

**OPERATING INSTRUCTION  
PISTON ACCUMULATOR**

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Translated from German original



## **General**

### **Roth pressure equipment - identification**

in accordance with the serial number on the nameplate and the according report, see

- Acceptance report, Pressure Equipment Directive 2014/68/EU  
TÜV Technische Überwachung Hessen GmbH

### **Explanation**

Roth piston accumulator = Roth pressure equipment

### **Translation**

If sold to a country in the EEA, this operating instruction must be translated into the language of the country in which the machine is to be used.

Should the translated text contain incongruities, the original operating manual (German) must be consulted or the manufacturer contacted for clarification.

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## 1 Designated application

### 1.1 Overview of standard Roth pressure equipment

The pressure equipment essentially consists of the following components:

1. Cylinder tube
2. Piston inclusive seals
3. End cap
4. Threaded ring (not for screw-in end cap)
5. End cap seal, oil side
6. End cap seal, gas side
7. N2 non-return valve (optional)
8. Screw plug (optional)

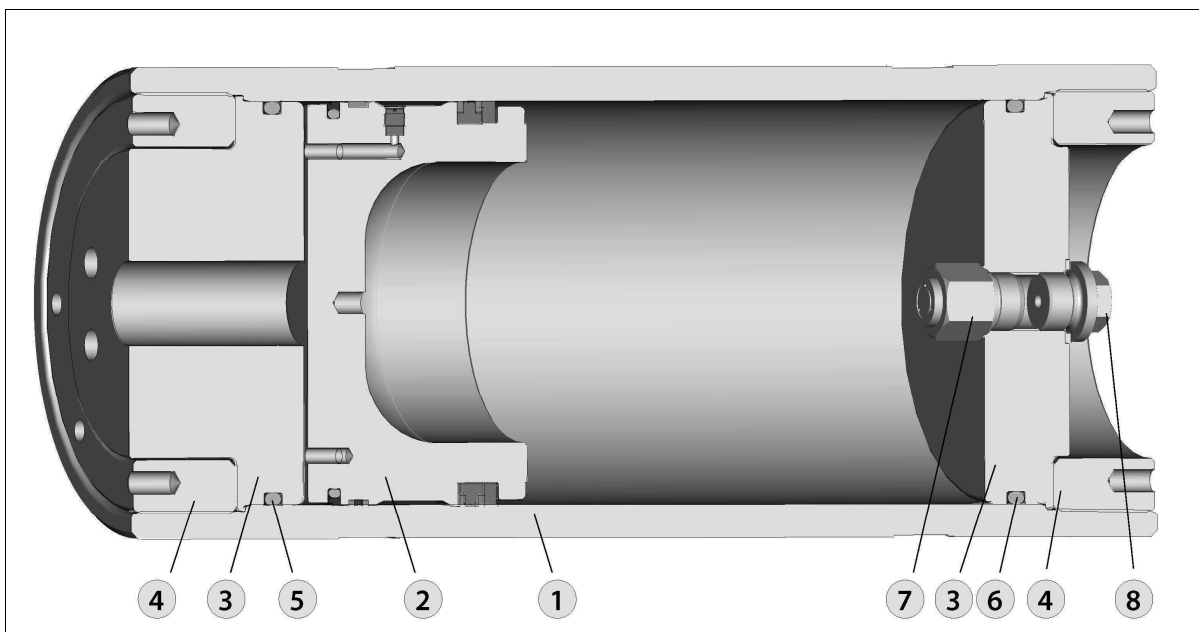


Figure 1-1 Overview of standard Roth pressure equipment

## 1.2 Notes on designated application

The Roth piston accumulator (Roth pressure equipment) was manufactured exclusively for use as an industrial and commercial component designed for acceptance and delivery of pressurised hydraulic fluids in hydraulic systems.

Any use of the pressure equipment other than or beyond as described above or any conversion by the operator or others shall be regarded as contrary to designated use, unless by prior written agreement of the manufacturer.

The manufacturer shall accept no liability for damages arising from this.

The pressure equipment may only be used with non-corrosive fluids in group 2 (Art. 13, PED 2014/68/EU) on the fluid side and with nitrogen (N<sub>2</sub>) on the gas side. Wear allowance (e.g. corrosion) is not considered. Exceptions may result from the declaration of conformity or from individual manufacturer's specifications of the pressure equipment.

