

***tyco***

*Electronics*

***Energy Division***

**RDSS**  
**Rayflate Duct Sealing System**  
**for power cables**



***Raychem***

## Rayflate Duct Sealing System for power cables



*Eliminates the need to pump man-holes dry, avoids ingress of mud into ducts, and withstands severely polluted environments.*

Unsealed cable pipes and ducts need not to cause dampness and flooding in substation basements, cable vaults and access manholes.

In these environments rust, corrosion and a humid environment inevitably result in damage to support structures, metal work and electrical equipment. The most common route for water to enter into such installations can be blocked simply and effectively by a field proven technique developed by Raychem.

The Rayflate Duct Sealing System (RDSS) has been designed for use on power cables to provide a watertight seal when used with plastic, concrete or steel ducting systems.

Once installed the Rayflate duct seals can provide operators with immediate access in clean and dry conditions, eliminating the routine of pumping manholes dry before work can begin.



### Clean, fast, easy sealing method

The Rayflate seal consists of an inflatable bladder of flexible metallic laminate, coated on both sides with a sealant strip. With the sealant strips lubricated, the product is simply wrapped around the cable and easily slides into the duct. The bladder is



then inflated with a gas pressure tool which presses the sealant coating against the duct wall and the cable. Upon removal of the filling tube, an automatic gel valve system reliably retains the gas pressure

in the Rayflate duct seal.

The entire installation is performed within a few minutes – even in congested enclosures – without any messy or installer-sensitive mixing and filling.



### Seals vacant and multiple cable ducts

Depending on the duct diameter, most Rayflate bags seal vacant ducts and ducts which contain up to two cables. Sealing of three or more cables can be easily achieved by merely inserting a mastic sealant-clip between the cables. The RDSS-Clip is made from a high-temperature mastic mounted on an installation stick.

### Versatility

As the Rayflate system adapts itself to most configurations, the system is independent of duct ovality. Each Rayflate seal covers a large range of cable and duct diameters.

### Ideal for both new and existing cable installations

The versatility of the wraparound concept enables use not only for new cable installations, but also for existing applications. Unlike other methods that require dry ducts, the Rayflate seals can be installed when water is still flowing out of the duct – thus saving valuable installation time.







### Removable

Rayflite seals are easier to be removed from a duct or a pipe than other systems. This allows cables to be replaced in an upgrade or repair. Since ducts are not damaged by the Rayflite system, they can easily be sealed again.

### Environmentally friendly

Rayflite seals do not require any mixing of liquids, thus eliminating typical hazards involved in preparation of 2-component resin systems, and the need for costly disposal of harmful residues or messy containers.

Empty gas cylinders or the lubricant bottles will be recycled when disposed in metal scrap or PE/PP collection containers, respectively. Residuals of the lubricant are treated as normal waste water.

### Performance Tested

Rayflite duct seals are a result of our long involvement in sealing and corrosion protection technologies.



Extensive testing at room temperature has shown water and air tightness at static pressures of more than 0.3 bar, even in conjunction with cable bending, vibration, torsion and axial pull. Resistance to common chemicals has been proven by immersion tests.

As the Rayflite system is specially designed for power cables, it was tested with cables load-cycled at conductor temperatures of 90°C, similar to specifications required for cable accessories. The sealing tests showed water and air tightness with internal duct pressures of 0.3 bar with single and multi-cable configurations. A detailed test report is available.

Lifetime calculations indicate that a typical Rayflite duct seal will withstand a 3 m waterhead for 30 years after installation. These results are based on typical utility cable loads at average ambient temperatures of 25°C and diffusion rate measurements at elevated temperatures and after ageing by load-cycling. The sealing performance was confirmed by sealing tests with reduced internal bladder pressures.

### Tools for easy and quick inflation

Rayflite duct seals can be installed using a wide variety of inflation tools, which have the capability to inflate the bag to  $3.0 \pm 0.2$  bar pressure.

We offer two inflation tools, using either a CO<sub>2</sub> cartridge or the customers' own source of compressed air. Both tools feature an easy-to-read gauge and a release valve to ensure proper inflation pressure:

**RDSS-IT-16:** Inflation tool complete with an ON/OFF switch and an automatic pressure monitoring system. The required CO<sub>2</sub> gas cylinders (E7512-0160) must be ordered separately. The standard package includes 1 tool per box plus operating manual and a 3-year warranty.



**E7512-0160:** 16 gr. CO<sub>2</sub> gas cylinders for RDSS-IT-16 tool. Each gas cylinder inflates approx. 5 pcs of RDSS-100 duct seals. Each box contains 10 gas cylinders.



**RDSS-IG-SR-AS:** Inflation tool using a pressure bottle, an air-compressor or a main air pressure line with pressure input between 4 bar and 10 bar. Features automatic shutoff, a VG8 valve connection and two alternative connections for plastic or rubber hoses.

The standard package includes 1 tool per box plus operating manual.



Each RDSS seals empty ducts (except for size 150) and ducts containing up to 2 cables. The table below shows the minimum and maximum diameter of the cable or of the sum of 2 cables depending on the duct size. Dimensions in mm.

Product description						
Duct inside dia.	RDSS-45 cable dia.	RDSS-60 cable dia.	RDSS-75 cable dia.	RDSS-100 cable dia.	RDSS-125 cable dia.	RDSS-150 cable dia.
32.5	0 – 14					
35	0 – 18					
40	0 – 27					
45	0 – 32					
50		0 – 18				
55		0 – 30				
60		0 – 38	0 – 28			
65		0 – 45	0 – 30			
70			0 – 40			
75			0 – 46			
80			0 – 56	0 – 45		
85				0 – 52		
90				0 – 60		
95				0 – 66		
100				0 – 74		
105				0 – 80	0 – 65	
110				0 – 85	0 – 75	
115				0 – 90	0 – 83	
120				55 – 95*	0 – 91	
125				60 – 100*	0 – 95	
130					0 – 103	60 – 100
135					70 – 110*	60 – 107
140					75 – 115*	60 – 112
145					80 – 120*	60 – 118
150					85 – 125*	60 – 123
155					90 – 130*	60 – 129
160						60 – 134*
165						60 – 139*
170						105 – 145*
175						110 – 150*
180						115 – 155*
>180**						120 – 160*

Clip Selection	RDSS-Clip-45	RDSS-Clip-75	RDSS-Clip-75	RDSS-Clip-100	RDSS-Clip-125	RDSS-Clip-150
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 Suitable also for empty ducts

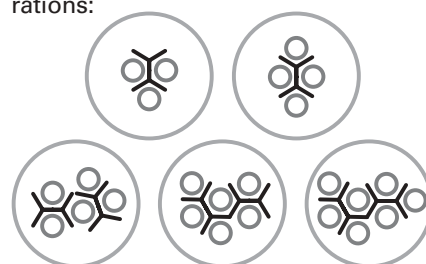
 Only with cables

\*RDSS-Clips must also be used for 2-cable configurations



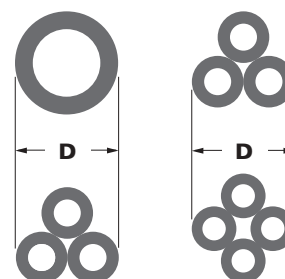
When three or more cables have to be sealed, an RDSS sealing clip is used in combination with the RDSS inflatable duct seal.

