

trunnion mounted ball valve



innovative
valves solutions

.ICARUS

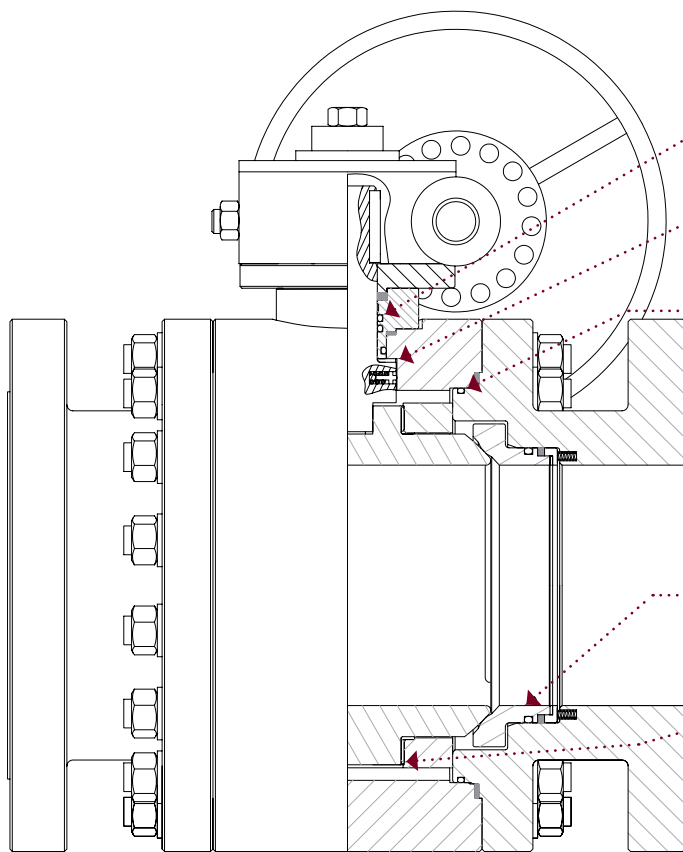
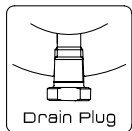
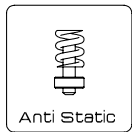
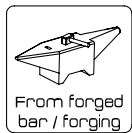
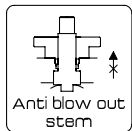


ICARUS' TRUNNION MOUNTED BALL VALVE design meets most advanced specifications. Every detail has been thought according to these specifications and to provide both efficiency and reliability. This involves several activities such as state of the art design, optimization through finite element analysis studies, reliable supplier network, highly accurate machining and extensive quality controls.

Please note that other customized design can be supplied on request.

general features

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**STEM SEALS
TRIPLE DESIGN**
2 SOFT SEALS
1 FIRESAFE BACK SEAL

**TRUE
ANTI BLOW-OUT DESIGN**

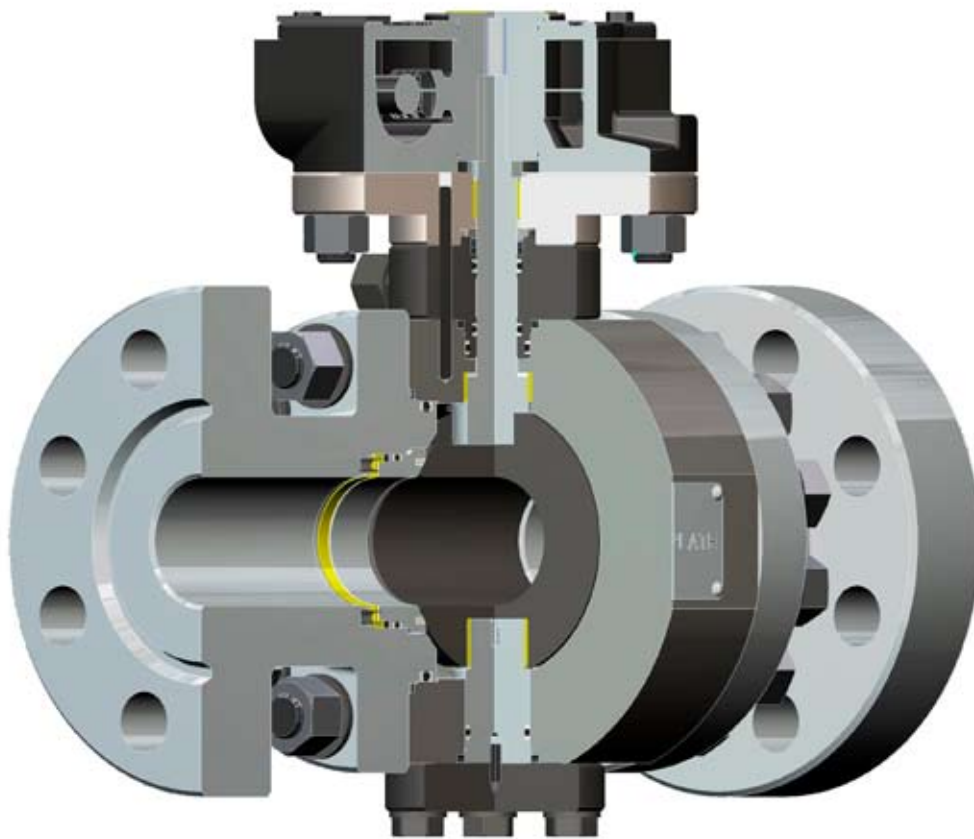
**SHELL SEALS
TWIN DESIGN**
1 SOFT SEAL
1 FIRESAFE BACK SEAL

SPRING ENERGIZED FLOATING SEAT

HIGH PRECISION BALL
..GUIDED BY ANTI FRICTION BEARINGS

	EQUIPMENT/FEATURE	STANDARD (STD)
		ACCORDING TO CUSTOMER CHOICE
		ON REQUEST (REQ)
GENERAL DESIGN & MATERIALS	Design acc. to API 6D or API 6A and/or customer specification	STD
	Firesafe acc. to API607 (ISO10497) / API6FA and/or customer specification	STD
	Antistatic design	STD
	Full / Reduced Bore	CUST
	End connections (ASME/API Flanges, Compact Flanges, Hubs, Buttweld)	CUST
	Parts machined from forgings or forged or rolled bars	STD
SHELL	2 or 3-piece body	CUST < 6in CL1500 (T type)
	3-piece body only	STD ≥ 6in CL1500 (P type)
	Bolted covers	STD
	Shell seals : TWIN design	STD
	Extended bonnet for special applications	REQ
BALL	High precision guided ball by two female trunnion plates – P type design	STD ≥ 6in CL1500
	High precision guided ball by two male trunnions – T type design	STD < 6in CL1500
SEAT	Metal seat / Soft seat (+ metal back seat for firesafe purpose)	CUST
	Spring energized for sealing at low pressure	STD
	2 single piston effect seats (+ cavity relief feature)	CUST (CLASS A / B)
	1 single piston effect seat (+ cavity relief feature) + 1 double piston effect seat	CUST (CLASS E)
	2 double piston effect seats	REQ
STEM	Anti -blowout	STD
	Extended stem	REQ
	Stem seals : TRIPLE design	STD
OPERATION	Manual (Lever/Gearbox) or Actuated	CUST
	Locking device (on lever-operated valves)	CUST
	Locking device (on gear-operated valves)	STD
DRAIN / VENT CONNECTION	Plugged drain connection	STD
	Plugged vent connection (≥ 4in)	STD
	Plugged sealant injection point at stem level (≥ 4in)	STD
	Plugged sealant injection point at seat level (≥ 6in)	REQ
OTHER	Lifting lugs (≥ 6in)	STD
	Feet (≥ 8in)	STD

Note: other arrangements are available on request.



ICARUS is able to provide a wide range of trunnion mounted ball valves, in terms of size, application and material. Each combination is advised by ICARUS engineering team to meet your needs completely.

Our custom valves can be used under standard conditions as well as extreme conditions: high pressure, low or high temperatures, corrosive and abrasive products.

product range & design

.ICARUS

In terms of size

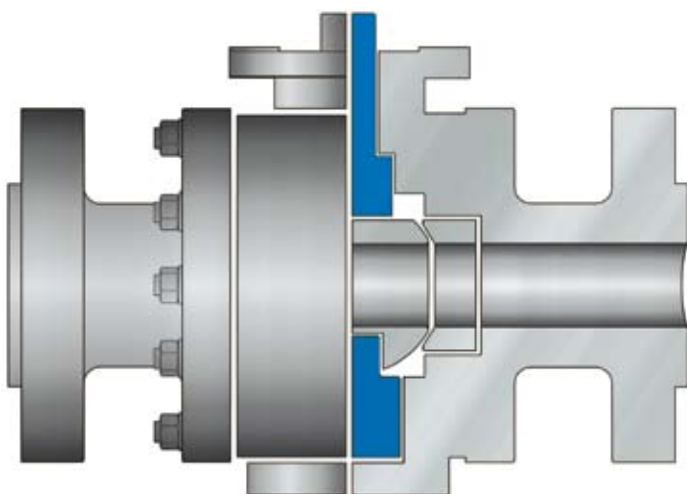
		CLASS (ACC. TO ASME B16.34)					
		150	300	600	900	1500	2500
SIZE (in)	<2	(1)	(1)	(1)	(1)	(2)	(2)
	2	"T type"	"T type"	"T type"	"T type"	"T type"	"T type"
	3	"T type"	"T type"	"T type"	"T type"	"T type"	"T type"
	4	"T type"	"T type"	"T type"	"T type"	"T type"	"T type"
	6	"T type"	"T type"	"T type"	"T type"	"P type"	"P type"
	8	"P type"	"P type"	"P type"	"P type"	"P type"	"P type"
	10	"P type"	"P type"	"P type"	"P type"	"P type"	"P type"
	12	"P type"	"P type"	"P type"	"P type"	"P type"	"P type"
	14	"P type"	"P type"	"P type"	"P type"	"P type"	"P type"
	16	"P type"	"P type"	"P type"	"P type"	"P type"	"P type"
	18	"P type"	"P type"	"P type"	"P type"	"P type"	"P type"
	20	"P type"	"P type"	"P type"	"P type"	"P type"	"P type"
	22	"P type"	"P type"	"P type"	"P type"	"P type"	"P type"
	24	"P type"	"P type"	"P type"	"P type"	"P type"	"P type"

(1) These valves are generally of the floating ball type (except for actuated valves)

(2) These valves can be quoted in both trunnion and floating ball types (except for actuated valves, which have to be trunnion mounted)

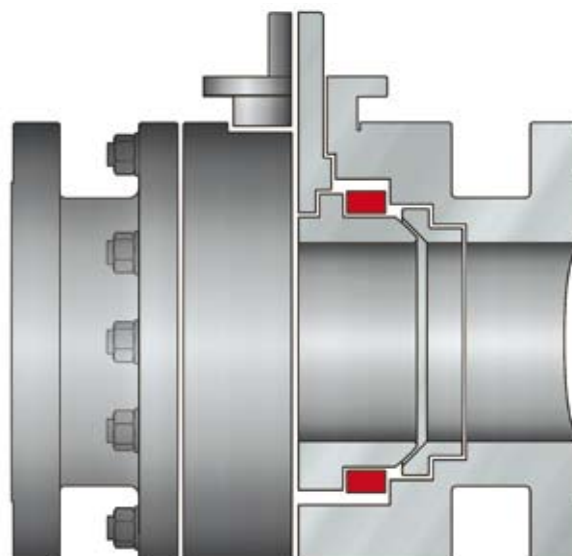
T Type

Ball with female connections & guided by two male trunnions
2 or 3-piece body



P Type

Ball fitted with male trunnions & guided by two plates
3-piece body



Depending on the size/rating, two ways exist to guide the ball: P type (plates) for bigger sizes and T type (trunnion) for the other. Depending on the service conditions, five classes can be defined, the main ones are class A, B and E.