Pursuant to ISO 4406 the degree of purity of the operating fluid shall be at least 19/17/14 (NAS 1638 Class 8) for vertical installation and at least 17/15/12 (NAS 1638 Class 6) for horizontal installation, or better.

Depending on the mode of operation, stricter requirements might be necessary. Nitrogen (N<sub>2</sub>) Class 4.0 (99.99%) or better shall be used.

If permissible load cycling are specified for specific pressure ranges in the acceptance documentation, the operator is responsible for compliance. If the pressure equipment is operated with different operating parameters, it is possible that the test intervals for periodic tests will become shorter. Please consult the manufacturer in such cases.



*Intended use also includes compliance with the manufacturer's operating, maintenance and servicing instructions.*

Furthermore, the operator is obliged to adhere to the legal state regulations according pressure equipments in connection with the adherence of the mandatory tests prior to commissioning and recurrent tests and must arrange these in compliance with the mandatory periods (see part 3.5).



*The commissioning is prohibited until the entire system into which the pressure equipment will be installed has been certified compliant with EU directives.*

*The fluids required for operation of the pressure equipment is procured and used by the operator. Proper treatment of these fluids and the associated dangers are the sole responsibility of the operator.*

*Furthermore, the selections of a fluid are into consideration low-risk operation based on experience gained by the operator in the course of repeated use thereof in pressure equipment.*

*We recommend you also concluding guarantee agreements with suppliers of the fluids.*

*Please request written approval from the "manufacturer" in cases of special uses or if you have queries.*

*It is not permissible to interrupt / stop operation of the system in a way to allow the piston (see Fig. 1-1, Pos. 2) to hit the end cap of oil side (see Fig. 1-1, Pos. 3) at high speed (e.g. fast oil pressure release without end position damping)! This excludes emergency stop systems.*

An internal test must be performed by an authorised inspection body (see AD 2000 leaflet p2, 12.3) on all pressure equipment with a specified number of permissible load cycles (load cycling number "N" for the defined pressure range  $p_{min} - p_{max}$ ) no later than when 50% of the permissible number of cycles have been completed. The specialist may then define the extended number of load cycles. The term for permissible load cycles > 2 000 000 is fatigue strength. Pressure equipment may be operated without restriction in this pressure range.

## 2 Function

### 2.1 General functional description

Roth pressure equipments are cylindrical pressure vessels with a separating element between gas and fluid volumes (see Fig. 1-1).

They are used in hydraulic systems among others for energy accumulator. If the fluid pressure rises above the gas filling pressure, hydraulic energy is stored in fluid form. This may be utilised for work steps when the fluid pressure falls below the pressure of the compressed gas.

### 2.2 Filling and testing the pressure equipment



*During or after filling with N<sub>2</sub>, use foaming agents to test all screwed connections, shut-off valves, connections and joints for gas-tight sealing.*



*In principle, use Roth filling and testing device and observe the relevant operating instruction.*

The pre-filling pressure ( $P_0$ ) depends on the ambient temperature (isochore behavior of N<sub>2</sub>, see Chapter 2.2.1) and should be 5 bar below the minimum operating pressure at maximum ambient temperature (unless otherwise specified).



**Never** use oxygen or other flammable gases to fill the pressure vessel.

### 2.2.1 Isochore behavior of N<sub>2</sub>

#### Determining or controlling the pre-filling pressure ( $P_0$ ) at different ambient temperatures

##### General

Unless otherwise specified, the given  $P_0$  refers to room temperatures of + 20°C. Should the actual ambient temperature be different at the time of filling or checking  $P_0$ , the diagram may be used to find the pressure corresponding to that temperature when filling or checking.

##### Example

Assume a gas system at 155 bar of pressure at a gas temperature of + 20°C. If the gas temperature rises to + 35°C, the intersection (155 bar at + 20°C) will shift to the next pressure-temperature curve to intersect the vertical + 35°C temperature line. The fill or corrected pressure  $P_0$  will need to be 166 bar in this example.

