# SINGLE WIRE SEALS AND CAVITY PLUGS

## for the Automotive Industry

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## Single Wire Seals

The single wire seal (SWS) are a rubber element with three interfaces:

- Wire
- Contact
- Cavity

**Seal to wire interface**

The SWS is automatically placed on the wire where the outer diameter is within a well-defined range.

The wire size is linked to the hole dimension of the SWS and is smaller in diameter in order to have geometrical interference needed to create the sealing.

Seal geometry with two lips is generally adopted to provide a point-distributed sealing pressure against the cable.

This geometry allows three main advantages:

- Multiple sealing surfaces are better than a continuous sealing surface due to possible cable shape defects.
- The inner lip profile assures good sealing even when the wires are bent.
- Fluid pressure drops occurs from the first lip to the second lip. For this reason, fluid infiltration is avoided.

**Seal to contact interface**

The contact barrels close and retain the SWS without generating cuts on the surfaces. The assembly operation is fully automatic.

**Seal to cavity interface**

The seal crimped onto the contact is inserted into the cavity. The difference between the outer diameter of the seal and the cavity diameter generates a radial compression of the rubber element and the consequent sealing pressure at the interface. This interference causes additional closure pressure on the wire interface increasing the tightness level towards the cable.

Most single wire seal designs use a three-lip configuration. Such designs creates three layers of redundant sealing. SWS elements are generally made of silicone rubber; this rubber offers high mechanical resistance and can work in a very wide window of operating temperatures. The material hardness is typically specified as 40-50 Shore A (ShA) durometer. This range is optimal in providing the necessary compression, tear resistance, and durability properties required for the automotive applications.

Lubrication is often necessary to facilitate the wire passage through the seal during the automatic crimping process and to reduce the force and the risk of damage when the seal element is inserted in the cavity of the connector housing. The amount of oil in the rubber is generally between 1% and 5% in weight.

## Cavity Plug

The cavity plug is used to seal a cavity where no contact is used. The geometrical profile is fully from the single wire seal element with the exception that it does not have an inner hole for wire.

Rubber material selection is very often limited to the silicone rubber with a ShA hardness range that is generally between 50 and 60; lubricant in the rubber raw material is generally not requested in order to increase the seal retention into cavity, as there is not any mechanical constraint for this rubber element.

## Single Wire Seals

| Product (Example) | Cavity Diameter (mm) | Wire Cross Section ($mm^2$) | Wire Diameter (mm) min. – max. | Material | Hardness Shore „A“ | Color | Part Number |
|---|---|---|---|---|---|---|---|
| 967067-2 | 3.45 | 0.20 - 0.35 | 0.90 - 1.40 | Silicone | 50 | Yellow | 967067-2 |
| | | 0.50 - 0.75 | 1.40 - 1.90 | Silicone | 50 | Green | 967067-1 |
| | | 3.50 | 2.80 - 3.20 | Silicone | 40 | Brown | 638865-1 |
| 963530-1 | 3.60 | 0.12 - 0.90 | 1.02 - 2.11 | Silicone | 30 | Blue | 794758-1 |
| | | 0.20 - 0.35 | 0.90 - 1.20 | Silicone | 50 | Green | 1718705-1 |
| | | 0.20 - 0.35 | 0.90 - 1.20 | Silicone | 50 | Red | 1718705-2 |
| | | 0.35 - 0.50 | 1.20 - 1.60 | Silicone | 50 | Black | 964971-1 |
| | | 0.35 - 0.50 | 1.20 - 1.60 | Silicone | 50 | Red | 1393457-2 |
| | | 0.35 - 0.50 | 1.20 - 1.60 | Silicone | 50 | Blue | 1394133-1 |
| | | 0.50 - 0.75 | 1.40 - 1.90 | Silicone | 50 | Grey | 963530-1 |
| | | 0.30 - 0.50 | 1.40 - 1.70 | Silicone | 60 | Grey | 316867-1 |
| | | 0.50 - 0.75 | 1.40 - 1.90 | Silicone | 50 | Green | 1-967067-1 |
| | | 0.50 - 0.75 | 1.40 - 2.00 | Silicone | 50 | Grey | 1393457-1 |
| | | 0.85 | 2.20 - 2.50 | Silicone | 50 | Brown | 2005673-4 |
| | | 1.00 | 1.90 - 2.40 | Silicone | 50 | Yellow | 964972-1 |
| | | 1.25 | 2.10 - 2.40 | Silicone | 40 | Brown | 2219708-4 |
| | | 1.50 | 2.20 - 2.40 | Silicone | 50 | Orange | 2112323-1 |
| | | 1.50 - 2.00 | 1.35 - 1.90 | Silicone | 50 | Red | 2098582-1 |
| | | 1.50 - 2.00 | 1.40 - 1.80 | NBR *) | 50 | Black | 2138898-1 |
| 963142-1 | 4.00 | 0.20 - 0.35 | 0.90 - 1.30 | Silicone | 50 | Grey | 963142-2 |
| | | 0.50 - 0.75 | 1.40 - 2.10 | Silicone | 50 | Black | 963142-1 |
| | | 1.50 - 2.00 | 1.40 - 2.10 | Silicone | 50 | Blue | 963142-3 |
| 900324-4 | 4.40 | 0.20 - 0.35 | 1.10 - 1.30 | Silicone | 40 | Orange | 347681-1 |
| | | 0.20 - 0.50 | 1.40 - 2.10 | NBR *) | 40 | Black | 2822356-1 |
| | | 0.20 - 0.50 | 1.40 - 2.40 | NBR *) | 38 | Black | 2822352-1 |
| | | 0.30 - 0.50 | 1.40 - 1.90 | Silicone | 50 | Yellow/Green | 900324-4 |
| | | 0.35 - 0.50 | 1.20 - 1.70 | Silicone | 40 | Blue | 184139-1 |
| | | 0.35 - 0.50 | 1.20 - 1.70 | Silicone | 50 | Blue | 1-368889-1 |
| | | 0.50 - 1.00 | 1.40 - 2.10 | Silicone | 40 | Brown | 1-178210-3 |
| | | 0.50 - 1.50 | 1.50 - 2.40 | Silicone | 40 | Green | 347874-1 |
| | | 0.50 - 1.25 | 2.00 - 2.60 | Silicone | 40 | Brown | 1-172888-3 |

