

ESSGE NCS - Installation Guide

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## ESSGE NCS – Installation Guide



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# 1 ESSGE NCS DESCRIPTION

ESSGE NCS (Non-Contact Insulation System) is a modular spacer system designed to maintain a defined air gap between the thermal insulation and the surface of pipes, tanks, and vessels. This separation reduces the moisture retention time within the insulation layer and thereby minimizes the risk of Corrosion Under Insulation (CUI) by preventing prolonged contact between moisture and coating. The system assumes that the insulation is protected by an intact external cladding. If the cladding is damaged or allows water ingress from external sources, the ESSGE NCS system cannot guarantee full functionality or continued reduction of wet time within the insulation system.

ESSGE NCS products are manufactured from polymer material supporting different service temperatures. The products are compatible with a broad range of insulation systems, including rock wool, mineral wool and other common industrial insulation types. Designed to carry the weight of the insulation and cladding. ESSGE NCS are not intended for foot traffic, that should have dedicated walkways. For detailed information about physical and chemical properties, refer to: Appendix C – Technical Data Sheet.

Under specific environmental and operational conditions, international standards such as API, DNV, NORSOK, and CINI recommend or mandate the use of spacer systems as part of a CUI mitigation strategy (refer to Appendix A – Concepts and Abbreviations). ESSGE NCS is designed in accordance with these guidelines to meet industry requirements, with a focus on modularity and cost efficiency.

ESSGE NCS enables and offers:

- Designed for simplified and time-efficient installation
- Robust design
- Accessibility for inspection
- A Spacer system for CUI mitigation – utilizing an air gap to minimize the wet time of the insulation and pipe.
- Noise dampening in accordance with ISO 15665
- Reduced risk of damage to heat tracing and pipe coatings during installation

Although ESSGE NCS is polymer based it supplies mechanical performance suitable for demanding oil and gas industry applications. It retains its functionality and dimensional integrity under demanding service conditions. A summarized overview of material properties, temperature limits, mechanical strength, and compatibility data is provided in Appendix C – Technical Data Sheet.

**Note – ESSGE NCS is intended for professional use only.**

In the table below the different applications and temperature ranges for ESSGE NCS are presented.

<b>Product name</b>	<b>Application</b>	<b>Temperature range</b>
ESSGE NCS Spacer Rings HT	Straight pipes (18 mm – 318 mm) or Wider bends (169 mm < OD < 318 mm)	Up to 160 °C *
ESSGE NCS Spacer Rings LT	Straight pipes (18 mm – 318 mm) or Wider bends (169 mm < OD < 318 mm)	Up to 100 °C *
ESSGE NCS Spacer Buttons HT	Bends (OD < 162 mm or tight areas)	Up to 160 °C *
ESSGE NCS Spacer Buttons LT	Bends (OD < 162 mm or tight areas)	Up to 100 °C *
ESSGE NCS Spacer Bands HT	For large pipes (OD > 318 mm) and tanks.  Recommended for applications >318 mm, however, may be used for smaller applications.	Up to 160 °C *

*Table 1 Description of all ESSGE NCS products with recommended application. \* See Appendix C – Technical Data Sheet for more details.*

## **1.1 ESSGE NCS - MATERIALS**

ESSGE NCS products are available in two material configurations: High Temperature (HT) and Low Temperature (LT). Each variant is developed for a specific operating temperature range, ensuring reliable performance under its respective service conditions. While the HT and LT materials differ in service temperature capability and mechanical properties, both provide the same function.

The LT variant offers a cost-efficient alternative for installations operating within lower temperature ranges. This enables project designers and end users to optimize total system cost without compromising safety, functionality, or long-term reliability.

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ESSGE NCS are engineered to prevent damage to pipe coatings and heat-tracing systems during installation and operation. ESSGE NCS materials have been tested and validated to meet the stringent requirements of regulated industries, including Oil & Gas and Rail/Transport, where safety, reliability, and installation integrity are critical.

The ESSGE NCS Spacer Band consists of a molded polymer leg integrated onto a stainless steel AISI 316L band. For further technical details, please refer to Appendix C – Technical Data Sheet.

