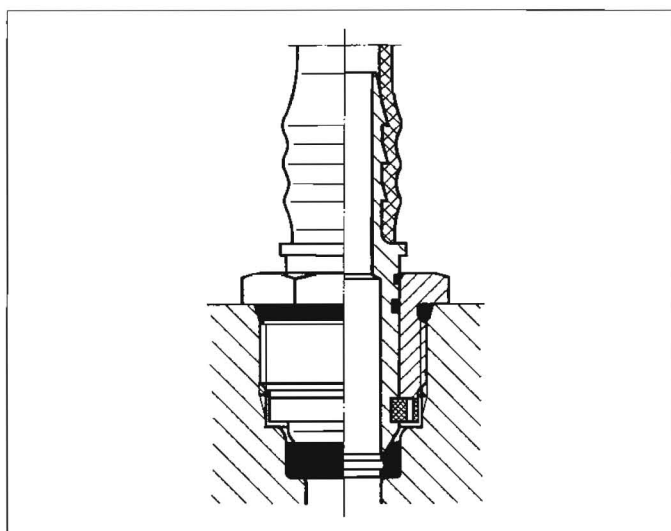


B 23 Assembly instructions

VOSS Plug connection system 230 for compressed air equipment in commercial vehicles

These assembly instructions are intended for qualified fitters of compressed air systems in commercial vehicles.



1. Introduction

Nowadays, nylon tubes are often used in the compressed air systems of commercial vehicles instead of the metal tubes previously employed. Nylon tubes are resistant to rust, vibrations and frame distortion. They are easier to handle than metal tubes and easier to install in the vehicle. The following factors are decisive for their functional reliability:

- the correct material and proper handling,
- the right connection fittings,
- correct assembly.

2. Nylon tubes

The properties of nylon tubes and their use in vehicles are defined in the following standards:

DIN 73378
Nylon tubes for motor vehicles

DIN 74324 Part 1
Nylon tubes and piping for compressed air brake systems, requirements and testing.

DIN 74324 Part 2
Nylon tubes and piping for compressed air brake systems, notes on installation.

CAUTION!

Observe section 3.5 when using nylon plugs owing to the different material properties.

3. VOSS plug connection system 230

The VOSS plug connection system 230 permits the rapid joining of nylon tubes. Merely a wrench (for wrench sizes, refer to 3.3.3.3) is needed to undo the connection.

The connection fittings are made of brass, die-cast aluminium, die-cast zinc or aluminium, depending on the version involved. The plugs are supplied in brass as the standard version. Individual variations (angle plug nom. size NG 12/9 and Tee plug NG 12/9) are also available in plastic (PA 11-GF 30). They are interchangeable. There are dimensional differences compared with the brass design (see table in section 3.3.2.1). The drawings and dimension tables shown here relate to the brass design.

When inserting the plastic plug into the nylon tube, the greater length of the fir-tree compared with the brass version is to be allowed for (see section 3.3.2.1).

3.1 Range of application

The components of the VOSS plug connection system 230 are designed for use in a temperature range of -40°C to $+100^{\circ}\text{C}$.

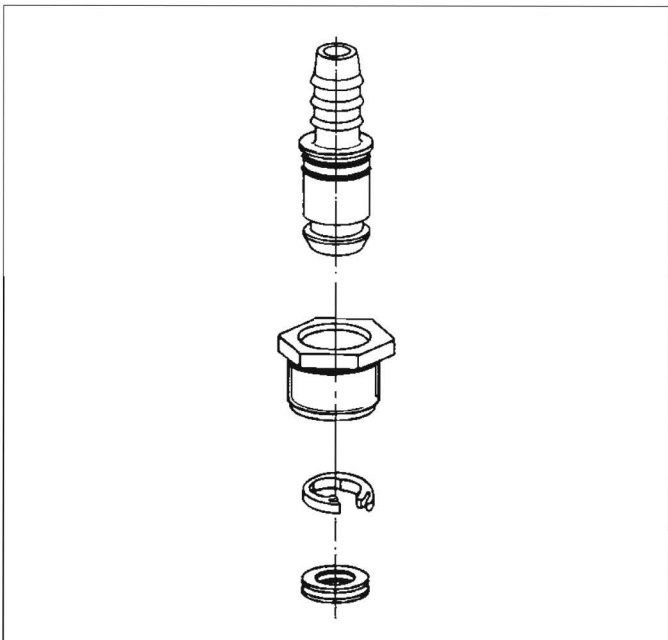
The admissible working pressure is 12 bar and is limited by the pressure resistance of the nylon tube.