In addition to these, class C (cryogenic) and D (high temperature) cover special (severe) applications.

Next pages show general arrangement drawings for both T and P type valves, giving the main possible feature combinations for each of the 3 main valve classes.

Obviously, for tailor-made arrangement, our highly flexible production is the best way to reach your goal.

In terms of application range (Fluid/Temperature)

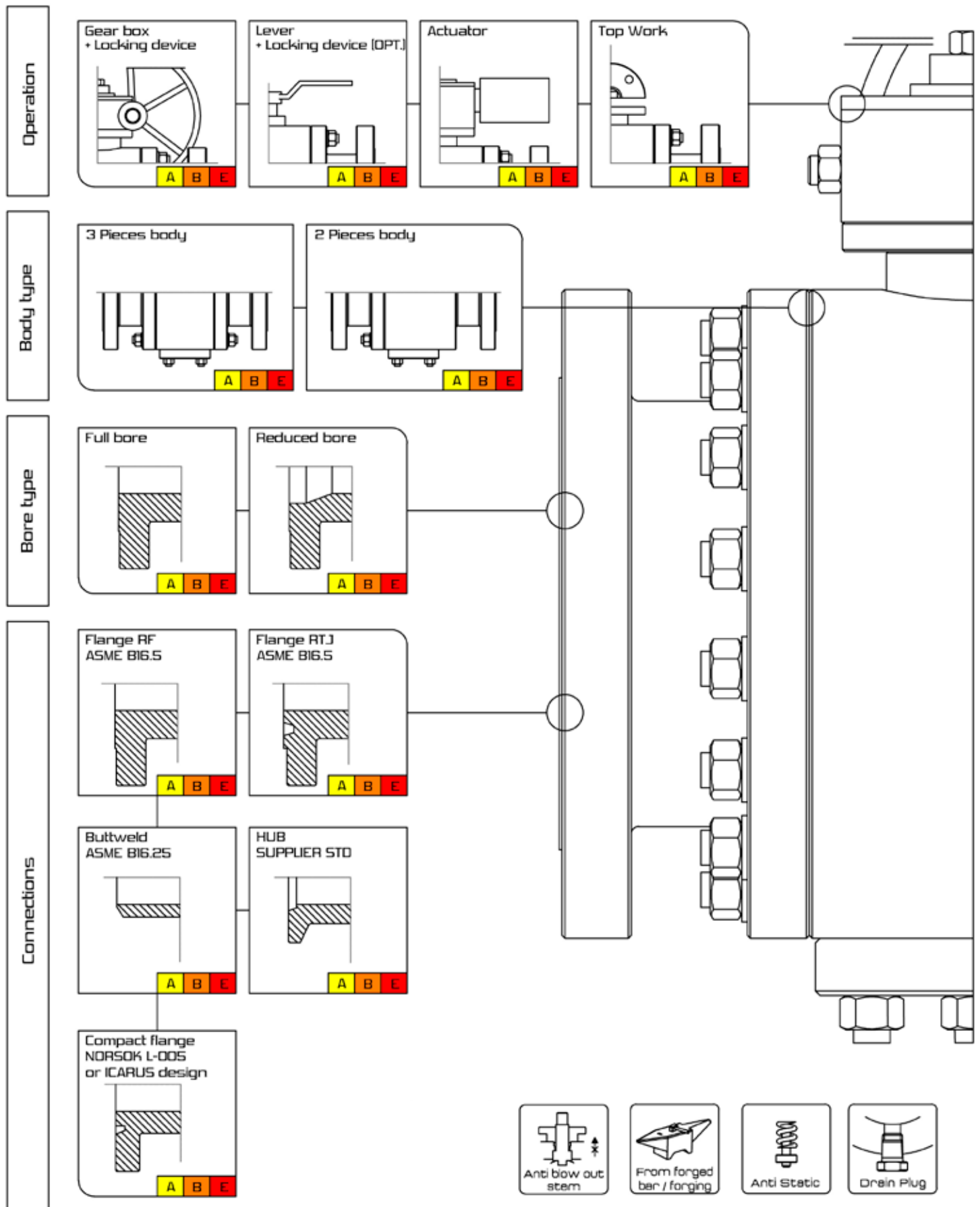
ICARUS product range cover all the service classes, depending on the size/rating:

ICARUS PRODUCT CLASS	"Class A" Utility	"Class B" Hydrocarbon General	"Class E" Hydrocarbon Critical	"Class C" Hydrocarbon Cryogenic	"Class D" Hydrocarbon High temp.
Fluids	Water Air Nitrogen Hydraulic fluids	Hydrocarbons (liquid and gas)	Hydrocarbons (liquid and gas)	Hydrocarbons (gas)	Hydrocarbons (liquid and gas)
Service	Utility or water injection	General process Production process Transport	Emergency Shut Down Valve (ESDV), Critical Motor Operated Valve (MOV) See Note 1 of table 3.1	General process (cryogenic)	General Process
Operating temperature range	Ambient $\leq$ T $\leq$ 75°C	-46°C $\leq$ T $\leq$ 200°C	-46°C $\leq$ T $\leq$ 200°C	T<-46°C	200°C<T $\leq$ 250°C
Size limit	24	24	24	On request	On request
Pressure class limit	2500	2500	2500	On request	On request
Seat design	SPE-SPE	SPE-SPE	SPE-DPE or DPE-DPE	SPE-SPE	SPE-SPE
Seat type	SOFT	SOFT or METAL	METAL	SOFT	METAL
Seat insert / Coating	TP	TP or HVOF	HVOF	TP	HVOF
Dynamic seals	ELAST	ELAST AED	ELAST AED or TP (LIP SEAL)	TP (LIP SEAL)	TP (LIP SEAL) or GRAPH
Primary Soft Static seals	ELAST	ELAST AED	ELAST AED or TP (LIP SEAL)	TP or METAL	METAL or GRAPH
Secondary Graphi- te / Metal static seals (FIRESAFE)	NA	YES	YES	YES or NA	NA
	STANDARD			ON REQUEST	

TP = Thermoplastic / ELAST = Elastomer / AED = Anti Explosive Decompression / METAL = Metallic type seal / GRAPH = graphite /HVOF = High Velocity Oxygen Fuel Tungsten Carbide Coating / SPE = Single Piston Effect / DPE = Double Piston Effect

TRUNNION MOUNTED T TYPE DESIGN

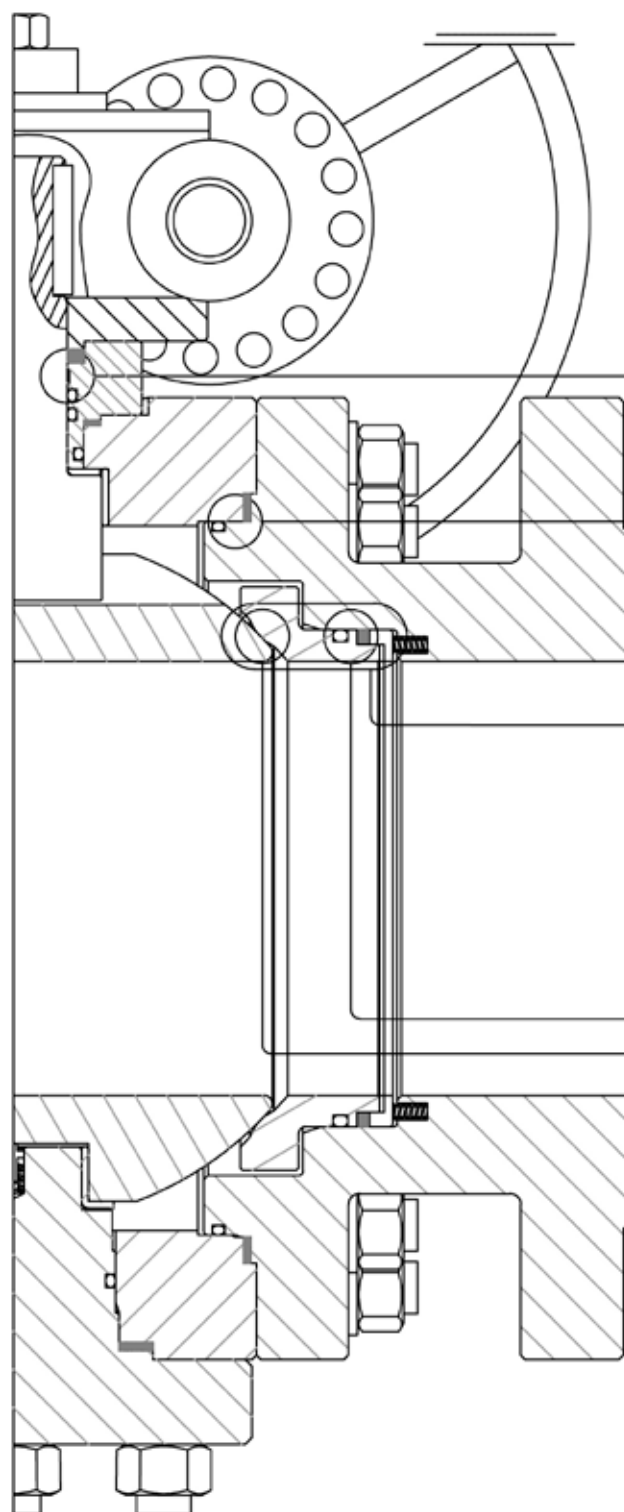
GENERAL FEATURES



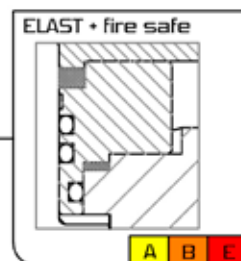
TRUNNION MOUNTED T TYPE DESIGN

■ "Class A" Utility
■ "Class B" Hydrocarbon General
■ "Class E" Hydrocarbon Critical

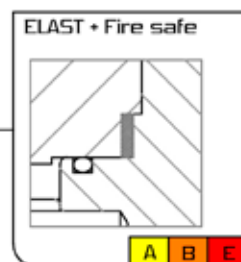
SEALING SOLUTIONS



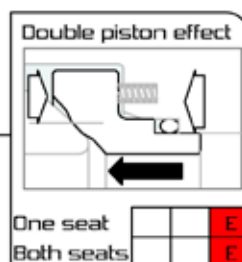
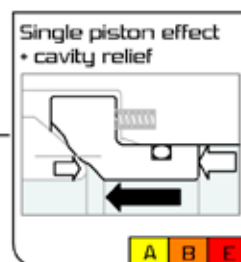
Custom arrangements are available on request !



