

Seaflex “Grade Ω”

ship to ship transfer hose



Shunichi Ono
Manager,
Business & Product Development
The Yokohama Rubber Co., Ltd.
4th June 2019

Outline

- **Design feature of “Seaflex Grade Ω STS hose”**
- **Structure of “Seaflex Grade Ω STS hose”**
- **How to mix “Seaflex Grade Ω STS hose” and current STS hoses in a hose string**

Outline

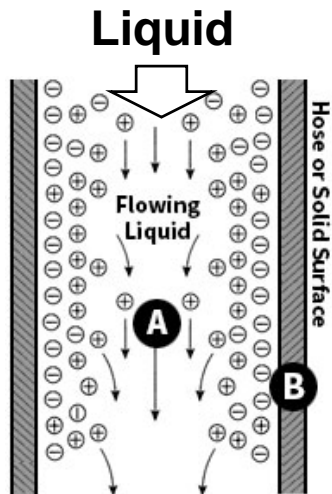
- **Design feature of “Seaflex Grade Ω STS hose”**
- **Structure of “Seaflex Grade Ω STS hose”**
- **How to mix “Seaflex Grade Ω STS hose” and current STS hoses in a hose string**

Design feature of “Seaflex Grade Ω STS hose”

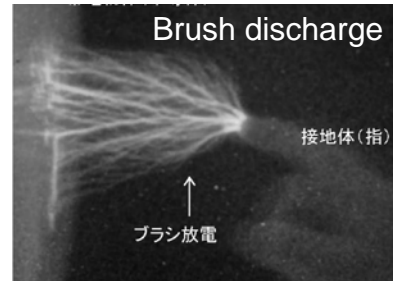
“Seaflex Grade Ω STS hose” is specially designed to minimize the risk of electrostatic discharges and prevent inductive sparks caused by the electrical potential difference between two tankers.

Electrostatic discharge

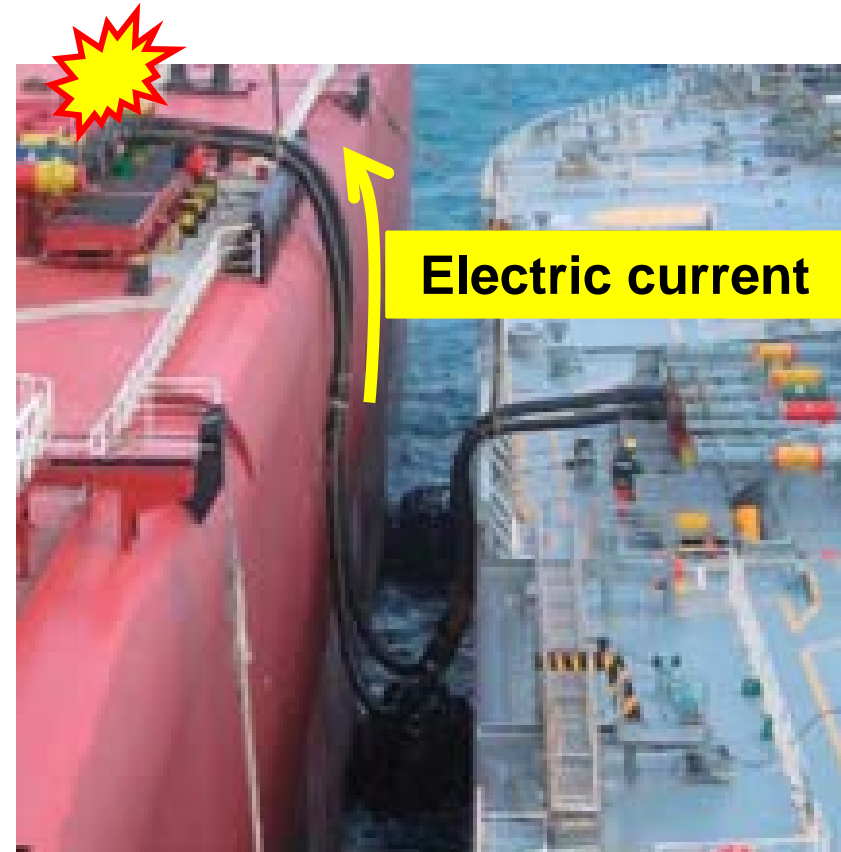
The arc caused by the electrostatic charge is created when the potential difference between the charged hose and the nearest conductive object becomes high enough for the electrons to “jump” over to the object.



