



## AETB 03 (Three phase)



**BOSCH**

en Operating instructions

Auto electrical test bench - F 002 H32 332



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## 1. Symbols used

### 1.1 In the documentation

#### 1.1.1 Warning notices - Structure and meaning

Warning notices warn of dangers to the user or people in the vicinity. Warning notices also indicate the consequences of the hazard as well as preventive action. Warning notices have the following structure:

Warning symbol	<p><b>KEY WORD – Nature and source of hazard!</b></p> <p>Consequences of hazard in the event of failure to observe action and information given.</p> <p>➤ Hazard prevention action and information.</p>
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The key word indicates the likelihood of occurrence and the severity of the hazard in the event of non-observance:

Key word	Probability of occurrence	Severity of danger if instructions not observed
<b>DANGER</b>	<b>Immediate</b> impending <b>danger</b>	<b>Death</b> or <b>severe</b> injury
<b>WARNING</b>	<b>Possible</b> impending <b>danger</b>	<b>Death</b> or <b>severe</b> injury
<b>CAUTION</b>	Possible <b>dangerous situation</b>	<b>Minor</b> injury

#### 1.1.2 Symbols in this documentation

Symbol	Designation	Explanation
!	Attention	Warns about possible property damage.
i	Information	Practical hints and other useful information.
1. 2.	Multi-step operation	Instruction consisting of several steps.
➤	One-step operation	Instruction consisting of one step.
↪	Intermediate result	An instruction produces a visible intermediate result.
→	Final result	There is a visible final result on completion of the instruction.

### 1.2 On the product

! Observe all warning notices on products and ensure they remain legible.

## 2. Alternator / starter test bench

### 2.1 Specification

- Motor - 5 HP, 3-phase, 1440rpm
- Digital DC voltmeter of 3.5 digit display with minimum readable upto 0.1 volt
- Digital DC ammeter for load of 3.5 digit display with minimum readable upto 1 amp
- Digital DC ammeter for battery charging of 3.5 digit display with minimum readable upto 1 amp
- Digital DC ammeter for starter free reu current 3.5 digit display with minimum readable upto 1 amp
- Alternator loading through wire wound resistors of 0-170A/14V, 120A/28V capacity
- Alternator loading through 8 rotary switches.
- 2-directional rugged mounting arrangement to suit various range of alternators.
- Provision for 2-speed check with one v /poly groove pulley and two small v pulleys to check at 1500/1800/6000 rpm with three belts
- Starter free spin testing from internal source using transformer/rectifier of 150 A capacity with short circuit protection.

#### 2.1.1 Structural Frame

Steel structure with mounting arrangement

#### Overall dimension

850 mm x 800 mm x 650 mm (lxbxh)

### 2.2 Features

#### Digital voltmeter

The 0-99.9 V scale voltmeter is used to monitor output voltage alternator/starter voltage with or without load.

#### Digital ammeter

##### Ammeter-I

The 0-200 A ammeter is used to monitor alternator output current.

##### Ammeter-II

The 0-200 A ammeter is used to monitor starter motor light running current (free spin current).

##### Ammeter-III

The 0-100 A ammeter is used to monitor battery charging current while testing alternator.

#### Fuse

1.5 A fuse is provided for rectifier field circuit protection (alternator dynamo testing).

4 A fuse is provided for rectifier assembly protection (4st circuit).

**3-phase indicator**

The light comes on immediately after power is connected to the equipment and switched "ON" indicating 3-phase input supply.

**Cable harness**

Separate cables harness are supplied for easy and quick connection of terminals to test bench for alternator/starter/battery and other end to subsequent terminal of the unit under test.

**Motor**

3-Phase, 5 HP, 1440 rpm, 415 V  $\pm 10\%$  motor with built in 3 stepped pulleys, one with low speed (1500 and 1800 RPM) and high speed (6000 RPM) with test pulley.

**2.3 Features****Fixed Resistance**

Load can be increased by switching on load rotary switches from 0-170 A/14 V.

1. Two separate terminals (positive and negative) are provided where an appropriate wiring harness can be connected through this terminal to respective starter motor terminals to check light run (free spin).
2. To battery: Two separate terminals are provided (positive and negative) to charge a battery, externally by using a appropriate cable harness.
3. 40V /80 V AC and 6 V DC continuity test has been provided.

