OPW® Fluid Transfer Group Europe B.V.
A DOVER™ COMPANY

Epsilon™

DRY DISCONNECT PRODUCTS

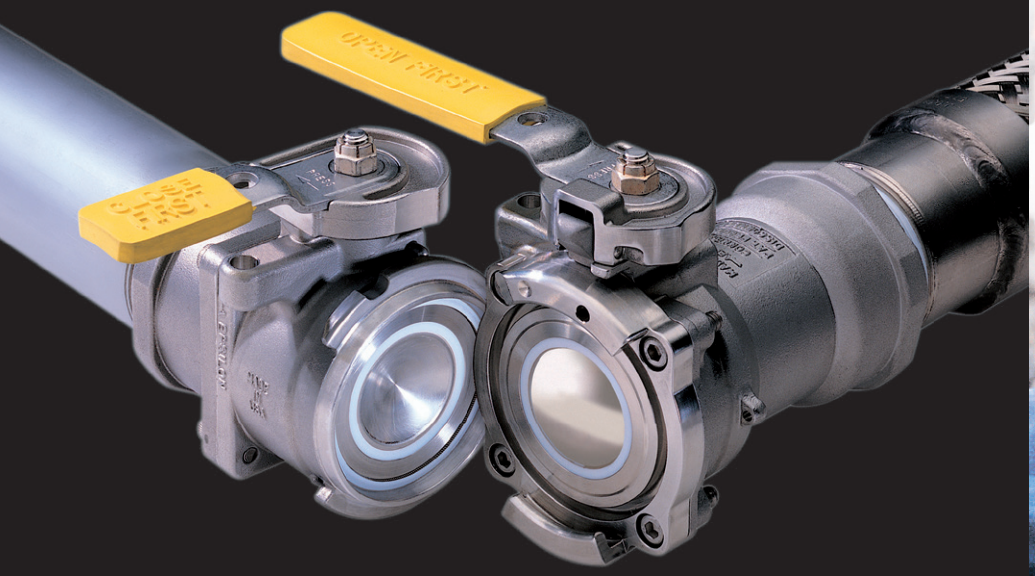
The Epsilon ™ coupling

The EPSILON™ coupling system is designed to prevent chemical spills and reduce fugitive emissions of volatile organic compounds (VOCs), particularly in the process facility and during transfer to and from truck tanks and railroad tank cars. During in-plant chemical transfers, EPSILON™ Chemical Containment System will provide your plant with process flexibility while also improving operator safety and enhancing environmental compliance and reducing overall capital expenditures and operating costs.

EPSILON™ is a low-spill coupling, based on a double-ball-valve system integrating a sophisticated safety design in sizes of 1", 2" and 3". The design is constructed to handle a pressure of 30 Bar for 1" and 2" sizes and 25 for the 3" size and temperature up to 240°C and is available with end connections complying to DIN and ANSI standards.

All wetted materials are stainless steel with TFM or PFA seals. Hastelloy® is also available for use with more aggressive fluids.

Beyond the common advantages of a ball-valve design, EPSILON™ provides for flow through an unrestricted flowpath and double shut-off reliability in the coupling connection.



Features and Benefits

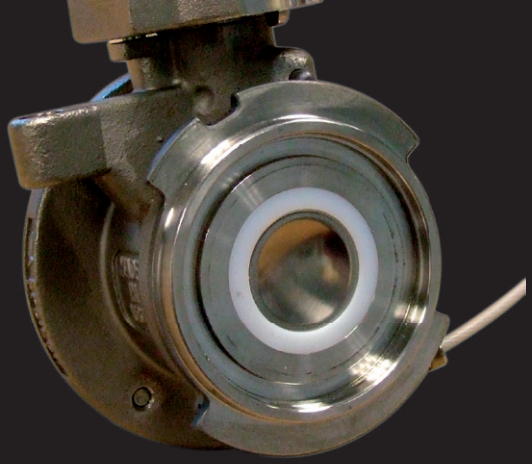
- **Spring-energized** TFM or PFA U-cup sealing
- **Male and female lug** and flange connection interfaces
- **Independent** and multi-level safety interlocks
- **Polyethylene dust cap** or Stainless Steel pressure cap
- Available in $^{3}/_{4}$", 1", $1^{1}/_{2}$", 2" and 3"
- Available in Stainless Steel and Hastelloy®
- **FDA-compliant** seal materials
- **Dry Disconnect Reliability** – low spill face seal reduces amount of loss upon disconnect.
- **Enhanced Environmental Compliance** – Positive shut-off of coupling halves eliminates line contamination and accidental release of potentially hazardous fluids into the environment during connection and disconnection.
- **Full Flow** – Straight-through flow path provides unrestricted flow in either direction, minimizing pressure drop.
- **Unparalleled Safety** – Multiple safety interlocks eliminate unintentional spills and catastrophic chemical releases that threaten worker safety and the environment.
- **Prevents Cross-Contamination** – Keyed couplings mechanically lock out and isolate transfer lines.

