Electrically heated SCR PA lines
Installation guide

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Fig. 1: VOSS quick connect system 241

Fig. 2: VOSS quick connect system 246 *NX*

Fig. 3: VOSS quick connect system 241 *N/N-SL*

1. General

Electrically heated SCR (Selective Catalytic Reduction) line with an inner tube made from a special polyamide of PA12 and couplings / plugs (male) VOSS QC systems 241, 246 *NX* and 241 *N/N-SL*.

The 241 connectors mate with SAE J2044 style connectors and the QC system 246 *NX* mate to a special connecting port. The couplings can be released without tools and are suitable for reassembly. For this, please refer to assembly / handling instructions 9177094202/201609, 9177001402/201009 9177185202/201407 and 7004567200/202001.

The line serves to convey DEF (Diesel Exhaust Fluid) respectively AdBlue® (DIN 70070) between SCR components, e.g. tank and dosing unit.

The line is electrically heated in order to maintain fluid flow of DEF / AdBlue® or to restore the line's ability to convey DEF / AdBlue® after starting the vehicle with frozen DEF / AdBlue®.

For this, the electrical heating must be activated by the vehicle control unit in an ambient temperature range from -40 °C to +5 °C. Electrical heating of the SCR line is not necessary at ambient temperatures higher than +5 °C and should be avoided to save energy.

Tube dimensions / nominal size corrugated tube / outer diameter	Min. bend radius (formed) [mm]	Min. bend radius (free installation) [mm]
4x1 / NS8.5 / OD 11.4	R 20	R 50
5x1 / NS10 / OD 12.6	R 25	R 60
6x1 / NS10 / OD 12.6	R 30	R 60
8x1 / NS12 / OD 15.6	R 40 / 50*	R 75

Table 1: Minimum bending radii
*) Due to production related restrictions the min. bending radii for 8x1 form-bended lines depends on the distance to the first bend from each end of the SCR line

2.1. Minimum bending radius requirement

Refer to table 1 for the minimum bending radius for both formed and free (non-formed) installations. A smaller bend radius is not allowed. The bending radius is to be measured to the centerline of the tube.
The bending radius can be analyzed in CAD by creating an arc or bridge curve that is tangent to the centerline of the tube at the clipping or restraint points and analyzing that curve for the minimum radius.

2.2 Electrical connectors

The electrical connectors should be fixed on the mating connector or the line itself.

The electrical harness must be protected against mechanical loads and abrasive surfaces.

2.3 Electrical operation

The maximal allowed ambient temperature for electrical operation is +5 °C for the allowed voltage range.

Fig. 4: Correct use of a plastic zip tie

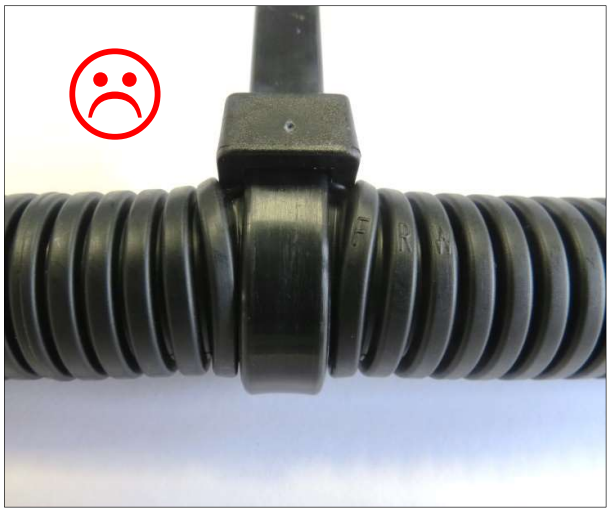

Fig. 5: Incorrect use of a plastic zip tie

2.4. Routing and clipping

The line assemblies must have additional clipping or support points. The line should be supported every 500 mm along the length. The recommended means of clipping is a metal P-clamp that has a rubber protective coating on it. The clamp should not be allowed to damage the corrugated tube.

Plastic zip ties may also be used to support the line assemblies. Caution should be used if this is the method of support as they can crush or kink the line. Crushing and kinking the corrugated tube with the zip tie is not allowed. The assembly force depends on the dimension and material of the zip tie. From our experience the approximate value for the assembly is 30 N. This is only a reference and must be checked for each different zip tie.