*) Nitrile Butadiene Rubber

(continued on page 4)

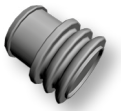
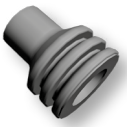
# Single Wire Seals

| Product (Example) | Cavity Diameter (mm) | Wire Cross Section ($mm^2$) | Wire Diameter (mm) min. – max. | Material | Hardness Shore „A“ | Color | Part Number |
|---|---|---|---|---|---|---|---|
| 2822355-1 | 4.40 | 0.50 - 1.25 | 2.00 - 3.00 | Silicone | 50 | Purple | 1-900325-9 |
| | | 0.50 - 1.25 | 2.00 - 2.60 | NBR *) | 38 | Black | 2822354-1 |
| | | 0.50 - 1.25 | 2.00 - 2.60 | NBR *) | 38 | Black | 2822354-2 |
| 368120-2 | | 0.50 - 1.25 | 1.80 - 2.60 | NBR *) | 40 | Black | 2822355-1 |
| | | 0.50 - 1.40 | 1.80 - 2.60 | Silicone | 50 | Grey | 368120-2 |
| | | 0.50 - 1.50 | 1.50 - 2.40 | Silicone | 40 | Red | 348989-1 |
| | | 0.50 - 1.50 | 1.70 - 2.40 | Silicone | 50 | Red | 1-368280-1 |
| 184140-1 | | 0.75 - 1.00 | 1.60 - 2.10 | Silicone | 40 | Orange | 184140-1 |
| | | 1.50 - 2.00 | 2.20 - 2.70 | Silicone | 40 | Purple | 184141-1 |
| | | 2.00 | 2.40 - 2.70 | Silicone | 40 | Yellow | 347875-1 |
| 284863-1 | 5.00 | 0.35 - 1.0 | 1.20 - 2.10 | Silicone | 50 | Orange | 284863-1 |
| | | 2.50 | 2.70 - 3.00 | Silicone | 50 | Grey | 282536-1 |
| 368932-1 | 5.10 | 0.30 - 1.00 | 1.20 - 2.10 | Silicone | 45 | Blue | 368932-1 |
| | | 2.50 - 4.00 | 2.20 - 3.00 | Silicone | 50 | Blue | 1743988-1 |
| 828905-1 | 5.20 | 0.35 - 1.00 | 1.20 - 2.10 | Silicone | 50 | Blue | 963294-1 |
| | | 0.35 - 1.00 | 1.20 - 2.10 | Silicone | 50 | Light Blue | 828904-1 |
| | | 0.50 - 1.50 | 2.00 - 2.70 | Silicone | 50 | Brown | 963293-1 |
| | | 0.50 - 2.50 | 2.20 - 3.00 | Silicone | 50 | White | 828905-1 |
| | | 0.50 - 1.50 | 2.00 - 2.70 | Silicone | 50 | Brown | 963293-2 |
| | | 1.50 - 2.50 | 2.70 - 3.00 | Silicone | 50 | Yellow | 963292-1 |
| | | 1.50 - 2.50 | 2.30 - 3.00 | NBR *) | 50 | Grey | 826764-1 |
| 828920-1 | 5.40 | 0.35 - 1.00 | 1.20 - 2.10 | Silicone | 50 | Dark Blue | 828920-2 |
| | | 0.35 - 1.00 | 1.20 - 2.10 | Silicone | 50 | Grey | 828920-1 |
| | | 0.75 - 1.00 | 1.70 - 2.10 | Silicone | 50 | Blue | 1393458-1 |
| | | 1.00 - 2.50 | 2.10 - 3.00 | Silicone | 50 | Yellow | 828921-1 |
| | | 1.50 - 2.50 | 2.20 - 3.00 | Silicone | 50 | Red/Brown | 1393457-4 |