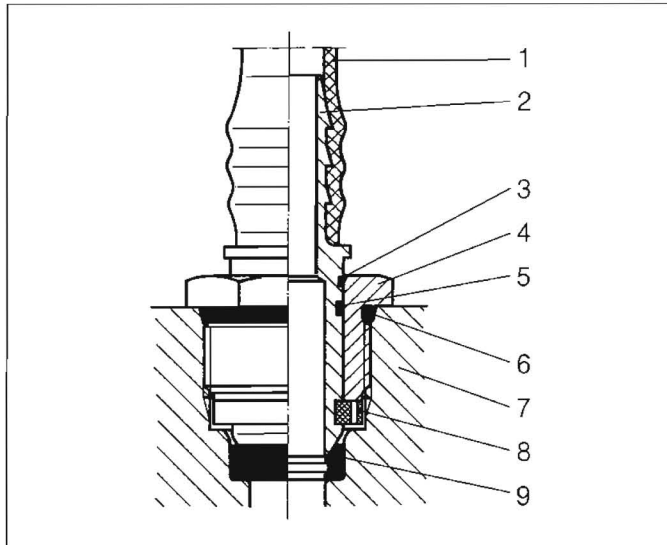
Use only for nylon tubes to DIN 74324 Part 1 made of nylon 11 or nylon 12.

3.2 Individual components

The VOSS plug connection system 230 consists of four components: plug with fir-tree, male fitting, retaining clip and spring element.

- The plug has a wide holding groove in which the retaining clip engages during assembly. Two other grooves accommodate O-rings. The first O-ring seals the connection against the medium. The second O-ring prevents the ingress of foreign matter. At the same time, its red colour serves as a visual check to indicate correct assembly.
- The male fitting is screwed tight into the brake unit. The stud thread is sealed by an O-ring.
- The plastic retaining clip is open on one side and is opened by the tapered tail of the plug during assembly. After insertion of the plug this clip engages the holding groove. The retaining clip is self-centring.
- The rubber spring element is inserted into an annular compartment at the base of the formed bore. The design of the spring element causes the plug to be placed under axial stress after the retaining clip has engaged.



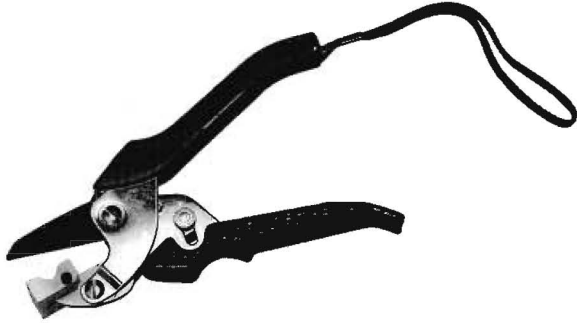


- 1 Nylon tube
- 2 Plug with fir-tree
- 3 Dirt seal and visual assembly check (red O-ring)
- 4 Male fitting
- 5 Plug seal (O-Ring)
- 6 Thread seal (O-Ring)
- 7 Component
- 8 Retaining clip
- 9 Spring element

VOSS plug connections 230
are available in the nominal sizes NG 6, 8 and 12.

Stud thread	Nom. size NG	Fir-tree for tubes d x s (mm)
M 10 x 1	6	6 x 1
M 16 x 1,5	8	6 x 1 8 x 1 / 9 x 1,5
M 22 x 1,5	12	6 x 1 8 x 1 / 9 x 1,5 10 x 1,25 12 x 1,5 14 x 2 16 x 2

The catalogue 230 contains part of the range of the VOSS plug connection system 230. Additional items are available on request.



Nylon tube cutting pliers
VOSS Part No. 5 9 94 55 00 00

CAUTION!

The connection between nylon tube and fir-tree must under no circumstances be secured with hose clips or clamping sleeves.

