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Safety and working conditions

All rotating parts must be guarded.
The tractor master shield, the driveline guards, and the implement input connection shields form an interactive guarding system.

Proper use and maintenance of the driveline and shielding is of primary importance for operator safety. A high percentage of driveline accidents occur when safety shielding is missing or does not function properly. Bondioli & Pavesi recommends the use of proper shields and guards for the driveline, tractor, and implement. Damaged or missing components must be replaced with original equipment spare parts, correctly installed, before using the driveline. Use the implement only with the original driveline. The implement input connection shield must be compatible with the driveline and the application.

To comply with international safety standards, the implement manufacturer shall provide safety sign(s) and instructions stating that guards must be kept in place and the machine should not be operated with guards open or removed. These sign(s) should be used to draw attention to the possible risks when the guard is unlocked, opened, or removed.

In addition it is recommended that the implement manufacturer provide a list of the guards, their corresponding warnings, their positions, and spare parts codes in the instruction manual. Basic information for safe and correct use of the driveline and shielding are shown in our catalogs and in the instruction sheet provided with Bondioli & Pavesi drivelines. Safety labels and user’s manuals in alternative languages are available to meet local requirements.

THE ABOVE INFORMATION CONCERNS YOUR SAFETY.
Safety and working conditions

Use the implement only with the original driveline, which is compatible in length, power capacity, torque limiters, overrunning clutches, and shielding. The driveline and safety devices are designed specifically for the implement, and should be used exclusively for this purpose.

Do not exceed the speed and power limits given by the operator’s manual. Drivelines, torque limiters, and overrunning clutches in this catalog are designed to be used at speeds that do not exceed 1000 min\(^{-1}\).

Do not overload the implement or suddenly engage the PTO clutch. Any torque limiter or clutch should be installed on the implement end of the driveline. Use the driveline, torque limiters, and overrunning clutches only for their intended purpose.

All rotating parts must be guarded. Contact with a rotating driveline can cause death or serious injury. The tractor master shield, the driveline guards, and the implement input connection shield form an interactive guarding system.

Ensure that all driveline, tractor, and implement shields are functional and in place before operation. Damaged or missing parts must be replaced with the original equipment spare parts, correctly installed, before using the driveline.

Disengage the PTO, turn off the tractor engine, remove the key, and check that all rotating parts have come to a standstill before approaching the implement or performing maintenance work.
Safety and working conditions

Do not approach, nor allow bystanders to come near the work zone or rotating parts. Do not wear loose clothing, jewelry, hair, or anything which could get caught in the machine. Contact with rotating parts could cause serious injury or death.

Do not stand, lean, or otherwise come in contact with the driveline. Do not step over or go under the driveline.

Keep the profile tubes overlapped as much as possible during transport and operation or rotation. Do not exceed the values given in this catalog for permissible length extension. If greater telescoping ability is required, contact Bondioli & Pavesi engineering.

Always hitch the tractor to STATIONARY MACHINERY (pumps, hoists, generators, dryers, etc.). Chock the tractor wheels to prevent rolling and check that joint angles are small and as equal as possible.

Always hitch the tractor to STATIONARY MACHINERY (pumps, hoists, generators, dryers, etc.) so that the profile tubes are not overextended. Under all working conditions, extension of the driveline should not exceed the values reported in this catalog. All rotating parts must be guarded.
Safety and working conditions

SINGLE CARDAN JOINTS
When operating, ensure that angles $\alpha_1 = \alpha_2$ are small and as equal as possible. The joint angles may vary widely during turns, but must never exceed 35° under power or 45° while rotating. Disengage the PTO when the joint angles become excessive or too unequal. See “Driveline applications” for more information.

CONSTANT VELOCITY JOINTS
Constant velocity joint can allow large joint angles -up to 50° or 80° depending upon the type. These joint angles should only be allowed for brief periods, for example during turning.
For drivelines with a constant velocity joint on the tractor side and a single cardan joint on the implement side, the maximum recommended angles of the single joint are 16° at 540 min$^{-1}$ and 9° at 1000 min$^{-1}$ to prevent irregular motion. See “Driveline Applications” for more information.

Attach the shield restraint chains, allowing sufficient slack for the driveline to move during turns and operation.
Best results are achieved when the chains are attached nearly perpendicular to the driveline guard. Adjust the length to allow articulation of the driveline in working or transport positions, but avoid excessive slack that may wrap around the driveline.
When used at night or in poor visibility, illuminate the driveline operating area.
Safety and working conditions

The tractor printed on the shield indicates the tractor end of the driveline. Any torque limiter or overrunning clutch must be installed on the implement end of the driveline.

Ensure that the driveline is securely attached to the tractor and the implement before operating. Check that all bolts or nuts are properly torqued.

Friction clutches may become hot during use. **Do not touch!**
Keep the area around the friction clutch clear of any material which could catch fire and avoid prolonged slipping.

Never use the shield restraint chains to support the driveline for storage. Always use the support on the implement.

Keep the driveline horizontal during handling to prevent the halves from sliding apart, which could cause injury or damage the shielding. Use suitable means to transport the driveline, depending on the weight.
Safety and working conditions

Always wear adequate safety equipment when performing any maintenance or repair work. Replace worn or damaged components with the original Bondioli & Pavesi spare parts. Do not alter or tamper with any driveline component. Contact an authorized Bondioli & Pavesi dealer concerning any operations not described in the instruction manual.
Farming is undergoing a period of tremendous change: market globalization has intensified competition demanding higher and higher levels of productivity, which in turn require more powerful, efficient and reliable machinery.

Improvements in farm productivity have occurred with the application of appropriate technologies. The traditional farmer is also changing, assuming the role of a business manager, leaving the machines to be operated by employees or hired hands. For these reasons, machines must be inherently safe and easy to use, and they must require little maintenance.

International safety standards and regulations provide important guidelines and are continually updated. The wealth of expertise accumulated by Bondioli & Pavesi in regards to driveline safety is at the basis of Global drivelines and accessories. Global drivelines comply with existing standards and regulations, as well as those under development.

Global drivelines are designed to respond to the user’s needs: reliability, low weight (with equal performance), easy installation and simplified, long-lasting lubrication.

Global drivelines are based on the experience Bondioli & Pavesi has gained in the design and manufacture of drivelines and accessories since 1950.

Constant research and exclusive production techniques, combined with stringent testing and quality control, have enabled Bondioli & Pavesi to obtain high levels of performance in a compact driveline.
Cross kits: designed and built for farming applications

Global drivelines are born of the expertise Bondioli & Pavesi has acquired through years of designing, testing and manufacturing cross kits and needle bearings in its own factories. This expertise has allowed us to create technically advanced cross kits that are perfectly suited for their intended use on agricultural equipment. Most of the cross kits available today are designed for industrial applications where the volume is much larger than the farming sector. Both utilize universal joints but industrial applications are quite different. Agricultural drivelines are subjected to high and fluctuating torque loads and require heavy-duty components. Working angles tend to be large and variable, unlike industrial settings where joint angles are generally small and almost never change.

Different working conditions produce different stresses on the cross kit; that’s why components specifically designed for farming applications achieve the best results.

The chief design objectives for cross kits are: higher strength trunnions on the cross, increased needle bearing life, and longer lubrication intervals.

Bondioli & Pavesi’s experience provided the technical background for the design of the cross kit and how to test them properly. Production quality is constantly monitored and maintained with state-of-the-art manufacturing processes and heat treatment methods.

Maintaining direct control in every stage of production, from design to finished cross kit, ensures products that provide extraordinary performance in a compact size, thereby improving driveline function.
Agricultural machines are often employed in harsh working environments - dust, dirt, and dampness can shorten a driveline’s life. Effective sealing is essential: to retain lubricants and protect from contamination by foreign elements.

Cross kits have needle bearings with double-lip seals designed to prevent contamination of the lubricant in severe working conditions, typical of farming applications. The seals allow excess grease to purge without damage during re-lubrication.

Bondioli & Pavesi analyzes cross kits using specially designed test fixtures. Data provided by these tests is used to optimize the shape, material, and heat treatment used for all the components of a cross kit - needles, cups, seals, and crosses.

Designed and manufactured in this manner, cross kits may allow extended lubrication intervals of 8 to 50 working hours, for most applications. Lubrication can be done on a weekly basis instead of every day, thereby resolving one of the most demanding user requirements.
GLOBAL Drivelines and accessories

**End yokes**
Safety and practicality were main objectives in designing SFT end yokes and the means to couple them to power take-off (PTO) shafts – sturdy, user friendly, and consistent with international safety regulations.

**Push-pin yokes**
The push-pin yokes provide sturdy and reliable coupling to PTO or implement shafts. The push-pin mechanism is easy to understand, easy to use and no tools are necessary. The pin is encircled by the hub’s rounded profile, eliminating protrusions as recommended by international safety standards, but remains easy to access.
Ball collar yokes
Ball collar yokes make it easy to connect (or disconnect) the yoke to the PTO or implement, quickly and without the use of tools.
Coupling is secured by hardened balls or spherical pins that engage the annular groove in the splined shaft. A spring-loaded collar controls the radial movement of the balls or pins.
The coupling elements are arranged symmetrically to uniformly distribute thrust forces generated by a telescoping driveline. Yokes can be converted from conventional (RT) to automatic (RTA) ball collar connections with the appropriate kit.
Global Drivelines and accessories

Automatic ball collar yokes
A special device in the collar makes it easy to connect and disconnect the yokes, automatically retaining or releasing the collar when the balls are in the correct position. This leaves both hands free to hold the driveline and align the yoke to the splines when connecting or disconnecting the driveline to the PTO. Standard RT ball collar yokes may be converted to automatic RTA yokes by replacing the collar kit.

Before slipping the yoke onto the implement shaft, the collar is pulled into the open position until it engages and is held in position by the automatic mechanism. Now both hands are free to maneuver the yoke into position on the PTO and support the driveline. Once the balls contact the splines of the PTO, the mechanism is released and the collar will return to its locked position when the balls engage the annular groove. The automatic mechanism also holds the collar open when disconnecting the driveline from the PTO, again enabling use of both hands to hold the driveline when uncoupling.
**Taper pin yokes**

Farm implements are supplied with a driveline designed and built for the specific application. For this reason, yokes are commonly coupled to the implement shaft with a semi-permanent type of connection. These types of connections usually require the use of tools to install or disconnect. Tapered pins provide a fixed coupling between yoke and PTO. Tapered pin yokes are intended for use on the implement end of primary drivelines (those that connect the tractor PTO to the first implement input shaft), or may be used on either, or both ends of drivelines internal to the machine. The tapered shape of the pin fits snugly into the annular groove of a splined shaft, reducing play between the splines to a minimum.
GLOBAL Drivelines and accessories

Safety equipment
Operator safety is a fundamental aspect of all Bondioli & Pavesi designs. Global transmissions are compliant with international safety regulations. Their simple construction with robust components makes them particularly reliable in operation.

The corrugated outer cone (1) is robust and elastic, and features a hole for greasing the cross. The support ring (2) is fitted to the internal yoke and serves to allow the mechanical assembly to rotate around the shield secured by the chains (3). The base cone (4) connects rigidly to the other parts of the shield.

The outer cone (1) and support ring (2) are rigidly secured to the base cone by self-tapping screws (5).

The tube (6) locks into the base cone so that the entire assembly forms a single unit. The support ring and cross grease fittings are located to facilitate maintenance.

The shields are easy to remove and refit with normal tools. The outer cones cover the internal yokes (as required by Machinery Directive 2006/42/EC) for all ends except for the FFV and FFNV clutches which are available for shafts without CE Mark.

Global transmissions are designed to allow for ample joint working angles before the shield itself obstructs the mechanism.
**Restraint standards and regulations**

UNI EN ISO 5674 and ANSI/ASABE AD5674 standards state that restraints must withstand a load of 400 N, and must detach at the end attached to the shield at loads of under 800 N. Bondioli & pavesi driveline chains meet these detachment requirements. Chains are attached to shields by **S-hooks**.

**Spring link: easy repair of improperly attached shield restraint chains**

Restraint chains can be supplied on request with the Spring Link device. This device includes a clip which can be opened and closed by screwdriver, and a spring hook which detaches from the shield when subjected to the loads described in the standards. Both **S-hook** and Spring Link connections separate the chain from the shield in compliance with UNI EN ISO 5674. If a shield chain with **S-hook** pulls free, the chain needs to be replaced. The Spring Link can be re-attached using a screwdriver.

If the chain length has not been properly adjusted and is too tight, during turning maneuvers the **S-hook** opens and the chain disconnects from the shield. If this happens, the chain has to be replaced. The **S-hook** of the new chain is fastened to an eyelet on the cone and must be closed and round to prevent unintended detachment.

See the section “Safety Shields” for more informations.

To request the chain with Spring Link, add the letter “Z” to the optional position in the driveline code as shown in chapter 2 “Codes and Dimensions”.
GLOBAL Drivelines and accessories

Constant velocity joints: high efficiency, low maintenance

Constant Velocity (CV) joints were first widely used for agricultural applications during the 70’s. CV joints increased the efficiency of towed implements by reducing or eliminating the problems associated with high and/or unequal joint angles during turns. The requirement for tight turns with the implement has dictated a wide range of motion for the centering disc inside the CV joint. This required large apertures in the CV joint body, which risks contamination of the lubricating grease. Until now, CV joints have allowed better maneuverability in the field compared to “equal angle” drivelines, but required frequent lubrication with copious amounts of grease.

The CV’s used on Global drivelines overcome these problems and require regreasing only once a week (see the section on “Lubrication”). In addition, Global drivelines 80° CV joints do not require nearly as much grease as conventional CV joints. Cross kits for Global constant velocity joints also feature the double-lip seal caps, and have the same lubrication interval of 50 hours.
The 80° CV joints achieve this by introducing two closing discs which follow the movement of the centering disc. These discs are not simple floating discs but are specifically designed springs which press against the sides of the housing and the centering disc in order to retain grease and limit contamination.

When the CV joint changes angle, the centering disc moves inside the housing. This movement displaces the grease inside the housing. Due to the sealing action of the closing discs against the centering disc and housing, the displaced grease is pushed through radial ducts in the disc to the centering ball and socket area. Grease is therefore distributed to the centering members of the 80° CV joint by the angular motion of the joint itself.

80° CV joint drivelines function properly when they work mainly in the straight position, but frequently make sharp turns, as illustrated in the section on “Driveline Applications”.

The motion of the centering disc also pushes grease into a hole directed toward the shield bearing groove. The movements of the 80° CV therefore automatically lubricates its own shield bearing.
Global CV joints are guarded in compliance with recent developments in international safety standards and are designed to integrate with the tractor’s master shield, as required by Directive 86/297/CEE, international standard ISO 500 and US standard ANSI/ASABE AD500.

The shield over the CV is connected to the rigid base cone and standard shield bearing. A second shield bearing supports the shield over the central housing of the CV joint. A metal ring helps stiffen the end of the shield cone of the 80° CV joints.

The greasing of Global shafts is designed to be as simple and quick as possible. Grease fittings are aligned and easily accessible so the user can line up the shield holes with the grease fitting to grease all components without fuss.
**Extended lubrication intervals or permanently lubricated torque limiters and overrunning clutches: less maintenance for higher efficiency**

Global drivelines are designed to respond to the user’s needs: reliability, high performance, low weight, easy installation, and less maintenance. These same goals were met with the design of the devices that control torque. The extended 50-hour lubrication interval represents a significant step forward in reduced maintenance requirements. In addition, LB shear bolt torque limiters require lubrication only once a season. All torque limiters and overrunning clutches, either standard 50 hour interval or seasonal lubrication frequency, may be lubricated with NLGI 2 grease.

The Global range includes permanently lubricated LR automatic torque limiters. During assembly, these devices are lubricated with NLGI 2 molybdenum disulphide grease (“moly grease”) and sealed. No further lubrication is required for their entire service life - they are not provided with grease fittings. Torque limiters are normally mounted on the implement end of the driveline, where they are protected by the driveline guard and an overlapping shield. UNI EN ISO 4254-1 and ANSI/ASABE S604.1 standards specify at least a 50 mm overlap.
**The cardan joint**
The cardan joint is an ancient mechanism. In the 16th century, Gerolamo Cardano, an Italian mathematician, described this mechanism, used to hold a compass so that it was no longer affected by the rolling motion of a ship.

Robert Hooke was the next to undertake research into the specifics of universal joint motion and discovered that two joints operating in series with the same joint angle eliminated the uneven motion generated by a single joint.

A cardan joint consists of two yokes connected to a cross by four bearings. A cardan joint transmits motion in an uneven manner when operated at an angle. If the rotational speed of the driving yoke is constant, the speed of the driven yoke varies with the angle of rotation.

The output speed is a function of the input speed and joint angle, and varies as the joint rotates.

\[
\omega_2 = \frac{\omega_1 \cdot \cos \alpha}{1 - \sin^2 \alpha \cdot \cos^2 \beta}
\]

The following diagram illustrates the variation in driven yoke speed during a complete revolution of the joint when the driving yoke speed is constant \( \omega_1 = 540 \text{ min}^{-1} \) and joint angle is 5° or 10°.

For \( \alpha = 0° \), the instantaneous speed of the driven yoke remains constant so \( \omega_2 = \omega_1 = 540 \text{ min}^{-1} \).

When the joint works at an angle, the instantaneous speed of the driven yoke varies continuously, undergoing two complete cycles for each revolution of the joint. For example, for \( \alpha = 5° \), the instantaneous speed of the driven yoke varies between \( \omega_2 = 538 \text{ min}^{-1} \) and \( \omega_2 = 542 \text{ min}^{-1} \). For \( \alpha = 10° \), the instantaneous speed of the driven yoke varies between \( \omega_2 = 532 \text{ min}^{-1} \) and \( \omega_2 = 548 \text{ min}^{-1} \).
Driveline applications

The angle of the cardan joint generates variations in speed; consequently producing accelerations and oscillating torque depending upon the inertia of the driveline and the torque transmitted. These stresses act on the driveline and are transmitted to its supports. In normal working conditions, the angle of the cardan joint must be limited to prevent excessive vibration and stress that can reduce component life. Through experience, we can determine practical limits to the angular acceleration of the driven yoke and from this we can determine the recommended maximum joint angle. We can use one of Hooke’s equations to approximate the maximum angular acceleration of the driven yoke, which is generally acceptable for any practical problems concerning cardan joints. According to this equation, the maximum angular acceleration $A_{\text{max}}$ depends upon the speed of the driving yoke $\omega_1$ and the angle of the joint $\alpha$.

$$A_{\text{max}} = \alpha^2 \cdot \omega_1^2$$

After estimating the largest acceptable angular acceleration, the maximum joint angle can be calculated as a function of the rotation speed.

The recommended maximum joint angles, based on Bondioli & Pavesi’s experience, are listed in the table and diagram below. These values are generally acceptable for agricultural implements, but the final determination of allowable torsional oscillation and accompanying vibration depends upon the specific construction of the implement and its intended use.

The angular acceleration generated by a single cardan joint or by more than one joint with different joint angles requires special attention and must be verified for each specific case.

<table>
<thead>
<tr>
<th>$\alpha_{\text{max}}$</th>
<th>$n$</th>
</tr>
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<tbody>
<tr>
<td>(°)</td>
<td>min$^{-1}$</td>
</tr>
<tr>
<td>16.1</td>
<td>540</td>
</tr>
<tr>
<td>14.5</td>
<td>600</td>
</tr>
<tr>
<td>13.4</td>
<td>650</td>
</tr>
<tr>
<td>12.4</td>
<td>700</td>
</tr>
<tr>
<td>11.6</td>
<td>750</td>
</tr>
<tr>
<td>10.9</td>
<td>800</td>
</tr>
<tr>
<td>10.2</td>
<td>850</td>
</tr>
<tr>
<td>9.7</td>
<td>900</td>
</tr>
<tr>
<td>9.2</td>
<td>950</td>
</tr>
<tr>
<td>8.7</td>
<td>1000</td>
</tr>
</tbody>
</table>
Driveline applications

A single cardan joint is suitable for transmitting power between two shafts with axes that intersect in the center of the joint. They are often used to connect internal shafts within an implement. More often, a cardan joint is used as part of a double joint or driveline. Installation of a single cardan joint is normally made by locking one of the yokes onto the shaft, and allowing the other yoke to move freely in the axial direction to compensate for small amounts of movement between the shafts or deflection of the structure.

A double cardan joint must be used when the axes of the connected shafts do not intersect with the center of the joint.

**Double cardan joint**

The variations in speed generated by a cardan joint operated at an angle can be eliminated by using a second joint, with the condition that the inner yokes are parallel and that the joint angles are equal and in the same plane. This is the situation found with parallel or intersecting shafts.

In both cases, the output shaft speed is the same as that of the input shaft at all times. Therefore, motion is transmitted at a constant velocity.

The central double yoke is subject to stresses generated by the cardan joints operating at an angle.

When the connected shafts and the central double yoke of the double joint are in the same plane, but the joint angles are different, there is a variation in output speed.
In this condition it is possible to define the equivalent joint angle $\alpha_{eq}$ as the joint angle that generates a variation in speed equal to that generated by two or more joints connected in phase.