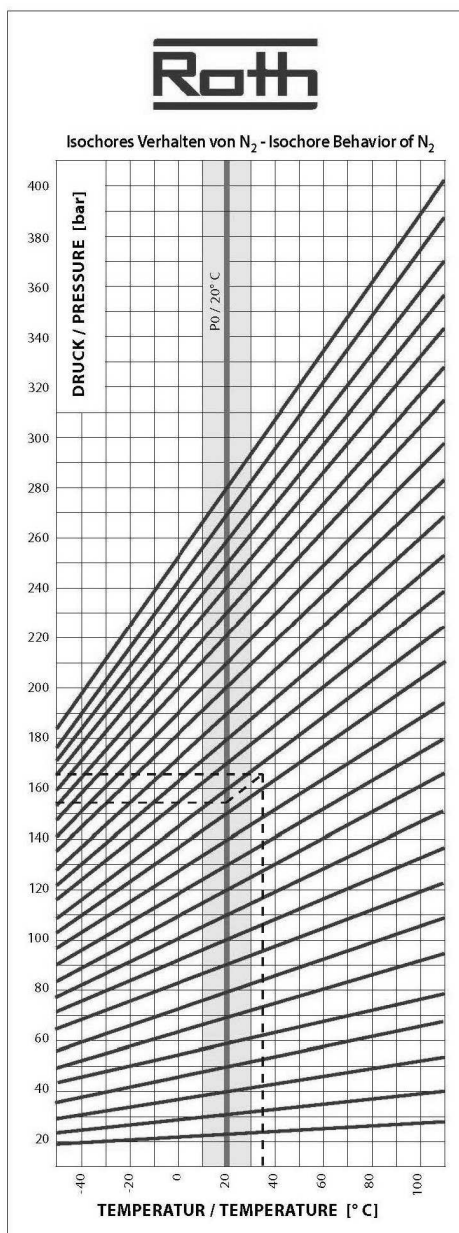


Figure 2-1 Isochore behavior of N<sub>2</sub>

### 3 Safety

#### 3.1 Notes / Explanations



**Operating instruction, mandatory:**

marked with a "book"



**Warnings:**

marked with a warning triangle "danger".



**Explosion:**

marked with a warning triangle "explosion".



**Notes:**

marked with a "hand".

Achtung Druckbehälter / Anlage	Attention Pressure vessel / Plant	注意 压力容器 / 设备
- Vor Demontage Druck ablassen! - Füllen nur mit Stickstoff! - Betriebsanleitung beachten!	- Discharge pressure prior to disassembly! - Only fill with nitrogen! - Take note of operating instruction!	- 拆卸前先切断电压! - 只能充氮气! - 请注意操作手册!
GASFÜLLDRUCK BEI 293 K:	GAS LOADED PRESSURE AT 293 K:	气侧预充压力 293 K:
N2 ..... bar He ..... %		
CZ Před demontáží vypusťte vzduch! Plnit pouze dusíkem! Respektujte návod k používání!	ES Descargar la presión antes del desmontaje! Llenar sólo con nitrógeno! Siga las instrucciones de uso!	FR Déchargement avant le démontage! Seulement remplissage d'azote! Attention le manuel d'utilisation!
IT Prima del smontaggio togliere la pressione! Riempi solo con azoto! Osservare le istruzioni per l'uso!	NL Voor demontage de druk eraf halen! Alleen met Stikstof vullen! Gebruiksaanwijzing in acht nemen!	PL Przed demontażem wypuścić gaz! Napełniać tylko azotem! Przestrzegać instrukcję eksploatacji!
PT Proceder à descarga da pressão antes de iniciar a desmontagem! Encher apenas com nitrogénio! Observe a instrução de operação!	RU Перед демонтажем сбросить давление! Заполнить только азотом, максимум! Руководствоваться инструкцией!	TR Sökmeden önce basıncı tahliye edin! Sadece azotla doldurun! Kullanma kılavuzunu dikkate alın!

Achtung Druckbehälter / Anlage	Attention Pressure vessel / Plant	注意 压力容器 / 设备
- Vor Demontage Druck ablassen! - Füllen nur mit Stickstoff! - Betriebsanleitung beachten!	- Discharge pressure prior to disassembly! - Only fill with nitrogen! - Take note of operating instruction!	- 拆卸前先切断电压! - 只能充氮气! - 请注意操作手册!
GASFÜLLDRUCK BEI 293 K:	GAS LOADED PRESSURE AT 293 K:	气侧预充压力 293 K:
N2 ..... bar He ..... %		

The vessel filled with N2 already, as given on the pressure equipment nameplate.