**Selector switches (Starter/alternator)**

There are three switches separately for alternator/starter to select the mode for testing that corresponds to unit under test.

**Selector switch power / bat switch**

This switch is to select excitation for either power, or bat. (In "battery" mode, battery should be connected to the butterfly terminals, positive and negative. For 14 V one battery should be connected and for 28 V two batteries should be connected in series).

**Alternator output terminals**

Heavy duty terminals are provided in the unit for quick and easy fitment of harness cable while checking starter/alternator.

**Special feature**

Three to five seconds cut off time introduced for starter checking to avoid continuous operating of starter motor using the internal timer.

**2.4 Installation and commissioning**

1. Break open the wooden case carefully and remove the nuts at the base corners of the case, remember to preserve the bolts at the corners for assembling mounting bushes
2. Place the mounting frame over a table.
3. Mount the mounting bush by fastening it on to the bolts provided at the four corners of the test bench.
4. Remove the plastic cover from the test bench
5. Remove the small cardboard box provided with all accessories for the test bench
6. Remove the mounting vice handle and mount it on the main vice rod for rotating
7. Check if all the fuses are intact with the fuse wires fixed properly.
8. Check for any damages and breakages and also for firm connections of all the components and wires.
9. Remove the spare cardboard box containing spares and check if all the contents listed in the packing slip are provided along with the box.
10. Check for operating manual and operate as per the instructions
11. Connect the test bench to three-phase power point with neutral and earthing . Ensure the color code for three phase is maintained as red/yellow/blue for phases and green for neutral on the mains cable
12. Switch on the main MCB and ensure that the meters and the power on three phase indicator is ON.
13. Switch on the motor and ensure the motor runs and the motor on indicator is on
14. Select the power/batt switch to power mode and ensure that the voltmeter indicate approximately indicated 12 V and 24 V in 12 V/24 V mode
15. Ensure in starter mode the voltage of 12 V/24 V is read after switching on the STR AC MCB with the push button pressed.
16. Check the alternator/starter as per procedure.

### 3. Alternator 14 V testing procedure

#### 3.1 Mounting


Mount the alternator on the V-block and align it with the motor pulley. Adjust the belt tension accordingly. Use only V-pulley and belt.

#### 3.2 Connections

Connect the alternator cable to the test bench. Positive of the test bench to positive terminal of alternator. Negative of the test bench to negative terminal of alternator. WL terminal to warning lamp terminal of alternator.

#### 3.3 Belt tension

Adjust the vice in Y axis and adjust the belt to 3/8" or 9.5 mm approximately under the thumb pressure.

 To check the alternator at low speed align the alternator pulley to the small pulley provided on the motor with small V belt A46 for 1500/1800 rpm.

#### 3.4 Warning lamp on procedure

##### Power mode


1. Switch on the main supply 4-pole MCB provided on the top side and ensure the power indicator is ON.
  2. Select the selector switches provided on the front panel as follows.
  3. Select the toggle switch (power/bat) to power mode.
  4. Select the toggle switch (14 V/28 V) to 14 V mode.
  5. Select the toggle switch (str/alt) to alt mode.
- The voltmeter should indicate 11-12 V approximately. The warning lamp should glow.

##### Battery mode

1. Switch on the batt on single pole MCB provided on the top side and ensure the power amp is on.
  2. Connect the 12 V battery to the terminals mentioned as battery.
  3. Select the selector switches provided on the front panel as follows.
  4. Select the toggle switch (power/bat) to bat mode.
  5. Select the toggle switch (14 V/28 V) to 12V mode.
  6. Select the toggle switch (str/alt) to alt mode.
- The voltmeter should indicate 12-13 V approximately. The warning lamp should glow.

#### 3.5 Warning lamp off procedure

1. Switch on the 5 A/10 A load switch.
2. Switch on the motor on MCB provided on the right top side.
  - ⇒ The warning lamp goes off and the voltmeter reads open circuit voltage of 14.0 - 14.5 V approximately. The load ammeter reads 5 A.
3. Open the batt charger. Ammeter reads the batt when batt mcb power/batt is selected to batt mode.
4. Increase the load by switching on more load switches depending on the capacity of the alternator.
5. Load upto full load capacity of the alternator and observe the voltage which should be 13.5 V at full load for a specific alternator.