### **1.2 Inspection**

ESSGE NCS system enables non-intrusive inspection of insulated piping without the need to remove the insulation or cladding. Access for inspection cameras can be achieved through the existing underside drainage holes, allowing visual verification of the pipe surface condition. This facilitates the early detection of corrosion or mechanical damage and supports routine inspection activities without interrupting normal operations, thereby reducing downtime and maintenance costs.

This approach is fully aligned with the preventive maintenance principles defined in NORSOK R-004 and R-501 (Insulation and Coatings), which recommend both scheduled inspections and the use of insulation systems designed for non-intrusive access.

For camera-based inspections, utilize an existing drainage hole. Once the camera is inserted, the air gap between the insulation and the pipe surface allows visual inspection of an extended pipe section from a single-entry point. This method provides efficient verification of pipe condition and identification of early corrosion indicators without removal of insulation or outer cladding.

## 2 ESSGE NCS – Spacer system – Installation

This chapter describes the correct installation of ESSGE NCS product portfolio. Installation shall ensure that all components are positioned to maintain the specified air gap, promote drainage, and preserve the mechanical and thermal integrity of the insulation system.

### 2.1 ESSGE NCS Spacer Ring: HT and LT

ESSGE NCS Spacer Rings are designed for pipe dimensions ranging from 18 mm to 318 mm in outer diameter. For applications requiring larger dimensions, it is recommended to use ESSGE NCS Spacer Band system, refer to section 2.2 ESSGE NCS Spacer Band HT for details.

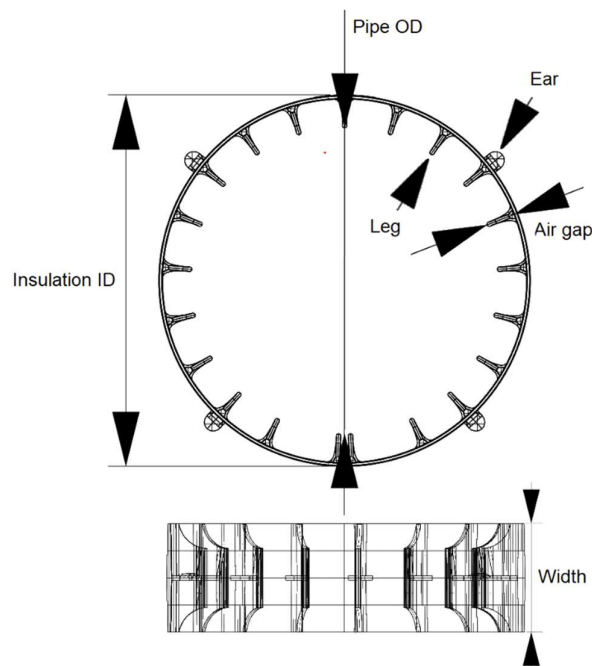


Figure 1 – Dimensions and component naming for ESSGE NCS Spacer Ring HT/LT

Type	Distance mm (mm)
Pipe OD (height)	See table 3
Width	See table 3
Ear	8

Table 2 – Dimensions for ESSGE NCS Spacer Ring HT/LT.

The table below provides the recommended ESSGE NCS Spacer Ring size matched to the corresponding pipe dimension and air gap. For a general overview and quick selection of insulation sizes, refer to Appendix B – Quick reference guide.

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ESSGE NCS Spacer Ring (Same for HT and LT)	Suited for pipe dimension (OD) (mm)	Air gap height (mm)	Width (mm)
18-25	18-25	15	48
28-38	28-38	16	48
42-57	42-57	16	48
60-80	60-80	18	48
83-114	83-114	18	48
121-163	121-163	18	48
169-222	169-222	18	48
230-318	230-318	16	48

Table 3 – Information regarding pipe dimension with corresponding spacer size and air gap. **Note:** Spacer sizing is based on pipe outer diameter (OD), not nominal pipe size (DN/NPS).

The spacer size is determined based on the pipe outer diameter (OD) values commonly available in the market. A single spacer size can typically be applied across a defined range of pipe outer diameters, see Figure 1 for an illustrative example. In applications involving steam-traced pipes, the opening in the spacer may be utilized to accommodate the steam tracing line while maintaining the designed air gap and mechanical stability of the insulation system.

When selecting the spacer size, ensure that the pipe outer diameter (OD) falls within the specified dimension range for the selected spacer model. The spacer should maintain uniform contact and alignment around the pipe circumference to preserve consistent air-gap geometry and prevent localized compression of the insulation.