Specifications

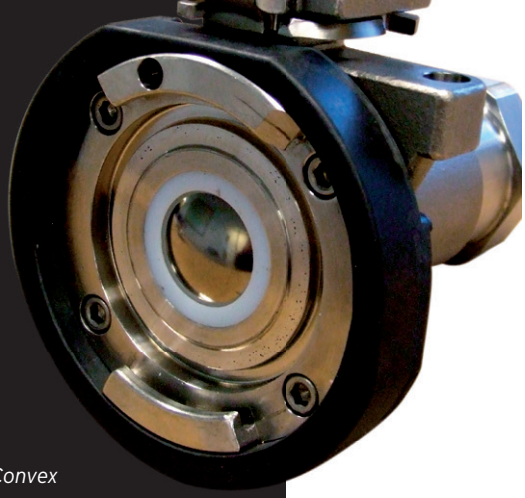
SAFETY:
EPSILON™ coupling is equipped with safety interlocks, which force the valves to open and close only with a deliberate action, preventing accidental opening of the valve.

ENVIRONMENT:
EPSILON™ is a low spill system, specified to less than 1 ml spillage for the 2" coupling (2000 cycles test average 0.6 ml) and less than 0.7 ml for the 1" coupling.

MAINTENANCE:
EPSILON™ was not only engineered for easy operations, but also for quick replacement of the transfer seal without any lockout. No special tools are required for replacement of seals.



Concave



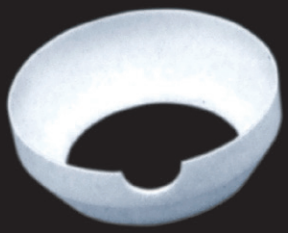
Convex

Spring-Energized and Spring-Loaded Teflon® U-Cup Sealing

A spring-energized stem and face and flange seal provide initial sealing. The spring supplies all the load required for sealing when the media pressure is too low to fully actuate the lips of the seal. Testing confirms the ultra-low spillage and emission specifications are still achieved after 2,000 cycles.

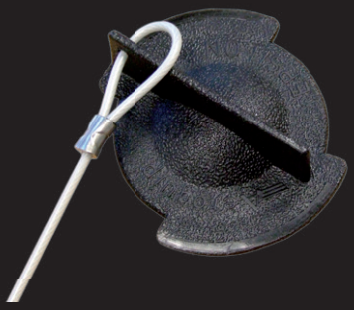
Ultra Low Spill Face Seal

This seal reduces the amount of spillage at disconnect to .2 cc. This seal is not pressure assisted and should only be used for applications lower than 100 psi.



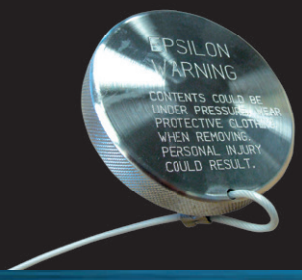
Cavity Filled

Designed to reduce the possibility of contamination by entrapment of process fluid in the void normally found behind the ball and the valve body. Ideal for applications where cross-contamination and cleanliness is a concern. Back side of the valve balls are bored for efficient cleaning.



Polyethylene Dust Cap

Used to protect the ball from damage and debris when coupling is closed and disconnected.