 If the voltage goes below the specified voltage then the alternator needs to be serviced.

6. Check the battery charging current when the alternator is tested with battery and ensure at each load that the battery ammeters do not read in negative. At full load of the alternator the battery should read always show positive.
7. Switch off all the load switch and switch off the motor.

## 4. Alternator 28 V testing procedure

### 4.1 Mounting


Mount the alternator on the v-block and align it with the motor pulley. Adjust the belt tension accordingly. Use only v-pulley and belt.

### 4.2 Connections

Connect the alternator cable to the test bench. Positive of the test bench to positive terminal of alternator. Negative of the test bench to negative terminal of alternator. WL terminal to warning lamp terminal of alternator.

### 4.3 Belt tension

Adjust the vice in Y axis and adjust the belt to 3/8" or 9.5 mm approximately under thumb pressure.

 To check the alternator at low speed align the alternator pulley to the small pulley provided on the motor with small v-belt.

### 4.4 Warning lamp on procedure

#### Power mode

1. Switch on the main supply MCB four-pole provided on the top side and ensure the power amp is on.
  2. Select the selector switches provided on the front panel as follows.
  3. Select the toggle switch (power/bat) to power mode.
  4. Select the toggle switch (14 V/28 V) to 28 V mode. Battery MCB should be in off condition.
  5. Select the toggle switch (str/alt) to alt mode. Batt MCB should be in off condition.
- The voltmeter should indicate 23-24 V approximately. The warning lamp should glow.


#### Battery mode

1. Switch on the main supply MCB four-pole provided on the top side and ensure the power amp is on.
  2. Connect the 24 V battery to the terminals mentioned as battery.
  3. Select the selector switches provided on the front panel as follows
  4. Switch on the battery MCB.
  5. Select the toggle switch (power/bat) to bat mode.
  6. Select the toggle switch (14 V/28 V) to 28 V mode. Batt on MCB should be in off condition.
  7. Select the toggle switch (str/alt) to alt mode.
- The voltmeter should indicate 23-24 V approximately. The warning lamp should glow.

## 5. Alternator 24 V test procedure

### 5.1 Warning lamp off procedure

1. Switch on the 5 A/10 A load switch.
2. Switch on the motor on MCB provided on the right top side.
  - ⇒ The warning lamp goes off and the voltmeter reads open current voltage of 27.0-28 V. The load ammeter reads 5 A.
3. Open the batt charger ammeter. It reads the batt when batt MCB power/batt is selected to batt mode.
4. Increase the load by switching on more load switches depending on the capacity of the alternator.
5. Load upto full load capacity of the alternator and observe the voltage which should be 26 V at full load for a specific alternator.

 If the voltage goes below the specified voltage B then the alternator needs to be serviced.

6. Check the battery charging current when the alternator is tested with battery and ensure at each load that the battery ammeter does not read in negative. At full load of the alternator the battery should read always in positive current.
7. Switch off all the load switch and switch off the motor.

## 6. Starter 12 V/24 V testing procedure light run only

### 6.1 Mounting

Fix the starter on the v-block properly and tighten it by rotating the screw rod.

### 6.2 Connections

Connect the starter using starter spare cable as follows.

Positive of starter points of the test bench to positive terminal of starter.

Negative of starter points of the test bench to negative terminal of starter.

### 6.3 Starter 12 V/24 V testing procedure light run only

#### 6.3.1 Switches selection

1. Switch on the main MCB 4 pole (power) provided on the top.
2. Ensure that three-phase supply is available.
3. Select the selector switches provided on the front panel as follows.
4. Select the toggle switch str (12 V/24 V) to 12 V/24 V mode.
5. Select the switch (str/alt) to str mode.
6. Switch on the str AC MCB.

### 6.4 Starter 14 V/24 V testing procedure light run only

#### 6.4.1 Operation

1. Press the starter push button switch and ensure the approximately 12 V and 24 V is available to check starter.
  2. Now switch on the str dc MCB.
  3. Now press the starter push button and observe the values on the voltmeter and the str ammeter. Based on the starter under test, select voltage drop and the current.
- The voltmeter should show a drop of maximum of 2 between the open current voltage and the light run cranking current for a good starter.

