 14   | 350  | 1829                              | 1558           | 556         | 1665         | 1462           | 436         | 1437         | 1331           | 272         | 1273         | 1236           | 153         |
| 16   | 400  | 2795                              | 2384           | 814         | 2531         | 2226           | 633         | 2166         | 2006           | 383         | 1903         | 1847           | 202         |
| 18   | 450  | 3540                              | 3046           | 1111        | 3186         | 2818           | 864         | 2696         | 2503           | 523         | 2342         | 2275           | 276         |
| 20   | 500  | 4854                              | 4213           | 1657        | 4347         | 3869           | 1292        | 3645         | 3394           | 786         | 3138         | 3050           | 421         |
| 22   | 550  | 6441                              | 5354           | 2282        | 5719         | 4909           | 1768        | 4719         | 4293           | 1056        | 3997         | 3848           | 542         |
| 24   | 600  | 7546                              | 6573           | 2837        | 6704         | 5979           | 2186        | 5539         | 5157           | 1285        | 4697         | 4563           | 5615        |
| 26   | 650  | 9180                              | 7718           | 3541        | 8103         | 7013           | 2743        | 6611         | 6037           | 1637        | 5534         | 5333           | 839         |
| 28   | 700  | 11591                             | 9870           | 4726        | 10160        | 8878           | 3664        | 8179         | 7504           | 2194        | 6748         | 6512           | 1132        |
| 30   | 750  | 13624                             | 12115          | 5871        | 11926        | 10801          | 4538        | 9573         | 8982           | 2691        | 7875         | 7668           | 1358        |
| 32   | 800  | 15437                             | 13143          | 5252        | 13466        | 11757          | 4068        | 10737        | 9838           | 2430        | 8766         | 8452           | 1246        |
| 34   | 850  | 17753                             | 15177          | 6212        | 15468        | 13548          | 4821        | 12303        | 11293          | 2895        | 10018        | 9665           | 1503        |
| 36   | 900  | 21441                             | 18397          | 7758        | 18604        | 16336          | 5998        | 14676        | 13482          | 3560        | 11839        | 11422          | 1800        |
| 40   | 1000 | 29641                             | 25763          | 11465       | 25487        | 22598          | 8847        | 19736        | 18215          | 5224        | 15582        | 15050          | 2607        |
| 42   | 1050 | 32309                             | 28087          | 12650       | 27740        | 24594          | 9738        | 21413        | 19758          | 5707        | 16845        | 16265          | 2795        |
| 44   | 1100 | 37234                             | 32596          | 15000       | 31956        | 28500          | 11617       | 24647        | 22829          | 6934        | 19369        | 18733          | 3551        |
| 48   | 1200 | 41346                             | 36349          | 16976       | 35381        | 31658          | 13142       | 27121        | 25162          | 7834        | 21156        | 20471          | 4001        |
| 56   | 1400 | 64935                             | 57362          | 28524       | 55049        | 49407          | 21861       | 41362        | 38392          | 12636       | 31476        | 30437          | 5973        |
| 60   | 1500 | 71736                             | 63727          | 32034       | 60612        | 54644          | 24570       | 45209        | 42069          | 14236       | 34085        | 32986          | 6772        |

NOTES: - 1) For Metal Seat, Fire Safe Design & Solid Metal Seat multiply above torque by 1.5.  
 2) For actuator selection or sizing, factor of safety of 1.3 - 1.5 is recommended.  
 3) INVACO reserves the right to change Design, Material or Specification or any information without prior notice.



