Technical Report

No. KO258.0E

on the „Trailer Emergency Module“ (TEM)

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0. General

This Technical Report serves as a working document for the officially authorised expert or examiner of the accredited testing laboratory in the assessment of trailers according to §§ 19, 20 and 21 StVZO or Directive 71/320/EEC and ECE Regulation No. 13.

For the sake of simplicity the abbreviation **TEM** is used in this report for the device „Trailer Emergency Module“.

1. Identification

1.1	Manufacturer:	**Haldex Brake Products GmbH** **Mittelgewannweg 27** **D-69123 Heidelberg-Wieblingen**
1.2	Applicant:	**see paragraph 1.1**
1.3	System component:	**Trailer brake valve with emergency brake device, combined control valves (shunt and parking brake valve with “safe parking” function)**
1.4	Type of device:	**Trailer Emergency Module**

1.4.1 Versions:			with shunt valve [part number]	without shunt valve [part number]
	A:	**With pressure protection valve without backflow** (see also paragraph 3.5.3)	**A S** [352 075 **00x**]	**A 0** [352 075 **03x**]
	B	**With pressure protection valve with limited backflow** (see also paragraph 3.5.3)	**B S** [352 075 **02x**]	**B 0** [352 075 **04x**]
	C	**Without pressure protection valve** (see also paragraph 3.5.3)	**C S** [352 075 **01x**]	**C 0** [352 075 **05x**]

Note: The letter "**x**" within the not fully specified Haldex part numbers above indicate that modifications to the TEM (e.g. threaded connections, characteristics etc.) are possible, but such modifications do not affect the function and performance in relation to the assessment conducted.

2 Area of use

2.1 Vehicles: Trailers of categories O according to the Framework Directives 2007/46/EC and according to Annex 7 of the "Consolidated Resolution on the Construction of Vehicles (R.E.3)"

2.2 Braking systems: Power-operated braking systems with pneumatic transmission; designed according to the specifications of StVZO or Directive 71/320/EEC or ECE-Regulation No. 13

2.2.1 Notice: The TEM is intended for installation in twin-line braking systems with purely pneumatic (see paragraph 5.1.3.1.1 of ECE-13) or pneumatic/electric control (see paragraph 5.1.3.1.2 of ECE-13) where the emergency braking function (automatic braking) acts exclusively on the spring brakes of the parking braking system.

3 Technical details

3.1 General:

TEM is a trailer brake valve with an emergency brake function (automatic braking), combined control valves (shunt and parking brake valve) and an optional pressure protection valve (see paragraph 1.4.1).

The shunt valve allows the disconnection of the "emergency braking" function, see paragraph 3.5.5 below.

Actuation of the parking brake valve releases or applies the parking braking system.

3.1.1 "Safe parking":

The "safe parking" function is an additional safety feature to ensure that no unintended release of the parking brake (spring brakes) occurs.

In case of pressure loss in the supply line, the parking brake control immediately changes from "not activated" to "activated" position (unless it is already in the activated position - red control knob pulled out).

When the supply line is re-coupled, the chamber of the spring brakes can only be inflated (parking brake released) after the driver has consciously pushed the parking brake control into the "not activated" position.

It is only possible to bring manually the red control knob into the "release position" ("not activated" position) when the supply line pressure has reached a certain level (around 400 to 500 kPa).

3.2 Installation:

The TEM is intended for the installation in trailers (semi-trailers, centre-axle trailers, full trailers) with ABS or EBS and with spring actuated braking systems.

3.3 Identification:

see paragraph 1.4.1

3.4 Ports: The TEM has the following ports:

Port 1: Supply line (coupling head, red)

Ports 1-2: Service brake air reservoir

Port 2: Spring braking system

Ports 21/21*: Shorted (common) connections for auxiliary equipments (e.g. air suspension, trailing axles etc.)

Port 3: Exhaust

* In the case of versions A) and B)

3.5 Function

3.5.1 Pressure loss in the supply line / automatic braking

Brake air reservoir / auxiliary equipment:

If the supply line (red coupling head) breaks off, the integrated non-return valves (circuit 1-2) prevent the supply air from escaping out of the air reservoir(s) of the trailer braking system and – if any – of the auxiliary equipment.

Effect on the service braking system:

Lowering of the pressure in the supply line does not reduce the air reservoir pressure due to the integrated non-return valve.