## 7. Starter short circuit test facility

When a burnt or short-circuited starter is tested, the trip indicator immediately switches on and no further test is possible. To start the test again, press the reset button and then test a good starter and ensure the readings.

## 8. Continuity test

When a continuity test is to be performed then switch on the continuity test switch. Connect the test leads to appropriate voltage required as 40 V/80 V AC and 6 V DC. To check the continuity touch the test leads on the points where the continuity is to be seen and check whether the corresponding LED glows.

## 9. Battery charging procedure for 12 V/24 V

1. Switch on the main supply MCB.
  2. Ensure that three-phase supply is available.
  3. Select the selector switches provided on the front panel as follows
  4. Select the toggle switch (power/bat) to batt mode.
  5. Select the toggle switch (14 V/28 V) to 14V mode.
  6. Select the toggle switch (str/alt) to alt mode.
  7. Switch on the single pole MCB batt on.
    - ⇒ The voltmeter should indicate 12 V/24 V approximately. The warning lamp should glow.
  8. Switch on the motor push button.
  9. The warning lamp goes off and the voltmeter reads open current voltage of 14.0-14.5 V / 27V-28 V.
- The battery charging ammeter reads the charging current. Once the battery is fully charged then the ammeter becomes zero (neutral) indicating that the battery is fully charged.



## 10. Troubleshooting

Sl. No.	Fault diagnosis	Parameters to check
1	W/L not glowing	1. Check if PCB1 LEDs glow. If green and red LEDs glow, then PCB is OK. If only the red LED glows, then replace PCB. 2. If red/green LED is off, check fuses. 3. Check for switches selection. 4. Check the bulbs.
2	Voltmeter not indicating	1. Check switch selections. 2. Check voltmeter.
3	Ammeter not indicating	1. Check switch selections. 2. Check shunts.
4	Motor problem	1. Check the supply voltage. 2. Check MCB, main fuses 415 V L-L and 230 V L-N. 3. Check the motor.
5	Loading improper	1. Check the conditions of the load resistors. 2. Check the connections.
6	Battery circuit	Check the battery MCB. Check the battery condition.

## 11. Trouble shooting chart

Sl. No.	Fault diagnosis	Parameters to check
1	Starter ckt	1. Check the switch selection. 2. Check the starter fuse 4 A 3. Check the MCBs on the front panel as well at the bottom 4. Check the 4st switches. 5. Check the push button switch 6. Check starter PCB 7. Check for trip LED 8. Check the starter power diodes using multimeter in diode mode 9. Check trip ckt relay on NC condition

## 12. Wiring procedure of test bench

1. Wire the test bench as per chart and drawings given.
2. Ensure the correctness of wiring after work completed.

### Wiring Chart

- Color codes
- AC supply
- Phase           Red     1 mm<sup>2</sup>
- Neutral        Black  1 mm<sup>2</sup>
- DC control
- 0.5 mm<sup>2</sup> / 1 mm<sup>2</sup> Grey
- DC power
- Positive       4 mm<sup>2</sup>/6 mm<sup>2</sup>   Red
- Negative      4 mm<sup>2</sup>/6 mm<sup>2</sup>   Black