Flow electrification

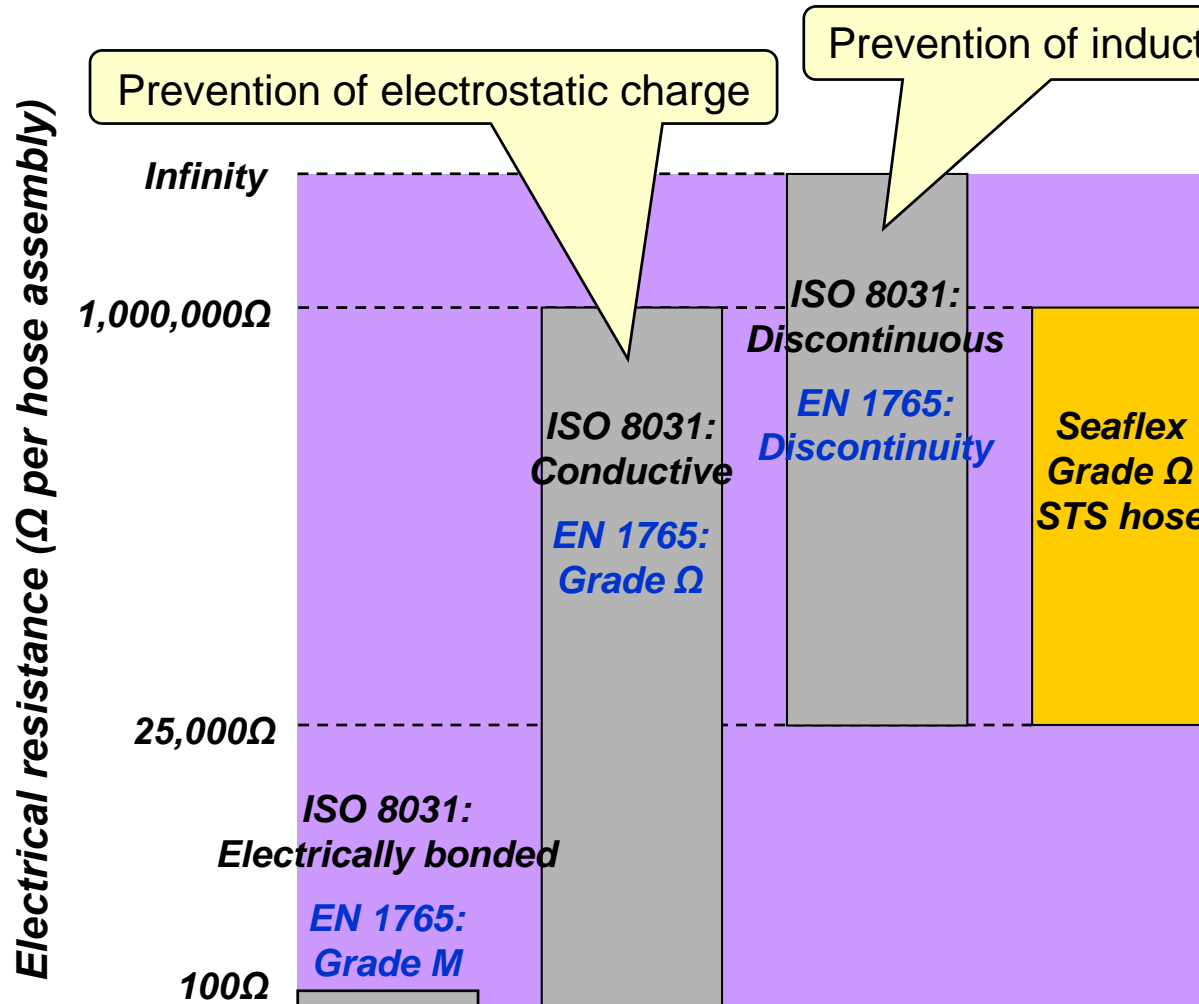


Inductive spark



Electrical resistance of “Seaflex Grade Ω STS hose”

The electrical resistance of “Seaflex Grade Ω STS hose” is low enough to avoid electrostatic charges but too high to transmit large current which may cause inductive sparks.



ISO 8031: Rubber and plastics hoses and hose assemblies - Determination of electrical resistance and conductivity

EN 1765: Rubber hose assemblies for oil suction and discharge services - Specification for the assemblies

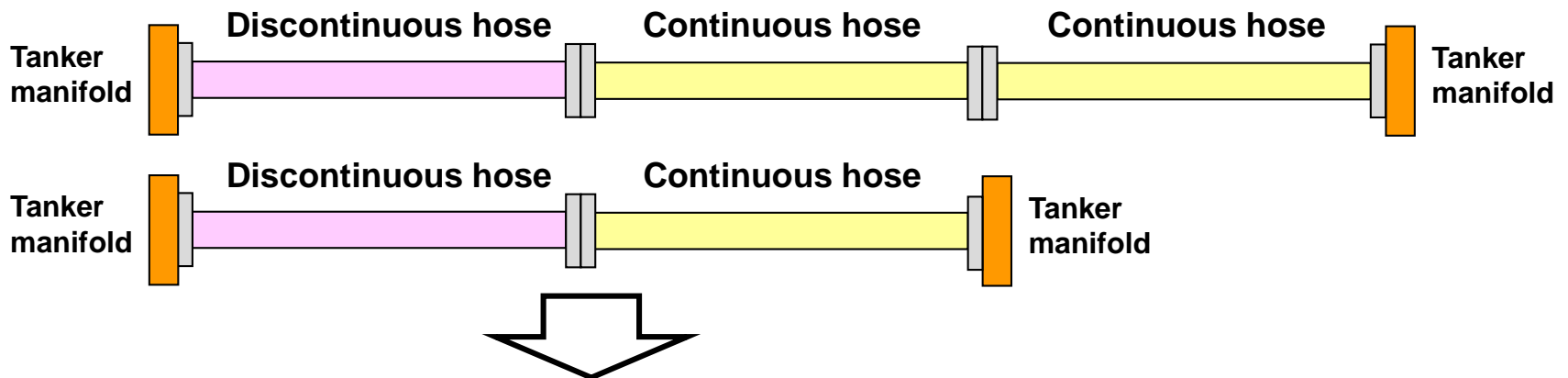
Yokohama original semi-continuous hose

max. 11,800,000 Ω
min. 9,100 Ω

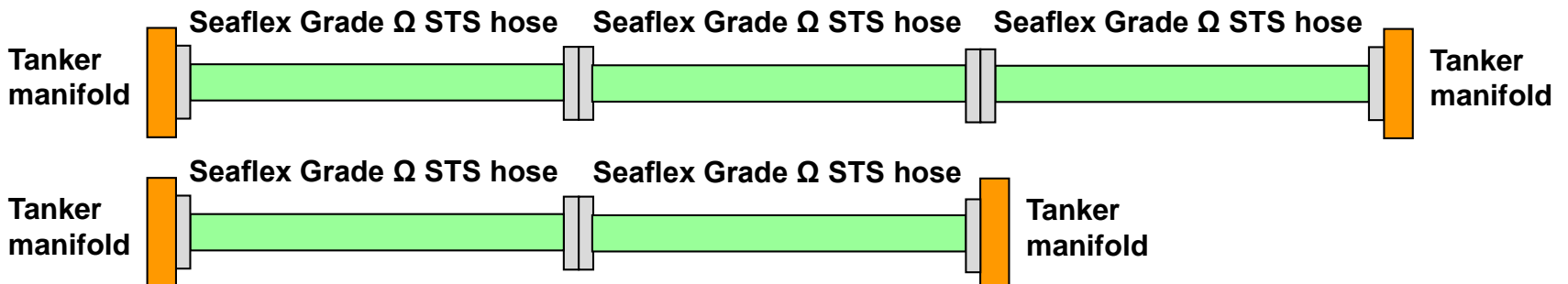
Advantages of “Seaflex Grade Ω STS hose”

- Operators only have to buy one type of hose “Seaflex Grade Ω STS hose” instead of buying two hose types.
- Operators can eliminate the risk of human mistakes in the hose string assembly process.

Current arrangement composed of two hose types

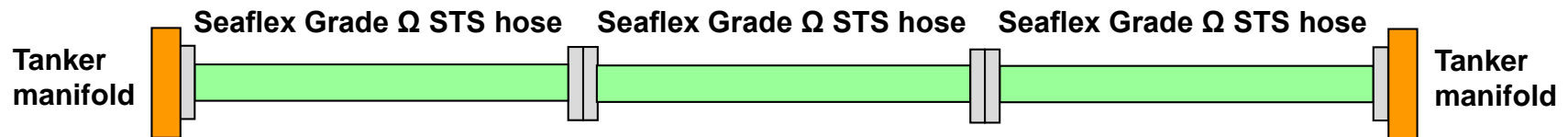


New arrangement composed of one type of hose



OCIMF's recommendations

The hose string composed of only “Seaflex Grade Ω STS hose” is one of the three arrangements recommended by ship to ship transfer guide 2013.



3.10.4 Electrical isolation

It is necessary to ensure that electrical isolation is maintained between the ships involved in STS operations during transfer line connection/disconnection and cargo transfer operations. This is to reduce the risk of high energy sparks being produced due to the electrical potential difference between the hulls.