Note: Braking system with TEM do not utilise the service braking system energy reserves to fulfil the requirements for the automatic brake as defined in paragraph 3.3 of Annex 4. Thus, the requirements of paragraph 2.8 of Annex 8 of ECE-R13 are not applicable.

Effect on the parking braking system / automatic braking

In the case of a pressure loss in the supply line the emergency brake function comes into operation. In addition, the “safe parking” function moves the control knob from the “not activated” to the “activated” position (red control knob pulled out, see also paragraph 3.1.1).

3.5.2 Pressure loss in the auxiliary equipment (Version A and B)

Brake air reservoir:

In the case of pressure loss in the auxiliary equipment a "securing pressure" of at least 520 kPa in the brake air reservoir of the service braking system is guaranteed by the integrated pressure protection valve (opening pressure of 620 (+10/-20) kPa) in order to meet the statutory requirements (see Directive 2002/78/EC, Annex I, paragraph 2.2.2.15 or ECE Regulation No. 13, paragraph 5.2.2.14 and paragraph 3.5.3 below in this report).

Effect on the service braking system:

A pressure loss in an auxiliary equipment does not reduce the pressure in the service braking system below the required "securing pressure" of e.g. 520 kPa (see paragraph 4.3 below).

Effect on the parking braking system:

With the spring braking system **released** (red control knob pushed) the pressure in the spring braking system is not lowered.

With the spring braking system **applied** (red control knob pulled out) the parking brake performance is maintained.

3.5.3 Pressure loss in brake air reservoir

Auxiliary equipment

Version A:

In the case of pressure loss in the brake air reservoir the auxiliary equipment is protected by a non-return valve integrated in the pressure protection valve. There is no backflow from the auxiliary equipment to the braking system. In this way the test requirement of isolating the energy storage device(s) for the auxiliary equipment according to paragraph 1.3.2.2 (Annex IV (A), Directive 71/320/EEC or Annex 7 (A) of ECE Regulation No. 13) is fulfilled.

Version B:

The auxiliary equipment is not protected by a non-return valve. However, due to a limited backflow a pressure reduction of the auxiliary air reservoir below a pressure level of about 520 kPa is avoided by a pressure protection valve.

With version B the **test** requirement of isolating the energy storage device(s) for the auxiliary equipment according to paragraph 1.3.2.2 (Annex IV (A), Directive 71/320/EEC or Annex 7 (A) of ECE Regulation No. 13) is not automatically fulfilled. Isolation of the auxiliary equipment must be ensured by other means (e.g. fitting of an additional shut off device).

Version C: **n / a** (no auxiliary equipment connected to TEM)

Effect on the service braking system: Lowering of the brake air reservoir pressure also reduces the pressure in the supply line (port 1), which triggers the automatic braking (see paragraph 3.5.1 above).

Effect on the parking braking system: see paragraph 3.5.1

3.5.4 Actuation of parking braking system:

By pulling the red control knob (**applied** position) the spring brake chamber (port 2) is connected with the air exhaust (port 3).

By pushing the red control knob the spring brake chamber is inflated with the air reservoir pressure (port 1-2). In this way the pressure in the spring braking system is increased and the parking braking system is **released**. To avoid an overload of the foundation brake an anti-compound valve has to be incorporated into the braking system.

3.5.5 Release device (shunt valve) Versions "xS":

The shunt valve allows the cancellation of the automatic braking ("emergency braking") triggered by disconnecting the supply line (see EC Directive, Annex I, paragraph 2.2.2.11 or ECE-R13, paragraph 5.2.2.11).
The automatic braking is cancelled by pushing the black control knob (with the supply line disconnected) and subsequent releasing the spring braking system (red control knob pushed).

When the supply line is reconnected and compressed air is made available the shunt valve returns automatically into normal operation position (see Directive 2002/78/EC, Annex I, paragraph 2.2.2.11 or ECE Regulation No. 13, paragraph 5.2.2.11).

Note: Irrespective whether a shunt valve is incorporated in TEM or not the functionality of cancellation of the automatic braking (see paragraph 3.5.6) is always available.

3.5.6 Release device (without shunt valve) - versions "x0":

The cancellation of the automatic braking (with the supply line disconnected) is also realised without a shunt valve incorporated in TEM when the red parking brake control knob is pushed and then continuously held down by hand. Releasing the control knob causes the "safe parking" function to move the control knob from the "not activated" back to the "activated" position (red control knob pulled out, see also paragraph 3.1.1) – "dead man function".

