

ALFA
ENGINEERING
SOCIETÀ COOPERATIVA

HEADQUARTERS
& PRODUCTION



MONOLITHIC ISOLATION JOINTS

ALFA Isolation Joints serve as a positive leak proof, long lasting block against the flow of electric current in all piping systems.

When you put ALFA Isolation Joints into service, you bury maintenance costs forever.

**MANUFACTURER OF HIGH QUALITY MONOLITHIC ISOLATION JOINTS FROM
OVER 30 YEARS**

FACTORY ASSEMBLED

ALFA Monolithic Isolation Joints are completely engineered, produced, assembled and tested inhouse and in accordance to all major international requirements of [ASME, ASTM, API, DIN and BS codes](#).

WARRANTY

All Alfa Engineering products are warranted against failure **caused by manufacturing defects** for a period of 2 years or more. Any product found to be so defective and returned to us within one year from date of shipment will be replaced without charge.

MADE IN ITALY

Made from italian raw materials, each Monolithic Isolation Joint is designed and manufactured **at our plant in Modena (Italy)** that has a registered ISO 9001:2000 Quality Management System. Copy of current ISO 9001:2000 certificate is available upon request.

FOR ONSHORE & OFFSHORE PIPELINE PROJECTS

DN: FROM 1/2" TO OVER 120"

ANSI: 150 - 300 - 600 - 900 - 1500 - 2500 - 5000

API: 10.000 - 15.000

CARBON STEEL - DUPLEX & SUPER DUPLEX CRA CLADDING

ASTM • DIN • ASME • DNV • API • ISO • EN • NORSOK

CE • PED Certified

Approved in all major Oil & Gas worldwide vendor's lists

www.alfa-eng.net



QUALITY

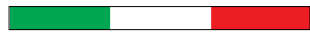
MADE IN ITALY

WE ARE ALFA ENGINEERING SOC. COOP.

ALFA Engineering is a worldwide manufacturer of high quality monolithic isolation joints for the Petrochemical & Gas industries from over 30 years. We are based in the north of Italy and we are proud to deliver the Italian Excellence of Isolation Joints all over the world. Wherever you find pipeline, gas distribution system or water pipelines you will also find a wide array of reliable ALFA Engineering Products.

WE ARE THE ITALIAN EXCELLENCE IN MONOLITHIC INSULATION JOINTS.

Our company is a keen supporter of the **genuine 100% Made in Italy label**, because we wish to guarantee to all our customers that the product they purchase from us is a **true product of quality Italian craftsmanship**. It means a product that is entirely made in Italy, from the design and working out on paper, the choice of Italian suppliers, up till the product is made, finished, extensively tested and ready for shipment.



Each Monolithic Insulation Joint is designed and manufactured at our plants in Modena (ITALY) that has a registered **ISO 9001:2008 Quality Management System**, is **PED Certified** and **CE Marked**.



WE ARE NOW A COPERATIVA

Each person working in Alfa Engineering is also owner of Alfa Engineering and has contributed with capital equity/shares. This is an important guarantee for customers because they can rely on a team working for the sole benefit of the company.

NEW On-Line ORDER TRACKING PLATFORM

ALFA ENGINEERING introduces our new on-line platform on Alfa's web-site to track the status of your orders with ALFA. You will receive on-time updates on PO confirmation, Arrival of Raw Material and constant tracking of the various production steps involved in your order together with pictures. You will never wonder again about what is the real status of your order!

INTRODUCTION

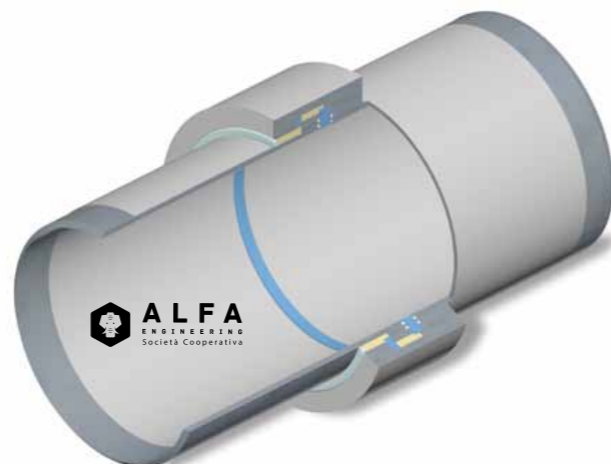
Why to use a Monolithic Isolation Joint

Corrosion destroys approximately 30% of the world's annual production of steel. Where you find pipelines for gas an oil distribution system, you will also find a range of Alfa Engineering isolation joints. The correct location of a monolithic isolation joint results in saving overall cost of corrosion control systems.

For onshore projects, an isolation joint is used to limit the spread and hence cost of cathodic protection current to those pipes that need to be effectively and economically protected by the main CP system.

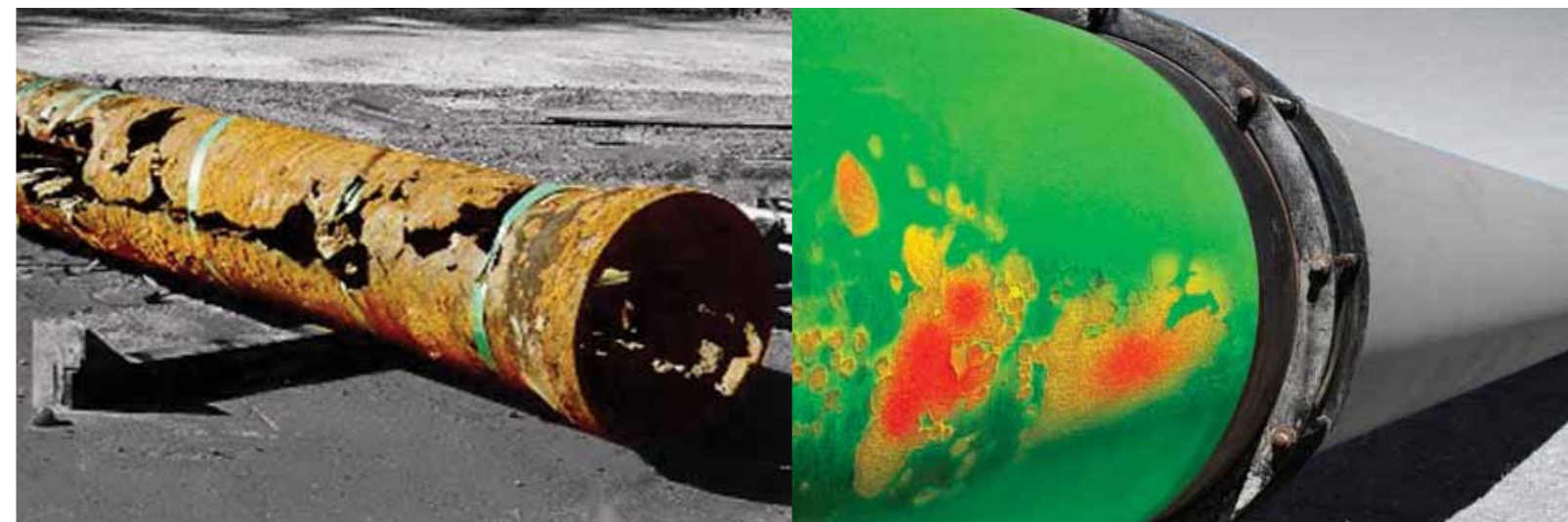
An isolation joint is used to electrically **"split up"** long pipelines into distinctive system. Or to isolate and ensure that CP or stray electricity currents do not cause increased corrosion.

