Technical description
of
the Flexible Jacketed Tube

Generally licensed by the supervisory building authority
Licence no.: Z-40.23-515

1. *Functional description:*

The double wall type tube **DWSL "System Klenk"** is a flexible jacketed tube **- patented -** that consists of two media resistant commercial type tubes that are slided into each another and that are connected by means of especially developed couplings and fittings. The thus created clearance between the two tubes serves for leakage control by means of a design approved underpressure leakage indicator.

A rise of pressure within the limits of the controlled space caused by damages to the inside or to the exterior tube will release an alarm.

2. *Scope of application*

The DWSL has been designed and developed especially for safe transport of flammable and inflammable water endangering liquids. It finds application wherever a flexible tube is needed and high demands on transport safety of dangerous media cannot be dispensed with.

3. *Application examples*

- Ship and boat refuelling
- Dredging boats
- Tanking up and refuelling of all kinds of media in ground water preservation areas and on airports
- Chemical plants and special installations
- Filling places of all kinds

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4. Specification

- *Tubes:*

Standard tubes:	Version and material depending on the medium transported.
Producer:	e.g. Contischlauch via Elaflex-Gummi Ehlers GmbH, Hamburg
All purpose tubes:	with and without steel spiral coil
Tank tubes + tubes for use in chemical installations:	with and without steel spiral coil
	See also chapter 5 for specification of tubes

- *Joining pieces:*

Turned parts
Their version type depends on the pairing sizes used

- The materials used depend on the medium transported: ranging from brass till titanium.
- O-rings for safe sealing.
- Identification engraved with 9-place identification number and part tracking up to the technical installation.

- *Intermediate layer:*

The inside tube is lined with a special net that serves as "spacer" to the exterior tube which at the same time enables free passage through the controlled space.

The special net used as lining is made of polyester elastomer.

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5. Dimensions, volume

Tube pairings:		Remarks:
Pairing 1:		
Inside tube: 1/2“ ID 13mm/OD 22mm Monitored space **approx. 424 cm³**	Exterior tube: 1 1/4“ ID 32mm/OD 44mm per m tube length	(only for inside tubes without inside lining !)
Pairing 2:		
Inside tube: 3/4“ ID 19mm/OD 31mm Monitored space **approx. 380 cm³**	Exterior tube: 1 1/2“ ID 38mm/OD 41mm per m tube length	Same version as with pairings 1 and 5 (only for inside tubes without inner lining !)
Pairing 3:		
Inside tube: 3/4“ ID 19mm/OD 31mm Monitored space **approx. 380 cm³**	Exterior tube: 1 1/2“ ID 38mm/OD 41mm per m tube length	Same version as with pairings 4 and 6
Pairing 4:		
Inside tube: 1 1/2“ ID 38mm/OD 51mm Monitored space **approx. 1.080 cm³**	Exterior tube: 2 1/2“ ID 63mm/OD 78mm per m tube length	Same version as with pairings 3 and 6
Pairing 5:		
Inside tube: 1 1/2“ ID 38mm/OD 51mm Monitored space **approx. 1.080 cm³**	Exterior tube: 2 1/2“ ID 63mm/OD 78mm per m tube length	Same version as with pairings 1, 2 and 6 (only for inside tubes without inner lining !)
Pairing 6:		
Inside tube: 2 1/2“ ID 63mm/OD 78mm Monitored space **approx. 3.075 cm³**	Exterior tube: 4“ ID 100mm/OD116mm per m tube length	Same version as with pairings 3 and 4
Pairing 7 + 8:		
Inside tube: 2“ ID 50mm/OD 66mm Monitored space **approx. 890 cm³**	Exterior tube: 3“ ID 75mm/OD91mm per m tube length	

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<u>Pairing 9 + 10:</u>

Inside tube:	Exterior tube:
3“	4“
ID 75mm/OD 91mm	ID 100mm/OD116mm
Monitored space **approx. 1.075 cm³**	per m tube length

ID = inside diameter
OD = upper outside diameter

6. Endangering potential – endangering classes

Tube lengths up to 50 m have been planned, depending on the diameter required for the particular task

Volume flow:
Depending on the medium conveyed: **3 m³/h** (50 l/min) up to **60 m³/h** (1000 l/min)
at mean rate of flow of **5 m/s**.

- *Water endangering, inflammable liquids respectively*

  - Products made of mineral oil
  - Chemical agents

- *Applicable danger classes:*

  - **AI, AII, AIII, B**
  - **Water endangering classes 0-3**
  - **Danger stages: up to stage "D"**

7. Resistance and tightness of the system

The maximum operation pressure of the tubes is 10 bar, the burst pressure higher than 50 bar. The temperature, depending on the medium transported, ranges between –30° to 100°C,
see also chapter 5 for tube specification.

The tightness of the space control has been tested.
A decrease of the vacuum that did not exceed 1 mb/h was measured and depends on the size of the monitored space, too.

8. Safety installations

The leakage control is effected via approved underpressure or overpressure indicator with integrated pump.
The closing sequence based on the pumping capacity of the pump of approx. 100 l/h at the switchpoints and based on the decrease of pressure measured, is less than 1 time during a 24 hour period.

In case a further decay of vacuum in the controlled space is detected, a visual or an acoustic alarm or another protective function is released.

- *Exterior tube used as collecting basin*

If the inside tube is damaged and the medium transported in it escapes, the exterior tube, which at least meets with the same requirements as the inside tube, serves as collecting basin. (space control).

The materials, such as couplings, connecting pieces and fittings, used in the monitored space are made of media resistant materials, which in turn allows for sufficient time in order to react in case they get in touch with the medium that leaks out.

- *Measures to be taken in case of damages*

The tanking up or refuelling procedure must be stopped immediately in case of an alarm.
The defective flexible tube must immediately be taken off service.
Make sure the tube will no longer be used till it was checked and the reason for the alert cleared and eliminated.
Should, in spite of that, the material conveyed escape into the environment, the measures prescribed to be taken against this particular dangerous substance must immediately be implemented and, pursuant to the relevant legal rules, the competent authorities be informed.

9. Installation, operation

The flexible jacketed tube **DWSL "System Klenk"** must only be installed, commissioned and operated by companies licensed as specialist enterprises pursuant to WHG § 19 l (Law on Water Resources Management), the personnel of which has received special trainings.

In addition, depending on the particular application case, the relevant acceptance prescriptions must be observed.
The installation, operation and servicing instructions established by the company Klenk including those established by producers of individual components integrated in the system must be thoroughly be obeyed and complied with.

The bending radii must not fall short of the radii indicated.
Always the exterior tube is decisive in this regard! (See also chapter 5 for specification of tubes).

10. Design test:

See report established by TÜV Nord Hamburg
(Technical Control Association)

11. Licensed by DIBt, the Berlin based Supervisory Building Authority

The flexible jacketed tube has been licensed on 8th June 1999 and granted the licence no.

Z-65.25-220

by the German Institute for Construction Technique.

A new license was given in July 2016:

NEW Z–40.23-515

12. Directives and standards

Basic standards: TRB 801 part 45
TRbF 131 part2
DIN 6601
DIN EN 12266-part1 and 2
DIN EN 3771 part 1-5
DIN EN 12115
DIN EN 14420 part 1-3

Use bases: WHG
VAwS
TRbF
TRwS

Established: Bodnegg, 2016-07-05

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