iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** III **Month of publication:** March 2018

DOI: http://doi.org/10.22214/ijraset.2018.3266

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue III, March 2018- Available at www.ijraset.com

Piston Ring Configurations and Their Benifits

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Abstract: Automotive is one of the interior ignition engines in which burning of the blend (air-fuel) consume inside. It contains distinctive parts which are to relate together to have required engine productivity. Among these parts is the piston which contains the piston ring that keeps up an ideal seal between the cylinder wall and the piston. The dimensional relationship of the cylinder ring decides the degree by which their seats in the groove present on the cylinder which decide the efficiency of the pressure of the engine which influences the yield of the engine. In this paper we are focusing on the different configuration of piston ring and benefits for those configurations. The different configurations may be square cut, angle cut, title joint, step cut and etc. have been discussed.

Keywords: Internal combustion Engine, piston rings, engine, piston ring gap.

I. INTRODUCTION

Automotive engines are also called an internal combustion engine in light of the fact that the fuel that runs them consumed inside in the burning chamber. These motors might be reciprocating or rotating. All automobile engine is of the reciprocating (cylinder motor). They are the wellspring of energy that influences the wheels to go around in this manner moving the vehicle on the earth. The consuming of fuel inside the motor creates high weight in the motor ignition chamber[1]. The engine comprises of numerous critical parts opposite cylinder head, barrel piece, cylinder and its rings, crankshaft, camshaft, tappet, flywheel and so on. The piston is fitted to the barrel as a face to get gas weight and transmit the push to the connecting rod. The cylinder must be a genuinely free fit in the chamber to abstain from adhering tight because of development of warmth and the leeway between the cylinder and barrel dividers must not be excessive to evade spillages of oil and weight[2]. The piston ring is one of the important parts of an inner burning motor. Its principle objects are to seal the burning assembly of the motor averting loss of the weight, limit the rubbing against the barrel liner yet in addition exchange warm from the cylinder to the cooled chamber liner. Another vital property of the piston ring is to equally circulate oil along the chamber liner keeping in mind the end goal to maintain a strategic distance from motor seizure[3]. The fundamental assignment of piston rings is to avert the section of ignition gas amongst cylinder and barrel divider into the crankcase. For the greater part of engines, this goal is accomplished by two pressure rings which together shape a gas. For configuration reasons, the snugness of piston ring fixing framework in burning engine is underneath 100%; subsequently a little measure of pass up gases will dependably go by the piston rings into the crankcase[4]. This is be that as it may, a typical state which can't be totally stayed away from because of the plan. It is fundamental, however, to keep any exorbitant exchange of hot ignition gases past the cylinder and chamber divider. Generally, this would prompt power misfortune, an increment of warmth in the segments and additionally louses the lubricating impacts.

A piston ring is a part ring that fits into a notch on the external diameter of a cylinder in a responding motor, for example, an inner ignition motor or steam motor. The three primary elements of piston rings in responding motors are:

A. Sealing the burning chamber so that there is negligible loss of gases to the wrench case.
B. Improving warmth exchange from the cylinder to the barrel divider.
C. Regulating motor oil utilization by scratching oil from the barrel dividers back to the sump.

The hole in the cylinder ring packs to a couple of thousandths of an inch when inside the barrel bore. Cylinder rings are a main consideration in recognizing if a motor is two strokes or four strokes. three-cylinder rings propose that it is a four-stroke motor while two-cylinder rings recommend that it is a two-stroke motor. Most cylinder rings are made of a hard and to some degree fragile cast press.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
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Figure 1. A pair of piston rings mounted on a two-stroke cycle scooter piston

II. LITERATURE SURVEY

A Piston ring is a part ring that fits into a notch on the external measurement of a cylinder in a responding motor, for example, an inward ignition motor or steam motor The split cylinder ring was concocted by John Ramsbottom who revealed the advantages to the Institution of Mechanical Engineers in 1854. It soon supplanted the hemp pressing until now utilized as a part of steam motors. The utilization of cylinder rings on the double drastically diminished the frictional protection, the spillage of steam, and the mass of the cylinder, prompting critical increments in power and productivity and longer support interims.

