Thank you for choosing a NIVELCO instrument!

NIVOSWITCH

R-400, R-400 Ex
VIBRATING FORK LEVEL SWITCH

USER'S MANUAL

1. APPLICATION

The NIVOSWITCH R–400 vibrating fork level switches are used for level or flow switching tasks of normal and explosive liquids. Overfill and dry run protection, as well as pump control, are also possible with the NIVOSWITCH vibrating fork level switches in low/high fail-safe operating mode.

2. TECHNICAL DATA

2.1 GENERAL DATA

R□□–4□□–□ R□□–4□□–□Ex		
Medium pressure		40 bar (580 psi), PP flange: 6 bar (87 psi) see "Temperature diagrams"
Insertion length		69…3000 mm (0.225…10 ft)
Material of wetted parts		DIN 1.4571, ECTFE / PFA coating
Process temperature		−40…+130 °C (−40…+266 °F) see section 5.1 and 2.6 diagrams
Ambient temperature		−40…+70 °C (−40…+158 °F) see table in 5.1 and diagrams R□□–4□□–L Ex; R□□–4□□–M / –4□□–K −25…+70 °C (−13…+158 °F)
Medium-density		≥ 0.7 kg/dm³
Medium viscosity		≤ 10000 mm²/s (cSt)
Response time	When immersed	0.5 sec
	When free	When free: ≤ 1 s see response time diagram
Output mode indication		Bi-color (LED)
Operation test		Output can be toggled by test magnet

(1) *Available max. cable length 30 m (100 ft)*

2.2 2-WIRE DC, NORMAL AND EX APPROVED VERSION

Type	R□□–4□□–6 R□□–4□□–8Ex	R□□–4□□–K R□□–4□□–LEx	R□□–4□□–7 R□□–4□□–9Ex
Electrical connection	Connector		3 m (10 ft) (1) cable (2 x 0.5 mm² [AWG20])
Ingress Protection	IP65	IP67	IP68
Output	DC current change: When free: 9 ±1 mA; When immersed: 14 ±1 mA		
Consumption	< 0.5 W		
Power supply (U_S)	15…29 V DC Provided by the PKK–312–8Ex remote switching unit for the Ex-version		
Setting operation mode	By switch on the remote switching unit (Low fail-safe – "L", High fail-safe – "H")		
Electrical protection	Class III.		
Ex marking (RC□–4□□–□Ex, RG□–4□□–□Ex)	⟨Ex⟩ II 1G Ex ia IIC T6…T4 Ga		
Ex marking (RB□–4□□–□Ex)	⟨Ex⟩ II 1G Ex ia IIB T6…T4 Ga		
Intrinsic safety data	U_i = 29 V; I_i = 100 mA; P_i = 1,4 W; C_i = 7 nF; L_i = 0 mH		U_i = 29 V; I_i = 100 mA; P_i = 1,4 W; C_i = 15 nF; L_i = 0 mH
	For temperature classes, see section 5.1		
Reference document number	rcm4004m060bh_11		

2.3 2-WIRE AC AND 3-WIRE DC VERSIONS

TYPE		2-WIRE AC		3-WIRE DC		
		R□□–4□□–1	R□□–4□□–2	R□□–4□□–3	R□□–4□□–M	R□□–4□□–4
Electrical connection (wire cross section)		Connector	3 m (10 ft) integral cable, 4 x 0.75 mm² (AWG18) (max cable length 30 m [100 ft])	Connector		3 m (10 ft) integral cable, 5 x 0.5 mm² (AWG20) (max. cable length 30 m [100 ft])
Mechanical protection		IP65	IP68	IP65	IP67	IP68
High/low mode setting (Low fail-safe – "L", High fail-safe – "H")		Determined by the wiring inside the connector	Determined by the wiring	Switch selectable	Connection within connector	Wire selectable
Output		2-wire AC, for serial connection		Field selectable, NPN / PNP transistor switch		Field selectable, galvanically isolated PNP/NPN transistor switch
Output protection		—		Reverse polarity, overcurrent and short-circuit protection		
Supply voltage		20…255 V AC, 50/60 Hz		12…55 V DC		
Consumption		Depending on the load		< 0.6 W		
Voltage drop when switched on		< 10.5 V		< 4.5 V		
Electrical protection		Class I		Class III		
Load current (I_L)	max. continuous	350 mA AC 13		I_{Lmax} = 350 mA DC / U_{max} = 55 V DC		
	min. continuous	10 mA / 255 V, 25 mA / 24 V		–		
	max. impulse	1.5 A / 40 ms		–		
Residual current, in switched off state (I_{min})		< 6 mA		< 100 μA		