In the normal arrangement of double joints and cardan shafts, the driving yoke of the second joint is in the same plane as the driven yoke of the first joint. The equivalent joint angle may be calculated as:

$$\alpha_{eq} = \sqrt{\alpha_1^2 - \alpha_2^2}$$

Example: $\alpha_{eq} = 10^\circ$, $\alpha_2 = 6^\circ$

$$\alpha_{eq} = \sqrt{10^2 - 6^2} = 8^\circ$$

If the driven yoke of the first joint is in the same plane as the driven yoke of the second joint, the joint angles must be squared and added together to calculate the equivalent angle. Naturally when the joint angles are equal and the driving yoke of the second joint is in the same plane as the driven yoke of the first joint, $\alpha_{eq} = 0^\circ$. The recommended limits on page 3.2 apply for the equivalent angle $\alpha_{eq}$ as a function of the rotational speed.

The double cardan joint is normally used for connecting internal shafts on agricultural implements. Installation of a double cardan joint is normally made by locking one of the yokes onto the shaft, and allowing the other yoke to move freely in the axial direction to compensate for small amounts of movement between the shafts or deflection of the structure. The central part of a double joint can be a one-piece double yoke:

or two flange yokes:

The flanged double joint is easier to install than a one-piece double joint. The selection of a one-piece or flanged double joint depends upon the particulars of the application and the installation requirements.
**Cardan joint driveline**

The cardan joint driveline consists of two cardan joints connected by telescoping members. Variations in speed generated by the joint angle of the first cardan joint can be eliminated by the second cardan joint on condition that the inner yokes are parallel and the joint angles are equal and in the same plane. These conditions are satisfied in the arrangement of parallel shafts or intersecting shafts.

In each of these situations, the output speed is transmitted at a constant velocity. The telescoping members are still subject to stress generated by the cardan joints working at an angle. For this reason, we recommend using drivelines with joint angles as small as possible.

The previous definition of equivalent joint angle $\alpha_{eq}$ is also valid for cardan joint drivelines.

The following tables give the values for the joint angle of the second joint, $\alpha_2$ max and $\alpha_2$ min, which would generate acceptable total speed variation as a function of the joint angle of the first joint $\alpha_1$ and the rotational speed.

For example, considering a rotational speed of 750 min$^{-1}$ and the first joint angle $\alpha_1 = 12^\circ$, the second joint angle should be between $\alpha_2 = 3^\circ$ e $\alpha_2 = 16^\circ$.

### Parallel Shafts

<table>
<thead>
<tr>
<th>$\alpha_1$ (°)</th>
<th>540 min$^{-1}$</th>
<th>650 min$^{-1}$</th>
<th>750 min$^{-1}$</th>
<th>850 min$^{-1}$</th>
<th>1000 min$^{-1}$</th>
</tr>
</thead>
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<tr>
<td>5°</td>
<td>16°</td>
<td>14°</td>
<td>12°</td>
<td>11°</td>
<td>10°</td>
</tr>
<tr>
<td>7°</td>
<td>17°</td>
<td>15°</td>
<td>13°</td>
<td>12°</td>
<td>11°</td>
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<tr>
<td>10°</td>
<td>19°</td>
<td>16°</td>
<td>15°</td>
<td>14°</td>
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<tr>
<td>12°</td>
<td>20°</td>
<td>18°</td>
<td>16°</td>
<td>15°</td>
<td>14°</td>
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<tr>
<td>15°</td>
<td>22°</td>
<td>20°</td>
<td>19°</td>
<td>18°</td>
<td>17°</td>
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<tr>
<td>17°</td>
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### Intersecting Shafts

<table>
<thead>
<tr>
<th>$\alpha_2$ min acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha_1$ (°)</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>5°</td>
</tr>
<tr>
<td>7°</td>
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<td>10°</td>
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<td>25°</td>
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</table>
The cardan joint driveline is the most commonly used method for transmitting power from a tractor PTO (Power Take Off) to agricultural implement PIC (Power Input Connection). Cardan joint drivelines carry out a very complex function: efficient transmission of power between two shafts that are continually changing their relative positions.

PTO’s have standardized dimensions:
- Type 1: 1 3/8”-Z6 (540 min⁻¹)
- Type 2: 1 3/8”-Z21 (1000 min⁻¹)
- Type 3: 1 3/4”-Z20 (1000 min⁻¹)

in compliance with ISO 500, DIN 9611 and ANSI/ASABE AD500 standards.

Specifications for the driveline are based on the requirements of the implement to which it is connected.

Since the driveline normally stays connected to the implement, the implement connection is often semi-permanent, requiring tools for assembly or disassembly.

The taper pin is the most stable connection for implement yokes and torque limiters. Torque limiters or overrunning clutches should be installed on the implement end of a primary driveline (i.e. the driveline that connects the tractor PTO to the PIC).

Suitable torque limiters protect the implement, the driveline, and the tractor from torque overloads, and allows balanced sizing of driveline components.

Connection of the driveline to the tractor PTO must be done quickly and easily, since tractors are normally used with more than one implement. The tractor end of the driveline is usually supplied with a “quick coupling” which can be a pushpin, ball collar, or an automatic ball collar connection.

The mechanism of the automatic ball collar holds the collar open and automatically releases it when the balls are in the proper position on the PTO. Both hands can be used to hold the driveline making installation much easier.

The driveline must be selected according to the requirements of each specific implement. However, it is possible to define some basic types of implements:
- mounted implements
- towed implements
- stationary implements
Mounted implements
Mounted implements are connected to the three-point hitch of the tractor. The three point hitch supports the weight of the implement., and allows adjustment of the vertical position of the implement to suit working conditions. The three-point hitch also permits the implement to be raised for turning and transport.

In working conditions, the PTO shaft and implement PIC should be parallel and aligned so joint angles are minimized and equal. If this cannot be achieved, joint angles should not exceed the values given in the table on page 3.5 to prevent vibrations and undue stress.

The magnitude of the joint angles influences the life of the cardan joint. As the joint angle increases, the life of the cardan joint is reduced, as explained in chapter 5 -“Size, Torque and Power”. Sometimes larger than normal drivelines are specified to compensate for large joint angles.

Raising the implement during maneuvers can lead to large unequal joint angles, and cause vibrations and noise. In extreme situations, it may be necessary to reduce speed or interrupt tractor PTO rotation.

Three-point mounted implements are hooked up close to the tractor, to reduce cantilevered weight, therefore requiring short drivelines. The telescoping members and the length of the driveline must be selected according to the distance between the PTO and PIC in the working and transport positions.

Length L of the driveline is defined as the distance between the centers of the joints with the driveline fully collapsed.
Length $L$ of the driveline must be selected so that the telescoping members never close completely, or “bottom out”, and maintain proper overlap while in use. For mounted implements, the driveline will reach its minimum length $D_{min}$ at some point between the fully raised or lowered position. The driveline length $L$ must be less than $D_{min}$:

$$L < D_{min}$$

The driveline will telescope as the hitch is raised or lowered. While the implement is under power, the working length $L_w$ of the driveline must provide for sufficient overlap of the telescoping members. If the implement is raised for transport, and the driveline is not rotating, the stationary length $D_s$ of the driveline must be less than the maximum permitted length $L_s$.

$$D_s < L_s$$

Splined telescoping members are available if triangular profile tubes do not allow sufficient $L_s$ extensions. See sections entitled “Telescoping members” and “Length”. Lubrication of the telescoping members is essential to limit wear and reduce axial thrust loads, which also reduce the life of cardan joints and PTO or PIC bearings. Users sometimes skip this important maintenance step, especially if the driveline must be removed from the PTO and partially disassembled to lubricate the telescoping members.

Lubrication of telescoping tubes can be facilitated by installing the Direct Greasing system. This system is available on request, and includes a grease fitting installed on the outer telescoping tube easily accessible through the safety shield. The Direct Greasing system is described and illustrated in the “Lubrication” section. Correct use of the driveline and the integrity of the safety shield are essential for the user’s safety. One of the main causes of damage to driveline shielding is incorrect attachment of the retaining chain. When fixing the chain to the implement (in compliance with EN standard 1553), ensure that the chain:
- is positioned perpendicular to the driveline in the working position.
- permits articulation of the shaft while working, transporting, or turning.
- does not wrap excessively around the shield.

In compliance with the UNI EN ISO 4254-1, shield chains cannot be used to support the driveline when the implement is not connected to the tractor. The implement must provide a proper support for the driveline when it is not in use. To avoid damaging the shield, it is important to check that other implement or tractor components do not interfere during turns or maneuvers.
Towed implements

Towed implements have wheels to support all or part of the weight of the implement (some of the weight may be supported by the tractor drawbar hitch). The implement is hooked to the tractor by a pin that provides articulating movements. The position of the pin with respect to the PTO is standardized in compliance with ISO 5673 and ANSI/ASABE AD5673 standards.

It is recommend to use the drawbar hitch as intended by the manufacturer of the implement (per labels, instruction manuals, or other documents). The use of inappropriate extensions or hitch hooks may damage the driveline and create hazards to the operator. Towed implements change position with respect to the tractor during turning or when traveling over bumps and holes.

In the working position, the implement proceeds in alignment with the tractor and the joint angles depend on the relative position of the PTO and PIC.

We recommend limiting differences between the joints angles to the values given in the tables on page 3.5.

When turning, the joint angles also depend upon the turning angle and the position of the hitch pin with respect to the PIC and PTO. The PTO and PIC are often both horizontal and located in-line with the hitch pin. If the hitch pin is at the same distance from the PTO as it is from the PIC, the turning angle is divided into equal parts between the two joints. This is called an “Equal Angle” hitch, the cardan joint angles are equal, and the total speed variation generated by the driveline is negligible both in the working position and during turns. The joint angles during turning but should not exceed 45° even when both joint angles are equal. When the PTO and PIC are at unequal distances from the hitch pin, turns will produce different cardan joint angles in each end of the driveline. The cardan joint nearest the hitch pin will be allotted the larger joint angle.
Driveline applications

In situations where the difference between the joint angles generates excessive vibrations and noise, it may be necessary to reduce speed or interrupt rotation of the PTO before turning.

In towed implements, the telescoping members of the driveline may retract or extend under load during turns or when the tractor and implement cross over rough terrain. Telescoping while transmitting torque generates axial thrust forces, which act upon joints, PTO’s, and PIC’s. These forces can reduce the life of these components.

The ratio of thrust $T$ generated for a given torque $M$ ($T/M$) is an important factor that must be considered when selecting telescoping members. The values of $T/M$ (N/Nm) are approximate and refer to properly greased telescoping members (lower values are better):

- Triangle profile tubes .................. 6 - 8
- Triangle profile Rilsan coated tubes... 3 - 5
- Triangle profile heat-treated tubes 9 - 10
- Splined telescoping members ........... 7 - 9

The telescoping members and the shaft length must be selected based on the distance between the PTO and PIC during working and transport maneuvers. In towed implements, the cardan shaft is at its minimum length when turning.

Length $L$ of the driveline must be selected so that the telescoping members never close completely, or “bottom out” when at the maximum turning angle and the tractor is pitched upwards (an inclination of 20° is considered as the maximum for most implements):

$$L < D_{\text{min}}$$

The driveline is at its maximum working length when the tractor is aligned with the implement. The telescoping members must be selected so that the maximum length of the shaft at work $D_{\text{wmax}}$ is less than the permissible maximum working length $L_w$:

$$D_{\text{wmax}} < L_w$$
Maximum extension of the driveline is obtained when the tractor is pitched downwards, such as when entering a hole or climbing over a bump. The driveline length in this condition $D_{\text{tmax}}$ must be less than the length $L_t$ allowed for temporary use:

$$D_{\text{tmax}} < L_t$$

If triangular tubes do not allow for sufficient extension $L_w$ and $L_t$, splined telescoping members may be used.

The values for $L$, $L_w$ and $L_t$ are indicated in the length tables in the “Length” section.

Lubrication of the telescoping members is essential to limit wear and reduce axial thrust loads, which also reduce the life of cardan joints and PTO or PIC bearings.

Users sometimes skip this important maintenance step, especially when the driveline must be removed from the PTO or partially disassembled to lubricate the telescoping members.

Lubrication of telescoping tubes can be facilitated by installing the Direct Greasing system. This system is available on request, and includes a grease fitting installed on the outer telescoping tube and easily accessible through the safety shield.

The Direct Greasing system is described and illustrated in the “Lubrication” section.

Correct use of the driveline and the integrity of the safety shield are essential for the user’s safety. One of the main causes of damage to driveline shielding is incorrect attachment of the retaining chain.

When fixing the chain to the implement (in compliance with UNI EN ISO 4254-1), ensure that the chain:
- is positioned perpendicular to the driveline in the working position
- permits articulation of the shaft while working, transporting, or turning
- does not wrap excessively around the shield.

In compliance with the UNI EN ISO 4254-1, shield chains cannot be used to support the driveline when the implement is not connected to the tractor. The implement must provide a proper support for the driveline when it is not in use.

To avoid damaging the shield, it is important to check that other implement or tractor components do not interfere during turns or maneuvers.
Driveline applications

**Driveline with three cardan joints**
On towed implements with a long hitch, the hitch pin is much closer to the tractor PTO than the implement PIC. To prevent excessive difference between the joint angles, towed implements with long hitches may be driven by drivelines composed of three joints in series.

The first two joints (primary driveline) may operate as an Equal Angle driveline, or operate with joint angles that are nearly equal.

The secondary driveline has a single cardan joint, and a splined stub shaft supported by an intermediate bearing attached to the implement hitch. The intermediate bearing may move back and forth, with a fixed length primary driveline and a telescoping secondary driveline.

More common is a fixed intermediate bearing, so the primary driveline telescopes and the secondary driveline is of a fixed length.

In either case, to facilitate installation and to compensate for structural flexing, telescoping tubes may be supplied for the secondary driveline.
The tractor end of the secondary driveline has a splined shaft that is fixed to the implement yoke of the primary driveline. The dimensions of the splined shaft are illustrated in specifications for each size of driveline.

By calculating the equivalent angle of the three cardan joints one can determine the correct phasing to produce minimal variation of total speed. If the third joint is in the same plane as the first two, the equation for calculating the equivalent angle can be extended to cover all three joints:

\[ \alpha_{eq} = \sqrt{\alpha_1^2 \pm \alpha_2^2 \pm \alpha_3^2} \]

The angles of the second and/or third joint are added if their driven yokes are parallel to the first joint. The angles of the second and/or third joint are subtracted if their driven yokes are at right angles to the first joint.

The recommended maximum values for the equivalent angle are given in the table and the diagram on page 3.2.

**Driveline with 80° constant velocity joint**

Drivelines with constant velocity (CV) joints are normally used as primary drivelines for implements with long drawbar hitches. Use of an 80° CV joint simplifies hitch construction and often eliminates the need for an intermediate bearing and secondary driveline.

An 80° CV joint can accommodate wide joint angles for short periods (for example during turning) without generating variations in velocity.

GLOBAL constant velocity joints require relubrication every 50 hours. (see Chapter 29 - Lubrication).

Movement of the 80° CV joint improves lubrication as grease is distributed over the surfaces of the centering components and the shield bearing surface. For this reason, it is recommended to use 80° CV joints for applications with frequent turning, and where the normal working position of the CV does not exceed 25°. 80° CV joints are not recommended for stationary or three point hitch applications.
Driveline applications

The most common configuration for CV drivelines is an 80° CV joint on one end (nearest the hitch pin) and a single cardan joint on the other end. Transmission of power through the driveline is influenced by the angle of the cardan joint and speed. The angle of the single cardan joint depends, in the vertical plane, on the height and inclination of the implement input shaft.

The working angle of the cardan joint should be limited to the recommended values shown on page 3.2 (16° at 540 min⁻¹ and 9° at 1000 min⁻¹) as it generates a speed variation not compensated for by other joints. To reduce the angle of the single cardan joint, the implement input shaft is often tilted toward the tractor PTO. The hitch pin of a towed implement with long hitch is nearer the tractor PTO than the implement PIC. The turning angle $\gamma$ is therefore mainly allotted to the constant velocity joint (joint angle $\alpha_1$) with respect to the cardan joint (joint angle $\alpha_2$).

The angle of the CV joint must be less than 80°, including both the horizontal and vertical planes. Therefore, turning angles under 70° are generally recommended.

The angle is largest during turning when the tractor is pitched upwards. A pitch of 20° is normally considered as the maximum value.

When the hitch pin is located on a common axis with the center of the constant velocity joint, the turning angle is seen only by the constant velocity joint, and the angle of the single cardan joint does not change during turning.

If the hitch pin is in an intermediate position between the two joints, the single cardan joint is at an angle during turning and thus generates speed variations and vibrations depending upon the angle (see page 3.2). The telescoping members of drivelines with 80° constant velocity joints must slide under load due to irregular terrain or during turns.

The thrust generated during these movements is transferred to the joints and bearings, reducing their working life. During turns, the direction of thrust also generates an oscillating bending stress on the tractor PTO and implement PIC.
To minimize thrust forces, drivelines with 80° constant velocity joints are supplied with Rilsan tubes as standard. Length $L$ of the driveline must be selected so that the telescoping members never close completely, or “bottom out” when the driveline is at its minimum length $D_{\text{min}}$. This occurs when the turning angle is at a maximum and the tractor is pitched upwards (an inclination of 20° is considered as the maximum for most implements)

$$L < D_{\text{min}}$$

The driveline is at its maximum working length when the tractor is aligned with the implement. The telescoping members must have adequate overlap while transmitting power. The maximum length of the shaft at work $D_{\text{wmax}}$ must be less than the permissible maximum working length $L_w$:

$$D_{\text{wmax}} < L_w$$

Maximum extension of the driveline is obtained when the tractor is pitched downwards, such as when entering a ditch or cresting a hill. Normally a tilt of 20° is considered. The driveline length in this condition $D_{\text{tmax}}$ must be less than the length allowed in temporary working conditions $L_t$:

$$D_{\text{tmax}} < L_t$$

The values for $L$, $L_w$, and $L_t$ may be found in the specifications for each size of CV driveline.
Driveline applications

Connection of the driveline to the tractor PTO must be done quickly and easily, since tractors are normally used with more than one implement. The yoke on the tractor end of the driveline is usually supplied with a “quick coupling” which may be a pushpin, ball collar, or an automatic ball collar connection.

The mechanism of the automatic ball collar holds the collar open and automatically releases it when the balls are in the proper position on the PTO. Both hands can be used to hold the driveline making installation much easier.

Lubrication of the telescoping members is essential to limit wear and reduce axial thrust loads, which also reduce the life of cardan joints and PTO or PIC bearings. Users sometimes skip this important maintenance step, especially when the driveline must be removed from the PTO or partially disassembled to lubricate the telescoping members.

Lubrication of telescoping tubes can be facilitated by installing the Direct Greasing system. This system is available on request, and includes a grease fitting installed on the outer profile tube and easily accessible through the safety shield.

The Direct Greasing system is described and illustrated in the “Lubrication” section.

Correct use of the driveline and the integrity of the safety shield are essential for the user’s safety. One of the main causes of damage to driveline shielding is incorrect attachment of the retaining chain.

When attaching the chain to the implement (in compliance with UNI EN ISO 4254-1), ensure that the chain:
- is positioned perpendicular to the driveline in the working position
- permits articulation of the shaft while working, transporting, or turning
- does not wrap excessively around the shield.

In compliance with the UNI EN ISO 4254-1, shield chains cannot be used to support the driveline when the implement is not connected to the tractor. The implement must provide a proper support for the driveline when it is not in use.

To avoid damaging the shield, it is important to check that other implement or tractor components do not interfere during turns or maneuvers.
Stationary Implements
Stationary implements are operated from a fixed position. Stationary implements include pumps, hoists, generators, dryers, etc. Stationary implements should only be used when directly coupled to the tractor by a three point or drawbar hitch. If necessary, prevent the tractor from moving by placing chocks on the wheels. The position of the implement with respect to the tractor is essential for safe and efficient operation of the driveline. The tractor must be coupled to the implement and positioned so the joint angles are small and equal. Any difference between the joint angles creates vibrations and stress that can compromise implement performance. See page 3.5. Joint life is also influenced by the joint angle, in particular in applications where the joint angle is fixed. Telescoping members must be adequately overlapped for the power transmitted. The distance between the centers of the joints during work must be less than the recommended maximum length $L_w$, listed in the specifications for each size of driveline.

Correct use of the driveline and the integrity of the safety shield are essential for user safety. Agriculture implements are often operated by tractors with more power than required by the implement, so it is a good idea to outfit the driveline with a torque limiter to prevent damage caused by overloading.

- If necessary, prevent the tractor from moving by placing chocks on the wheels.
- Only use the implement with its original driveline that is specifically designed for the required length, size, torque limiters or clutches, and shield.
- When using the implement and its driveline, do not exceed the speed and power requirements stated in the implement manual.
- Standard catalog drivelines, torque limiters, and overrunning clutches are designed for speeds not to exceed 1000 min$^{-1}$.
- All rotating parts must be guarded.
Driveline applications

The tractor master shield, the driveline guard(s), and the implement input connection shield form an integrated guarding system.

One of the main causes of damage to driveline shielding is incorrect attachment of restraint chains, and interference with tractor and/or other implement components.

When attaching the chain to the implement (in compliance with UNI EN ISO 4254-1), ensure that the chain:
- is positioned perpendicular to the driveline in the working position
- permits articulation of the shaft while working, transporting, or turning
- does not wrap excessively around the shield

In compliance with the EN standard 1553, shield chains cannot be used to support the driveline when the implement is not connected to the tractor. The implement must provide a proper support for the driveline when it is not in use.