**Butterfly Valve - Torque in N-m for ASME Class 600**

| Size |     | Pressure Difference - bar ( psi ) |                |             |              |                |             |              |                |             |              |                |             |
|------|-----|-----------------------------------|----------------|-------------|--------------|----------------|-------------|--------------|----------------|-------------|--------------|----------------|-------------|
|      |     | 102 ( 1480 )                      |                |             | 51 ( 740 )   |                |             | 20 ( 290 )   |                |             | 7 ( 102 )    |                |             |
| in   | mm  | Break Torque                      | Seating Torque | Open Torque | Break Torque | Seating Torque | Open Torque | Break Torque | Seating Torque | Open Torque | Break Torque | Seating Torque | Open Torque |
| 3    | 80  | 109                               | 81             | 29          | 90           | 76             | 19          | 78           | 73             | 13          | 73           | 71             | 10          |
| 4    | 100 | 249                               | 197            | 84          | 206          | 180            | 58          | 180          | 170            | 42          | 169          | 165            | 35          |
| 6    | 150 | 503                               | 389            | 190         | 401          | 344            | 117         | 339          | 317            | 72          | 313          | 305            | 53          |
| 8    | 200 | 899                               | 733            | 349         | 714          | 631            | 229         | 602          | 569            | 157         | 555          | 543            | 126         |
| 10   | 250 | 1505                              | 1236           | 566         | 1186         | 1051           | 371         | 992          | 939            | 253         | 910          | 892            | 204         |
| 12   | 300 | 2872                              | 2384           | 1065        | 2187         | 1943           | 676         | 1770         | 1674           | 439         | 1595         | 1562           | 340         |
| 14   | 350 | 3359                              | 2762           | 1339        | 2520         | 2222           | 813         | 2010         | 1893           | 493         | 1796         | 1755           | 359         |
| 16   | 400 | 4892                              | 4085           | 1762        | 3640         | 3237           | 1106        | 2879         | 2721           | 707         | 2560         | 2505           | 539         |
| 18   | 450 | 6256                              | 5279           | 2348        | 4598         | 4109           | 1458        | 3590         | 3398           | 917         | 3167         | 3100           | 690         |
| 20   | 500 | 8896                              | 7644           | 3544        | 6497         | 5871           | 2223        | 5038         | 4793           | 1420        | 4427         | 4341           | 1084        |
| 24   | 600 | 14982                             | 13071          | 6373        | 10624        | 9668           | 3878        | 7974         | 7600           | 2362        | 6864         | 6732           | 1726        |
| 28   | 700 | 23508                             | 19942          | 9761        | 14517        | 12939          | 5250        | 12086        | 11387          | 3606        | 10276        | 10031          | 2630        |
| 30   | 750 | 28488                             | 24279          | 12075       | 19643        | 17538          | 7235        | 14267        | 13442          | 4293        | 12012        | 11724          | 3059        |

NOTES: -1) For Metal Seat, Fire Safe Design & Solid Metal Seat multiply above torque by 1.5.  
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### Coefficient of Flow for Butterfly Valve (Model – 9000 & 9900)

| <b>Coefficient of Flow ( Cv ) Value of Butterfly Valve ( ASME Class 150)</b> |           |  |            |            |            |            |            |            |            |            |
|--|-----------|--|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>Size</b>  |           | <b>Disc Angle ( Degree of Opening)</b> |            |            |            |            |            |            |            |            |
| <b>mm</b>  | <b>in</b> | <b>10°</b>                             | <b>20°</b> | <b>30°</b> | <b>40°</b> | <b>50°</b> | <b>60°</b> | <b>70°</b> | <b>80°</b> | <b>90°</b> |
| 2  | 50        | 2                                      | 6          | 13         | 26         | 40         | 57         | 79         | 97         | 101        |
| 2.5  | 65        | 3                                      | 10         | 22         | 43         | 67         | 96         | 134        | 165        | 172        |
| 3  | 80        | 5                                      | 13         | 29         | 56         | 87         | 124        | 173        | 213        | 222        |
| 4  | 100       | 9                                      | 26         | 57         | 109        | 170        | 244        | 339        | 418        | 435        |
| 6  | 150       | 24                                     | 73         | 158        | 304        | 473        | 678        | 945        | 1163       | 1211       |
| 8  | 200       | 43                                     | 129        | 280        | 541        | 840        | 1206       | 1680       | 2068       | 2154       |
| 10   | 250       | 70                                     | 211        | 457        | 882        | 1371       | 1968       | 2741       | 3373       | 3514       |
| 12   | 300       | 104                                    | 312        | 677        | 1307       | 2030       | 2914       | 4060       | 4997       | 5205       |
| 14   | 350       | 127                                    | 381        | 826        | 1595       | 2478       | 3552       | 4956       | 6100       | 6354       |
| 16   | 400       | 170                                    | 510        | 1105       | 2134       | 3315       | 4760       | 6630       | 8160       | 8500       |
| 18   | 450       | 210                                    | 629        | 1364       | 2633       | 4090       | 5873       | 8181       | 10069      | 10488      |
| 20   | 500       | 266                                    | 797        | 1728       | 3336       | 5183       | 7442       | 10365      | 12757      | 13289      |
| 24   | 600       | 401                                    | 1202       | 2603       | 5026       | 7810       | 11214      | 15620      | 19224      | 20025      |
| 26   | 650       | 453                                    | 1359       | 2943       | 5683       | 8830       | 12678      | 17659      | 21734      | 22640      |
| 28   | 700       | 534                                    | 1601       | 3468       | 6696       | 10404      | 14940      | 20809      | 25611      | 26678      |
| 30   | 750       | 621                                    | 1863       | 4036       | 7792       | 12107      | 17385      | 24214      | 29802      | 31044      |
| 32   | 800       | 710                                    | 2130       | 4616       | 8912       | 13847      | 19883      | 27694      | 34085      | 35505      |
| 34   | 850       | 798                                    | 2395       | 5188       | 10018      | 15565      | 22350      | 31131      | 38315      | 39911      |
| 36   | 900       | 968                                    | 2903       | 6290       | 12145      | 18869      | 27094      | 37738      | 46447      | 48382      |
| 40   | 1000      | 1220                                   | 3659       | 7928       | 15307      | 23783      | 34151      | 47567      | 58544      | 60983      |
| 42   | 1050      | 1306                                   | 3918       | 8488       | 16389      | 25464      | 36564      | 50929      | 62681      | 65293      |
| 44   | 1100      | 1426                                   | 4277       | 9268       | 17894      | 27803      | 39922      | 55606      | 68438      | 71290      |
| 48   | 1200      | 1545                                   | 4636       | 10045      | 19395      | 30135      | 43271      | 60271      | 74179      | 77270      |
| 52   | 1300      | 2001                                   | 6003       | 13007      | 25114      | 39022      | 56031      | 78044      | 96054      | 100056     |
| 56   | 1400      | 2333                                   | 6999       | 15165      | 29279      | 45494      | 65324      | 90987      | 111984     | 116650     |
| 60   | 1500      | 2484                                   | 7451       | 16143      | 31168      | 48429      | 69539      | 96858      | 119210     | 124177     |
| 64   | 1600      | 3061                                   | 9184       | 19898      | 38419      | 59695      | 85715      | 119389     | 146941     | 153063     |
| 72   | 1800      | 4059                                   | 12178      | 26385      | 50943      | 79154      | 113657     | 158308     | 194841     | 202959     |
| 76   | 1900      | 4503                                   | 13508      | 29266      | 56506      | 87799      | 126070     | 175598     | 216120     | 225125     |
| 80   | 2000      | 4984                                   | 14952      | 32395      | 62548      | 97186      | 139549     | 194371     | 239226     | 249194     |
| 88   | 2200      | 6059                                   | 18176      | 39382      | 76038      | 118146     | 169646     | 236292     | 290821     | 302939     |