#### 3.2 Identification / Nameplate

The pressure equipment has a nameplate and acceptance certificate attached. These show essential technical data.

**Please provide the following with all your enquiries:**

- Indication of the type
- Serial number
- Date of manufacture

#### 3.3 Safety systems



*The safety systems may be included in the delivery (see delivery papers) or constitute part of the customer installation.*

*They will always be required and should be tested for effectiveness prior to commissioning.*

#### 3.4 Safety precautions

The operator shall instruct the operating and maintenance staff on the proper operation of the pressure equipment and monitor compliance with the safety precautions.



The responsible specialist superiors must instruct the operating, servicing and maintenance staff before starting in their jobs or prior to commissioning of the pressure equipment and thereafter at appropriate intervals of at least once per year. All services, maintenance and instruction courses must be recorded in a control book.

**Qualified technician** (definition based on EN 60204-1)

- A person who, based on specific training, knowledge and experience and knowledge of pertinent standards, will be in a position to assess assigned work and recognise potential hazards.

### 3.5 Responsibilities of the operator



*The national implementations of framework Directive 89/391/EEC as amended and the associated individual directives, including specifically Directive 2009/104/EC as amended, on the minimum requirements for safety and health of employees working with work materials must be observed and complied within the EEA (European Economic Area).*

*The BetrSichV [Operational Safety Ordinance] transposes Directives 89/391/EEC, 2009/104/EC and other Directives on occupational safety at systems requiring supervision into German law. The BetrSichV, and especially Section 3, deals with the “Special requirements for systems requiring supervision” governing this pressure equipment. The operator is urged to familiarise itself with this section, since basic requirements are described here which the operator will be obligated to comply with!*

*The TRBS [Technical rules for operational safety], especially TRBS 3146, TRBS 2141 Parts 1-3, TRBS 1111, TRBS 1122 and TRBS 1201 Part 2 are other important guidelines that apply here. We recommend testing the surfaces for cracks near the thread and its transition in the course of internal routine testing in accordance with §16 and Annex 2, Section 4, Nos. 6.10 and 6.17. This is carried out ideally be performed by the manufacturer or by a “qualified person” designated by the manufacturer. Please refer to Chapter 6.2 for more detail.*

*Also ensure that the pressure equipment is not operated outside of the permissible range of operating pressures (see nameplate operating data). It is not permissible to operate the pressure equipment at pressures exceeding this.*

Also ensure that local regulation on

- the safety of staff (accident regulations)
- the safety of working material (protective equipment and maintenance)
- product disposal (waste disposal laws)
- material disposal (waste disposal laws)
- cleaning (cleaning agents and disposal)
- and environmental protection

will be complied with.

Local regulations must be observed during installation and commissioning carried out by the operator itself (e.g. acceptance testing etc.).

## 4 Dangers

### 4.1 General hazard notes

Operations must remain within the maximum and minimum limits specified on the nameplate and in the technical documentation.

The pressure equipment must be installed ensuring that operating staff will not be endangered by escaping operating materials should parts of the safety system trigger.

#### **Structural modifications**

Structural modifications to the pressure equipment are prohibited. Mechanical reworking or welding is prohibited.

### 4.2 Installation of spare and wearing parts

The manufacturer's guarantees will lapse should parts that have not been tested or approved by the manufacturer be installed.



*Pressure-retaining components must only be replaced by or with the approval of the manufacturer.*

*Renewed acceptance testing by a notified body will be required! The N2 concentration in the environment may increase when N2 is filled or drained. Adequate ventilation must be ensured.*

### 4.3 Cleaning, maintenance and repair work

Cleaning, maintenance or repair work may only be carried out by qualified technicians.

These activities require that systems pressure must be relieved on the oil side, including securing against accidental switch-on.

The gas side pressure must also be relieved before performing work on gas side components.

## 5 Installation

### 5.1 Scope of delivery

The supplied pressure equipment / components include(s) technical documentation with operating instructions, drawings and the declaration of conformity (acceptance report by the notified body in case of individual acceptance tests).

#### **Delivery**

##### **Incoming inspection:**

- Check completeness as per the delivery note!