2.4 ACCESSORIES

– User's manual
– Warranty Card
– EU-declaration of conformity
– 1× Sealing ring (2 mm [0.079"] thick Klinger Oilit)
– Accessories (sold separately): - Adjustable sliding sleeve (RPH–112–0)
- Test magnetic-screwdriver (RPS–101)

2.5 ORDER CODES

NIVOSWITCH R □ □ – 4 □ □ – □ *

TYPE	CODE
Tube + plastic (ECTFE / PFA) coated fork	B
Tube + fork: 1.4571	C
Tube + highly polished fork	G
Tube + fork: 1.457, without reed sensor(1)	E

(1) *Ex version not available*

PROCESS CONNECTION	CODE
1" BSP	M
1½" BSP	H
1" NPT	P
1½" NPT	N
DN50 PN16 PP DIN	F
DN50 PN40 1.4571 DIN	G
ANSI 2" RF150 PP	A
ANSI 2" RF600 1.4571	B
JIS 10K 50A PP	J
JIS 40K 50A 1.4571	K
TriClamp 1½"	T
TriClamp 2"	R
DN40 Pipe coupling	D
DN50 Pipe coupling	E

PROBE LENGTH	CODE
Short (69 mm [2.7"])	00
Standard (125 mm [4.9"])	01
0.2…3 m (0.66…10 ft)	02…30

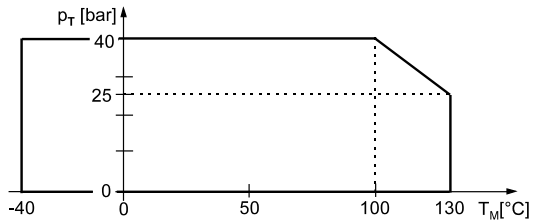
OUTPUT	CODE
2-wire AC + connector	1
2-wire AC + cable	2
3-wire DC + connector	3
3-wire DC + cable	4
2-wire DC + connector	6
2-wire DC + cable	7
2-wire DC + connector + Ex	8
2-wire DC + cable + Ex	9
2-wire DC + M12 connector	K
2-wire DC + M12 connector + Ex	L
3-wire DC + M12 connector	M

* Ex version with **Ex** mark

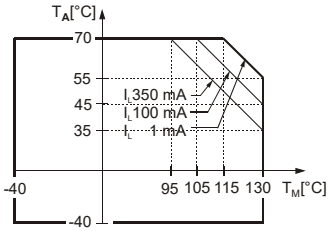
Note: Flanged versions have 1" process connection

Manufacturer:
NIVELCO Process Control Co.
H-1043 Budapest, Dugonics u. 11.
Tel.: (36-1) 889-0100 Fax: (36-1) 889-0200
E-mail: sales@nivelco.com www.nivelco.com

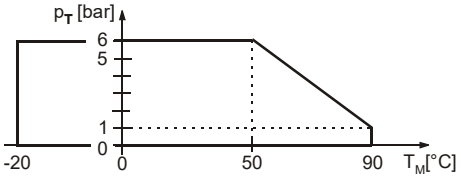
2.6 TEMPERATURE DIAGRAMS



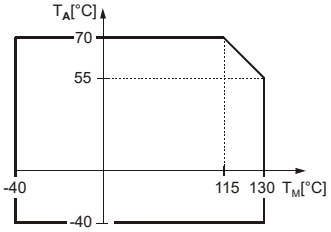
Pressure [p_T] as a function of temperature [T_M] for all versions (except PP-flanged version)



The thermal limits of DC versions, [IL] load current



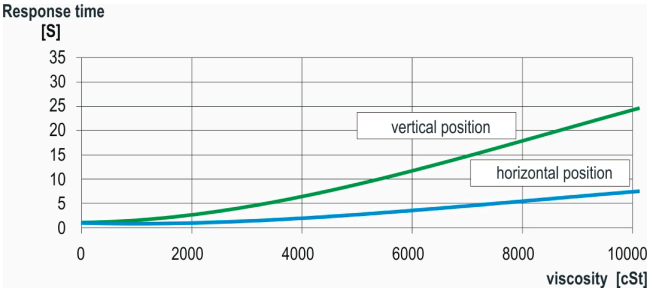
Pressure [p_T] as a function of temperature [T_M] for PP flanged version