Lines must be routed in such a way as to provide protection against damage. The lines must not contact sharp edges or abrasive surfaces. It is recommended that clamping/tie down methods be used to avoid these situations. Grommets or other protective pass-through devices are recommended when routing through sheet metal. It is required that lines be kept away from moving parts when at the limit of travel.

The lines must be kept far enough away from heat sources to insure that the lines do not exceed their maximum tube temperatures of 120 °C. If temperatures are exceeded, a protective shield may need to be added to the line. The vehicle designer/ manufacturer is often best suited to apply heat shielding to the lines to meet their application specific requirements and insure the lines meet this application guide.

The routing of the SCR lines immediately next to coolant lines (with constant coolant flow) for long runs or other higher temperature components may negatively affect the intended performance of the DEF (it should not exceed 80 °C). It is good practice to route the lines away from the heat source or with a large gap between the items. Higher temperature environments may also negatively impact DEF performance.

SCR lines must not be routed so that they are pinched between vehicle components.

Lines must not be kinked during the routing on the vehicle, this can occur by routing the line over an edge or small diameter surface and pulling the line tight. Or if a loop is in the line it can kink as it is pulled tight (similar to what can happen with a garden hose).

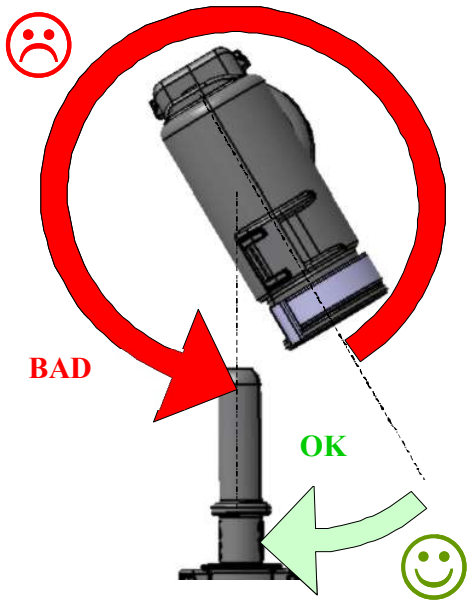

Fig. 6: The line has to be mounted free from mechanical constraints in the vehicle

Line length	Max torsion angle
< 1 m	20°
1 – 1.5 m	45°
1.5 – 2 m	90°
> 2 m	180°

Table 2: Maximum amount of torsion angle that can be applied to the line during assembly

3. Installation requirements and guidelines

The following information must be communicated to the assembly facility that will be installing the SCR lines.

3.1. Protective plugs

Lines are shipped with protective plugs on the fluid connectors. These must remain on until final assembly. This ensures the cleanliness of the lines to prevent possible damage or contamination of the DEF / AdBlue® fluid system. It is the customer's responsibility to ensure that this requirement is followed during the material handling and assembly process. To maintain cleanliness, the quick connectors have to be closed with caps or covered with a plastic bag whenever the SCR-Line is disassembled (e.g. during maintenance and/or vehicle repair).

3.2. Installation process

Please refer to the Appendix A for the detailed installation and disassembly process for the connectors. Lines must not be stepped on or pinched between other parts during the assembly process.

1. Remove protective plugs
2. Align fluid connector on fitting
3. Press firmly until a click is heard
4. Pull back on connector to check that connection was made, and this will also seat the connector
5. Repeat steps 1 to 4 at the other connector; note that the maximum amount of twist has not been exceeded (Fig. 6 and Table 2).
6. Install clipping to constrain the line.

The line has to be positioned free of tension in the vehicle.

During the connection process the maximum torsion angle must not be exceeded (see Table 2).

Both hydraulic connections need to be complete before adding clips or zip ties to retain the line.

4. Other applicable documents

VOSS specification "Electrically heated SCR lines made from PA tubes" (latest revision)

Handling instructions 9177094202/201609 (Appendix A)

Assembly instructions 9177001402/201009 Part2 (Appendix B)

Assembly instructions 9177185202/201407 (Appendix C)

Assembly instructions 7004567200/202001 (Appendix D)

Appendix A

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Handling instructions for electrically heated SCR PA lines

Keep quick connectors and lines clean!

