

Conclusions

The sum of the shafts has 62% of entire cone guard, the 14% are deteriorated, while 23% of the shafts are without cone guards. Shafts with less than 2 years have 92% intact cone guards and in good condition. Interviews have revealed that the presence of the cone guards makes particularly difficult for coupling to the machine tool, this is due to limited space between the cone guards and the PTO protection shield

Moreover, the total number of shafts has 63% of the entire telescopic tubes, 19% have deteriorated tubes and 17% without telescopic tubes. The shafts with ages between 2 and 7 years show intact telescopic tubes or slightly deteriorated compared to older ones.

72% of the total of PTO drive shafts do not have the restraining device, while 28% has got them. The drive shafts from the first age group (less than or equal to 2) have a higher percentage of presence of chains than older ones.

Regarding the pictograms, the 54% of the shafts has pictograms unreadable, 46% had read pictograms. The newest drive shafts exhibit higher percentage of read pictograms.

In conclusion, any mechanical device with use and age, are prone to wear, but as noted, the tendency of users is to replace and carry out proper maintenance of this tool useful to man, but extremely dangerous. To reduce the immediate risks associated mechanical PTO drive shaft, it may be provided for all operators in the agro-forestry, appropriate training and information on how to use, maintenance, conservation and above all the risks associated with it. For the future it is hoped that, with technological innovation, we can design systems to block the operation of the moving parts of machinery, equipment and safety devices that have damaged or absent.



Experimental Survey on Maintenance and Safety of Tractor PTO Drive Shafts in Central Italy

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Introduction

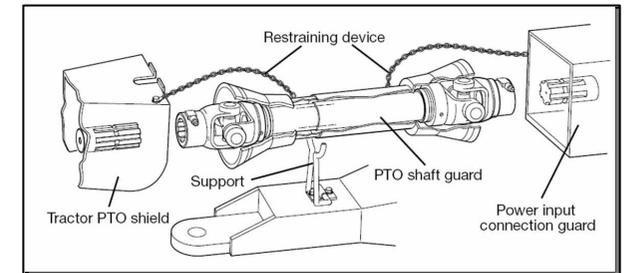
Between equipment frequently used in agriculture, the PTO drive shaft deserves special attention and it plays a central role, both for its dissemination and for the serious implications of risk that characterize potentially use. The aim of the research is to analyze the propellers shafts in a sample of 52 farms, situated in the province of Viterbo.

For each drive shaft was evaluated:

- the presence and efficiency of safety devices;
- the maintenance mode for storage;
- the possible difficulties in the use phase.

The safety devices of a drive shaft are:

- the cone guard;
- the telescopic tube type guard;
- the restraining device;
- the pictograms.



Cone and tube type guard (source: HSE)

The terminal cone guards are sized to cover only the internal drive shaft forks or in the case of wide-angle shafts outside the center of the joint. Appropriate and similar protection (covers, caps, shields) are necessary and they have to be present both on the machine and on the tractor: particularly, as required by EN 1553:2001, these protections should overlap those the propeller shaft for least 50 mm when the gimbal is aligned. A safety guard for drive shafts can not be marketed unless it has been approved according to existing standards (EN 1152).

Materials and Methods

According current legislation, each drive shaft must be accompanied by details of: manufacturer name (stamped), model, year of construction and CE mark (stamped), side to connect the tractor (stamped), notices danger (label). Each drive shaft must always be provided of its use and maintenance manual, which contains the following information: manufacturer and declaration of conformity, conditions, instructions for installation, for the replacement of its protections devices, for maintenance (such as periodicity and greasing points), similar instructions as regards special joints and their conditions.

In this research the law was taken into reference:

- Machinery Directive (2006/42/EC)
- Legislative Decree no. 81/2008
- UNI EN 12965
- EN 12965
- EN 1152
- UNI 1152



According to standards requirements and statistically achieved in this work was completed an acquisition card data for each drive shaft: for a total of 52 companies were drawn 98 cards. The information contained in the card are: brand name, model, year of manufacture, greasing interval, but especially the presence or absence of protectors, pictograms and of the CE mark. Was also detected the location, extent and address manufacturing companies, keeping them in anonymity for privacy reasons. The farms visited are located in the province of Viterbo. Production on farms concern cereals, fodder, olives and hazelnuts.