##### **In case of damages:**

- Check the delivery for damages (visual inspection)!

##### **In case of complaints:**

If the shipment damaged during transportation:

- Contact the most recent forwarder immediately!
- Keep the packaging (for possible inspection by the forwarder or for return shipment).

## 5.2 Transport and packaging

Ensure that the pressure equipment will not be damaged on the outside. Always ensure that the pressure equipment, should it need to be returned to the manufacturer, will not be pressurized.

Use suitable transport equipment for onward transportation or installation. Do not load the threaded bores on the face of the pressure equipment with more than the total weight given in the table. Using lashing straps for additional securing would be sensible. Consult the drawing for the weight of the pressure equipment or its components. Take note of the centre of gravity.

The permissible total weight of the pressure equipment for attachment of the slings to the threaded ring (see Fig. 1-1, Pos. 4) depends on the accumulator type series:

Type series (diameter)	Fastening bores	Permissible total weight of the pressure equipment (see drawing)
100	2 x M 8	500 kg
180	2 x M 12	1500 kg
250	2 x M 12	1500 kg
360	2 x M 16	2000 kg

## 5.3 Storage

### Intermediate storage (packaged)

The pressure equipment and the spare and replacement parts are delivered to allow for storage up to 3 months.

### Storage conditions

Closed and dry room according to the designated operating conditions.

### Storage / packaging for further transport

The pressure equipment and any accessories must be stored to ensure that they will be protected from external factors and to exclude damage.

The manufacturer will protect all the components of the pressure equipment from corrosion, allowing for a time up to 3 months in storage.

### Optimal short-time storage conditions:

- Dry rooms
- Protected from mechanical stress

The operator of the pressure equipment may need to implement protective measures in cases of longer times in storage or unfavourable storage conditions. Please consult the manufacturer for relevant advice.

The connecting apertures of the pressure equipment must be closed in transportation or storage, to prevent the intrusion of dirt or moisture and to prevent condensation.

The operator of the system must be on receipt of the pressure equipment assume responsibility for storage in accordance with these instructions. Lengthy periods in transport or storage whilst packaged should be avoided.

### Packaging for further transportation (change of location)

The pressure equipment and its components should be packaged to exclude mechanical damage in the event of further transportation.



*The components may need to be decontaminated before packaging for further transportation. Consult the datasheets for the fluids coming into contact with the components. Observe the notes on transportation and in the drawings.*

## 5.4 Assembly / Commissioning

### Setup / Installation

The assembly of the pressure equipment is to be carried out by qualified staff and must be specially trained for this kind of work.

A vertical arrangement with the oil side at the bottom is recommended. Different arrangements are likely to increase wear.

Use fastening hardware that is designed to handle the static and dynamic forces.

Welding or soldering on the pressure equipment or mechanical modification is **prohibited**.

**No** additional forces or moments are allowed to impact on the pressure equipment. The pressure equipment must **not** be exposed to flames or electrical / magnetic fields that may heat the equipment. Ensure that the cylinder tube (see Fig. 1-1, Pos. 1) of the pressure equipment will not be deformed or otherwise damaged when mounting the consoles / clamp.



**Extensive damage may cause the pressure equipment to explode.**

**Do not install and operate the pressure equipment in rooms that are unprotected against lightning and earthquakes.**

*Depending on operation, surface temperatures capable of causing burns may occur at the limits of operating conditions. The operator should provide suitable protection.*

*Consult Chapter 6 for service notes and test schedules.*

Use the **fastening hardware** provided by the manufacturer to ensure that all parts will be securely fastened.

#### Before assembly:

- Check the delivery for transport damage to ensure that it is technically intact.
- Instruct the qualified staff.

#### Prior to commissioning, the operator should:

- Check the technical documentation for completeness as per Chapter 5.1.
- Completion of the infeed and outfeed systems and the **parts of the system** into which the pressure equipment will be incorporated that have a **safety functionality**.
- Ensuring the functionality of installed instrumentation.



*The operator should have the entire system acceptance tested (see Chapter 3.5) before commissioning the pressure equipment.*

*Observe Chapters 2 and 4 when filling or draining.*

### Uninstalling the pressure equipment

Measure and ensure that the oil and gas sides are depressurised before uninstalling.