III. PISTON RINGS

In the early steam engines has no cylinder rings were utilized. The temperatures and the steam weights were not as high as the comparing parameters in the present inward ignition motors, and the requirement for thinking about warm developments and clearances was littler. Expanding power requests required higher temperatures, which caused more grounded warm development of the cylinder material. This made it important to utilize a sealant between the cylinder and the barrel liner to permit a lessening in the freedom in icy conditions, i.e. at the point when the clearances were at their greatest. Keeping the freedom between the cylinder and liner divider at least significantly decreases the ignition gas spill out of the ignition chamber past the cylinder. The primary cylinder rings utilized as a part of a motor had the sole assignment of fixing off the ignition chamber, in this manner keeping the burning gases from trailing down into the crankcase.

This advancement expanded the powerful weight on the cylinder. Ramsbottom and Mill operator were among the pioneers to explore the conduct of the cylinder rings in steam motors. Ramsbottom, in 1854, built a solitary piece, metallic cylinder ring. The free distance across of the ring was 10 for each penny bigger than the breadth of the barrel bore. At the point when fitted in a score in a cylinder, the ring was squeezed against the chamber bore by its own flexibility. Past cylinder rings had comprised of numerous pieces and with springs to give a satisfactory fixing power against the barrel bore. Mill operator, in 1862, presented an adjustment to the Ramsbottom ring. This change comprised of permitting the steam strain to follow up on the rear of the ring, henceforth giving a higher fixing power. This new arrangement empowered the utilization of more adaptable rings, which adjusted better to the barrel bore (Priest and Taylor, 2000). In the good 'ol days, the ring pack was greased up exclusively by sprinkle oil; i.e. oil by the sprinkling of the turning crankshaft into the crankcase oil surface. Consequently, when the burning conditions turned out to be considerably all the more requesting, i.e. with higher temperatures, weights and cylinder speeds, oil control rings were presented. A appropriate ointment film on the cylinder, cylinder rings and liner divider was required so as to avert harm. The oil control rings were, and are, particularly intended to suitably convey the oil on the chamber liner and to rub off surplus oil to be come back to the crankcase.

IV. TYPES OF PISTON RING

Most automotive pistons have three rings: The top two while also controlling oil are primarily for compression sealing (compression rings); the lower ring is for controlling the supply of oil to the liner which lubricates the piston skirt and the compression rings (oil control rings). At least two piston rings are found on most piston and cylinder combination.

A. Top compression ring (ucrs-upper compression rings) :

It controls the burning chamber gases enabling the cylinder to exchange the vitality of the growing ignition gases, to the crankshaft. These rings likewise assume a noteworthy part in the warmth exchange process between the cylinder and barrel divider. The 4 prominent styles are

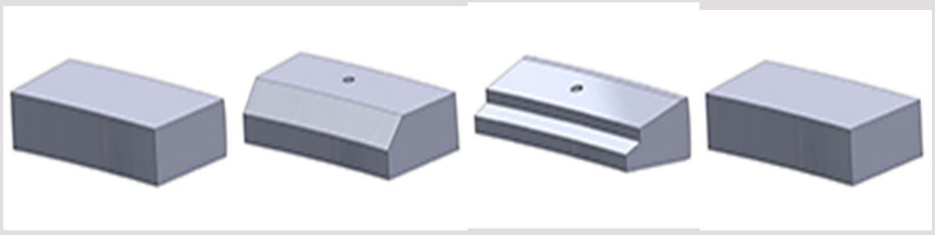

Figure 2. Top compression ring

B. Secondary Compression Ring (LCRs-lower compression rings)

It scraps the oil and keep it from achieving the burning chamber. They likewise give a moment fixing to trap burning gases and help in the warmth exchange to the barrel divider. Auxiliary pressure rings can be made of dark cast press, malleable iron, high combination steel, or stainless steel. Optional pressure ring profiles come in three famous styles.

C.

Figure 3. secondary compression ring

C. Oil control Rings

Scrambling is the pioneer of oil control ring tech. It is invigorated by our FLEX-Vent expander, Which gives uniform weight through two steel rails guaranteeing positive oil control. The three piece configuration enables rails to be made with a little cross sectional region for better comparability to the bores of todays low strain, low grinding motors. The prevalent styles are