To eliminate the potential for incendive arcing between the two ships, when presenting the hose string for connection one of the following arrangements should be used:

- • A single insulating flange fitted at the manifold of one ship or within each hose string and all hoses in the string electrically continuous; or
- • A single length of electrically discontinuous hose fitted in each hose string; or
- • Hoses that are specially constructed to prevent static build-up and limit electrical conductance to an inherently safe level (see section 9.2.1).

Seaflex Grade Ω STS hose

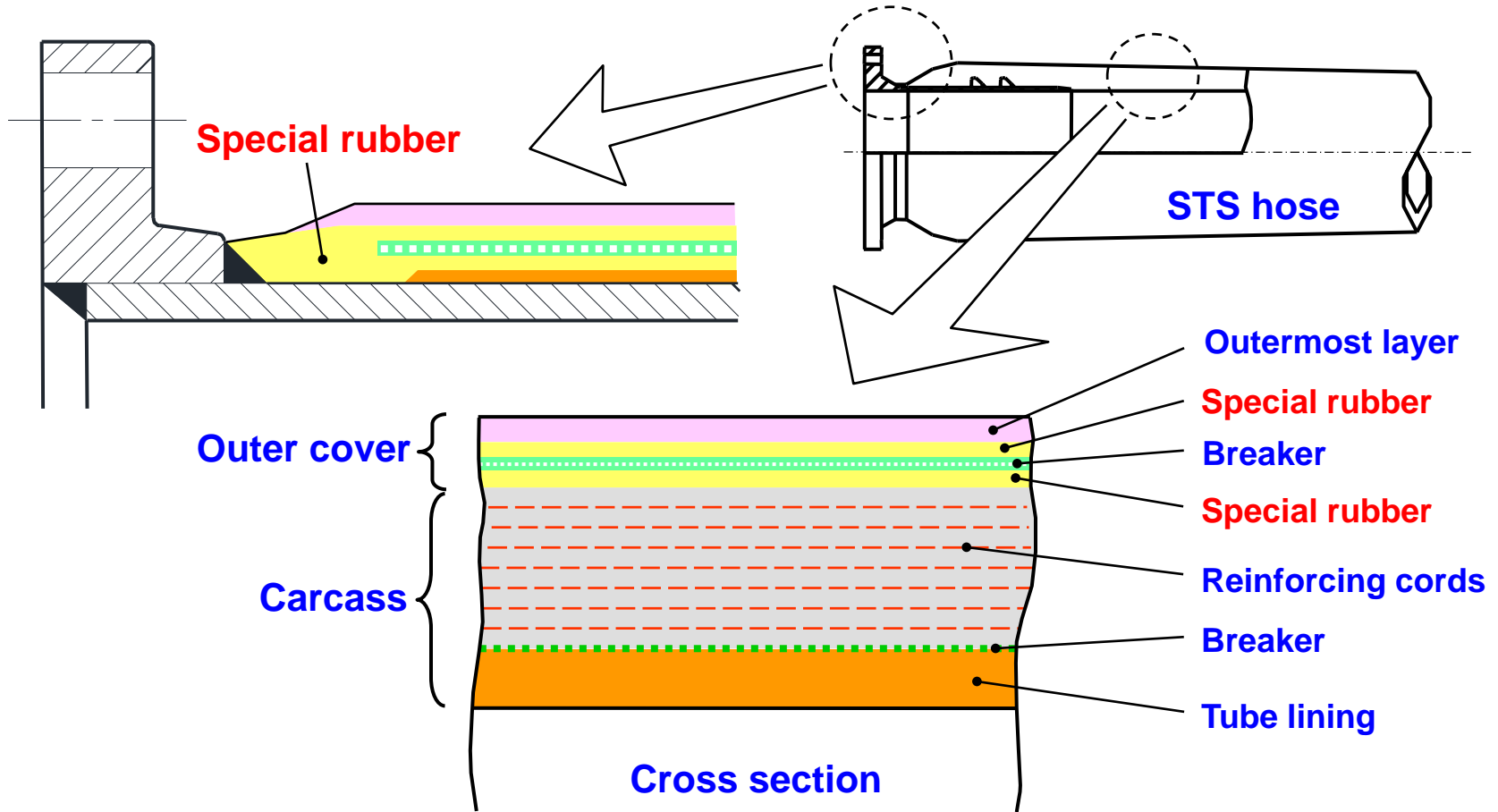
Outline

- Design feature of “Seaflex Grade Ω STS hose”
- **Structure of “Seaflex Grade Ω STS hose”**
- How to mix “Seaflex Grade Ω STS hose” and current STS hoses in a hose string

Structure of “Seaflex Grade Ω STS hose”

The special rubber with specific electrical resistance connects the fittings at both ends. The special rubber was improved to minimize variation in the electrical resistance.

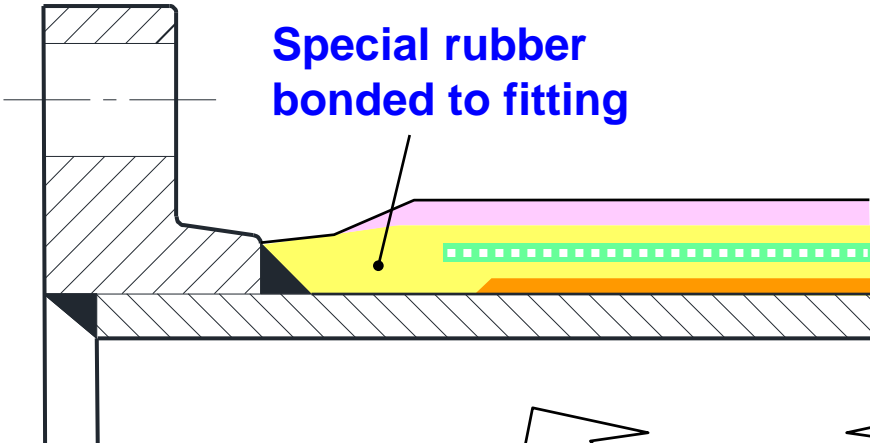
Special rubber is firmly bonded to the fittings.