To avoid damaging the shield, it is important to check that other implement or tractor components do not interfere during turns or maneuvers.
A basic Bondioli & Pavesi driveline is specified by a fifteen position alphanumeric code.

The fifteen essential positions of the code are used to list the following specifications:
- Standard Shaft (position 1)
- Size (positions 2 and 3)
- Telescoping members (position 4)
- Length (positions 5-6-7)
- Labels, instruction manuals and retaining chains (pos. 8-9)
- Tractor end yokes (pos.10-11-12)
- Implement end yokes (pos 13-14-15).

The three additional positions make it possible to select optional safety cones and Spring Link chains (see chapter -"Safety Shields").

Drive shafts running at 1000 min⁻¹ are identified by an “X” letter in a final additional position.

Charts for the main types of drivelines and their codes are given on the following pages. Each end of the driveline is defined by three-digit codes that identify the yoke or torque limiter.

For example, code R07 identifies a yoke with ball collar for a single cardan joint. The code WR7 identifies 80° CV joint with ball collar yoke.

It is important to enter the three digit codes for the yokes and torque limiters in the correct positions in the shaft code. These positions specify whether the yokes and joints are to be fitted on the tractor or implement end.

Positions 10-11-12 of the code are used for the tractor end of primary drivelines. Positions 13-14-15 are used for the implement end of primary drivelines. For example, if an 80° constant velocity joint is required with a ball collar on the tractor end, enter code WR7 in positions 10-11-12 of the shaft code. If an RA2 (1 3/8” Z6) overrunning clutch is required on the implement end, enter code A50 in positions 13-14-15 of the shaft code.

For primary shafts, any torque limiter or overrunning clutch must be fitted on the implement side. All rotating parts must be guarded.

The three-digit codes for yokes and torque limiters are shown in chapters 10-27 of this catalog.
Codes and dimensions

Global Cardan joint driveline

<table>
<thead>
<tr>
<th></th>
<th>Ø</th>
<th>H</th>
<th>G</th>
<th>T</th>
<th>F</th>
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<th>B</th>
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# Codes and dimensions

## Codes for Global Cardan joint driveline

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</thead>
<tbody>
<tr>
<td>7</td>
<td>Standard cardan joint driveline.</td>
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</tbody>
</table>

### Size

- **G1 - G2 - G3 - G4 - G5 - G7 - G8 - G9**
- See chapter “Size, torque and power”.

### Telescoping members

- **N** - Regular triangle profile tubes.
- **R** - Rilsan® coated profile tubes (not available for size G1).
- **T** - Heat treated triangle profile tube.
- **S** - Splined telescoping members (exclusively for size G4 - G5 - G7 - G8 - G9).
- See chapter “Telescopic members”.

### Length

- **Triangle profile tubes:**
- **Splined telescoping members:**
  - 041 - 046 - 051 - 056 - 061 - 066 - 071 - 076 - 081.
- See chapter “Length”.

### Warning labels, instruction manuals and shield restraint chains

- **CE** - CEE-EFTA countries bearing CE mark.
- **US** - USA and Canada without restraint chains.
- **U2** - USA and Canada with restraint chains.
- **JP** - Japan.
- **FX** - Other countries and CEE-EFTA countries not bearing CE mark.
- See chapter “Safety shields”.

### Tractor (or driver) end yoke

- Specify the three-digit code for the yoke, which will also denote the type of joint.

### Implement (or driven) end yoke

- Specify the three-digit code for the yoke, which will also denote the type of joint, torque limiter or overrunning clutch.

### Additional positions

- Use these positions only if requesting optional outer cones or Spring Link System.
- See chapter “Safety Shields”.
- If both options are requested, select the outer cones before and “Z” letter for Spring Link in position 18.
- Add an “X” letter at the end of the code for drive shaft running at 1000 min⁻¹.

---

**All rotating parts must be guarded. The shields on the tractor and on the implement machine work with the integral driveline guard to form an interactive guarding system.**

**For primary drivelines (i.e. the driveline connecting the tractor PTO to the initial power input connection on the implement), torque limiters or overrunning clutches must be fitted on the implement end of the driveline.**
## Codes and dimensions

### Global driveline with 80° constant velocity joint

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</table>
Codes and dimensions

Codes for Global driveline with 80°constant velocity joint

1  

7: standard cardan joint driveline.

2 3

Size.
G2 - G4 - G5 - G7 - G8.
See chapter “Size, torque and power”.

4  

Telescoping members.
R - Rilsan®-coated triangle profile tubes.
See chapter “Telescopic members”.

5 6 7

Length.
Tubi triangolari Rilsan®:
See chapter “Length”.

8 9

Warning labels, instruction manuals and shield restraint chains.
CE - CEE-EFTA countries bearing CE mark.
US - USA and Canada without restraint chains.
U2 - USA and Canada with restraint chains.
JP - Japan.
FX - Other countries and CEE-EFTA countries not bearing CE mark.
See chapter “Safety shields”.

10 11 12

Tractor (or driver) end yoke.
Specify the three-digit code for the yoke, which will also denote the type of joint.

13 14 15

Implement (or driven) end yoke.
Specify the three-digit code for the yoke, which will also denote the type of joint, torque limiter or overrunning clutch.

16 17

Additional positions
Use these positions only if requesting optional outer cones or Spring Link System.
See chapter “Safety Shields”.
If both options are requested, select the outer cones before and “Z” letter for Spring Link in position 17.
Add an “X” letter at the end of the code for drive shaft running at 1000 min⁻¹.

All rotating parts must be guarded. The shields on the tractor and on the implement machine work with the integral driveline guard to form an interactive guarding system.
For primary drivelines (i.e. the driveline connecting the tractor PTO to the initial power input connection on the implement), torque limiters or overrunning clutches must be fitted on the implement end of the driveline.
Codes and dimensions

Global Cardan joint drivelines with splined stub shaft

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<th>E₃</th>
<th>Ø₁</th>
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<th>P</th>
<th>T</th>
<th>G</th>
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4.6
Codes and dimensions

Codes for Global Cardan joint driveline with splined stub shaft

1

2 3

4

5 6 7

8 9

10 11 12

13 14 15

16 17

7: standard cardan joint driveline.

G4 - G5 - G7 - G8 - G9.
See chapter “Size, torque and power”.

N - Regular triangle profile tube
See chapter “Telescopic members”.

See chapter “Length”.

US - USA and Canada without restraint chains.
U2 - USA and Canada with restraint chains.
JP - Japan.
FX - Other countries and CEE-EFTA countries not bearing CE mark.
See chapter “Safety shields”.

Specify the three-digit code for the splined stub shaft member required.

Specify the three-digit code for the yoke, which will also denote the type of joint, torque limiter or overrunning clutch.

Add additional positions
Use these positions only if requesting optional outer cones or Spring Link System.
See chapter “Safety Shields”.
If both options are requested, select the outer cones before and “Z” letter for Spring Link in position 17.
Add an “X” letter at the end of the code for drive shaft running at 1000 min⁻¹.

All rotating parts must be guarded. The shields on the tractor and on the implement machine work with the integral driveline guard to form an interactive guarding system.

For primary drivelines (i.e. the driveline connecting the tractor PTO to the initial power input connection on the implement), torque limiters or overrunning clutches must be fitted on the implement end of the driveline.
Size, torque and power

The size of the driveline must be selected according to the functional requirements of the application. The needle bearings of the cross kit must operate for the desired lifetime, according to the dictates of torque, speed and joint angle. The strength must be sufficient to transmit the required torque under all working conditions.

Agricultural implements are often subject to overloads and torque peaks that are difficult to quantify. Torque limiters are available to help prevent possible failure of the driveline or other components. The setting of the torque limiter may also be used as a reference in proper sizing of the driveline.

A suitable type of torque limiter must be selected according to the duty cycle; the setting must be selected according to the median torque transmitted $M$ and the peak torque ($M_{\text{max}}$ for the driveline). Briefly, the following conditions apply for the different types of torque limiters.

Ratchet torque limiters, shear bolt torque limiters and automatic torque limiters are used on implements whose duty cycle is constant or alternating with possible overloads or torque peaks. The setting of these torque limiters is generally 2 to 3 times the median torque $M$.

Friction torque limiters are used on implements whose duty cycle is alternating with frequent overloads. A friction torque limiter allows these frequent overloads to be surmounted without stopping the driveline. Combination friction clutch torque limiters with incorporated overrunning clutches are used on implements with high inertial loads (e.g. rotors or flywheels). These types of implements are subject to torque peaks during start up. Overloads during operation can be overcome without interrupting the transmission. The setting of friction clutch torque limiters is normally about twice the median torque $M$.

When setting torque limiters it is recommended to define proper safety parameters with respect to the strength limit of the entire driveline.

**Maximum torque $M_{\text{max}}$**

The driveline strength must be sufficient to transmit the desired torque under all foreseeable working conditions. Therefore the driveline must be sized so the maximum torque required by the application will always be lower than the maximum torque of the driveline $M_{\text{max}}$, even in case of accidental torque peaks.

<table>
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<tr>
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</table>
Size, torque and power

Maximum dynamic torque $M_{d\text{max}}$
Cardan joints must operate for the desired lifetime under normal working conditions. For this to occur, the transmitted torque must be lower than the maximum dynamic torque $M_{d\text{max}}$.

The maximum dynamic torque $M_{d\text{max}}$ is defined as the maximum working torque for the joint, and it is considered as the upper limit when determining the lifetime of a cardan joint. Each torque value considered in a load cycle and used to calculate working life must be less than the maximum dynamic torque $M_{d\text{max}}$ for the given size.

### Lifetime of single cardan joints
The lifetime of a single cardan joint $L_h$ usually corresponds to the life of the needle bearings. It can be determined by the following parameters:
- $M$ Transmitted torque (Nm) or $P$ Transmitted power (kW).
- Velocity of rotation $n$.
- Joint angle $\alpha$.

Example: $L_h = 700$ hours is the theoretical life for a cardan joint size G4, torque 500 Nm, velocity 540 min$^{-1}$ and joint angle = 5°. The nomogram for the lifetime can also be used to determine the proper joint size for a required lifetime.

Example: for a life of 1000 hours, joint angle 10°, velocity = 1000 min$^{-1}$ and torque $M = 500$ Nm, a size G7 cardan joint must be used.

Torque and power are related by the following formula:
$$P \ [\text{kW}] = \frac{M \ [\text{Nm}] \cdot n \ [\text{min}^{-1}]}{9553}$$
$$P \ [\text{hp}] = \frac{M \ [\text{in-lb}] \cdot n \ [\text{min}^{-1}]}{63025}$$

Power can be expressed in (HP) by the formula:
$$P \ [\text{kW}] \cdot 1,36 = P \ (\text{HP})$$

The torque is expressed in (kpm) or (in.lb.) by the formula:
$$M \ [\text{Nm}] \cdot 0,102 = M \ (\text{kpm})$$
$$M \ [\text{Nm}] \cdot 8,85 = M \ (\text{in-lb})$$
### Size, torque and power

Nomogram to calculate single cardan joint lifetime

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<th>Torque M (N·m - in·lb)</th>
<th>Velocity (min⁻¹)</th>
<th>Angle (°)</th>
<th>Lifetime (hours)</th>
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Size, torque and power

Duty cycles
The lifetime can be calculated with more accuracy by examination of a duty cycle that represents the various operating conditions.
For a given duty cycle, joint lifetime is divided into percentages of use for each condition. Specific working conditions (torque, rotational velocity, and joint angle) are set for each segment of the duty cycle. Together, these percentages form the total life.

The total lifetime of can be calculated as follows:

\[ L_{\text{tot}} = \frac{1}{\sum_{i=1}^{m} \frac{X_i}{L_i}} \]

where:
\( X_i \) = percentage of total lifetime corresponding to segment i of duty cycle
\( L_i \) = lifetime defined according to the working conditions of segment i of duty cycle.
\( m \) = total number of segments

Example: determine the lifetime \( L_{hi} \) of a size G7 driveline with the duty cycle shown in the table below:

<table>
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<tr>
<th>Torque</th>
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<th>%</th>
<th>( L_{hi} )</th>
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The resulting lifetime is 920 hours:

\[ L_{hi_{\text{tot}}} = \frac{1}{0.30 + 0.50 + 0.15 + 0.05} = 920 \]

Nominal Power and Torque
The nominal torque \( M_n \) of a driveline can be defined as the torque associated with a 1000 hour lifetime of a joint operating with joint angle \( \alpha = 5^{\circ} \), rotational velocity \( n = 540 \text{ min}^{-1} \) (or \( 1000 \text{ min}^{-1} \)), and a 50 hour lubrication frequency.
The nominal power \( P_n \) is the power corresponding to the nominal torque \( M_n \).
Following charts report technical data and values for nominal power \( P_n \) and nominal torque \( M_n \) for each type and driveline size.

Categories ASAE
In the U.S., drivelines are often bracketed into one of the categories defined by ANSI/ASAE S331.5. This standard classifies drivelines on the basis of dynamic and static strength.
The standard also recognizes two duty levels: Regular Duty and Heavy Duty. These duty levels pertain to the static strength of the telescoping members.
Drivelines can be classified in compliance with ASAE standard according to the chart below, for each size.
Size, torque and power

Global Cardan joint drivelines

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Regular and heat treated tubes

Rilsan® coated tubes

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## Size, torque and power

Global Cardan joint driveline with splined telescoping members

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### Size, torque and power

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5.6
Size, torque and power

Global driveline with 80° constant velocity joints

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### Size, torque and power

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<td></td>
<td></td>
<td></td>
<td></td>
<td>3.7</td>
<td>54.0</td>
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<td>45.6</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3500</td>
<td>30980</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Size, torque and power

Global driveline with splined stub shaft

<table>
<thead>
<tr>
<th>Categories</th>
<th>ASAE</th>
<th>Global driveline with splined stub shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Size, torque and power

<table>
<thead>
<tr>
<th>Ø</th>
<th>H</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Mmax</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>Nm</td>
</tr>
</tbody>
</table>

| G1  | 27.0 | 74.6 | 3.4 | 43.5 | 4.0 | 36.0 | 2000 | 17700 |
| G2  | 30.2 | 79.4 | 3.0 | 51.5 | 3.8 | 45.0 | 2500 | 22130 |
| G3  | 30.2 | 91.4 | 4.0 | 54.0 | 4.2 | 45.0 | 2900 | 25670 |
| G4  | 34.9 | 93.5 | 4.0 | 54.0 | 5.5 | 45.0 | 3500 | 30980 |
| G5  | 34.9 | 106.0 | 4.0 | 63.0 | 4.0 | 54.0 | 3900 | 34520 |
| G6  | 34.9 | 106.0 | 4.0 | 63.0 | 4.0 | 54.0 | 3900 | 34520 |
| G7  | 34.9 | 106.0 | 4.0 | 63.0 | 4.0 | 54.0 | 3900 | 34520 |
| G8  | 34.9 | 106.0 | 4.0 | 63.0 | 4.0 | 54.0 | 3900 | 34520 |
| G9  | 34.9 | 106.0 | 4.0 | 63.0 | 4.0 | 54.0 | 3900 | 34520 |

### Power and Torque

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<th>H</th>
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<th>B</th>
<th>C</th>
<th>D</th>
<th>Mmax</th>
</tr>
</thead>
<tbody>
<tr>
<td>kW</td>
<td>CV</td>
<td>Nm</td>
<td>in·lb</td>
<td>kW</td>
<td>CV</td>
<td>Nm</td>
</tr>
</tbody>
</table>

| G1  | 26  | 35  | 460 | 4050 | 40  | 55  | 380 | 3350 | 780 | 6900 | 3  | 3  |
| G2  | 35  | 47  | 620 | 5500 | 54  | 74  | 520 | 4600 | 1050 | 9290 | 4  | 3  |
| G3  | 47  | 64  | 830 | 7350 | 74  | 100 | 710 | 6250 | 1450 | 12830 | 4  | 4  |
| G4  | 61  | 83  | 1080 | 9560 | 96  | 130 | 913 | 8050 | 2000 | 17690 | 5  | 5  |
| G5  | 70  | 95  | 1240 | 10950 | 110 | 150 | 1050 | 9300 | 2250 | 19910 | 6  | 5  |

5.8
Agricultural machines are often employed in harsh working environments – dust and dampness can shorten a driveline’s life span. Sealing elements of the cross kits are very important: they retain lubricants, protect the needles and lubricants from contamination by foreign substances, and allow excess grease to purge without damage.

The needle bearings in Bondioli & Pavesi cross kits are equipped with double-lip seals designed to prevent contamination of the lubricant in the severe working conditions typical of farming applications. Trials carried out on specially designed test fixtures provided data for optimizing the shape, materials, and the required heat treatment for all components – needles, caps, seals, and crosses.

Proper design and manufacturing allow universal joints to be lubricated at extended intervals of 50 working hours, for most applications. Lubrication can be done on a weekly basis instead of every day, reducing one of the most burdensome maintenance requirements. Under certain working conditions, drivelines may be lubricated only once for an entire season.
Cross kits

Cross kits for single cardan joints

The codes below refer to the cross kit as a spare part – complete with the four snap rings required for assembly. They are supplied in single-item or multiple-item packs. The pack quantity is indicate by the numbers following the “R” in the code.

<table>
<thead>
<tr>
<th>Ø</th>
<th>H</th>
<th>Cross kit code</th>
<th>Multiple-item pack code</th>
</tr>
</thead>
<tbody>
<tr>
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<td>54.0</td>
<td>4120B0012</td>
<td>4120B0012R50</td>
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<tr>
<td>23.8</td>
<td>61.3</td>
<td>4120C0012</td>
<td>4120C0012R30</td>
</tr>
<tr>
<td>27.0</td>
<td>74.6</td>
<td>4120E0012</td>
<td>4120E0012R25</td>
</tr>
<tr>
<td>27.0</td>
<td>74.6</td>
<td>4120E0012</td>
<td>4120E0012R25</td>
</tr>
<tr>
<td>30.2</td>
<td>79.4</td>
<td>4120G0012</td>
<td>4120G0012R40</td>
</tr>
<tr>
<td>30.2</td>
<td>91.4</td>
<td>4120H0012</td>
<td>4120H0012R30</td>
</tr>
<tr>
<td>34.9</td>
<td>93.5</td>
<td>4120L0012</td>
<td>4120L0012R24</td>
</tr>
<tr>
<td>34.9</td>
<td>106.0</td>
<td>4120M0012</td>
<td>4120M0012R20</td>
</tr>
</tbody>
</table>

Cross kits for constant velocity joints

<table>
<thead>
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<th>H₁</th>
<th>Cross kit code</th>
<th>Multiple-item pack code</th>
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</thead>
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<tr>
<td>22.0</td>
<td>76.0</td>
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<td>4120C0051R25</td>
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<tr>
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<td>86.0</td>
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<td>4120E0051R40</td>
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<td>4120G0051</td>
<td>4120G0051R24</td>
</tr>
<tr>
<td>27.0</td>
<td>100.0</td>
<td>4120G0051</td>
<td>4120G0051R24</td>
</tr>
<tr>
<td>30.2</td>
<td>106.0</td>
<td>4120L0051</td>
<td>4120L0051R20</td>
</tr>
</tbody>
</table>
Telescoping members of Bondioli & Pavesi drivelines allow power transmission from the power take off (PTO) to the power input connection (PIC); they also compensate for the length variation occurring during operation or transport.

Among the chief characteristics of a shaft is its torsional strength, i.e. its resistance to twisting forces. The torsional strength should be large enough to withstand the torque transmitted under all predictable operating conditions.

A driveline’s torsional strength is expressed by the maximum torque $M_{\text{max}}$ determined by the properties of the telescoping profile tubes. The size of driveline must be chosen so the maximum torque exerted during all predicted operations is less than the telescoping member’s torsional strength $M_{\text{max}}$. The following tables give the torsional strength $M_{\text{max}}$ of each size of telescoping profile member.

Machines used in agriculture are often subjected to loads and torque peaks that are not easy to quantify. Torque limiters are useful in many applications. Torque limiters help prevent damage, as well as provide a benchmark for choosing the proper size of driveline. The setting of the torque limiter $M_t$ must be less than the maximum torque $M_{\text{max}}$, and is determined by the type of torque limiter and the requirements of the application.

Another important consideration is the telescoping capability of the drive tubes. Drivelines must vary their length to satisfy the application. If regular telescoping members can’t satisfy the length requirement of the application, splined profile members can may be used instead.

Another important property of telescoping members is their capacity to slide under load while producing low telescopic thrust forces. Thrust forces create axial and bending loads that are transmitted to the universal joints, the power take off (PTO) and the power input connection (PIC) shafts and their bearings, reducing their life.

The capacity to slide under load while producing low thrust force is expressed by the ratio thrust ($T$) over torque ($M$); an important factor to consider when choosing telescoping members. The following indicative values of the $T/M$ ratio refer to adequately lubricated telescoping members. The smaller the $T/M$ ratio, the lower the thrust forces acting on the joints, shafts, and bearings.

