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Design And Analysis Of Gang Lock Nut Socket For Rear End Oil Seal In Three Cylinder Diesel Engine

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Abstract: Diesel engines are used to various automobile vehicles. It's the large number of vehicles sold in India at every year. As in case of three cylinder diesel engines assembly, the most time consuming process is the fixing of rear end oil seal for the crank shaft. This is a most important stage and if we can't do this fixing, due to the leakage and vibrations in the engine, it would make them cheese. So they are fixing this oil seal by tightening several numbers of bolts to the cylinder block. In this operation, they are tightening nine bolts individually one by one and in a particular sequence. It can take more time depending upon the labor's efficiency. Our main aim of this work is an innovative thinking of tightening the nine bolts together. It doesn't need a skilled labor and more over its time consumption is very less. We can achieve this by using gears, bearings and shafts. They are assembled together to transmit the power from one single input to nine outputs. This is having a lot of advantages and uses. It is a new dimension for tightening the bolts. They are called as gang nut runner handle.
KEYWORDS: Gang Socket nut, oil seal, Nx-nastran, wrench and Efficiency

I. INTRODUCTION

The present invention relates generally to the field of removal and replacement of oil seal, and more specifically to a device for removing and assembling all of the gang nuts on the engine rear end oil seal simultaneously. Alternatively, a specialized gang nut tool with a lock nut socket and long shaft for leverage is used to remove lock nuts. This method also requires that each nut be removed individually. A tool that allows all of the lock nuts on a wheel to be removed at the same time would greatly reduce the amount of time required for oil seal are removed. The present invention provides such a tool, by taking advantage of different sized gears.

A gear can be described as a toothed wheel or cylinder that is used to transmit rotary or reciprocating motion from one part of a machine to another. The simplest gear is the spur gear, a wheel with teeth cut across its edge parallel to the axis. Spur gears transmit rotating motion between two shafts or other parts with parallel axes. In simple spur gearing, the driven shaft revolves in the opposite direction to the driving shaft. If rotation in the same direction is desired, an idler gear is placed between the driving gear and the driven gear. The idler revolves in the opposite direction to the driving gear and therefore turns the driven gear in the same direction as the driving gear. In any form of gearing the speed of the driven shaft depends on the number of teeth in each gear.

Internal, or annular, gears are variations of the spur gear in which the teeth are cut on the inside of a ring or flanged wheel rather than on the outside. Internal gears usually drive or are driven by a pinion, a small gear with few teeth. A rack, a flat, toothed bar that moves in a straight line, operates like a gear wheel with an infinite radius and can be used to transform the rotation of a pinion to reciprocating motion, or vice versa. Silent operation: In a helical gear train, the teeth engage a little at a time rather than the entire face at once. This causes less noisy power transfer in case ofhelical gears. Strength: For same tooth size (module) and equivalent width, helical gears can handle more load than spur gears because the helical gear tooth is effectively larger since it is diagonally positioned. Simple helical gearing has the disadvantage of producing a thrust that tends to move the gears along their respective shafts. This thrust can be avoided by using double helical gear. A large gear that drives multiple smaller gears around its periphery would allow multiple sockets to be turned with a single ratchet. There is a need in the industry for such a tool that would reduce the amount of time required to remove and assemble the rear end oil seal in engine for heavy vehicles and trucks. [1] McIntire, Wayne L.; Malott, Richard C. general motors corp. Indianapolis Ind Allison div advancement of helical gear design technology by the investigation of four geometric variables indicated that the endurance strength was significantly affected by changes in pitch diameter and pressure angle. These effects were in some instances greater than those predicted by bending stress calculations. The