3.3 Assembly

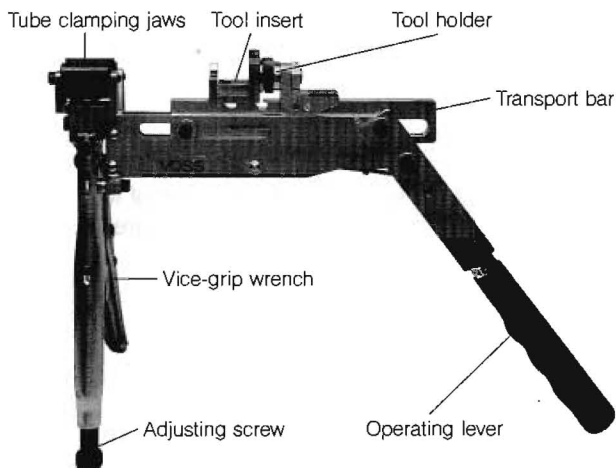
3.3.1 Cutting the nylon tube to length

The nylon tube must be cut off square. A saw must not be used for this purpose as the unavoidable formation of burrs jeopardises the sealing capability of the connection. For cutting the nylon tube to length, we recommend the use of the VOSS tube cutting pliers shown in the adjacent illustration so that the tube can be cut cleanly and at right angles. Reworking the cut surface, such as deburring, is then no longer necessary.

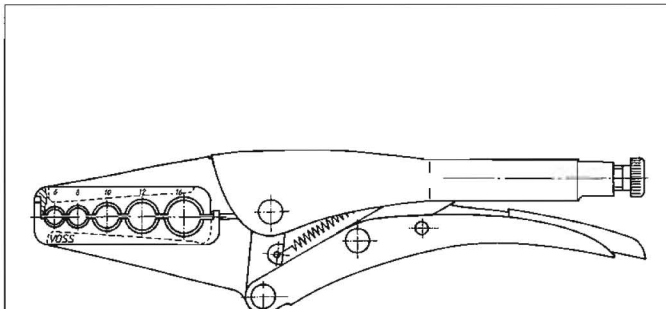
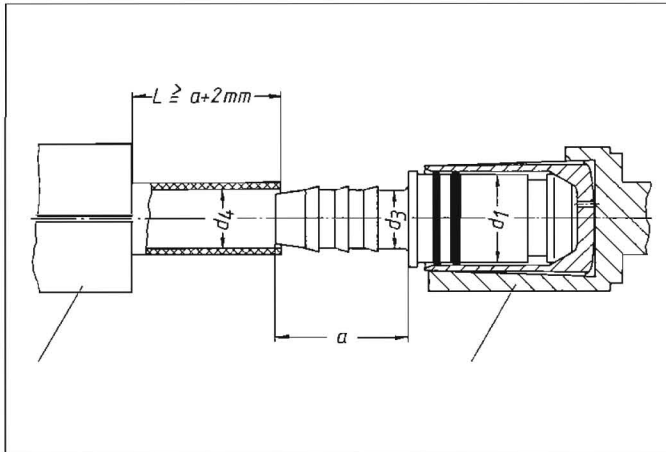
3.3.2 Pressing the fir-tree into the nylon tube

The following is to be observed when pressing the fir-tree into the nylon tube:

- The pressing-in procedure is to be performed at room temperature.
- The nylon tube must not be heated.
- The fir-tree must not exhibit any damage as otherwise the connection with the nylon tube will not be tight.
- The fir-tree should be clean and free of grease.



nylon tube hand press
VOSS Part No. on request



Plastic tube holding pliers

VOSS Part No. 5 9 94 50 70 00 f. tube ODs 6, 8, 10, 12, 16
VOSS Part No. 5 9 94 50 73 00 f. tube ODs 6, 9, 12, 14, 16

3.3.2.1 Pressing-in with the nylon tube hand press

The tube clamping jaws are turned into the correct position to suit the outside diameter of the tube to be mounted. Then a tool insert matching the plug to be inserted (nom. size NG 8 or 12, straight plug or angle plug) is introduced into the tool mount.