Or to **provide protection against earthing currents** at domestic and industrial premises where the PME (Protection Multiple Earthing) system is in use.



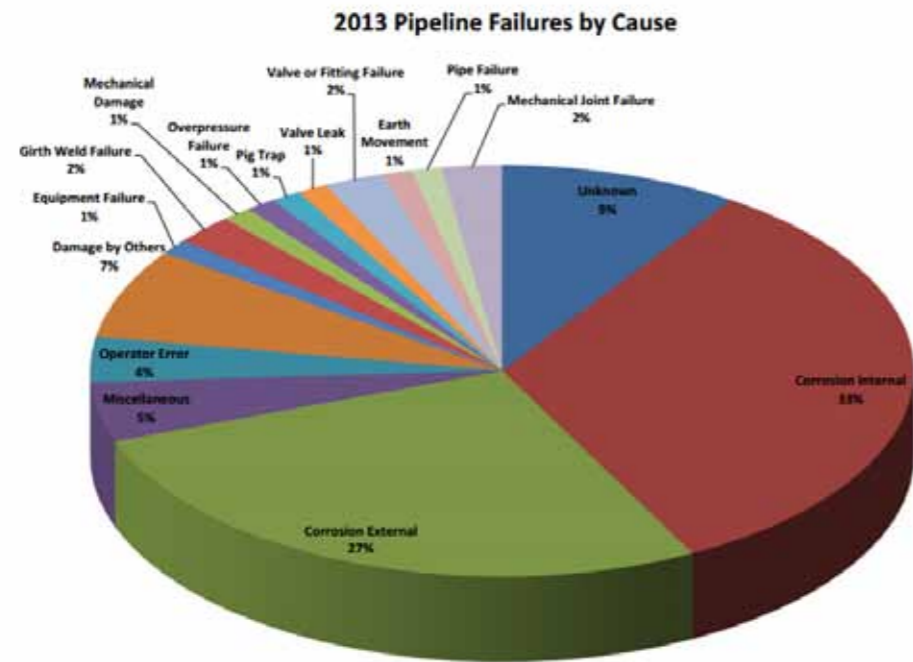
ONSHORE

1. To limit the spread and hence cost of cathodic protection current to those pipes that need to be effectively and economically protected by the main cathodic protection system (e.g. where steel pipelines are connected to iron or ductile iron pipelines, where a well coated/wrapped pipe is connected to a badly coated /wrapped pipe, or where branch connections are made to the main pipeline).
2. To electrically "split up" long pipelines into distinctive cathodic protection systems to prevent "long line" currents and to make the individual systems more effective and hence economical.
3. To isolate a pipeline to ensure that cathodic protection or stray electricity currents do not cause increased corrosion, cause damage or constitute a hazard (e.g. where a pipeline enters a refinery or governor station).
4. To ensure effective electrical isolation at strategic points within designated hazardous areas (e.g. at fuel loading points).
5. To provide protection against earthing currents at domestic and industrial premises where the PME system is in use.
6. Where dissimilar metals are found together, the use of isolating joints may prevent galvanic action (i.e. where steel and ductile iron pipelines are joined).
7. Where pipelines enter or pass through mass concrete, i.e. the wall of a valve pit or building or the wall of a storage tank or treatment plant.
8. Where a pipeline is supported from a metallic structure that is in contact with soil or water, i.e. a bridge crossing a road or river, but there is a need to maintain electrical continuity throughout the pipeline. Isolating joints may be provided on either side of the metallic structure. The cathodic protection system may be bonded across the isolated section using a jumper cable.
9. Where both sacrificial anodes and impressed current is used on a pipeline it may be advantageous to electrically isolate each section.
10. To assist control or for testing, of a cathodic protection system applied to various sections of a pipeline or pipeline system. Current controlling resistors may be bonded across an isolating joint linking the various system.
11. Electrical isolation of power and instrumentation grounding systems may be required where electrically operated valves and similar components form part of a pipeline system. Electrical isolation measures taken in this respect must comply with all relevant safety standards.



OFFSHORE

1. In riser pipes on offshore structures to isolate the pipeline cathodic protection system from the structure cathodic protection system.
2. At field 'tie-ins'



*The Unknown cause of failures are failures still being investigated.

The above data are showing that the main reason behind pipeline failures is corrosion, 60% of pipeline failures is attributed to corrosion. Ensuring an efficient cathodic protection system is the best way to ensure the longevity of the pipelines.

SOURCE: Penn West 2013

COST AND PERFORMANCE ADVANTAGES OF MONOLITH JOINTS VS. FLANGES+KITS

MONOLITHIC ISOLATION JOINTS	VS	FLANGES & KITS
ADVANTAGES OF USING MONOLITHIC ISOLATION JOINTS		DISADVANTAGES OF USING FLANGE & INSULATION KITS
1. Pre-Assembled and Pre-Tested		1. Has to be assembled on field
2. Saving on skilled on-site labour		2. Requires skilled knowledge to be installed
3. No maintenance required		3. It easily breaks during Installation
4. No Failure caused by improper installation.		4. Failure may cause plant shut down and expensive leakages.
5. No Pipeline shutdown because of failure, replacement or leakage.		5. Does not grant the same level of electrical insulation as Monolithic Insulation Joints.
6. Simplified serviceability and maintenance		6. Water can sometime go thru the gasket isolation.
7. Increases the safety of the pipeline		7. Repairing a damaged or leaking Kit exceeds by far the initial cost of a Monolithic Insulation Joint
8. Increases the life duration of the pipelines		8. Has to be assembled on field
9. Drastically decreases the OVERALL project LIFE CYCLE COSTS.		9. Drastically increases the OVERALL project LIFE CYCLE COSTS IN COMPARISON TO MONOLITHIC JOINTS