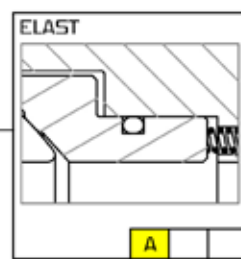
Stem seals
TRIPLE design®



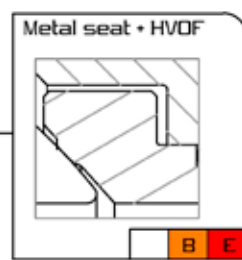
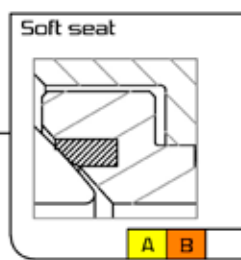
Shell seals
TWIN design®



Seat design



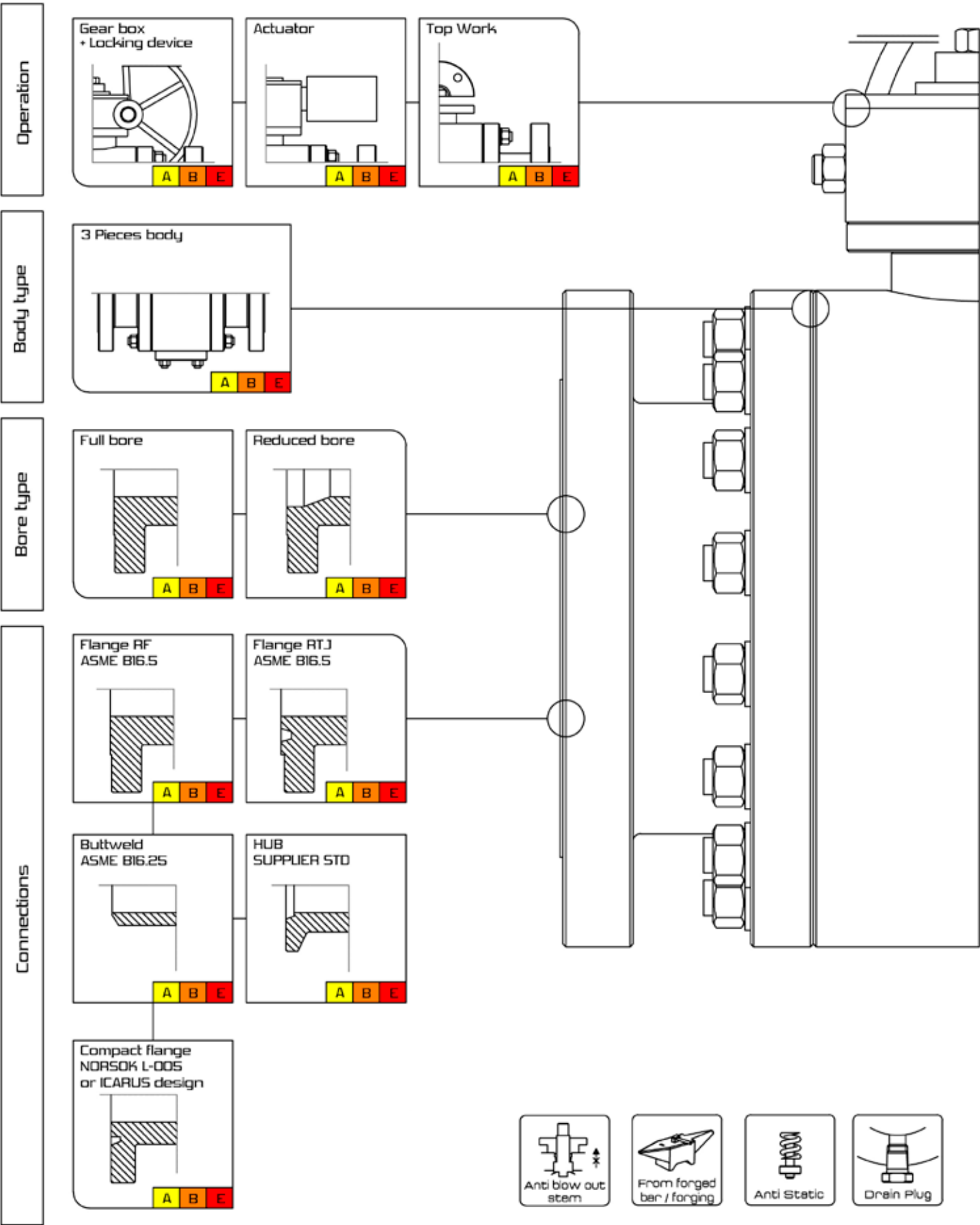
Seat back seals



Seat front seals

TRUNNION MOUNTED P TYPE DESIGN

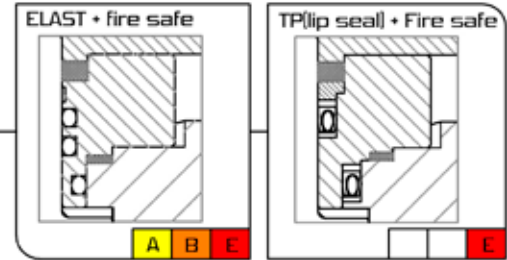
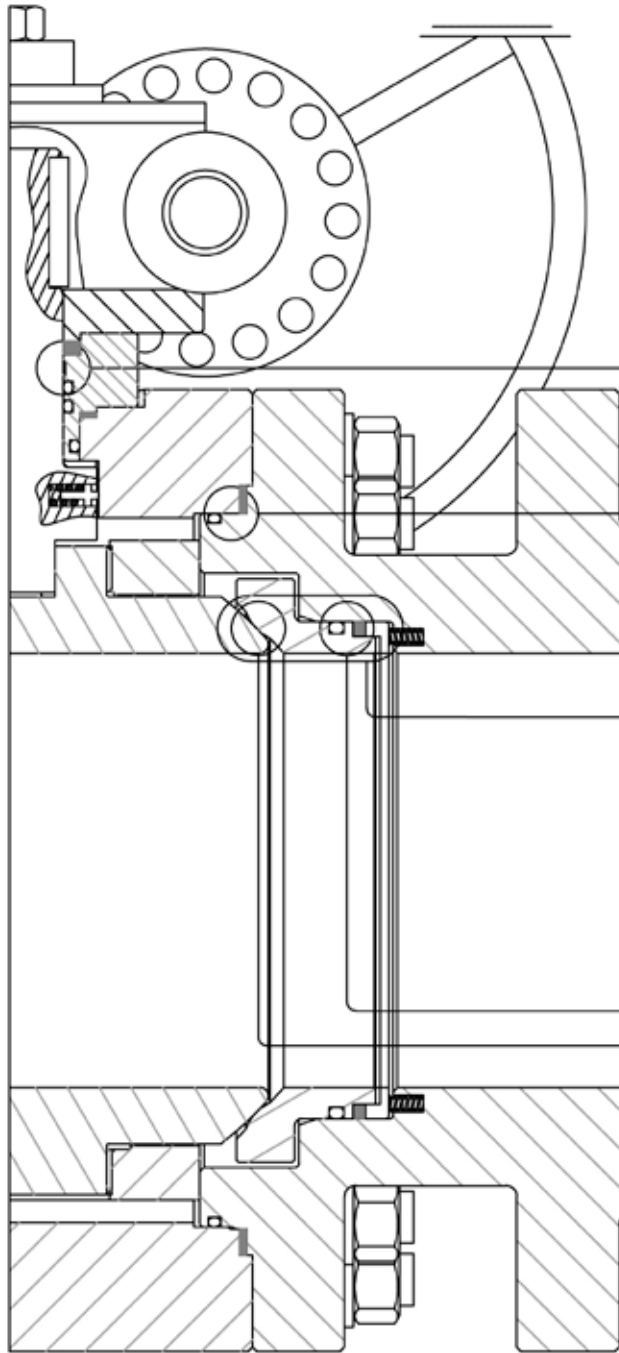
GENERAL FEATURES



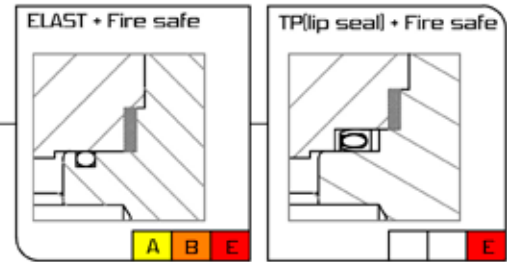
TRUNNION MOUNTED P TYPE DESIGN

■ "Class A" Utility
■ "Class B" Hydrocarbon General
■ "Class E" Hydrocarbon Critical

