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THE ANALYSIS OF CAUSES OF LORRY PISTON COMBUSTION ENGINE DAMAGE

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ABSTRACT

The article deals with analysis of causes of lorry piston combustion engine harm. For documentation and analysis of causes was used megascopic, microscopical and scanning microscopy. The analysis showed that the rationale of fatal harm resides in production method of lorry combustion pistons that well-tried in implication of fatigue harm and consequent burnout in 2 piston place.

1. INTRODUCTION

The pistons for combustion engines square measure created of metallic element alloys with numerous atomic number 14 contents and extra parts in numerous constructional version. The composition of metallic element alloy and application of production technology differs in dependence of specific utilize [1,2]. Engine pistons square measure one in all the foremost advanced parts among all automotive or alternative trade field parts [3,4]. The pistons square measure directly presented fuel explosions and products of fuel combustion. Such obtained energy with facilitate of piston is remodeled into mechanical energy that is employed for wheel drives. huge half in material draft plays used style of fuel itself. fuel engines work additional with efficiency throughout higher turns yet as speeds from that follow that fatigue strength is achieved earlier and it conjointly involves higher friction than oil engines. Compression ignition engines work throughout distinctively higher pressures and better temperatures. The decisive influence on the activity and conjointly engine time period has chemical composition of fuel [5], so combustion product itself bound fuel compounds sharply influence used materials in active a part of engine. harm mechanisms have totally different origins and square measure primarily wear, temperature, and fatigue connected. Among the fatigue damages, thermal fatigue and mechanical fatigue, either at space or at warmth, play a outstanding role [6,7]. Also, analysis of the piston thermal behaviour is very crucial in coming up with additional economical engine [8,9].The aim of the article is to see the reason for lorry piston combustion engine harm.

2. BROKEN PISTON CHARACTERIZATION AND USED EXPERIMENTAL

Procedures 2 broken pistons of lorry combustion engine were used for analysis. The broken pistons in engine were modified before automobile had done ten thousand metric linear unit. each broken pistons were exhausted same in active and also the most exposed elements of piston (Fig. 1) and in sideway of piston (Fig. 2). Crack occurred closely (red arrows) to burnout elements that detached from piston pivot up to the central a part of active piston space. The burnout places and conjointly form of the crack were identical in each cases of broken pistons. The origin of harm make up my mind victimisation large and microscopic analysis (optical and scanning negatron microscopy) of broken pistons.

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Fig:-1 Burnout place and crack in active part of piston

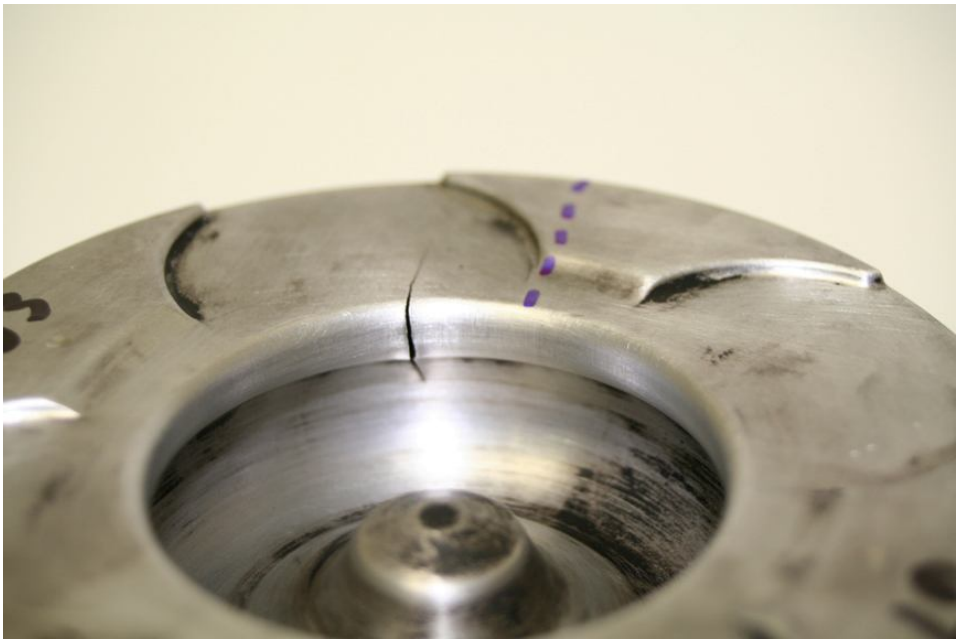

Fig:-2 Place of burnout sideway of piston and crack propagation

For microscopical analysis piston was delve additional elements that were subject to analysis. elements for microscopical analysis were ready customary metallographical procedure while not etching. For scanning microscopy fracture surfaces and elements of piston joined with degradation harm were clean in propanone victimisation ultrasound. The analysis was meted out by suggests that of TESLA SB three hundred scanning microscope.