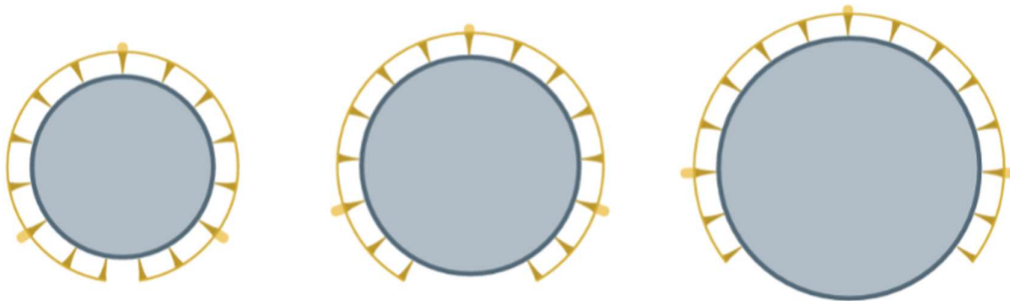


Figure 2 – The Spacer will fit between 75% and 100% of circumference of the pipe. Sufficient to create the needed air gap under the insulation and provide a mechanical base for the insulation.

### 2.1.1 How to install?

ESSGE NCS Spacer Rings are designed for quick and secure attachment to the pipe. Each ring is clipped directly onto the pipe surface, and the inherent spring tension of the material ensures that it remains firmly in position without additional fastening.

The rings can be installed on both vertical and horizontal pipes.

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Each spacer ring includes ears that engage with the insulation layer, helping to stabilize and retain the insulation during installation and throughout the system's service life — even on vertical piping. Note: The ears on the spacer rings are designed solely to support and retain the insulation during installation and operation. They do not contribute to the mechanical load-bearing capacity of the spacer or affect the specified air gap between the pipe surface and the insulation. The structural spacing and mechanical performance are provided exclusively by the spacer ring body.

Select the correct ring size based on the pipes outer diameter (OD). No tools are required to complete the installation of ESSGE NCS Spacer Ring system.

1. Select the correct ring size based on the pipes outer diameter (OD). (pipe OD + 2 × air gap = minimum insulation ID) See table 2 above.
2. Clip the spacer ring directly onto the pipe surface. The inherent spring tension will secure it in position without the need for tools.
3. For the first meter of pipe: install four (4) rings. One at each pipe end and two with 330 mm spaced in between.
4. For the remaining pipe length, install three (3) rings per meter. Ensure that the maximum distance between adjacent rings does not exceed 400 mm to maintain consistent spacing and prevent the insulation from sagging between spacers.
5. For horizontal piping, orient the ring opening downward. See Figure 1 above.
6. Apply the insulation directly over the installed spacer ring system. Refer to Appendix B – Quick Reference Guide for insulation sizing.
7. If a metal band is used after cladding installation, it is advantageous to position the band directly over each ESSGE NCS Spacer Ring. This configuration improves insulation stability and enhances the mechanical integrity of the overall insulation system.

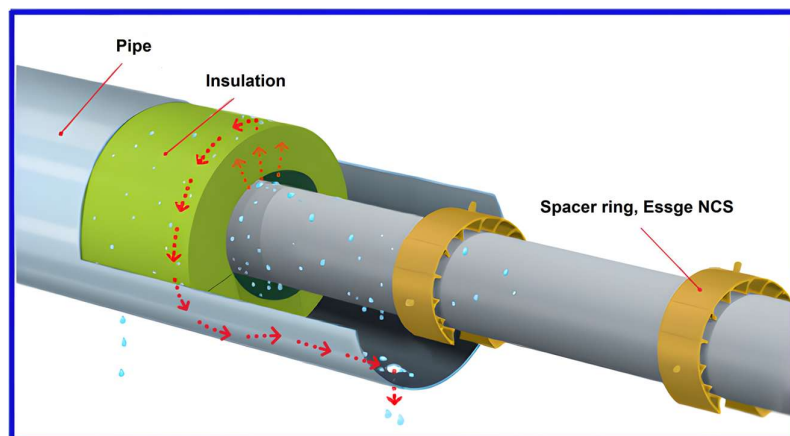


Figure 3 - Illustration of a complete insulation system with ESSGE NCS Spacer Ring using drainage holes.

