

## Duoseal Sealing

“the ideal solution for preventing both ingress and egress of fluids and gases”

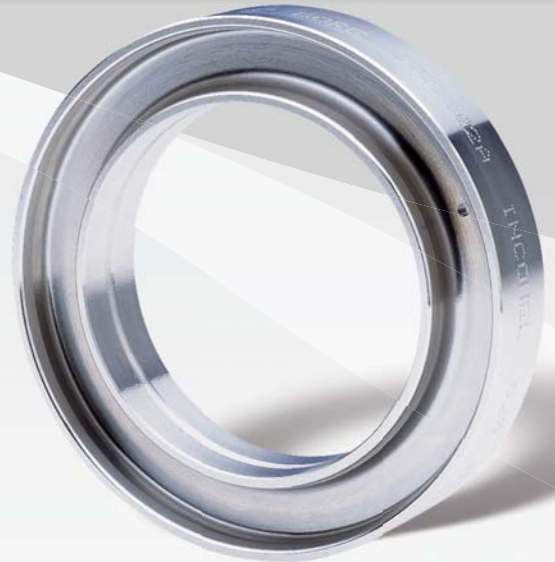
### Introduction

The Duoseal was developed in conjunction with the Optima Subsea Connector but has proven to be extremely popular in a vast range of other applications within and without the oil industry.

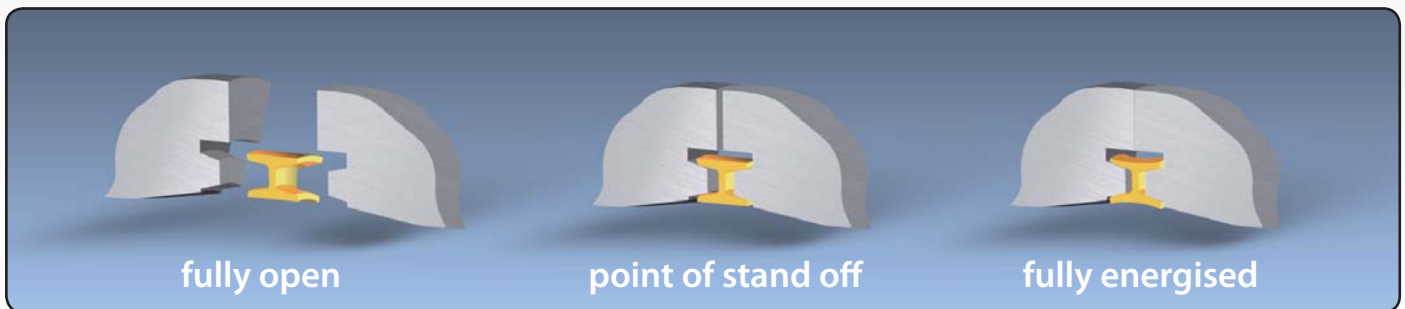
The Duoseal is a metal-to-metal seal that prevents both ingress and egress of fluids and gases at the joints.

The joints may be the Optima, flanges, clamp connectors, valve bonnets or any other joint where two seals are required.

The design is not a “double seal” whereby if the primary seal fails you have a secondary seal. It is an internal external seal with the capacity to carry out a reverse integrity test on the seals.



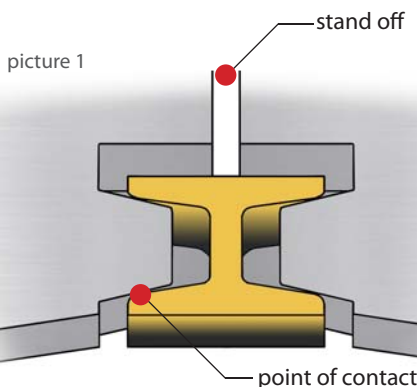
### Energisation : how the Duoseal creates the perfect seal



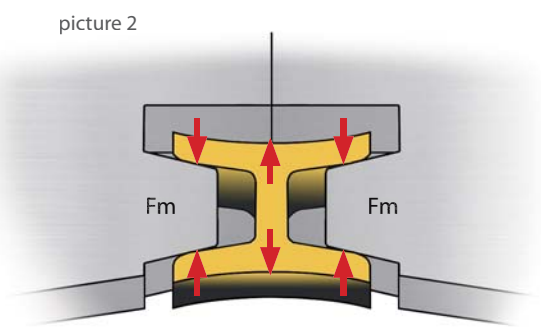
**Fully open :** The Duoseal is shown as being separate from both joints. It is most likely that the sealing would be sitting or located in one of the seat pockets.

**Point of stand off:** Once the two joints have been pulled together this is the point at which all four sealing surfaces are in contact. The stand off between the two joints can be seen (picture 1).

**Fully Energised :** From the position above to fully closed the Duoseal is energising. Once the joint is face to face, the sealing has gone to its maximum point of deflection. This creates the self-energisation loads required for the seal to function (picture 2).



**i** It is the self-energisation force “Fm” between the Duoseal and seat that creates the initial seal of the joint. The rib between the inner and outer seals ensures energisation occurs by reacting against this force.



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## Pressurisation

Once the joint is pressurized the joint now pressure energised. This of course could be due to either internal or external pressure.



The pressure creates a seating force which further energizes either or both the inner and outer seals. In simple terms the radial sealing force for the inner and outer seals is as follows :

Internal sealing force =  $F_m + F_{pi}$       External sealing force =  $F_m + F_{px}$

Therefore the greater the pressure the more sealing force exists. There is of course a maximum internal/external pressure that the Duoseal (much greater than normal operating pressures) and the joint can both withstand.

With the pressure differential between the internal and external values, the central rib will have a tendency to move towards the low pressure side. Finite Element Analysis and testing has shown that within the working limits of the Duoseal the resulting deformations will not de-seat the lower pressure seal.

## Annulus Test

The void between the inner and outer seals is ideal for carrying out a Reverse Integrity Test (RIT). This test will prove that the joint has been correctly assembled and that the seals are intact. The pressure required for this test is independant of the line or external pressures as it is a measure of the seals mechanical resistance. The RIT pressure is attempting to lift the sealing off the seat. If the force on the sealing lips is “Frit” in simple terms the following is true.

Internal sealing force =  $F_m - F_{rit}$       External sealing force =  $F_m - F_{rit}$

These means as the RIT pressure increases it will get closer to the make-up force. At the point where  $F_m = F_{rit}$  the seal would no longer be in contact with the seat. The test therefore is set to value which gives a good factor of safety (5).

The Duoseal therefore is extremely suitable for all subsea applications and as an alternative to RIT rings for topside joint integrity.

## Duoseal cross section drawing