DESIGN

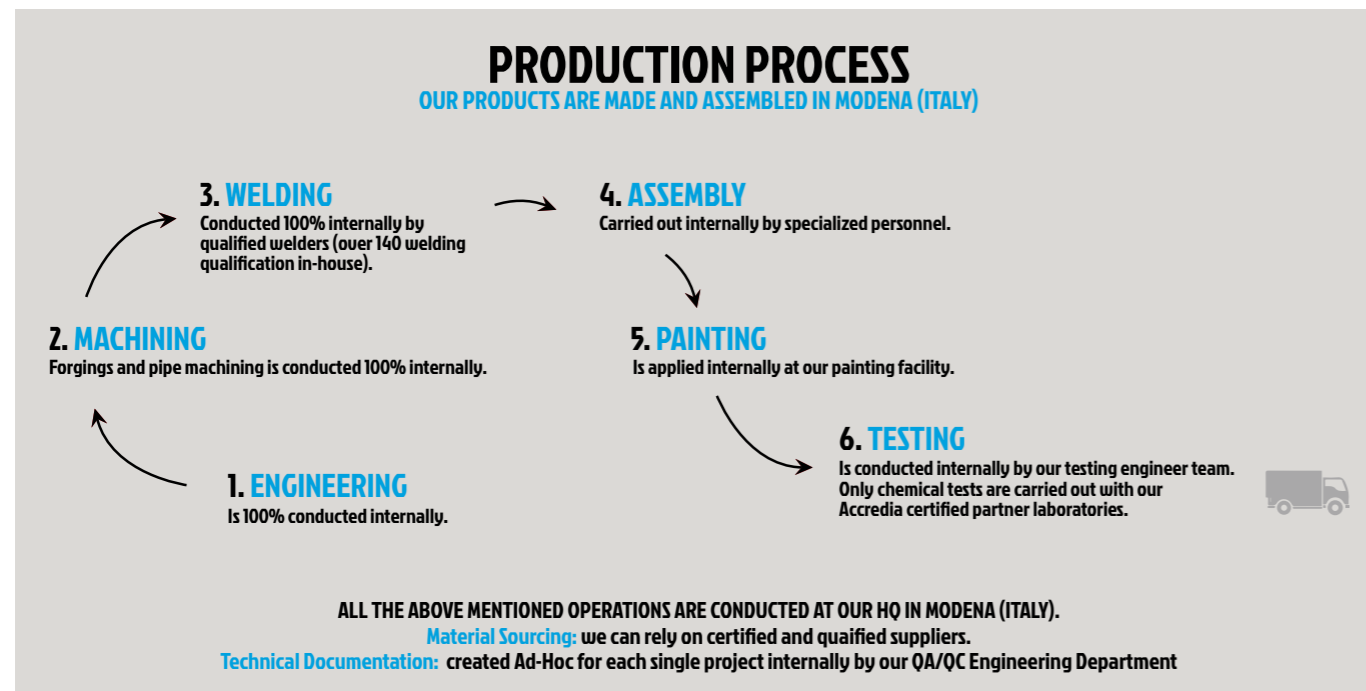
The design of the ALFA Engineering S.C. monolithic isolating joint has been proven by extensive independent prototype testing and is supported by many years satisfactory "in-line" service in the most arduous conditions. The ALFA Engineering S.C. joint design has been verified by Lloyds Register for arduous offshore project use. Standard ALFA Engineering S.C. joints can withstand considerable external loads (bending/torsion/axial) in addition to internal pressure.





Production Process:

Alfa Engineering Soc. Coop. carries out internally all the production steps involved in the manufacturing, assembly and testing of all our monolithic isolation joints because we want our customer to have the guarantee that every single step is carefully monitored and managed by qualified personnel with extensive knowledge of the Oil & Gas Sector.



QUALITY CONTROL TEST & INSPECTION

One of the main features characteristics of Alfa Engineering is its high quality level, integrity and control of procedures application. It is therefore fundamental for the future not only to maintain the same levels but to improve them. This is the reason of continuous investments on improving production and testing processes. It is our policy to provide our customers with high quality products and reliability that meet their expectation.

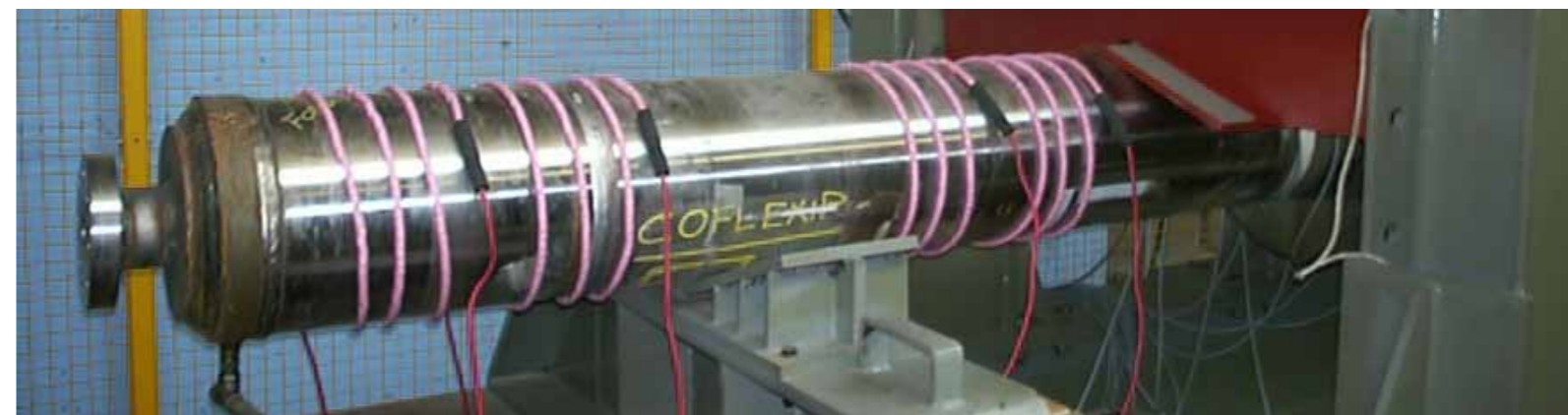
ALFA Engineering Soc.Coop. Monolithic Isolating Joints are guaranteed to have the mechanical and electrical proprieties as specified and this is achieved by operating a very strict control over all phases of our business from design and material procurement to final dispatched, All staff are committed to Quality.