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### **2.1.2 Elbow and bends**

For pipe bends, the use of ESSGE NCS Spacer Buttons (HT or LT) is recommended. Each Spacer Button is a stand-alone spacer unit designed specifically for curved pipe sections, such as bends and elbows, where standard spacer rings cannot maintain full surface contact.

The Spacer Button is pressed directly into the insulation material (e.g. mineral wool) to provide localized support and to maintain the designed air gap and insulation geometry along the curve. Install one spacer ring immediately before and one after the bend to ensure continuous alignment and consistent spacing throughout the section.

### **2.1.3 T Connections**

Use correctly sized spacer rings for each pipe diameter. Cut the insulation hole on the main pipe to accommodate the branch diameter plus the air gap specified in the sizes table.

### **2.1.4 Reducers**

Install one ESSGE NCS Spacer Ring at the inlet (large end) and one at the outlet (small end) of the reducer. Different ring sizes may be required to match the respective pipe outer diameters at each end.

## 2.2 ESSGE NCS Spacer Band HT

ESSGE NCS Spacer Band is designed for pipes, tanks or vessels with a dimension ranging above 318 mm in outer diameter. The table below provides dimensions and typical application for the product.

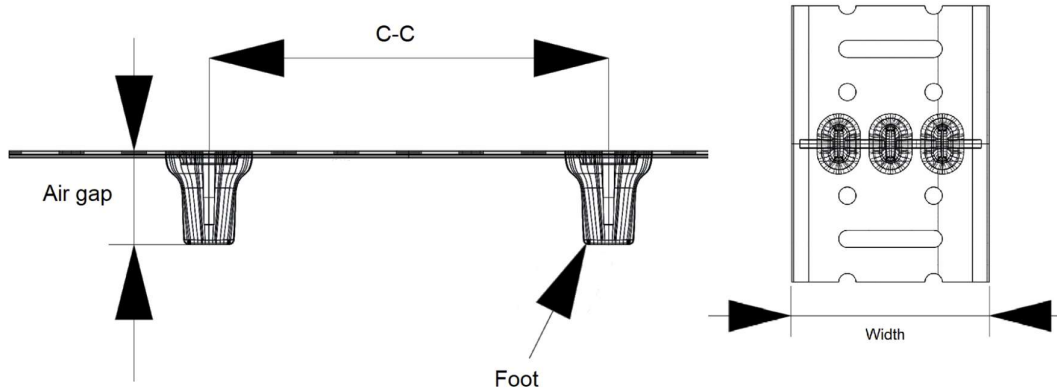


Figure 4 – Dimensions and component naming for ESSGE NCS Spacer Band HT.

Type	Distance (mm)
Suited for dimension (OD)	>318
Air gap height	15
Width	46
C-C	64

Table 4 – Application and dimensions for ESSGE NCS Spacer Band HT.

### 2.2.1 How to install?

Measure the circumference of the pipe, tank or vessel and add a small overlap to allow fastening through the prefabricated holes.



Figure 5 - ESSGE NCS Spacer Band around a large tank with polymer legs facing inward.

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1. **Cut to length:** Cut the spacer band to the required length using suitable tooling (e.g., sheet-metal scissors or metal shears). ESSGE NCS Spacer band are supplied in 10-meter rolls. Overlap the band ends sufficiently to allow secure fastening using the prefabricated  $\varnothing 4$  mm holes or  $24 \times 4$  mm slots provided along the edges of the band.
2. **Installation:** Wrap the band around the pipe, tank, or vessel with the polymer legs facing inward toward the surface. Refer to *figure 5*.
3. **Joining:** Connect the overlapping ends, using stainless-steel wire or rivets inserted through the holes or slots, to ensure firm attachment.
4. **Spacing – Pipe, tank or vessel:** For the first meter of pipe, install three (3) spacer bands — two near the insulation edges (one at each end) and one in the middle. For the remaining length, continue with three bands per meter, maintaining a maximum pitch of 400 mm between adjacent bands to ensure uniform air-gap geometry and insulation support. Refer to Appendix D – ESSGE NCS Spacer Band HT - Reference figure 2 and 3.  
Ensure that spacer bands are positioned at both ends of each insulation section.
5. **Spacing – Flat surface:** For flat and horizontal surfaces, reduce the maximum pitch to 300 mm to prevent insulation sagging or displacement between the bands. Add horizontal bands every 1000 mm for stability. Refer to Appendix D – ESSGE NCS Spacer Band HT - Reference figure 1.