One RDSS-Clip seals up to 4 cables. If more cables are to be sealed, use one extra clip per three additional cables as shown in the following examples for different multi-cable configurations:



For each clip used, subtract 5 mm from the maximum cable diameter shown in the table to determine the maximum cable bundle diameter.

Cable or cable bundle diameters:



All RDSS sizes are packed in boxes of 10 pieces with 1 lubricant dispenser and an installation instruction.

RDSS-Clips are packed in boxes of 5 pieces. RDSS-Clips must be ordered as a separate item.

\*\* For more specific information on cable diameter ranges and for duct sizes > 180 mm contact your local sales representative.

All of the above information, including drawings, illustrations and graphic designs, reflects our present understanding and is to the best of our knowledge and belief correct and reliable. Users, however, should independently evaluate the suitability of each product for the desired application. Under no circumstances does this constitute an assurance of any particular quality or performance. Such an assurance is only provided in the context of our product specifications or explicit contractual arrangements. Our liability for these products is set forth in our standard terms and conditions of sale.

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## RDSS

### Rayflate duct sealing system

The Rayflate duct sealing system (RDSS) has been designed for use in conjunction with plastic, concrete, or steel ducts to provide a watertight duct seal. The RDSS seals cable ducts and helps to prevent flooding in cable vaults, access manholes, substation basements, and customer feeds.

#### Provides watertight seal

The RDSS sealing system consists of an inflatable, sealed bladder of flexible, metallic laminate material, which has preinstalled, high-temperature sealant strips on both sides. The bladder is first inflated to 45 psi (three-bar) internal pressure, and then presses the sealant

against the duct wall and onto the substrate. The bag uses a self-sealing gel material to seal the filling hole when the filling tube is removed.

#### Seals multiple cable ducts

For applications with three or more cables, an RDSS-CLIP is inserted between the cables. The RDSS-CLIP is a high-temperature mastic mounted on an installation stick. It seals the area between the cables when used in conjunction with the RDSS inflatable bladder.



#### Selection information (dimensions in inches/millimeters)

Duct inner diameter	Number of cables in duct / <i>Maximum Cable Bundle Diameter</i>					
	0, 1, or 2 cables		3 or 4 cables		5, 6, or 7 cables	
1.25 (32)	RDSS-45	0.5 (13)	RDSS-45, 1 RDSS-CLIP-45	0.3 (8)	RDSS-45, 2 RDSS-CLIP-45	0.1 (3)
1.50 (38)	RDSS-45	1.0 (25)	RDSS-45, 1 RDSS-CLIP-45	0.8 (20)	RDSS-45, 2 RDSS-CLIP-45	0.6 (15)
1.75 (45)	RDSS-45	1.3 (32)	RDSS-45, 1 RDSS-CLIP-45	1.05 (27)	RDSS-45, 2 RDSS-CLIP-45	0.9 (22)
2.00 (50)	RDSS-60	1.2 (30)	RDSS-60, 1 RDSS-CLIP-75	1.0 (25)	RDSS-60, 2 RDSS-CLIP-75	0.8 (20)
2.25 (57)	RDSS-60	1.6 (41)	RDSS-75, 1 RDSS-CLIP-75	1.4 (36)	RDSS-75, 2 RDSS-CLIP-75	1.2 (31)
2.50 (64)	RDSS-75	1.5 (38)	RDSS-75, 1 RDSS-CLIP-75	1.3 (33)	RDSS-75, 2 RDSS-CLIP-75	1.1 (28)
2.75 (70)	RDSS-75	1.8 (46)	RDSS-75, 1 RDSS-CLIP-75	1.6 (41)	RDSS-75, 2 RDSS-CLIP-75	1.4 (36)
3.00 (75)	RDSS-75	2.2 (56)	RDSS-75, 1 RDSS-CLIP-75	2.0 (50)	RDSS-75, 2 RDSS-CLIP-75	1.8 (46)
3.25 (83)	RDSS-100	2.2 (56)	RDSS-100, 1 RDSS-CLIP-100	2.0 (50)	RDSS-100, 2 RDSS-CLIP-100	1.8 (46)
3.50 (89)	RDSS-100	2.6 (66)	RDSS-100, 1 RDSS-CLIP-100	2.4 (61)	RDSS-100, 2 RDSS-CLIP-100	2.2 (56)
3.75 (95)	RDSS-100	2.9 (74)	RDSS-100, 1 RDSS-CLIP-100	2.7 (69)	RDSS-100, 2 RDSS-CLIP-100	2.5 (64)
4.00 (100)	RDSS-100	3.2 (80)	RDSS-100, 1 RDSS-CLIP-100	3.0 (75)	RDSS-100, 2 RDSS-CLIP-100	2.8 (70)
4.25 (108)	RDSS-100	3.5 (89)	RDSS-100, 1 RDSS-CLIP-100	3.3 (85)	RDSS-100, 2 RDSS-CLIP-100	3.1 (79)
4.50 (114)	RDSS-100	3.5 (89)	RDSS-100, 1 RDSS-CLIP-100	3.3 (85)	RDSS-100, 2 RDSS-CLIP-100	3.1 (79)
4.75 (121)	RDSS-125	3.8 (97)	RDSS-125, 1 RDSS-CLIP-125	3.6 (92)	RDSS-125, 2 RDSS-CLIP-125	3.4 (87)
5.00 (125)	RDSS-125	4.1 (104)	RDSS-125, 1 RDSS-CLIP-125	3.9 (98)	RDSS-125, 2 RDSS-CLIP-125	3.7 (93)
5.25 (133)	RDSS-150 <sup>†</sup>	4.3 (109)	RDSS-150 <sup>†</sup> , 1 RDSS-CLIP-150	4.1 (104)	RDSS-150 <sup>†</sup> , 2 RDSS-CLIP-150	3.9 (98)
5.50 (140)	RDSS-150 <sup>†</sup>	4.7 (120)	RDSS-150 <sup>†</sup> , 1 RDSS-CLIP-150	4.5 (114)	RDSS-150 <sup>†</sup> , 2 RDSS-CLIP-150	4.3 (109)
5.75 (146)	RDSS-150 <sup>†</sup>	4.9 (124)	RDSS-150 <sup>†</sup> , 1 RDSS-CLIP-150	4.7 (119)	RDSS-150 <sup>†</sup> , 2 RDSS-CLIP-150	4.5 (114)
6.00 (150)	RDSS-150 <sup>†</sup>	5.1 (129)	RDSS-150 <sup>†</sup> , 1 RDSS-CLIP-150	4.9 (124)	RDSS-150 <sup>†</sup> , 2 RDSS-CLIP-150	4.7 (120)
6.25 (159)	RDSS-150 <sup>†</sup>	5.4 (138)	RDSS-150 <sup>†</sup> , 1 RDSS-CLIP-150	5.2 (133)	RDSS-150 <sup>†</sup> , 2 RDSS-CLIP-150	5.0 (125)

<sup>†</sup>See Ordering information below.

#### Ordering information

- In ducts where the cable/cable bundle is less than 2.4" (60mm) in diameter, an RDSS-AT/AP-150 device must be used in conjunction with the RDSS-150.
- Standard package: RDSS = 10 kits/box, RDSS-CLIP = 5 clips/box  
RDSS-TOOLS = 1 each/box, CO<sub>2</sub> cartridges = 10 each/box,  
RDSS-AT/AP-150 = 1 each/box
- Related test report: [EDR-5253](#)
- S-1278 sealant, used in RDSS-CLIPS, is available separately (see page 48).

