OPW®

Engineered Systems

EPSILON™
DRY DISCONNECT PRODUCTS

OPW Engineered Systems, part of OPW Fluid Transfer Group, provides expert solutions for the safe handling, transfer, monitoring, measuring and protection of hazardous bulk products worldwide.

OPW Engineered Systems offers the most comprehensive line of dry disconnect products in the industry. OPW's line of dry disconnects include Drylok™, Kamvalok® and Epsilon™, all suitable for a broad range of hazardous liquid applications.

OVERVIEW

KAMVALOK®

OPW Kamvalok® dry disconnect couplings are considered the standard of the industry. Used at liquid transfer points where product loss could occur, OPW Kamvaloks® provide a reliable solution to prevent spillage during connection or disconnection.

OPW Kamvalok® dry disconnect couplings are used by manufacturers of paint, lacquers, inks, adhesives, fatty acids, pharmaceuticals, liquid soaps and many other liquid products. They are particularly well suited for handling petroleum products, solvents, ag-chemicals, vegetable oils, detergents and many acids and caustics.

DRYLOK™

Drylok™ is designed to safely transfer hazardous corrosive, volatile liquids such as acids, solvents and petrochemicals. An interlocking handle averts accidental spills by preventing uncoupling while the valve is open. And, the unit's flat face minimizes fluid loss, further reducing exposure to risk during operation. Drylok™ is ideal for all kinds of hazardous fluids where product loss is a problem, such as high-pressure lines, high flow rates, slurries and gases.

EPSILON™

The EPSILON™ Coupling System is designed to prevent chemical spills and reduce fugitive emissions of Volatile Organic Compounds (VOC's), particularly in the process facility and during transfer to and from truck tanks and railroad tank cars. During in-plant chemical transfers, the EPSILON™ Chemical Containment System will provide your plant with process flexibility while improving operator safety, 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 435 psi (30 Bar) and temperature up to 450°F (230°C) and is available with end connections complying to ANSI and DIN standards.

All wetted materials are 316/316L stainless steel (1.4401/1.4404) with TFM or PFA seals. Hastelloy® C 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.

Manifold station with EPSILON™ adapters.

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.

Epsilon Applications

- **Bulk Storage**
- **In-plant Processing**
- **Reactor Units**
- **Filtration Units**
- **Tank Car**
- **Rail Car**

Features

- **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 ¾", 1", 1½", 2" and 3"**
- **Available in Stainless Steel and Hastelloy®**
- **FDA-compliant seal materials**

Benefits

- **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.

OPW Engineered Systems Offers the Best-in-Class Family of Dry Disconnect Products in the Industry

OPW Engineered Systems, an OPW Fluid Transfer Group company, designs and manufactures quick and dry disconnect fittings to offer complete solutions for the safe and efficient loading and unloading of hazardous liquids.

OPW Engineered Systems' industry-standard dry and quick disconnect products include EPSILON™, Drylok™, Kamvalok®, Autolok® and Kamlok®

* Hastelloy® is a registered trademark of Haynes International, Inc.