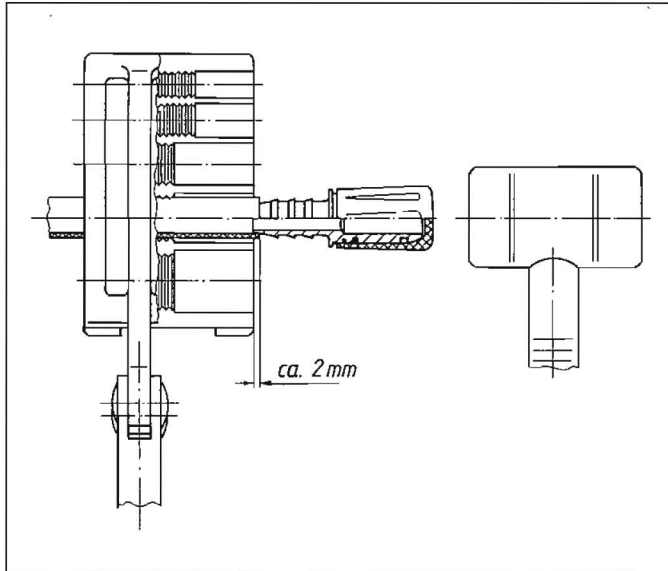
The diameter d_3 of the fir-tree is to be combined with the inside diameter of the nylon tube according to the following table so that the specified preload conditions are achieved.

	d1 (mm)	Tube (mm)	d3 (mm)	d4 (mm)	a brass (mm)	a nylon (mm)
NG 8	9,4	6 x 1	4,6	4,0	16	–
		8 x 1 / 9 x 1,5	6,9	6,0	16	–
NG 12	14,9	6 x 1	4,6	4,0	16	–
		8 x 1 / 9 x 1,5	6,9	6,0	16	–
		10 x 1,25	8,1	7,5	22	–
		12 x 1,5	10,3	9,0	22	26
		14 x 2	11,2	10,0	23	–
		16 x 2	13,6	12,0	25	–

The nylon tube is inserted into the tube clamping jaws; it must protrude by the distance "L". The nylon tube is firmly secured with the vice-grip wrench. The clamping force can be varied with the adjusting screw.

The plug to be mounted is introduced into the tool insert and the transport bar pressed manually in the direction of the nylon tube until the fir-tree is centred in the inside diameter of the tube.

The nylon tube is pressed right to the end of the fir-tree with the pressing lever. The vice-grip wrench can be released and the mounted nylon tube removed.



3.3.2.2 Assembly with the nylon tube holding pliers

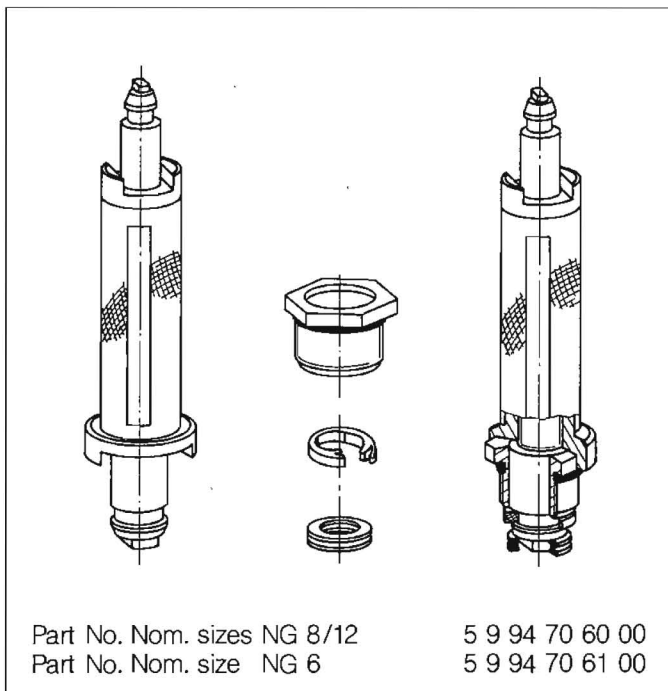
The nylon tube is introduced into the tube holding pliers in such a way that the tube end projects about 2 mm out of the side that is not ribbed. The clamping force of the tube clamping jaws can be set with the adjusting screw.

The fir-tree is pressed into the tube end by hand as far as possible and driven straight into the nylon tube using a plastic hammer until the fir-tree is covered by the nylon tube.

3.3.2.3 Protective cap

All plugs are supplied with a protective plastic cap to prevent damage to the plug. This protective cap must not be removed until immediately before final assembly.

Operating instructions and product descriptions on all the above-mentioned preassembly components and tools are available on request.