Related installation instructions

[RDSS](#)

**RDSS sealing clip**

RDSS duct sealing clips are to be used if the duct is occupied by more than two cables. The maximum number of cables sealed with one RDSS-CLIP is four. If more cables are to be sealed, one extra clip is needed for every three additional cables. Check with your Tyco Electronics representative for applications with more than seven cables.

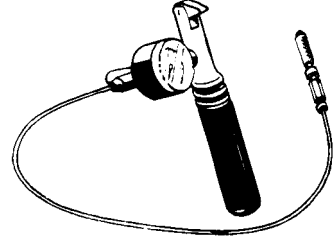
Catalog number	Kit used with
RDSS-CLIP-45	RDSS-45
RDSS-CLIP-75	RDSS-75 and RDSS-60
RDSS-CLIP-100	RDSS-100
RDSS-CLIP-125	RDSS-125
RDSS-CLIP-150	RDSS-150

**RDSS installation tools**

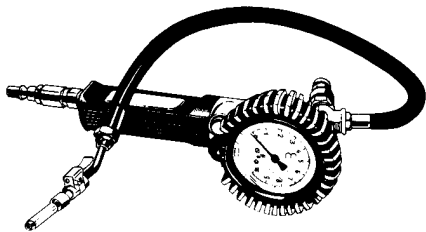
RDSS duct seals can be installed with a variety of inflation tools having the capability of inflating RDSS to 45±3 psi (3 bar) of pressure. The tools Tyco Electronics offers are summarized in the table below.

Catalog number	Description	Standard package
RDSS-IT-16	Inflation tool designed with an ON/OFF switch and an automatic pressure-monitoring system. The required CO <sub>2</sub> gas cylinders (E7512-0160) must be ordered separately.	1 tool/box
E7512-0160	16-gr CO <sub>2</sub> gas cylinders for the RDSS-IT-16 tool. Each gas cylinder inflates approximately four RDSS-100 duct seals.	10 cylinders/box
RDSS-IG-SR-AS	Inflation tool designed for use with customer's own source of nitrogen or compressed air. Features a pressure gauge, automatic shutoff, VGF valve connection, and two alternate connections for plastic or rubber hoses.	1 tool/box
E7512-0200	Spare gas-cylinder holder for RDSS-IT-16 inflation tool.	1 each/box
E7512-0220	Tube snap assembly.	1 each/box
E7512-0240	Spare pressure gauge assembly for RDSS-IT-16 inflation tool.	1 each/box
E7512-0260	Spare delivery pipe for RDSS-IT-16 inflation tool.	1 each/box
S-1278-3 x 61 x 7620	RDSS sealant roll.	1 25-ft roll/box
RDSS-AT/AP-150	For use with the RDSS-150 in duct 5.25" or larger with cable/cable bundles less than 2.4" (60mm) in diameter.	1 each/box
E4540-1250	RDSS-LUBE for installation of RDSS.	25 each/box

RDSS-IT-16



RDSS-IG-SR-AS





## **RDSS-AD-210** **Rayflate adapter for large duct sizes**

### **Features**

- RDSS-AD-210 – a prefabricated adapter for sealing large diameter ducts
- Incorporates the proven RDSS Rayflate system
- Range taking
- Tool-free, fast and easy installation
- Modular system
- Re-enterable
- Unlimited shelf life

The RDSS-AD-210 adapter is moulded from a specially formulated rubber for easy installation and superior duct sealing. The one-piece, single-sized adapter is designed to work with RDSS-125 and RDSS-150 Rayflate duct sealing products for sealing ducts up to 210 mm in diameter (see EPP 0569 brochure).

The adapter is a simple add-on to existing RDSS products and requires no additional training or change in installation procedures and practices.

Once installed, the duct sealing system ensures that manholes remain clean and dry. This eliminates the need to pump out rain or sewage water from the manholes and provides immediate access for maintenance crews, significantly reducing downtime.



### **Clean, fast, easy, tool-free sealing**

After the sealant tape has been lubricated the RDSS-AD-210 adapter is coiled over the cable to fit the duct. The coiled adapter slides easily into the duct and when released snaps into position against the inner wall of the duct. Then the RDSS is inserted between the cable and the pre-positioned adapter and inflated in the usual way. Certain configurations may require two adapters. For details check the selection table.

The entire installation is performed in a few minutes – even in congested enclosures – without messy and potentially harmful mixing and filling agents.

### **Versatility**

The special type of rubber adapts to most configurations. The standard size covers a large range of cable and duct diameters.

### **Performance tested**

Extensive testing with various duct sizes at room temperature and under load cycling conditions has shown that the sealing system is watertight and airtight at specific temperatures, even when cables were subjected to bending or vibration. Resistance to common chemicals has been proven by immersion tests.

The detailed PPR-1659 test report is available on request.

## RDSS-AD-210

## Ordering Information and Selection Table

For use with RDSS-125 and RDSS-150 duct seals.  
Suitable for empty ducts.

RDSS-AD-210 is boxed in batches of 4 and supplied with 1 lubricant dispenser and installation instructions.



The table lists the minimum and maximum diameter of the cable or cable bundle that can be accommodated in a cable duct for a specific combination of RDSS and RDSS adapter.

### RDSS-AD-210 selection table All dimensions in mm.

Duct inside Ø	1 x RDSS-AD-210 + RDSS-125 Cable Ø	2 x RDSS-AD-210 + RDSS-125 Cable Ø	1 x RDSS-AD-210 + RDSS-150 Cable Ø	2 x RDSS-AD-210 + RDSS-150 Cable Ø
130	0*			
135	0*			
140	0 - 40			
145	0 - 50			
150	0 - 65			
155	0 - 83			
160	0 - 91			
165	0 - 103			
170	70 - 110	0*	60 - 107	
175	75 - 115	0 - 40	60 - 112	
180	80 - 120	0 - 50	60 - 118	
185	90 - 130	0 - 65	60 - 129	
190		0 - 83	60 - 135	
195		0 - 95	60 - 139	
200		0 - 103	105 - 145	60 - 100
205		75 - 115	115 - 155	60 - 112
210		80 - 120	120 - 160	60 - 118

\* Empty ducts only

Suitable for empty ducts  
 With cables only

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**Energy Division – a pioneer in the development of economical solutions for the electrical power industry. Our product range includes: Cable accessories, connectors & fittings, electrical equipment, instruments, lighting, insulators & insulation enhancement and surge arresters.**