Stainless Steel Pressure Cap

Used to increase the level of safety when coupling is closed, disconnected and under operating pressure.

Male and Female Lug and Flange Connection Interfaces

Ramped lug and flange interfaces are first aligned and then connected with a push, followed by a quarter (90°) turn. This "instant" connection method is done by hand without tools in order to create compression on the critical interface seal.

Concave/Convex Full-Flow Shut-Off Valve

A convex ball nests in a concave ball to virtually eliminate any cavity between the mating halves. The positive shut- off ball valves, and the absence of a cavity between them, minimize chemical loss when the coupling is disconnected. Each half is an independently operated, positive shut-off ball valve that is controlled by manually rotating the valve handles. The straight-through EPSILON™ valve design also provides unrestricted, high flow in either direction and low pressure drop. All metal wetted components are 316 stainless steel or Hastelloy®.

Independent and Redundant Safety Interlocks

EPSILON™ technology involves five independent and redundant mechanical interlocks. They require deliberate sequential action by users, thereby eliminating unintentional spills and catastrophic chemical releases that threaten worker safety and the environment.

Transportation Coupling System (TCS)

Specially designed for railcar, truck, isotainer or tote equipment used in transporting chemicals safely. Contact us for more information.

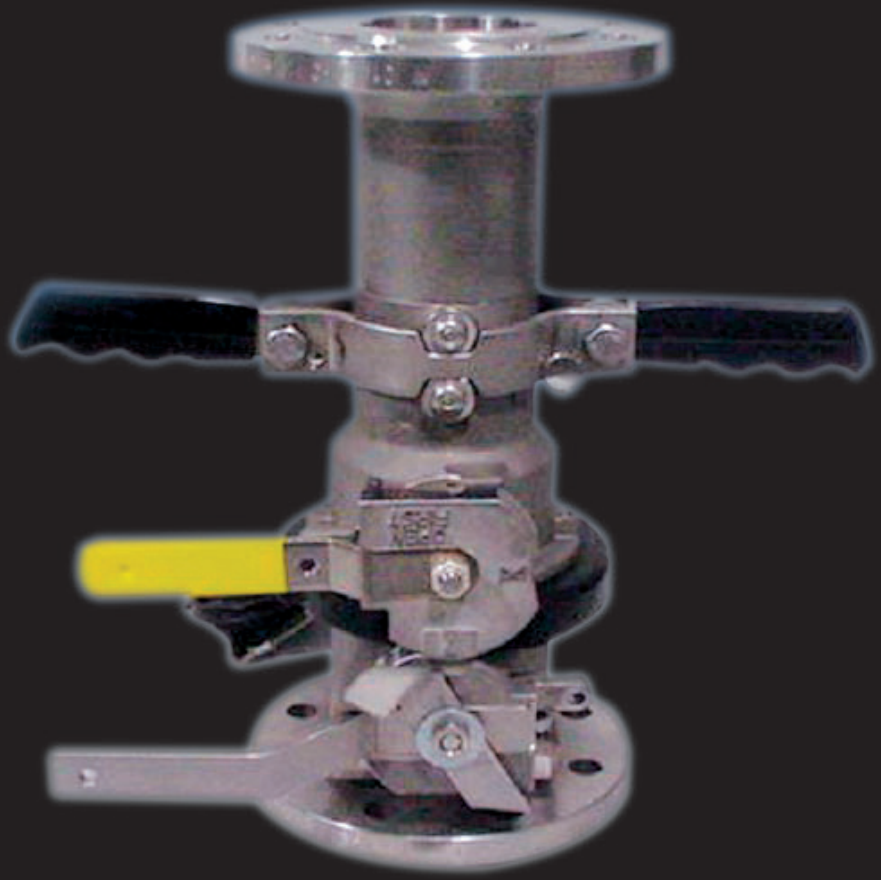
Keyed Couplings

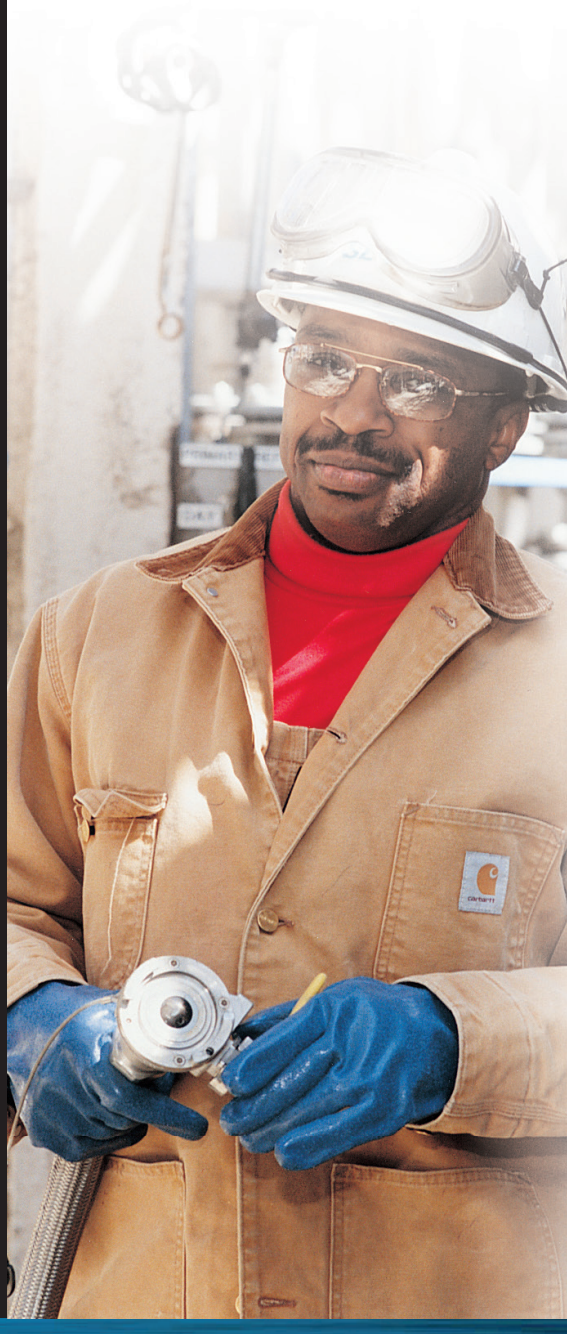
For extremely critical operations, EPSILON™ offers the unique Keyed interface which locks out and isolates transfer lines, preventing cross-contamination.

Designed for Maintainability