Refer to Appendix D – ESSGE NCS Spacer Band HT - Reference as reference figures for the complete installation.

## 2.3 ESSGE NCS Spacer Buttons: HT and LT

ESSGE NCS Spacer buttons are pressed directly into the insulation to create the same air gap as rings and bands.

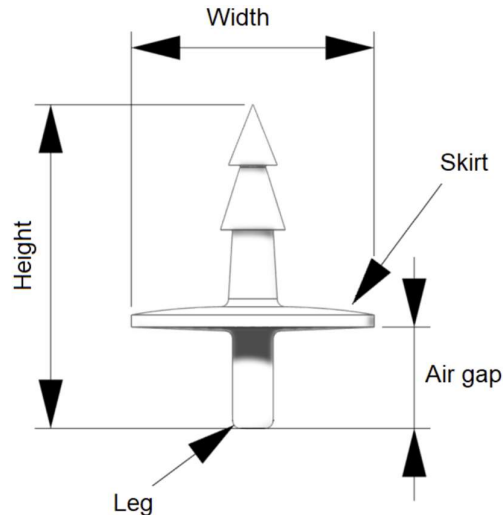


Figure 6 – Dimensions and component naming for ESSGE NCS Spacer Buttons HT/LT

Type	Distance (mm)
Height	48
Width	30
Air gap	12.5

Table 5 - Dimensions for ESSGE NCS Spacer Ring HT/LT

They are particularly designed for high adaptability where more complex distancing is needed such as tight bends, flanges or irregular sections.

ESSGE NCS Spacer Buttons can be utilized for bend and elbows with a diameter below 169mm OD, where rings become too wide to fit the inside of the bend properly. Like spacer rings, the spacer buttons require no tools and are available in both HT & LT.

Pipe bends and elbows on smaller pipe diameters require special attention during installation, as ESSGE NCS Spacer Rings may not fit properly for smaller pipes (<169mm OD). Up to 169mm OD the ESSGE NCS Spacer Rings become too wide to fit the inside of the bend. ESSGE NCS Spacer Buttons are used in these cases to maintain an air gap between the surface and insulation. Buttons are inserted directly into the insulation material and provide the same corrosion-mitigation function as the rings.

Designed to carry the weight of the insulation and cladding (**note** - not external loads). They are not intended for foot traffic, that should have dedicated walkways. Spacer buttons can also be used on straight sections, though installation is more time-consuming than with rings.

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Figure 4 - ESSGE NCS spacer buttons in two rows with 5 pcs each and a C-C of 100mm

### 2.3.1 How to install?

Distribute spacer buttons evenly around the circumference along the bend or irregular section. A maximum C-C of 100mm is recommended between the ESSGE NCS Spacer Buttons, but also to the rings at section ends. Maximum C-C will typically be on the outside of the elbow and the dictating factor on how many buttons will be needed. When an odd number is used, use one extra button on top of the pipe, where the weight will be distributed.

Spacing table for elbows and bends. For irregular sections use a maximum C-C of 100mm.

Pipe OD (mm)	Minimum spacer buttons per row HT/LT	Air gap (mm)
18-57	4	12.5
57-80	5	12.5
80-121	6	12.5
121-169	7	12.5
≥169	Use ESSGE NCS Spacer Rings or Bands instead of spacer buttons	

Table 4: Density of spacers to maintain the air gap without the insulation touching the pipe.  $Insulation\ ID = Pipe\ OD + (2 * 12.5)$

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Instructions on how to install:

1. Select the right variant HT/LT and calculate how many spacers are needed with 100mm as maximum C-C distance. The maximum C-C will typically be on the outside of the elbow/bend. See table above for the recommended quantity of buttons for each pipe diameter and row.
2. Place one distance ring before and after the bend or section where buttons will be installed as a transition from rings to buttons. This helps stabilize the installation.
3. Start with a maximum C-C of 100mm from the ring. Press the pointed end of the spacer button straight into the insulation until the tip is buried in the insulation with the skirt flush against the insulation. Buttons should be inserted at a 90° angle.
4. Distribute the buttons evenly along the bend or irregular section. This ensures a maintained air gap without the insulation touching the pipe.
5. Place the insulation with the installed ESSGE NCS Spacer Buttons on the pipe and make sure the ESSGE NCS Spacer Rings at the ends are halfway covered by the insulation section, with the ear as reference. Secure the insulation in place as instructed by the project standard/per supplier instructions.
6. Fit the outer cladding as instructed by the project standard/per supplier instructions.