NOTE: - \* The Coefficient of Flow ( Cv ) is defined in U.S. gallon per minute of water required to pass through a valve with a pressure drop of 1 psi. \* INVACO reserves the right to change any information without prior notice.



**Coefficient of Flow ( Cv ) Value of Butterfly Valve ( ASME Class 300)**

| Size |      | Disc Angle ( Degree of Opening) |      |       |       |       |       |       |        |        |
|------|------|---------------------------------|------|-------|-------|-------|-------|-------|--------|--------|
| mm   | in   | 10°                             | 20°  | 30°   | 40°   | 50°   | 60°   | 70°   | 80°    | 90°    |
| 2    | 50   | 2                               | 6    | 13    | 25    | 40    | 57    | 79    | 97     | 101    |
| 2.5  | 65   | 3                               | 10   | 22    | 43    | 67    | 96    | 134   | 165    | 172    |
| 3    | 80   | 4                               | 13   | 29    | 56    | 87    | 124   | 173   | 213    | 222    |
| 4    | 100  | 9                               | 26   | 57    | 109   | 170   | 245   | 339   | 418    | 435    |
| 6    | 150  | 23                              | 71   | 153   | 295   | 459   | 659   | 918   | 1130   | 1177   |
| 8    | 200  | 40                              | 120  | 261   | 503   | 782   | 1123  | 1564  | 1925   | 2005   |
| 10   | 250  | 68                              | 205  | 445   | 859   | 1335  | 1917  | 2671  | 3287   | 3424   |
| 12   | 300  | 99                              | 297  | 644   | 1243  | 1913  | 2773  | 3863  | 4754   | 4952   |
| 14   | 350  | 125                             | 374  | 810   | 1565  | 2431  | 3491  | 4862  | 5984   | 6233   |
| 16   | 400  | 168                             | 503  | 1090  | 2104  | 3270  | 4695  | 6539  | 8049   | 8384   |
| 18   | 450  | 203                             | 608  | 1317  | 2542  | 3950  | 5672  | 7901  | 9724   | 10129  |
| 20   | 500  | 257                             | 770  | 1668  | 3220  | 5003  | 7183  | 10005 | 12314  | 12827  |
| 24   | 600  | 389                             | 1168 | 2530  | 4884  | 7589  | 10897 | 15177 | 18680  | 19458  |
| 26   | 650  | 423                             | 1270 | 2749  | 5308  | 8248  | 11843 | 16495 | 20302  | 21148  |
| 28   | 700  | 518                             | 1554 | 3367  | 6500  | 10100 | 14503 | 20200 | 24862  | 25898  |
| 30   | 750  | 617                             | 1849 | 4007  | 7736  | 12021 | 17260 | 24041 | 29589  | 30822  |
| 32   | 800  | 697                             | 2091 | 4530  | 8745  | 13588 | 19512 | 27177 | 33448  | 34842  |
| 34   | 850  | 774                             | 2322 | 5032  | 9717  | 15097 | 21678 | 30195 | 37163  | 38711  |
| 36   | 900  | 935                             | 2804 | 6075  | 11730 | 18225 | 26169 | 36450 | 44862  | 46731  |
| 40   | 1000 | 1188                            | 3563 | 7719  | 14903 | 23156 | 33250 | 46313 | 57000  | 59375  |
| 42   | 1050 | 1296                            | 3887 | 8421  | 16259 | 25263 | 36276 | 50527 | 62187  | 64778  |
| 48   | 1200 | 1537                            | 4611 | 9990  | 19289 | 29972 | 43036 | 59943 | 73776  | 76850  |
| 56   | 1400 | 2312                            | 6937 | 15030 | 29020 | 45091 | 64746 | 90182 | 110993 | 115618 |
| 60   | 1500 | 2455                            | 7366 | 15959 | 30812 | 47876 | 68745 | 95751 | 117848 | 122758 |