OPW® Engineered Systems
PART OF OPW FLUID TRANSFER GROUP
A DOVER COMPANY
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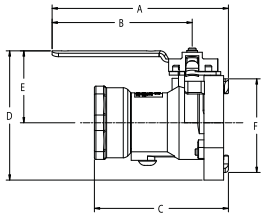
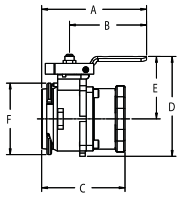
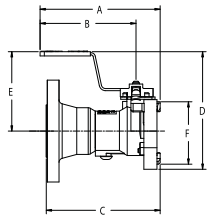
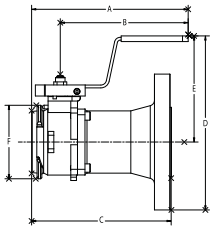
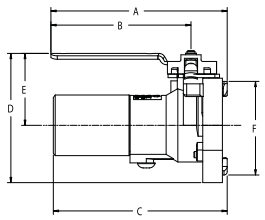
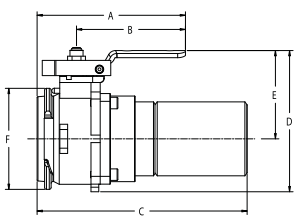
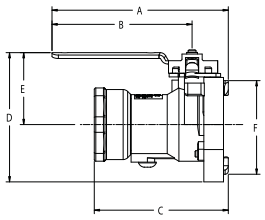
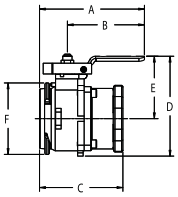
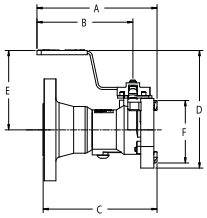
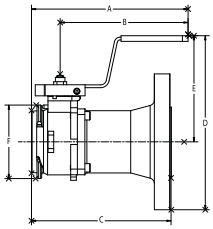
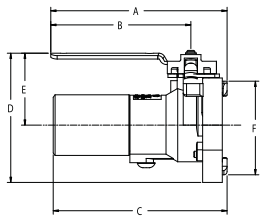
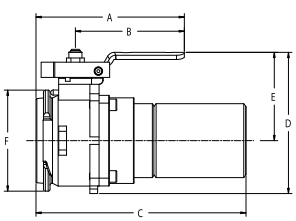
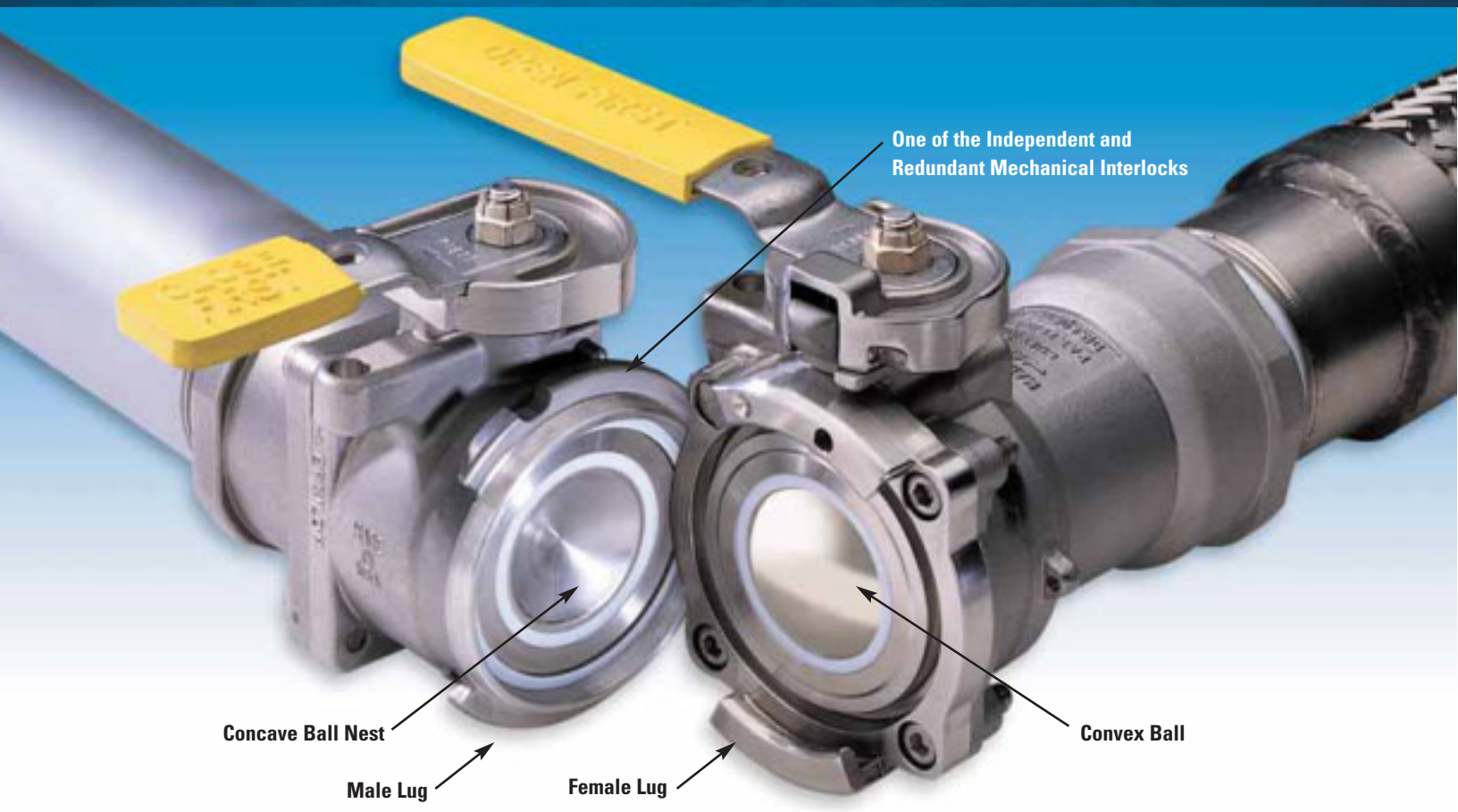
Sl. No.	Type	Size	End Connection	Dimensional Data - inch					
				A	B	C	D	E	F
1	COUPLER HALF, NPT	1"	3/4"	4.7	3.6	4.2	4.5	2.7	3.4
		1"	1"	4.7	3.6	4.2	4.5	2.7	3.4
		2"	1 1/2"	7.0	5.6	5.3	5.2	2.9	4.0
		2"	2"	7.0	5.6	5.3	5.2	2.9	4.0
		3"	3"	9.6	7.5	8.1	7.4	4.4	5.9
2	ADAPTER HALF, NPT	1"	3/4"	4.5	3.6	3.3	4.3	2.7	2.7
		1"	1"	4.5	3.6	3.3	4.3	2.7	2.7
		2"	1 1/2"	4.8	3.6	3.8	4.6	2.9	3.2
		2"	2"	4.8	3.6	3.8	4.6	2.9	3.2
		3"	3"	9.5	7.5	5.5	7.2	4.4	4.8
3	COUPLER HALF, FLANGED 150 LBS ANSI	1"	3/4"	4.7	3.6	5.8	4.6	2.7	2.7
		1"	1"	4.7	3.6	5.8	4.8	2.7	2.7
		2"	1 1/2"	7.0	5.6	6.8	7.2	4.7	4.0
		2"	2"	7.0	5.6	6.8	7.7	4.7	4.0
		3"	3"	9.6	7.5	10.8	8.2	4.4	5.9
4	ADAPTER HALF, FLANGED 150 LBS ANSI	1"	3/4"	4.5	3.6	5.4	4.6	2.7	3.4
		1"	1"	4.5	3.6	5.4	4.8	2.7	3.4
		2"	1 1/2"	4.8	3.6	6.3	5.4	2.9	3.2
		2"	2"	4.8	3.6	6.3	6.0	2.9	3.2
		3"	3"	9.5	7.5	8.2	8.9	5.2	4.8
5	COUPLER HALF, BUTT WELD SHEDULE 40	1"	3/4"	4.5	3.6	6.3	4.3	2.7	3.4
		1"	1"	4.5	3.6	6.3	4.3	2.7	3.4
		2"	1 1/2"	4.8	3.6	6.8	4.6	2.9	3.2
		2"	2"	4.8	3.6	6.8	4.6	2.9	3.2
		3"	3"	9.5	7.5	8.5	7.4	4.4	4.8
6	ADAPTER HALF, BUTT WELD SHEDULE 40	1"	3/4"	4.5	3.6	6.3	4.3	2.7	3.4
		1"	1"	4.5	3.6	6.3	4.3	2.7	3.4
		2"	1 1/2"	4.8	3.6	6.8	4.6	2.9	3.2
		2"	2"	4.8	3.6	6.8	4.6	2.9	3.2
		3"	3"	9.5	7.5	8.5	7.4	4.4	4.8