4 Tests

4.1 General:

The tests listed below were conducted on sample braking systems (bench tests) according to annexes 2 and 3.

4.2 Pressure loss in the supply line / automatic braking (paragraph 3.5.1)

Brake air reservoir / auxiliary equipment:

With the supply line (red coupling head) disconnected/broken off (red coupling head), the integrated non-return valves (circuit 1 2) prevented the supply air from escaping out of the brake air reservoir. The pressure level of the air reservoir for the auxiliary equipment also remained unchanged.

Effect on the service braking system:

Lowering of the pressure in the supply line did not reduce the air reservoir pressure (see above paragraph).

Effect on the parking braking system / automatic braking

- Spring brakes not applied: When the pressure in the supply line fell by at least 100 kPa per second, the automatic braking (spring brakes) began at a pressure of approx. 220 kPa and the control knob was moved from the “not activated” to the “activated” position.

- Spring brakes applied: When the pressure in the supply line fell by at least 100 kPa per second, no change occurred (spring brakes stayed applied).

4.3 Auxiliary equipment (paragraph 3.5.2) (Versions A and B)

Opening pressure: When the pressure in the brake air reservoir was increased the pressure protection valve opened at a pressure of about 625 kPa to pressurize the auxiliary air reservoir.

Closing pressure: When the pressure in the auxiliary air reservoir was decreased from a pressure level of 820 kPa the pressure protection valve closed at a pressure of about 600 kPa (securing pressure for the service braking system).

Effect on the parking braking system: A loss of pressure in the auxiliary air reservoir did not affect the parking braking system:

- With the spring braking system **released** (red control knob pushed) the pressure in the spring braking system was not lowered.
- With the spring braking system **applied** (red control knob pulled out) the parking brake performance was maintained.

4.4 Pressure loss in the brake air reservoir (paragraph 3.5.3) (with insuffient recharging from the supply line*)

*** Supply line connected; however, closed.**

Closing pressure: When the pressure in the brake air reservoir was decreases from a pressure level of 820 kPa the pressure protection valve closed at a pressure of about 625 kPa to pressurize the auxiliary air reservoir.

Auxiliary equipment (Version A): (With pressure protection valve without backflow)
When the pressure in the brake air reservoir was lowered from 820 kPa to a value of 0 kPa there was no backflow from the air reservoir of the auxiliaries.

Auxiliary equipment (Version B): (With pressure protection valve with limited backflow)
When the pressure in the brake air reservoir was lowered from 820 kPa to a value of 0 kPa there was a backflow from the air reservoir of the auxiliaries to the brake air reservoir until a pressure of 550 kPa was reached.

Effect on the service braking system:
Lowering the brake air reservoir pressure reduces the performance of the braking system according to the available air reservoir pressure

Effect on the parking braking system / automatic braking:
see paragraph 4.2

4.5 Response time behaviour:

In order to show the improved response time behaviour t [s] of braking systems with TEM in contrast to systems fitted with TrCM (or TrCM$^+$), see Annex 3, comparing time measurements had been carried out.

Brake system **A** and **B**: TrCM fitted

Brake system **C1** and **C2**: TEM fitted

In contrast to system A system B is also fitted with an additional double check valve in order to improve the response time behaviour.

The brake system C1 and C2 are different with respect to the length of the control line. The difference of length of 2 m reflects the additional 2 m control line length needed in the case when TrCM is mounted at the rear (behind the EB$^+$ modulator), see diagram D in Annex 3.

	Diagram	t [s]
TrCM	**A**	**0,42**
TrCM	**B**	**0,40**
TEM	**C1**	**0,39**
TEM	**C2**	**0,36**

4.6 Actuation of parking braking system (paragraph 3.5.4):

At a pressure of 820 kPa in the brake air reservoir the pressure in the spring braking system was exhausted by pulling the red control knob and the parking braking system was **applied**.

By pushing the red control knob the pressure in the spring braking system was increased and the parking braking system **released**.

4.7 Release device (paragraphs 3.5.5 and 3.5.6):

With the supply line disconnected the automatic braking (emergency braking) was suspended by pushing either the black control knob (shunt valve) or by pushing the red control knob (parking brake valve).
When the supply line was reconnected and compressed air was fed, the shunt valve returned automatically into normal operating position. This was also achieved by manual operation (pulling the black control knob).

Due to the dead man function (see paragraph) the "activated" position (red control knob pulled out) was restored by releasing the control knob.