**NOTE :-**

\* The Coefficient of Flow ( Cv ) is defined in U.S. gallon per minute of water required to pass through a valve with a pressure drop of 1 psi.

\* INVACO reserves the right to change any information without prior notice.

**Coefficient of Flow ( Cv ) Value of High Performance Butterfly Valve ( ASME Class 600)**

| Size |     | Disc Angle ( Degree of Opening) |      |      |      |       |       |       |       |       |
|------|-----|---------------------------------|------|------|------|-------|-------|-------|-------|-------|
| mm   | in  | 10°                             | 20°  | 30°  | 40°  | 50°   | 60°   | 70°   | 80°   | 90°   |
| 2    | 50  | 2                               | 6    | 12   | 24   | 37    | 53    | 74    | 91    | 95    |
| 3    | 80  | 4                               | 12   | 26   | 50   | 78    | 111   | 155   | 191   | 199   |
| 4    | 100 | 8                               | 24   | 52   | 100  | 155   | 223   | 310   | 382   | 398   |
| 6    | 150 | 20                              | 62   | 133  | 258  | 400   | 575   | 800   | 985   | 1026  |
| 8    | 200 | 36                              | 108  | 233  | 451  | 701   | 1006  | 1401  | 1724  | 1796  |
| 10   | 250 | 56                              | 167  | 361  | 698  | 1084  | 1557  | 2168  | 2669  | 2780  |
| 12   | 300 | 96                              | 289  | 626  | 1208 | 1877  | 2695  | 3753  | 4620  | 4812  |
| 14   | 350 | 122                             | 364  | 790  | 1525 | 2369  | 3402  | 4739  | 5832  | 6075  |
| 16   | 400 | 164                             | 492  | 1066 | 2058 | 3198  | 4592  | 6396  | 7872  | 8200  |
| 18   | 450 | 200                             | 599  | 1297 | 2504 | 3891  | 5587  | 7781  | 9577  | 9976  |
| 20   | 500 | 203                             | 610  | 1322 | 2552 | 3966  | 5695  | 7932  | 9762  | 10169 |
| 24   | 600 | 348                             | 1044 | 2263 | 4369 | 6789  | 9748  | 13578 | 16712 | 17408 |
| 28   | 700 | 463                             | 1390 | 3012 | 5816 | 9036  | 12975 | 18073 | 22243 | 23170 |
| 30   | 750 | 548                             | 1645 | 3564 | 6881 | 10692 | 15353 | 21384 | 26319 | 27416 |

NOTE :- \* The Coefficient of Flow ( Cv ) is defined in U.S. gallon per minute of water required to pass through a valve with a pressure drop of 1 psi.

\* INVACO reserves the right to change any information without prior notice.