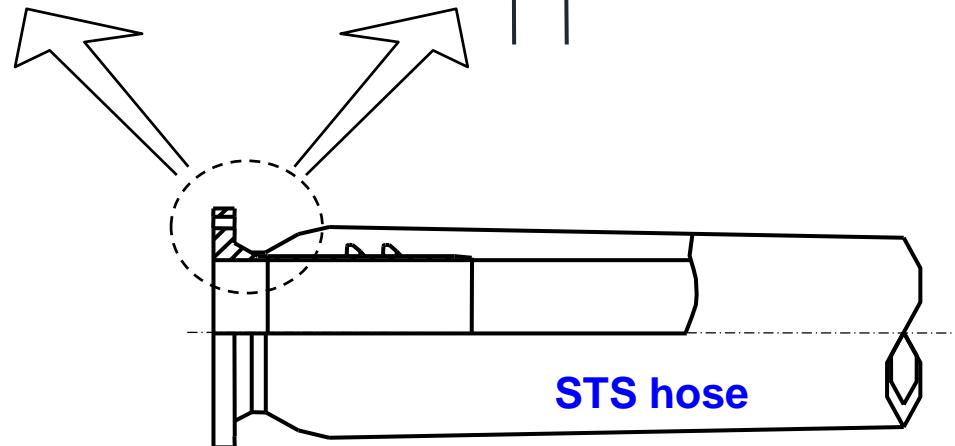
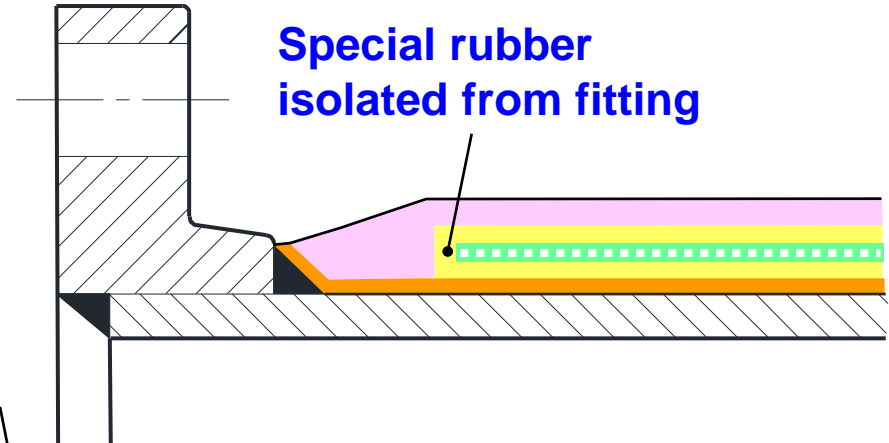
Structure of electrically discontinuous hose

In the electrically discontinuous hose certified by EN1765, the special rubber is electrically isolated from the fittings.

Seaflex Grade Ω STS hose

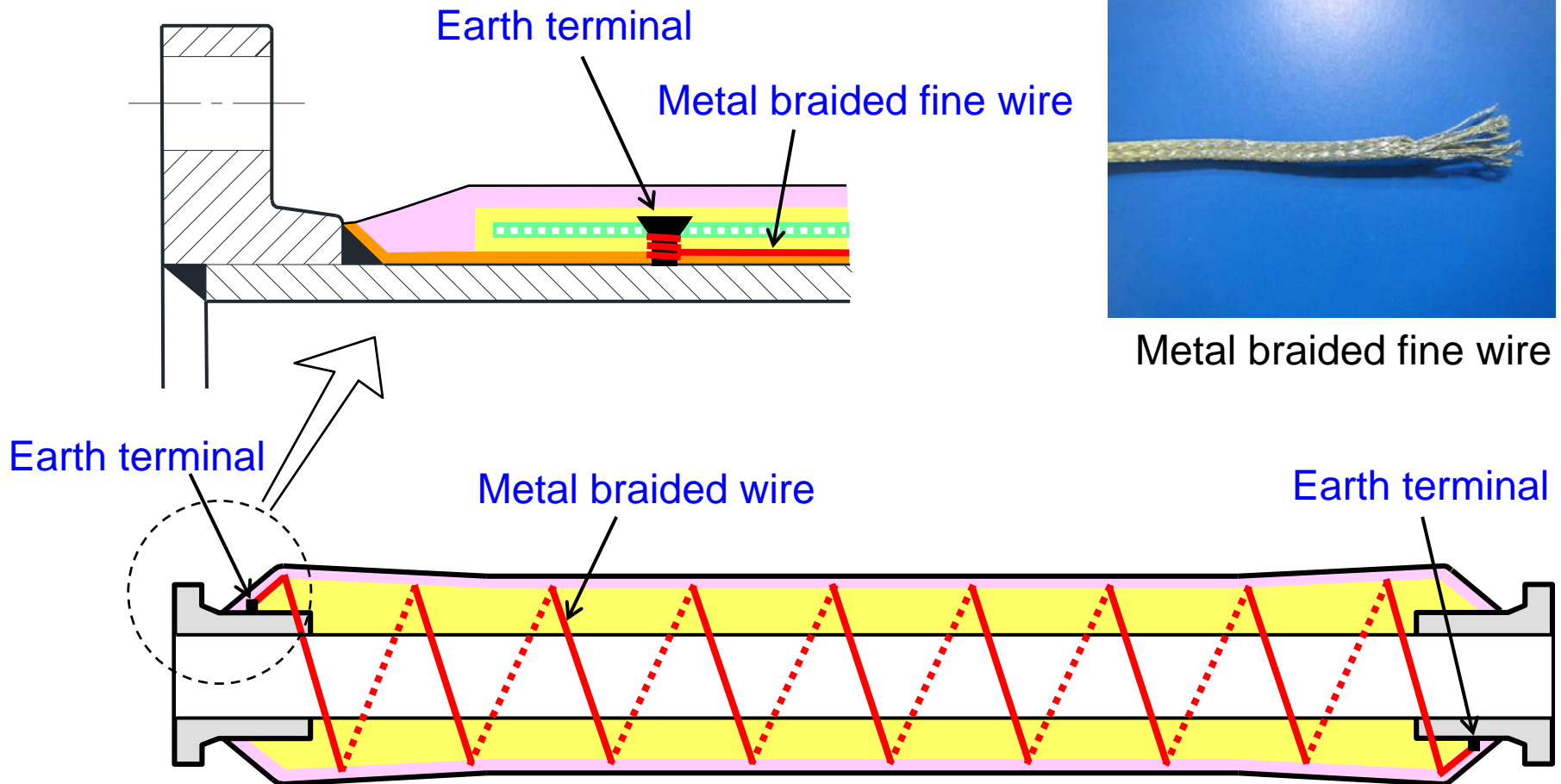


Electrically discontinuous hose



Structure of electrically continuous hose

In the electrically continuous hose certified by EN1765, the metal braided fine wire connect the earth terminals welded to the fittings at both ends.