OPW Engineered Systems' EPSILON™ designs allows for easy maintenance. Seals, stems and bearings can be replaced easily to keep the connections performing like new.

WARNING: Due to the variety of chemicals that these couplings may be used to transfer, the user is responsible to verify the compatibility of the coupling body and the seal materials with the chemical being conveyed





General specifications

Wetted components are available in either 316 Stainless Steel or Hastelloy®. Spring Energized and Spring Loaded Teflon® TFM or PFA U-Cup Seals. Each U-Cup Seal is energized with a Hastelloy C276 Slant Coiled Spring to provide initial sealing, including reverse pressure (each coupling is rated to full vacuum). With the U-Cup design, load is increased on the sealing surface as internal pressure increases.

TFM

Next generation PTFE with best combination of temperature ranging from -30°C/-22°F to 230°C/450°F, sealing, and sliding characteristics.

PFA

Best chemical compatibility, best sealing characteristics (zero fugitive emissions at operator exposable distance*). Will operate in temperatures ranging from -30°C/-22°F to 120°C /250°F.
*Below limit of analytical detection.

Performance Characteristics

Valve Size	Spillage	Maximum Emissions	Flow Rate L/MIN (GPM)	C_v	Max Working Pressure bar (psi)	Weight - kg (lbs) Adapter	Weight - KG (LBS) Coupler	Min	Temp = °C (F)Max PFA	Temp = °C (F) Max TFM
1-inch	<0.7 ml	<25 ppm	189 (50)	42	30 (435)	1.2 (2.7)	1.4 (3.0)	-30°C (-22°F)	120 (250)	230 (450)
2-inch	<0.8 ml	<25 ppm	568 (150)	160	30 (435)	1.8 (4.0)	2.7 (6.0)	-30°C (-22°F)	120 (250)	230 (450)
3-inch	<2 ml	<25 ppm	1135 (300)	240	25 (360)	7.3 (16.0)	8.6 (19.0)	-30°C (-22°F)	120 (250)	230 (450)

The features of the EPSILON™dry disconnect coupling are extensive. Chart 1 below provides the specifics of these features.