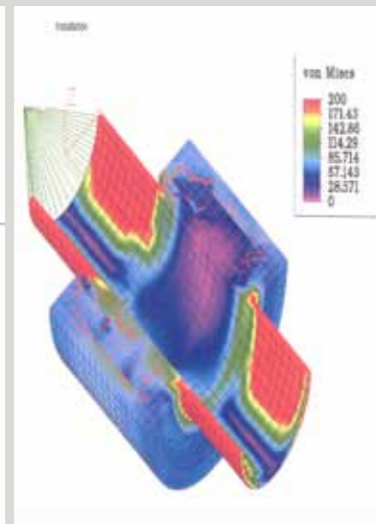
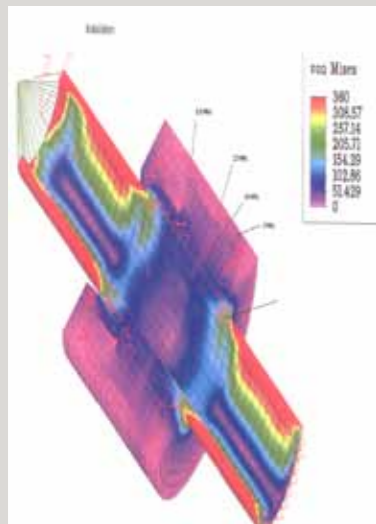
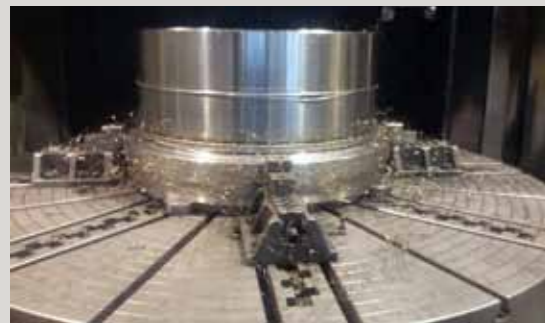
Alfa Engineering operates a Quality Assurance System in accordance with the requirements of UNI EN ISO 9001:2008. This ensures close control over all steps of production and manufacturing. Alfa Engineering staff and personnel take pride in manufacturing top quality products and are very proud of the reputation Alfa Engineering has within the Petrochemical & Gas Industries as a Qualified and Quality Oriented Company.

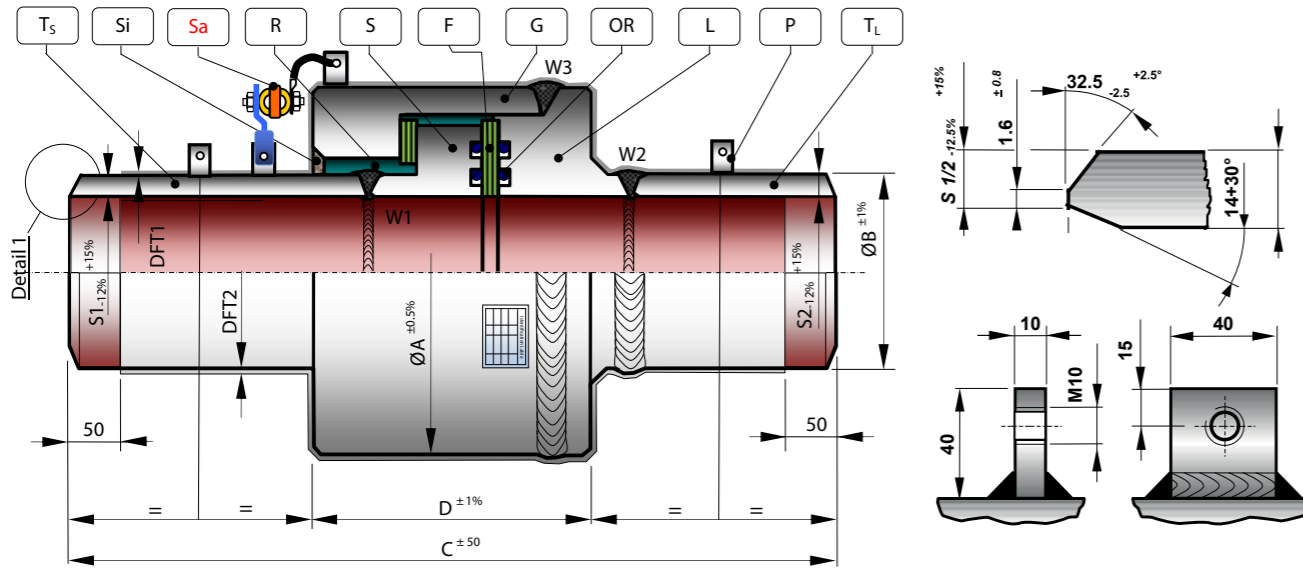
PROTOTYPE TESTING



The design of a monolithic isolating joint is very complex and not easily verified by manual calculation. The best way of proving the design is by Prototype testing and many major customers request that a special test programme system is carried out before granting their approval. Prototype tests may involve independent or customer witness of various stages during the joint manufacture followed by mechanical testing, The mechanical testing usually comprises; Hydrostatic, cyclic and air pressure, combined pressure and bending and torsional loading. Deflections of internal joint faces are often measured to ensure that under all service conditions the joint will maintain its fluid seal without any reduction in electrical properties. ALFA Engineering Soc.Coop. joints have undergone extensive testing including the measurement of electrical resistance and dielectric strength before and after a combination pressure tests and other specific testing activities.







INSTALLATION	ABOVEGROUND / UNDERGROUND/ SUBSEA –On-Shore/Off-Shore
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MATERIALS	PIPELINE (ISO3183 - API 5L)	Carbon Steel All Grades + Low Alloy & Alloy Steel + Duplex & Super Duplex
	BODY PARTS	ASTM / ASME / UNS / EN Materials
	ISOLATING ELEMENTS	NEMA G10/G11 - ASTM D709 –Class H
	“OR” GASKET	Double “O” Ring ASTM D 2000 we can use ANY kind of O’Ring depending on project for SOUR - NON-SOUR - TOXIC environment requirements and special applications.
	BACK SEAL	Silicon Neutral Low Module
	FILLER ISOLATOR	Epoxy Resin Cold Cured
	CABLE LUGS M10	EN 10025 235JR (Carbon Steel)
INTERNAL / EXT. COATING	Amine Cure Epoxy Resin 200÷1500 microns We can apply any painting system based on customer requirements.	