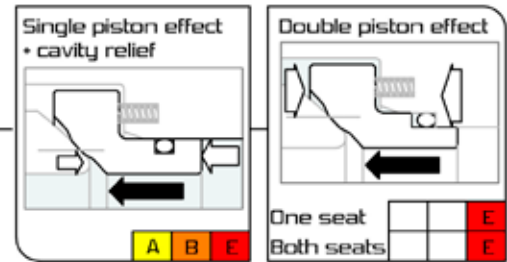
SEALING SOLUTIONS



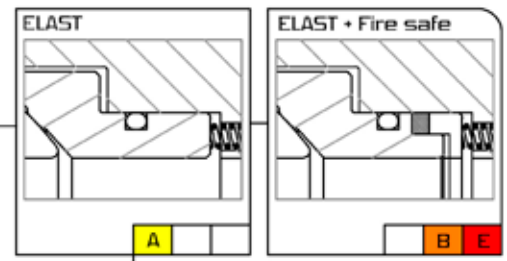
Stem seals
TRIPLE design®



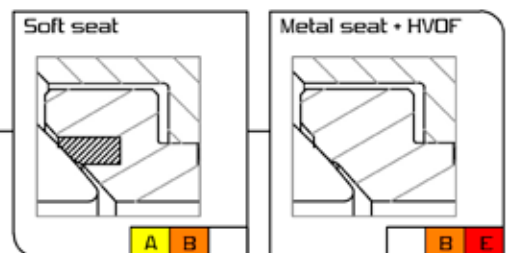
Shell seals
TWIN design®



Seat design



Seat back seals



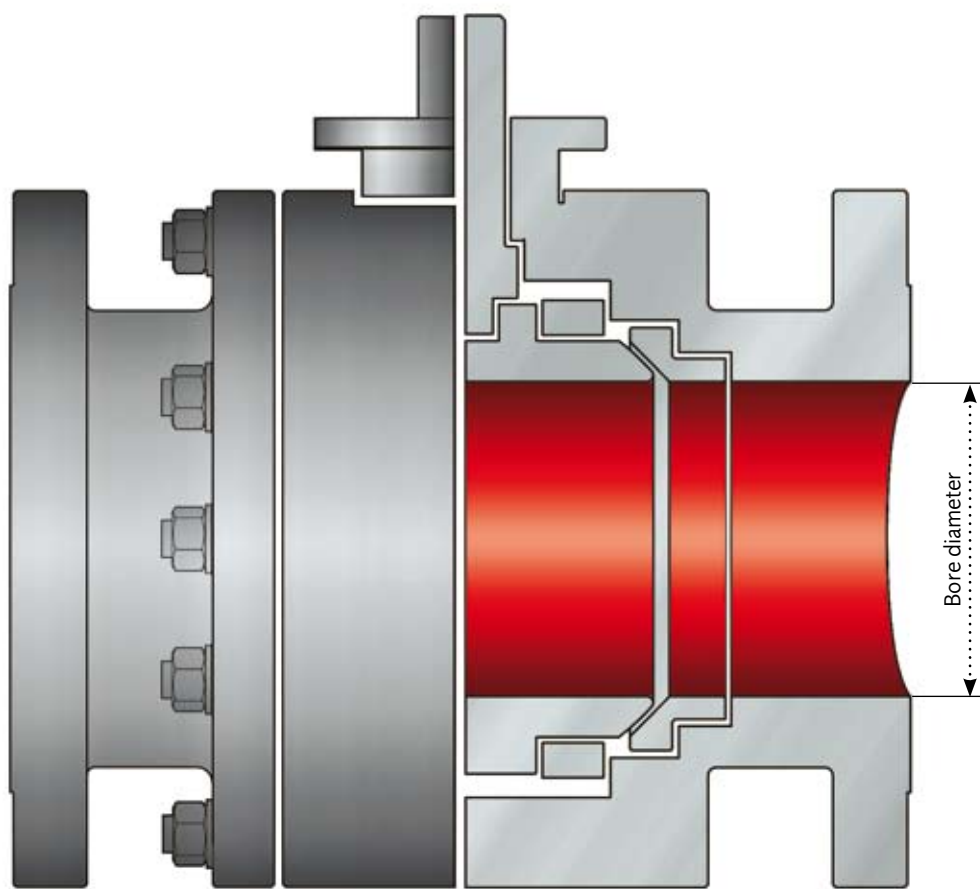
Seat front seals

Custom arrangements
are available on request.

In terms of bore type

FULL BORE VALVE

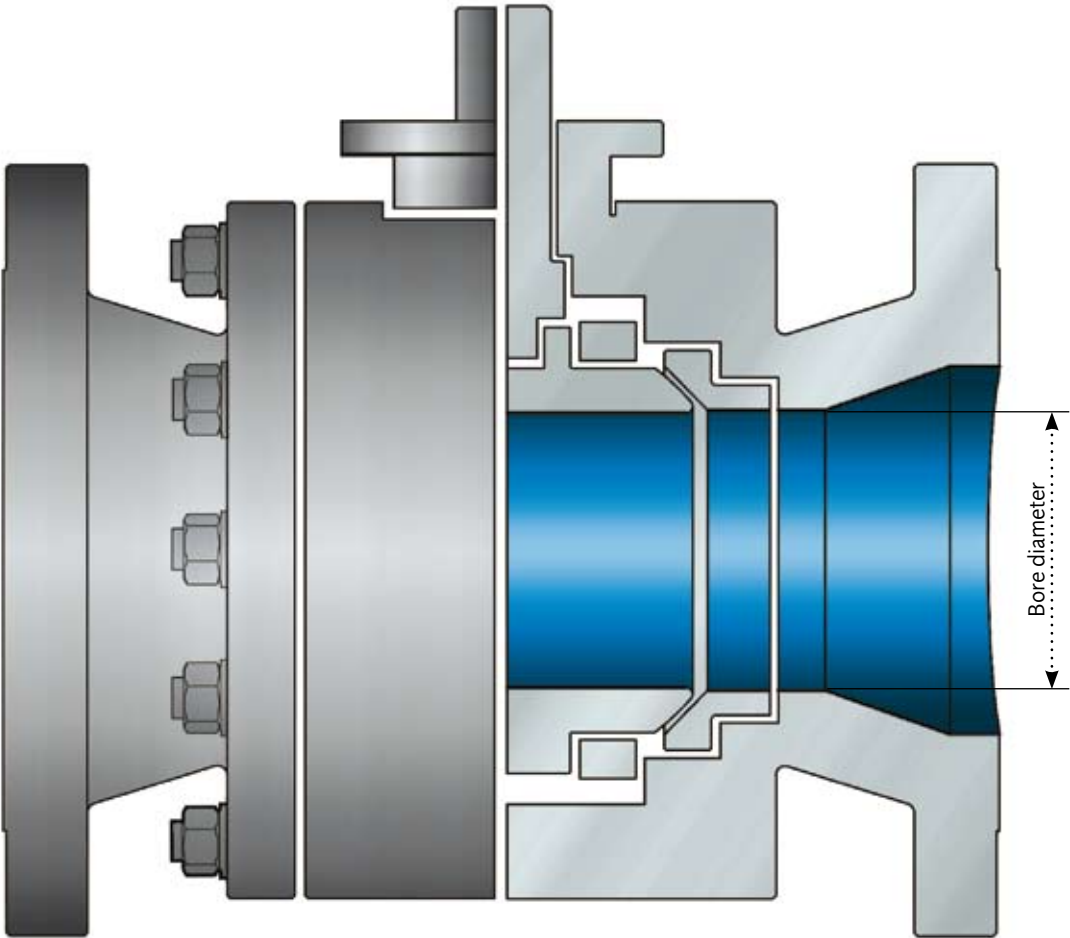
DN	NPS	BORE DIAMETER BY CLASS (mm)				
		CLASS 150 to 600	CLASS 900	CLASS 1500	CLASS 2500	TOL
50	2"	49	49	49	42	+0,5/-0
80	3"	74	74	74	62	
100	4"	100	100	100	87	
150	6"	150	150	144	131	+1/-0
200	8"	201	201	192	179	
250	10"	252	252	239	223	
300	12"	303	303	287	265	+2/-0
350	14"	334	322	315	292	
400	16"	385	373	360	333	
450	18"	436	423	406	374	
500	20"	487	471	454	419	
550	22"	538	522	500	-	
600	24"	589	570	546	-	



Bore diameter according to API 6D

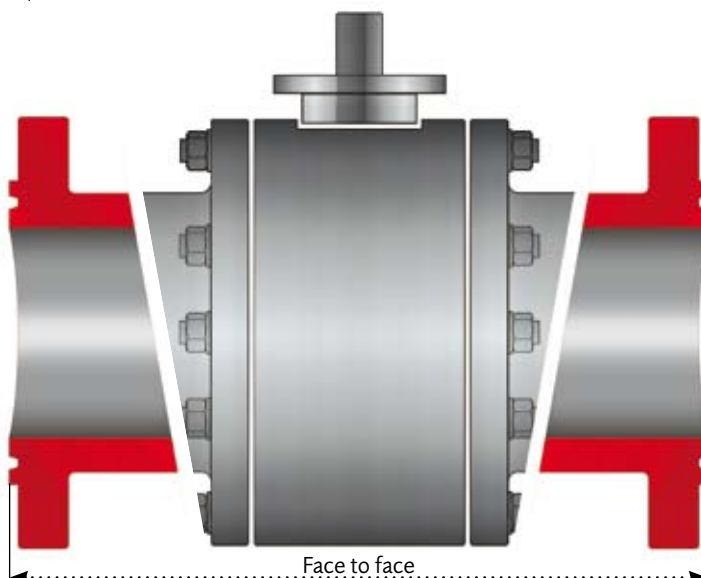
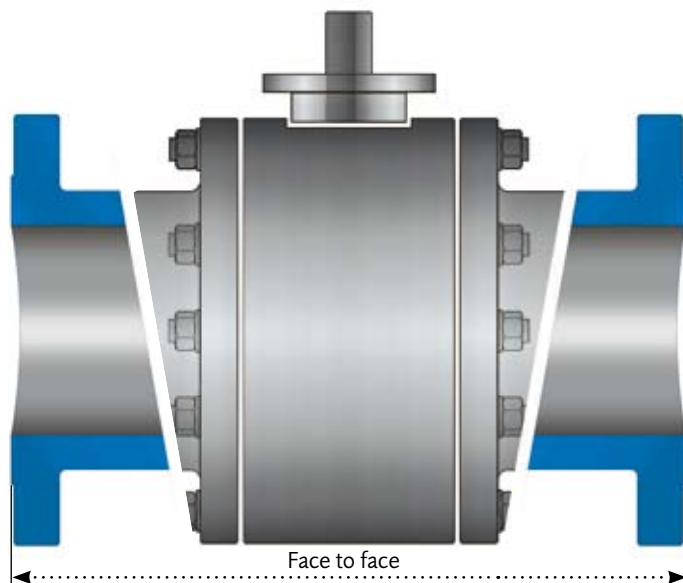
REDUCED BORE VALVE

DN	NPS	BORE DIAMETER BY CLASS (mm)				
		CLASS 150 to 600	CLASS 900	CLASS 1500	CLASS 2500	TOL
50 x 40	2" x 1 1/2"	38	38	38	38	+0,5/-0
80 x 50	3" x 2"	49	49	49	42	
100 x 80	4" x 3"	74	74	74	62	
150 x 100	6" x 4"	100	100	100	87	+1/-0
200 x 150	8" x 6"	150	150	144	131	
250 x 200	10" x 8"	201	201	192	179	
300 x 250	12" x 10"	252	252	239	223	
350 x 250	14" x 10"	252	252	239	223	+2/-0
350 x 300	14" x 12"	303	303	287	265	
400 x 300	16" x 12"	303	303	287	265	
400 x 350	16" x 14"	334	322	315	292	
450 x 400	18" x 16"	385	373	360	333	
500 x 400	20" x 16"	385	373	360	333	
500 x 450	20" x 18"	436	423	406	374	
600 x 500	24" x 20"	487	471	454	419	



In terms of end connections ⁽³⁾

NPS	DN	CLASS 150 (PN 20)					CLASS 300 (PN 50)					CLASS 600 (PN 100)				
		FACE TO FACE (mm) (1)				WEIGHT (kg) (2)	FACE TO FACE (mm) (1)				WEIGHT (kg) (2)	FACE TO FACE (mm) (1)				WEIGHT (kg) (2)
		RF FLANGES	RTJ FLANGES HUB ENDS	BW ENDS	TOL		RF FLANGES	RTJ FLANGES HUB ENDS	BW ENDS	TOL		RF FLANGES	RTJ FLANGES HUB ENDS	BW ENDS	TOL	
2"	50	178	191	178	± 2	33	216	232	216	± 2	36	292	295	292	± 2	38
3"	80	203	216	203		63	283	298	283		69	356	359	356		72
4"	100	229	241	229		101	305	321	305		105	432	435	432		128
6"	150	394	406	394		179	457	419	457		196	559	562	559		282
8"	200	457	470	457		282	502	518	502		309	660	664	660		537
10"	250	533	546	533		429	568	584	568		553	787	791	787		837
12"	300	610	622	610	± 3	618	648	664	648	± 3	810	838	841	838	± 3	1103
14"	350	686	699	686		839	762	778	762		1135	889	892	889		1415
16"	400	762	775	762		1125	838	854	838		1563	991	994	991		1681
18"	450	864	876	864		1433	914	930	914		1975	1092	1095	1092		2308
20"	500	914	927	914		1976	991	1010	991		2434	1194	1200	1194		2905
22"	550	-	-	-		2598	1092	1114	1092		3070	1295	1305	1295		3963
24"	600	1067	1080	1067		3248	1143	1165	1143		3809	1397	1407	1397		5213