Sl. No.	Type	Size	End Connection	Dimensional Data - mm A	B	C	D	E	F
7	COUPLER HALF, BSP	1"	G 3/4"	119	91	107	114	69	86
		1"	G 1"	119	91	107	114	69	86
		2"	G 1 1/2"	178	142	135	132	74	102
		2"	G 2"	178	142	135	132	74	102
		3"	G 3"	244	191	206	188	112	150
8	ADAPTER HALF, BSP	1"	G 3/4"	114	91	84	109	69	69
		1"	G 1"	114	91	84	109	69	69
		2"	G 1 1/2"	122	91	97	117	74	81
		2"	G 2"	122	91	97	117	74	81
		3"	G 3"	241	191	140	183	112	122
9	COUPLER HALF, FLANGED DIN 2633	1"	DN20	142	115	131	152	95	86
		1"	DN25	142	115	131	152	95	86
		2"	DN40	180	144	155	202	120	102
		2"	DN50	180	144	155	202	120	102
		3"	DN80	244	191	274	208	112	122
10	ADAPTER HALF, FLANGED DIN 2633	1"	DN20	137	115	121	152	95	69
		1"	DN25	137	115	121	152	95	69
		2"	DN40	176	144	141	202	120	81
		2"	DN50	176	144	141	202	120	81
		3"	DN80	241	191	208	226	132	122
11	COUPLER HALF, WELD END DIN 2559	1"	20	114	91	160	109	69	69
		1"	25	114	91	160	109	69	69
		2"	40	122	91	173	117	74	81
		2"	50	122	91	173	117	74	81
		3"	80	241	191	216	188	112	122
12	ADAPTER HALF, WELD END DIN 2559	1"	DN20	114	91	160	109	69	69
		1"	DN25	114	91	160	109	69	69
		2"	DN40	122	91	173	117	74	81
		2"	DN50	122	91	173	117	74	81
		3"	DN80	241	191	216	188	112	122