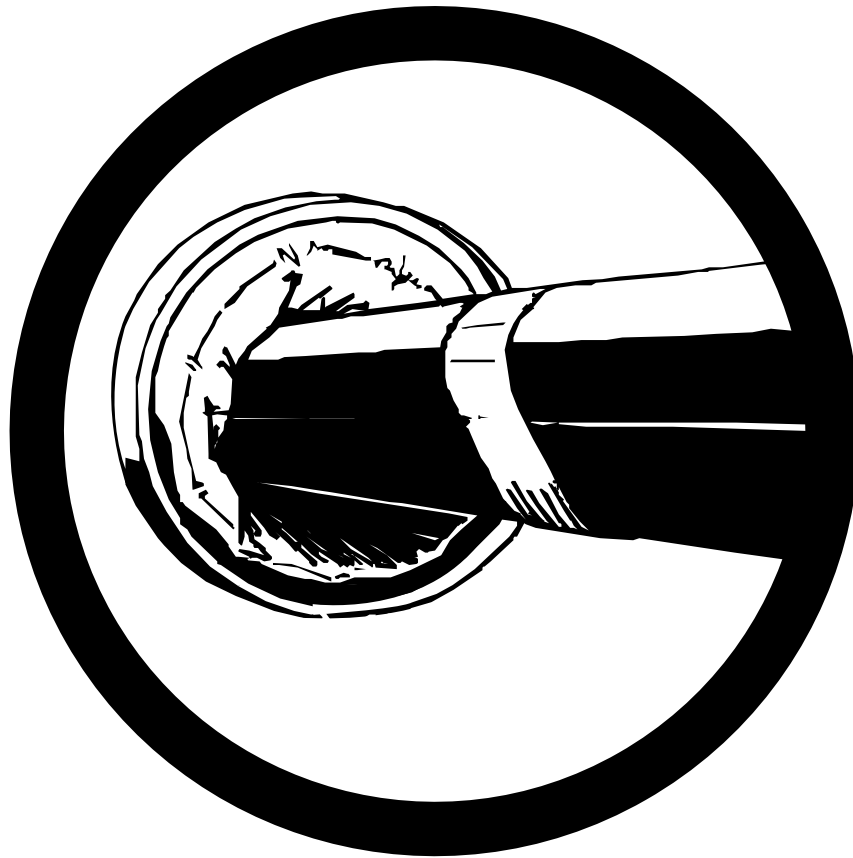
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## RDSS Rayflate Duct Sealing System

For Moisture Sealing on 2" to 6"  
Ducts with 0, 1, or 2 Cables  
For 3 or More Cables the  
RDSS-Clip is also required



When using the RDSS-150, if the cable/bundle is less than 2.4" (60mm) in diameter, an RDSS-AT/AP-150 device must also be used.

## Selection table

Duct Inner Diameter	Number of Cables in Duct		
	0, 1, or 2 cables	3 or 4 cables	5, 6, or 7 cables
1-1/4" (32mm)	RDSS-45 0.5" (13mm)	RDSS-45 + 1 RDSS-CLIP-45 0.30" (8mm)	RDSS-45 + 2 RDSS-CLIP-45 0.10" (3mm)
1-1/2" (38mm)	RDSS-45 1.0" (25mm)	RDSS-45 + 1 RDSS-CLIP-45 0.8" (20mm)	RDSS-45 + 2 RDSS-CLIP-45 0.6" (15mm)
1-3/4" (45mm)	RDSS-45 1.3" (32mm)	RDSS-45 + 1 RDSS-CLIP-45 1.05" (27mm)	RDSS-45 + 2 RDSS-CLIP-45 0.9" (22mm)
2" (50mm)	RDSS-60 1.2" (30mm)	RDSS-60 + 1 RDSS-CLIP-75 1.0" (25mm)	RDSS-60 + 2 RDSS-CLIP-75 0.8" (20mm)
2-1/4" (57mm)	RDSS-60 1.6" (41mm)	RDSS-60 + 1 RDSS-CLIP-75 1.4" (36mm)	RDSS-60 + 2 RDSS-CLIP-75 1.2" (31mm)
2-1/2" (64mm)	RDSS-75 1.5" (38mm)	RDSS-75 + 1 RDSS-CLIP-75 1.3" (33mm)	RDSS-75 + 2 RDSS-CLIP-75 1.1" (28mm)
2-3/4" (70mm)	RDSS-75 1.8" (46mm)	RDSS-75 + 1 RDSS-CLIP-75 1.6" (41mm)	RDSS-75 + 2 RDSS-CLIP-75 1.4" (36mm)
3" (75mm)	RDSS-100 2.2" (56mm)	RDSS-100 + 1 RDSS-CLIP-100 2.0" (51mm)	RDSS-100 + 2 RDSS-CLIP-100 1.8" (46mm)
3-1/4" (83mm)	RDSS-100 2.2" (56mm)	RDSS-100 + 1 RDSS-CLIP-100 2.0" (51mm)	RDSS-100 + 2 RDSS-CLIP-100 1.8" (46mm)
3-1/2" (89mm)	RDSS-100 2.6" (66mm)	RDSS-100 + 1 RDSS-CLIP-100 2.4" (61mm)	RDSS-100 + 2 RDSS-CLIP-100 2.2" (56mm)
3-3/4" (95mm)	RDSS-100 2.9" (74mm)	RDSS-100 + 1 RDSS-CLIP-100 2.7" (69mm)	RDSS-100 + 2 RDSS-CLIP-100 2.5" (64mm)
4" (100mm)	RDSS-100 3.2" (80mm)	RDSS-100 + 1 RDSS-CLIP-100 3.0" (75mm)	RDSS-100 + 2 RDSS-CLIP-100 2.8" (70mm)

Duct Inner Diameter	Number of Cables in Duct		
	0, 1, or 2 cables	3 or 4 cables	5, 6, or 7 cables
4-1/4" (108mm)	RDSS-100 3.5" (89mm)	RDSS-100 + 1 RDSS-CLIP-100 3.3" (85mm)	RDSS-100 + 2 RDSS-CLIP-100 3.1" (79mm)
4-1/2" (114mm)	RDSS-100 3.5" (89mm)	RDSS-100 + 1 RDSS-CLIP-100 3.3" (85mm)	RDSS-100 + 2 RDSS-CLIP-100 3.1" (79mm)
4-3/4" (121mm)	RDSS-125 3.8" (97mm)	RDSS-125 + 1 RDSS-CLIP-125 3.6" (92mm)	RDSS-125 + 2 RDSS-CLIP-125 3.4" (87mm)
5" (125mm)	RDSS-125 4.1" (103mm)	RDSS-125 + 1 RDSS-CLIP-125 3.9" (98mm)	RDSS-125 + 2 RDSS-CLIP-125 3.7" (93mm)
5-1/4" (133mm)	RDSS-150 4.3" (109mm)	RDSS-150 + 1 RDSS-CLIP-150 4.1" (104)	RDSS-150 + 2 RDSS-CLIP-150 3.9" (98mm)
5-1/2" (140mm)	**RDSS-150 4.7" (120mm)	**RDSS-150 + 1 RDSS-CLIP-150 4.5" (115mm)	**RDSS-150 + 2 RDSS-CLIP-150 4.1" (110mm)
5-3/4" (146mm)	**RDSS-150 4.9" (124mm)	**RDSS-150 + 1 RDSS-CLIP-150 4.7" (119mm)	**RDSS-150 + 2 RDSS-CLIP-150 4.5" (114)
6" (150mm)	**RDSS-150 5.1" (129mm)	**RDSS-150 + 1 RDSS-CLIP-150 4.9" (124mm)	**RDSS-150 + 2 RDSS-CLIP-150 4.7" (120mm)
6-1/4" (159mm)	**RDSS-150 5.4" (138mm)	**RDSS-150 + 1 RDSS-CLIP-150 5.2" (133mm)	**RDSS-150 + 2 RDSS-CLIP-150 5.0" (128mm)

## NOTES

<sup>\*\*</sup>In ducts where the cable/cable bundle is less than 2.4" (60mm) in diameter, an RDSS-AT/AP-150 device must be used in conjunction with the RDSS-150.