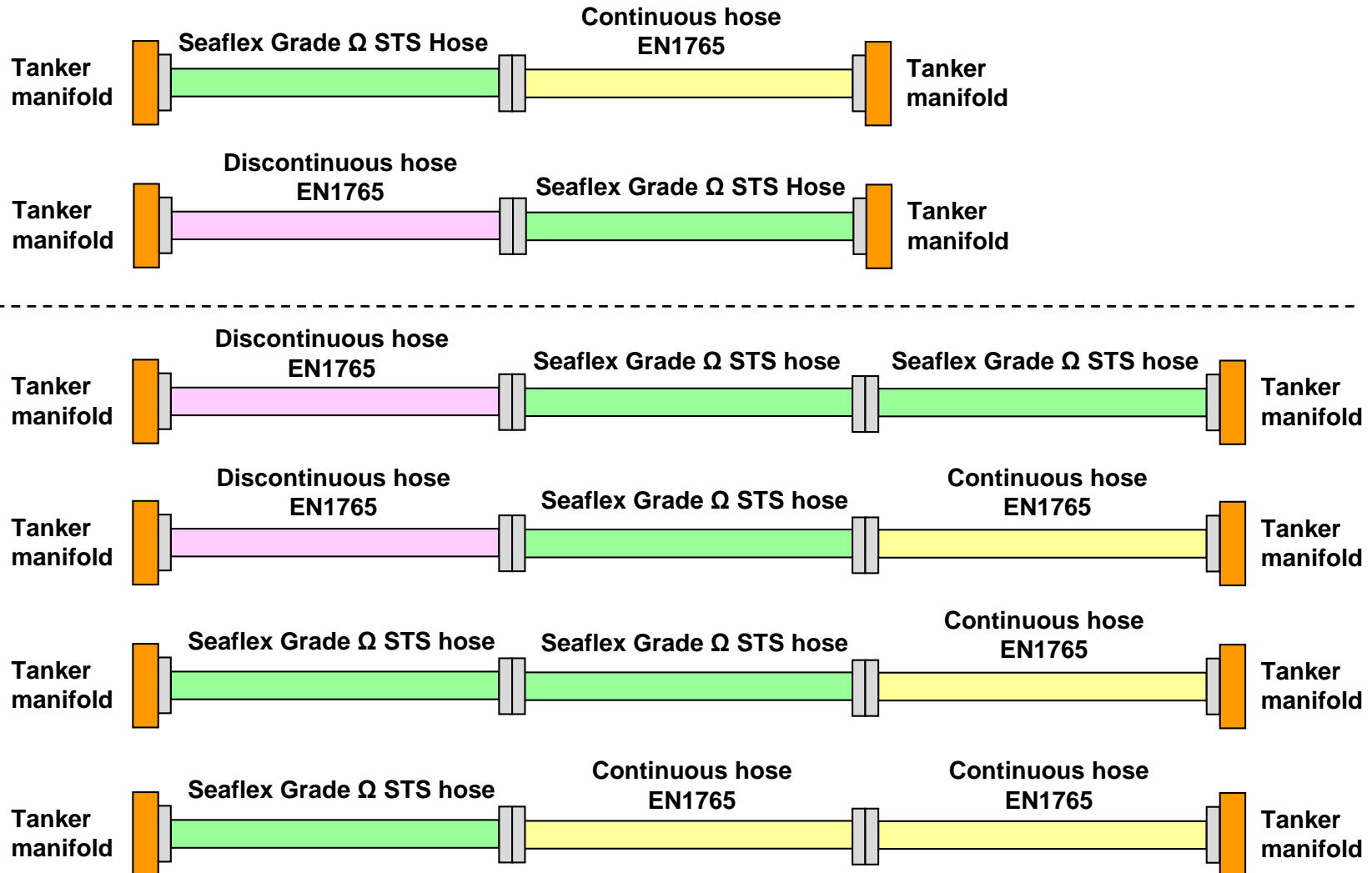


Outline

- Design feature of “Seaflex Grade Ω STS hose”
- Structure of “Seaflex Grade Ω STS hose”
- **How to mix “Seaflex Grade Ω STS hose” and current STS hoses in a hose string**

Combination with EN1765 certified hoses

The following arrangements do not interfere with the concept of “Seaflex Grade Ω STS hose”.



Conclusion

Yokohama launched “Seaflex Grade Ω STS hose” last October.

“Seaflex Grade Ω STS hose” conforms to EN 1765.

“Seaflex Grade Ω STS hose” allow operator to use only one type of hose, which eliminate the risk of inductive sparks and electrostatic discharges caused by the human mistakes.

Thank You for Your Attention!

Change in guideline on prevention of static electricity

In the past, the electrical resistance should be less than 1 MΩ per meter. A new guideline* says that the electrical resistance should be less than 1 MΩ per hose assembly including fittings.

Old guideline : $R < 1\text{M}\Omega$ per meter



Latest guideline : $1\text{ k}\Omega \leq R < 1\text{M}\Omega$ per hose assembly including fittings

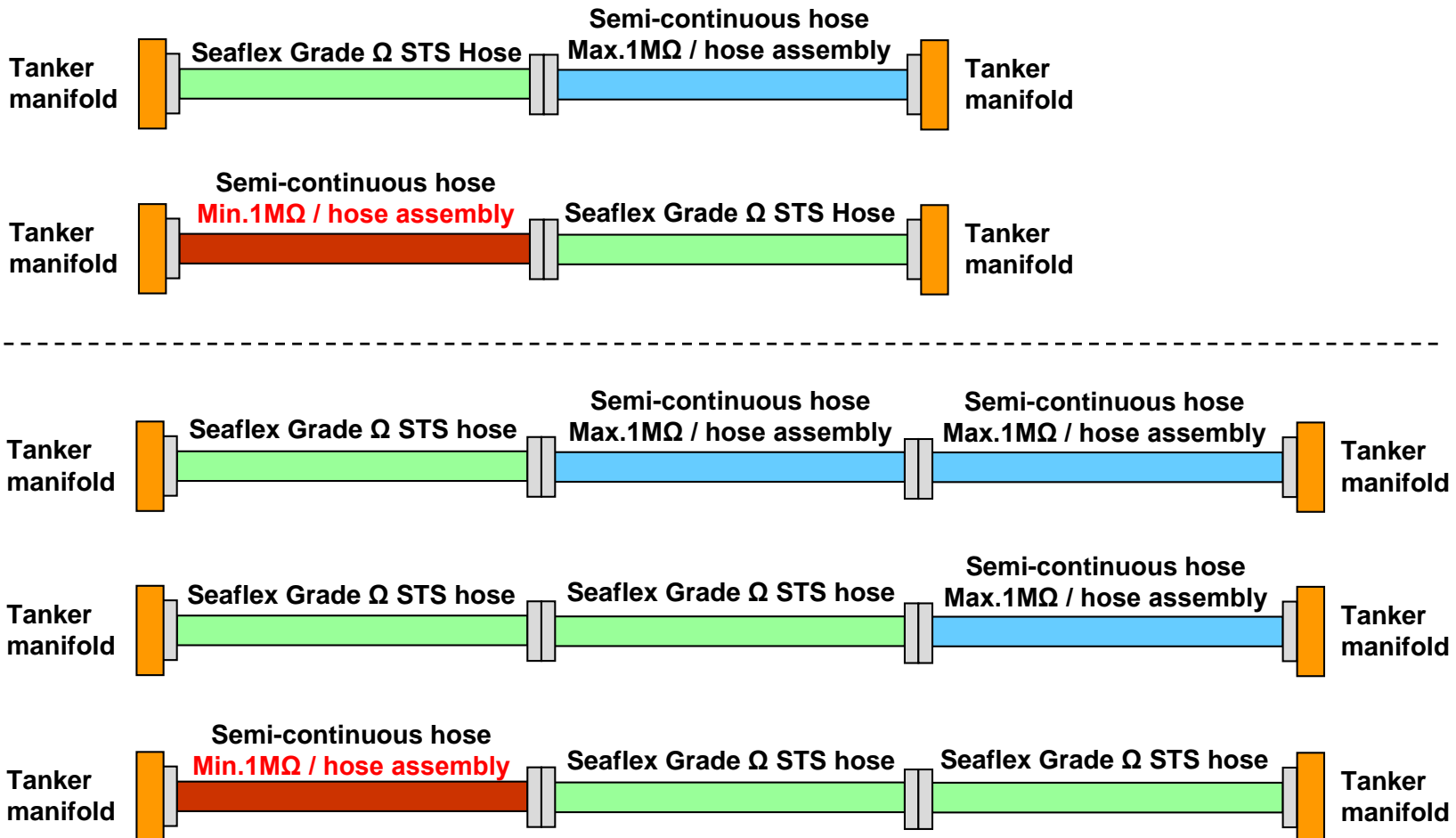
R : Electrical resistance of the hose.