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.

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.

*Teflon® is a Registered Trademark of DuPont.

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.

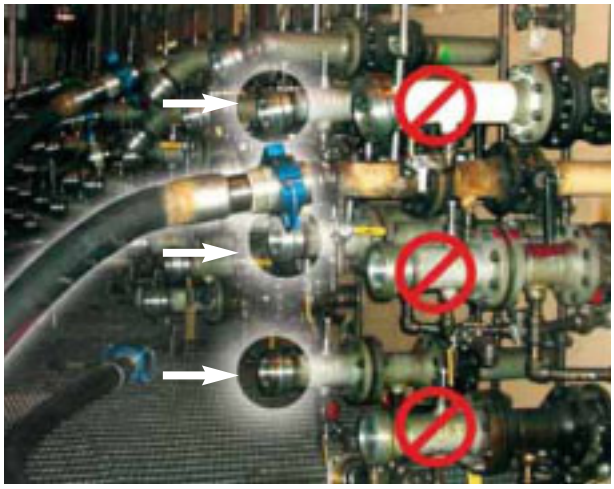
Stainless Steel Pressure Cap

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

**National Emission Standards for Hazardous Air Pollutants

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.

OPW Engineered Systems
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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 -22°F to 450°F (230°C), sealing, and sliding characteristics.

PFA

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

*Below limit of analytical detection.

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.