Test bench AC Section				
AC power and control				
From	To	Wire Size	Fer-rules	Color
Main input connector	32 A MCB	4 mm <sup>2</sup>	R, Y, B, N	Red/Black
32 A MCB	Dol starter for motor starter/ three phase indication meter phase, control transformer	4 mm <sup>2</sup> 1 mm <sup>2</sup> 1 mm <sup>2</sup>	R1, Y1, B1, N1	Red/Black
Dol starter	Motor input	4 mm <sup>2</sup>	M1, M2, M3	Red
Motor start/stop push buttons	Control supply	1 mm <sup>2</sup> 1 mm <sup>2</sup>	1 A, 2 A	Grey/Red
Neutral supply form MCB 32 A	Three-phase neutral, control transformers, power transformer, meters, timer, dol starter	1 mm <sup>2</sup> 4 mm <sup>2</sup>	20	Black
Control transformer 12 V	Power supply PCB	1 mm <sup>2</sup>	21	Grey
Control transformer 0 V	Power supply PCB STR trip PCB 0 V	1 mm <sup>2</sup> 0.5 mm <sup>2</sup>	4 A	Grey
1.5 A fuse	Power supply PCB STR trip PCB 12 V	1 mm <sup>2</sup>	4B	Grey
Power transformer secondary	4ST solenoid switch, 2 nos, rectifier assy,	16 mm <sup>2</sup>		Black
Test bench DC power				
ALT positive	200 A shunt positive	25 mm <sup>2</sup>		Black
ALT shunt positive	Load resistor common	6 mm <sup>2</sup> / 16 mm <sup>2</sup>		Black
Batt positive	20 A MCB	6 mm <sup>2</sup>		Red
20 A MCB	30 A shunt negative	6 mm <sup>2</sup>		Black
30 A shunt	Alternator shunt 200 A positive	6 mm <sup>2</sup>		Red
Batt negative	Power/batt switch	6 mm <sup>2</sup>		Black
Power/batt pole	Alternator negative terminal	6 mm <sup>2</sup>		Black
Load switch 1	2.7 Ω load	4 mm <sup>2</sup>	L1	Red
Load switch 2	1.3 Ω load	4 mm <sup>2</sup>	L2	Red
Load switch 3	1.3 Ω load	6 mm <sup>2</sup>	L3	Red
Load switch 4	1 Ω load - 2 nos	6 mm <sup>2</sup>	L4	Red
Load switch common	Negative alternator terminal	4,6,10 mm <sup>2</sup>		Red
Load switch 5	1 Ω load - 2 nos	10 mm <sup>2</sup>	L1	Red

Load switch 6	0.4 Ω load	10 mm <sup>2</sup>	L2	Red
Load switch 7	0.6 Ω - 2 nos load	16 mm <sup>2</sup>	L3	Red
Load switch 8	0.4 Ω - 2 nos	16 mm <sup>2</sup>	L4	Red
Test bench DC power	Power			
Rectifier assy positive	200 A shunt positive	16 mm <sup>2</sup>		Black
ALT shunt negative	63 A MCB DC	16 mm <sup>2</sup>		Black
63 A MCB DC	Starter positive terminal	16 mm <sup>2</sup>		Red
Rectifier Negative	Starter negative terminal	16 mm <sup>2</sup>		Black

**DC control**

From	To	Wire Size	Ferruls	Color
Switch 1 way 1	2.7 Ω / 100 W	1 mm <sup>2</sup>	16	Grey
2.7 Ω/100 W 2	Switch 1 way 2 relay pole	1 mm <sup>2</sup>	L9	Grey
Relay NC	4st coil positive	1 mm <sup>2</sup>	43	Grey
4st coil negative	push button	1 mm <sup>2</sup>	42	Blue
STR push button	Batt negative	1 mm <sup>2</sup>	41	Blue
PCB CC	Switch 1 pole	1 mm <sup>2</sup>	14	Grey
PCB 12 V	Switch 1 way	1 mm <sup>2</sup>	15	Grey
PCB 24 V	Switch 1 way	1 mm <sup>2</sup>	13	Grey
Ammeter positive	Switch 3 pole	1 mm <sup>2</sup>	8	Grey
Ammeter negative	Switch 3 pole	1 mm <sup>2</sup>	7	Grey
STR shunt positive / negative	Switch 3 way	1 mm <sup>2</sup>	37,39	Grey
ALT shunt positive / negative	Switch 3 way	1 mm <sup>2</sup>	38,40	Grey
PCB positive output	Switch 2 way 1	1 mm <sup>2</sup>	24	Grey
Batt fuse positive	Switch 2 way 2	1 mm <sup>2</sup>	25	Grey
Switch 2 pole	17 Ω 1 Switch 1 pole	1 mm <sup>2</sup>	26	Grey
17 Ω 2	ALT positive terminal	1 mm <sup>2</sup>	27	Grey
Switch 1 way	WL 12 V	1 mm <sup>2</sup>	12	Grey
Switch 1 way	WL 24 V	1 mm <sup>2</sup>	10	Grey
STR fuse	SW1 pole	1 mm <sup>2</sup>	17	Grey
Warning lamp common	WL terminal	1 mm <sup>2</sup>	23	Grey
Switch 2 way (2)	Batt negative terminal	4 mm <sup>2</sup>	30	Blue
PCB negative output	Switch 2 way	1 mm <sup>2</sup>	28	Blue
Switch 2 pole (2)	ALT negative terminal	4 mm <sup>2</sup>	29	Blue
Voltmeter 1,2	Switch pole 1,2	1 mm <sup>2</sup>	6,7	Grey / Blue
STR volt +/-	Switch way 1,2	1 mm <sup>2</sup>	33,35	Grey / Blue
ALT volt +/-	Switch way 1,2	1 mm <sup>2</sup>	34,36	Grey / Blue
STR PCB con 2	STR trip	0.5 mm <sup>2</sup>	2 A	Grey
STR PCB con 3	STR reset	0.5 mm <sup>2</sup>	5 A	Grey
STR PCB con 4	STR shunt mV	0.5 mm <sup>2</sup>	1 A	Grey
STR PCB con 1	Relay coil	0.5 mm <sup>2</sup>	3 A	Grey