<table>
<thead>
<tr>
<th>Ratio thrust $T$ / Torque $M$</th>
<th>N/Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Triangle profile tubes</strong></td>
<td></td>
</tr>
<tr>
<td>Regular</td>
<td>6 - 8</td>
</tr>
<tr>
<td>Rilsan®-coated inner tube</td>
<td>3 - 5</td>
</tr>
<tr>
<td>Heat-treated inner tube</td>
<td>9 - 10</td>
</tr>
<tr>
<td><strong>Splined profile tubes</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 - 9</td>
</tr>
</tbody>
</table>

Lubrication of telescoping members is an extremely important factor to reduce thrust forces and help prevent wear.
Telescoping members

Triangle profile tubes
Triangle profile tubes are designed to provide maximum resistance and optimal telescoping. The profile will only couple so the joints are properly in phase with respect to each other.

Rilsan®-coated triangle profile tubes
The Rilsan® coating on the inner tube helps reduce telescopic thrust. These tubes are recommended for shafts that have to slide for long lengths under loads, e.g. primary drivelines of towed implements when going around turns. Rilsan® coated triangle profile tubes are standard on drivelines fitted with constant velocity (CV) joints. The thickness of the Rilsan® coating is compensated for by a thinner outer tube, that is different from a regular tube.

Triangle profile tube with heat-treated inner tube
Applying heat treatment to the inner profile tube increases the surface hardness. Heat treated tubes are usually chosen for short drivelines that work in aggressive environments (abrasive particles) and are subject to frequent short sliding, e.g. the primary driveline of towed implements. Heat treatment does not effect the thickness of the tubes, so a regular outer tube is used.

Splined telescoping members
Splined telescoping members can satisfy the requirements of applications with high torques, frequent sliding under load and extensions longer than those permitted by regular telescoping tubes or maximum extension tubes. See chapter Lengths. Splined telescoping members have a CUNA involute profile. Thrust forces generated by the transmitted torque is divided among the spline teeth.

<table>
<thead>
<tr>
<th>Splined members CUNA involute profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>D mm</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>G1</td>
</tr>
<tr>
<td>G2</td>
</tr>
<tr>
<td>G3</td>
</tr>
<tr>
<td>G4</td>
</tr>
<tr>
<td>G5</td>
</tr>
<tr>
<td>G7</td>
</tr>
<tr>
<td>G8</td>
</tr>
<tr>
<td>G9</td>
</tr>
</tbody>
</table>

How to select telescoping member
The telescoping member required is indicated by the fourth letter in the driveshaft code. The table below lists the various telescoping members available and the code with which they are identified in the driveshaft code.

Drivelines with 80° constant velocity joints have Rilsan® telescoping tubes.

<table>
<thead>
<tr>
<th>Telescoping member type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle profile tubes</td>
</tr>
<tr>
<td>Rilsan®-coated triangle tubes</td>
</tr>
<tr>
<td>Heat-treated triangle tubes</td>
</tr>
<tr>
<td>Splined telescoping members</td>
</tr>
</tbody>
</table>
Telescoping members

**Triangle profile tube**
Add the letter “N” in the fourth position of the shaft code to select regular triangle profile tubes. Tubes as spare part are supplied either in 3-meter lengths, 1-meter lengths or 1-meter lengths drilled for roll pin. Add “3000” or “1000” to the selected profile code to order 3-meter or 1-meter tubes respectively.

---

Drilled tube codes are shown on the table.

---

### Table

<table>
<thead>
<tr>
<th>A (mm)</th>
<th>B (mm)</th>
<th>Profile code</th>
<th>Drilled tube code</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>Profile code</th>
<th>Drilled tube code</th>
<th>Mmax (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>2.6</td>
<td>32.5</td>
<td>12503</td>
<td>225021000R</td>
<td>4.0</td>
<td>26.5</td>
<td>12502</td>
<td>225011000R</td>
</tr>
<tr>
<td>G2</td>
<td>3.2</td>
<td>36.0</td>
<td>12505</td>
<td>225051000R</td>
<td>4.0</td>
<td>29.0</td>
<td>12504</td>
<td>225041000R</td>
</tr>
<tr>
<td>G3</td>
<td>3.4</td>
<td>43.5</td>
<td>12508</td>
<td>225121000R</td>
<td>3.2</td>
<td>36.0</td>
<td>12505</td>
<td>225051000R</td>
</tr>
<tr>
<td>G4</td>
<td>3.4</td>
<td>43.5</td>
<td>12508</td>
<td>225121000R</td>
<td>4.0</td>
<td>36.0</td>
<td>12507</td>
<td>225101000R</td>
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<tr>
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<td>51.5</td>
<td>12510</td>
<td>225701000R</td>
<td>3.8</td>
<td>45.0</td>
<td>12597</td>
<td>225111000R</td>
</tr>
<tr>
<td>G7</td>
<td>4.0</td>
<td>54.0</td>
<td>12512</td>
<td>225211000R</td>
<td>4.2</td>
<td>45.0</td>
<td>12509</td>
<td>225161000R</td>
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<tr>
<td>G8</td>
<td>4.0</td>
<td>54.0</td>
<td>12512</td>
<td>225211000R</td>
<td>5.5</td>
<td>45.0</td>
<td>12511</td>
<td>225181000R</td>
</tr>
<tr>
<td>G9</td>
<td>4.0</td>
<td>63.0</td>
<td>12522</td>
<td>225721000R</td>
<td>4.0</td>
<td>54.0</td>
<td>12512</td>
<td>225711000R</td>
</tr>
</tbody>
</table>

---

The image shows an outer tube and an inner tube, with measurements A, B, C, and D indicated.

---

Triangle profile tube

Add the letter “N” in the fourth position of the shaft code to select regular triangle profile tubes. Tubes as spare part are supplied either in 3-meter lengths, 1-meter lengths or 1-meter lengths drilled for roll pin. Add “3000” or “1000” to the selected profile code to order 3-meter or 1-meter tubes respectively.

---

Drilled tube codes are shown on the table.
Telescoping members

Rilsan®-coated triangle profile tubes
Add “R” to position 4 in the shaft code to select Rilsan®-coated triangle profile tubes. Outer tubes for spare parts are supplied either in 3-meter lengths, 1-meter lengths or 1-meter lengths drilled for roll pin. Add “3000” or “1000” to the selected profile code to order 3-meter or 1-meter tubes respectively. Drilled tube codes are shown on the table.

For the inner Rilsan® coated tubes, add “1500” or “1000” to the code of drilled for roll pin tube to have a 1,5-meter lengths or 1-meter lengths respectively.

<table>
<thead>
<tr>
<th>Profile code</th>
<th>Drilled tube code</th>
<th>C</th>
<th>D</th>
<th>Profile code</th>
<th>Drilled tube code</th>
<th>Mmax mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>G2</td>
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<td>43.5</td>
<td>12516</td>
<td>225311000R</td>
<td>4.3</td>
<td>36.6</td>
</tr>
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<td>225271000R</td>
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<td>45.6</td>
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<td>225751000R</td>
<td>4.3</td>
<td>54.6</td>
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</table>
Telescoping members

Triangle profile tubes with heat-treated inner tube
Add “T” to position 4 in the shaft code to select triangle profile tube with heat-treated inner tube.

Outer tubes for spare parts are supplied either in 3-meter lengths, 1-meter lengths or 1-meter lengths drilled for roll pin. Add “3000” or “1000” to the selected profile code to order 3-meter or 1-meter tubes respectively.

Drilled tube codes are shown on the table.

Heat-treated inner tubes are supplied for spare parts only inner drilled tube codes are shown on the table and drilled to accept the roll pin.

<table>
<thead>
<tr>
<th></th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>Profile code</th>
<th>Drilled tube code</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>Profile code</th>
<th>Drilled tube code</th>
<th>Mmax (mm)</th>
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<tbody>
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<td>--</td>
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<td>750</td>
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<td>225051000R</td>
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<td>--</td>
<td>270051000R</td>
<td>1700</td>
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<td>2000</td>
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</tr>
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<td>4.0</td>
<td>54.0</td>
<td>--</td>
<td>270711000R</td>
<td>3900</td>
</tr>
</tbody>
</table>
Telescoping members

Triangle profile tubes with splined stub shaft
Shafts with external tube welded to the stub shaft are used in transmissions with three joints. See “Driveline applications". A splined stub shaft is identified as the end of the cardan shaft with the three digit code given in “Codes and dimensions".
Normal triangle profile tubes are identified with the letter “N" in the fourth position of the cardan shaft code.
The spare part codes for the tube welded to the spline are shown on the table.

Internal tubes as spare parts are supplied either in three meter lengths, one meter lengths or one meter lengths drilled for roll pin. The codes for the 3-metre and 1-metre bars consists of the profile code given in the table plus “3000” or “1000” respectively.
Drilled tube codes are shown on the table.

<table>
<thead>
<tr>
<th>Tube Code</th>
<th>Dia Code</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>Profile Code</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>Profile Code</th>
<th>Drilled Tube Code</th>
<th>Mmax (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G4</td>
<td>1 3/8&quot; Z6</td>
<td>3.4</td>
<td>43.5</td>
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<td>4.0</td>
<td>36.0</td>
<td>12507</td>
<td>225100000R</td>
<td>2000</td>
</tr>
<tr>
<td></td>
<td>1 3/8&quot; Z21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G5</td>
<td>1 3/8&quot; Z6</td>
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<td>51.5</td>
<td>12510</td>
<td>3.8</td>
<td>45.0</td>
<td>12597</td>
<td>225110000R</td>
<td>2500</td>
</tr>
<tr>
<td></td>
<td>1 3/8&quot; Z21</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>1 3/4&quot; Z20</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>G7</td>
<td>1 3/8&quot; Z6</td>
<td>4.0</td>
<td>54.0</td>
<td>12512</td>
<td>4.2</td>
<td>45.0</td>
<td>12509</td>
<td>225160000R</td>
<td>2900</td>
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<tr>
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<td>1 3/8&quot; Z21</td>
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<tr>
<td></td>
<td>1 3/4&quot; Z20</td>
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<td></td>
</tr>
<tr>
<td>G8</td>
<td>1 3/8&quot; Z6</td>
<td>4.0</td>
<td>54.0</td>
<td>12512</td>
<td>5.5</td>
<td>45.0</td>
<td>12511</td>
<td>225180000R</td>
<td>3500</td>
</tr>
<tr>
<td></td>
<td>1 3/8&quot; Z21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 3/4&quot; Z20</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G9</td>
<td>1 3/8&quot; Z6</td>
<td>4.0</td>
<td>63.0</td>
<td>12522</td>
<td>4.0</td>
<td>54.0</td>
<td>12512</td>
<td>225710000R</td>
<td>3900</td>
</tr>
<tr>
<td></td>
<td>1 3/8&quot; Z21</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>1 3/4&quot; Z20</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Diagram of outer and inner tubes]

7.6
**Splined telescoping members**

Add letter “S” to position 4 in the shaft code to select splined telescoping tube. Splined bars and outer tube welded and sleeve assemblies for spare parts are supplied to the requested length $L_t$ in mm.

Splined bars are supplied for spare parts cut-to-length (up to 700 mm length) and drilled for the roll pin. To select cut-to-length members add the required length $L_b$ in mm to the codes listed below.

**Example:**
Splined bar, G5, $L_b = 390$ mm.
Code of spare bar = 249110390R

<table>
<thead>
<tr>
<th>$E$ (mm)</th>
<th>$z$</th>
<th>Outer tube and sleeve assembly</th>
<th>Splined bar code</th>
<th>Mmax (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G4</td>
<td>30</td>
<td>10</td>
<td>52AG4....R</td>
<td>24917....R</td>
</tr>
<tr>
<td>G5</td>
<td>35</td>
<td>12</td>
<td>52AG5....R</td>
<td>24911....R</td>
</tr>
<tr>
<td>G7</td>
<td>35</td>
<td>12</td>
<td>52AG6....R</td>
<td>24911....R</td>
</tr>
<tr>
<td>G8</td>
<td>40</td>
<td>14</td>
<td>52AG7....R</td>
<td>24921....R</td>
</tr>
<tr>
<td>G9</td>
<td>40</td>
<td>14</td>
<td>52AG9....R</td>
<td>24929....R</td>
</tr>
</tbody>
</table>
The cardan joint driveline is the most commonly used method for transmitting power from a tractor PTO (power take off) to the PIC (power input connection) of an agricultural implement. The distance and angle between the PTO and PIC are constantly changing as the implement moves through the field. The variable extension of drivelines makes them easy to install and compensates for this relative motion between shafts, both in working conditions and when transporting the implement.

Driveline length $L$ is defined as the distance between the centers of the crosses, with the driveline fully collapsed.

On drivelines fitted with constant velocity (CV) joints, the reference points are the centers of the inboard crosses.

Driveline length is represented in the code by the length $L$ (3 digits) in centimeters. Standard length and corresponding codes are shown below.

Other lengths are available on request (1 cm intervals).

<table>
<thead>
<tr>
<th>Code</th>
<th>041</th>
<th>046</th>
<th>051</th>
<th>056</th>
<th>061</th>
<th>066</th>
<th>071</th>
<th>076</th>
<th>081</th>
<th>086</th>
<th>091</th>
<th>101</th>
<th>111</th>
<th>121</th>
</tr>
</thead>
<tbody>
<tr>
<td>L (mm)</td>
<td>410</td>
<td>460</td>
<td>510</td>
<td>560</td>
<td>610</td>
<td>660</td>
<td>710</td>
<td>760</td>
<td>810</td>
<td>860</td>
<td>910</td>
<td>1010</td>
<td>1110</td>
<td>1210</td>
</tr>
</tbody>
</table>
**Driveline length**

**Triangle profile tubes**

Lw is defined as the maximum allowable working length, center to center. For brief periods, such as traversing over bumps, the driveline may extend to the maximum temporary length, Lt. The maximum allowable length for non-rotating shafts is Ls.

- **Lw**: maximum working length.
- **Lt**: maximum temporary length.
- **Ls**: maximum length for non-rotating shafts.

Lw and Lt refer to drivelines rotating at a maximum speed of 1000 min⁻¹, except for items marked * which refer to a maximum speed of 540 min⁻¹. For shaft lengths longer than those shown, or for speeds higher than 1000 min⁻¹, please contact Bondioli & Pavesi’s Engineering Department.

<table>
<thead>
<tr>
<th>Code</th>
<th>Lw (mm)</th>
<th>Lt (mm)</th>
<th>Ls (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>514 612 687 762 837 912 987 1062 1137 1212 1287 1362 1437 1512 1587 1662 1737</td>
<td>564 662 746 829 912 996 1079 1162 1246 1329 1412 1496 1579 1662 1746 1829 1912</td>
<td>593 688 775 863 950 1038 1125 1213 1300 1388 1475 1563 1650 1737 1825 1912 2000</td>
</tr>
<tr>
<td>G2</td>
<td>506 606 683 758 833 908 983 1058 1133 1208 1283 1358 1433 1508 1583 1658 1733 1808 1883</td>
<td>556 656 740 824 907 990 1074 1157 1240 1324 1407 1490 1574 1657 1740 1823 1907 1990 2073</td>
<td>585 682 769 857 944 1032 1120 1208 1296 1384 1472 1560 1648 1736 1824 1912 2000</td>
</tr>
<tr>
<td>G8</td>
<td>481 581 681 781 881 981 1081 1181 1281 1381 1481 1581 1681 1781 1881 1981 2081 2181 2281</td>
<td>556 656 756 856 956 1056 1156 1256 1356 1456 1556 1656 1756 1856 1956 2056 2156 2256 2356</td>
<td>629 729 829 929 1029 1129 1229 1329 1429 1529 1629 1729 1829 1929 2029 2129 2229 2329 2429</td>
</tr>
<tr>
<td>G9</td>
<td>555 655 755 855 955 1055 1155 1255 1355 1455 1555 1655 1755 1855 1955 2055 2155 2255 2355</td>
<td>630 730 830 930 1030 1130 1230 1330 1430 1530 1630 1730 1830 1930 2030 2130 2230 2330 2430</td>
<td>685 785 885 985 1085 1185 1285 1385 1485 1585 1685 1785 1885 1985 2085 2185 2285 2385 2485</td>
</tr>
</tbody>
</table>

---

8.2

**Bondioli & Pavesi**
Lw: maximum working length. 
Lt: maximum temporary length. 
Ls: maximum length for non-rotating shafts.

<table>
<thead>
<tr>
<th>Code</th>
<th>Lw = Lt</th>
<th>Lt</th>
<th>Lt</th>
<th>Lt</th>
<th>Lt</th>
<th>Lt</th>
<th>Lt</th>
<th>Lt</th>
<th>Lt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ls = Lt</td>
<td>Ls</td>
<td>Ls</td>
<td>Ls</td>
<td>Ls</td>
<td>Ls</td>
<td>Ls</td>
<td>Ls</td>
<td>Ls</td>
</tr>
<tr>
<td>G1</td>
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<td>560</td>
<td>610</td>
<td>660</td>
<td>710</td>
<td>760</td>
<td>810</td>
</tr>
<tr>
<td>G2</td>
<td>501</td>
<td>510</td>
<td>576</td>
<td>657</td>
<td>750</td>
<td>842</td>
<td>935</td>
<td>1027</td>
<td>1120</td>
</tr>
<tr>
<td>G3</td>
<td>501</td>
<td>510</td>
<td>576</td>
<td>657</td>
<td>750</td>
<td>842</td>
<td>935</td>
<td>1027</td>
<td>1120</td>
</tr>
<tr>
<td>G4</td>
<td>510</td>
<td>585</td>
<td>675</td>
<td>750</td>
<td>842</td>
<td>935</td>
<td>1027</td>
<td>1120</td>
<td>1212</td>
</tr>
<tr>
<td>G5</td>
<td>510</td>
<td>585</td>
<td>675</td>
<td>750</td>
<td>842</td>
<td>935</td>
<td>1027</td>
<td>1120</td>
<td>1212</td>
</tr>
<tr>
<td>G6</td>
<td>510</td>
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<td>G7</td>
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<tr>
<td>G9</td>
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<td>585</td>
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<td>750</td>
<td>842</td>
<td>935</td>
<td>1027</td>
<td>1120</td>
<td>1212</td>
</tr>
</tbody>
</table>

Driveline length

Splined telescoping members

Lw and Lt refer to drivelines rotating at a maximum speed of min⁻¹. For shaft lengths longer than those shown, or for speeds higher than min⁻¹, please contact Bondioli & Pavesi’s Engineering Department.
Global driveshafts are provided with safety labels and operator’s manual as prescribed by international safety standards and regulations.

**Outer labels**
The outer label displays basic safety information for using the driveline, presented according to the rules existing in the country of destination.
In Europe, the Machinery Directive requires that information shown on the outer label must be understood in the language of the country of destination, which in practice means all EEC languages. For this reason, label no. 399CEE051 provides information by means of illustrations. This label is used for all CE marked drivelines, as well as other countries.

In North America (United States, Canada, Mexico) standard ANSI/ASABE AD11684 details the requirements for labels and text. Drivelines for sale into North America are provided with the outer label no. 399141000.

Drivelines bound for Japan are provided with the outer label no. 399JAP001.
The outer label 399LUB... displays the following information:
- The lubrication frequency;
- The driveshaft lubrication points;
- The grease quantity, in grams and ounce, to be applied to each component;
- Driveshaft code;
- Customer reference;
- Type of implement;
- Batch of production;
- A QR code, that allows to access to the operator’s manuals on internet by a mobile device, containing explanations on the labels, information on safe and correct driveline use, and instructions for proper maintenance;
- Tractor side;
- CE mark when needed, year of production and driveshaft size;
- The mark and address of the manufacturer.

**Inner label**
This safety label draws the operators’ attention to the fact that the protective guard is missing and therefore the driveline is hazardous to operate. This is shown by the pictorial of a person entangled by a rotating shaft.
In addition, the signal word “DANGER” is used, which is understood throughout the world.
Inner label no. 399143000 is applied on the outer profile tube, under the protective guard, and provided on drivelines for all countries.
Safety labels and operator’s manual

Operator’s manual
Operator’s manual contains explanations on the labels, information on safe and correct driveline use, and instructions for proper maintenance. Machinery Directive 2006/42/CE specifies that drivelines between self-powered vehicles (or tractors) and implements, marketed in EU and EFTA countries, should be CE marked. The manual 399UNI001 is provided with all drivelines and includes a Declaration of Compliance with Machinery Directive 2006/42/CE.

The destination of the driveline, and consequently its labels and operator’s manual, is indicated by a destination code, i.e. the character in the eighth position in the driveline code number.

The table below shows the codes assigned to the labels and operator’s manual provided with Series Global drivelines, according to their destination codes.

<table>
<thead>
<tr>
<th>Country of destination</th>
<th>Destination code</th>
<th>Inner label</th>
<th>Outer label</th>
<th>Operator’s manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drivelines bearing the CE mark</td>
<td>C</td>
<td>399143000</td>
<td>399CEE051 399LUB...</td>
<td>399UNI001</td>
</tr>
<tr>
<td>Drivelines made for USA and CANADA</td>
<td>U</td>
<td>399143000</td>
<td>399141000 399LUB...</td>
<td>399UNI001</td>
</tr>
<tr>
<td>Drivelines made for Japan</td>
<td>J</td>
<td>399143000</td>
<td>399JAP001 399LUB...</td>
<td>399UNI001</td>
</tr>
<tr>
<td>Drivelines made for other countries and for CEE – EFTA countries not bearing CE mark</td>
<td>F</td>
<td>399143000</td>
<td>399CEE051 399LUB...</td>
<td>399UNI001</td>
</tr>
</tbody>
</table>
The safety features of Global drivelines meet the requirements of international safety standards. They are made of simple, sturdy components which make them both functional and reliable. The outer shield cone is of rigid construction but the corrugated shape also gives it elasticity. It has a hole giving access to the cross kit lubricator fitting. The shield bearing is fixed to the inner yoke and allows the mechanical part to rotate inside the shield restrained by the chains. The base cone acts as a sturdy connection for the other safety shield components. The outer shield cone and the shield bearing are fixed to the base cone by means of self-tapping screws. The shield tube slots into the base cone so that once assembled, the tube and base cone form a single component. The grease fittings for the shield bearing and cross kit easily accessible to make maintenance easier. Installing and removing driveline shields is a simple operation that can be done with commonly available tools.
Safety shields

This size Global G9 is equipped with SFT shield so shield bearings, tube+cones and end cones are different than other sizes as shown on figure.