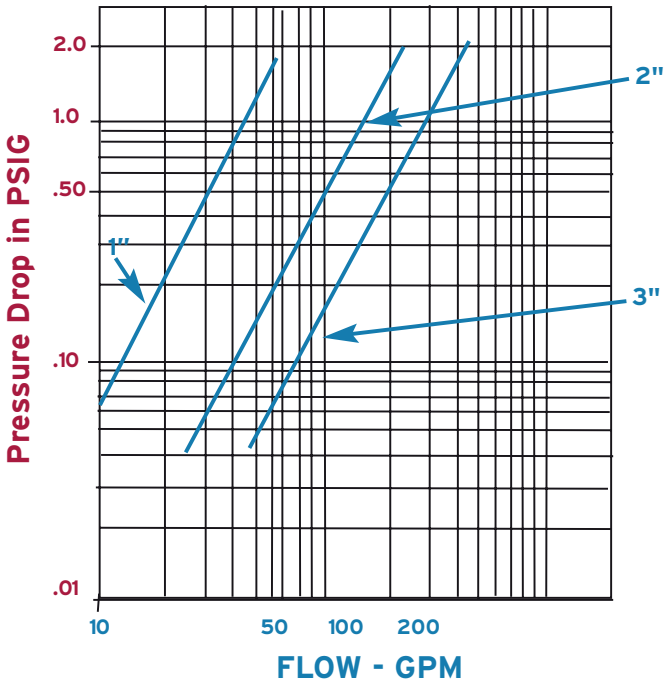
- Flow rates from 50 GPM for the 1" to 300 GPM for the 3" product line. This coupling will keep up with demand, whatever your application.
- Flow coefficient (Cv) for valves. Flow rate shown in gallons per minute of 70°F water with1.0 psi, pressure drop across the valve, 2"coupling features (Cv) of 160.
- Fugitive emissions of less than 25 ppm, is standard. In most cases, it is below the limit of analytical detection.

Valve Size

EPSILON™ couplings can be attached to hose or pipe sizes ranging from 3/4" to 3" or DN 20 to DN 80. There are three different valve body sizes that are machined to accept the different sizes and different connection types. Chart 2 indicates the valve body size that would be used with a given port size.

Pressure Drop vs. Flow 1", 2" & 3" EPSILON™ Coupling

Flow vs. Pressure Drop - 70° F Water



Valve Size	Port Size
1-inch	3/4", 1", DN 20 or DN 25 Port
2-inch	1-1/2", 2", DN 40 or DN 50 Port
3-inch	3" or DN 80 Port

Approvals

EPSILON™ couplings are approved/listed for pressure service through a comprehensive set of international agencies.

CRN

(Canadian Registration Number) issued by TSSA for EPSILON™ couplings.

(Association of American Railroads) approved EPSILON™ couplings

TÜV

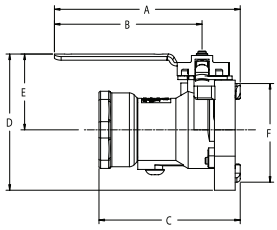
Süd-Munich approved EPSILON™ couplings

IMPORTANT: OPW products should be used in compliance with applicable federal, state, provincial, and local laws and regulations. Product selection should be based on physical specifications and limitations and compatibility with the environment and materials to be handled. OPW MAKES NO WARRANTY OF FITNESS FOR A PARTICULAR USE. All illustrations and specifications in this literature are based on the latest product information available at the time of publication.

OPW reserves the right to make changes at any time in prices, materials, specifications and models and to discontinue models without notice or obligation.