Results and Discussion

Data processing has provided analysis of the conditions of each drive shaft safety device in the various farms under study. Farms were grouped by extension of the surface (S): small (less than 5 ha), medium (between 5 and 20 ha), and large (more than 20 ha).

	S < 5 ha nr. PTO drive shafts	5 < S < 20 ha nr. PTO drive shafts	S > 20 ha nr. PTO drive shafts
Use and maintenance manual	12	21	19
Greasing	14 every 8 hours 12 every 10 hours 6 every 15 hours	17 every 8 hours 12 every 10 hours 1 every 15 hours	20 every 8 hours 15 every 10 hours 1 every 5 hours
Storage	21 connected, 9 not connected	18 connected 13 not connected	23 connected 14 not connected
Defects reported	No defects	23 no defects 6 problems in mounting and dismounting	10 problems in mounting and dismounting

Summary of technical cards

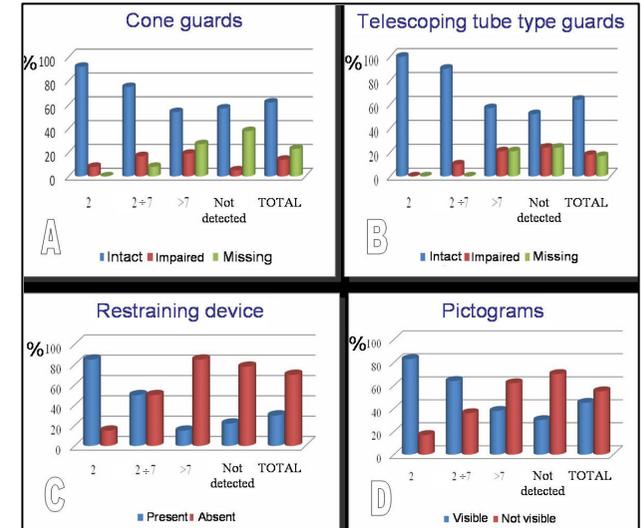
The number of shafts at the farms varies from a maximum of 10 to a minimum of 1. It was noted that most of small and medium companies have between 3 and 4 shafts.



On the basis of information gathered with the data acquisition was possible to study what changes the efficiency of various safety devices in the age of the PTO drive shaft. To facilitate the statistical analysis were grouped according to age: less than 2 years, between 2 and 7 years, more than 7 years of age and those not detected.

Statistical results*:

- percentages of shafts with intact cone guards, impaired and missing cone guards depending the age of the drive shaft
 - percentage of shafts with intact telescoping tube type guards, impaired and missing telescoping tubes
 - percentage of shafts having the restraining device
 - percentage of shafts having visible pictograms
- *on X axis the age of the PTO drive shaft



Scheda tecnica #C...5	
Albero Cardanico	
Indirizzo dell'azienda: CEREALICOLA FORAGGERIO Località TUSCANIA (Cardarelli) Data del rilievo: 27/01/2010	
Albero cardanico n.	5
Marca	BONDIOLE PAVESI
Modello	399072000
Anno di fabbricazione	1997
Tipologie di trattori Associate all'albero cardanico	FIAT 680 DT
Attrezzature associate all'albero cardanico	
Libretto d'uso e manutenzione	SI
Scudo di protezione	SI
Catenelle di ritegno	SI
Pictogrammi	SI
Marchio CE	SI
Stato dei dispositivi di protezione	BUONO
Presenza del registro di manutenzione	NO
Tipologia di manutenzione effettuata	INGRASSAGGIO: OGNI 8 ORE LE CROCIERE, OGNI 16 ORE L'ASSE DELL'ALBERO OGNI 50 ORE SMONTAGGIO EPULIZIA COMPLETA
Modalità di immagazzinamento in fase di non utilizzo	RIPOSTO IN GARAGE ATTACCATO ALL' ATTREZZO
Presenza dei DPI consigliati	GUANTI E SCARPE ANTIFORTUNISTICHE
Descrizione tecnica ed uso in azienda	DA FERMO VIENE AGGANCIATO AL TRATTORE
Modifiche apportate	NON E' STATA APPORTATA NESSUNA MODIFICA CHE POSSA COMPROMETTERE LA STRUTTURA ORIGINARIA DELL'ALBERO CARDANICO
Stato di uso	DISCRETO
Eventuali difetti di funzionamento segnalati	NESSUNO