80° constant velocity joints in Global drivelines are protected by a single cone that reflects the very latest requirements of international safety standards and designed to integrate with the master shield of the tractor in accordance with standards ISO 500, 86/297/CEE and ANSI/ASABE AD500. The shield around the 80° constant velocity joint is connected to the base cone and the standard shield bearing. Another bearing is fitted to the center housing on the CV joint. The metal ring stiffens the end of the shield.
Safety shields

Restraint chains
Section 3.4.7 of Annex 1 to the Machinery Directive (2006/42/CE) states for primary drivelines the outside parts of the shield must be so designed, constructed and arranged that they cannot turn with the transmission shaft.

UNI EN 12965 regulations specify that drivelines connecting tractors to implements (primary drivelines) must be fitted with a restraining system to prevent the shield from rotating with the driveline. The most common way of restraining the shields is to use chains to fasten the two halves of the shield to the tractor and to the implement. Drivelines are normally supplied with the implement, which should provide a proper attachment point for the shield restraint chains.

Attaching the chain to the tractor can be more difficult, since tractors are normally used to drive more than one implement and driveline. Modern tractors are provided with a hole in the master shield for attaching the shield restraint chain. Incorrect attachment of shield restraint chains may cause damage to the shields.

A few simple recommendations can help avoid damaging the shields and exposing the user to potential hazards.

Bondioli & Pavesi recommends that implement manufacturers provide a suitable fastening point for the chain on the implement. In addition, the following recommendations should be included in the operator’s manual:

- Attach the shield restraint chain properly. The best method is to attach the chain so that it is perpendicular with respect to the driveline.
- Adjust the length of the chain length so the driveline can move freely under any condition when working, traveling, or maneuvering.
- Adjust the length of the chains so they do not wrap excessively around the driveline.
- Do not use the chains to support or suspend the driveline when the implement is not in use.
Safety shields

Restraint standards and regulations
UNI EN ISO 5674 and ANSI/ASABE AD5674 standards state that restraints must withstand a load of 400 N, and must detach at the end attached to the shield at loads of under 800 N.
Bondioli & Pavesi driveline chains meet these detachment requirements. Chains are attached to shields by S-hooks.

Spring Link
Restraint chains can be supplied on request with the Spring Link device. This device includes a clip which can be opened and closed by screwdriver, and a spring hook which detaches from the shield when subjected to the loads described in the standards.
Both S-hook and Spring Link connections separate the chain from the shield in compliance with UNI EN ISO 5674 and ANSI/ASABE AD5674.
If the chain detaches, a chain with S-hook needs to be replaced, while the Spring Link can be put back as shown below.

If the chain length has not been properly adjusted and is too tight, during turning maneuvers the S-hook opens and the chain falls from the shield. If this happens, the chain has to be replaced.
The S-hook of the new chain is fastened to an eyelet on the cone and must be closed and round to prevent unintended detachment.

To request the chain with Spring Link, add the letter “Z” to the optional position in the driveline code as shown in chapter “Codes and Dimensions”.

“S” hook

Spring link
Safety shields

If the Spring Link chain length has not been properly adjusted and is too tight, during turning maneuvers.

---

The Spring Link will detach and the chain falls from the shield (as shown in figure 1). If this happens, the chain can be re-fitted as follows:

1. Remove the screw and open the clip (figure 2).
2. Fit the chain and reposition the clip (figure 3).
3. Close clip (figure 4) and replace the screw.
Safety shields

**Ordering complete shield kits**
Drivelines are equipped with shield restraint for all markets, except the USA and Canada where they are optional. S-hook connections of the restraint chains to the shield are standard. Add letter “Z” to the optional position in the shaft code to specify Spring Link device.

The table below shows the characters used to specify the type of shield restraint, or to delete the shield restraints, if desired, for USA and Canada.

<table>
<thead>
<tr>
<th>Country of destination</th>
<th>With restraints</th>
<th>Without restraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drivelines bearing the CE mark</td>
<td>E</td>
<td>-</td>
</tr>
<tr>
<td>Drivelines made for USA and Canada</td>
<td>2</td>
<td>S</td>
</tr>
<tr>
<td>Drivelines made for Japan</td>
<td>P</td>
<td>-</td>
</tr>
<tr>
<td>Drivelines made for other countries and for CEE – EFTA countries not bearing CE mark</td>
<td>X</td>
<td>-</td>
</tr>
</tbody>
</table>
Safety shields

Standard shield cone configurations based on the driveline end

Standard shield cones for yokes, torque limiters and overrunning clutches.
- Code .................................................. S

<table>
<thead>
<tr>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>G1</td>
<td>27</td>
</tr>
<tr>
<td>G2</td>
<td>23</td>
</tr>
<tr>
<td>G3</td>
<td>32</td>
</tr>
<tr>
<td>G4</td>
<td>32</td>
</tr>
<tr>
<td>G5</td>
<td>40</td>
</tr>
<tr>
<td>G7</td>
<td>33</td>
</tr>
<tr>
<td>G8</td>
<td>31</td>
</tr>
<tr>
<td>G9</td>
<td>30</td>
</tr>
</tbody>
</table>

Shield for 80° CV joint.
- Code .................................................. W

<table>
<thead>
<tr>
<th>F_80</th>
<th>G_80</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>G1</td>
<td>-</td>
</tr>
<tr>
<td>G2</td>
<td>36</td>
</tr>
<tr>
<td>G3</td>
<td>-</td>
</tr>
<tr>
<td>G4</td>
<td>31</td>
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<tr>
<td>G5</td>
<td>41</td>
</tr>
<tr>
<td>G7</td>
<td>41</td>
</tr>
<tr>
<td>G8</td>
<td>52</td>
</tr>
<tr>
<td>G9</td>
<td>-</td>
</tr>
</tbody>
</table>

Driveline shield cones can cover the joint partially or completely, but they are not intended to replace proper implement input connection (IIC) shields, tractor master shields, or other appropriate guarding.

Spare parts code for optional extended cones and plates are shown in the following pages.
Safety shields

Shield for splined stub shaft.
- Code ........................................... Q

<table>
<thead>
<tr>
<th>F mm</th>
<th>G mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>-</td>
</tr>
<tr>
<td>G2</td>
<td>-</td>
</tr>
<tr>
<td>G3</td>
<td>-</td>
</tr>
<tr>
<td>G4</td>
<td>16</td>
</tr>
<tr>
<td>G5</td>
<td>16</td>
</tr>
<tr>
<td>G7</td>
<td>16</td>
</tr>
<tr>
<td>G8</td>
<td>16</td>
</tr>
<tr>
<td>G9</td>
<td>16</td>
</tr>
</tbody>
</table>

Shields for FFV and FFNV clutches.
Drivelines with FFV clutches are not EC marked since the shield cone does not entirely cover the inboard yoke, as specified by Machinery Directive 2006/42/CE.
- Code ........................................... E

<table>
<thead>
<tr>
<th>F mm</th>
<th>G mm</th>
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<tbody>
<tr>
<td>G1</td>
<td>23</td>
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<tr>
<td>G2</td>
<td>27</td>
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<tr>
<td>G3</td>
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<td>G4</td>
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<tr>
<td>G5</td>
<td>11</td>
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<tr>
<td>G7</td>
<td>18</td>
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<tr>
<td>G8</td>
<td>20</td>
</tr>
<tr>
<td>G9</td>
<td>18</td>
</tr>
</tbody>
</table>

Driveline shield cones can cover the joint partially or completely, but they are not intended to replace proper implement input connection (IIC) shields, tractor master shields, or other appropriate guarding.

Spare parts code for optional extended cones and plates are shown in the following pages.
Optional extended outer cones

Global shields can be provided with extended outer cones that cover the joint completely. The ends of these extended cones must be supported by the implement by means of a clamp, and the shield must be properly restrained.

Extended outer cones are normally used on internal drivelines that handle the flow of processed material such as fodder or forage.

Extended outer cones are available in various lengths and diameters, depending on the size of the driveline.

To have your driveline fitted with one, or two extended outer cones, add the appropriate letter (shown below) in the additional positions of the driveline code. The letter indicates the type of cone, and which end of the driveline it will be positioned.

---

Optional extended cone, medium length, narrow diameter

- Tractor end.......................................... P
- Implement end.................................M

---

<table>
<thead>
<tr>
<th></th>
<th>A (mm)</th>
<th>F₁ (mm)</th>
<th>G₁ (mm)</th>
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<tbody>
<tr>
<td>G1</td>
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<td>172</td>
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<td>G2</td>
<td>83</td>
<td>168</td>
<td>170</td>
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<tr>
<td>G3-G4</td>
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<td>156</td>
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<td>* G5</td>
<td>83</td>
<td>154</td>
<td>170</td>
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<tr>
<td>* G7</td>
<td>115</td>
<td>159</td>
<td>200</td>
</tr>
<tr>
<td>* G8</td>
<td>115</td>
<td>157</td>
<td>200</td>
</tr>
<tr>
<td>* G9</td>
<td>115</td>
<td>155</td>
<td>200</td>
</tr>
</tbody>
</table>

* Extended cone available in 1-hole version only.
The access to the greasing fitting is not allowed with torque limiters or overrunning clutches.

Codes replacement for optional extended cone and plates with clamps are described below.

---

Driveline shield cones can cover the joint partially or completely, but, for safety purposes, they are not intended to replace proper implement input connection (IIC) shields, tractor master shields, or other appropriate guarding.
Safety shields

Optional extended cone, long length, narrow diameter
- Tractor end........................................... N
- Implement end....................................... L

<table>
<thead>
<tr>
<th></th>
<th>A (mm)</th>
<th>F₂ (mm)</th>
<th>G₂ (mm)</th>
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<tbody>
<tr>
<td>G1</td>
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<td>217</td>
<td>170</td>
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<td>G2</td>
<td>83</td>
<td>213</td>
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<td>G3-G4</td>
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<td>201</td>
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<td>199</td>
<td>170</td>
</tr>
<tr>
<td>** G7</td>
<td>115</td>
<td>204</td>
<td>200</td>
</tr>
<tr>
<td>** G8</td>
<td>115</td>
<td>202</td>
<td>200</td>
</tr>
<tr>
<td>** G9</td>
<td>115</td>
<td>200</td>
<td>200</td>
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</tbody>
</table>

** Extended cone available in 1-hole version. 2-hole extended cone version for torque limiters and overrunning clutches is available on request.
F₂ = 249 mm for dimension G7.
F₂ = 247 mm for dimension G8.
F₂ = 245 mm for dimension G9.

Optional extended cone, short length, wide diameter
- Tractor end................................. F
- Implement end.............................. H

<table>
<thead>
<tr>
<th></th>
<th>A (mm)</th>
<th>F₃ (mm)</th>
<th>G₃ (mm)</th>
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</thead>
<tbody>
<tr>
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<td>139</td>
<td>170</td>
</tr>
<tr>
<td>G2</td>
<td>125</td>
<td>135</td>
<td>170</td>
</tr>
<tr>
<td>G3-G4</td>
<td>125</td>
<td>122</td>
<td>170</td>
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<tr>
<td>G5</td>
<td>-</td>
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<tr>
<td>G7</td>
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<tr>
<td>G8</td>
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<tr>
<td>G9</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Driveline shield cones can cover the joint partially or completely, but, for safety purposes, they are not intended to replace proper implement input connection (IIC) shields, tractor master shields, or other appropriate guarding.

Codes replacement for optional extended cone and plates with clamps are described below.
Safety shields

Optional extended cone, medium length, wide diameter.
- Tractor end.................................R
- Implement end.............................T

<table>
<thead>
<tr>
<th>A</th>
<th>F₄</th>
<th>G₄</th>
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</thead>
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<tr>
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<tr>
<td>G2</td>
<td>125</td>
<td>157</td>
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<tr>
<td>G3-G4</td>
<td>125</td>
<td>145</td>
</tr>
<tr>
<td>* G5</td>
<td>125</td>
<td>143</td>
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<tr>
<td>* G7</td>
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<td>141</td>
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<tr>
<td>* G8</td>
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<td>139</td>
</tr>
<tr>
<td>* G9</td>
<td>145</td>
<td>137</td>
</tr>
</tbody>
</table>

* Extended cone available in 1-hole version only.
The access to the greasing fitting is not allowed with torque limiters or overrunning clutches.

Optional extended cone, long length, wide diameter.
- Tractor end.................................V
- Implement end.............................Y

Driveline shield cones can cover the joint partially or completely, but, for safety purposes, they are not intended to replace proper implement input connection (IIC) shields, tractor master shields, or other appropriate guarding.

Codes replacement for optional extended cone and plates with clamps are described below.
Safety shields

Extended cones with diameters of 125 or 145 mm may be attached to the implement with the slotted plates shown below. These plates should be bolted to the implement, and the extended cone clamped around their circumference. The codes listed in the tables below include the slotted plate and an appropriate sized clamp.

<table>
<thead>
<tr>
<th>Code</th>
<th>E (mm)</th>
<th>A (mm)</th>
<th>B x C (mm)</th>
<th>D (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>395011211R</td>
<td>125</td>
<td>54</td>
<td>11 x 27</td>
<td>46</td>
</tr>
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<tr>
<td>395011261R</td>
<td>125</td>
<td>84</td>
<td>11 x 20</td>
<td>52</td>
</tr>
</tbody>
</table>
Complete shield kits for spare part

Complete shield kits for spare parts are sized to fit the drivelines on which they will be used.

⚠ Shield tubes can be cut to fit a specific driveline length, but the shield tubes should maintain sufficient overlap for all operating and transport conditions.

Different types of joints, yokes, torque limiters and clutches have different shield requirements. The types of shield cones available are illustrated on the following pages.

Safety labels and operator’s manuals are included according to the standards and regulations of the country of destination.

Shield kits are supplied with chains except for USA-Canada, where shields restraints are optional and may be deleted at the customer’s request.

Standard chains are fitted to shields with a S-hooks. Add the letter “Z” to the optional position in the shield kit code to have your chain fitted with Spring Link.

Bondioli & Pavesi drivelines and shields are tested to comply with UNI EN ISO 5674, UNI EN 12965 standards and are EC certified. Complete shields are supplied as spare parts and therefore, in compliance with the Machinery Directive, do not require CE marking. However, shield kits may be EC marked on request.

⚠ Regulations UNI EN ISO 4254-1 and ANSI/ASABE S604.1 prescribe a 50 mm overlap of the driveline shield with the implement input connection shield.
Safety shields

**Codes for Global driveline complete shield kit**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>5</th>
<th>C</th>
</tr>
</thead>
</table>

**Shield kit.**
5C

**Size.**
G1 - G2 - G3 - G4 - G5 - G7 - G8 - G9.
See chapter “Size, torque and power”.

**Length.**
Triangle profile tube:
Splined telescoping members:
041 - 046 - 051 - 056 - 061 - 066 - 071 - 076 - 081.
See chapter “Length”.

**Warning labels, operator’s manual and restrain chains.**

<table>
<thead>
<tr>
<th>Country of destination</th>
<th>with chains</th>
<th>without chains</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE-EFTA countries bearing EC mark.</td>
<td>CE</td>
<td>-</td>
</tr>
<tr>
<td>North America (USA, Canada and Mexico)</td>
<td>U2</td>
<td>US</td>
</tr>
<tr>
<td>Japan</td>
<td>JP</td>
<td>-</td>
</tr>
<tr>
<td>Other countries and CEE-EFTA countries not bearing CE mark.</td>
<td>FX</td>
<td>-</td>
</tr>
</tbody>
</table>

**Shield cone.**

<table>
<thead>
<tr>
<th>End type</th>
<th>tractor end</th>
<th>implement end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single cardan joint</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>80° CV joint</td>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>Splined stub</td>
<td>Q</td>
<td>-</td>
</tr>
<tr>
<td>Single cardan joint with FFV or FFNV clutches</td>
<td>-</td>
<td>E</td>
</tr>
<tr>
<td>Extended cone, medium length, narrow diameter</td>
<td>P</td>
<td>M</td>
</tr>
<tr>
<td>Extended cone, long length, narrow diameter</td>
<td>N</td>
<td>L</td>
</tr>
<tr>
<td>Extended cone, short length, wide diameter</td>
<td>F</td>
<td>H</td>
</tr>
<tr>
<td>Extended cone, medium length, wide diameter</td>
<td>R</td>
<td>T</td>
</tr>
<tr>
<td>Extended cone, long length, wide diameter</td>
<td>V</td>
<td>Y</td>
</tr>
</tbody>
</table>

**Optional feature.**
Z : Spring Link chains.

---

All rotating parts must be guarded. The shields on the tractor and on the implement machine work with the integral driveline guard to form an interactive guarding system.

For primary drivelines (i.e. the driveline connecting the tractor PTO to the initial power input connection on the implement), torque limiters or overrunning clutches must be fitted on the implement end of the driveline.
# Safety shields

## Shield length

<table>
<thead>
<tr>
<th>Code</th>
<th>410</th>
<th>460</th>
<th>510</th>
<th>560</th>
<th>610</th>
<th>660</th>
<th>710</th>
<th>760</th>
<th>810</th>
<th>860</th>
<th>910</th>
<th>1010</th>
<th>1110</th>
<th>1210</th>
</tr>
</thead>
<tbody>
<tr>
<td>L [mm]</td>
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<td>046</td>
<td>051</td>
<td>056</td>
<td>061</td>
<td>066</td>
<td>071</td>
<td>076</td>
<td>081</td>
<td>086</td>
<td>091</td>
<td>101</td>
<td>111</td>
<td>121</td>
</tr>
</tbody>
</table>
Safety shields

Standard shield cone configurations based on the driveline end

Standard shield cones for yokes, torque limiters and overrunning clutches.
- Code .................................................. S

Shield for 80° CV joint.
- Code .................................................. W

Shield for splined stub shaft.
- Code .................................................. Q

Shields for FFV and FFNV clutches. Drivelines with FFV clutches are not EC marked since the shield cone does not entirely cover the inboard yoke, as specified by Machinery Directive 2006/42/CE.
- Code .................................................. E

Driveline shield cones can cover the joint partially or completely, but they are not intended to replace proper implement input connection (IIC) shields, tractor master shields, or other appropriate guarding.

10.16
Safety shields

Shield cone configurations

**Extended cone, medium length, narrow diameter.**
- Tractor end .................................. P
- Implement end .............................. M

**Extended cone, long length, narrow diameter.**
- Tractor end ................................. N
- Implement end ............................. L

**Extended cone, short length, wide diameter.**
- Tractor end ................................. F
- Implement end ............................. H

**Extended cone, medium length, wide diameter.**
- Tractor end ................................. R
- Implement end ............................. T

**Extended cone, long length, wide diameter.**
- Tractor end ................................. V
- Implement end ............................. Y

Driveline shield cones can cover the joint partially or completely, but they are not intended to replace proper implement input connection (IIC) shields, tractor master shields, or other appropriate guarding.
Safety shields

### Spare parts for shields

#### End cones for single cardan joints

<table>
<thead>
<tr>
<th>G</th>
<th>H</th>
<th>D</th>
<th>Spare part code</th>
</tr>
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<tbody>
<tr>
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<td>87</td>
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<td>G3</td>
<td>137</td>
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<td>102</td>
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<td>G5</td>
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<td>119</td>
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<td>G7</td>
<td>158</td>
<td>119</td>
<td>219051001R</td>
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<td>G8</td>
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<tr>
<td>G9</td>
<td>160</td>
<td>120</td>
<td>2190L0201R</td>
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</tbody>
</table>

#### End cone for FFV and FFNV clutches

<table>
<thead>
<tr>
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</table>

#### End cones for 80° CV joints

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<th>D</th>
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<td>G4</td>
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<td>G5</td>
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<td>G9</td>
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</tbody>
</table>

The code also includes the reinforcement metal rings.
Safety shields

End cones for splined stub shaft

<table>
<thead>
<tr>
<th></th>
<th>G (mm)</th>
<th>H (mm)</th>
<th>D (mm)</th>
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<tbody>
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<tr>
<td>G4</td>
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<td>18</td>
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<td>G5</td>
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<tr>
<td>G9</td>
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</tbody>
</table>

Outer tube + cone assembly

<table>
<thead>
<tr>
<th></th>
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<th>U (mm)</th>
<th>S (mm)</th>
<th>Spare part code</th>
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</table>

Codes refer to the tube + cone assemblies for drivelines of length L=1210 mm.
Replace the letter "F" with "U" for North America, or "J" for Japan.