effects of fillet size and fillet configuration full form or protuberance were not significant with respect to the endurance strength of the configurations tested. Stress calculations did not accurately consider the fillet configuration. A basic material strength curve for carburized AMS-6265 was established by R. R. Moore specimens. This strength curve correlated very closely with the AGMA method of calculating stress. By averaging all fatigue test data points, a design S/N curve was established. For design purposes, 1-percent failure endurance strength of 102,000 p.s.i. was also established. Of the five strength formulas investigated, the AGMA bending strength formula provides the most accurate method for assessment of helical gear tooth bending strength. The limited dynamic testing conducted indicated that a dynamic factor for lightweight aircraft gears should be considered for applications with a pitch line velocity over 8000 feet/minute. A centrifugal speed factor is necessary for high pitch line velocity applications. A modification is required to the Dolan-Broghamer stress concentration factor used in the AGMA formula to consider tooth geometry more accurately. The AGMA formula modified to incorporate a centrifugal speed, a high speed dynamic factor, and to use R. R. Moore material strength data will produce an accurate estimate of gear tooth bending stress and life. [2] Larry Boston., Joseph M. Kress General Electric Company Multi- nut socket tool using helical gear by A device for simultaneously removing or replacing all lock nuts from a oil seal where in a driving force provided at one location causes multiple lock nut sockets to rotate thereby simultaneously screwing or unscrewing all of the lock nuts attached to the engine. The device comprises a lock nut interface plate that rotatively holds the multiple lock nut sockets around a perimeter of the lock nut interface plate. The sockets are positioned so that there is a one to one correspondence between the sockets and the lock nuts to be removed or replaced. The device also comprises a turning force interface plate which has a central gear that when rotated transfers a rotational force to each lock nut socket of the lock nut interface plate. The central socket comprises a gear with a hole or slot in the center for receiving a turning tool, which can be a hand tool or a power tool. The turning tool provides the rotational force and teeth on the circumference of the central gear mesh with teeth of smaller lock gears that subsequently turn the lock nuts of the lock nut interface plate. Plate connectors provide a releasable connection between the lock nut interface plate and the turning force plate. The lock nut sockets of the lock nut interface plate can be removed and replaced with different sized sockets when required. Alternatively, different lock nut plates each plate having different sized sockets can be provided. The device can also be mounted on a wheeled jack thereby providing ease of movement for the device around a garage, for instance. The jack is used for raising and lowering the device to desired heights and may optionally include a turning force that provides the rotational force to the central gear. In an alternative embodiment the two plates are contained in one housing and the release pin is used to
temporarily disengage the lock sockets from the lug gears so that they may be freely rotated to seat the sockets over the lock nuts to be removed. In another alternative embodiment the gears and sockets are again contained inside one housing. However in this embodiment the lug gears are rotatively held by a luggear plate that surrounds the bases of the lock gears. When the release pin is pushed, the luggear plate moves downward disengaging the lug gears from the central gear. The lug sockets may then be freely rotated to seat the sockets over the lock nuts to be removed. It is an object of the present invention to provide a time saving device to mechanics and others that routinely remove and assemble the rear end oil seal in diesel engine.

A. Summary of the Invention

A device for simultaneously removing or replacing all lock nuts from a engine rear end oil seal where in a torque force provided at one location causes multiple lock nut sockets to rotate thereby simultaneously screwing or unscrewing all of the lock nuts attached to the oil seal.

The device comprises a lock nut interface plate that rotatively holds the gang lock nut sockets around a perimeter of the lock nut interface plate. The sockets are positioned so that there is a one to one correspondence between the sockets and the lock nuts to be removed or replaced. This process are operating in opposite direction when the nut are assembled tight the nut of oil seal. The device also comprises a turning force interface plate which has a central gear that when rotated transfers a rotational force to each lock nut socket of the lock nut interface plate. The central socket comprises a gear with a hole or slot in the center for receiving a turning tool, which can be a hand tool or a power tool.

The turning tool provides the rotational force and teeth on the circumference of the central gear mesh with teeth of smaller lock gears that subsequently turn the lock nuts of the lock nut interface plate. Plate connectors provide a releasable connection between the lock nut interface plate and the turning force plate.

B. Objective of the Work

Gang spindle nut runners also are one of the most exclusive and highly demanded products of our company which we are not only

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manufacturing but also are extensively supplying in several regions of the country. These gang spindle nut runners are generally used for the purpose of fastening and fitting of the nuts in various machinery and appliances in an efficient and convenient manner. We have used most excellent quality raw materials for the manufacture of these gang spindle nut runners with all the latest and advanced technologies inbuilt. Conventional prices, Durable and tensile, Easy to understand and operate, Superb construction and Reliable and efficient.