5 Annexes

Diagram of Trailer Emergency Module	Annex 1
Bench test set up – TEM (function tests)	Annex 2
Bench test set up **with** TrCM^{+} and TEM (response time measurements)	Annex 3

6 Concluding certification

It is hereby confirmed that there is no technical reason to object to the installation / replacement of the trailer emergency module TEM for the intended use (pneumatic control line directly connected to the brake device (e.g. EB$^+$).

Under the condition that all performance requirements are met the TEM may be installed in place of a TrCM or TrCM$^+$.

The provisions of Directive 71/320/EEC in the version of the Directive 2002/78/EC and ECE Regulation No. 13, including Supplement 5 to the 11 series of amendments* and of Section 41 StVZO can be regarded as satisfied with respect to the statutory requirements given in this report.

* The **technical** content of this report remains valid for future of ECE-Regulation No. 13 provided that such future amendments do not change the performance requirements or procedures associated with the systems covered by this report (as it is in the case of supplements 6 and 7 to the 11 series of amendments which will enter into force on 28.10.2011).

Essen, 11th August 2011

TDB/Gaupp

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TÜV NORD Mobilität GmbH & Co. KG
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Technical Service for Braking Systems

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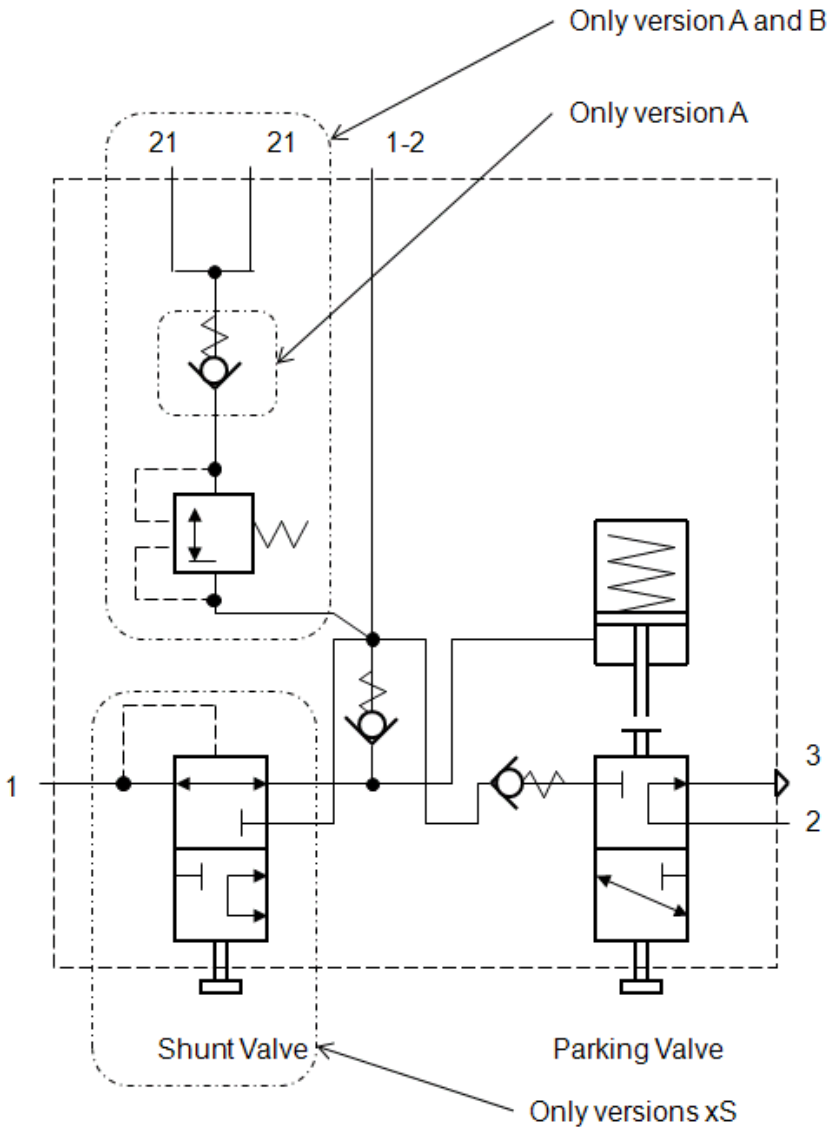
Accredited according to DIN EN ISO/IEC 17025: D-PL-11109-01-00 / Designated as Technical Service by Kraftfahrt-Bundesamt: KBA-P 00004-96