3. LARGE ANALYSIS

Two base options of piston degradation (except abrasion) were known by visual investigation of harm piston combustion engine. initially the crack was created that rose up to the opening into piston pivot (Fig. 2) and stopped virtually at the center active piston half. The second feature was comparatively huge burnout holes in active and conjointly sideway a part of the gear piston. The ring was joined with piston in burnout place, distinctively abrasively worn and broken. as a attributable to the burnout localization near the crack it can't be expressed that burnout was instigator of piston harm however burnout was result of crack formation and its propagation in exhibition method of piston. in this case attention was targeted on crack that had an equivalent form in each broken combustion engine pistons. External cylindrical surface was worked on the bottom of morphology by roughly latheturning. Probably, cutting implement caused tearing out of fabric by wrong machining parameters in hole place for piston (Fig. 3) from

hole edge for piston pivot (green arrows) in consequence comparatively sharp and enormous notches were created at that place. That approach broken hole edge had result because the initiation place for formation of scissure that when achieving hole for leading away excess oil from wipeable ring and later propagated in its direction. That documents Fig. four wherever fast modification is seen within the orientation throughout crack propagation. Material is within the closeness of that hole weakened what permits its next propagation up to the active piston half. during this place high temperatures and pressure result for material of piston. Fuel mixture was entering into material volume by the crack what caused conjointly native melting down of fracture surface and by medium pressure caused its removal through crack and also the weakest section out of piston material.

Fig:-3 Split off piston edge of pivot after machining

4. MICROSCOPIC ANALYSIS

Microstructure of piston solid was analysed in bottom, middle and active a part of piston. all told 3 areas microstructure was shaped by base matrix on the premise of metallic element primary solid solution, sharp-edge Si particles and interdendritic areas were crammed by eutectics. On the bottom of microstructure it will states that it's alloyed hypereutectic Al-Si alloy [10]. Microstructure of active piston half is documented in Fig. 5, its middle half is given in Fig. six and bottom a part of piston is shown in Fig. 7. Microstructural heterogeneousness in individual piston elements is discovered in pictures. In Fig. eight fracture surface in situ of the scissure initiation will be seen. Typical fatigue (relaxation) lines were discovered in fracture surface that proceeded from place of initiation fracture during this case from place wherever elements of fabric were torn out from surface throughout machining. Groove for safety ring of piston pivot was located in left higher a part of image.

Fig nine documents micrograph of external machined surface that contains tracks caused by cutting implement. Places were discovered in edge (left) wherever material was torn out throughout machining of surface. Same harm (tearing out) was discovered in opposite aspect of hole for piston pivot

5. DISCUSSION AND CONCLUSION

On the bottom of meted out analyses it will be expressed that the foremost grounds of piston harm throughout exhibition method is caused by wrong machining parameters of external cylindrical piston surface. elements of fabric were torn go in hole place for piston pivot throughout machining. This place is cyclically conjointly dynamically strained throughout the activity of engine whereas role itself plays conjointly natural action of fabric of piston. As microscopic analysis showed within the microstructure of combustion engine piston comparatively huge particles of primary and mixture origin occurred that support the fabric to tear out when impact of tool. The tearing out of little material particle in edge hole junction rectifier in consequence of alternating loading to initiation and consequent quick scissure propagation that continued in direction of the smallest amount material resistance of piston, i.e. in direction of channel that serves for conducting away excess oil deflated by wipeable ring from combustion engine cylinder. following consequence of created crack was formation of the burnout. The fuel that was equipped into combustion area

over piston penetrated by result of pressure by crack into material piston volume and through its igniting it in all probability causes native warming and later melting down of surface fracture. within the method of your time burning out of piston happened by approach of recurrent pressure of burning fuel. dissolved down material had result as abrasive that wore piston rings in burnout place. The conclusion states that in whole production method conditions of individual technological operations square measure required to respect. Not respecting of outline conditions will cause harm of part and it suggests that to distinctive decrease of time period and truly to complete destruction of constructional unit that half is part [11].

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