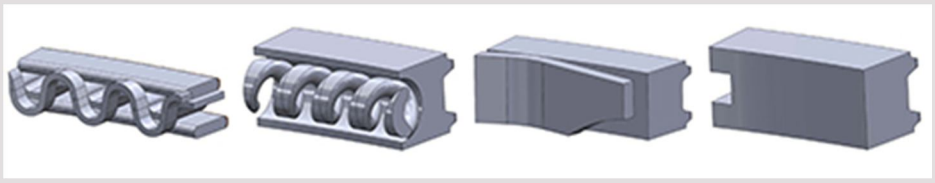

Figure 4. oil control ring

V. MATERIAL USED

The cylinder may be a genuinely free fit in the chamber. In the event that it were a tight fit, it would extend as it got hot and might stick tight in the chamber. In the event that a cylinder sticks (seizes) it could make genuine harm the motor. In the event that there is excessively freedom between the cylinder and chamber dividers, a great part of the weight from the consuming fuel vapor will spill past the cylinder (a condition known as pass up) and into the crankcase, and the push on the cylinder from ignition will be substantially less successful in conveying power. Cylinder rings are liable to wear as they climb and down the chamber bore because of their own inalienable load and because of the gas stack following up on the ring. To limit this, they are made of wear-safe materials, for example, cast iron and steel, and are covered or treated to improve the wear protection. Two-stroke port outline is basic to ring life

A. top ring and oil control rings will be covered with chromium, or Nitrided, conceivably plasma showered or have a PVD (physical vapor testimony) earthenware covering.

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B. For upgraded scrape protection and further enhanced wear, most present day diesel motors have top rings covered with a changed chromium covering known as CKS or GDC, a covering which has aluminum oxide or jewel particles incorporated into the chrome surface

C. The lower oil control ring is intended to leave a greasing up oil film, as the cylinder dives. Three piece oil rings, i.e. with two rails and one spacer, are utilized for four-stroke fuel motors.

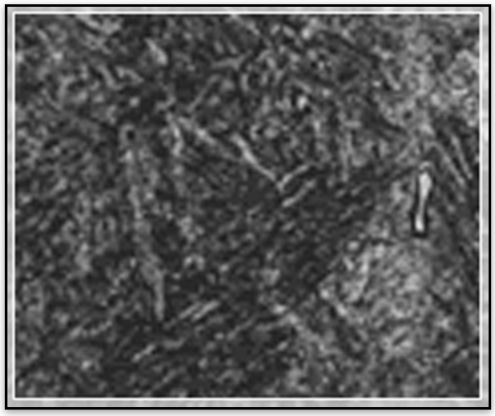


Figure 5

RIK-SP is a steel material chose and enhanced as a material appropriate for cylinder rings. It is utilized for weight rings of smaller fast motors and side rails of blend oil rings. It is additionally utilized for elite diesel oil ring "Diesel Vent-M".RIK-SS is unrivaled in formability, spring qualities, warm safe penetrability, and is chosen and utilized as a spacer material of a blend oil ring "Rick vent" as indicated by an extensive variety of motor particulars.

VI. RING GAP

When fitting new cylinder rings or softening them up inside a motor, the end hole is a vital estimation. To fit the ring into the "sections" of the cylinder, which isn't ceaseless however is broken at one point on its outline. The ring hole might be checked by putting the ring into the drag/liner (squared to drill) and estimating with a sensor measure. End hole ought to be inside prescribed cutoff points for size of bore and proposed "stack" of motor.

A. A sensor check is an apparatus used to quantify hole widths. Sensor checks are for the most part utilized as a part of building to gauge the leeway between two sections

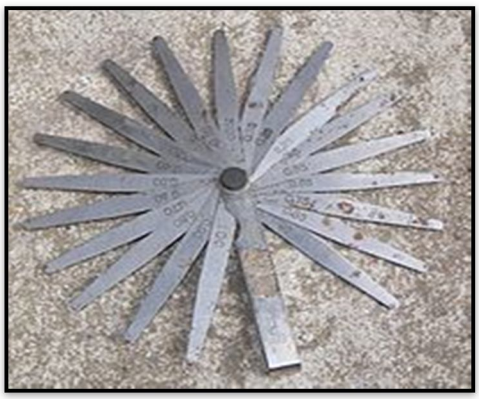


Figure 6

Determination of the best possible ring hole setup is vital in fixing applications. Satisfactory spillage rate, sizes of the ring and kinds of gathering are factors that assistance decide the best possible hole arrangement of our cylinder rings and seal rings

VII. PISTON RING FOR DIESEL ENGINE

"Diesel Vent-M" Oil Ring has been demonstrated to demonstrate high performance for long period of time by many bench tests and actual vehicle tests, which can not be obtained with conventional cast iron oil rings.