**Body & Trim Material for Butterfly Valve (Model – 9000 & 9900)**

| Body & Trim Material         |                   |                        |
|------------------------------|-------------------|------------------------|
| Material Group / Type        | Casting           | Forging                |
| Carbon Steel                 | A216 Gr WCB , WCA | A105 / A 106           |
|                              | A216 Gr WCC       | A105N                  |
| Low Temperature Carbon Steel | A352 Gr LCB       | A350 Gr LF2 CL.1       |
|                              | A352 Gr LCC       |                        |
|                              | A352 Gr LC1 / LC2 |                        |
|                              | A352 Gr LC3       | A350 Gr LF3 CL.1       |
| Alloy Steel                  | A217 Gr WC1       | A182 Gr F1             |
|                              | A217 Gr WC5       |                        |
|                              | A217 Gr WC6       | A182 Gr F11 CL.2       |
|                              | A217 Gr WC9       | A182 Gr F22 CL.3       |
|                              | A217 Gr C5        | A182 Gr F5a            |
|                              | A217 Gr C12       | A182 Gr F9             |
|                              | A217 Gr C12A      | A182 Gr F91            |
| Stainless Steel              | A217 Gr CA15      | A182 Gr F6A / ANSI 410 |
|                              | A351 Gr CF10M     | A182 Gr F304H          |
|                              | A351 Gr CF8A      | A182 Gr F347H          |
|                              | A351 Gr CF8       | A182 Gr F304           |
|                              | A351 Gr CF3       | A182 Gr F304L          |
|                              | A351 Gr CF8M      | A182 Gr F316           |
|                              | A351 Gr CF3M      | A182 Gr F316L          |
|                              | A351 Gr CF8C      | A182 Gr F347           |



|                                     |                        |                       |
|-------------------------------------|------------------------|-----------------------|
| <b>Duplex / Super Duplex</b>        | A890 Gr CD4MCuN (1B )  |                       |
|                                     | A890 Gr CD3MCuN (1C )  |                       |
|                                     | A890 Gr CE8MN (2A )    |                       |
|                                     | A890 Gr CD3MN (4A )    | A182 Gr F51           |
|                                     | A890 Gr CE3MN (5A )    | A182 Gr F53           |
|                                     | A890 Gr CD3MWCuN (6A ) | A182 Gr F55           |
| <b>Nickel / Super Nickel Alloys</b> | A494 Gr CY40           | Inconel 600           |
|                                     | A494 Gr CZ100          |                       |
|                                     | A494 Gr CW6MC          | Inconel 625           |
|                                     | A494 Gr M 35 -1        | Monel 400             |
|                                     |                        | Monel K-500           |
|                                     | A494 Gr CW6M / CW12MW  | Hastalloy C / C-276   |
| <b>Aluminum Bronze</b>              | B148 Gr C95200         |                       |
|                                     | B148 Gr C95400         |                       |
|                                     | B148 Gr C95500         |                       |
|                                     | B148 Gr C95800         |                       |
| <b>Titanium</b>                     | B367 Gr C2             | B381 Gr F2            |
|                                     | B367 Gr C3             | B381 Gr F3            |
| <b>Special Materials</b>            | A351 Gr CN7M           | Alloy 20              |
|                                     | A351 Gr CN2MCuN        | 904L                  |
|                                     | A351 Gr CK3MCuN        | SMO 254 / A182 Gr F44 |
|                                     | CB7CU -1               | 17 - 4 PH             |

**Note:** - Wrought names are given as a reference for commonly accepted equivalent material. "INVACO" cannot hold any liability for any damages incurred due to this table. For more information kindly contact "INVACO".

### Material Specification for Fastener's:-

| Bolting Material   | Nut Materials          | Temperature Range | Body Material   |
|--|------------------------|-------------------|---|
| ASTM A193 Gr. B7   | ASTM A194 Gr. 2H       | -40°C to +538°C   | Carbon Steel  |
| ASTM A193 Gr B7M   | ASTM A194 Gr. 2HM      | -50°C to +538°C   | Low Alloy Steel   |
| ASTM A320 Gr. L7   | ASTM A194 Gr. 7/4      | -100°C to +371°C  | Low Temp. Carbon Steel  |
| ASTM A320 Gr. L7M  | ASTM A194 Gr. 7M       | -75°C to +538°C   | Low Temp. Carbon Steel  |
| ASTM A193 Gr. B8   | ASTM A194 Gr. 8        | -200°C to +538°C  | Stainless Steel   |
| ASTM A193 Gr. B8M  | ASTM A194 Gr. 8M / 8MA | -200°C to +538°C  | Stainless Steel/Nickel Alloys /   |
| A453 Gr 660 CL A   | A453 Gr 660 CL A       | -30°C to +538°C   | Duplex  |
| <b>NOTE:-</b> <ul style="list-style-type: none"> <li>➤ Above temperature range is for BOLTING, not body materials.</li> <li>➤ Welding repair on Bolting is strictly not allowed.</li> <li>➤ Temperature range &amp; use may vary with requirement like NACE, Impact Test.</li> <li>➤ For more information refer ASME B31.3, B16.34, A193, A194, A320 &amp; A453.</li> <li>➤ Other Bolt &amp; Nut material available on request.</li> <li>➤ INVACO cannot hold any liability for any damages incurred to this table.</li> </ul> |                        |                   | <b>Coating for Fastener's</b> <ul style="list-style-type: none"> <li>➤ ENP</li> <li>➤ Hot Deep Galvanized</li> <li>➤ Hot Zinc</li> <li>➤ Red Xylem</li> <li>➤ PTFE Coating</li> <li>➤ Cadmium</li> <li>➤ Cadmium with PTFE</li> </ul> |