HYDROSTATIC TEST	1.5 Times the Design Pressure (Or as per Customer Requirements)
DIELECTRIC TEST	1.5-5 KV (5-1 min.) @ AC 50÷60 Hz (Special 12 KV @ 1 minute AC 50÷60 Hz)
ELECTRIC INSULATION TEST	> 200 MΩ @ 1000 Volt DC (Special > 100 GΩ @ 5000 Volt DC)
NDE TEST	W1-W2-W3: MT & UT, Bevel Ends MT - According to ASME V ASME VIII
WELDS	W1-W2-W3: According To ASME IX - API 1104 –DNV (X-RAY upon request)
CERTIFICATION	EN 10204 - 3.1 (EN 10204 - 3.2 if requested)
INSPECTION & TEST/ ACCEPTANCE	Manufacturer Standard / Customer Applicable Requirements
HYDRO-BENDING TEST	Based on customer requirements up to 90 % of SMYS
HYDRO-THERMAL BENDING TEST	Based on customer requirements up 100 Celsius
TORSION TEST	5% of SMYS
HYDRO FATIGUE TEST	From 5 to 40 cycles at 80% TP or as per customer requirements
HIC TEST	From Accredia Certified Laboratories; on Forgings and on Pipes

SSC TEST	From Accredia Certified Laboratories; on Forgings and on Pipes
VACUUM TEST	Up to 1 Milli-bar
PIGGABILITY/DRIFT TEST	Up to 98% SMYS
HIGH PRESSURE HELIUM AIR LEAK TEST	Based on customer requirements
3% SALINE IMMERSION TEST	As per any customer requirement
PULL OFF TEST-ADHESION TEST	Based on customer requirements
HOLIDAY TEST	From 90 V to 15 kV
ADDITIONAL TEST AVAILABLE	Upon request
SERVICES	SOUR / NON SOUR /TOXIC /LETHAL
CORROSION ALLOWANCE	As per Customer Requirements
FLUIDS	Gas, Hydrocarbons, Oil, Chemical Fluids, Water
PIPING CLASS	As per Customer Requirements



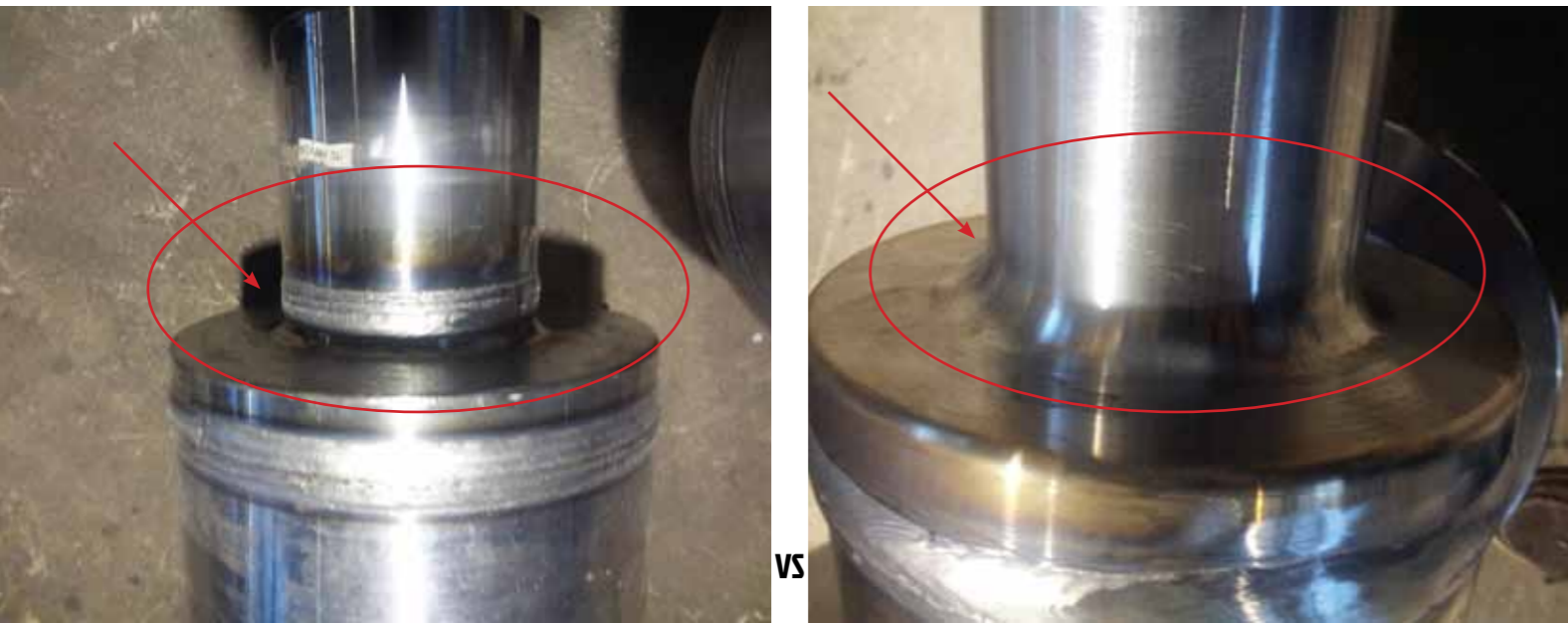
INTRODUCING THE ADVANCED QUALITY CONCEPT OF ALFA WELD-LESS MONOLITHIC ISOLATION JOINTS

Alfa has advanced the design of the “REAL” Monolithic Isolation Joints.

The new engineering behind our new proposed product of the Weld-less MIJ brings several advantages in terms of performance and overall pipeline cost reduction.

1. This new model is manufactured so that there are no welds W1 and W2, implying that no weld is in touch with the pipeline fluid.
2. We bring 100% uniformity of material thru all the MIJ.
3. Mechanical and Chemical properties are the same thru all the MIJ
4. Eliminates disalignment problems between pipes and forging rings
5. 0% risk to have defect welds

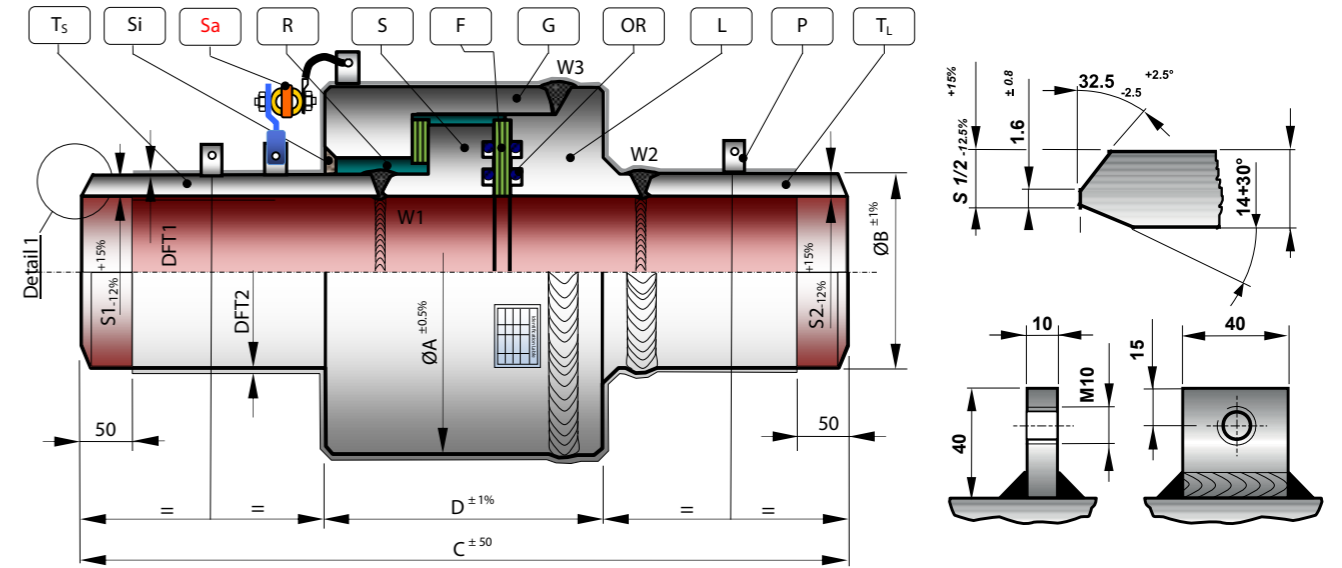
The absence of the 2 welds W1 and W2 is a very important quality improvement of the joint itself. Isolation Joints as per international standard have to have the minimum number of welds. Our design is so that NO