A. Features

Oil control action is good and oil consumption is low.

Compared to cast iron oil rings, "Diesel Vent - M" has good circularity, is flexible and has excellent followability to cylinder walls. In addition, because it does not cause functional deterioration against surface pressure change, ideal oil control action lasts steadily for a long time, and oil consumption is greatly reduced.

Piston Ring Specification

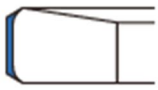
Position	Configuration	Material (Material)	Surface treatment
Top		Steel	Chromium Plating Ion Plating Gas Nitriding
2nd		Cast Iron	Chromium Plating
Oil		Steel	Chromium Plating Gas Nitriding

TABLE: 1

B. Stable quality and high unwavering quality.

Since it has a structure reasonable for large scale manufacturing and high accuracy preparing should be possible, high caliber can be acquired steadily. Besides, on the grounds that the fundamental body is made into steel, there is no stress, for example, breakage that happens amid dealing with or splits that happen amid gathering.

C. Lightweight And low Rubbing Misfortune.

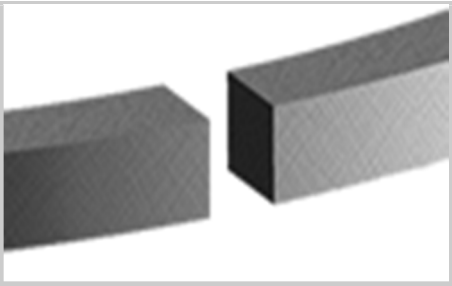
Since it can be 35 to 45% lighter than cast press, the contact surface against the chamber divider is little and the total estimation of pressure can be set low. What's more, because of the more slender width and shrinkage of the separation between the upper and lower rails, regardless of whether the surface weight is even lower, the capacity weakening is little, which adds to lessening of grinding misfortune and decrease of oil utilization.

Figure 7 Piston ring used in diesel engine

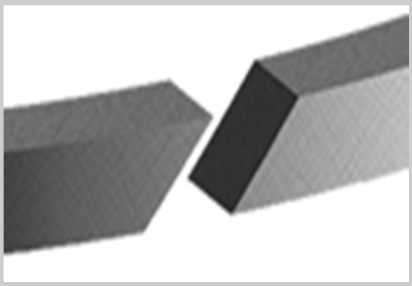
When fitting new rings to a used engine, special "ridge dodger" rings are sometimes used for the top compression ring, to improve compression and oil consumption without reboring the cylinder. These have a small step of iron removed from the top section to avoid making contact with any wear ridge at the top of the cylinder, which could break a conventional ring... During engine assembly, a piston-ring compressor is used to evenly squeeze the rings long enough to slide the piston into the cylinder. Rings are not a very expensive part, but fitting new ones is usually very costly. This is because to fit them, the mechanic must essentially take the whole engine apart. Therefore the labour costs are the major factor. Once going that far, one might as well correct many other problems found inside - so fitting new rings is usually done as part of an entire engine rebuild/reconditioning.

VIII. PISTON RING CONFIGURATIONS

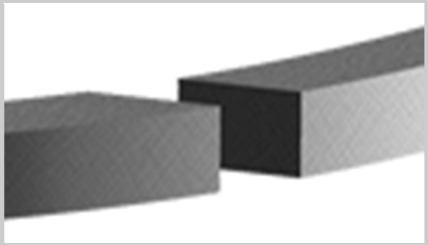
The most commonly piston ring configurations are



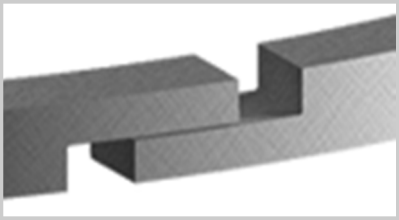
SQUARE CUT : The most practical and economical ring gaps. Recommended for most applications. Good leakage control.



ANGLE CUT : Widely used on rotating seals. Rings should be oriented so the leading edge points in the direction of rotation. Rings with an angle gap decrease the tendency to score at the gap.



TITE JOINT : Sometimes applied to contracting and snap rings so that they can be easily removed from the groove.



STEP CUT : Used where two rings per groove are not practical. The step cut is used to prevent a direct flow path between the piston and cylinder. Cross section must be larger to accommodate strength to the steps.