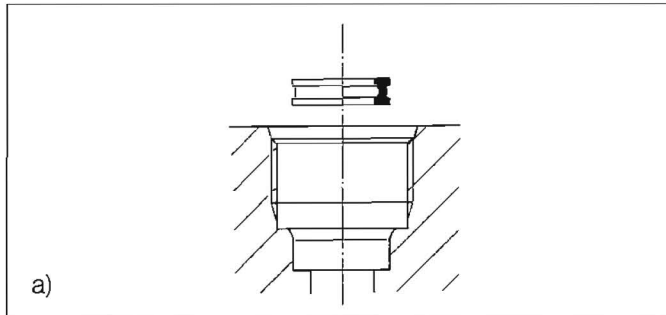


3.3.3 Assembly of spring element, retaining clip and male fitting

In order to guarantee reliable operation, the connection bore must be cleaned before assembly.

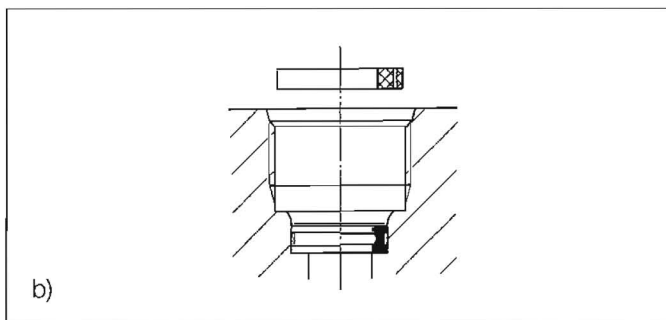
3.3.3.1 Series assembly with assembly mandrel

The male fitting with greased O-ring, retaining clip and spring element are successively mounted onto the assembly mandrel. The assembly mandrel prepared in this way is screwed hand-tight into the connection bore. The mandrel is withdrawn, the individual components remain in their position. Then the male fitting is tightened (for tightening torque, see 3.3.3.3).

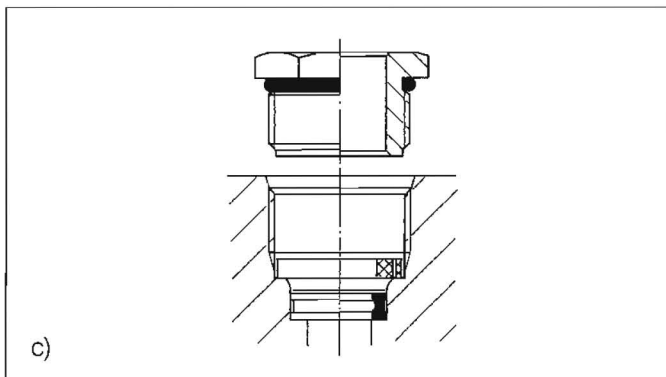


3.3.3.2 Single assembly

- The spring element is inserted into the chamber under the thread root of the connection bore (a) and (b).



- The retaining clip is introduced so that it rests flat on the thread root (b) and (c).
- The spring element and retaining clip are symmetrical.



- The male fitting pre-assembled with the pre-greased O-ring to seal the thread is screwed by hand into the tapped bore (c) and tightened.

CAUTION!

Plug connections which are not correctly engaged can cause failure of the brake system.

3.3.3.3 Torques

Stud thread	Nom. size NG	Wrench size AF	Tightening torque Nm
M 10 x 1	6	12	5 + 1
M 16 x 1,5	8	19	10 + 1
M 22 x 1,5	12	24	10 + 1

3.3.4 Connection between plug and component

Only now is the protective cap to be removed from the plug (see section 3.3.2.3). The plug with the nylon tube pressed on is pushed into the bore of the male fitting and pressed against the spring element until the retaining clip engages the groove of the plug (see illustration). The correct fit of the retaining clip must be checked by pulling the plug against the direction of insertion. It must be ensured that the plug does not cant in the bore.

Testing tools (nom. size NG 8/12 VOSS Part No. 5 9 94 71 20 00 and nom. size NG 6/8 VOSS Part No. 5 9 94 71 21 00) are available for testing in the form of a levering test. The tool is pushed between the plug collar and the male fitting and pressed with minimal force (30 N) against the male fitting (see illustration).

The plug connection must not become detached during this test; it is correctly engaged when the red O-ring is no longer visible.