## **6 Maintenance**

### **6.1 General maintenance notes**

The pressure equipment will be largely maintenance-free after filling.

To ensure perfect operation and long life of the pressure equipment, carry out the following services to the schedule specified by the operator.

A **monthly** inspection is recommended. The intervals may be adjusted depending on experience gained.

- Check the accumulator anchoring.
- Check the connections of the lines.
- Inspect and assess the condition of the instrumentation, safety systems and seals.
- Check all screwed connections, shut-off valves, connections and joints for gas leakage using foaming agents.
- Check the N<sub>2</sub> pre-filling pressure ( $P_0$ ) to prevent the piston (see Fig. 1-1, Pos. 2) from colliding with the gas-side end cap (see Fig. 1-1, Pos. 3).

### **6.2 Initial operating, repeated inspection and periods of repeated inspection**

#### **Initial operating**

In Germany, the pressure equipment is subject to the Operational Safety Ordinance. §15 will apply to commissioning.

#### **Repeated inspection**

§16 of the Occupational Safety Ordinance sets the schedule for routine testing (pay attention to the according national directives of the set-up country, see Chapter 3.5).

#### **Periods of repeated inspection**

Roth Hydraulics GmbH recommends the following periods:

- External tests every 2 years
- Internal tests every 5 years
- Pressure tests depending on the number of load cycles, but after 10 years at least.

The customer must agree on the intervals of repeated inspection with the local authorities.

#### **Initiation and execution**

The operator must be responsible for compliance with and execution of period of repeated inspection (see Operational Safety Ordinance, Section 3).

## 7 Disturbance, causes, troubleshooting (qualified staff only)

Disturbance	Cause	Troubleshooting
Pressure equipment system will not supply hydraulic fluid	<ul style="list-style-type: none"><li>• Shut-off valve closed</li><li>• Pressure relief open</li><li>• Gas-side pressure too low</li></ul>	<ul style="list-style-type: none"><li>• Open shut-off valve</li><li>• Close pressure relief valve</li><li>• Check the charging pressure</li></ul>
Hydraulic pressure too low	<ul style="list-style-type: none"><li>• Shut-off valve closed</li><li>• Pump does not deliver</li></ul>	<ul style="list-style-type: none"><li>• Open shut-off valve</li><li>• Check the pump functionality and repair, if necessary</li></ul>
N2 safety valve triggers	<ul style="list-style-type: none"><li>• Gas-side pressure too high</li><li>• Operation has markedly increased the gas temperature</li><li>• Fluid overflow</li></ul>	<ul style="list-style-type: none"><li>• Check charging pressure and plant settings</li><li>• Find reason for temperature rise</li><li>• Depressurise pressure equipment</li></ul>

## 8 Emergencies

This pressure equipment is a passive system, without own drives. The stored energy will be charged or discharged by the connected active system of the operator.

Emergency measures such as the operation of Emergency-Off systems or fast pressure relief action should therefore preferably be defined and documented in the work instructions of the operator.

## 9 Disassembling / disposal

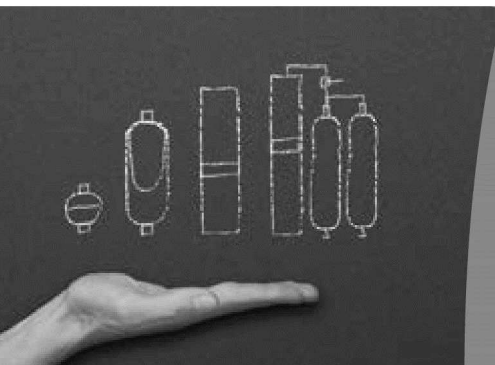
Ensure that the pressure equipment is depressurised on the gas and oil sides before disposal.

Sort the pressure equipment by materials to be disposed in accordance with applicable local environmental regulations.

Decontaminate and dispose of any contaminated parts according to local environmental regulations.

## Notes

[illegible]



## Roth Hydraulics

### Accumulators

- > Diaphragm accumulators
- > Bladder accumulators
- > Piston accumulators

### Accumulator systems

- > Accumulator units
- > Monitoring systems
- > System accessories
- > Pressure vessels

### Special solutions

- > Spring accumulators
- > Damper systems
- > Rail hydraulics
- > Special accumulators

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