Inner tube + cone assembly

<table>
<thead>
<tr>
<th></th>
<th>T (mm)</th>
<th>U (mm)</th>
<th>S (mm)</th>
<th>Spare part code</th>
</tr>
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<tbody>
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Codes refer to the tube + cone assemblies for drivelines of length L=1210 mm.
Replace the letter "F" with "U" for North America, or "J" for Japan.
Safety shields

### Shield bearings for outer tube

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The code also includes the restrain spring.

10.20
### Safety shields

#### Self-tapping screws

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## Safety shields

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### Safety shields

#### Extended cone, short length, wide diameter

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#### Extended cone, medium length, wide diameter

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Safety shields

Extended cone, medium length, narrow diameter for overrunning clutches and ratchet torque limiters.

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Extended cone, long length, narrow diameter for overrunning clutches and ratchet torque limiters.

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Safety shields

Extended cone, medium length, wide diameter for overrunning clutches and ratchet torque limiters.

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Extended cone, long length, wide diameter for overrunning clutches and ratchet torque limiters.

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### Safety shields

Slotted plates with clamps for optional extended cones.

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![Diagram of safety shields](attachment:image.png)

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In farming, the most common way to transmit power from a tractor to an implement is by a driveline, connected to the PTO (Power Take Off) of the tractor to the IIC (Implement Input Connection). Drivelines are also commonly connected to shafts within the implement to transmit power to various mechanisms. Standards ISO 500, DIN 9611 and ANSI/ASABE AD500: specify the dimensions of the common PTO types:

- Type 1 : 1 3/8” Z6 (540 min⁻¹)
- Type 2 : 1 3/8” Z21 (1000 min⁻¹)
- Type 3 : 1 3/4” Z20 (1000 min⁻¹).

Coupling a driveline to a PTO should be quick and simple, because in normal use tractors must operate a number of different implements. Consequently, yokes on the tractor-end of the driveline are fitted with a quick-disconnect system, such as push-pin, ball collar, or automatic ball collar.

Specifications for a driveline, including the way it is coupled to a PTO, depends upon the implement. Yokes on the IIC side are rarely disconnected and may be fastened by quick-lock couplings (push-pin or ball collar) or semi-permanent couplings that can only be removed using tools. Taper pins are the most stable connection for splined shafts, and are commonly used in yokes and torque limiters. Taper pins are also often used to connect internal drive shafts on drivelines that are not frequently disconnected. Torque limiters and clutches must always be installed on the implement side of the primary driveline.
Yoke - shaft connections

Taper pin yokes
Push-pin yokes provide a quick and reliable connection to the PTO. The push-pin is simple and easy to use – no special tools are required.
The pin is encased by the rounded profile of the hub to eliminate protrusions, as required by international safety standards.

⚠️ Make sure the pin snaps back to its original position after connection to the PTO.
Ball collar yokes
Ball collar yokes provide easy and fast connection (or disconnection) of the yoke to the PTO, with no tools required. Connection is secured by hardened steel balls or rounded pins that engage the annular groove of a splined shaft, such as a tractor’s PTO. The balls or pins are arranged symmetrically so thrust forces generated by the telescoping driveline are uniformly distributed to the splined shaft. Yokes are designed to enable field conversion from a standard ball collar to an automatic ball collar. Only the collar needs to be changed, without changing the entire yoke.

⚠️ Make sure the collar snaps back to its original position after connecting to the PTO.
Yoke - shaft connections

Taper-pin yokes
Drivelines are rarely removed from the implement to which they are attached. For this reason, yokes are commonly coupled to the implement shaft with a semi-permanent type of connection. These types of connections usually require the use of tools to install or disconnect. Tapered pins provide a fixed coupling between yoke and PTO. Tapered pin yokes are intended for use on the implement end of primary driveline (those that connect the tractor PTO to the first implement input shaft), or may be used on either or both ends of drivelines internal to the machine. The tapered shape of the pin fits snugly into the annular groove of a splined shaft, reducing play between the splines to a minimum.

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<td>220 Nm - 1950 in·lbs</td>
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Do not replace taper pin with standard bolts- ask for the correct tapered pins from Bondioli & Pavesi.

Ensure the nut is tight before each use.
Yokes for single cardan joints

Push pin yokes

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Yokes for single cardan joints

Ball collar yokes

RT

Collar 1" Z15

Collar type A2  Collar type A1  Collar type A

Collar type B

Collar type C1  Collar type C

Collar type D1  Collar type D
Yokes for single cardan joints

Ball collar yokes

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## Yokes for single cardan joints

Taper pin yokes with counter-clockwise rotation

Do not use on tractor PTO (Power Take Off)

Recommended tightening torque:
- 150 Nm for 1 3/8" Z6 – Z21
- 220 Nm for 1 3/4" Z6 – Z20

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Yokes for single cardan joints

Yokes for splined bar
Same type of yoke is used for regular, Rilsan®-coated and heat-treated tubes.

![Diagram of yoke](image)

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See chapter 5 - Telescoping members for codes of yoke, tube, and sleeve assemblies as spare parts.
## Yokes for 80° constant velocity joints

### Ball collar yokes TRACTOR SIDE

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Yokes for $80^\circ$ constant velocity joints

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13.2
## Yokes for 80° constant velocity joints

### Automatic ball collar yokes TRACTOR SIDE

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Yokes for 80° constant velocity joints

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Yokes for 80° constant velocity joints

Taper pin yokes for counter-clockwise rotating drivelines

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Yokes for 80° constant velocity joints

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### Yokes for 80° constant velocity joints

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Torque limiters and overrunning clutches

Implements are designed to work for a certain lifetime, determined by a specific duty cycle associated with the application. Due to accidental overloads or unusual working conditions, loads may exceed what is considered normal. When this happens, the implement must absorb whatever power is available from the tractor. Generally, the tractor can supply more power than the implement can reliably absorb.

Extremely high torque peaks can be generated by overloads, blockages, or sudden starts and stops of the implement. Eventually, these torque peaks may cause premature wear of the driveline and other implement components. Protection against overloads is achieved by installing a torque limiter or clutch on the driveline to help prevent damage and allow more rational sizing of power transmission components.

Different types of torque limiters and clutches are available. They should be selected according to the specific features of each implement and the particular duty cycle involved.

The torque absorbed by a farm implement usually varies, such as shown in the following diagram. Along with normal working conditions (torque M), variations occur (torque M₁), and overloads (shown eliminated by a torque limiter Mₜ) are possible as well.

For implements with high inertia (flywheels, heavy rotors), torque peaks are possible during startup and stopping. The reverse loads caused by stopping these types of implements are eliminated by an overrunning clutch.
Torque limiters and overrunning clutches

The type of torque limiter must be selected according to the type of loads transmitted to the implement. The setting (Mt) is made according to the median torque transmitted (M) and to the torque limit of the system (Mmax for the driveline).
When determining the setting, it is recommended to consider a tolerance of at least ±10% with respect to the nominal value. It is also suggested to consider factors of safety with respect to the strength of the entire power transmission system.
Overrunning clutches are used to eliminate reverse torques generated by the inertial load of implements with large rotating masses such as flywheels. These reverse loads occur during deceleration or stopping the implement.
The torsionally resilient joints are able to limit torque peaks by temporarily absorbing them. This smoothes vibrations and alternating loads that generate fatigue stresses in the driveline.
Ratchet torque limiters, shear bolt limiters and automatic torque limiters are used with implements with constant or alternating torque cycles, with possible overloads or torque peaks. The setting (Mt) of these torque limiters is usually 2 to 3 times the median torque M.
In respect to torque limiter settings and the nominal torque Mn of the driveline, adequate settings for LR automatic torque limiter (used at 1000 min⁻¹) are defined. These settings are marked with (*) in the charts on the following pages.
It is suggested to use ratchet torque limiters for drivelines operating at a speed of 700 min⁻¹ or less.

Friction torque limiters are used on implements with alternating torque cycles and frequent overloads. They are able to protect the drive system from overloads, but allow work to continue without stopping.
Friction torque limiters with incorporated overrunning clutches are used on implements with high inertia (flywheels, rotors), subject to torque peaks (especially during start up) and overloads.
The setting of friction torque limiters (Mt) is usually 2 times the median torque M.
Standard settings for friction clutch torque limiters have been defined considering the pressure on the linings and the slipping velocity. As a consequence, maximum suggested settings have been defined for each friction torque limiter model and size, for drivelines operating at 1000 min⁻¹.
These settings are marked with (*) and shown on the following pages.
Torque limiters and overrunning clutches

### Overrunning clutches and torsionally resilient joints

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- Overrunning clutch weekly lubrication RA - Overrunning clutch permanently lubricated RL
  - RA1  RA1  RA1  RA1  RA1
  - RA2  RA2  RA2
  - RLA

- Torsionally resilient joints GE
  - GE4  GE4
  - GE6
  - GE8  GE8

### Standard settings

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- Ratchet torque limiters, uni-directional, weekly lubrication SA
  - SA1  400
  - SA2  650 650 800
  - SA3  900 1000 1000 1200 1200 1200
  - SA4  1400 1400 1400 1400 1600 1600 1600 1600

- Ratchet torque limiters, symmetrical, weekly lubrication LN
  - LN1  300
  - LN2  460 600 600
  - LN3  800 900
  - LN4  1000 1000 1200 1200 1200

- Shear bolt torque limiters
  - LB   650 700 950 1050 1400 1400 1700 1700 2000 2100 2400 2400 2700 2700 3000 3200 3500

Mmax: maximum torque allowed for driveline with regular triangle tubes.
Settings marked with (*) are suggested for use at 1000 min⁻¹.
## Torque limiters and overrunning clutches

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<td><strong>FT32 - FK32</strong></td>
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<td>*900</td>
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<td><strong>FT42 - FK42</strong></td>
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<td></td>
<td>*1450</td>
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<td><strong>FT34 - FK34</strong></td>
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<td>1800</td>
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<tr>
<td><strong>FT44 - FK44</strong></td>
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<td>1800</td>
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<td></td>
<td></td>
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<td>*2200</td>
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</table>
## Torque limiters and overrunning clutches

<table>
<thead>
<tr>
<th>Mmax (Nm)</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>G5</th>
<th>G7</th>
<th>G8</th>
<th>G9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>750</td>
<td>1050</td>
<td>1700</td>
<td>2000</td>
<td>2500</td>
<td>2900</td>
<td>3500</td>
<td>3900</td>
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</tbody>
</table>

### Adjustable friction torque limiters with overrunning clutch

**FNV34 - FFNV34**

<table>
<thead>
<tr>
<th></th>
<th>1200</th>
<th>*1200</th>
<th>1350</th>
<th>1350</th>
<th>*1450</th>
<th>1600</th>
<th>1800</th>
<th>*1800</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1450</td>
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<td></td>
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<td>2000</td>
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</table>

### Non-adjustable friction torque limiters with overrunning clutch

**FNT34**

<table>
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<tr>
<th></th>
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<th>*1200</th>
<th>1450</th>
<th>*1450</th>
<th>1800</th>
<th>*1800</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2200</td>
</tr>
</tbody>
</table>

**FNT44**

|       | 1800 | *1800 | 2200 |

Mmax: maximum torque allowed for driveline with regular triangle tubes.

Settings marked with (*) are suggested for use at 1000 min⁻¹.
An overrunning clutch transmits rotary motion only in one direction. It is used to eliminate torque peaks generated by the inertia of implements with heavy rotating masses, such as rotors or flywheels during deceleration or stopping.

A standard overrunning clutch is designed to operate with counter-clockwise rotation of the driveline on which it is installed. This is the typical rotation of an overrunning clutch installed on the implement side of a driveline connecting a tractor's rear-mounted PTO (clockwise rotation viewed into the shaft) to the implement PIC (counter-clockwise rotation viewed into the shaft), as shown below.

During normal operation (tractor driving implement), the three pawls transmit motion from the housing to the hub. During sudden deceleration or stopping, the driveline is driven by the inertia of the implement, which is connected to the hub of the overrunning clutch.

The pawls are depressed into grooves machined into the hub, and consequently motion is not transmitted to the housing or other driveline components. The pawls, under pressure from the underlying springs, automatically reengage the grooves in the housing when transmission of motion is restored in the normal direction.

Three sizes of overrunning clutches are available, with different lengths of pawls and attachments to the PTO.
- RA1: Push-pin attachment, for sizes G1, G2, G3, G4 and G5.
- RA2: Taper pin attachment, for sizes G5, G7 and G8.
- RLA: RT ball collar attachment, for size G9.

Versions RA1 and RA2 are equipped with a grease fitting and lubrication is recommended every 50 hours of use with NLGI grade 2 grease. The RLA version overrunning clutches are lubricated with grease during assembly.
Overrunning clutches

RA1

<table>
<thead>
<tr>
<th>Maximum torque</th>
<th>B (mm)</th>
<th>1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>2400 Nm</td>
<td>G1</td>
<td>94</td>
<td>94</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>100</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>G3-G4</td>
<td>109</td>
<td>109</td>
<td>-</td>
<td>-</td>
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<tr>
<td></td>
<td>G5</td>
<td>112</td>
<td>112</td>
<td>-</td>
<td>-</td>
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</tbody>
</table>

Driveline codes RA1

<table>
<thead>
<tr>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>096</td>
<td>631</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Spare parts codes RA1

<table>
<thead>
<tr>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1 601101701R</td>
<td>601101702R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G2 601102701R</td>
<td>601102702R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G3-G4 601104701R</td>
<td>601104702R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G5 601105704R</td>
<td>601105702R</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
# Overrunning clutches

## RA1

<table>
<thead>
<tr>
<th>Ref</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>348014000R20</td>
<td>Grease fitting</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>G1</td>
<td>418011201R</td>
<td>Outer housing + yoke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>418021201R</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G3-G4</td>
<td>418041203R</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G5</td>
<td>418051201R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>4210C0001R03</td>
<td>Pawl + spring kit</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>403000001R10</td>
<td>Push-pin kit</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>5130C0301R</td>
<td>Hub with push-pin</td>
<td>1 3/8” Z6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5130C3701R</td>
<td></td>
<td>1 3/8” Z21</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>246000132R02</td>
<td>Locking plate</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>338005000R20</td>
<td>Snap ring</td>
<td>82 x 2.5 DIN 472/1</td>
</tr>
</tbody>
</table>
Overrunning clutches

RA2

<table>
<thead>
<tr>
<th>Maximum torque</th>
<th>B (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3800 Nm</td>
<td>S = 1 3/8&quot; Z6</td>
</tr>
<tr>
<td>G5</td>
<td>140</td>
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<td>G7</td>
<td>147</td>
</tr>
<tr>
<td>G8</td>
<td>160</td>
</tr>
</tbody>
</table>

Driveline codes RA2

<table>
<thead>
<tr>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>A50</td>
<td>A51</td>
<td>A52</td>
<td>A53</td>
</tr>
</tbody>
</table>

Spare parts codes RA2

<table>
<thead>
<tr>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G5</td>
<td>601205601R</td>
<td>601205602R</td>
<td>601205603R</td>
</tr>
<tr>
<td>G7</td>
<td>601206601R</td>
<td>601206602R</td>
<td>601206603R</td>
</tr>
<tr>
<td>G8</td>
<td>601217601R</td>
<td>601217602R</td>
<td>601217603R</td>
</tr>
</tbody>
</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
Overrunning clutches

Ref | Size | Spare part code | Description | Technical data
--- | --- | --- | --- | ---
1 |  | 348014000R20 | Grease fitting | 1 3/8" Z6 - Z21
2 | G5 | 418052203R | Outer housing + yoke | 1 3/4" Z6 - Z20
 | G7 | 418062203R | | |
 | G8 | 418172203R | | |
3 |  | 4210E0001R03 | Pawl + spring kit | |
4 |  | 408000047R02 | Taper pin | 1 3/8" Z6 - Z21
 |  | 408000046R02 | | 1 3/4" Z6 - Z20
5 |  | 5150E0301R | Hub with taper pin | 1 3/8" Z6
 |  | 5150E3701R | | 1 3/8" Z21
 |  | 5150E0401R | | 1 3/4" Z6
 |  | 5150E3801R | | 1 3/4" Z20
6 |  | 246000132R02 | Locking plate | 1 3/8" Z6 - Z21
 |  | 246000134R02 | Split locking plate | 1 3/4" Z6 - Z20
7 |  | 338005000R20 | Snap ring | 82 x 2.5 DIN 472/1
Overrunning clutches

RLA
(permanent lubrication)

![Diagram of RLA overrunning clutch]

<table>
<thead>
<tr>
<th>Maximum torque</th>
<th>B (mm)</th>
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<tbody>
<tr>
<td>6200 Nm</td>
<td>G9</td>
</tr>
<tr>
<td>S = 1 3/8” Z6</td>
<td>193</td>
</tr>
<tr>
<td>1 3/8” Z21</td>
<td>193</td>
</tr>
<tr>
<td>1 3/4” Z6</td>
<td>193</td>
</tr>
<tr>
<td>1 3/4” Z20</td>
<td>193</td>
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</table>

Driveline codes RLA

<table>
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<th>A34</th>
<th>A36</th>
<th>A37</th>
</tr>
</thead>
<tbody>
<tr>
<td>S = 1 3/8” Z6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 3/8” Z21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 3/4” Z6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 3/4” Z20</td>
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</table>

Spare parts codes RL3

<table>
<thead>
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<th></th>
<th>B (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S = 1 3/8” Z6</td>
<td>G9</td>
</tr>
<tr>
<td>1 3/8” Z21</td>
<td>60170M101R</td>
</tr>
<tr>
<td>1 3/4” Z6</td>
<td>60170M103R</td>
</tr>
<tr>
<td>1 3/4” Z20</td>
<td>60170M104R</td>
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</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
# Overrunning clutches

## RLA

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G9</td>
<td>4180M7010R</td>
<td>Outer Housing + Yoke</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>354108025R</td>
<td>Bearing</td>
<td>6305 (25x62x17 )</td>
</tr>
<tr>
<td>3</td>
<td>G9</td>
<td>4210G0001R03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>G9</td>
<td>2270G0306R</td>
<td>Hub</td>
<td>1 3/8&quot; Z6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2270G3706R</td>
<td></td>
<td>1 3/8&quot; Z21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2270G0406R</td>
<td></td>
<td>1 3/4&quot; Z6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2270G3806R</td>
<td></td>
<td>1 3/4&quot; Z20</td>
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<tr>
<td>5</td>
<td></td>
<td>340070014R</td>
<td>Spacer</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>354114070R</td>
<td>Bearing</td>
<td>61914 (70x100x16)</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>338000100R20</td>
<td>Snap ring</td>
<td>100 x 3,0 DIN 472/1</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>337001070R20</td>
<td>Snap ring</td>
<td>70 x 2,5 DIN 471/1</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>435000341R</td>
<td>RT ball collar kit</td>
<td>1 3/8&quot; Z6 - Z21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>435000440R</td>
<td></td>
<td>1 3/4&quot; Z6 - Z20</td>
</tr>
</tbody>
</table>
The GE torsionally resilient joint is used on drivelines for different functions depending upon the specific application:
- The GE can reduce torque peaks generated by the inertia of machines with heavy flywheels or rotors during abrupt starts or deceleration.
- The GE can smooth alternating or pulsating loads that may shorten the life of power transmission components.
- The GE can modify the natural frequency of a system, to avoid resonance events that could cause failures.
- The GE can smooth torsional vibrations generated by unequal working angles on drivelines with more than one joint.

A rubber ring within the GE operates like a torsional spring. This rubber ring connects the yoke / housing to the hub. The rubber is vulcanized to both the inner and outer metal surfaces to prevent the hub from slipping and to maintain phasing of the yokes.

The GE torsionally resilient joint has an internal limit pin that constrains flexure to ± 20°. This avoids excessive deformations that could create failure of the components.

GE torsionally resilient joints can be supplied without the 20° limit pin upon request. In case of high torque peaks, it is sometimes recommended to install a torque limiter (e.g. automatic torque limiter or shear bolt torque limiter).

GE torsionally resilient joints are installed at the end of the driveline, outboard the inner yokes. Consequently the joints maintain proper phasing even when the hub is deformed to its flexural limit.
Torsionally resilient joints

GE torsionally resilient joint is supplied in three models:
- GE4 for sizes G4 and G5
- GE6 for size G7
- GE8 for size G8.

The typical operating features of the torsionally resilient joint are expressed by torsional rigidity (R) and torque at maximum deformation (M$_{20}$). Beyond the latter value, torque will be transmitted without resiliency. It is recommended to consider these parameters when selecting the proper joint and to use a torque limiter (e.g. shear bolt) able to eliminate torque peaks exceeding torque at maximum deformation M$_{20}$.

Torsional rigidity is defined as the torque that creates 1° angular deformation of the torsionally resilient joint. This is an indicative value; in fact, deformation of rubber parts is linear only with small deformations. The torque at maximum deformation (M$_{20}$) and the torsional rigidity (R) of the GE varies according to the Shore hardness of the rubber (see chart below). GE6 torsionally resilient joints can be supplied with rubber in either 55 or 65 Shore hardness.

<table>
<thead>
<tr>
<th>Shore hardness</th>
<th>R Nm/°</th>
<th>M20° Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE4</td>
<td>65 Sh</td>
<td>50</td>
</tr>
<tr>
<td>GE6</td>
<td>55 Sh</td>
<td>50</td>
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<tr>
<td>GE8</td>
<td>65 Sh</td>
<td>100</td>
</tr>
<tr>
<td>GE8</td>
<td>65 Sh</td>
<td>250</td>
</tr>
</tbody>
</table>

Cardan shafts with torsionally resilient joints are often used on multi-spindle rotary cutters, whose blades have overlapping cutting edges. When an overload slows a rotor, the GE joint can absorb the inertia of the rotor as a deformation of the elastic member. The amplitude of this deformation varies with respect to the torsional rigidity of the elastic member and the 20° limit pin. The torsionally resilient joint can reduce overloads but still maintain proper phasing of the rotors. Unlike other torque limiters (e.g. friction clutch), this avoids collision and damage to the blades.