welds are in touch with the fluid bringing a great advantage in terms of corrosion resistance, uniformity of material, weight of the product and for these reasons grants a longer lasting life of the IJ decreasing all type of welding defect probability.

In those cases where big dimensions would not allow such a production we can still propose a second alternative which is by using pup pieces made out of forging material still bringing the following advantages:

1. We bring 100% uniformity of material thru all the MIJ.
2. Mechanical and Chemical properties are the same thru all the MIJ
3. Eliminates dissaligment problems between pipes and forging rings. This problem is very evident in large size isolation joints.



ANSI 150# (PN or DP 25)

DN (Inch)	Ø (mm)	EU DN	WT (mm)	Pipe Grade	A	C	D	Kg
1"	33,4	25	3,38	B	76	400	92	4,2
2"	60,3	50	3,91	B	104	400	106	5,2
3"	88,9	80	4,78	B	130	400	114	9
4"	114,3	100	4,78	B	155	400	120	12
6"	168,3	150	5,56	B	216	400	134	21
8"	219,1	200	6,35	B	269	400	148	30
10"	273	250	6,35	B	320	450	156	41
12"	323,9	300	6,35	B	378	450	160	54
14"	355,6	350	7,92	B	419	500	190	100
16"	406,4	400	7,92	B	478	600	210	133
18"	457,2	450	7,92	B	529	700	224	154
20"	508	500	7,92	B	580	800	234	187
24"	609,6	600	9,52	B	695	800	274	320
26"	660,4	650	9,52	B	734	900	286	327
28"	711,2	700	9,52	B	784	900	296	356
30"	762	750	9,52	B	840	1000	304	391
32"	812,8	800	9,52	B	890	1000	314	427
34"	863,6	850	9,52	B	940	1100	322	452
36"	914,4	900	9,52	B	990	1200	330	534

Larger Diameters available upon request. Our production capacity can reach up 120" Inches

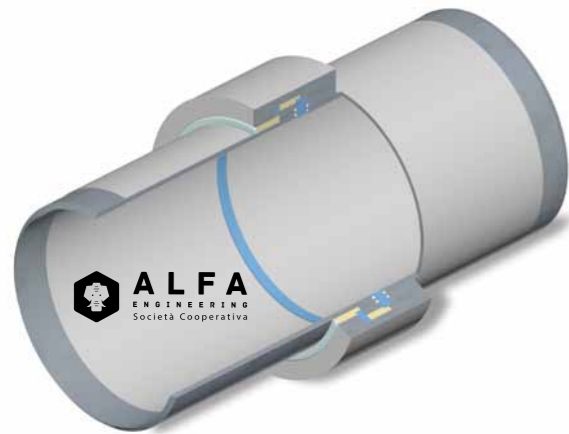
* A & D are indicative misure



ANSI 300-400# (PN or DP 50-64)

DN (Inch)	Ø (mm)	EU DN	WT (mm)	Pipe Grade	A	C	D	Kg
1"	33,4	25	3,38	B	76	400	92	4,2
2"	60,3	50	3,91	B	110	500	108	7,6
3"	88,9	80	5,49	B	150	500	114	15
4"	114,3	100	6,02	B	175	500	120	19
6"	168,3	150	7,11	X52	240	500	140	36
8"	219,1	200	8,18	X52	294	600	160	59
10"	273	250	8,74	X52	352	700	180	86
12"	323,9	300	9,52	X52	404	700	204	127
14"	355,6	350	9,52	X52	448	800	214	154
16"	406,4	400	10,31	X52	495	800	234	185
18"	457,2	450	11,91	X52	546	800	260	236
20"	508	500	11,91	X52	605	900	274	298
24"	609,6	600	14,27	X52	705	1000	324	438
26"	660,4	650	14,27	X52	756	1000	336	483
28"	711,2	700	14,27	X52	815	1200	360	644
30"	762	750	15,88	X52	879	1200	376	762
32"	812,8	800	15,88	X52	884	1200	390	826
34"	863,6	850	17,5	X52	957.5	1300	415	893
36"	914,4	900	19,05	X52	1031	1300	440	1128

Larger Diameters available upon request. Our production capacity can reach up 120" Inches



CERTIFICATION:	EN 10204 3.1 or 3.2
NDE Pup Bevels	100% MT/UT - ASME V - ASME VIII
NDE W3 Closure Weld	100% MT/UT - ASME V - ASME VIII
NDE W1-W2 Butt Welds	100% MT/UT/RX- ASME V - ASME VIII
Pneumatic Air Test	10 bar 10 Min.
Hydrostatic Test	At Test Pressure or as per customer requirements
Hydro-Fatigue Test (barg x cycles)	5 Cycles at 80% TP or as per customer requirements
Electric Insulation Resistance	>200 MΩ
Dielectric Strength Test	5 to 12 kV (AC) % 50 Hz (1-5 min)
Design Code	ASME VIII D.1 - ANSI B 31.8/4
Design Factor	0,2 to 0.6
Max Allowable Loads	Up to 95% SMYS-based on customer requirements
Insulator	NEMA G11 Class H
Resin Filler	Cold Cured Epoxy