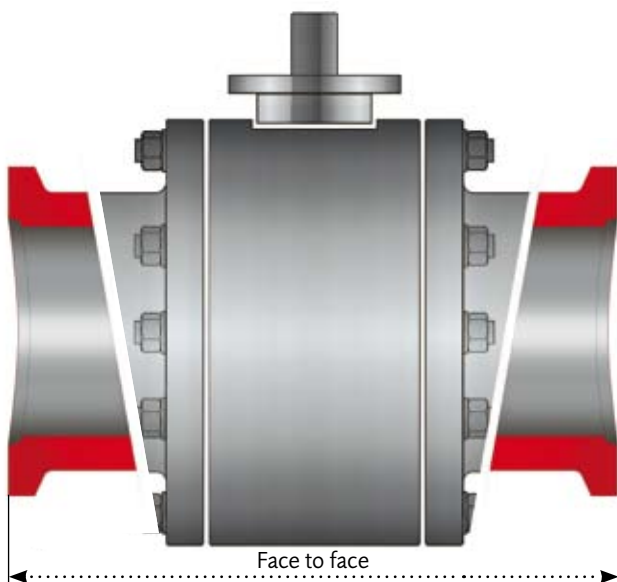
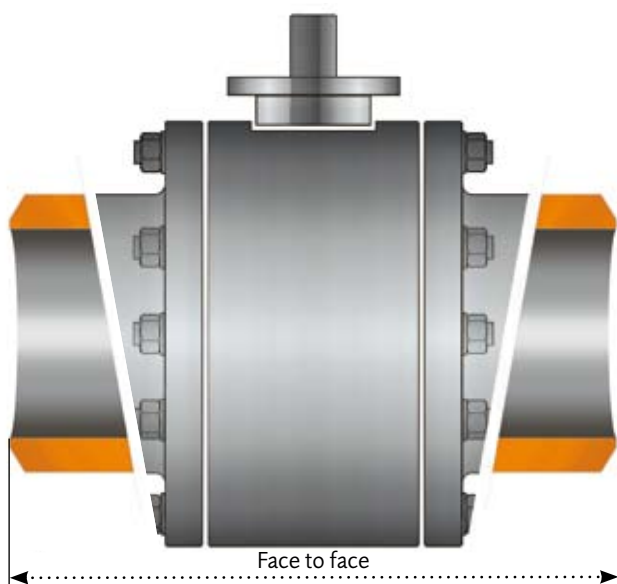


ICARUS trunnion mounted ball valves range is wide - up to 24" cl-2500.

For each valve, the face-to-face and the bore diameter are normalized (API 6D).

The following charts are aimed at providing all these information quickly together with the weight (please note that the latter can change slightly according to the chosen options).

CLASS 900 (PN 150)					CLASS 1500 (PN 250)					CLASS 2500 (PN 420)				
FACE TO FACE (mm) (1)					FACE TO FACE (mm) (1)					FACE TO FACE (mm) (1)				
RF FLANGES	RTJ FLANGES HUB ENDS	BW ENDS	TOL	WEIGHT (kg) (2)	RF FLANGES	RTJ FLANGES HUB ENDS	BW ENDS	TOL	WEIGHT (kg) (2)	RF FLANGES	RTJ FLANGES HUB ENDS	BW ENDS	TOL	WEIGHT (kg) (2)
368	371	368	± 2	56	368	371	368	± 2	58	451	454	451	± 2	100
381	384	381		97	470	473	470		110	578	584	578		209
457	460	457		163	546	549	546		221	673	683	673		421
610	613	610		399	705	711	705		531	914	927	914		850
737	740	737		641	832	841	832		905	1022	1038	1022		1496
838	841	838		1114	991	1000	991		1653	1270	1292	1270		2313
965	968	965	± 3	1664	1130	1146	1130	± 3	2478	1422	1445	1422	± 3	3534
1029	1038	1029		1928	1257	1276	1257		3138	-	-	-		-
1130	1140	1130		2368	1384	1407	1384		4480	-	-	-		-
1219	1232	1219		3105	1537	1559	-		6818	-	-	-		-
1321	1334	1321		4623	1664	1686	-		9986	-	-	-		-
-	-	-		-	-	-	-		-	-	-	-		-
1549	1568	1549		7483	-	1972	-		15711	-	-	-		-



- (1) These "face-to-face" dimensions are standard. Non-standard dimensions are available on request.
- (2) Calculated figures for a RF flanged and full bore valve. The real weight should be slightly different. For reduced bore valve, please decrease these figures by 15%.
- (3) These types of ends are standard. Other connection types are available on request.



TOP QUALITY MATERIAL SOURCING

- Small & reliable supplier network
- European origin only
- Material according to - ASTM
 - NORSOK M630*
 - TOTAL specifications*

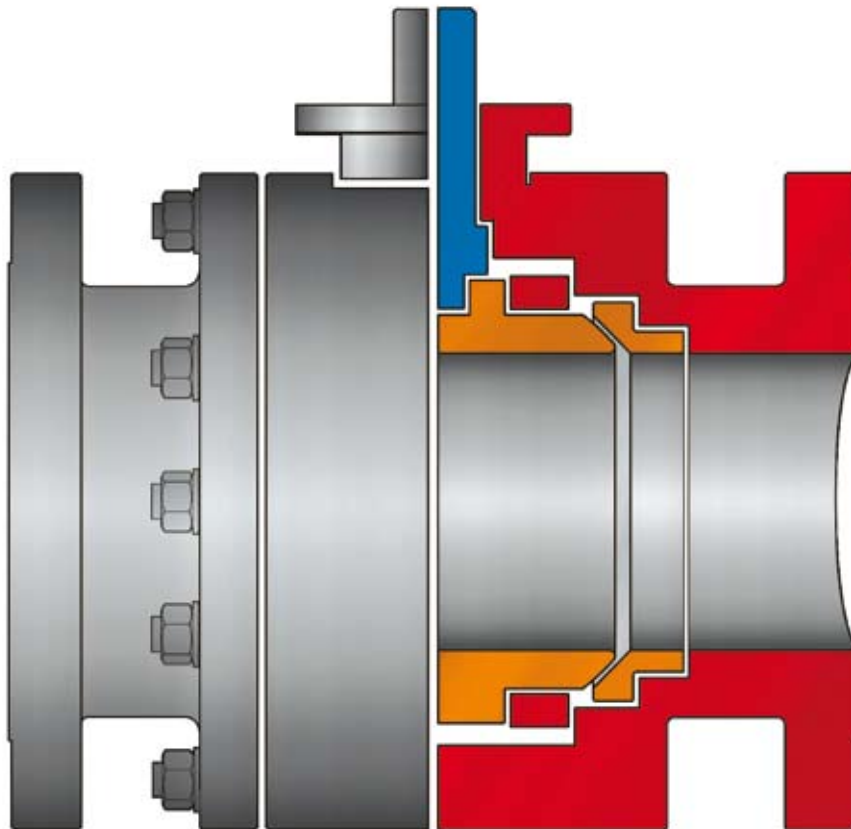
*When applicable

ICARUS trunnion mounted ball valves are also available in a wide range of materials. The main combinations are given above.

In terms of material

	BODY	BALL / SEATS	STEM
Carbon Steel	ASTM A105N, A350 LF2	A182 F6a, AISI 410	17-4PH, UNS S17400
Low Alloy Steel	A694 F65	A182 F6a, AISI 410	A479 XM19 (Nitronic 50)
	A182 F11, F22, F91		
	AISI 4130, 4140		
Austenitic Stainless Steel	ASTM A182 F316	ASTM A182 F316	ASTM A276 316, 321
	ASTM A182 F321	ASTM A182 F321	
	A182 F44 (6Mo)	A182 F44	UNS S31254
Duplex Stainless Steel	ASTM A182 F51	ASTM A182 F51	UNS S31803
	ASTM A182 F53 / F55	ASTM A182 F53 / F55	UNS S32750 / S32760
Nickel Alloy	ALLOY 625 (B564)	ALLOY 625 (B564)	ALLOY 718 (B637)
	ALLOY 825 (B564)	ALLOY 825 (B564)	ALLOY 825 (B425)
	ALLOY 400 UNS N04400	ALLOY 400 UNS N04400	ALLOY K-500

Note: Above materials are listed because they are widely used. Any other material including DIN & AISI are available on request.





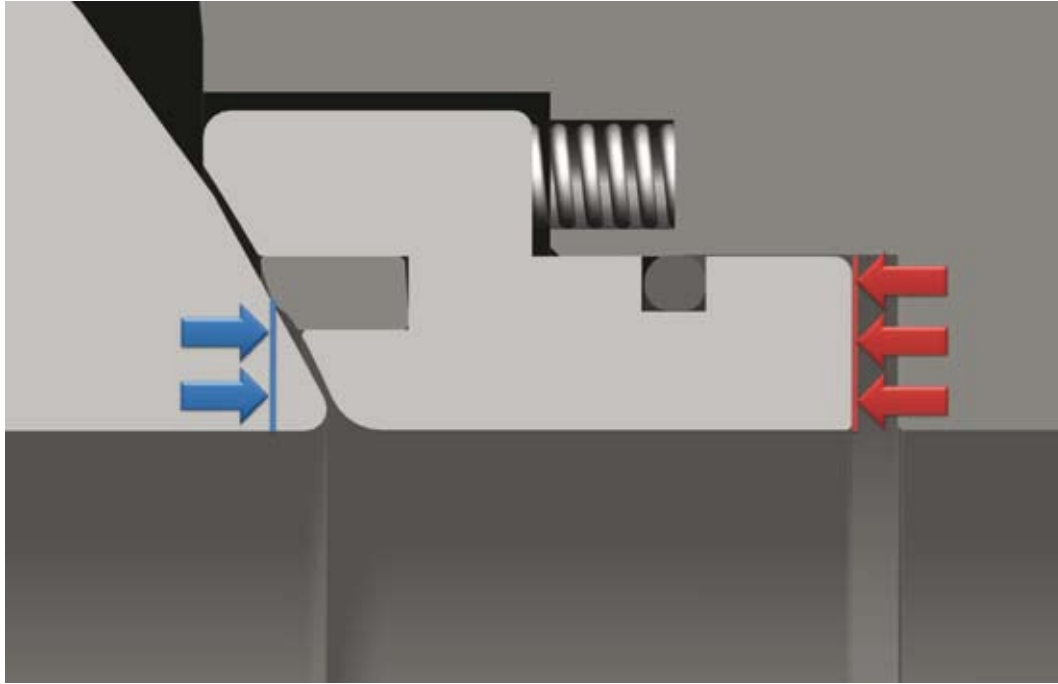
Ball & seats... or the heart of the valve. Aimed at providing a reliable leak-proof shut off of the valve, their design is critical.