<sup>1</sup>For duct sizes other than those shown, contact your local Raychem Representative.

<sup>2</sup>The dimension shown in parenthesis is the maximum diameter of the cable or cable bundle for use with the specified RDSS part number. If your diameter is greater than this number, contact your local Raychem representative.

Example: Max. cable diameter



(for 1 cable installation)

Max. cable bundle diameter



(for multi-cable applications)

## Safety Rules:

## Lubricant:

Protect from frost. In case of eye contact, flush with clean water during 15 minutes, holding eyelids open. Seek medical attention if irritation persists. Wash with mild soap and water if skin irritation occurs.

## Gas cylinders:

If the carbon dioxide gas cylinders are used to inflate RDSS, the following safety rules should be considered. The gas pressure in the cylinder is approximately 870 lb/in<sup>2</sup> at room temperature. Max. operational

temperature is 120°F (50°C). Keep cool and dry. Use only as instructed in operating manual of RDSS-IT-16 inflator. Misuse can be dangerous. Do not handle the cylinder with unprotected hands immediately after filling RDSS duct seal. Frostbite can result.

When using the RDSS-150, if the cable/bundle is less than 2.4" (60mm) in diameter, an RDSS-AT/AP-150 device must also be used.

## Application:

RDSS will seal ducts with and without cable(s). In case three or more cables have to be sealed, a RDSS sealing clip is use in combination with the RDSS inflatable duct seal. The RDSS-Clip must be ordered as a separate item. Avoid exposure of the installed RDSS

duct seal to direct sunlight.

**Note:** For beveled ducts, the RDSS may not be installed in the beveled portion. Position the RDSS-Clip (if used) and RDSS bag in the straight portion of the duct.

## Installation Instructions

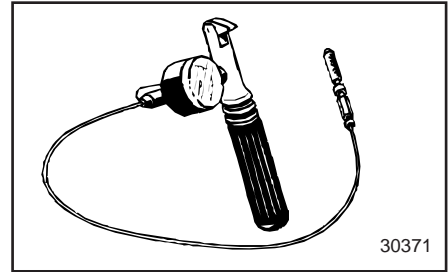
### Tooling:

RDSS duct seals can be installed with a variety of inflation tools having the capability to inflate RDSS to  $43.5 \pm 0.6$  lb/in<sup>2</sup> of pressure. The following tools are available from Raychem:

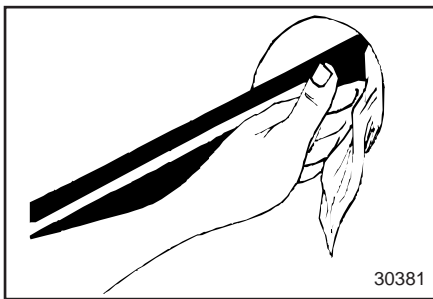
RDSS-IG-SR-AS tool for use with compressed air or nitrogen tanks

RDSS-IT-16 inflation tool equipped with a manometer and safety relieve valve using compressed CO<sub>2</sub> gas cylinders (to be ordered separately; part no. E7512-0160).

**Refer to the operating manual of the specific tool being used.**



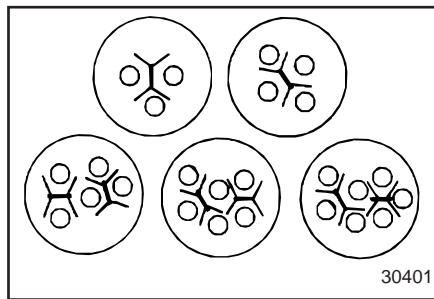
## INSTALLATION



1. It is recommended to wet clean the duct and cable sheath. Remove as much dirt, crust, mud, etc. as possible.

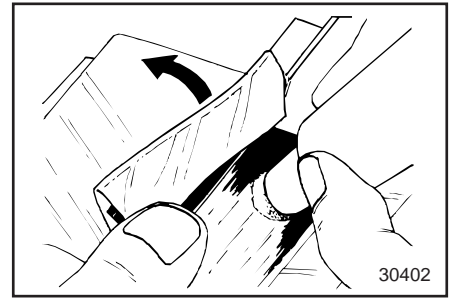
**For ducts with 3 or more cables, continue with step 2.**

**For 0, 1, or 2 cables, skip to step 9.**

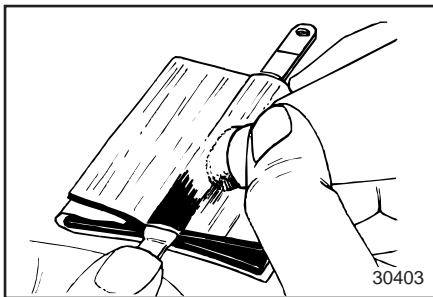


### 2. Examples for different multiple cable configuration.

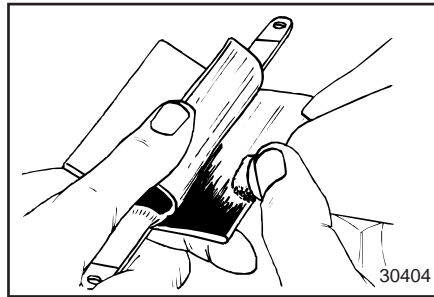
One RDSS-Clip can seal up to four cables. If more cables are to be sealed, use one extra clip per three additional cables.



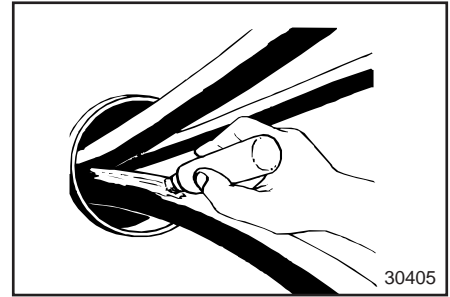
3. Open clip wings on one side. Lubricate the wings abundantly, to ensure that they don't stick together.



4. Remove one protection paper and lubricate abundantly the larger surface of the clip wing.



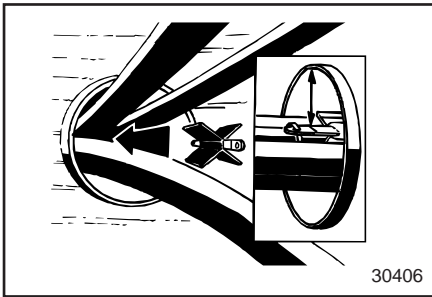
5. Repeat steps 3 & 4 for the other clip wings. Remove protection paper only after lubricating at least one wing side.



6. Abundantly lubricate the cables in the crotch area as much as possible.

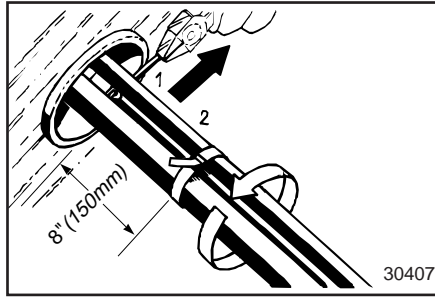


## Installation Instructions

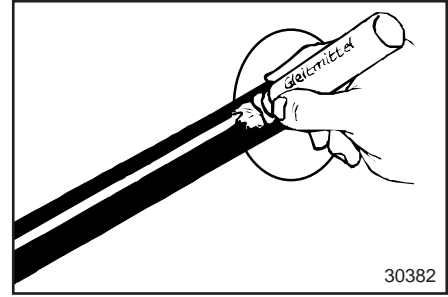


**7.** Insert the clip in between the cables, assuring that there is only one cable between each clip wing (see picture, step 2).