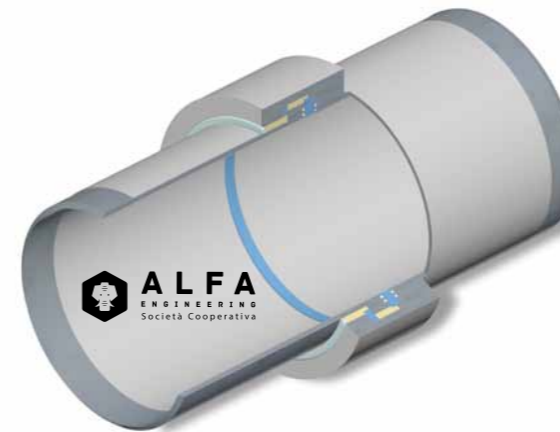
* A & D are indicative measure



ANSI 600# (PN or DP 100)

DN (Inch)	Ø (mm)	EU DN	WT (mm)	Pipe Grade	A	C	D	Kg
1"	33,4	25	3,38	B	76	400	92	4,2
2"	60,3	50	5,54	B	110	500	108	7,6
3"	88,9	80	5,49	B	150	500	116	15
4"	114,3	100	6,02	B	175	500	130	20
6"	168,3	150	7,11	X52	240	500	150	37
8"	219,1	200	8,18	X52	294	600	178	63
10"	273	250	9,27	X52	352	600	204	94
12"	323,9	300	9,52	X52	404	700	224	137
14"	355,6	350	9,52	X52	453	700	250	177
16"	406,4	400	10,31	X52	502	800	274	215
18"	457,2	450	11,91	X52	552	800	300	267
20"	508	500	11,91	X52	609	800	322	337
24"	609,6	600	14,27	X52	739	900	358	570
26"	660,4	650	14,27	X52	783	1000	386	667
28"	711,2	700	14,27	X52	836	1200	376	828
30"	762	750	15,88	X52	907	1200	426	978
32"	812,8	800	17,5	X52	946	1300	430	1342
34"	863,6	850	19,05	X52	1013	1300	461	1480
36"	914,4	900	19,05	X52	1080	1300	492	1503

NOTE: Higher Pressure Class (#900, #1500, #2500, #5000 and #10.000) available upon request. Larger Diameters available upon request. Our production capacity can reach up 120" Inches



CERTIFICATION:	EN 10204 3.1 or 3.2
NDE Pup Bevels	100% MT/UT - ASME V - ASME VIII
NDE W3 Closure Weld	100% MT/UT - ASME V - ASME VIII
NDE W1-W2 Butt Welds	100% MT/UT/RX- ASME V - ASME VIII
Pneumatic Air Test	10 bar 10 Min.
Hydrostatic Test	At Test Pressure or as per customer requirements
Hydro-Fatigue Test (barg x cycles)	5 Cycles at 80% TP or as per customer requirements
Electric Insulation Resistance	>200 MΩ
Dielectric Strength Test	5 to 12 kV (AC) % 50 Hz (1-5 min)
Design Code	ASME VIII D.1 - ANSI B 31.8/4
Design Factor	0,2 to 0.6
Max Allowable Loads	Up to 95% SMYS-based on customer requirements
Insulator	NEMA G11 Class H
Resin Filler	Cold Cured Epoxy

* A & D are indicative measure



DOUBLE SEALING SYSTEMS WITH 4 O'RINGS IS THE BEST WAY TO GUARANTEE LONG TERM INSULATION CAPACITY OF THE ISOLATION JOINT.

" All major corporates viz BP, Shell and ConocoPhillips are enhancing awareness by doing everything within their power to minimize the impact of atmospheric leakage and oil spills in the environment. Not least to ban and replace all those unregulated U-Seals and X-Seals from their plants, if do exist.

...it has been proven that those unregulated U-shape or X-shape rubber seals are unfit

to work under extreme conditions nor high pressure services.

...dubious sealing design such as U shape seal rubbers can determine failures.

The International Standards Organization (ISO) is developing new guidelines to classify and ban dubious rubber seals mounted on pipeline accessories."

Sources: Charles D. Coleman , Ph.D ME/AM

Publication: Choosing Mechanical Seals to Optimize Life Cycle Cost, Safety and Environmental

Compliance. Journal of Polymer Science, Polymer Physics. E. Gibson, and S.L. Coope, Michel Biron, Gas Loads and O-Rings General oil leak and gas atmospheric leaks. Oil & Gas Journal.

Many internationally recognized gas .oil and engineering's companies do recommend in their specification to use elastomeric "O" rings only which are toroidal in shape and are used for sealing components against the ingress or egress of fluids under dynamic and static conditions. Alfa Engineering as an internationally recognized isolation joint manufacturer have adhered to the concept of using "O" Rings in the design and fabrication of monolithic isolation joints.

This concept is applied in strict accordance with several international codes and standards: ASTM D2000 – AS 568A – BS 1806 – SMS 1586 – DIN 3771 and ASME VII Div.1 appendix II.

In the seal design of isolation joints, it is essential to ensure the correct type of polymer to be used for each specific application.

Behind this description there is a very remarkable technology in synthetic rubber compounding and the need to produce high precision details with aside the necessary extensive quality control.

Appropriate grade and type of elastomer can be used to best satisfy the fluid temperature.

Many type of elastomers are readily available Viton –NBR – Karletz – PTFE, and spring Energised elastomers unexplosive to pipeline decompression.

Mechanical design of joint body is not fixed by stock and dimension can vary. Body to suit any loadings, wall , grade etc..."O" rings are not affected by temperature change as they can expand and contract easily in the groove.

Compression set is not a problem as the pre-compression is of small entity for static performance.








Double "O" ring seals are accommodated easily to give an increased safety factor in sealing.

It is worthwhile to mention that "O" Ring seal design is the only recognised and coded application for static, dynamic and intermittent use under low, medium and very high pressures. "O" Rings are recommended for all pressure vessels and are in use for pressure vessels such as valves, cylinders, isolation joints and have also large and secure application in aerospace and naval engineering practice.