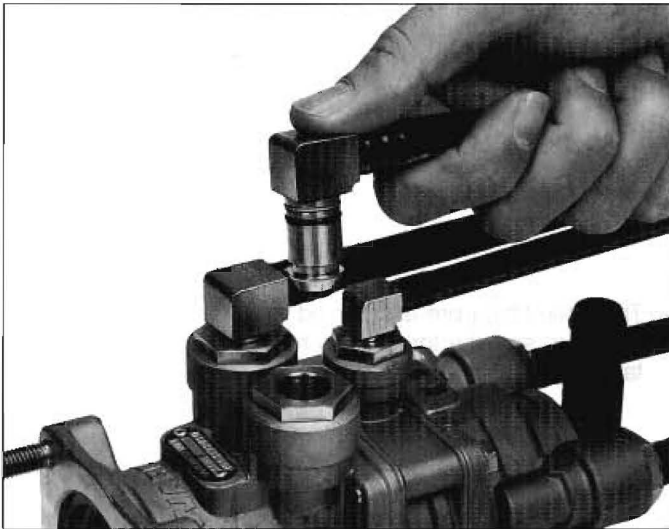
3.3.5 Releasing the connection and re-assembly

The connected line must be depressurised in order to release the connection. All components are to be cleaned before re-assembly.

3.3.5.1 Replacement of components

The male fitting is undone and the plug connection unscrewed. The nylon tube with the plug, the male fitting with the O-ring and the retaining clip form one assembly.

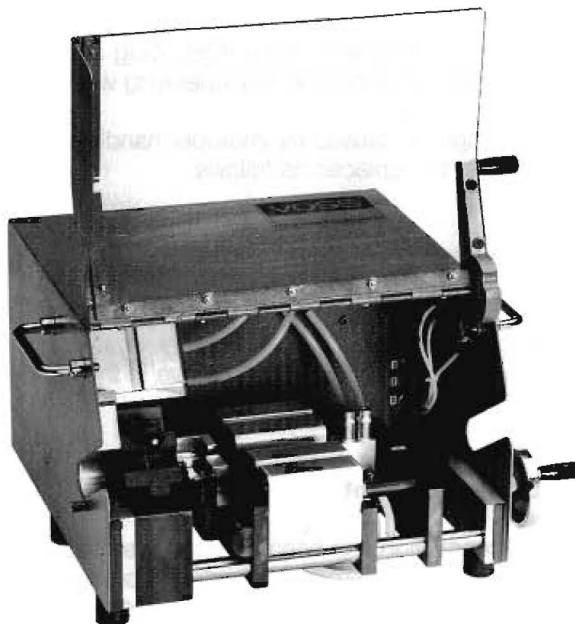
Insert into the new component the spring element into the chamber at the bottom of the formed bore. Then screw in the plug connection assembly with the greased O-ring and tighten the male fitting.



Final assembly



Final check with testing tool



VOSS pre-assembly machine type 56
VOSS Part No. 5 9 94 56 40 00



Pneumatic assembly tool for nylon tube
VOSS Part No. 5 9 94 50 80 00

3.3.6 Pre-assembly machines and tools

The following VOSS pre-assembly machines and tools are available for assembling the plug connections.

Series assembly:

- VOSS pre-assembly machine type 56 for pressing the fir-tree into the nylon tube (see illustration).
- Pneumatic assembly tool for nylon tube (see illustration).

Small series or single assembly:

- Nylon tube hand press with tool inserts
- Nylon tube holding pliers
- Nylon tube cutting pliers

Service sector:

- **Service case 1:** VOSS Part No. 5 9 94 49 70 00

- 1 Nylon tube holding pliers for tube ODs Ø 6, 8, 10, 12, 16
- 1 Plastic hammer
- 1 Nylon tube cutting pliers
- 1 Assembly mandrel nom. sizes NG 8 / NG 12
- 1 Wrench sizes AF 19 / AF 24
- 1 Testing tool nom. sizes NG 8 / NG 12

- **Service case 2:** VOSS Part No. on request

- 1 Special-purpose hand press with tube clamping jaws for tube ODs 6, 8, 10 and 12 as well as 11, 12, 14 and 16
- 1 Tool insert for straight plug nom. size NG 8
- 1 Tool insert for straight plug nom. size NG 12
- 1 Tool insert for elbow plug nom. size NG 8, tube 6 x 1, 8 x 1 and 9 x 1,5
- 1 Tool insert for elbow plug nom. size NG 12, tube 6 x 1, 8 x 1 and 9 x 1,5
- 1 Tool insert for elbow plug nom. size NG 12, tube 10 x 1,25 and 12 x 1,5
- 1 Tool insert for elbow plug nom. size NG 12, tube 16 x 2
- 1 Nylon tube cutting pliers
- 1 Assembly mandrel nom. sizes NG 8 / NG 12
- 1 Wrench sizes AF 19 / AF 24
- 1 Testing tool nom. sizes NG 8 / NG 12

3.4 Repairs

The individual components of the VOSS plug connection system 230 are not subject to any operating wear.