Do not remove protection caps until final assembly!

Do not squeeze or kink the lines!

Protect quick connectors against dirt during assembly/ disassembly!

Take care of proper electrical connections!

Contact of electrical plug with urea not allowed!

The line has to be positioned free of tension in the vehicle.

In the connecting process the maximum torsion angle must not be exceeded.

A fixing of lines, e. g. with zip ties, has not to be carried out until the hydraulic connection is made.

Protect line and connectors against damages especially during assembly/ disassembly!
e.g.
- crushing with zip ties
- disassembly with screwdriver

Maximum torsion

Line length	Maximum torsion angle
< 1 m	20°
1 – 1.5 m	45°
1.5 – 2 m	90°
> 2 m	180°

Under normal environmental conditions (refer to ISO 291) the maximum duration of storage is 5 years. Exposure to direct sunlight, UV light sources or heat sources (e.g. radiators) is not permitted. In case of assembling SCR lines 6 months after its manufacturing date, re-lubrication of O-rings is recommended for easier assembly. Use VOSS grease 9499000526 on male pin before attaching the SCR line.

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Appendix B

Assembly instructions VOSS quick connect system 241
Part 2: Applications in electrically heated SCR systems

Fig. 3: Coupling and male connection before assembly

Fig. 5: Pushing the coupling as far as it will go onto the male connector; in the process the holding clip engages

Fig. 6: Pulling back the coupling to the locked position

Fig. 7: Pushing the coupling out of the locked position for disconnecting

Fig. 8: Compressing the lugs of the holding clip and pulling the coupling off

4. Assembly instructions

4.1. Assembly

Before assembly the components have to be checked. They must be clean and should not show any signs of damage.

During the assembly process the holding clip has to be in a centered position (fig. 4).

The coupling is pushed onto the male connector to the limit stop. The holding clip of the coupling engages behind the bead of the male connector.

By pulling back the coupling manually against the pushing direction, the holding clip reaches the locking position. In this position the system cannot be opened.

4.2. Disassembly

Before disconnecting the line must be free of pressure and the area of the holding clip free from dirt.

Moving the coupling in the initial pushing direction causes the holding clip to leave the locked position. The lugs of the holding clip can be compressed and the coupling can be pulled off the male connector.

Fig. 4:
Holding clip in centered position

Fig. 9:
System not locked (see also figs. 5 and 7); pull the coupling back in the indicated direction for locking the system.

Fig. 10:
System locked (see also fig. 6)

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Appendix C

Assembly instructions VOSS quick connect system 246 NX
Application in electrically heated SCR systems

Fig. 1: Plug and connecting profile before assembly

Fig. 2: Pushing the plug as far as it will go onto the connecting profile; in the process the snap-in and release element engages

Fig. 3: Checking the correct locking by pulling back the plug

Fig. 4: Pushing the plug in the connection direction for disconnecting

Fig. 5: Pressing the snap-in and release element and pulling off the plug

1. Assembly

Prior to assembly all components have to be checked. They must be clean and should not show any signs of damage.

The plug has to be pushed as far as it will go onto the connecting profile. The snap-in and release element of the plug engages behind the bead of the connecting profile (fig. 2).

The correct locking has to be checked by manually pulling back the plug (fig. 3).

2. Disassembly

Prior to disassembly the line must be pressure less and the area of the snap-in and release element must be free of dirt.

Pushing the plug in the connecting direction makes operating and unlocking easier (fig. 4).

For setting a preferred actuation direction the position of the snap-in and release element is freely rotatable on the plug (fig. 4).

Pressing the serrated area of the snap-in and release element as far as it will go spreads the locking element and the plug can be pulled off the connecting profile (fig. 5).

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Appendix D

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1. Assembly

Step 1

Coupling and male connector are separated (starting situation).

Only 241$^{N\text{-}SL}$: Retaining clip with secondary lock extends beyond clip cage.

241^{N}

Fig. 6: Separated coupling 241^{N} and male connector

241$^{N\text{-}SL}$

Fig. 7: Separated coupling 241$^{N\text{-}SL}$ and male connector

Step 2

Place coupling centered above male connector.