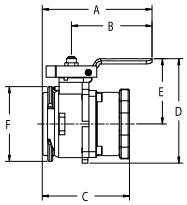
Size	End Connection	A	B	C	D	E	F
1"	3/4"	119	91	107	114	69	86
1"	1"	119	91	107	114	69	86
2"	1 1/2"	178	142	135	132	74	102
2"	2"	178	142	135	132	74	102
3"	3"	244	191	206	188	112	150

1. COUPLER HALF, BSP



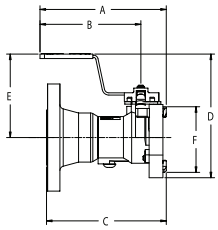
1"	3/4"	114	91	84	109	69	69
1"	1"	114	91	84	109	69	69
2"	1 1/2"	122	91	97	117	74	81
2"	2"	122	91	97	117	74	81
3"	3"	241	191	140	183	112	122

2. ADAPTOR HALF, BSP



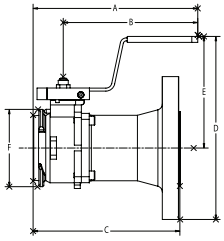
1"	3/4"	142	115	131	152	95	86
1"	1"	142	115	131	152	95	86
2"	1 1/2"	180	144	155	202	120	102
2"	2"	180	144	155	202	120	102
3"	3"	244	191	274	208	112	122

3. COUPLER HALF, FLANGED DIN EN 1092-1



1"	3/4"	137	115	121	152	95	69
1"	1"	137	115	121	152	95	69
2"	1 1/2"	176	144	141	202	120	81
2"	2"	176	144	141	202	120	81
3"	3"	241	191	208	226	132	122

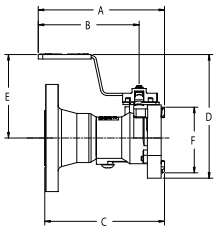
4. ADAPTOR HALF, FLANGED DIN EN 1092-1



Dimensional Data - mm

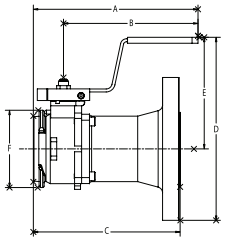
Size	End Connection	A	B	C	D	E	F
1"	3/4"	119	91	147	117	69	69
1"	1"	119	91	147	122	69	69
2"	1 1/2"	178	142	173	183	119	102
2"	2"	178	142	173	196	119	102
3"	3"	244	191	274	208	112	150

5. COUPLER HALF, FLANGED 150 LBS ANSI



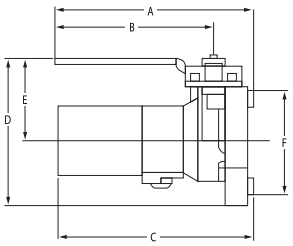
1"	3/4"	114	91	137	117	69	86
1"	1"	114	91	137	122	69	86
2"	1 1/2"	122	91	160	137	74	81
2"	2"	122	91	160	152	74	81
3"	3"	241	191	208	226	132	122

6. ADAPTOR HALF, FLANGED 150 LBS ANSI



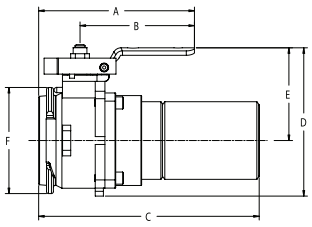
1"	3/4"	114	91	160	109	69	69
1"	1"	114	91	160	109	69	69
2"	1 1/2"	122	91	173	117	74	81
2"	2"	122	91	173	117	74	81
3"	3"	241	191	216	188	112	122

7. COUPLER HALF, BUTT WELD SCHEDULE 40



1"	3/4"	114	91	160	109	69	69
1"	1"	114	91	160	109	69	69
2"	1 1/2"	122	91	173	117	74	81
2"	2"	122	91	173	117	74	81
3"	3"	241	191	216	188	112	122