Should damage be caused by improper handling, individual parts can be replaced as follows.

3.4.1 Retaining clip

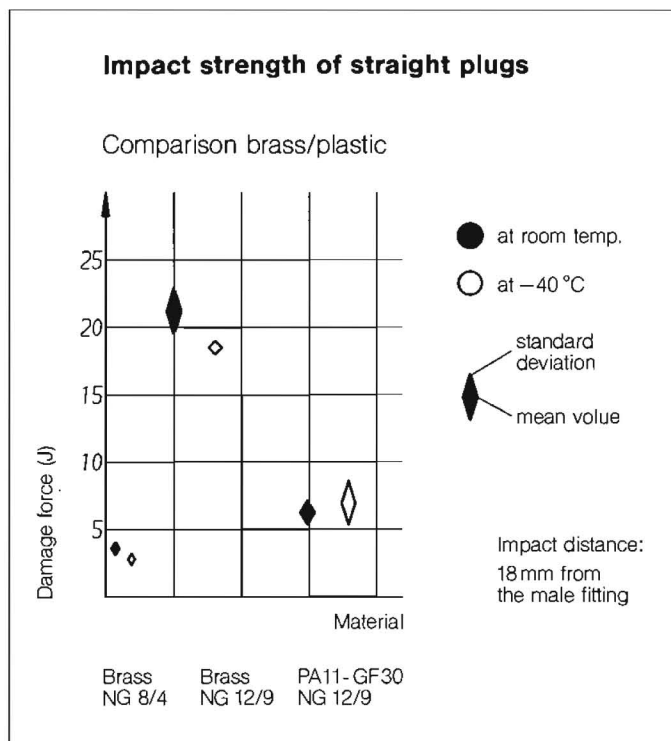
When the connection has been released (see section 3.3.5), the damaged retaining clip is pulled sideways – radially to the plug stud – out of the holding groove in the stud and replaced by a new one.

3.4.2 Spring element

When the connection has been released (see section 3.3.5), the damaged spring element is removed from the chamber of the formed bore and replaced by a new one.

3.4.3 O-rings

When the connection has been released (see section 3.3.5), the O-ring is removed. The groove must be cleaned thoroughly. A new greased O-ring is mounted. When doing so, avoid damaging, stretching or twisting the ring.



3.5. VOSS plug connection system 230 plastic

3.5.1 Reduced impact strength

The VOSS plug connection system 230 plastic is a variation of the plug connection system 230 brass which can be installed in the same valves and other components of brake systems.

However, compared with the VOSS plugs 230 brass, they have a considerably lower impact strength over the whole temperature range from -40 °C to +100 °C. The result is a reduced safety margin against sudden loads (initial and repeat assembly, improper handling in service operations, crushing, risk of impact from stones in travel mode etc.). However, the values are above those for the brass plugs nom. sizes NG 8/4 (see adjacent illustration).

3.5.2 Long-term behaviour

Plastics have a different long-term behaviour as regards strength and dimensional stability. They are to be protected against extreme temperatures (e.g. heat radiated from engine).

3.6 Miscellaneous

During assembly, service and operation the plugs must not be damaged as the functions of the brake system could be impaired. It is necessary to inspect the operational safety after assembly and service work (pressure test). The plug connections are to be protected against damage through appropriate positioning (e.g. cover plate).

Under extreme conditions the defined application limits of the materials are to be observed (see section 3.1).

Piping under torsional stress may start to leak after prolonged action ($\geq 1/2$ hour) and at temperatures $\geq 100^\circ\text{C}$ in the area around the fir-tree.

If the functionality of the brake system is impaired as a result, appropriate safety action is to be taken.

4. VOSS after-sales service

The VOSS after-sales service is at your disposal for all questions relating to plug connections, nylon tubes, installation etc. at any time to offer you advice.

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