C. Application

Gang nut runner are operated by the pneumatically powered rotary nut- runner including an output spindle is adopted for engagement with a threaded fastener, a first drive shaft carrying sun gear otherwise planetary gear are rotate surrounding gear are planetary gear used to industry application. gang nut runner is used to tight more number of bolts at a time. Generally they are mainly run by electrically powered or manually operated. They are having power source of hydraulically operated and pneumatically operated in the already available gang nut runner are driven their separate spindles by power given to the each spindles separately. It is usage in manufacturing industries and large scale company. It reduces the time consuming And also it increase the production rate. It requires only less labour work.

II. PROBLEM IDENTIFICATION AND RECTIFICATION

In this existing system of fixing of rear end oil seal of the crank shaft is one of the most time consuming process. First of all put the paste and the gasket. After that we fix the oil seal to the cylinder block and put the nine screw/bolts in the holes, make some turns by hand. And then go for the pulse tool for tightening the bolts. These can be done in a particular sequence. After that we can ensure the torque by using the torque wrench. In this system it is consuming more time. And due to the laziness and unskilled labors operations the sequence of the tightening of the bolt is missed. This reduces the productivity of the engine manufacturing. This time of tightening of the nine bolts according to the labors skill normally varied upto 15-18 secs. This is our problem we can go for analysis and get the solution. From these things the production rate decreases rate decreases from 300 engines to 280 or 270 engines. As we calculated for the year basis, the loss will be a makeable one. This will lead to fall of production. As we gone for the analysis and got very sharp idea of tightening the various number of bolts at the same time. We go for the gang nut runners .This will reduce the working time of tightening the bolts. This doesn't require any special sequence. Reduces the workers ability to do work. It reduces the time taken by the single nut runners between half of the time by gang nut runners. This can be shown in detail by following chapters.

III. GANG-NUT RUNNER

Gang nut runner is used to tight more number of bolts at a time. Generally they are mainly run by electrically powered or manually operated. They are having power source of hydraulically operated and pneumatically operated in the already available gang nut runner are driven their separate spindles by power given to the each spindles separately. The existing model of gang nut runner is shown below