## Appendix A – Concepts and Abbreviations

- **Air gap** - The distance between the pipe surface and the insulation, created by the spacer system. This prevents insulation from making direct contact with the pipe, allowing moisture to escape and allowing the pipe to dry.
- **API** - American Petroleum Institute
  - **API RP 583** - Recommended practice, widely used globally in refining, petrochemicals.
- **Bend** - A custom-made curve in the pipe (non-standard radius or angle). Typically made by bending the actual pipe rather than installing a separate fitting.
- **Center-To-Center - C-C** - Refers to the linear distance measured between the central axes of two adjacent or repeated components. It is used to define regular spacing where components are installed in a continuous pattern along a pipe, vessel, or structure.
- **CUI – Corrosion Under Insulation** - Typically develops when water, condensation, or process leakage penetrates the insulation or cladding and becomes trapped against the pipe, tank, or vessel surface. The problem is particularly pronounced within the temperature range of 60°C to 150°C.
- **DNV – Det Norske Veritas** – Act as an independent, global assurance and risk-management company.
  - **DNV-RP-G109** - Applied internationally in process industries and Oil & Gas as a risk-based CUI methodology
- **Drainage holes** - Openings placed at the lowest point of insulated pipework to allow trapped moisture to drain and to permit camera access for inspection.
- **Elbow** - A prefabricated, standard fitting (usually 45° or 90°) used to change the direction of a pipe run.
- **Heat tracing** - Electrical or steam-based heating cable or tube system designed to maintain the process temperature within the required operating range.
- **Inspection camera** - A device used to visually inspect the pipe surface through drainage holes without removing insulation or cladding. Allows early detection of corrosion and reduces downtime during routine inspections.
- **NORSOK standard** - A set of technical standards developed by the Norwegian petroleum industry to ensure safe and cost-effective design, operation, and maintenance of offshore installations. NORSOK is highly respected internationally and used as “best practice”.

Specifically:

  - **NORSOK M-501** focuses on surface preparation and protective coatings, including guidance on preventing corrosion under insulation (CUI). These standards emphasize preventative maintenance, advocating for insulation systems that support scheduled inspections and allow non-intrusive access (R-004/R-501).

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- **Pipe bends and Elbows** - Pipe bends and elbows on smaller (<169mm) OD require special attention during installation, as standard spacer rings may not fit properly for smaller pipes. ESSGE NCS Spacer Buttons are used in these cases to maintain an air gap between the surface and insulation. Buttons are inserted directly into the insulation material and provide the same corrosion mitigation function as the spacer rings.

## Appendix B – Quick reference guide

Below table can be used to get a first understanding of what dimensions the insulation to use. Note: this is a reference guide and doesn't exchange standards or subject matter expert advice.

Outer Pipe diameter (mm)	ESSGE NCS Spacer Ring (HT and LT)	Min. inside diameter of insulation pipe section (mm)	Closest standard insulation dimension (mm)
18	18-25	48	48
22	18-25	52	54
28	28-38	60	60
35	28-38	67	67/70
42	42-57	74	76
48	42-57	80	83
54	42-57	86	89
60	60-80	96	102
64	60-80	100	102
70	60-80	106	108
76	60-80	112	114
83	83-114	119	121
89	83-114	125	127
102	83-114	138	140
108	83-114	144	151
114	83-114	150	159
121	121-163	157	159
127	121-163	163	169
133	121-163	169	169
140	121-163	176	178
159	121-163	195	205
169	169-222	205	205
194	169-222	230	230
219	169-222	255	260
230	230-318	262	273
245	230-318	277	280
273	230-318	305	305
305	230-318	337	341
318	230-318	354	356
>318: OD+2x15 mm	ESSGE NCS Spacer BAND	OD+2x15 mm	