*IEC TS 60079-32-1:2013

Explosive atmospheres - Part 32-1:Electrostatic hazards, guidance
7.7.3 Hoses and hose assemblies

Combination with semi-continuous hose

The following arrangements do not interfere with the concept of “Seaflex Grade Ω STS hose”.



Electrical continuity in EN 1765

For electrical continuities, the description in EN 1765 (2016) is in line with the description in ISO8031 (2009).

Property	Unit	Requirement	Method of test
Electrical properties (continuity)	Ω	After carrying out the change in length and vacuum tests the continuity measured between the couplings shall be maintained. Maximum electrical resistance 100 per assembly. Grade M. Maximum electrical resistance 10^6 per assembly. Grade Ω .	EN ISO 8031:2009
Electrical properties (discontinuity) (types S and L only)	Ω	Minimum $2,5 \times 10^4$ between the couplings	EN ISO 8031:2009

Quotation from “Table 4, page 15 of EN 1765 (2016)”

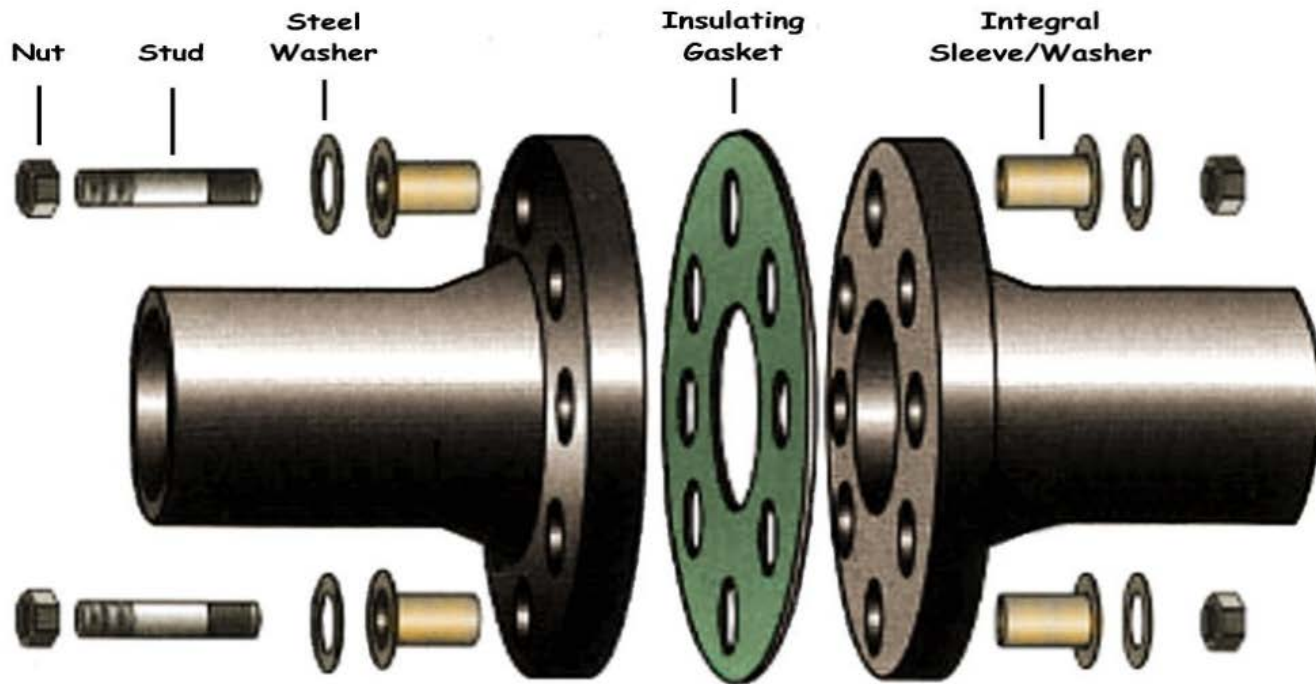
Electrical continuity in ISO 8031

Construction	Terms		Limits		Test method
	Current description	Recommended new description	Current specification	Recommended new specification	
At least two metallic flexible bonding wires (with or without a metallic helix) (Type M)	Conductive Continuous Electrically bonded	Electrically bonded (Grade M)	< 10 Ω per assembly < 10 ² Ω per assembly < 10 ⁵ Ω per assembly	< 10 ² Ω per assembly (between fittings)	ISO 8031
Incorporating conductive rubber or plastics layer(s) (Type Ω) New recommended marking to be specified in hose and hose assembly product standards ^a	Conductive Semi-conductive Antistatic	Conductive (Grade Ω-L, Grade Ω-C, Grade Ω-CL) ^a	< 10 ⁶ Ω per assembly 10 ³ Ω to 10 ⁶ Ω per assembly	< 10 ⁶ Ω per assembly ^b (between fittings)	ISO 8031 ^c
		Antistatic ^d	10 ³ Ω to 10 ⁸ Ω per assembly	10 ³ Ω to 10 ⁸ Ω per assembly ^d	
Metallic helix(es) connected to both fittings by means of flexible bonding wires (normally soldered to fitting and helix)	Continuous	Continuous Electrically bonded	No limits (light bulb dimly lit with 4,5 V battery)	< 10 ² Ω per assembly (between fittings)	ISO 8031 using ohmmeter (see 5.1) or electric light bulb + battery (see 5.2)
Fittings isolated from metallic helix(es) and from conductive rubber or plastics layer(s)	Insulating Discontinuous	Discontinuous	> 2,5 × 10 ⁴ Ω per assembly	> 2,5 × 10 ⁴ Ω per assembly	ISO 8031