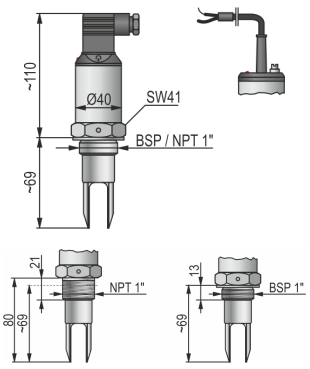
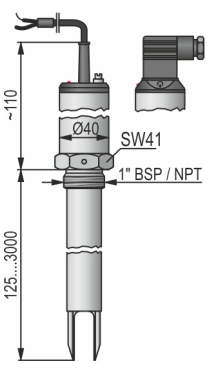
Temperature limits of AC versions, *[T_A] ambient temperature [T_M] medium temperature*

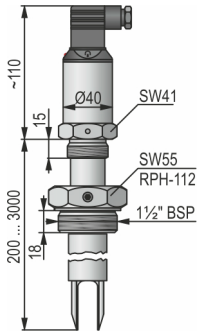
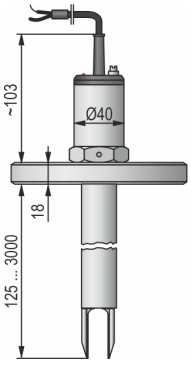
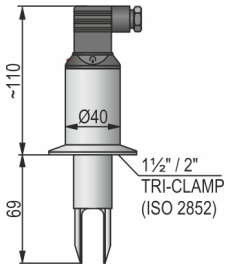
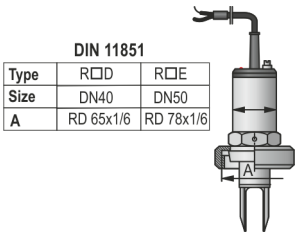
2.7 RESPONSE TIME DIAGRAM

(when the level of the medium drops below the fork)

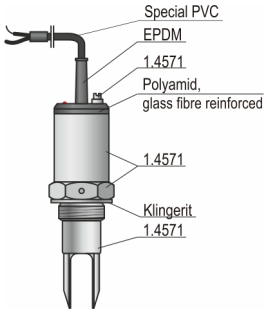


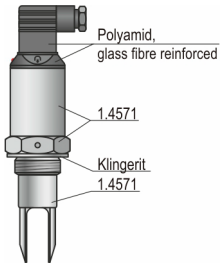
2.8 DIMENSIONS

RO□–400–□	RO□–4□□–□
	

Version with sliding sleeve RCM–4□□–□ + RPH–112–0	Version with flange RCF–4□□–□
	
TriClamp (ISO 2852) RCT–400–□, RCR–400–□	**Pipe coupling (DIN11851) RO□D–4□□–□, RO□E–4□□–□**
	

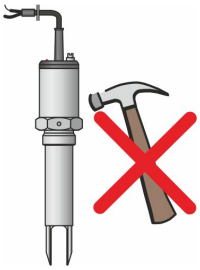
2.9 MATERIALS

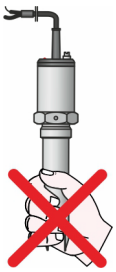




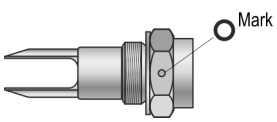
3. INSTALLATION

Protect the device from any mechanical damage.





To adjust the position of prongs use the marking on the hexagonal neck.



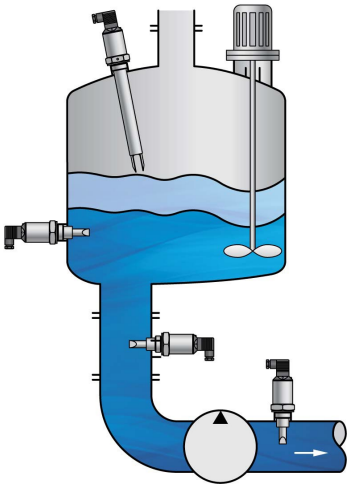
- If the prongs have to be positioned directionally (side mounting), use PTFE tape to seal the thread and position the prongs.
- In this case, vertical positioning of the fork is suggested.