*) Nitrile Butadiene Rubber

(continued on page 5)

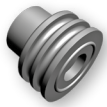
# Single Wire Seals

| Product (Example) | Cavity Diameter (mm) | Wire Cross Section ($mm^2$) | Wire Diameter (mm) min. – max. | Material | Hardness Shore „A“ | Color | Part Number |
|---|---|---|---|---|---|---|---|
| 281934-4 | 5.50 | 0.35 - 0.50 | 1.20 - 1.60 | Silicone | 50 | Green | 281934-4 |
| | | 0.50 - 1.00 | 3.40 - 6.20 | Silicone | 50 | Red | 368947-2 |
| | | 0.50 - 1.00 | 3.40 - 6.20 | Silicone | 50 | Yellow | 368947-1 |
| | | 0.75 - 1.50 | 1.70 - 2.40 | Silicone | 50 | Yellow | 281934-2 |
| 368947-1 | | 1.20 - 1.60 | 1.70 - 2.40 | Silicone | 50 | White | 281934-5 |
| | | 1.50 - 2.00 | 1.20 - 1.60 | Silicone | 50 | Brown | 1745057-2 |
| | | 2.00 - 2.50 | 2.50 - 3.30 | Silicone | 50 | Red | 281934-3 |
| 967610-1 | 6.40 | 0.35 - 1.00 | 1.40 - 2.10 | Silicone | 50 | Grey | 967610-1 |
| | | 1.50 - 2.50 | 2.20 - 3.00 | Silicone | 50 | Yellow | 967609-1 |
| | | 1.50 - 2.50 | 2.20 - 3.00 | Silicone | 50 | Yellow | 2236402-1 |
| | | 2.50 - 4.00 | 3.00 - 3.70 | Silicone | 50 | Green | 828985-1 |
| 368933-1 | 6.78 | 1.50 - 2.50 | 2.20 - 3.00 | Silicone | 45 | White | 368933-1 |
|  963245-1 | 7.20 | 0.35 - 1.00 | 1.40 - 2.10 | Silicone | 50 | Light Blue | 963243-1 |
| | | 1.50 - 2.50 | 2.20 - 3.00 | Silicone | 50 | White | 963244-1 |
| | | 2.50 - 4.00 | 3.40 - 3.70 | Silicone | 50 | Yellow | 963245-1 |
| | | 4.00 - 6.00 | 3.60 - 4.30 | Silicone | 50 | Green | 967011-1 |
| | | 7.00 | 4.30 - 5.20 | Silicone | 50 | Red | 968043-1 |
| | | 0.30 - 1.25 | 2.00 - 2.70 | NBR *) | 40 | Grey | 85024-1 |
|  85011-1 | 7.50 | 2.00 - 3.00 | 2.90 - 3.80 | NBR *) | 40 | Black | 85011-1 |
| | | 6.00 - 8.00 | 3.30 - 3.80 | Silicone | 45 | Grey | 368940-1 |
| 2188967-3 | 7.80 | 5.00 | 4.60 - 5.00 | Silicone | 45 | Grey | 2188967-3 |
| 347713-1 | 8.05 | 0.50 - 1.50 | 1.60 - 2.40 | Silicone | 40 | Orange | 347707-1 |
| | | 2.00 - 3.00 | 2.60 - 3.40 | Silicone | 40 | Yellow | 347713-1 |

*) Nitrile Butadiene Rubber

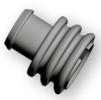
(continued on page 6)