Quotation from “Annex A, page 15 of ISO 8031 (2009)”

Flange insulation

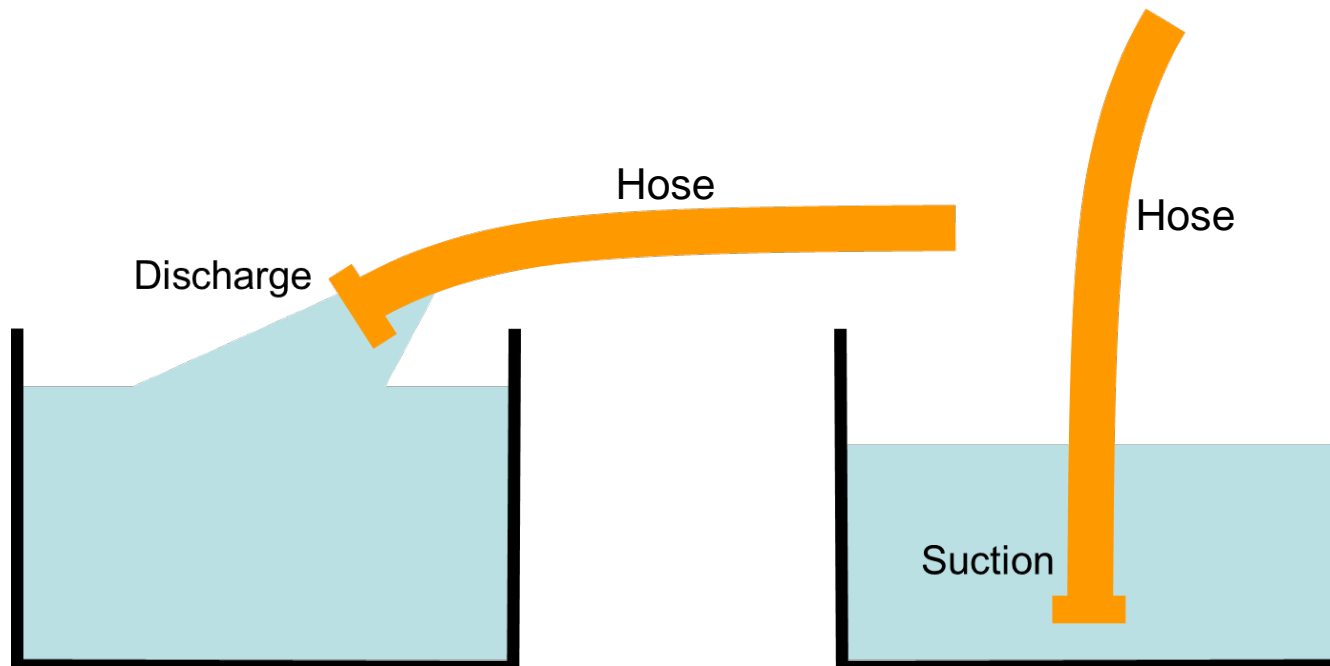
Insulating flanges are those flanges equipped with plastic pieces that insulate and prevent the flow of an electric current between two metal surfaces. Insulating flanges are used in cathodic protection systems to prevent electrolytic corrosion.



Oil resistance for outer cover of STS hose

The oil resistance of the outer cover is not necessary for the ship to ship transfer hose because the flanges at both ends are always connected to the manifold when transferring oil.


The hoses certified by EN1765 must be designed not to suffer the effect of liquids even when the hose is dipped directly in the tank to suction the liquid or the hose discharges the liquid to the tank without connecting the flange as shown in figures below.




Certificates of prototype hose approval

“Seaflex Grade Ω STS hose” conforms to EN1765.

Factory in Japan

Certificate no: YKA1820031/1 Page 1 of 2	
	
Project: Prototype Hose Approval of Seaflex STS	
Client: The Yokohama Rubber Co., Ltd.	Office: Yokohama
Client's Order Number: Ref. MHC-8174	Date: 20 August 2018
Order Status: Complete	
Inspection Dates	Final: 31 July 2018
First: 20 June 2018	
This certificate is issued to the above client to certify that the undersigned Surveyor to Lloyd's Register Group Limited did at their request attend at their Hiratsuka Plant on the dates shown above for the purpose of inspection and testing the undernoted equipment.	
<u>Yokohama Seaflex STS Prototype Hose</u>	
Hose Type/Designation	: Seaflex STS (Type of hose assembly according to EN1765/ Type-L15)
Rated Pressure	: 15 bars
Size	: 300 mm diameter x 10.0 m length
Drawing No.	: MH-9179-02(Continuous GRADE M/MH-9180-02(Conductive GRADE Ω Note: Min. 250000)/MH-9181-02(Discontinuous)
Test Hose No.	: S#170133(Continuous GRADE M & S#170134(Conductive GRADE Ω (NOTE: Min. 250000)
Prototype test specification	EN1765: 2016/ Type-L15
The following scope of inspection was carried out using above test hoses in accordance with technical requirements for Prototype Hose Approval of "Rubber hose assemblies for oil suction and discharge services-Specification for the assemblies(EN 1765 : 2016)".	
1. Physicality test of rubber compounds used in the construction of prototype hose including the following tests. - Lining : Resistance to liquids(volume swell) (ISO 1817, Liquid C). - Cover : Abrasion resistance (Method A of ISO 4649), Resistance to ozone(ISO 1431-1) and Resistance to liquids(volume swell) (ISO 1817, Liquid B). Note : Test samples and result of tests performed by Chemicals Evaluation and Research Institute(CERI) were verified by Lloyd's Register Group Limited.	
2. Adhesion tests between composites(dry and wet). - Tube lining to breaker. - Breaker to reinforcement cord. - Reinforcement cord to reinforcement cord. - Breaker to outer cover.	
3. Weight test in air.	
4. Hydrostatic test (change in length at max. working pressure).	
<small>Lloyd's Register Group Limited, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as "Lloyd's Register". Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.</small>	
Form 1123 (2017.07)	