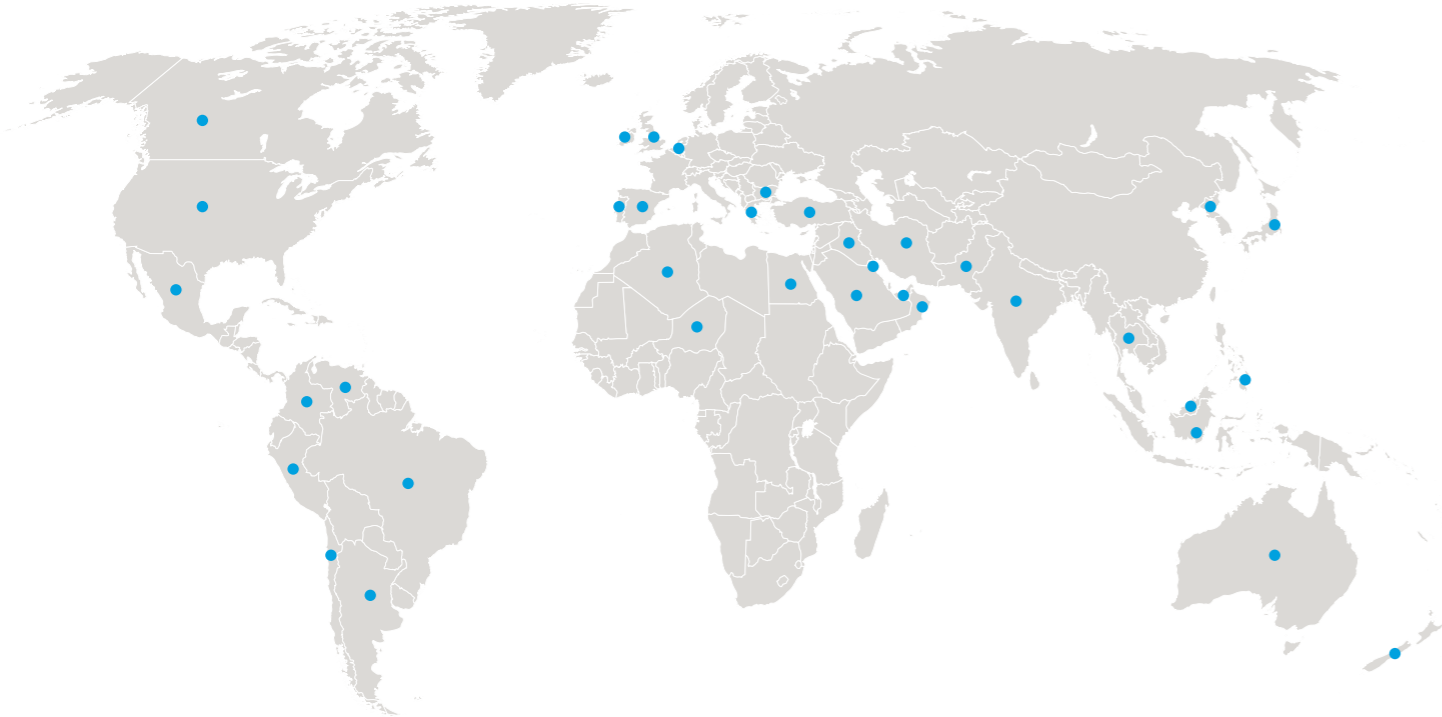
REFERENCES

In the petrochemical and gas industry for most engineering companies the use of "O" Rings in the design and construction of isolation joints and pressure vessels is mandatory requirement. Below some sample of companies requesting provision O'Rings seals in a double sealing system (Shell, Bechtel, Petronas, BP, Eni, ADCO, BG).

THE IMPORTANCE OF O'RINGS:

DESIGNATION	MATERIAL	RECOMMENDED APPLICATION	NOT RECOMMENDED FOR:	DESIGN TEMPERATURE
NBR	Nitrile Butadiene Rubber Nitrile (Buna-N)	General purpose sealing Petroleum oils and fluids Natural Gas Cold water	Halogenated Hydrocarbons (Carbon Tetrachloride Trichlorethylene) Nitro Hydrocarbons (Nitrobenzene, Aniline) Phosphate Ester Hydraulic Fluids (Skydrol, Fyrquel, Pydraul) Ketones (MEK, Acetone) Strong Acids OzoneAutomotive Brake Fluid	 -40°C to +110°C
FPM	Fluorocarbon	Petroleum Oils Wet Gas (Sour) Di ester Based Lubricants Silicate Ester Base Lubricants Silicone Fluids and Greases Halogenated Hydrocarbons (Carbon Tetrachloride, Trichloro - Ethylene) Selected Phosphate Ester Fluids Acids	Ketones Skydrol fluids Amines, Anhydrous Ammonia Hot hydrofluoric or Chlorosulfonic Acids	 -20°C to +200°C
FKM - (GFLT)	Tetrafluoroethylene (Anti Decompression)	Petroleum Oils Wet Gas (Sour) Di ester Based Lubricants Silicate Ester Base Lubricants Silicone Fluids and Greases Halogenated Hydrocarbons (Carbon Tetrachloride, Trichloro - Ethylene) Selected Phosphate Ester Fluids Acids	Ketones Skydrol fluids Amines, Anhydrous Ammonia Hot hydrofluoric or Chlorosulfonic Acids	 -50°C to +200°C
FEP-O-SEAL (MVQ - SIL)	Teflon® Virgin (PTFE) F.E.P. ENCAPSULATED O-RINGS SILICONE (Anti Decompression)	Chemical Processing and Production Oil Extraction (on shore and off shore) Petrochemical Refining Pharmaceutical Production Food and Drink Processing Automotive Components Aerospace Engineering	Dynamic use where high speeds and poor finishes are encountered. Where the housing design requires excessive stretch or collapse of the O-ring during installation.	 -60°C to +204°C
FEP-O-SEAL (FPM)	Teflon® Virgin (PTFE) F.E.P. ENCAPSULATED O-RINGS VITON® (Anti Decompression)	Chemical Processing and Production Oil Extraction (on shore and off shore) Petrochemical Refining Pharmaceutical Production Food and Drink Processing Automotive Components Aerospace Engineering	Dynamic use where high speeds and poor finishes are encountered. Where the housing design requires excessive stretch or collapse of the O-ring during installation.	 -20°C to +204°C
ENERSEAL	Teflon® Virgin (PTFE) (Anti Decompression)	Chemical Processing and Production Oil Extraction (on shore and off shore) Petrochemical Refining Pharmaceutical Production Food and Drink Processing Automotive Components Aerospace Engineering	Dynamic use where high speeds and poor finishes are encountered. Where the housing design requires excessive stretch or collapse of the O-ring during installation.	 -195°C to +270°C
KARLEZ	KALREZ® Du Pont & Dow Elastomers (Anti Decompression)	Chemical Processing and Production Oil Extraction (on shore and off shore) Petrochemical Refining Pharmaceutical Production Food and Drink Processing Automotive Components Aerospace Engineering	Dynamic use where high speeds and poor finishes are encountered. Where the housing design requires excessive stretch or collapse of the O-ring during installation.	 -50°C to +315°C

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| BECHTEL | GUJARAT STATE PETRONET | QATAR PETROLEUM |
| BONATTI | HYUNDAI | SAIPEM |
| BP BRITISH PETROLEUM | IJAS | SAMSUNG ENGINEERING |
| BPA | INELECTRA | SHELL |
| BRITISH GAS | IPS GROUP | SHINWOO FA CO |
| CHIYODA ALMANA | JGC | SINOPEC |
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