**PCB assembling procedure:****Starter trip PCB**

1. Cut the track which is going to pin no:11 of IC LM 324 from R1
2. Then, connect R1 with pin no:4

**PCB details:****Resistors:**

- R1: 100 Ω, ¼ W
- R2:150 Ω, ¼ W
- R3:10 KΩ, ¼ W
- R4:1 KΩ, ¼ W
- R5:100 Ω, ¼ W
- R6:Jumper
- R7:1 MΩ, ¼ W
- R8:10 KΩ, ¼ W
- R9:3.3 KΩ, ¼ W
- R10:1 MΩ, ¼ W
- R11:10 KΩ, ¼ W
- R12: 10 KΩ, ¼ W

**Trimpot:**

- VR1:5 KΩ

**Capacitor:**

- C1:100 μF/16 V
- C2:1 μF/25 V
- C3:470 μF/25 V
- C4:100 μF/25 V
- C5:10 μF/63 V

**Diodes:**

- D1:1N4148
- D2:1N4007
- D3: 1N4148
- D4: 1N4007
- D5: 1N4007

**Regulator:**

- U1:7805

**Transistor:**

- U2: SL 100

**IC:**

- LM 324

**IC Base:**

- 14 pin IC base.

**RMC Connectors:**

- 2 pin RMC connectors CN1 to CN5.

**RMC connectors:**

- CN1:Shunt input
- CN2:Trip LED
- CN3:Relay
- CN4:9 V AC Supply
- CN5:Reset switch N/O

**Tuning:**

1. Connect battery and measure current using external ammeter. Then measure millivolt at shunt and set it as current in DPM by tuning the DPM trimpot.
2. Measure the voltage at pin no:12 of IC LM 324 when max current is passing through the circuit.
3. Then set the same voltage at pin no:13.
4. Now the system is ready to perform

**PCB assembling procedure:****Power supply PCB****PCB details:****Resistors:**

- R1: 5.1K ¼ W
- R2: 1.5K ¼ W
- R3: 3.8K ¼ W
- R4: 10K ¼ W
- R5: 2.2K ¼ W-2NOS
- JUMPER-1NO
- R7:4.7K ¼ W
- R8: 8.2 ¼ W
- R9:3.3 KΩ, ¼ W
- R10:1 MΩ, ¼ W
- R11:10 KΩ, ¼ W
- R12: 10 KΩ, ¼ W

**Trimpot:**

- VR1:10 KΩ

**Capacitor:**

- C1: 2200 µF/63 V
- C2:220 µF/50 V
- C3:104 µF/25 V-2NOS

**Diodes:**

- D1:3 A DIODES -5 NOS
- D2:6 A DIODE-1 NO

**LEDS:**

- 5 MM LED -2 NOS,R-1,G-1

**Transistor:**

- U2: 2N3055 WITH HEATSINK

**IC:**

- LM723 10 PIN IC

**RMC Connectors:**

- 8 pin RMC connectors CN1

**Connector details**

Connectors	
Pin 1 - 12 V	Selector switch sw1 way 1
Pin 2 - 24 V	Selector switch sw1 way 2
Pin 3 / Pin 6	Negative to switch sw2 way
Pin 4	Tr secondary 12 V
Pin 5	Tr secondary 12 V
Pin 7	Common to switch sw1 pole
Pin 8	Positive output to sw2 way







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