Factory in Indonesia

Statement no: JKT 1812053 / 23 Page 1 of 2	
	
Statement of Fact Prototype Seaflex STS	
Project: Prototype Hose Approval of Seaflex STS	
Client: PT, Yokohama Industrial Product Manufacturing Indonesia	Office: Batam
Client's Order Number:	Date: 30 November 2018
Order Status: Complete	
Inspection Dates	Final: 21 November 2018
First: 19 October 2018	
This statement is issued to PT, Yokohama Industrial Products Manufacturing Indonesia, to certify that the undersigned surveyor to this society, did at their request attend at their workshop at Batam , in order to inspection and testing the undernoted equipment.	
<u>Yokohama SEAFLEX STS Prototype Hose</u>	
Hose Type	: SEAFLEX STS
Designation	: Type L15 (Type of hose assembly according to EN1765:2016).
Size	: 300mm Diameter x 10.0 M Length.
Rate Pressure (RW/P)	: 15 Bars.
Drawing No.	: MH-9180-02 / continuity, Grade Ω .
ITP No.	: PE-ITP-13
Test Hose No.	: S#164062 / continuity, Grade Ω .
The following scope of inspection was carried out using above test hoses in accordance with technical requirements for prototype Hose Approval of Rubber hose assemblies for oil suction and discharge services-specification for the assemblies (BS EN 1765:2016).	
1. Physicality test of Rubber Compounds used in the construction of Prototype Hose Including the following tests: - Lining : Resistance to Liquids (volume swells). - Cover : Abrasion Resistance, Resistance to Liquids (volume swells) and Resistance to Ozone. Note: Test samples and result of test performed by Chemical Evaluation and Research Institute (CERI) Japan were verified by Lloyd's Register Group Limited.	
2. Adhesion test between composites (dry & wet). - Tube Lining to Breaker - Breaker to Reinforcement Cord - Hoop ply to Reinforcement - Reinforcement Cord to Reinforcement Cord - Tie cross to Cover.	
3. Weight test in air Approx 642 Kg.	
4. Hydrostatic test at 15 Bars (Change in length at maximum working pressure).	
5. Hydrostatic test at 22.5 Bars (Resistance to proof pressure 1.5xRWP).	
6. Minimum Bending Test with internal pressure 3.5 Bars.	
<small>Lloyd's Register Group Limited, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as "Lloyd's Register". Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.</small>	

Seaflex “Grade Ω”

ship to ship transfer hose



Shunichi Ono
Manager,
Business & Product Development
The Yokohama Rubber Co., Ltd.
30th May 2019

Outline

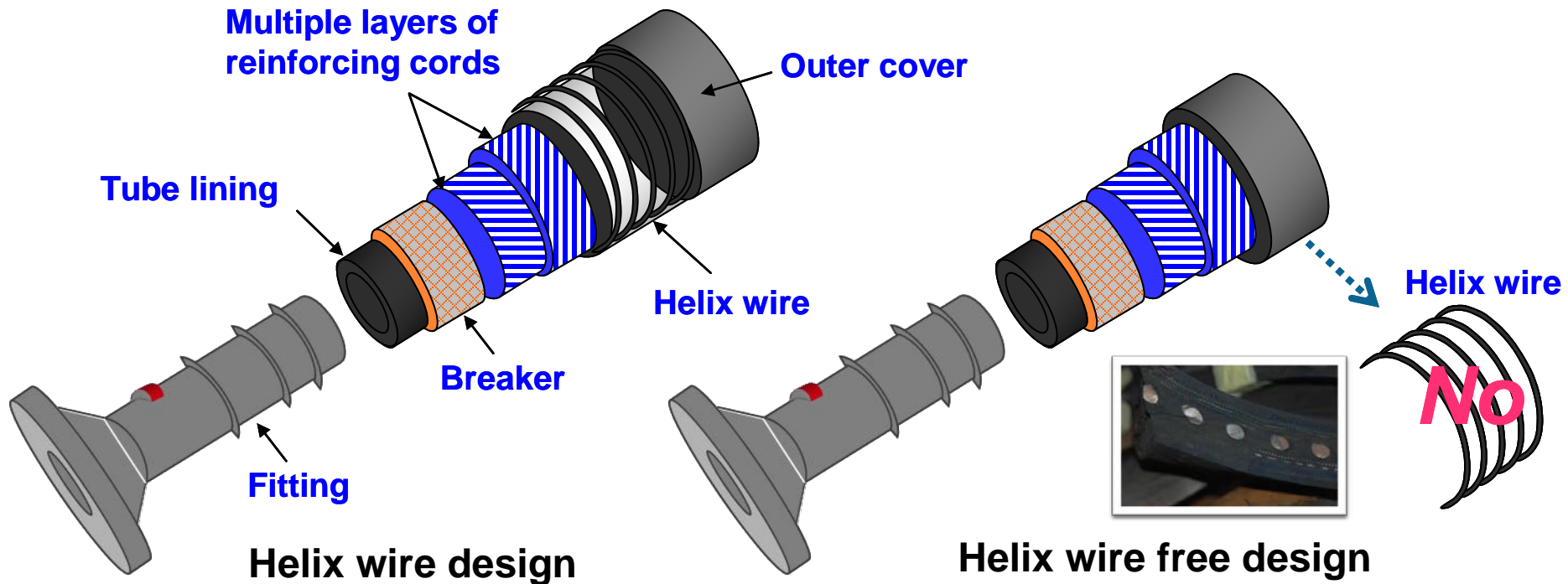
- **Design feature of Yokohama STS hose**
- **Newly developed “Seaflex Grade Ω STS hose”**
- **How to mix “Seaflex Grade Ω STS hose” and current EN1765 certified STS hose**

Outline

- **Design feature of Yokohama STS hose**
- **Newly developed “Seaflex Grade Ω STS hose”**
- **How to mix “Seaflex Grade Ω STS hose” and current EN1765 certified STS hose**

Helix wire free design

Helix wire free design is more “kinking tolerant” than a conventional helix wire reinforced design.



Helix wire free design



Is it OK to kink Yokohama STS hose?

STS hose is specially designed to withstand kinking. However, it is recommended operator try to avoid kinking as much as possible to avoid unnecessary early hose retirement.

Product	Unavoidable situations	Normal operation
		
		

Kink performance test

The kink performance test confirms that the hose can withstand 20,000 kinkings at 90 degrees angles.

Test results

- Adhesion between layers => Acceptable
- Strength of reinforcing cords => Acceptable
- Physical properties of tube lining => Acceptable
- Appearance of tube lining => Acceptable



20,000 cycles
with 250 mm stroke



Minor crease mark



Kink performance test

Number of cycles : 20,000 cycles



180 degrees angle kink performance test

The 180 degrees angle kink performance test confirms that the hose can withstand 5,000 kinkings at 180 degrees angles.



Test results

- Adhesion between layers => Acceptable
- Physical properties of tube lining => Acceptable
- Appearance of tube lining => Acceptable



Crease mark

Burst test on retired STS hose

The burst test was conducted on the retired hose which had been in service for 4 years. The burst pressure far exceeded the retirement criteria.

- **Residual burst pressure : 86 %**
- **Retirement criteria : 60 %**