## Appendix C – Technical Data Sheet

Property	HT (Beige)	LT (Black)	Test Method	Comment
Maximum Operating Temperature (Continuous)	160 °C	100 °C	IEC 60216	
Maximum Operating Temperature (Short-term)	219 °C	140 °C	ASTM D 1525	
Minimum Operating Temperature	-30 °C	-30 °C	HT = ISO 179/1eU LT = ISO 179/1eA	ESSGE NCS has been tested in -30 with no impact. This will either indicate that the lowest operating temperature is -30°C or that ESSGE NCS can operate at lower temperatures than tested.
ESSGE NCS Spacer ring - Failure load	3,0kN	3,2kN		An in-house test was performed in which a load was applied to the ESSGE NCS Spacer Ring mounted on a pipe. No deformation, cracking, or other functional defects were observed.

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<b>ESSGE NCS Spacer Button - Failure load</b>	2,0kN	1,0kN		An in-house test was performed in which a load was applied to the ESSGE NCS Spacer Button mounted in insulation. No deformation, cracking, or other functional defects were observed.
<b>Flammability</b>	UL Recognized, 94-5VA: >= 1.9 mm	UL Recognized, 94-5VA: 1.5 mm	UL 94	Lowest possible for polymers
<b>Flammability</b>	UL Recognized, 94V-0: >= 0.41 mm	UL Recognized, 94V-0: >= 1.5 mm	UL 94	Lowest possible for polymers
<b>Toxicity and Smoke Density</b>	Class F1 (NF F16-101)	Class F1 (NF F16-101)	IEC 60695-11-10, -20	Polymer allowed for use in passenger trains
<b>Acoustic properties</b>	For pipe diameter up to 300 mm: Class A1, B1, C1		ISO 15665:2003	Insulation with 85 mm thickness, ESSGE NCS Spacer Ring and 1 mm of steel cladding.
<b>Acoustic properties</b>	For pipe diameter 300-650 mm: Class A2, B2, C2		ISO 15665:2003	Insulation with 85 mm thickness, ESSGE NCS Spacer Band and 1 mm of steel cladding.
<b>Manufactured in</b>	Sweden	Sweden		Manufactured by Essge-Plast AB in Östersund, Sweden.

# Appendix D – ESSGE NCS Spacer Band HT – Reference

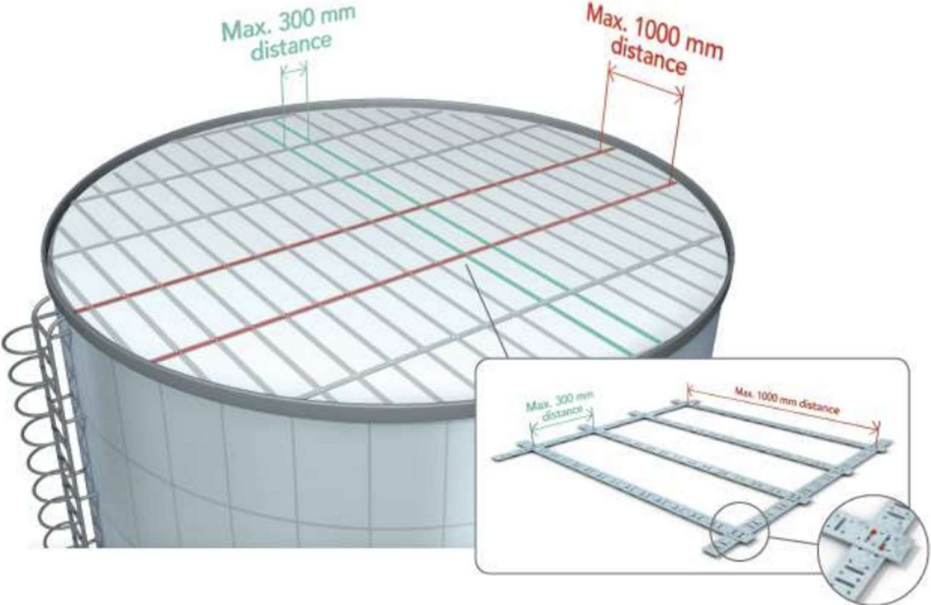


Figure 1: Showing installation of ESSGE NCS Spacer Band HT



Figure 2: ESSGE NCS band on a large tank with maximum 400mm spacing

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*Figure 3: ESSGE NCS band on a large tank with maximum 400mm spacing*