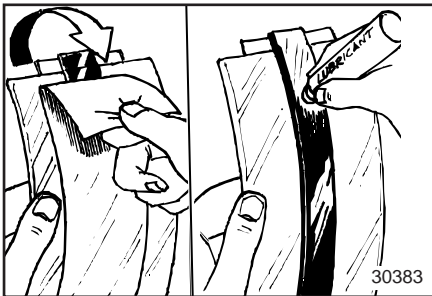
Make sure that the central part of the clip is well positioned in the crotch area. The raised line on center stick should be flush with the end of the duct. Use the short tie-wrap to hold the clip in place. Cut off the excess tie-wrap and position the locking part between the cables.



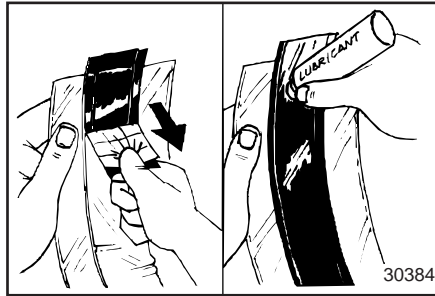
**8.** Install the long tie-wrap around the cable bundle at a distance of approx. 8" (150mm) from the duct entrance.



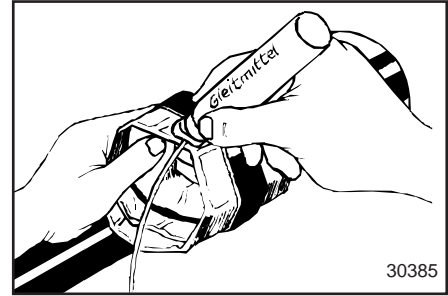
**9.** For ease of installation lubricate the cable sheaths.



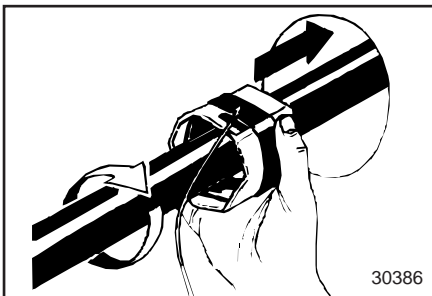
**10.** Remove the protective paper from the outside of the sealing strip and lubricate abundantly.



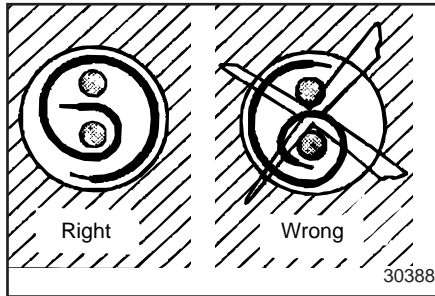
**11.** Continue with lubrication of the inside of the sealing strip.



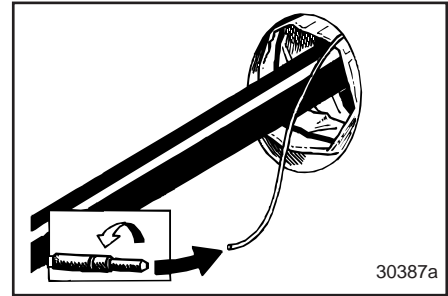
**12.** Lubricate the filling tube on the RDSS section.



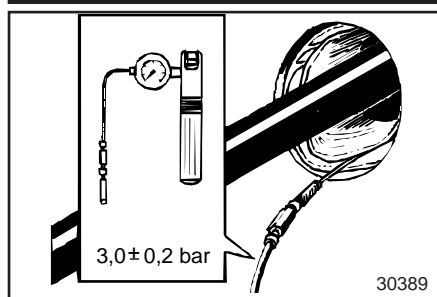
**13.** Wrap RDSS around the cable (or cable bundle) and slide completely into the duct.



**14.** In case of two cables, wrap RDSS around the cables as shown starting with the largest cable.

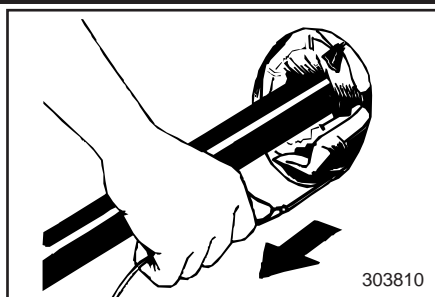


**15.** Connect the filling tube to the tube snap of the inflation tool. Gently insert the filling tube until it will not go any further. Tighten down the nozzle.



**16.** Inflate RDSS up to the pressure of 3,0 bar (43.5 psi) and keep the pressure there for 30 seconds, after which the tool must be shut off.

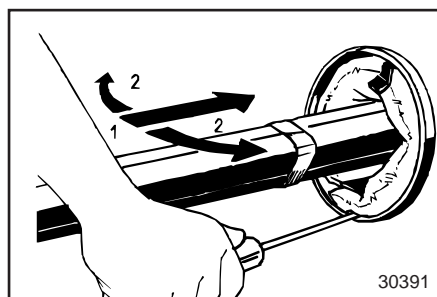
**Note:** Please refer to the operation manual for the specific inflation tool being used.



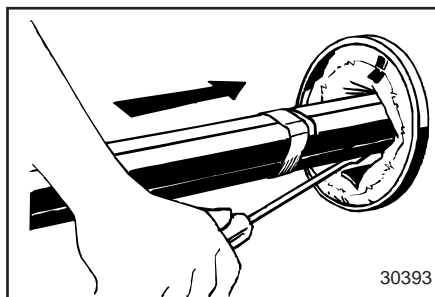
**17.** BEFORE removing the installation tool connection from the filling tube, pull out the filling tube in one gentle move in the direction of the cable.

**Installation is complete.**

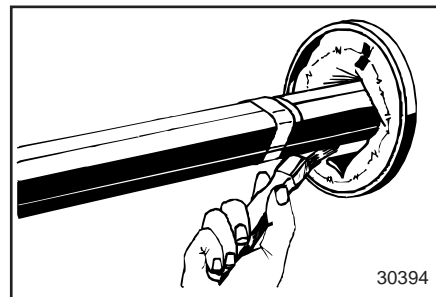
## REMOVAL



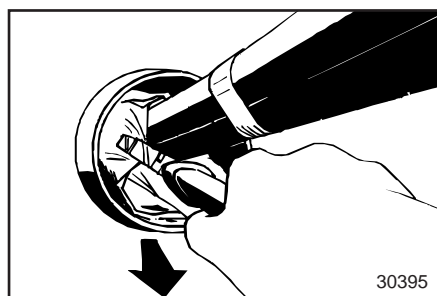
**1.** Deflate the RDSS duct seal by piercing with a screwdriver. Release the RDSS from the duct wall by using a blunt tool.



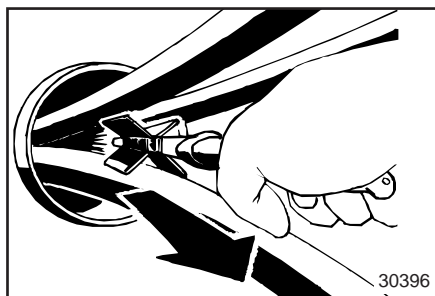
**2.** Release RDSS from the cable or cable bundle



**3.** Apply lubricant on the released areas.



**4.** Remove RDSS out of the duct with a pair of pliers.



**5.** If applicable: Remove tie wraps from the cable bundle. Spread cables. Remove clip core and sealant as much as possible with a pair of pliers.