Torsionally resilient joints can also smooth vibrations, alternating, and / or pulsating loads that could generate fatigue stress in the driveline.
Torsionally resilient joints

GE4

Driveline codes GE4

<table>
<thead>
<tr>
<th>M20°</th>
<th>Shore hardness</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700</td>
<td>65 Sh</td>
<td>0D4</td>
<td>0D5</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

GE4 spare parts codes

<table>
<thead>
<tr>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G4 65 Sh</td>
<td>608E46501R</td>
<td>608E46502R</td>
<td>-</td>
</tr>
<tr>
<td>G5 65 Sh</td>
<td>608G46501R</td>
<td>608G46502R</td>
<td>-</td>
</tr>
</tbody>
</table>

Codes for taper pins

<table>
<thead>
<tr>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>408000047R02</td>
<td>408000047R02</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
Torsionally resilient joints

GE6

Driveline codes GE6

<table>
<thead>
<tr>
<th>M20° Nm</th>
<th>Shore hardness</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700</td>
<td>55 Sh</td>
<td>0D0</td>
<td>0D1</td>
<td>0D2</td>
<td>0D3</td>
</tr>
<tr>
<td>3000</td>
<td>65 Sh</td>
<td>0D4</td>
<td>0D5</td>
<td>0D6</td>
<td>0D7</td>
</tr>
</tbody>
</table>

GE6 spare parts codes

<table>
<thead>
<tr>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G7 55 Sh</td>
<td>608H65501R</td>
<td>608H65502R</td>
<td>608H65503R</td>
</tr>
<tr>
<td></td>
<td>608H65504R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65 Sh</td>
<td>608H66501R</td>
<td>608H66502R</td>
<td>608H66503R</td>
</tr>
<tr>
<td></td>
<td>608H66504R</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Codes for taper pins

<table>
<thead>
<tr>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>408000047R02</td>
<td>408000047R02</td>
<td>408000046R02</td>
<td>408000046R02</td>
</tr>
</tbody>
</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

16.4
Torsionally resilient joints

GE8

<table>
<thead>
<tr>
<th>B (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S = 1 3/8” Z6</td>
</tr>
<tr>
<td>G8</td>
</tr>
<tr>
<td>G9</td>
</tr>
</tbody>
</table>

Driveline codes GE8

<table>
<thead>
<tr>
<th>M20° Nm</th>
<th>Shore hardness</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000</td>
<td>65 Sh</td>
<td>0D4</td>
<td>0D5</td>
<td>0D6</td>
<td>0D7</td>
</tr>
</tbody>
</table>

GE8 spare parts codes

<table>
<thead>
<tr>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G8</td>
<td>608L86501R</td>
<td>608L86502R</td>
<td>608L86503R</td>
</tr>
<tr>
<td>G9</td>
<td>608M86501R</td>
<td>608M86502R</td>
<td>608M86503R</td>
</tr>
</tbody>
</table>

Codes for taper pins

<table>
<thead>
<tr>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>408000047R02</td>
<td>408000047R02</td>
<td>408000046R02</td>
<td>408000046R02</td>
</tr>
</tbody>
</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
A ratchet torque limiter is a device able to interrupt the transmission of power in the event of a torque peak or overload that exceeds the setting. The torque limiter is automatically re-engaged after the cause of the overload is removed. Ratchet torque limiters are generally employed to protect implements subject to constant or alternating torques from overloads. The setting is normally two to three times the median torque to be transmitted. When the device is slipping, the user should promptly stop the PTO to avoid excessive wear.

Ratchet torque limiters should be used only on drivelines operating at speeds less than 700 min⁻¹. Ratchet torque limiters may be supplied in either symmetrical (LN) or one-way types (SA). Their lubrication interval is 50-hours with NLGI 2 grease.

SA1 and SA2 models (with one and two rows of ratchets, respectively) have a push pin attachment. SA3 and SA4 models (with three and four rows of ratchets, respectively) have a ball collar attachment.

Standard one-way ratchet torque limiters are designed to operate on a driveline with counter-clockwise rotation. It transmits approximately 15% of the rated torque in the opposite direction. Symmetrical ratchet torque limiters transmit the same torque in both direction of rotation.
Ratchet torque limiters

SA1
one-way

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>400</td>
<td>94</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Driveline codes SA1

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>117</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

SA1 codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>400</td>
<td>610124001R</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

To establish more accurate torque settings, a clutch may contain a different number of springs than what is listed in these tables.

⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

17.2
Ratchet torque limiters

SA1
one-way

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>348014000R20</td>
<td>Grease fitting</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>G1</td>
<td>422011020R</td>
<td>Outer housing + yoke</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>421340001R06</td>
<td>Ratchet + spring kit</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>513340302R</td>
<td>Hub with push-pin</td>
<td>1 3/8&quot; Z6</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>403000001R10</td>
<td>Push-pin kit</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>240000033R02</td>
<td>Locking plate</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>338005000R20</td>
<td>Snap ring</td>
<td>82 x 2.5 DIN 472/1</td>
</tr>
</tbody>
</table>
Ratchet torque limiters

SA2
one-way

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>650</td>
<td>114</td>
<td>-</td>
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<td>-</td>
</tr>
<tr>
<td>G2</td>
<td>650</td>
<td>120</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Driveline codes SA2

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>650</td>
<td>128</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>136</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

SA2 codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>650</td>
<td>610234001R</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G2</td>
<td>650</td>
<td>611234005R</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>611239001R</td>
<td>-</td>
<td>-</td>
<td>12 12</td>
</tr>
</tbody>
</table>

To establish more accurate torque settings, a clutch may contain a different number of springs than what is listed in these tables.

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
## Ratchet torque limiters

### SA2

#### one-way

![Image of ratchet torque limiter components]

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>348014000R20</td>
<td>Grease fitting</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>G1</td>
<td>422012020R</td>
<td>Outer housing + yoke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>422022020R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>4213400001R06</td>
<td>Ratchet + spring kit</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>513350302R</td>
<td>Hub with push-pin</td>
<td>1 3/8&quot; Z6</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>4030000001R10</td>
<td>Push-pin kit</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>240000033R02</td>
<td>Locking plate</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>3380005000R20</td>
<td>Snap ring</td>
<td>82 x 2.5 DIN 472/1</td>
</tr>
</tbody>
</table>
Ratchet torque limiters

SA3
one-way

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G2</td>
<td>900</td>
<td>149</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>G3-G4</td>
<td>1000</td>
<td>158</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>G5</td>
<td>1200</td>
<td>161</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Driveline codes SA3

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>900</td>
<td>153</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>156</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td>159</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

SA3 codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G2</td>
<td>900</td>
<td>611341501R</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>G3-G4</td>
<td>1000</td>
<td>613344501R</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td>613348501R</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>G5</td>
<td>1200</td>
<td>614348501R</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

To establish more accurate torque settings, a clutch may contain a different number of springs than what is listed in these tables.

⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
Ratchet torque limiters

**SA3**

one-way

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>348014000R20</td>
<td>Grease fitting</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>G2</td>
<td>422023020R</td>
<td>Outer housing + yoke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G3-G4</td>
<td>422043020R</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G5</td>
<td>422053020R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>421340001R06</td>
<td>Ratchet + spring kit</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>2270Q0303R</td>
<td>Hub</td>
<td>1 3/8&quot; Z6</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>240000033R02</td>
<td>Locking plate</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>338005000R20</td>
<td>Snap ring</td>
<td>82 x 2.5 DIN 472/1</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>435000321R</td>
<td>Ball collar kit</td>
<td></td>
</tr>
</tbody>
</table>
# Ratchet torque limiters

## SA4

**one-way**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>B (mm)</th>
<th>1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G3-G4</td>
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<td>178</td>
<td>-</td>
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<td>-</td>
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</tr>
<tr>
<td></td>
<td>1600</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>G5</td>
<td>1400</td>
<td>181</td>
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<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1600</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>G7</td>
<td>1400</td>
<td>188</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1600</td>
<td></td>
<td></td>
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</tbody>
</table>

**Driveline codes SA4**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1400</td>
<td>168</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1600</td>
<td>170</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**SA4 codes as spare parts**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G3-G4</td>
<td>1400</td>
<td>613452501R</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1600</td>
<td>613456501R</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G5</td>
<td>1400</td>
<td>614452501R</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1600</td>
<td>614456501R</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G7</td>
<td>1400</td>
<td>615452501R</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td></td>
<td>1600</td>
<td>615456501R</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

To establish more accurate torque settings, a clutch may contain a different number of springs than what is listed in these tables.

⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

17.8
# Ratchet torque limiters

## SA4

one-way

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>348014000R20</td>
<td>Grease fitting</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>G3-G4</td>
<td>422044020R</td>
<td>Outer housing + yoke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G5</td>
<td>422054020R</td>
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<td></td>
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<td>422064020R</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
<td>421340001R06</td>
<td>Ratchet + spring kit</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>2270R0302R</td>
<td>Hub</td>
<td>1 3/8&quot; Z6</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>240000033R02</td>
<td>Locking plate</td>
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</tr>
<tr>
<td>6</td>
<td></td>
<td>338005000R20</td>
<td>Snap ring</td>
<td>82 x 2.5 DIN 472/1</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>435000321R</td>
<td>Ball collar kit</td>
<td></td>
</tr>
</tbody>
</table>
Ratchet torque limiters

LN1
symmetrical

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>( S = 1 \frac{3}{8}&quot; ) Z6</th>
<th>1 ( \frac{3}{8}&quot; ) Z21</th>
<th>1 ( \frac{3}{4}&quot; ) Z6</th>
<th>1 ( \frac{3}{4}&quot; ) Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
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</tbody>
</table>

Driveline codes LN1

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>( S = 1 \frac{3}{8}&quot; ) Z6</th>
<th>1 ( \frac{3}{8}&quot; ) Z21</th>
<th>1 ( \frac{3}{4}&quot; ) Z6</th>
<th>1 ( \frac{3}{4}&quot; ) Z20</th>
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<tbody>
<tr>
<td></td>
<td>300</td>
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</table>

LN1 codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>( S = 1 \frac{3}{8}&quot; ) Z6</th>
<th>1 ( \frac{3}{8}&quot; ) Z21</th>
<th>1 ( \frac{3}{4}&quot; ) Z6</th>
<th>1 ( \frac{3}{4}&quot; ) Z20</th>
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<tbody>
<tr>
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<td>-</td>
<td>- 6 6</td>
</tr>
</tbody>
</table>

To establish more accurate torque settings, a clutch may contain a different number of springs than what is listed in these tables.

⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
## Ratchet torque limiters

**LN1**

symmetrical  

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>348014000R20</td>
<td>Grease fitting</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>G1</td>
<td>422B0S301R</td>
<td>Outer housing + yoke</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>421340007R06</td>
<td>Ratchet + spring kit</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>513340302R</td>
<td>Hub with push-pin</td>
<td>1 3/8&quot; Z6</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>403000001R10</td>
<td>Push-pin kit</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>240000294R02</td>
<td>Locking plate</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>338005000R20</td>
<td>Snap ring</td>
<td>82 x 2.5 DIN 472/1</td>
</tr>
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</table>

---

BONDIOLI & PAVESI

17.11
Ratchet torque limiters

LN2
symmetrical

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>460</td>
<td>114</td>
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<tr>
<td></td>
<td>600</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G2</td>
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<td>120</td>
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<td>-</td>
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Driveline codes LN2

<table>
<thead>
<tr>
<th>Setting</th>
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<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>460</td>
<td>0E7</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td>0E9</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tbody>
</table>

LN2 codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>460</td>
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</tr>
<tr>
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<td>600</td>
<td>60A2B3203R</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G2</td>
<td>600</td>
<td>60A2C3203R</td>
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<td>-</td>
</tr>
</tbody>
</table>

To establish more accurate torque settings, a clutch may contain a different number of springs than what is listed in these tables.

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
## Ratchet torque limiters

**LN2**

Symmetrical

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>348014000R20</td>
<td>Grease fitting</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>G1</td>
<td>422B0T301R</td>
<td>Outer housing + yoke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>422C0T301R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>421340007R06</td>
<td>Ratchet + spring kit</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>513350302R</td>
<td>Hub with push-pin</td>
<td>1 3/8” Z6</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>403000001R10</td>
<td>Push-pin kit</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>240000294R02</td>
<td>Locking plate</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>338005000R20</td>
<td>Snap ring</td>
<td>82 x 2.5 DIN 472/1</td>
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</tbody>
</table>
Ratchet torque limiters

LN3
symmetrical

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
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</thead>
<tbody>
<tr>
<td>G2</td>
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<td>149</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td></td>
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</table>

Driveline codes LN3

<table>
<thead>
<tr>
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<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
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</thead>
<tbody>
<tr>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>900</td>
<td>0F4</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tbody>
</table>

LN3 codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G2</td>
<td>800</td>
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<td>-</td>
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<tr>
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<td>900</td>
<td>60B3C4103R</td>
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<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

To establish more accurate torque settings, a clutch may contain a different number of springs than what is listed in these tables.

⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
## Ratchet torque limiters

### LN3

Symmetrical

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>348014000R20</td>
<td>Grease fitting</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>G2</td>
<td>422C0U301R</td>
<td>Outer housing + yoke</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>421340007R06</td>
<td>Ratchet + spring kit</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>2270Q0303R</td>
<td>Hub</td>
<td>1 3/8” Z6</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>240000294R02</td>
<td>Locking plate</td>
<td>82 x 2.5 DIN 472/1</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>338005000R20</td>
<td>Snap ring</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>435000321R</td>
<td>Ball collar kit</td>
<td></td>
</tr>
</tbody>
</table>
Ratchet torque limiters

LN4
symmetrical

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G3-G4</td>
<td>1000</td>
<td>178</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G5</td>
<td>1200</td>
<td>181</td>
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</tr>
</tbody>
</table>

Driveline codes LN4

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1000</td>
<td>0F7</td>
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<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td>0F9</td>
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<td>--</td>
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</tr>
</tbody>
</table>

LN4 codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
<th>24</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>G3-G4</td>
<td>1000</td>
<td>60B4E4403R</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>9</td>
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<tr>
<td></td>
<td>1200</td>
<td>60B4E4803R</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>G5</td>
<td>1200</td>
<td>60B4G4803R</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

To establish more accurate torque settings, a clutch may contain a different number of springs than what is listed in these tables.

⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
## Ratchet torque limiters

**LN4**

Symmetrical

### Parts List

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>348014000R20</td>
<td>Grease fitting</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>G3-G4 G5</td>
<td>422E0V301R 422G0V301R</td>
<td>Outer housing + yoke</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>421340007R06</td>
<td>Ratchet + spring kit</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>2270R0302R</td>
<td>Hub</td>
<td>1 3/8&quot; Z6</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>240000294R02</td>
<td>Locking plate</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>338005000R20</td>
<td>Snap ring</td>
<td>82 x 2.5 DIN 472/1</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>435000321R</td>
<td>Ball collar kit</td>
<td></td>
</tr>
</tbody>
</table>
Shear bolt torque limiters type LB are devices able to interrupt power transmission when the torque transmitted exceeds the setting. This interruption in power is caused by the shearing of a bolt. This bolt must be replaced before power can be restored. Use of shear bolt torque limiters is recommended to avoid damage to drivelines mounted on implements subject to accidental overloads or torque peaks.

The torque setting for shear bolt torque limiters is usually two or three times the median torque M and must never exceed maximum torque of the driveline (Mmax).

| Standard settings for each size of driveline - according to the telescoping member used - are listed in the table to the right. LB shear bolt limiters are designed to more evenly distribute their mass with respect to the axis of rotation, thereby helping to decrease vibrations. LB shear bolt limiters are lubricated during assembly. No further lubrication is required for versions installed on size G1 and G2 drivelines, therefore no grease fitting is provided. For other sizes it is recommended to lubricate at least once in a season. The grease is necessary to lubricate the surfaces of the hub and yoke that rotate independently after the bolt has sheared.

<table>
<thead>
<tr>
<th>Maximum settings LB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting torque</td>
</tr>
<tr>
<td>Nm</td>
</tr>
<tr>
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</tr>
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<td>G2</td>
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<td>G3</td>
</tr>
<tr>
<td>G4</td>
</tr>
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<td>G5</td>
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<tr>
<td>G7</td>
</tr>
<tr>
<td>G8</td>
</tr>
<tr>
<td>G9</td>
</tr>
</tbody>
</table>

LB torque limiters up to size G4 have push-pin attachment to the PTO. Larger sizes use a taper-pin attachment.
Shear bolt torque limiters LB

LB shear bolt limiters are integrated devices that cannot be separated after assembly. Components supplied as spare parts include the complete torque limiter, shear bolts (packaged in quantities of five pieces, including the nuts), push-pins or taper pins, and grease fittings.

Bolts used on standard LB shear bolt limiters are metric class 8.8, steel, with a minimum strength (Rm) equal to 800 N/mm². ISO standards and SAE standards (for USA) for shear bolts with corresponding strengths (Rm) are tabulated to the right. The setting is increased by approximately 20% when replacing the standard class 8.8 bolt with one of the same diameter but class 10.9.

Standard bolts are partially threaded, and the nominal settings usually are referenced to shearing on the un-threaded shank of the bolt. The nominal setting is reduced approximately 20% when replacing the standard bolt with another of the same class, but will shear on the threaded portion of the bolt.

Recommended tightening torques for standard bolts.

<table>
<thead>
<tr>
<th>ISO standard</th>
<th>Class</th>
<th>Rm minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.6</td>
<td>5.6</td>
<td>500 N/mm²</td>
</tr>
<tr>
<td>8.8</td>
<td>8.8</td>
<td>800 N/mm²</td>
</tr>
<tr>
<td>10.9</td>
<td>10.9</td>
<td>1000 N/mm²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAE standard</th>
<th>Class</th>
<th>Rm minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>74000 psi 510 N/mm²</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>120000 psi 827 N/mm²</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>150000 psi 1034 N/mm²</td>
</tr>
</tbody>
</table>

For the safety of the operator and reliable function of the driveline, replace the bolt only with one equal in length, diameter, and grade as the original.
The torque setting, assigned according to type and size of telescoping members, must never exceed the maximum torque of the driveline $M_{\text{max}}$.

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
Shear bolt torque limiters LB

**LB codes as spare parts**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>650</td>
<td>6060B0304R</td>
<td>6060B3703R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>700</td>
<td>6060B0302R</td>
<td>6060B3702R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G2</td>
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<td>6060C0302R</td>
<td>6060C3702R</td>
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<td>-</td>
</tr>
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<td>1050</td>
<td>6060C0308R</td>
<td>6060C3704R</td>
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<td>-</td>
</tr>
<tr>
<td>G3</td>
<td>1400</td>
<td>6060E0303R</td>
<td>6060E3704R</td>
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<td>6060E3702R</td>
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</tr>
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<td>G4</td>
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**Spare part codes**

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<th>Technical data</th>
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LR automatic torque limiters interrupt transmission of power in the event of torque peaks that exceed the setting. The LR will automatically re-engage after removing the cause of the overload and allowing the driveline to slow to a lower speed.

LR torque limiters apply to implements subject to accidental overloads or torque peaks, such as tillers, square balers, and feed mixers.

The torque setting is generally two or three times the median torque M.

LR torque limiters are designed to operate in one direction. Standard versions are suitable for drivelines operated by the rear-mounted PTO of a tractor, in the direction of rotation shown.

Special versions with the opposite direction of rotation can be supplied upon request.

LR torque limiters are lubricated with NLGI 2 molybdenum disulphide grease during assembly. No additional lubrication is required for the service life of the unit.

The torque setting can be easily reset by substitution of different spring packs.

LR torque limiters have taper pin attachment to the PTO.

Standard LR24 and LR35 models re-engage only once per revolution.

Special models LR24 and LR35 are available that re-engage either in three positions (LR23) four positions (LR24) or five positions (LR35). These have been developed especially for operation at 1000 min⁻¹, but can also be used at lower speeds.

Special LR24 and LR35 for use at 1000 min⁻¹ are identified by the letter “L” stamped on the flange fork, next to the value of the nominal torque setting.

Ensure the device is properly attached and the taper pin is properly tightened before operating the implement.

Recommended tightening torques:
- 150 Nm for profiles 1 3/8"-6 ed 1 3/8"-21
- 220 Nm for profiles 1 3/4"-6 ed 1 3/4"-20

### Standard settings (Nm)

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<th>G3</th>
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(LR23) four positions (LR24) or five positions (LR35). These have been developed especially for operation at 1000 min⁻¹, but can also be used at lower speeds.

Special LR24 and LR35 for use at 1000 min⁻¹ are identified by the letter “L” stamped on the flange fork, next to the value of the nominal torque setting.

Ensure the device is properly attached and the taper pin is properly tightened before operating the implement.