8. ADAPTOR HALF, BUTT WELD SCHEDULE 40



Dimensional Data - mm

Design Materials and Construction

Standard Port Types

A	Female NPT (Pipe Thread)
B	Female BSP (Whitworth Straight Thread)
C	Sch. 40 Butt Weld
D	ANSI 150 lb. Flange
E	ANSI 300 lb. Flange
F	Tri-Clover Flange
G	ANSI 600 lb. Flange
J	DIN EN 1092-1 (B1 Facing), PN40
K	DIN EN 1092-1 (B2 Facing), PN40
M	DIN 11850 Butt Weld, Range 1
N	JIS 10K
P	DIN 11850 Butt Weld, Range 2
Q	DIN 11850 Butt Weld, Range 3

Part Number Descriptions

Example Part Number = ZE 32 A S 32 A 0 1 2 3 2

OPW Engineered Systems Part Number Prefix

Base Valve Size (in Sixteenths of an inch)
16 = 1" (DN 25)
32 = 2" (DN 50)
48 = 3" (DN 80)

System Half
A = Adaptor half
H = Hose half (or Coupler)
U = Ultralow Spill

Material of Construction
S = Stainless Steel
H = Hastelloy® (wetted components)
A = All Hastelloy® Construction

End Connection Size
12 = 3/4" (DN 20)
16 = 1" (DN 25)
24 = 1-1/2" (DN 40)
32 = 2" (DN 50)
48 = 3" (DN 80)

End Connection Type
A = FNPT
B = FBSP
C = Sch. 40 Butt Weld
D = ANSI 150 lb. Flange
E = ANSI 300 lb. Flange
F = Tri-Clover (Sanitary Flange)
G= ANSI 600 lb. Flange
J = DIN EN 1092 -1, (B1 Facing), PN40
K = DIN EN 1092 -1, (B2 Facing), PN40
M = DIN 11850 Range 1 Butt Weld
N = JIS 10K
P = DIN 11850 Range 2 Butt Weld
Q = DIN 11850 Range 3 Butt Weld

Cavity Filler
0 = No
1 = Yes

Handle
1 = Standard
2 = Raised
3 = Long Coupler
4 = 6" Welded

Protective Cap
1 = Dust
2 = Pressure

Key
0 = None
1 = 1
2 = 2
3 = 3
4 = 4
5 = 5
6 = 2-3
7 = 2-3-4
8 = 3-4

Seal
1 = TFM
2 = PFA

OPW Fluid Transfer Group: One Company, Five Brands

OPW Fluid Transfer Group Europe B.V. — A DOVER COMPANY

From the European Head office near Amsterdam The Netherlands, these 5 OPW Fluid Transfer Group brands are supported. In addition Loading Arms, Tank Truck equipment and its related accessories are designed and manufactured here to serve the OPW FTG Europe BV territory.
www.opw-ftg.nl

HILTAP FITTINGS LTD.

Dedicated engineered and patented solutions for pipe, tube and hose connections used for extreme applications high/low temperature & pressure and nuclear.
Examples: RapidLOK™ for flange replacement; save vents and drains; locking quick connect; product recovery systems; cryogenic couplings; autoclave check valves.
www.opw-es.com

civacon — KNAPPCO — SURE SEAL

Mechanical and electronic components and systems for the save loading, transportation and offloading of hazardous fluids on road tankers.
Examples: flat bottom API's; bottom valves; vapour recover valves; overfill prevention system; sealed parcel delivery system; onboard monitoring system; crossover prevention system.
Components for pneumatic tank trailers, rail cars, chemical and pharmaceutical plants, and any application requiring the processing, movement and storage of dry bulk or liquid materials. Example: butterfly valves; ball valves; sample systems; actuators; aeration systems; swing check valves.
www.civacon.com

OPW® Engineered Systems

Mechanical and electronic components and systems for the safe storage, transfer and loading of hazardous fluids at chemical plants, refineries and terminals.
Examples: loading arms for fuels, chemicals, bitumen; rack monitoring system; quick disconnects (kamlok®, autolok™); dry disconnects (epsilon™, drylok™, kamvalok®); floating suction assemblies.
www.opw-es.com

MIDLAND™

Components and systems for the save loading, transportation and offloading of hazardous fluids and dry bulk on pressure & non-pressure railroad tank cars and dry bulk road tankers.
Examples: pressure & vacuum relief valves; needle valves; top transfer valves; valve actuator systems; overfill prevention systems.
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