Performance Characteristics

Valve Size	Spillage	Maximum Emissions	Flow Rate GPM (l/min)	C_V	Max Working Pressure psi (bar)	Weight - lbs (kg) Adapter	Weight - lbs (kg) Coupler	Temp = °F (°C) Min	Temp = °F (°C) Max PFA	Temp = °F (°C) Max TFM
1-inch	<0.7 ml	<25 ppm	50 (189)	42	435 (30)	2.7 (1.2)	3.0 (1.4)	-22°F (-30°C)	250 (121)	450 (230)
2-inch	<0.8 ml	<25 ppm	150 (568)	160	435 (30)	4.0 (1.8)	6.0 (2.7)	-22°F (-30°C)	250 (121)	450 (230)
3-inch	<2 ml	<25 ppm	300 (1135)	240	360 (25)	16.0 (7.3)	19.0 (8.6)	-22°F (-30°C)	250 (121)	450 (230)

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

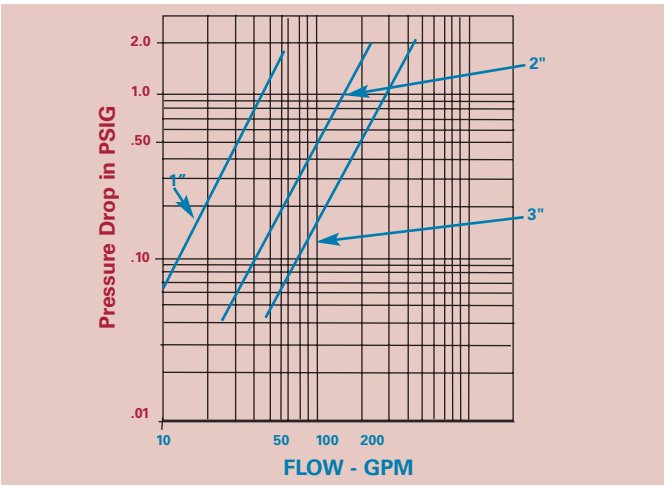

Chart 1

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

Chart 2

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 1092-1/11 (B1 Facing), PN16
K	DIN EN 1092-1/11 (B2 Facing), PN16
L	DIN EN 1092 -1/11(B1 Facing), PN40
M	DIN 11850 Butt Weld
N	JIS 10K

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 50)
- 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 = 316 Stainless Steel
- H = Hastelloy® C-276 (wetted components)
- A = All Hastelloy® C-276 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 -1/11 (B1 Facing), PN16
- K = DIN EN 1092 -1/11 (B2 Facing), PN16
- L = DIN EN 1092 -1/11(B1 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

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.

Süd-Munich approved EPSILON™ couplings.

OPW FLUID TRANSFER GROUP
A DOVER COMPANY

OPW Fluid Transfer Group (OPWFTG), part of Dover Corporation (NYSE:DOV), is comprised of market-leading operating companies, each dedicated to designing, manufacturing and distributing world-class solutions for the safe handling and transporting of hazardous bulk products. In addition to these companies, OPWFTG has manufacturing plants in North America, Europe, Brazil and India; and sales offices in Singapore, and China.

Throughout the world, OPWFTG companies are hard at work ensuring the safe processing, loading, transporting and unloading of hazardous bulk products and safeguarding against costly petroleum and chemical spills, tank overfills and fugitive vapor emissions. Whether your need is in the chemical plant,at the terminal loading rack, or outfitting a fleet of rail tank cars, cargo tanks or dry-bulk trailers, OPWFTG systems set the standard for safety, performance and peace-of-mind assurance in the most rigorous and demanding applications. If the safe, profitable handling of hazardous liquids and dry bulk commodities such as gasoline and diesel, chlorine, chlor-alkali products, LPG, acids, cement, flour and starch, among others, is your concern, trust OPWFTG.