Based on its wide experience, ICARUS has developed several seats arrangement based on different sealing solutions: from a soft single piston effect seat equipped with o-rings to a metal double piston effect seat coated with tungsten carbide and fitted with lip seals.

seat arrangement

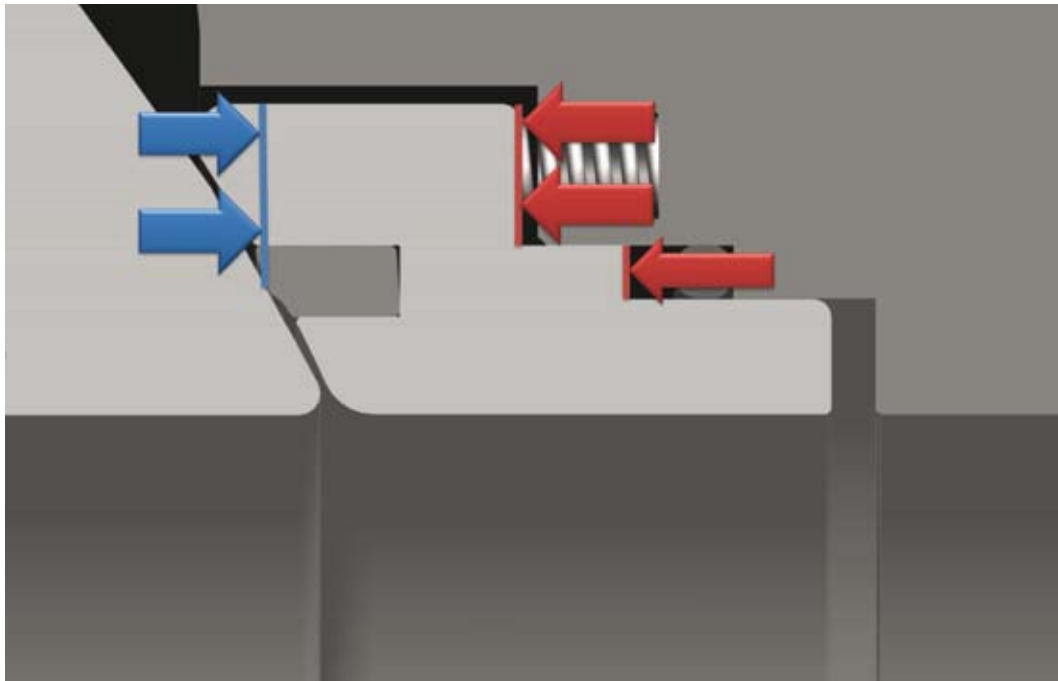
Single-Piston effect (SPE) vs Double-Piston effect (DPE)

The seat designs can be divided into two groups: Single-piston effect (SPE) and double-piston effect (DPE).



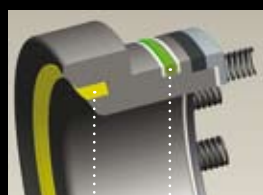
Single-piston effect (SPE)

This seat type can ensure a tight contact with the ball in only one direction. Indeed, when the line (and therefore the valve) is under pressure (normal direction), the seat is pushed toward the ball. This is due to the fact that the red arrow (pressure effect on the back of the seat) is bigger than the blue one (pressure effect on the front of the seat) - what is called the piston effect!



Double-piston effect (DPE)

This seat type is able to provide a tight contact with the ball in the normal direction (as explained above), and also in the reverse direction. In the picture (reverse direction case), the red arrow (pressure effect on the back of the seat) is bigger than the blue one (pressure effect on the front of the seat) even if now, it is the body cavity which is under pressure. The resultant force on the seat pushes it against the ball. This design is used in severe applications, in order to provide a second leakage barrier downstream as well as upstream.



SOFT SEAT INSERT

SEAT name	DRAWING	MAIN FEATURES	ICARUS PRODUCT CLASS
SS-10		FRONT SEAL: Soft seat insert BACK SEAL: O-ring TYPE: Single piston effect	A STANDARD
SS-11		FRONT SEAL: Soft seat insert BACK SEAL: O-ring + graphite TYPE: Single piston effect	B AT CHOICE
SD-11		FRONT SEAL: Soft seat insert BACK SEAL: O-ring + graphite TYPE: Double piston effect	B AT CHOICE
SS-21		FRONT SEAL: Soft seat insert BACK SEAL: Lip seal + graphite TYPE: Single piston effect	(B) OPTIONAL
SD-21		FRONT SEAL: Soft seat insert BACK SEAL: Lip seal + graphite TYPE: Double piston effect	(B) OPTIONAL

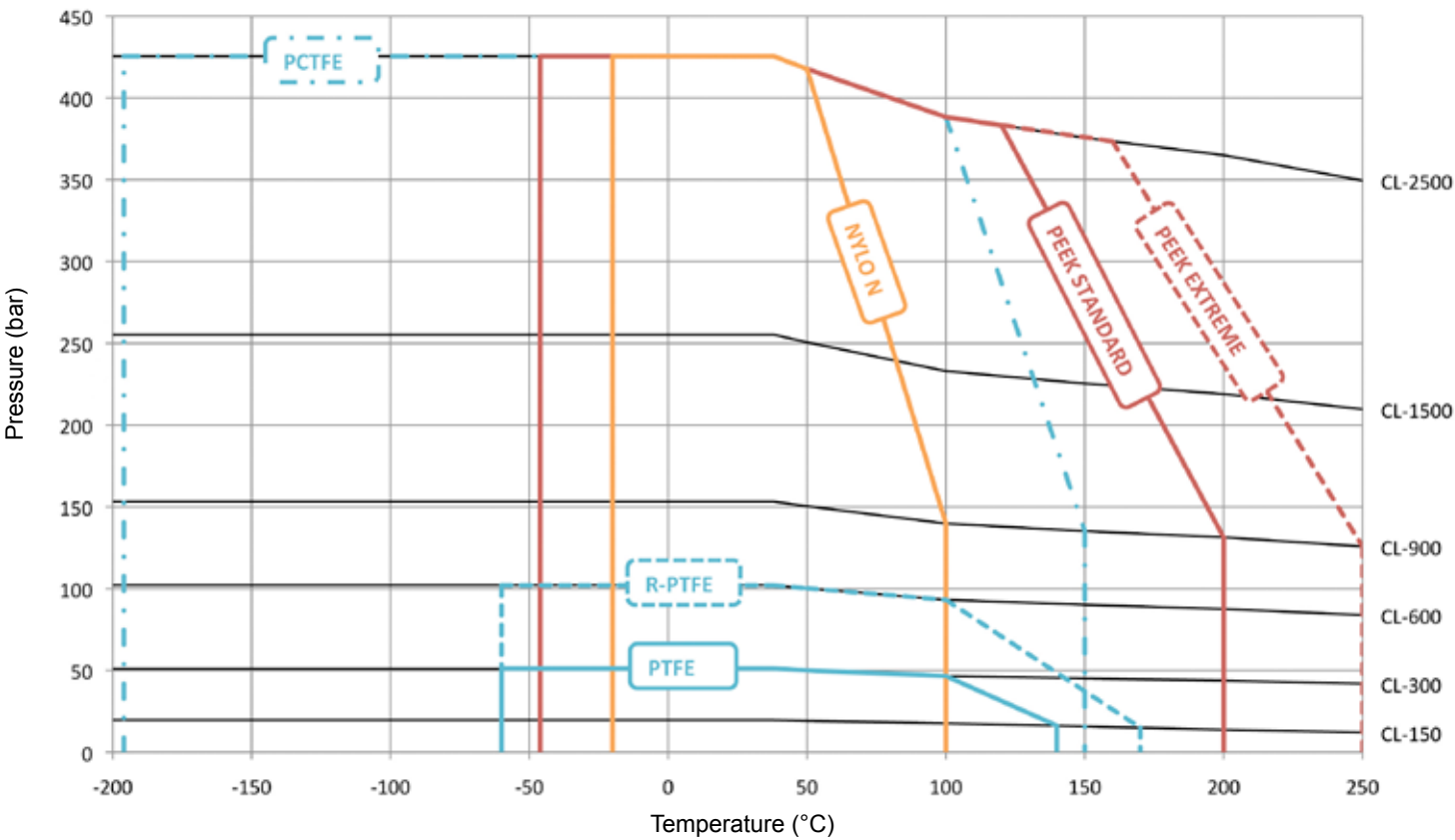
For both SPE and DPE seats, several sealing solutions are available for both front and back seals ⁽¹⁾. This table also shows the association between each design and the valve class(es).

METAL TO METAL

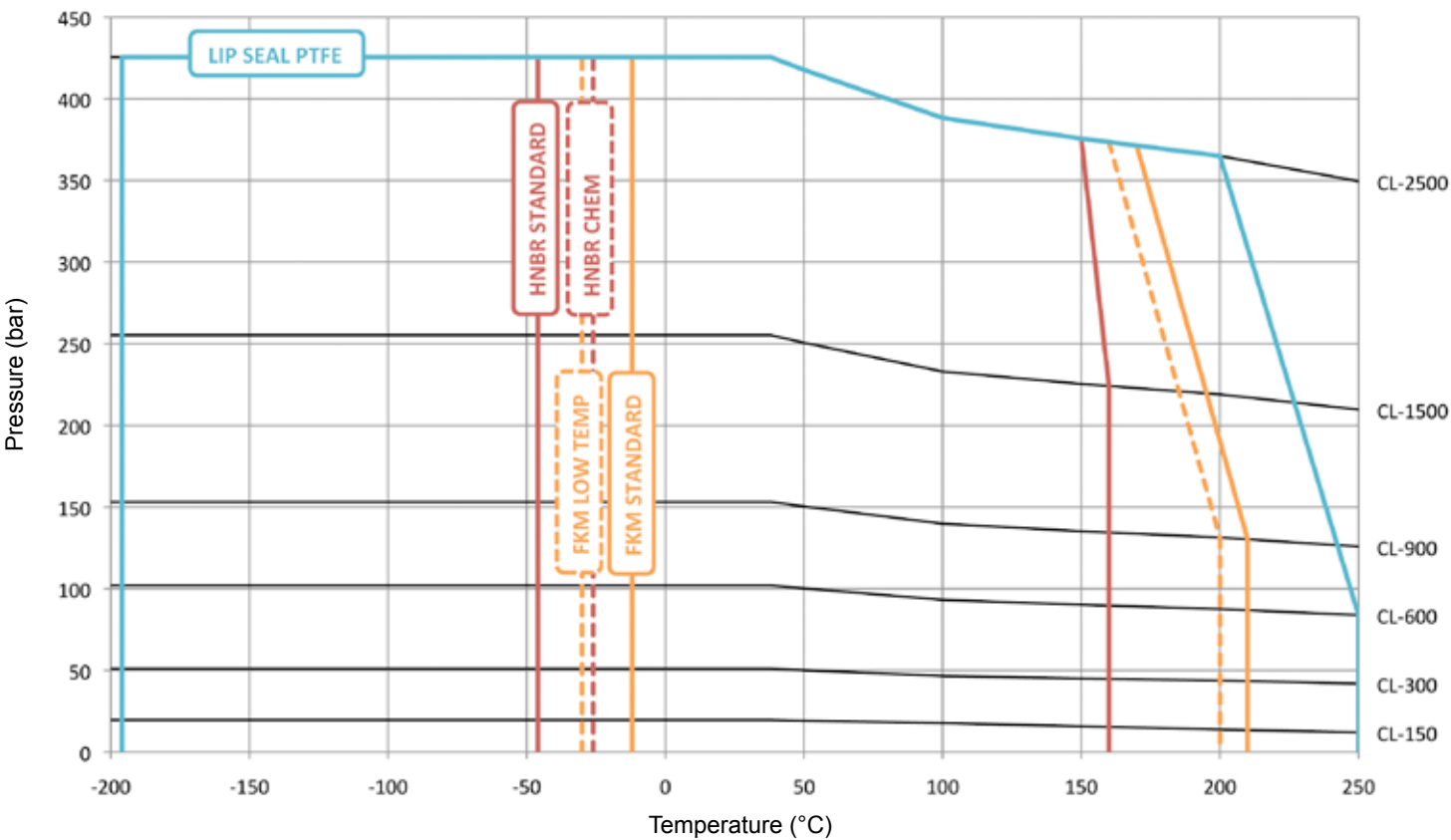
SEAT name	DRAWING	MAIN FEATURES	ICARUS PRODUCT CLASS
MS-11		FRONT SEAL: Metal to metal / Hardfacing BACK SEAL: O-ring + graphite TYPE: Single piston effect	(B) OPTIONAL
			(E) STANDARD
MD-11		FRONT SEAL: Metal to metal / Hardfacing BACK SEAL: O-ring + graphite TYPE: Double piston effect	(B) OPTIONAL
			(E) OPTIONAL
MS-21		FRONT SEAL: Metal to metal / Hardfacing BACK SEAL: Lip seal + graphite TYPE: Single piston effect	(B) OPTIONAL
			OPTIONAL
MD-21		FRONT SEAL: Metal to metal / Hardfacing BACK SEAL: Lip seal + graphite TYPE: Double piston effect	(B) OPTIONAL
			OPTIONAL