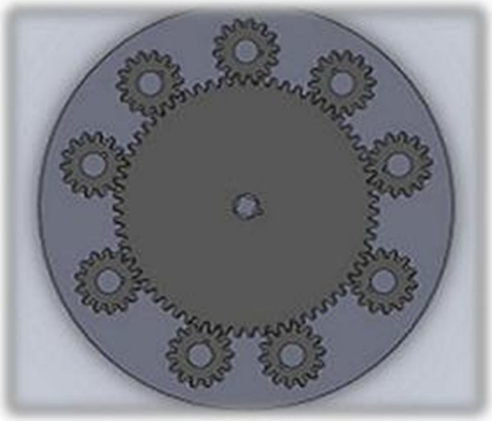

Fig.3.1 Gang-nut runner

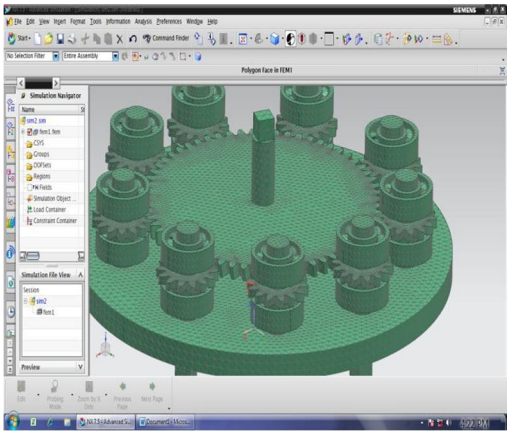

Fig.3.1.1 Nx-nastran simulation

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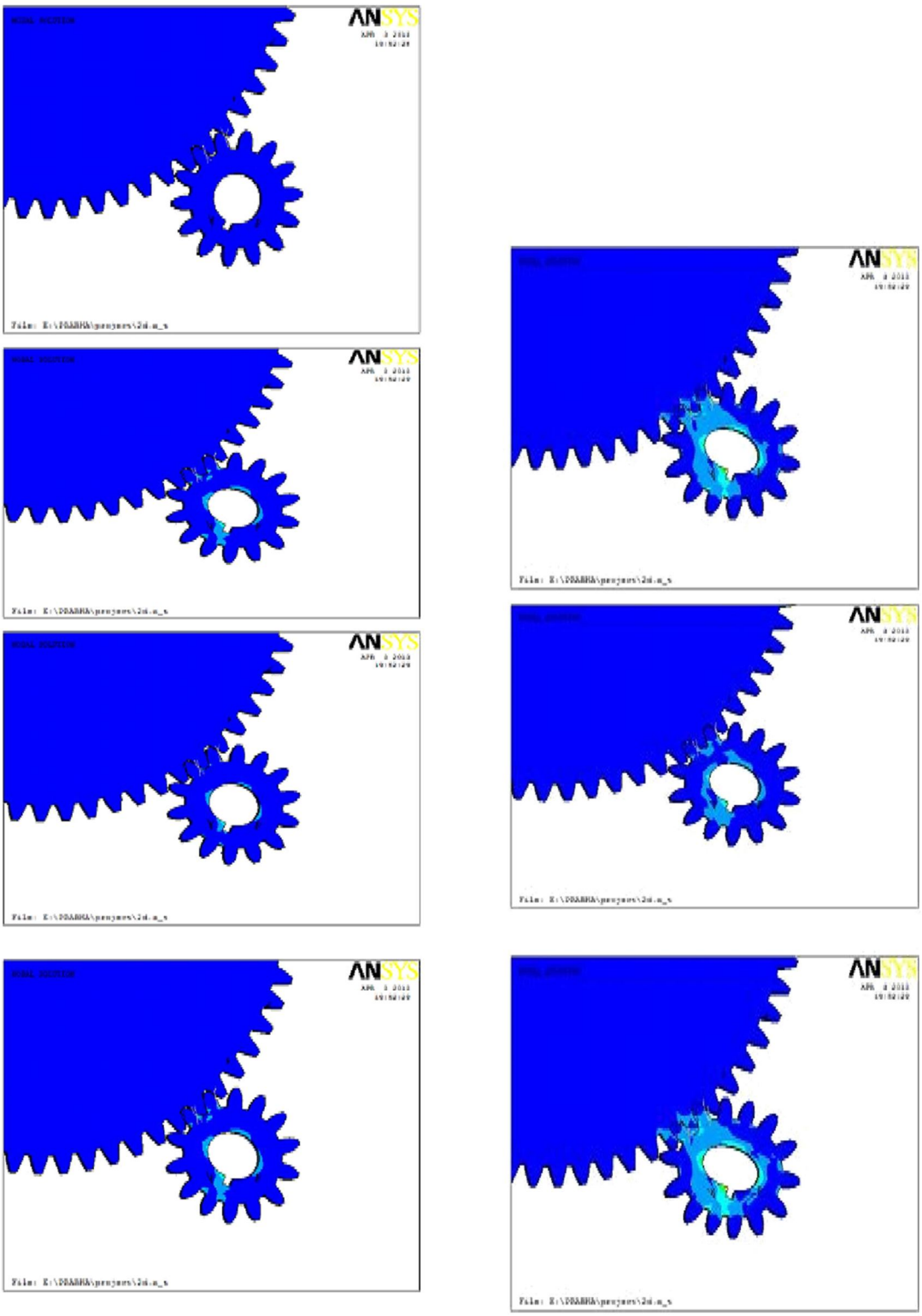
A. Analysis in ansys stress diagrams



IV. DESIGN PROCESS

To select gears from a stock gear catalogue or do first approximation for a gear design select the gear material and obtain a safe working stress.Determine the input speed, output speed, torque to be transmitted.Select material for the gears.Determine the safe

working stresses.Determine the allowable endurance stress.Select the module value and determine the resulting geometry of the gear.Use the lewis formula and the endurance formula to establish the resulting face width.If the gear proportions are reasonable then-proceed to more details evaluations

V. DESIGN CALCULATION

Gear ratio i = 4.28

Selection of mate rial:
For both pinion and gear are alloy steel 40 Ni 2 Cr 1 Mo 28 can be selected consulting table of data book.