EXPERT SOLUTIONS FOR THE SAFE HANDLING & TRANSPORTING OF HAZARDOUS BULK PRODUCTS

	Applications	Processing	Load	Transporting		Unload
PETROLEUM	• Gasoline • Ethanol • Alcohols • Fuel Oil • LPG	• Bellow Sealed Valves • Sample Valves • Lined Ball Valves • Lined Butterfly Valves • Industrial Valves • ISO Rings • Sight Flow Indicators • Globe Valves • Swivels • Dry Disconnects	• Loading Arms • Couplers • Rack Monitors • Dry Disconnects • API Coupler • Swivels	Cargo Tanks • Manholes • Vapor Vents • Electronics • Internal Valves • API Adaptors • Sealed Parcel • Pneumatic Controls • Manifold Systems	Rail Tank Cars • Pressure Relief Valves • Plug Valves • Ball Valves • Level Measurement • Autoloks • Kamvaloks • Dryloks • Rupture Disc Devices • Angle Valves	• Drylok Couplers • Adaptors • Delivery Elbows • Vapor Recovery Elbows • Swivels
CHEMICALS	• Chlorine • Acids & Bases • Amines • Anhydrous Ammonia • Propylene • Butadiene • Hazardous Liquids	• Bellow Sealed Valves • Sample Valves • Lined Ball Valves • Lined Butterfly Valves • Industrial Valves • ISO Rings • Sight Flow Indicators • Globe Valves • Swivels • Dry Disconnects • Quick Disconnects • Epsilon	• Loading Arms • Autoloks • Kamvaloks • Dryloks • Loading Manholes • Valves • Actuators • Swivels • Epsilon	Cargo Tanks • Manholes • Vapor Vents • Electronics • Internal Valves • Sealed Parcel • Epsilon	Rail Tank Cars • Safety Valves • Plug Valves • Ball Valves • Level Measurement • Autoloks • Kamvaloks • Dryloks • Rupture Disc Devices • Angle Valves • Epsilon	• Loading Arms • Autoloks • Kamvaloks • Dryloks • Valves • Actuators • Safety Breakaways • Swivels • Epsilon
DRY BULK	• Cement • Flour/Starch • Pharmaceuticals	• Industrial Valves • Sight Flow Indicators • Butterfly Valves • Swivels	• Loading Arms • Aerators • Hatch Covers • Swivels	Cargo Tanks • Manholes • Check Valves • Hopper Tees • Butterfly Valves • Aerators • Weld Rings	Rail Cars • Manholes • Hatches • Access Ports • Check Valves • Hopper Tees • Butterfly Valves • Aerators • Pressure Vacuum Valves	• Aerators • Butterfly Valves • Tank Hatches • Pressure Relief • Vacuum Relief • Temperature Monitoring
INDUSTRIAL/GENERAL	• Food Processing • Pharmaceuticals • Waste Water • High-Purity Liquids • Breweries • Pulp and Paper • Steel Processing	• Lined Ball Valves • Lined Butterfly Valves • Sample Systems • Sight Flow Indicators • ISO Rings • Dry Disconnects • Swivels • Quick Disconnects • High-Performance Butterfly Valves • Epsilon	• Loading Arms • Couplers • Rack Monitors • Swivels • Dry Disconnects • Quick Disconnects • Butterfly Valves • Epsilon	Cargo Tanks • Manholes • Vapor Vents • Electronics • Weld Rings • Hopper Tees • Pneumatic Controls • Sealed Parcel • Dry Disconnects • Epsilon	Rail Tank Cars • Safety Valves • Plug Valves • Ball Valves • Level Measurement • Autoloks • Kamvaloks • Dryloks • Rupture Disc Devices • Angle Valves • Epsilon	• Loading Arms • Couplers • Rack Monitors • Swivels • Dry Disconnects • Quick Disconnects • Butterfly Valves • Epsilon

Chemical & Industrial Processing Market Unit

- Food Processing
- Chemical Plants
- Petroleum Loading Stations
- Steel Processing, Pulp & Paper
- Waste Water Treatment
- Pharmaceutical
- Breweries
- High-Purity Liquids

Rail Market Unit

- Pressure & General Purpose Rail Tank Cars
- Dry Bulk Rail Cars
- Ethanol Rail Tank Cars

Cargo Tank Market Unit

- Gasoline & Diesel
- Dry Bulk
- Ethanol

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