## Electrical Products Division Report

Title  
Performance Testing to Determine the  
Water Sealing Capabilities of the RDSS  
Rayplate Duct Sealing System

Pages: 9

Report Number:  
EDR- 5253

Date:  
9/5/95

Rev:  
A

Tested by:  
Dana Pierce

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9/5/95

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9/5/95

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9/5/95

Approved by:  
Bill Dittman, P. E.  
for Technical Operations

Signature:

Date:

CA.P.E.#1068 10/31/95



I. OBJECTIVE

To evaluate the water sealing capabilities of the RDSS Rayflate Duct Sealing System.

II. SUMMARY

Currently, there is no standard that adequately addresses the performance required of this product. A test program was devised based on customer input and other internal Raychem specifications. The RDSS system was performance tested in various conditions, including: load cycling, axial pull, torsion, bending, air cycling, vibration, chemical resistance, and air cycling. All samples have successfully passed these requirements, which are detailed in this test report.

III. CONCLUSION

By satisfying the test scheme, it is concluded that the RDSS duct sealing system is a suitable means of sealing ducts from water ingress.

#### IV. TEST PROCEDURES

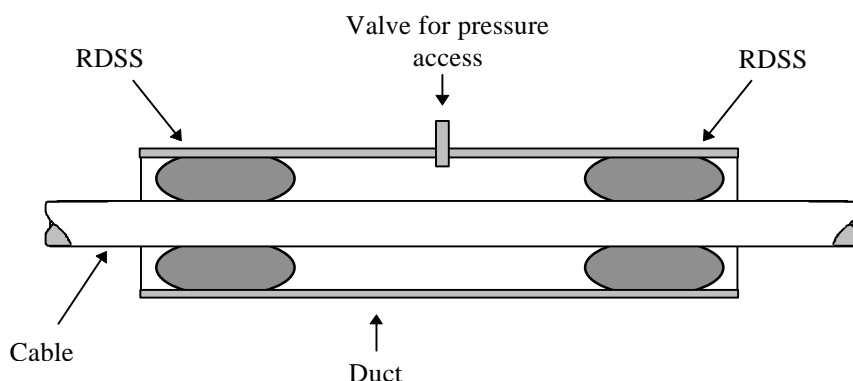
All testing was performed as described in Section V, "Testing". The samples were allowed to rest under standard laboratory conditions for at least 24 hours prior to testing.

#### V. TESTING

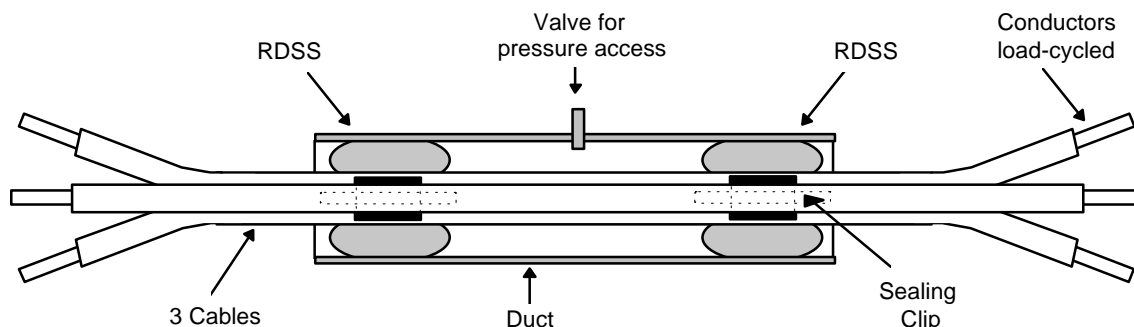
##### Test Set Up

Duct and cable types and diameters were selected in accordance to the installation instructions. The length(s) of cable(s) were selected to be most appropriate for the test in question. For configurations with multiple cables in/out, the largest cable diameter was used to calculate the clamping distance for the test in question.

The following drawing shows the principle of the test used for all tests involving a single cable:



The following drawing shows the principle of the test used for all tests involving multiple cables:



1. Tightness Test

**Requirement:** The tightness of installed samples shall be checked by pressurizing the duct to 7.25 psi (50 kPa) for a period of 15 minutes while the assembly is completely immersed in water at room temperature. The installation shall be considered tight if there is no continuous stream of air bubbles escaping from the area of the RDSS installation.

**Result:** All samples passed (In total, 412 samples passed).

2. Chemical Resistance Tests

**Requirement:** RDSS samples shall be installed at either end of a 600mm duct and tightness tested per the test described above. The samples shall be immersed in various chemical solutions for 30 days:

<u>Immersion Medium</u>	<u># RDSS samples</u>
pH 12 solution of NaOH	16
pH 2 solution of HCl	16
3.5% Na <sub>2</sub> SO <sub>4</sub> solution	10
3.5% NaCl solution	10
Diesel fuel for cars NBN T52-713	12
Kerosene ISO 1998/I 1.005	10
Petroleum Jelly	4

All samples shall be required to pass the "Tightness Test" per Section V.1 both before and after immersion.

**Result:** All samples passed

3. Storage

**Requirement:** RDSS samples shall be placed in an air circulation oven at a temperature of 60°C (140°F) for 30 days, or 70°C (158°F) for 5 days.

After this conditioning period, all samples shall be required to pass the "Tightness Test" per Section V.1.

<u>Temperature</u>	<u>Duration</u>	<u># samples</u>
60°C	30 days	21
70°C	5 days	24

**Result:** All samples passed.



#### 4. Temperature Cycling Test

**Requirements:** 120 samples shall be installed in either end of 600 mm ducts and shall be supported in racks during testing, in such a way that they are thermally isolated. There shall be free circulation of air both between specimens and the chamber surfaces. Installed samples shall be placed in an environmental chamber and subjected to 20 cycles, each lasting for 12 hours with a profile as follows:

3/4 hour transition from -15°C (5°F) to 30°C (86°F)

5 1/4 hours at 30°C (86°F)

3/4 hour transition from 30°C (86°F) to -15°C (5°F)

5 1/4 hours at -15°C (5°F)

For the duration of the test, the samples shall be connected to an air supply regulating the duct pressure at a pressure of 7.25 psi.

Upon completion of the 20 cycles, all samples shall be required to pass the "Tightness Test" per Section V.1

**Result:** All 120 samples passed

#### 5. Waterhead Test

**Requirement:** Twelve (12) installed samples shall be subjected to the equivalent of 5 meters (16.4 feet) of waterhead.

After 30 days on test, all samples shall be required to pass the "Tightness Test" per Section V.1

**Result:** All samples passed

#### 6. Axial Pull Test

**Requirement:** 22 RDSS samples shall be installed in ducts with a single cable in them. A load calculated from the formula:  $D / 2 \times 10$  Newtons shall be applied to each cable for a period of 4 hours (where D = the outer diameter of the cable in mm). For the duration of the test, the duct shall be pressurized internally to 7.25 psi.