Diagram of Trailer Emergency Module

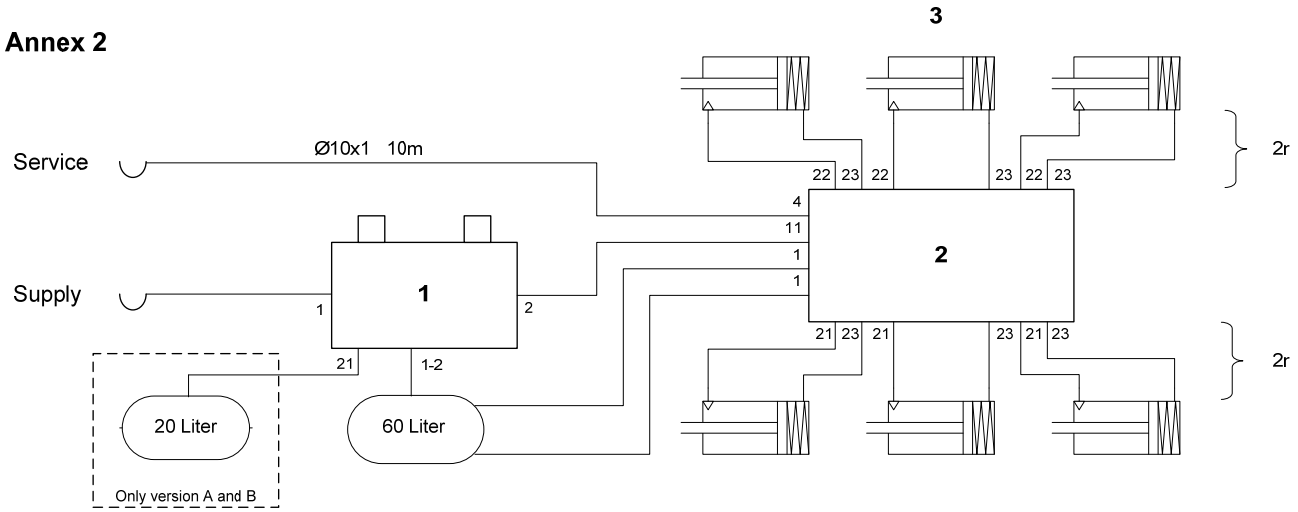


1 = Gladhand Emergency
1-2 = Service Reservoir
2 = Spring Brake
21 = Air Suspension Circuit
3 = Atmosphere

xS ⇒ AS / BS / CS (see paragraph 1.4.1)