HOOK STEP : Used for blind assembly or when ring must pass ports in the cylinder wall. Limits free expansion.

MITRE STEP : The only single rings that have tighter leakage control than any other single ring. Used on larger diameter rings when using one ring per groove.

IX. CONCLUSION

In outcome of this paper was to list out different configuration of piston ring and benefits of these configurations. All these configurations such as square cut, angle cut, title joint, step cut and etc, of piston rings have their unique and different benefits and purposes, like square cut configuration is most commonly used because of its practical and economical use and also it has Good control over the leakage.

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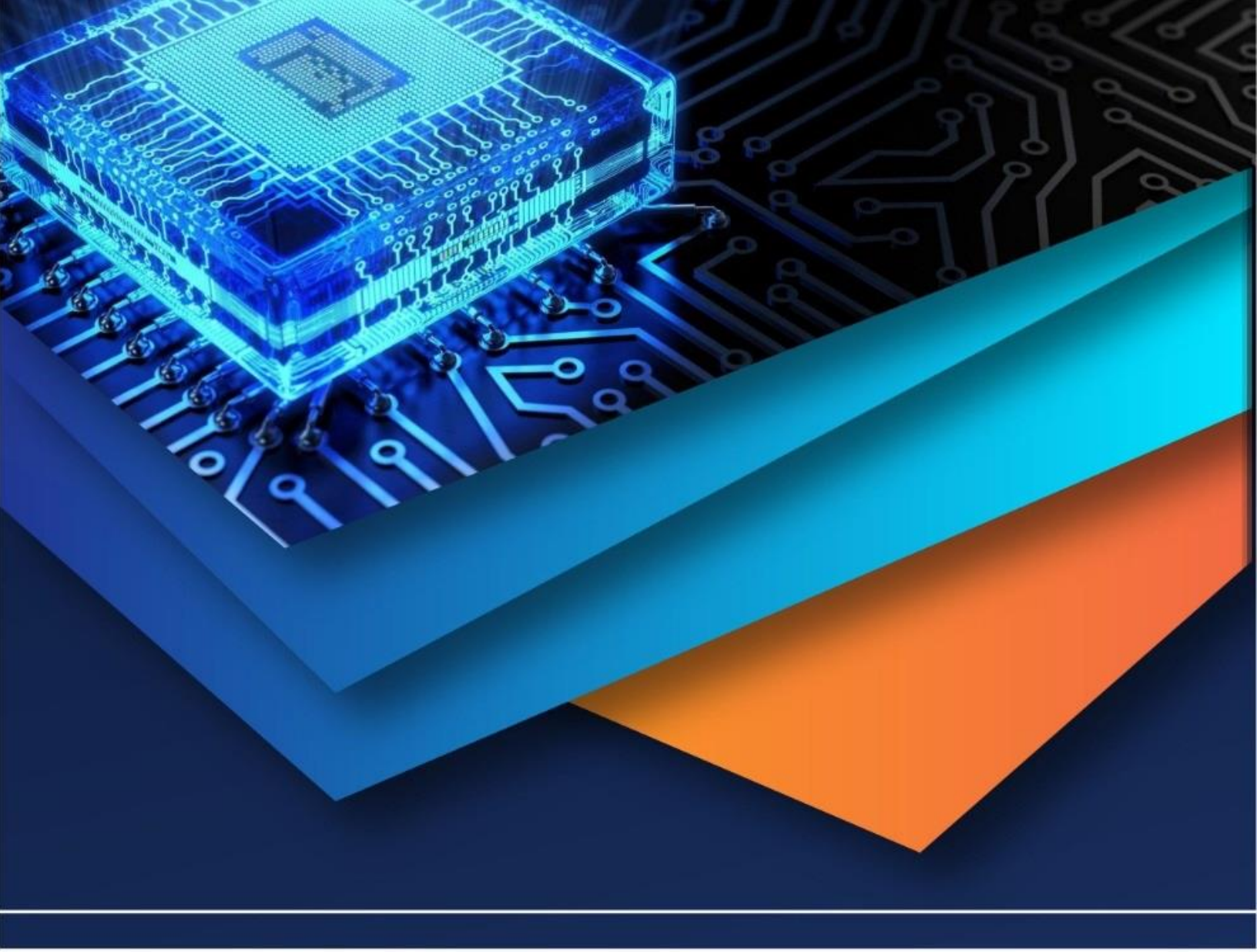

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