# Single Wire Seals

| Product (Example) | Cavity Diameter (mm) | Wire Cross Section ($mm^2$) | Wire Diameter (mm) min. – max. | Material | Hardness Shore „A“ | Color | Part Number |
|---|---|---|---|---|---|---|---|
| 2822353-1 | 8.20 | 0.85 - 1.25 | 1.80 - 2.10 | NBR *) | 50 | Grey | 368811-1 |
| | | 1.25 - 3.00 | 2.50 - 4.10 | NBR *) | 38 | Black | 2822353-1 |
| | | 4.00 - 6.00 | 3.85 - 4.75 | Silicone | 50 | Grey | 282362-1 |
| | | 3.00 - 5.00 | 3.60 - 4.60 | NBR *) | 45 | Black | 368910-1 |
|  1394512-1 | 8.48 | 0.50 - 1.50 | 2.00 - 2.70 | Silicone | 50 | White | 1394511-1 |
| | | 0.50 - 1.00 | 1.40 - 2.00 | Silicone | 50 | Yellow | 2177018-1 |
| | | 4.00 | 3.40 - 3.70 | Silicone | 50 | Blue | 1394512-1 |
| | | 4.00 - 6.00 | 4.00 - 4.50 | Silicone | 50 | Green | 1719043-1 |
| 967608-1 | 8.50 | 1.50 - 2.50 | 2.20 - 3.00 | Silicone | 50 | Yellow | 967607-1 |
| | | 1.50 - 2.50 | 2.70 - 3.00 | Silicone | 50 | Red Brown | 1823111-1 |
| | | 2.50 - 4.00 | 2.65 - 3.90 | Silicone | 50 | Yellow | 1544941-1 |
| | | 4.00 | 3.40 - 3.70 | Silicone | 50 | Green | 967608-1 |
| | | 5.00 - 6.00 | 3.80 - 4.50 | Silicone | 50 | Red | 1544941-2 |
| | | 16.0 | 3.50 - 5.50 | Silicone | 50 | Blue | 1719972-1 |
| 1544316-1 | 10.5 | 2.50 - 50.0 | 2.65 - 4.00 | Silicone | 50 | Brown | 1544970-1 |
| | | 3.00 - 6.00 | 3.20 - 4.10 | Silicone | 50 | Green | 1544316-1 |
| | | 3.00 - 6.00 | 3.10 - 4.20 | Silicone | 50 | Green | 1544664-1 |
| | | 6.00 - 7.00 | 4.10 - 5.00 | Silicone | 50 | Blue | 1544970-2 |
| | | 7.00 - 10.00 | 4.90 - 5.90 | Silicone | 50 | Orange | 1544316-2 |
| | | 7.00 - 10.0 | 4.60 - 5.70 | Silicone | 50 | Orange | 1544664-2 |
| | | 10.0 | 5.10 - 6.00 | Silicone | 50 | Yellow | 1544970-3 |
| 1355437-2 | 15.0 | 5.00 - 6.00 | 4.70 - 5.30 | Silicone | 50 | Light Blue | 1355307-1 |
| | | 5.00 - 6.00 | 4.60 - 5.20 | Silicone | 50 | Violet | 1355437-1 |
| | | 10.0 | 5.80 - 6.60 | Silicone | 50 | Light Blue | 1355437-2 |
| | | 10.0 - 16.0 | 7.10 - 8.10 | Silicone | 50 | Red | 1355437-3 |

*) Nitrile Butadiene Rubber

## Cavity Plugs

| Product (Example) | Cavity Diameter (mm) | Material | Hardness Shore | Color | Part Number |
|---|---|---|---|---|---|
| 967056-1 | 3.45 | Silicone | 60 | Blue | 967056-1 |
| 963531-1 | 3.60 | Silicone | 60 | Red brown | 1473234-1 |
| | | Silicone | 50 | White | 963531-1 |
| | | Silicone | 50 | Natural | 1394132-1 |
| | | Silicone | 50 | White | 1393457-3 |
| 963143-1 | 4.00 | Silicone | 60 | White | 963143-1 |
| 963143-1 | 4.40 | Silicone | 50 | Grey | 348461-1 |
| | | NBR *) | 50 | Black | 2822357-1 |
| 828906-2 | 5.00 | Silicone | 50 | Brown | 828906-2 |
| 828922-1 | 5.40 | Silicone | 50 | Natural | 828922-1 |
| | | Silicone | 50 | Green | 828922-2 |
| 282081-2 | 5.50 | Silicone | 50 | Yellow | 282081-2 |
| | | Silicone | 50 | Red | 282081-1 |
|  828986-1 | 6.40 | Silicone | 50 | Black | 100132-1 |
| | | Silicone | 50 | Natural | 967653-1 |
| | | Silicone | 50 | Brown | 828986-1 |
| 967652-1 | 8.50 | Silicone | 50 | Natural | 967652-1 |
| 2822358-1 | 9.80 | Silicone | 50 | Grey | 348462-1 |
| | | NBR *) | 50 | Black | 2822358-1 |
| 1544316-3 | 10.5 | Silicone | 45 | White | 1544664-3 |
| | | Silicone | 45 | White | 1544316-3 |
| | | Silicone | 45 | White | 1544970-4 |

*) Nitrile Butadiene Rubber

Dalroad

Enterprise Way
Luton
Bedfordshire
LU3 4BU

Tel: 01582 505 252
E-mail: sales@dalroad.com

**TE Connectivity Germany GmbH**
Ampèrestrasse 12–14
64625 Bensheim
Germany
Phone: +49 (0)6251 133-0
Fax: +49 (0)6251 133-1600

www.TE.com
www.TE.com/Automotive

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