Bench test set up – TEM

Annex 2

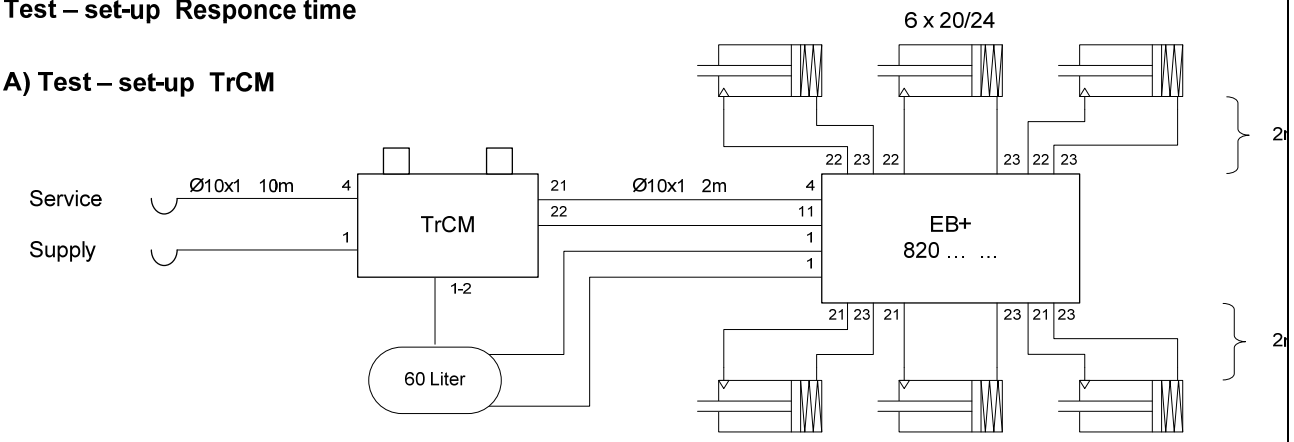


No.	Description
1	TEM 352 075 …
2	EB+ 820 … …
3	6 x Spring brake chambers 20/24

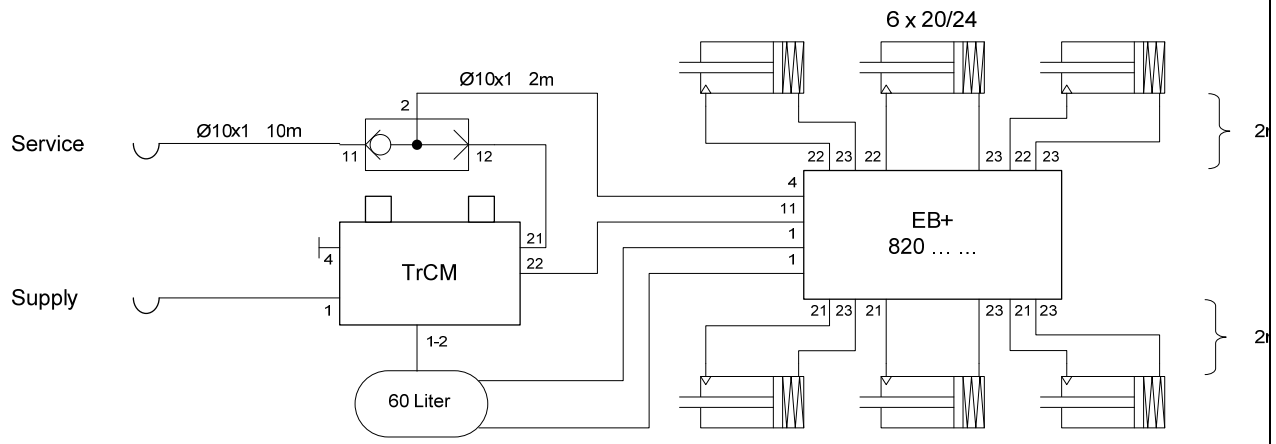
Bench test set up with TrCM+ and TEM (response time measurements)

Test – set-up Responce time

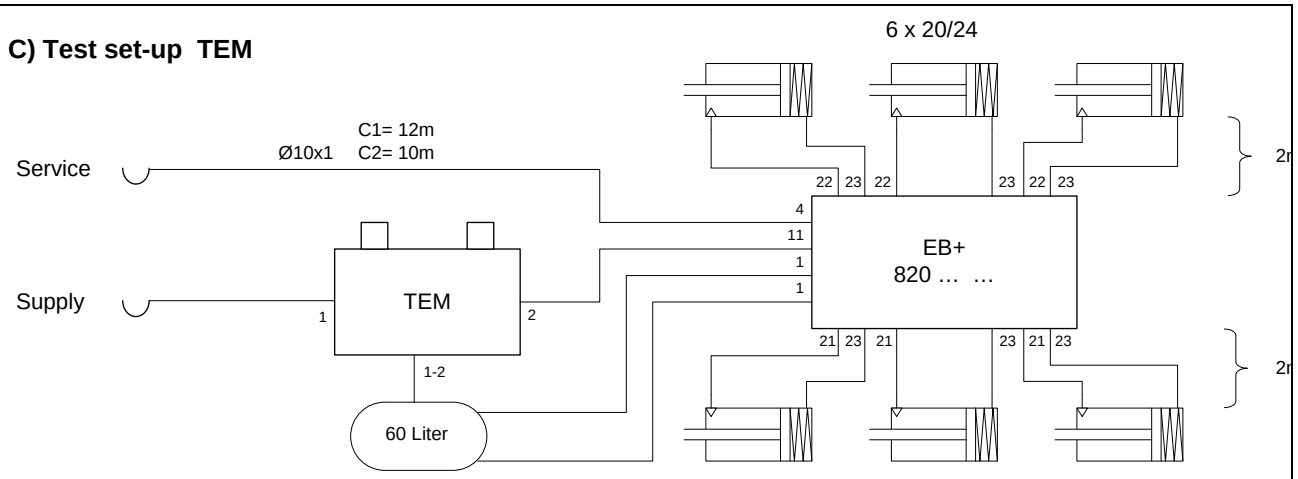
A) Test – set-up TrCM



B) Test set-up TrCM with Double Check Valve 333 001 001



C) Test set-up TEM



D)