### Seat Insert & Seal Material:-

| Materials             | Temperature Range °C |      | Pressure Class |       | Size         |             |
|-----------------------|----------------------|------|----------------|-------|--------------|-------------|
|                       | Min.                 | Max. | Seat Rings     | Seal  | Seat Rings   | Seal        |
| PTFE ( Glass Filled)  | - 100                | +200 | 600#           | ----  | 24"(600mm)   | ----        |
| PTFE ( Carbon Filled) | - 100                | +180 | 600#           | ----  | 24"(600mm)   | ----        |
| Nylon6 ( Devlon)      | - 60                 | +140 | 2500#          | ----  | 60"(1500mm)  | ----        |
| Nylon                 | - 60                 | +120 | 2500#          | ----  | 60"(1500mm)  | ----        |
| Peek                  | - 100                | +240 | 2500#          | ----  | 24"(600mm)   | ----        |
| Derlin                | - 45                 | +90  | 1500#          | ----  | 24"(600mm)   | ----        |
| Viton B               | - 29                 | +180 | 600#           | 2500# | 160"(4000mm) | 60"(1500mm) |
| Viton AED             | - 40                 | +200 | 600#           | 2500# | 160"(4000mm) | 60"(1500mm) |
| Buna N / NBR          | - 30                 | +120 | 600#           | 2500# | 160"(4000mm) | 60"(1500mm) |
| HNBR                  | - 40                 | +150 | 600#           | 2500# | 160"(4000mm) | 60"(1500mm) |
| Graphite              | - 240                | +560 | ----           | 2500# | 24"(600mm)   | 60"(1500mm) |

**NOTE:** - \*\*Above table is for reference, information may differ, INVACO cannot hold any liability for any damages incurred due to this table.  
 \*\* Temperature & Pressure range may vary with different brands manufacturer.

### Static and Dynamic Seals (Gaskets & Packing):-

- Graphite Packing / Gasket.
- PTFE, R-PTFE Packing / Rings.
- Spiral Wound Gasket ( Soft + Metal filled )
- Metal Gasket (RTJ, BX, T type seal ring).
- Lip Seal (U/O type, radial or face seal).

### Testing Pressure:-

| ASME CLASS | Working Pressure |       |                    | Body Test ( Hydro) |     |                    | Seat Test ( Hydro) |     |                    | Seat Test ( Air ) |     |                    |
|------------|------------------|-------|--------------------|--------------------|-----|--------------------|--------------------|-----|--------------------|-------------------|-----|--------------------|
|            | psi              | bar   | Kg/cm <sup>2</sup> | psi                | bar | Kg/cm <sup>2</sup> | psi                | bar | Kg/cm <sup>2</sup> | psi               | bar | Kg/cm <sup>2</sup> |
| 150        | 285              | 19.6  | 20                 | 464                | 32  | 33                 | 333                | 23  | 23.5               | 100               | 6   | 7                  |
| 300        | 741              | 51.1  | 52                 | 1145               | 79  | 81                 | 842                | 58  | 59                 | 100               | 6   | 7                  |
| 400        | 988              | 68.1  | 69                 | 1523               | 105 | 107                | 1189               | 82  | 84                 | 100               | 6   | 7                  |
| 600        | 1480             | 102.1 | 104                | 2262               | 156 | 159                | 1653               | 114 | 116                | 100               | 6   | 7                  |
| 800        | 2001             | 138   | 141                | 3046               | 210 | 214                | 2248               | 155 | 158                | 100               | 6   | 7                  |
| 900        | 2222             | 153.2 | 156                | 3423               | 236 | 240                | 2494               | 172 | 175                | 100               | 6   | 7                  |
| 1500       | 3703             | 255.3 | 260                | 5685               | 392 | 400                | 4177               | 288 | 293                | 100               | 6   | 7                  |
| 2500       | 6171             | 425.5 | 434                | 945                | 652 | 665                | 6932               | 478 | 487                | 100               | 6   | 7                  |