On completion of the test, all samples shall be required to pass the "Tightness Test" per Section V.1

**Result:** All samples passed

7. Bending Test

**Requirement:** 22 RDSS samples shall be installed in ducts with a single cable in them. For the duration of the test, the duct shall be pressurized to 7.25 psi. The protruding cables shall be bent to an angle of 45° with the bending force being applied at a distance from the end of the duct of 10 times the cable outer diameter. The cable shall be held in this position for 5 minutes. The operation shall be repeated in the opposite direction.

Upon completion of the test, all samples shall be required to pass the "Tightness Test" per Section V.1

**Result:** All samples passed

8. Torsion Test

**Requirement:** Ten (10) RDSS samples shall be installed in duct with a single cable in them. For the duration of the test, the duct shall be pressurized to 7.25 psi. A torque calculated from the formula:  $D / 2 \times 10 \text{ Nm}$  (maximum 50 Nm, where D = the cable outer diameter) shall be applied at a distance from the end of the duct of ten times the cable outer diameter (minimum 250 mm). The cable shall be held in this position for 5 minutes. The operation shall be repeated in the opposite direction.

On completion of the test, all samples shall be required to pass the "Tightness Test" per Section V.1

**Result:** All samples passed

9. Vibration Test

**Requirement:** 88 RDSS samples shall be mounted on a vibration bench with the cables firmly clamped at a distance equivalent to 10 times the cable outer diameter, minimum 250 mm, from each duct end. The center point of the duct shall be subjected to a sinusoidal vibration having a frequency of 10 Hz and a peak-to-peak amplitude of 6 mm for 10 days.

For the duration of the test, the duct shall be pressurized internally to 7.25 psi.

On completion of the test, all samples shall be required to pass the "Tightness Test" per Section V.1

**Result:** All samples passed.

10. Load Cycling Test

**Requirement:** Two RDSS samples shall be installed in a 4" PVC duct with a 1.5" outer diameter 15kV Al cable. The cable shall be load cycled to 130°C conductor temperature per IEEE 404 with the RDSS subjected to 6 feet of water head. There shall be no detectable leaks.

**Result:** All samples passed.

11. Multi-conductor Load Cycling Test

**Requirement:** Four RDSS plus RDSS-CLIP samples shall be installed in a 4" PVC duct with 3-1/C 15kV power cables and the ducts shall be immersed in a water bath. The cable shall be load cycled to 130°C conductor temperature per IEEE 404 with the RDSS subjected to 10 feet (3 m) of water head. There shall be no detectable leaks.

**Result:** All samples passed

12. Multi-conductor Bend Test Under Load

**Requirement:** Two RDSS plus RDSS-CLIP samples shall be installed in a 4" duct with 3-1/C 15kV power cables. The temperature of the cable conductors shall be increased to 130°C and the RDSS sealing system shall be subjected to 16.5 feet (5m) of water head pressure. After 1 hour of heating, each individual cable, and then the entire cable bundle, shall be bent per the specification below. There shall be no detectable leaks.

**BENDING**

Clamping distance 10 x diameter of cable (minimum 10")

Bend angle 45 degrees

**Result:** All samples passed

13. Multi-Conductor Vibration / Bending / Axial Pull Test Under Load

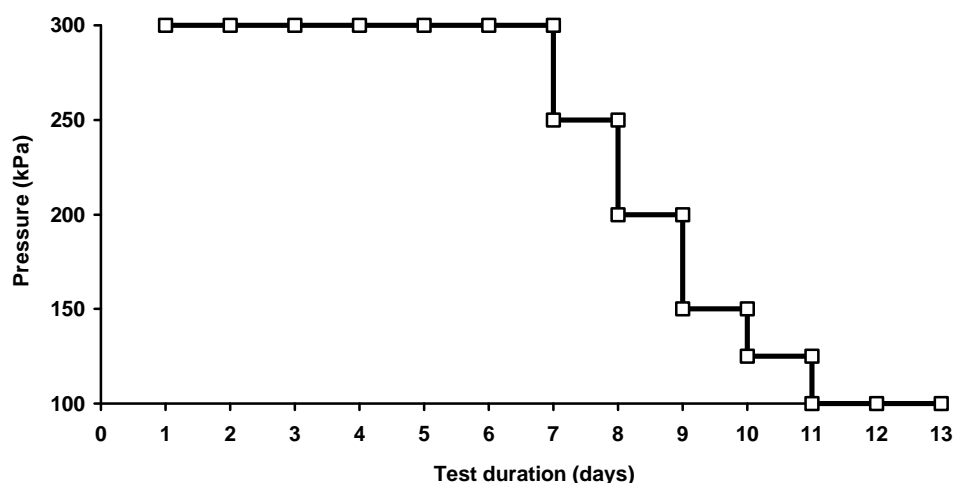
**Requirement:** Four samples shall be subjected to the following thermal and mechanical requirements and also seal against 4.4 psi (10 feet waterhead) water pressure. There shall be no detectable leaks.

- a. Six weeks load cycling at 90°C conductor temperature
- b. 24 hrs. vibration (15Hz, 6mm peak-to-peak) without load cycling
- c. 24 hrs. vibration (15Hz, 6mm peak-to-peak) with 90°C load cycling
- d. 24 hrs. bending and pulling load (axial pull > 450N)

**Result:** All samples passed

#### 14. Pressure Retention Test with multi-cable configuration

**Requirement:** Four RDSS samples were installed in 5" inner diameter PVC ducts with 3-1C, XLPE insulated, 150 mm<sup>2</sup>, 20 kV cables to fully installed internal bag pressure of 43.5 psi (300 kPa) over atmospheric. The cables were continuously load-cycled to 90 °C conductor temperature per PPS 3013 with the RDSS subjected to 10 feet (3 m) of water head. After 7 days, the internal bag pressure of the RDSS samples was reduced by 7.25 psi (50 kPa) at 24-hour intervals until 14.5 psi (100 kPa) internal pressure was reached (1/3 the original internal pressure). The pressure time relationship is shown in the following graph :



The samples continued to load cycle for 24 hours at 14.5 psi (100 kPa) internal bag pressure. The water in the ducts was then exchanged for air. With an air pressure of 4.35 psi (0,3 bar) in the duct, the samples continued to load cycle for another 24 hours at 14.5 psi (100) kPa internal bag pressure.

**Result:** No detectable leakage occurred during the entire test.



15. Helium Diffusion Rate after Ageing

**Requirement:** Eight (8) RDSS samples were installed in short 4" inner diameter PVC ducts with 1-4/C; XLPE-insulated; 150 mm<sup>2</sup>; 1 kV cable. The RDSS samples were inflated with a Helium pressure of 29 psi (200 kPa) over atmospheric.

The diffusion rates measured under vacuum after installation were less than  $4,4 \times 10^{-6}$  mbar l / sec He. All samples were subjected to 6 weeks load-cycling in air with conductor temperatures of the cables at 95 °C in accordance to PPS 3013.

**Result:** The diffusion rate measured under vacuum after the load-cycling did not exceed  $6,5 \times 10^{-6}$  mbar l / sec He.

## VI. REFERENCES

Raychem Telecommunications Division Test Report CTR-271, July, 1994

Memo from Harry Yaworski - "RDSS Preliminary Testing", dated 3/1/94

IEEE-404-1986, "IEEE Standard for Cable Joints for use with Extruded Dielectric Cable Rated 5000V through 46000V and Cable Joints for use with Laminated Dielectric Cable Rated 2500V through 500000V"