Fig. 8: Centered placement of coupling 241^{N} above male connector

Fig. 9: Centered placement of coupling 241$^{N\text{-}SL}$ above male connector

Appendix D

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241 N

241 N-SL

Step 3

Plug coupling onto male connector.

Fig. 10: Plugging of coupling 241 N onto male connector

Fig. 11: Plugging of coupling 241 N-SL onto male connector

Only 241 N-SL:
Retaining clip with secondary lock cannot be activated in this position.

Fig. 12: Blocked secondary lock

Step 4

Plug coupling onto the male connector until it stops.

Fig. 13: Until stop plugged coupling 241 N

Fig. 14: Until stop plugged coupling 241 N-SL

Go on with step 6 (page 8)

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241 N

241 N-SL

Step 5

Only 241 N-SL:
Activate retaining clip with secondary lock with flat finger…

Fig. 15: Activation of seocndary lock

… until retaining clip with secondary lock engages and is flush with clip cage.

Fig. 16: Activated secondary lock

Step 6

Slightly retract coupling, until it reaches the collar of the male connector.

Fig. 17: Retracting of connected coupling 241 N

Fig. 18: Retracting of connected coupling 241 N-SL

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Step 7

Completely connected coupling (final position)

241 ^{N}

Fig. 19: Completely connected coupling 241 ^{N}

241 $^{N\text{-}SL}$

Fig. 20: Completely connected coupling 241 $^{N\text{-}SL}$

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2. Disassembly

Before disconnecting, the line must be free of pressure, and the area around the secondary lock must be free of dirt.

241 ^{N} | 241 $^{N\text{-}SL}$

Step 1

Slightly push down coupling.

Fig. 21: Pushing down coupling 241 ^{N}

Fig. 22: Pushing down coupling 241 $^{N\text{-}SL}$

Step 2

Push in retaining clip with fingertip.

Fig. 23: Pushing in retaining clip 241 ^{N}

Fig. 24: Pushing in retaining clip 241 $^{N\text{-}SL}$

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241 N

241 N-SL

Step 3

Pull off coupling to the top…

Fig. 25: Pulling off detached coupling 241 N

Fig. 26: Pulling off detached coupling 241 N-SL

… until coupling and male connector are completely disconnected.

Fig. 27: Disconnection of coupling 241 N and male connector

Fig. 28: Disconnection of coupling 241 N-SL and male connector

Step 4

Completely disassemble coupling with male connector.

Only 241 N-SL: Retaining clip with secondary lock is flush with clip cage.

Fig. 29: Completely disassembled coupling 241 N with male connector

Fig. 30: Completely disassembled coupling 241 N-SL with male connector

Assembly instructions VOSS quick connect systems 241 N/N-SL, page 11 of 16

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3. Subsequent assemblies: 241 N-SL

Before connecting both sides, components must be checked. They have to be clean and must not show any signs of damage.

Step 1

Coupling with flush retaining clip with secondary lock and male connector are separated (starting situation).

241 N-SL

Fig. 31: Disconnected coupling 241 N-SL and male connector (subsequent assemblies)

Step 2

Place coupling centered above male connector.

Fig. 32: Centered placement of coupling 241 N-SL above male connector (subsequent assemblies)

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241 N-SL

Step 3

Plug coupling onto male connector.

Fig. 33: Plugging of coupling 241 N-SL onto male connector (subsequent assemblies)

When the coupling passes the collar of the male connector, the retaining clip with secondary lock jumps forward, back to its original position, so it extends beyond the clip cage (visual connection indicator).

Fig. 34: Visual connection indicator for subsequent assemblies

Step 4

Plug coupling further onto the male connector until it stops.

Fig. 35: Until stop plugged coupling 241 N-SL (subsequent assemblies)

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241 N-SL

Step 5

Activate retaining clip with secondary lock with flat finger…

Fig. 36: Activation of seocndary lock (subsequent assemblies)

… until retaining clip with secondary lock engages and is flush with clip cage.

Fig. 37: Activated secondary lock (subsequent assemblies)

Step 6

Slightly retract coupling, until it reaches the collar of the male connector.

Fig. 38: Retracting of connected coupling 241 N-SL (subsequent assemblies)

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Step 7

Completely connected coupling (final position)

241 N-SL

Fig. 38: Completely connected coupling 241 N-SL (subsequent assemblies)

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