**Note:** - Rating Pressure may be change for different materials.

### Spares part list:-

| Spares for Butterfly |                     |                       |                                |
|----------------------|---------------------|-----------------------|--------------------------------|
| Part No              | Part                | Quantity for Start up | Quantity for 2 years Operation |
| 4                    | Gasket( End Cover ) | 2                     | 3 nos                          |
| 10                   | Gland Packing       | 1 Set                 | 3 Set                          |
| 15                   | Gasket ( Retainer)  | 2                     | 3 nos                          |
| 14                   | Seat Ring           | ---                   | 3 nos                          |





## How to Order Butterfly Valves

| Valve Type | Size | Pr. Rating | End. Conn | Body Material | Disc Material | Stem Material | Seat Ring | Gland Packing | Operation | Spec |
|------------|------|------------|-----------|---------------|---------------|---------------|-----------|---------------|-----------|------|
| A          | B    | C          | D         | E             | F             | G             | H         | I             | J         | K    |

### A - Valve Type

| Code | Valve Type                          | Series | Code | Valve Type                          | Series |
|------|-------------------------------------|--------|------|-------------------------------------|--------|
| 1    | Triple Offset Butterfly Valve       | 9000   | 4    | Damper or Clearance Butterfly Valve | 9300   |
| 2    | Double Offset Butterfly Valve       | 9900   | 5    | Weld End Butterfly Valve            | 9200   |
| 3    | Sleeve or Resilient Butterfly Valve | 9400   | 6    | Other                               |        |

### B - Size

|             |           |            |           |           |           |           |           |           |           |           |           |           |           |
|-------------|-----------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| NPS         | 2"        | 2.1/2"     | 3"        | 4"        | 5"        | 6"        | 8"        | 10"       | 12"       | 14"       | 16"       | 18"       | 20"       |
| DN          | 50        | 65         | 80        | 100       | 125       | 150       | 200       | 250       | 300       | 350       | 400       | 450       | 500       |
| <b>Code</b> | <b>02</b> | <b>025</b> | <b>03</b> | <b>04</b> | <b>05</b> | <b>06</b> | <b>08</b> | <b>10</b> | <b>12</b> | <b>14</b> | <b>16</b> | <b>18</b> | <b>20</b> |
| NPS         | 22"       | 24"        | 26"       | 28"       | 30"       | 32"       | 34"       | 36"       | 40"       |           |           |           |           |
| DN          | 550       | 600        | 650       | 700       | 750       | 800       | 850       | 900       | 1000      |           |           |           |           |
| <b>Code</b> | <b>22</b> | <b>24</b>  | <b>26</b> | <b>28</b> | <b>30</b> | <b>32</b> | <b>34</b> | <b>36</b> | <b>40</b> |           |           |           |           |

Note:- For higher size code use respective NPS (inch) as Code

### C - Rating

|             |           |           |           |           |           |           |           |           |           |           |           |           |           |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Class       | 125       | 150       | 300       | 400       | 600       | 800       | 900       | 1500      | 2500      | PN 2.5    | PN6       | PN10      | PN16      |
| <b>Code</b> | <b>01</b> | <b>02</b> | <b>03</b> | <b>04</b> | <b>05</b> | <b>06</b> | <b>07</b> | <b>08</b> | <b>09</b> | <b>10</b> | <b>11</b> | <b>12</b> | <b>13</b> |
| Class       | PN 25     | PN 40     | PN 63     | PN 100    | PN 160    | PN 320    |           |           |           |           |           |           |           |
| <b>Code</b> | <b>14</b> | <b>15</b> | <b>16</b> | <b>17</b> | <b>18</b> | <b>19</b> |           |           |           |           |           |           |           |

### D - End Connection

| Class | Type                   | Class | Type                | Class | Type        |
|-------|------------------------|-------|---------------------|-------|-------------|
| A     | Wafer                  | D     | Flange-Long Pattern | G     | INVACO Std. |
| B     | Lug                    | E     | But Weld            | H     | Other       |
| C     | Flange (Short Pattern) | F     | Customized          |       |             |

### E - Body/ End Cover Material

| Code | Material | Code | Material | Code | Material | Code | Material | Code | Material     |
|------|----------|------|----------|------|----------|------|----------|------|--------------|
| 01   | WCB      | 06   | WC9      | 11   | CF3M     | 16   | 6A       | 21   | C95800       |
| 02   | WCC      | 07   | CA15     | 12   | CK3MCuN  | 17   | M35-1    | 22   | C62300       |
| 03   | LCB      | 08   | CF8      | 13   | CN7M     | 18   | CW6MC    | 23   | Ductile Iron |
| 04   | LCC      | 09   | CF8M     | 14   | 4A       | 19   | CW12MW   | 24   | Cast Iron    |
| 05   | WC6      | 10   | CF3      | 15   | 5A       | 20   | C95500   | 25   | Other        |