(1) Other seat arrangements can be supplied on request, especially for cryogenic (C class) and high temperature (D class) applications.

Seat front seal (insert) material:
pressure-temperature chart



Seat back seal material:
pressure-temperature chart

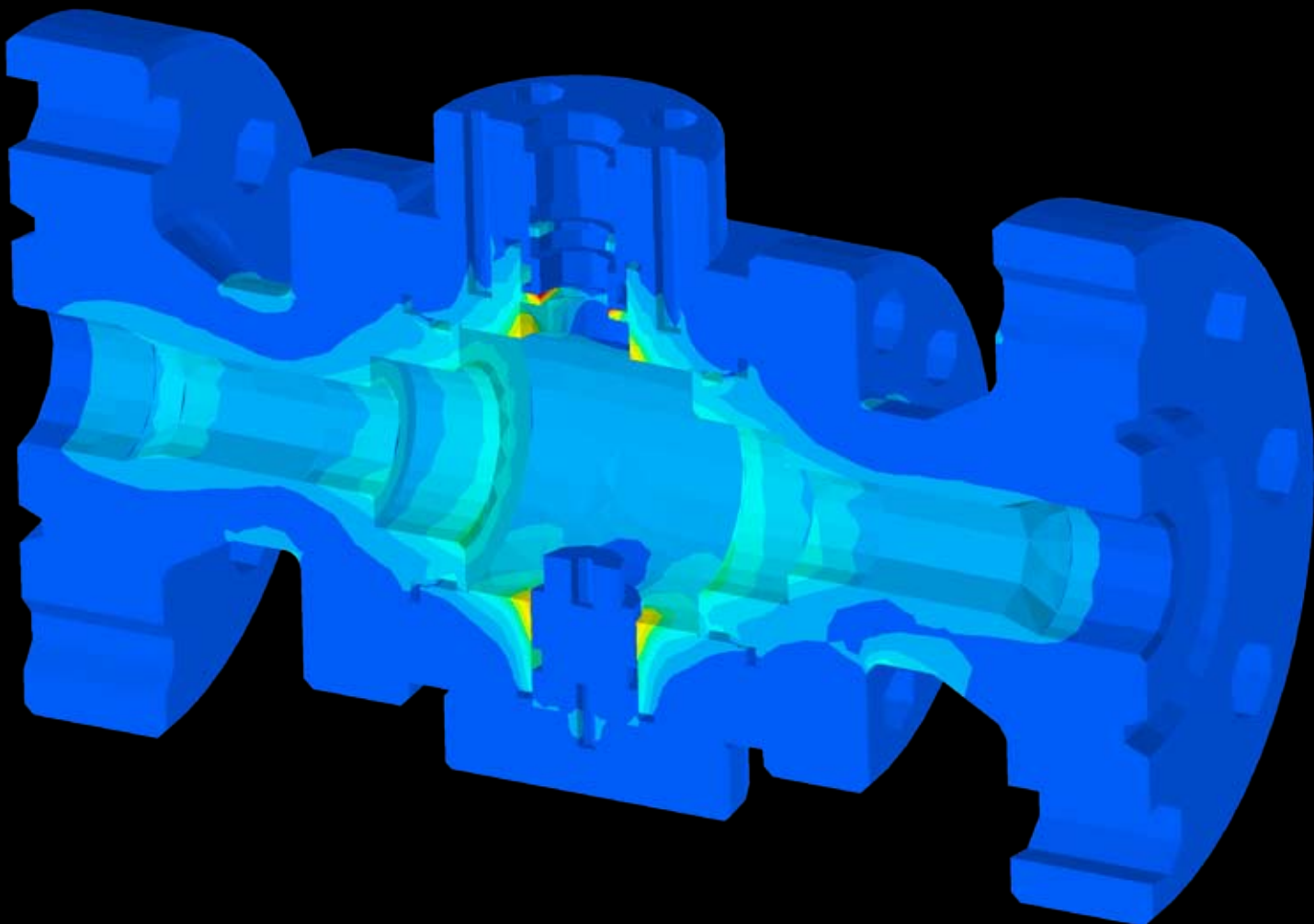




The seals materials or coatings used for the couple ball/seats have limited utilization range in terms of pressure and temperature. The table below and the associated charts are a guide for choosing the seals materials.

Please note that for each material type, several grades do exist, which means that the utilization range may be slightly different to the one given here. Moreover, special grades developed for very specific conditions can be provided if needed.

		F=FRONT B=BACK	TEMPERATURE		SIZE LIMIT	PRESSURE LIMIT
			Min (°C)	Max (°C)	ND	CLASS
THERMOPLASTIC	PTFE	F	-60	140	12"	300
	RPTFE	F	-60	170	24"	600
	NYLON	F	-20	100	24"	2500
	PEEK STD	F	-46	200	24"	2500
	PEEK EXT	F	-46	250	24"	2500
	PCTFE	F	-196	150	24"	2500
	PTFE	B - Lip seal	-60	140	NA	2500
ELASTOMER	HNBR STD	B - Oring	-46	160	NA	2500
	HNBR CHEM	B - Oring	-26	160	NA	2500
	FKM STD	B - Oring	-12	210	NA	2500
	FKM LT	B - Oring	-30	200	NA	2500
COATINGS METAL TO METAL CONTACT	HVOF WC	F	-196	450	24"	2500



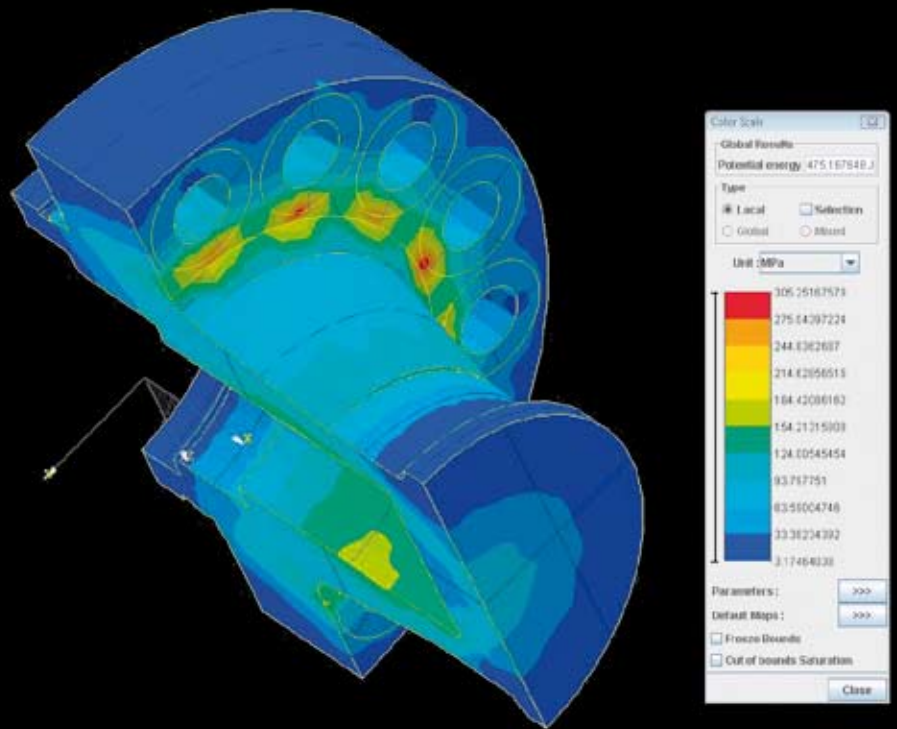
ICARUS TRUNNION MOUNTED BALL VALVE design is optimized thanks to:

- A multidisciplinary design office, allowing reaching an efficient & reliable design.
- Up-to-date CAD (Computer Aided Design) software, that provides all the possibilities of 3D design.
- Suitable validation by means of:
 - Stem mechanical strength calculation
 - Bolting sizing and mounting torque calculation based on ASME B16.34 and on our own spreadsheet
 - Shell design assessment by means of verification of the wall thickness (based on ASME B16.34)
 - Use of FEA (Finite Element Analysis) to validate the design of the most critical parts: shell, seat to ball contact...