Low-viscosity liquids

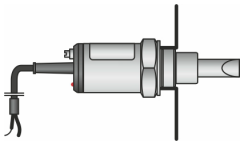
If the measured medium is a low-viscosity liquid, the position of the prongs is irrelevant.

High-viscosity liquids

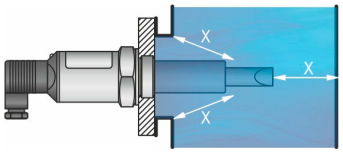
If the measured medium is highly viscous, mounting the fork horizontally is recommended.



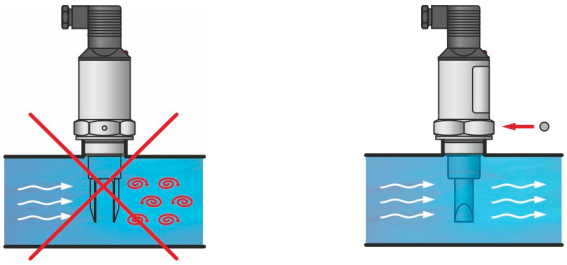
Installation options



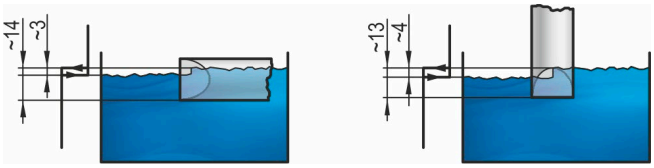
Threaded version



Flanged version, critical distances x > 5 mm (0.2")



For pipe mounting, the prongs must be parallel to the direction of flow



Switching point and differential for water at 25 °C (77 °F)

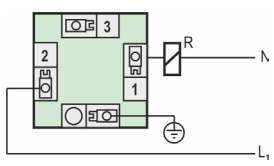
The switching point, and the switching differential, depends on the liquid density and mounting position.

4. WIRING

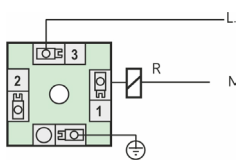
4.1 2-WIRE AC VERSIONS R□□–4□□–1 (connector) R□□–4□□–2 (cable)

Do not power up the device without a load connected in series with the unit and without grounding it!

4.1.1 Version with connector R□□–4□□–1



"L" Low-level limit switch

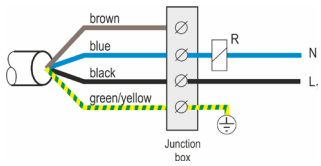


"H" High-level limit switch

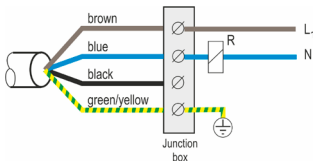
The terminal block cover can be rotated in 90° steps to ensure appropriate cable positioning.

4.1.2 Version with cable R□□–4□□–2

This version is equipped with a 4-wire cable. Only one of the black and brown wires is used, depending on the operating mode (high or low).
Connect the unused wire to an unused terminal in the terminal block.



"L" Low-level limit switch

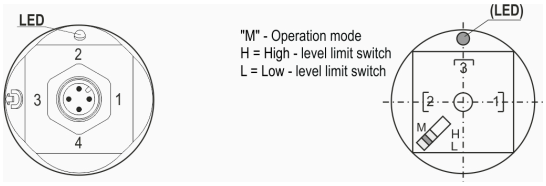


"H" High-level limit switch

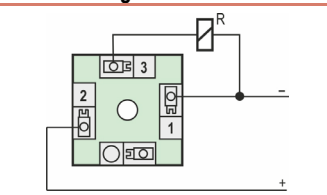
4.2 3-WIRE DC VERSIONS

If there is overload caused by a short circuit, the transistor will switch on and off, and the LED will start to blink.