VI. CONCLUSION

Hereby we concluded that multi- nut runners are the very easy and much more efficient as compared to the manually operated or other machine operated runners. Single spindle nut runneris having more number of repeated processes as compared to multi- nut runners. In our multi nut runner we reduce the worker fatigue stress. It reduces the time consumption of doing that process. Thus, by doing this project the company will be beneficial in increasing their productivity &there by reducing time consumption.

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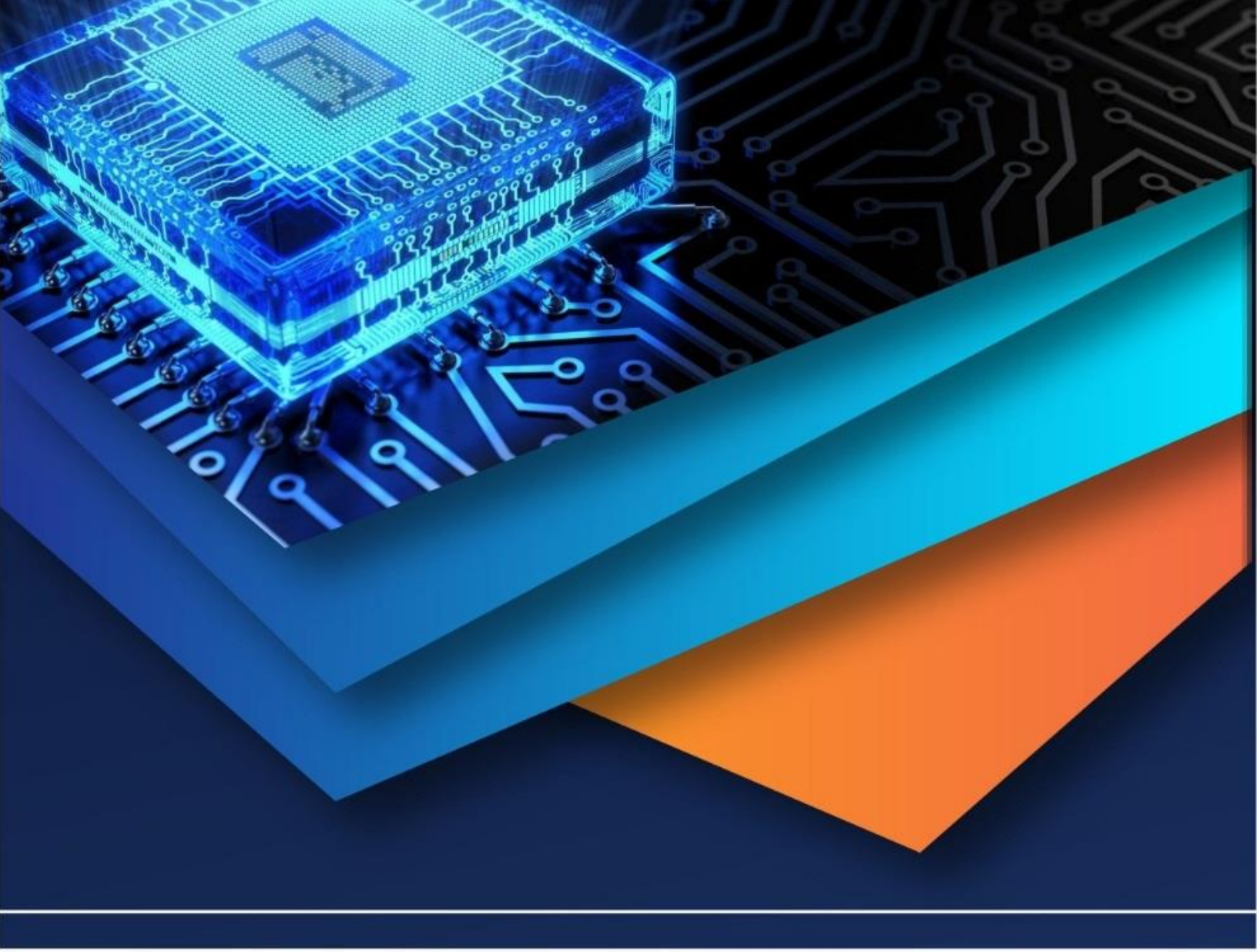

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