**F - Disc Material**

| Code | Material | Code | Material | Code | Material | Code | Material |
|------|----------|------|----------|------|----------|------|----------|
| 01   | CF8      | 05   | CK3MCuN  | 09   | 6A       | 13   | C95500   |
| 02   | CF8M     | 06   | CN7M     | 10   | M35-1    | 14   | C95800   |
| 03   | CF3      | 07   | 4A       | 11   | CW6MC    | 15   | C62300   |
| 04   | CF3M     | 08   | 5A       | 12   | CW12MW   | 16   | Other    |

**G - Stem Material**

| Code | Material   | Code | Material    |
|------|------------|------|-------------|
| A    | A105N      | I    | F53         |
| B    | 410        | J    | F55         |
| C    | F6A        | K    | F44         |
| D    | F304/F304L | L    | Incoloy 825 |
| E    | F316/F316L | M    | Inconel 625 |
| F    | 17-4PH     | N    | Monel       |
| G    | F11        | O    | 904L        |
| H    | F51        | P    | Other       |

**H - Seat Ring**

| Code | Material     |
|------|--------------|
| A    | PTFE         |
| B    | RPTFE        |
| C    | EPDM         |
| D    | NBR / BUNA N |
| E    | NYLON        |
| F    | HNBR         |
| G    | Other        |

**I - Gland Packing**

| Code | Material     |
|------|--------------|
| A    | PTFE         |
| B    | RPTFE        |
| C    | Graphite     |
| D    | NBR / BUNA N |
| E    | HNBR         |
| F    | Other        |

**J - Operations**

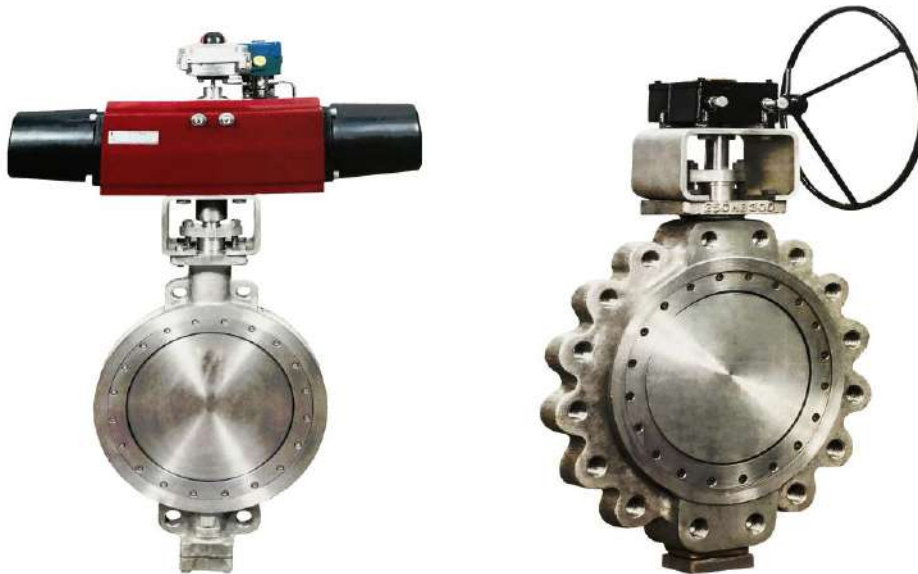
| Code | Operations       |
|------|------------------|
| A    | Bare Stem        |
| B    | Lever            |
| C    | Gear             |
| D    | Electrical Act'r |
| E    | Pneumatic Act'r  |

**K - Special**

| Code | Special Req.    |
|------|-----------------|
| A    | Extended Bonnet |
| B    | Extended Stem   |
| C    | Cryogenic       |
| D    | Other           |
| E    |                 |

**Example:** - 8" x 150#, Double Offset, Wafer Design Butterfly Valve, Body/ End cover - WCB, Disc- CF8M & Stem - F316, Seat Ring - RPTFE, Packing - PTFE, Gear Operated, Cryogenic Design.

**CODE:** - 2 08 02 A 01 02 D B A C C





Triple Offset Butterfly Valve - Model 9000  
Double Offset Butterfly Valve - Model 9900

Double & Triple Offset Butterfly Valve

Your Local INVACO Representative -

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We are 70 Km away from Mumbai International Airport.