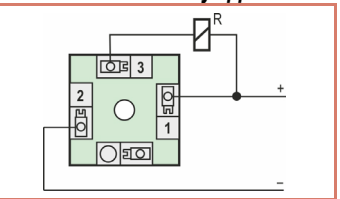
4.2.1 Version with connector R□□–4□□–M, R□□–4□□–3



4.2.1.1 Wiring of the 3-wire DC version with connector in a relay application



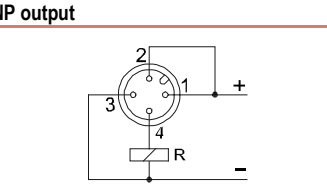
PNP wiring



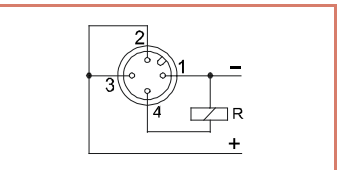
NPN wiring

The terminal block cover can be rotated in 90° steps to ensure appropriate cable positioning.

PNP output

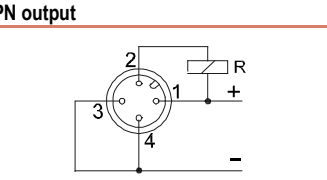


"L" Low-level limit switch

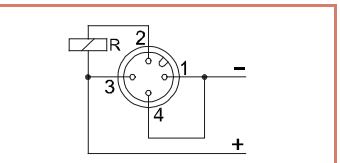


"H" High-level limit switch

NPN output

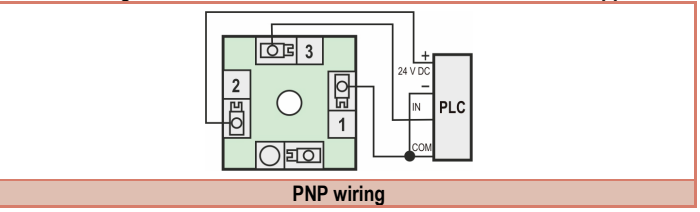


"L" Low-level limit switch



"H" High-level limit switch

4.2.1.2 Wiring of 3-wire DC version with connector in case of PLC application

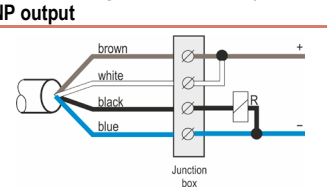


PNP wiring

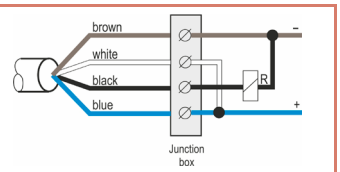
4.2.2 Version with cable R□□–4□□–4

4.2.2.1 Wiring in case of relay applications

PNP output

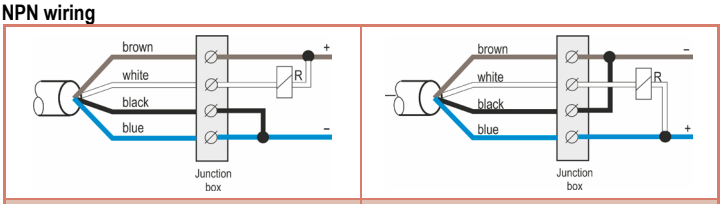


"L" Low-level limit switch



"H" High-level limit switch

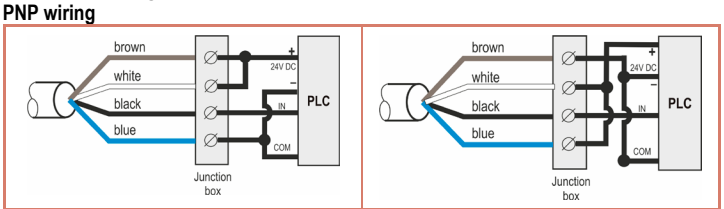
NPN wiring



"L" Low-level limit switch	"H" High-level limit switch

4.2.2.2 *Wiring in case of PLC applications*

PNP wiring

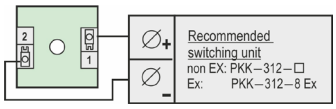


"L" Low-level limit switch	"H" High-level limit switch

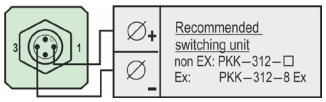
4.3 2-WIRE DC VERSIONS, NORMAL OR EX

4.3.1 Version with connector

R□□–4□□–6
R□□–4□□–8 Ex

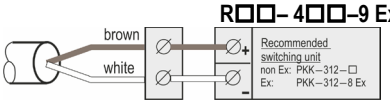


R□□–4□□–K
R□□–4□□–L Ex



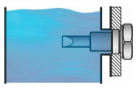
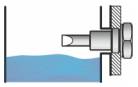
4.3.2 Version with cable