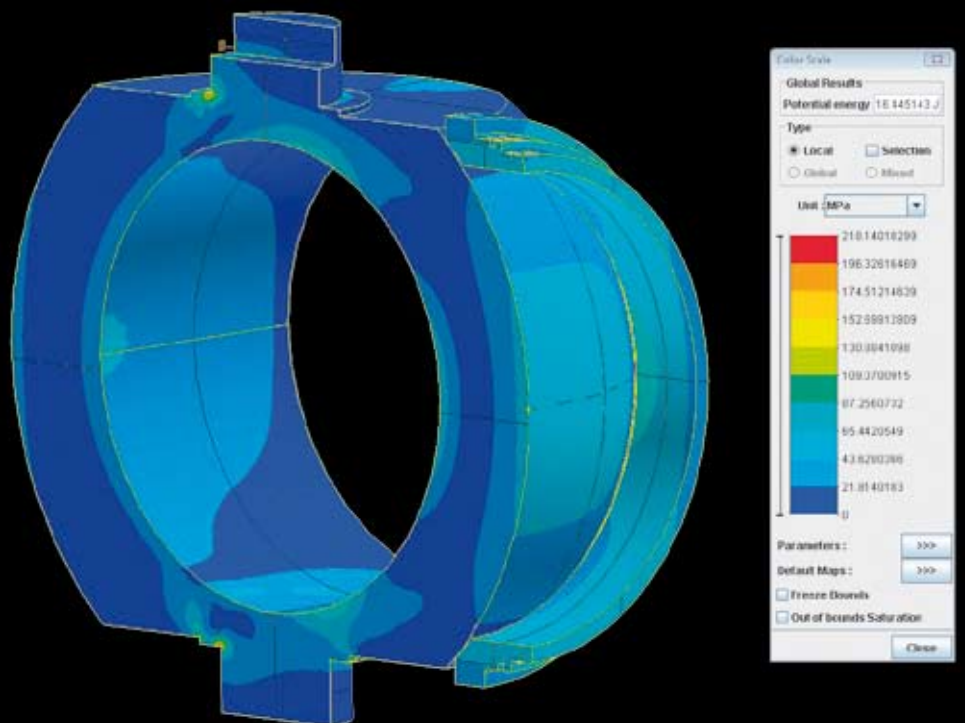
To do this, ICARUS owns several licenses for SAMCEF FIELD from SAMTECH, for linear and non-linear calculations.

design tools

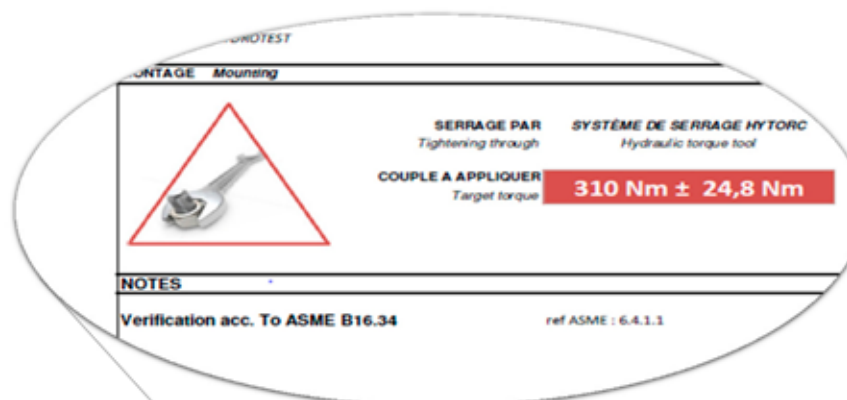
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Stress distribution in the side cover of an 8IN CL2500 TM BALL (half model).



Ball and seat analysis (stress) to improve the contact area design and to ensure that both parts are suitable to undergo the test pressure and associated loads (half model). Moreover, it can be proven that the tightness will be reached.





At all stages of the production process, the quality control is a very important activity which fulfills two main objectives: quality and reliability.

To achieve this goal, ICARUS can count on highly qualified quality controllers skilled in performing dimensional checks, non-destructive examination and also pressure testing (water and gas).

quality control & testing

.ICARUS



1 2



We have certified controllers, equipment and necessary experience to undertake performance testing:

- Non-destructive test: Dye Penetrant Examination DPE (picture 3), Magnetic Particles Examination MPE (picture 6), Ultra-Sound US and Radiography (Rx)
- Chemical check: Ferrite Testing FT, Positive Material Identification PMI (picture 7)
- Destructive test: Corrosion, resilience, traction, hardness
- Pressure testing: hydrotesting (pictures 4-5), pneumatic testing and high gas pressure testing in a dedicated bunker (pictures 1-2).
- Pressure testing in extreme conditions: cryogenic testing, high temperature testing

5



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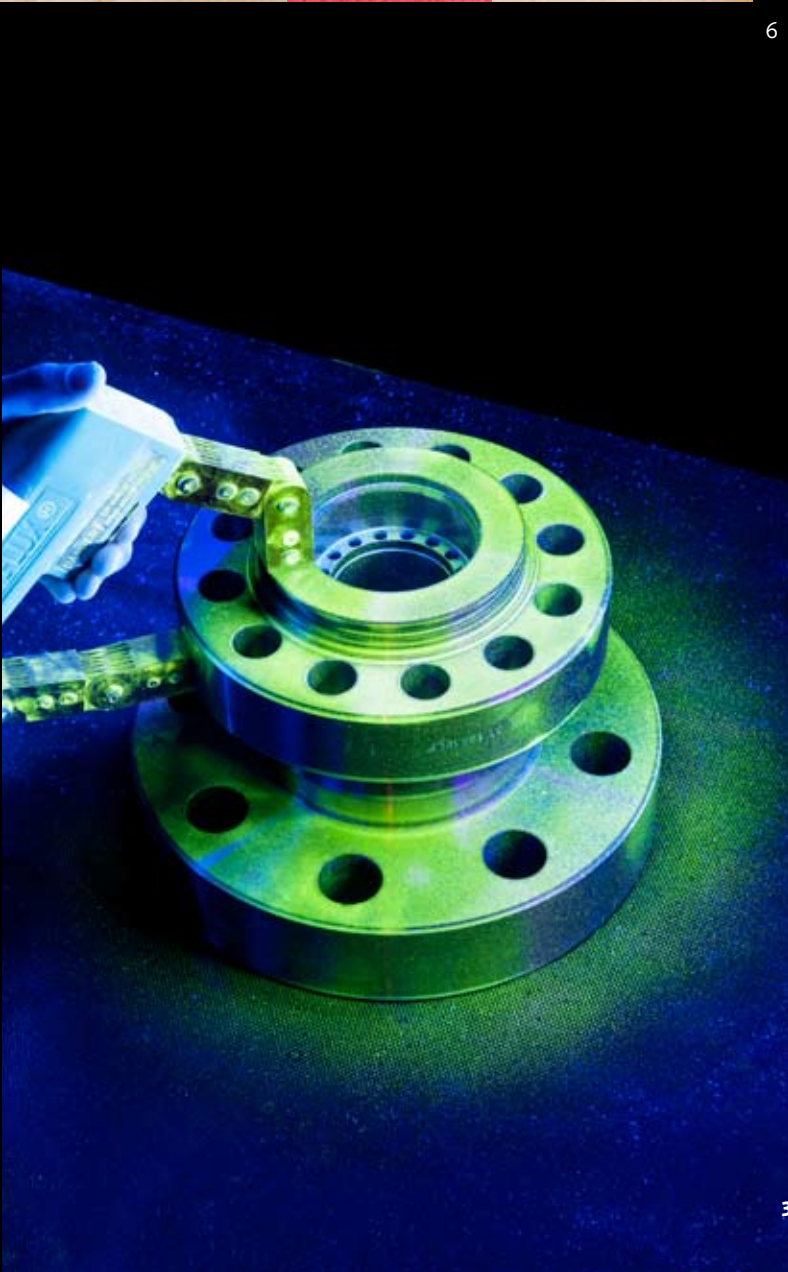
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Our ongoing aim to achieve excellence is evident through our Quality management system, which is supported by triple certification (ISO 9001 / ISO 14001 / OHSAS 18001).

In addition to this, we are also PED certified and therefore entitled to sell our valves on the European market.

With our concern for quality, safety and respect of the environment, we ensure compliance with the HSE restrictions of our clients.

Our trunnion mounted ball valves are designed to meet fire safety standards (API 607-ISO 10497, API 6FA) requirements.

Furthermore, this has been certified based on fire resistance testing.



Some references

YEAR (DELIVERED)	CUSTOMER	END USER	PROJECT	DESTINATION	VALVE TYPES	TYPE OF SEATS	SIZE RANGE	CLASS RANGE	BODY MATERIALS
2012	AMEC	Blue water		UK	Trunnion & Floating	Soft & Metal Seats	3/4" to 12"	150 - 300	LF2 / SS 316 / F51
2012	Hyundai Heavy Industries Co LTD	Rasgas	Barzan	Qatar	Trunnion & Floating	Soft Seats	1/2" to 4-1/16"	150-5000psi	Alloy 825 & 625
2012	Ahlsell	Statoil	Seal-oil system Oseberg	Norway	3-Way	Metal Seats	2"	2500	LF2
2012	Total E&P Qatar	Total E&P Qatar	DP2 (Pig Launcher)	Qatar	Trunnion	Soft Seats	20"	1500	A105
2012	Total Nigeria	Total Nigeria	Amenam	Nigeria	Trunnion	Soft Seats	6"	2500	F51
2011	Reinertsen	Statoil	Manifold Extension on Grane platform	Norway	Trunnion	Metal / Double piston effect	3"	1500	CS+overlay / SS316
2011	PFF	GDF Suez E&P Netherland	Replacement unknown project	Netherland	3-Way	Soft Seats	12" & 18"	150	LF2
2011	SVS / Amec	Apache	Forties Alpha shutdown	UK	Double Block & Bleed	Metal Seats	3"	150	F51
2010	Total E&P Angola	Total E&P Angola	Gas export project : Girassol & Dalia topsides modifications	Angola	Trunnion	Soft Seats	3/4" to 12"	300 - 2500	Alloy 625 / LF2 / SS 316
2010	Reinertsen	Statoil	Grane platform: project for well cleaning	Norway	Trunnion	Metal Seats	6"	600	F51
2010	Ahlsell	Statoil	Seal-oil system Oseberg	Norway	3-Way	Metal Seats	2"	2500	LF2
2006-09	Mc Dermott	Rasgas	Rasgas expansion project phase	Qatar	Trunnion	Soft & Metal Seats	1/2" to 2"	2500 -5000	CS / SS / Alloy 825
2009	BP Angola	BP Angola	Block 18	Angola	Trunnion	Soft Seats	12"	1500	F51
2008	Total Congo	Total Congo	Nkossa	Congo	Trunnion	Soft Seats	3/4" to 10"	300 - 600	LF3 / 316Mo / LF2
2008	SVS	Petrofac	Don develop-ment detail design-northern producer	UK	Double Block & Bleed	Soft Seats	6"	150	CS / SS / Alloy 825
2008	SVS	Petrofac	Don develop-ment detail design-northern producer	UK	Double Block & Bleed	Soft Seats	8"	300	LF2
2008	SVS	Sakhalin Technical Services Network	Sakhalin 1 project phase 1	Russia	Trunnion	Soft Seats	1" to 2"	2500	SS 316
2008	SVS	Sakhalin Technical Services Network	Sakhalin 1 project phase 1	Russia	Trunnion	Actuated	8"	2500	LF2
2008	AVS	Wood Group	Apache	Egypt	Trunnion	Metal Seats	10"	300	F51
2007	Saipem	Total Congo	Awa Paloukou + Appoint gas	Congo	Trunnion	Soft Seats	2" to 12"	150 - 600	CS
2007	Norsk Hydro	Statoil	Seal-oil system Oseberg	Norway	3-Way	Metal Seats	2"	2500	LF2
2006	Aberdeen trader			UK	Trunnion	Soft Seats	3/4" to 18"	150	F53
2006	Aberdeen trader			UK	Trunnion	Soft Seats	8"	2500	F51
2005	Norway trader			Norway	Trunnion	Soft Seats	16"	150	SS 316
2005	Norway trader			Norway	Trunnion	Soft Seats	8"	2500	LF2
2004	SVS		Water injection Project c/o A&P Tyne Ltd Waggon Way Hebburn	UK	Double Block & Bleed	Soft Seats	3/4" & 1"	2500	F51



Parc industriel des Hauts Sarts, zone 3
Rue des Alouettes, 100
4040 Herstal
Belgique

Telephone : + 32.(0)4.240.01.01
Fax : + 32.(0)4.240.06.40
info@icarus-be.com
www.icarus-be.com

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