R□□–4□□–7
R□□– 4□□–9 Ex

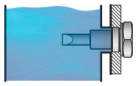
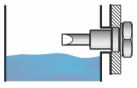


5. COMMISSIONING AND, ADJUSTMENT

Check the wire connections and the position of the operating mode switch (if there is one). After connecting and powering up, the vibrating fork is operational.
The operating diagram of the NIVOSWITCH:

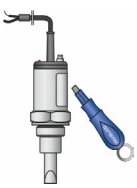
Power supply	Fork	Mode	Display (LED)	Output
ON	 Immersed	High	Red	OFF (I_{min})
		Low	Green	ON (I_L)
	 Free	High	Green	
		Low	Red	OFF (I_{min})
NONE	Free or immersed	H or L	Off	

Operation diagram of the 2-wire DC version

Fork		Display (LED)	Output
Immersed		Red	14 ±1 mA
Free		Green	9 ±1 mA

OPERATION TEST

The correct operation of the switching circuit of an installed device can be tested with the optional test magnet (RPS–101).
Moving the test magnet in front of the mark on the cover of the housing, the device will perform a switching (LED changes color).



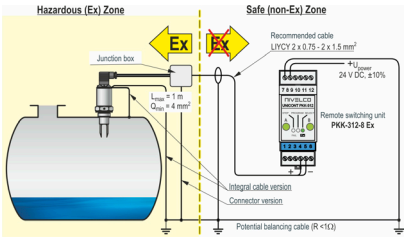
5.1 APPLYING EX APPROVED MODELS

When using an Ex-approved model, mind the table of thermal limits below.

Temperature classification	T6		T5	T4
$T_{ambient}$	70 °C (158 °F)	60 °C (140 °F)	60 °C (140 °F)	60 °C (140 °F)
T_{medium}	70 °C (158 °F)	75 °C (167 °F)	95 °C (203 °F)	130 °C (266 °F)

Table of possible temperatures

Recommended Installation



5.2 CONDITIONS OF SAFE OPERATION

⟨Ex⟩II 1G Ex ia IIC T6…T4 Ga and ⟨Ex⟩II 1G Ex ia IIB T6...T4 Ga approved vibrating forks must be powered by intrinsically safe [Ex ia IIC or IIB] certified and approved devices.

These units must be cleaned only with a damp cloth.

A junction box must be used to wire the cable connection version R□□–4□□–9 Ex devices. The junction box must meet the applicable safety requirements.

The instrument has built-in overvoltage protection, so:

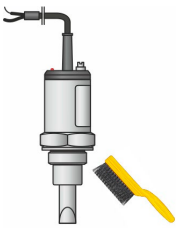
- Outer grounding of the housing must be connected to the steel silo wall with a minimal 4 mm² (AWG12), shielded copper cable — outside the Zone 0 — within 1 m (3.3 ft) of the boundary of the Zone 0.
- According to 6.3.12 of EN 60079-11, the standard dielectric strength test must not be performed on the instrument.

To avoid the accumulation of electrostatic charge when using the coated version of the RB□–4□□–□ the following safety rule must be observed:

- The measured medium must be electrostatically conductive, the electrical resistivity of the medium must be ≤ 10^4 Ω.
- The speed of the filling and emptying process must be chosen properly according to the measured medium.

6. MAINTENANCE AND REPAIR

The sensor probe may need occasional cleaning to remove surface deposits. This must be carried out gently, without harming the vibrating section of the vibrating fork.



Before returning the device for repairs, it must be cleaned thoroughly. The parts in contact with the medium may contain harmful substances; therefore, they must be decontaminated. Our official form (Returned Equipment Handling Form) must be filled and enclosed in the parcel. Download it from our website www.nivelco.com. The device must be sent back with a declaration of decontamination. A statement must be provided in the declaration that the decontamination process was successfully completed and that the device is clean from any hazardous substances.

7. STORAGE CONDITIONS

Ambient temperature: −40…+70 °C (−40…+158 °F)
Relative humidity: max. 98%

rcm400en23h13
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