Recommended tightening torques:
- 150 Nm for profiles 1 3/8"-6 ed 1 3/8"-21
- 220 Nm for profiles 1 3/4"-6 ed 1 3/4"-20

### Standard settings (Nm)

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<tr>
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<th>G1</th>
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(LR23) four positions (LR24) or five positions (LR35). These have been developed especially for operation at 1000 min⁻¹, but can also be used at lower speeds.

Special LR24 and LR35 for use at 1000 min⁻¹ are identified by the letter “L” stamped on the flange fork, next to the value of the nominal torque setting.

Ensure the device is properly attached and the taper pin is properly tightened before operating the implement.

Recommended tightening torques:
- 150 Nm for profiles 1 3/8"-6 ed 1 3/8"-21
- 220 Nm for profiles 1 3/4"-6 ed 1 3/4"-20

(Bondioli & Pavesi)
## Automatic torque limiter LR

### LR23

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*Recommended settings for a 1000 min⁻¹ velocity

### Driveline codes LR23 for use at 540 min⁻¹

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### Driveline codes LR23 for use at 1000 min⁻¹

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![Diagram of LR23](image)

> For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

19.2
### Automatic torque limiter LR

#### LR23

Sparse parts codes LR23 for use at 540 min⁻¹

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Sparse parts codes LR23 for use at 1000 min⁻¹

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*Recommended settings for a 1000 min⁻¹ velocity
### Automatic torque limiter LR

#### LR23

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<th>Size</th>
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<th>Description</th>
<th>Technical data</th>
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**Automatic torque limiter LR**

**LR24**

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

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<tr>
<th>Setting</th>
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*Recommended settings for a 1000 min$^{-1}$ velocity*

**Codes LR24 for use at 540 min$^{-1}$**

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**Codes LR24 for use at 1000 min$^{-1}$**

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Automatic torque limiter LR

LR24

Spare parts codes LR24 for use at 540 min⁻¹

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Spare parts codes LR24 for use at 1000 min⁻¹

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*Recommended settings for a 1000 min⁻¹ velocity

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side.
All rotating parts must be guarded.
## Automatic torque limiter LR

### LR24

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<thead>
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## Automatic torque limiter LR

### LR35

![LR35 Diagram](image)

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### Driveline codes LR35 for use at 540 min⁻¹

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### Driveline codes LR35 with improved re-engagement

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### Codes as spare parts for use at 540 min⁻¹

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### Codes as spare parts with improved re-engagement

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⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
### Automatic torque limiter LR

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<td>162 x 4 DIN 472/1</td>
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Friction torque limiters, commonly referred to as friction clutches, are devices used to limit torque during overloads. During operation, the plates of the torque limiter slip against friction linings, transmitting torque at the clutch setting. The friction clutch is effective in limiting possible overloads and torque peaks generated during start-up by implements with high inertia (i.e. those equipped with flywheels or heavy rotating masses). On these implements, a friction clutch is normally used with an overrunning clutch, able to eliminate reverse torque peaks during deceleration or stopping. The torque setting of friction clutches is generally 2 times that of the median torque $M$. Friction clutches are supplied as two types: torque limiters with an adjustable setting ($FV$, $FFV$) or torque limiters with a non-adjustable setting ($FT$, $FK$). All versions have metal surfaces that are specially treated to help prevent sticking and corrosion of the friction linings. FT models can be supplied with the Spring Release System. This system permits the spring pressure to be reduced during storage, without requiring disassembly of the torque limiter.
Friction torque limiter

pv Factor
The reliable function of a friction clutch is highly dependent on many different parameters. Temperature is important. When slipped frequently and for long periods, friction clutches may become hot. This can impair the condition of the clutch, and alter the torque setting drastically. Temperature increases rapidly with longer slipping cycles. It is recommended to select a setting suitable for each specific application, allowing only occasional and brief slipping (only a few seconds per cycle should be permitted).

After the setting has been chosen in accordance with the conditions of the application (median torque M, torque limit of driveline), one must select the proper type of friction clutch in regards to diameter and number of plates or friction linings.

When selecting a suitable type of friction clutch, pressure $p$ and slipping velocity $v$ must also be taken into account. The pressure on the friction linings is determined by the force exerted from the springs, and their surface area. Slipping velocity is influenced by overloads (starting, stopping or blockages of the implement) and is related to the speed of rotation for the driveline.

The influence of pressure $p$ and velocity $v$ on the clutch is considered by factor $p \cdot v$, equal to their product. The maximum value of factor $p \cdot v$, suggested for reliable function of a friction clutch, is usually determined by experimentation. Maximum recommended torque settings for 1000 min$^{-1}$ speed are determined in accordance with this limiting value and shown on the opposite page (marked with *).

Friction clutches may become hot. Do not touch!
Keep the area around the friction clutch clear of any material that could catch fire, and avoid prolonged slipping that will generate excess heat and wear.
Release System
The materials used in friction linings can react with the metal surfaces of the clutch, and over time this can cause adhesion phenomena, or seizure of the clutch. Several parameters that are difficult to quantify influence this reaction, but high pressure and humid environments help cause adhesion over time.

Certain metal surfaces of the FV and FT clutches are specially treated to reduce chances of seizure. Nevertheless, reducing the pressure on the linings during storage, and storing the clutch in a dry environment are recommended for any friction clutch.

The Release System permits reduction of the pressure on the linings during storage without disassembly of the clutch. The system also permits verification of proper operation after storage.

Pressure on the linings is reduced to a minimum by turning four socket headed screws (located on the flange yoke) completely into the flange yoke.

The screws are only threaded on a portion of their body, so they are captured in the clutch and can be removed only upon disassembly of the clutch.

All friction clutches with the Release System are equipped with a hex wrench (code 399000030) to adjust the screws, and an operator’s manual (code 399FRR001) to explain the proper use of the system.

To check proper function of a friction clutch with the Release System, the four socket screws are turned all the way in. Start the PTO at low speed so the clutch will slip for two or three seconds (longer slipping may cause damage). If the clutch will not slip after two or three attempts, disassemble the clutch and clean the contact surfaces, and replace any damaged parts.

Before operating a clutch with the Release System, pressure on the linings must be restored by turning the four set screws completely out.

Letter R in the shaft code identifies friction clutches equipped with Release System.
FV friction clutches are equipped with special Belleville springs, designed to apply pressure that varies with the amount of compression.

Five models of FV friction clutches are available, with different diameters and number of friction linings.

All versions are available with treated hubs and driving plates to help prevent sticking and corrosion of the friction linings.

The chart below indicates the diameter D, number of linings, and the standard settings for each model, corresponding to each driveline size.

Maximum settings recommended for use at 1000 min\(^{-1}\) are marked (*).

### Standard settings (Nm)

<table>
<thead>
<tr>
<th>Model</th>
<th>D (mm)</th>
<th>Number of Plates</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>G5</th>
<th>G7</th>
<th>G8</th>
<th>G9</th>
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<td>*500</td>
<td>600</td>
<td>*600</td>
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<td>800</td>
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<td>900</td>
<td>1000</td>
<td>1000</td>
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<td>1000</td>
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<td></td>
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<td>*1450</td>
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<td></td>
<td></td>
<td></td>
<td>1800</td>
<td>*1800</td>
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<td>FV44</td>
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</tbody>
</table>
Friction torque limiters FV

FV friction torque limiters have an adjustable torque setting. The torque setting of FV friction clutches varies with different compression (h) of the Belleville spring.

The tables below set out spring codes, thicknesses and compression “h” measured as shown in the figure for standard settings.

The height of the spring is measured next to each bolt and may be ± 0.2 mm of the listed value.

The tables also show the amount of rotation of each bolt required to achieve the next higher or lower setting, relative to the nominal setting (listed with no rotation noted on the bolt).

In addition to the listed settings, intermediate settings may be obtained by tightening or loosening the bolts proportionately.

Do not over-tighten the bolts. This may endanger the function of the clutch.

To avoid excessive wear to the implement, driveline, or tractor, Bondioli & Pavesi recommends that the defined setting not be altered.

Friction clutches may become hot. **Do not touch!**

Keep the area around the friction clutch clear of any material that could catch fire, and avoid prolonged slipping that will generate excess heat and wear.
### Friction torque limiters FV

**FV22 Friction clutches**  
2 plates, diameter 155 mm

<table>
<thead>
<tr>
<th>Spring code</th>
<th>t mm</th>
<th>Setting Nm</th>
<th>h mm</th>
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<tbody>
<tr>
<td>367005850R</td>
<td>3.75</td>
<td>400</td>
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<td></td>
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<td>12.5</td>
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**FV32 Friction clutches**  
2 plates, diameter 180 mm

<table>
<thead>
<tr>
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<th>t mm</th>
<th>Setting Nm</th>
<th>h mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>367008860R</td>
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<td></td>
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<td>17.0</td>
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<td>16.5</td>
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**FV34 Friction clutches**  
4 plates, diameter 180 mm

<table>
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<th>Setting Nm</th>
<th>h mm</th>
</tr>
</thead>
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<tr>
<td>367008860R</td>
<td>3.75</td>
<td>1200</td>
<td>18.0</td>
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<td></td>
<td>1600</td>
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<td></td>
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<td>2200</td>
<td>16.5</td>
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**FV42 Friction clutches**  
2 plates, diameter 202 mm

<table>
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<tr>
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<th>t mm</th>
<th>Setting Nm</th>
<th>h mm</th>
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<tbody>
<tr>
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<td>1450</td>
<td>18.0</td>
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<tr>
<td></td>
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<td>17.0</td>
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</table>

**FV44 Friction clutches**  
4 plates, diameter 202 mm

<table>
<thead>
<tr>
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<th>t mm</th>
<th>Setting Nm</th>
<th>h mm</th>
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<tbody>
<tr>
<td>367009870R</td>
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Friction torque limiters FV

FV22
adjustable setting

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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<tbody>
<tr>
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<td>92</td>
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<td>G3</td>
<td>*600</td>
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<td>101</td>
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<tr>
<td></td>
<td>800</td>
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<tr>
<td>G4</td>
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*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FV22

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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<tbody>
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<td>N09</td>
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<td>500</td>
<td></td>
<td>N00</td>
<td>N03</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>600</td>
<td></td>
<td>N07</td>
<td>N10</td>
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<td>-</td>
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<td>800</td>
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<td>N11</td>
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</table>

FV22 codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
<th>h mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>*400</td>
<td>661B24103R</td>
<td>661B24137R</td>
<td>-</td>
<td>-</td>
<td>13.5</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>661B24103R</td>
<td>661B24137R</td>
<td>-</td>
<td>-</td>
<td>13.5</td>
</tr>
<tr>
<td>G2</td>
<td>*500</td>
<td>661C28103R</td>
<td>661C28137R</td>
<td>-</td>
<td>-</td>
<td>13.0</td>
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<td></td>
<td>600</td>
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<td>661C32137R</td>
<td>-</td>
<td>-</td>
<td>12.5</td>
</tr>
<tr>
<td>G3</td>
<td>*600</td>
<td>661E32103R</td>
<td>661E32137R</td>
<td>-</td>
<td>-</td>
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<td>800</td>
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<td>661E39137R</td>
<td>-</td>
<td>-</td>
<td>12.5</td>
</tr>
<tr>
<td>G4</td>
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<td>661E39137R</td>
<td>-</td>
<td>-</td>
<td>12.5</td>
</tr>
</tbody>
</table>

⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
### Friction torque limiters FV

**FV22**

**adjustable setting**

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>432000003R08</td>
<td>Bolt</td>
<td>M8 x 50 mm</td>
</tr>
<tr>
<td>2</td>
<td>G1</td>
<td>2530B8503R</td>
<td>Flange yoke</td>
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<tr>
<td></td>
<td>G2</td>
<td>2530C8503R</td>
<td></td>
<td>D = 124 ; d = 67 mm</td>
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<tr>
<td></td>
<td>G3-G4</td>
<td>2530E8503R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>258005320R02</td>
<td>Bushing</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>247006151R08</td>
<td>Friction lining</td>
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<td>5</td>
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<td>403000001R10</td>
<td>Push-pin kit</td>
<td>1 3/8&quot; Z6 - Z21</td>
</tr>
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<td>6</td>
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<td>513850307R</td>
<td>Hub with push pin</td>
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<td>1 3/8&quot; Z21</td>
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<td>Pressure plate</td>
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<td>t = 3.75 mm</td>
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Friction torque limiters FV

FV32
adjustable setting

<table>
<thead>
<tr>
<th>Setting</th>
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<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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<tbody>
<tr>
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<tr>
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<td>G5</td>
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<td>G7</td>
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<tr>
<td>*1100</td>
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</table>

*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FV32

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<th>1 3/4&quot; Z20</th>
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<tbody>
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<td>N17</td>
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<tr>
<td>1000</td>
<td>N31</td>
<td>N33</td>
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<tr>
<td>1100</td>
<td>N12</td>
<td>N15</td>
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FV32 codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
<th>h mm</th>
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</thead>
<tbody>
<tr>
<td>G4</td>
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<td>661G41237R</td>
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<td>661H44237R</td>
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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

21.6
Friction torque limiters FV

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>432000054R08</td>
<td>Bolt</td>
<td>M10 x 55 mm</td>
</tr>
<tr>
<td>2</td>
<td>G4</td>
<td>253048602R</td>
<td>Flange yoke</td>
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</tr>
<tr>
<td></td>
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<tr>
<td></td>
<td>G7</td>
<td>25306903R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>258005320R02</td>
<td>Bushing</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>247006251R08</td>
<td>Friction lining</td>
<td>D = 141 ; d = 77 mm</td>
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<tr>
<td>5</td>
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<td>515860305R</td>
<td>Hub with push pin</td>
<td>1 3/8&quot; Z6</td>
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## Friction torque limiters FV

### FV42

Adjustable setting

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*Recommended settings for a 1000 min⁻¹ velocity

### Driveline codes FV42

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### FV42 codes as spare parts

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21.8
Friction torque limiters FV

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<th>Technical data</th>
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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
## Friction torque limiters FV

**FV34**
adjustable setting

![Diagram of FV34](image)

<table>
<thead>
<tr>
<th>Setting Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
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*Recommended settings for a 1000 min⁻¹ velocity

### Driveline codes FV34

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### FV34 codes as spare parts

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<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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BONDIOLI & PAVESI

21.10
Friction torque limiters FV

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

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<th>Description</th>
<th>Technical data</th>
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FV34 adjustable setting
Friction torque limiters FV

FV44
adjustable setting

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*Recommended settings for a 1000 min\(^{-1}\) velocity

Driveline codes FV44

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FV44 codes as spare parts

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<th>1 3/4&quot; Z6</th>
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<th>h (mm)</th>
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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
# Friction torque limiters FV

## FV44

*adjustable setting*

<table>
<thead>
<tr>
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<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
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<tbody>
<tr>
<td>1</td>
<td></td>
<td>432000114R08</td>
<td>Bolt</td>
<td>M10 x 75 mm</td>
</tr>
<tr>
<td>2</td>
<td>G8</td>
<td>253078702R</td>
<td>Flange yoke</td>
<td></td>
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<tr>
<td></td>
<td>G9</td>
<td>253089001R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>258005320R02</td>
<td>Bushing</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>247006351R08</td>
<td>Friction lining</td>
<td>D = 162 ; d = 85 mm</td>
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<tr>
<td>5</td>
<td></td>
<td>248737702R02</td>
<td>Driving plate</td>
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</tr>
<tr>
<td>6</td>
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<td>248870011R02</td>
<td>Inner plate</td>
<td>Thickness = 4 mm</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>515900305R</td>
<td>Hub with push pin</td>
<td>1 3/8” Z6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>515903705R</td>
<td></td>
<td>1 3/8” Z21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>515900405R</td>
<td></td>
<td>1 3/4” Z6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>515903805R</td>
<td></td>
<td>1 3/4” Z20</td>
</tr>
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<td>8</td>
<td></td>
<td>408000047R02</td>
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</tr>
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<td>408000046R02</td>
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<td>1 3/4” Z6 - Z20</td>
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<td></td>
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<td>Thickness = 8 mm</td>
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<td>10</td>
<td></td>
<td>367009870R</td>
<td>Belleville spring</td>
<td>t = 4.25 mm</td>
</tr>
</tbody>
</table>

---

21.13
Friction torque limiters FFV

FFV friction clutches are equipped with helical (coil) springs, that apply pressure in proportion to their compression. Five models of FFV friction clutches are available, with different diameters and number of friction linings. All versions are available with treated hubs and driving plates to reduce corrosion and help prevent seizure.

The chart below indicates the diameter D, number of linings, and the standard settings for each model, corresponding to each driveline size. Maximum settings recommended for use at 1000 min⁻¹ are marked (*).

Drivelines with FFV clutches are not EU marked because the shield does not cover the entire inner yoke as required by Machinery Directive 2006/42/CE. An implement with an FFV clutch on the primary driveline must have a shield that overlaps the driveline guard by at least 50 mm overlap as specified by UNI EN ISO 4254-1 and ANSI/ASABE AD500.

<table>
<thead>
<tr>
<th>Model</th>
<th>D (mm)</th>
<th>Plates</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>G5</th>
<th>G7</th>
<th>G8</th>
<th>G9</th>
</tr>
</thead>
<tbody>
<tr>
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<td>159</td>
<td>2</td>
<td>*400</td>
<td>500</td>
<td>*500</td>
<td>500</td>
<td>*600</td>
<td>800</td>
<td>800</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FFV32</td>
<td>180</td>
<td>2</td>
<td>*900</td>
<td>900</td>
<td>900</td>
<td>900</td>
<td>1000</td>
<td>*1100</td>
<td>*1100</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>FFV42</td>
<td>202</td>
<td>2</td>
<td>1200</td>
<td>*1200</td>
<td>1350</td>
<td>1350</td>
<td>1350</td>
<td>1450</td>
<td>*1450</td>
<td>*1450</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>FFV34</td>
<td>180</td>
<td>4</td>
<td>1200</td>
<td>*1200</td>
<td>1350</td>
<td>1350</td>
<td>1450</td>
<td>*1450</td>
<td>1600</td>
<td>1600</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

* Recommended settings for a 1000 min⁻¹ velocity
FFV friction clutches have an adjustable torque setting. The torque setting varies with different compression (h) of the springs.

The compression of the springs must be adjusted to compensate for wear of the friction linings and to maintain the desired torque setting.

To avoid excessive wear to the implement, driveline, or tractor, Bondioli & Pavesi recommends that the defined setting not be altered.

Do not over-tighten the bolts; this may impair the function of friction clutches.

The tables below show the spring code, thickness f and compression height h for standard settings. Check the compression of each spring using a sliding caliper as shown below. The height of the spring may be ± 0.2 mm of the “h” value shown.

The tables also show the amount of rotation of each bolt required to achieve the next higher or lower setting, relative to the nominal setting (listed with no rotation noted on the bolt). In addition to the listed settings, intermediate settings may be obtained by tightening or loosening the bolts proportionately.

Friction clutches may become hot during use. **Do not touch!** Keep the area around the friction clutch clear of any material that could catch fire, and avoid prolonged slipping that will generate excess heat and wear.
### Friction torque limiters FFV

#### FFV22 Friction clutches
2 plates, diameter 159 mm

<table>
<thead>
<tr>
<th>Spring code</th>
<th>f mm</th>
<th>Setting Nm</th>
<th>h mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>351015001</td>
<td>6</td>
<td>400</td>
<td>30.0</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td>29.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>29.0</td>
<td></td>
</tr>
</tbody>
</table>

#### FFV32 Friction clutches
2 plates, diameter 180 mm

<table>
<thead>
<tr>
<th>Spring code</th>
<th>f mm</th>
<th>Setting Nm</th>
<th>h mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>351022370</td>
<td>6</td>
<td>900</td>
<td>28.8</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>28.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1100</td>
<td>28.2</td>
<td></td>
</tr>
</tbody>
</table>

#### FFV34 Friction clutches
4 plates, diameter 180 mm

<table>
<thead>
<tr>
<th>Spring code</th>
<th>f mm</th>
<th>Setting Nm</th>
<th>h mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>351022370</td>
<td>6</td>
<td>1200</td>
<td>29.5</td>
</tr>
<tr>
<td></td>
<td>1450</td>
<td>29.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1800</td>
<td>28.5</td>
<td></td>
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#### FFV42 Friction clutches
2 plates, diameter 202 mm

<table>
<thead>
<tr>
<th>Spring code</th>
<th>f mm</th>
<th>Setting Nm</th>
<th>h mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>351013370</td>
<td>7</td>
<td>1200</td>
<td>29.5</td>
</tr>
<tr>
<td></td>
<td>1450</td>
<td>29.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1800</td>
<td>28.8</td>
<td></td>
</tr>
</tbody>
</table>

#### FFV44 Friction clutches
4 plates, diameter 202 mm

<table>
<thead>
<tr>
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<th>f mm</th>
<th>Setting Nm</th>
<th>h mm</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1800</td>
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<td></td>
<td>2200</td>
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Friction torque limiters FFV

FFV22
adjustable setting, coil springs

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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</thead>
<tbody>
<tr>
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<tr>
<td></td>
<td>500</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>G2</td>
<td>*500</td>
<td>100</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G3</td>
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<td>800</td>
<td>101</td>
<td>101</td>
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</table>

*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FFV22

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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<tbody>
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<td></td>
<td>800</td>
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<td>0R9</td>
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FFV22 codes as spare parts

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<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
<th>h mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>*400</td>
<td>635B24103R</td>
<td>635B24137R</td>
<td>-</td>
<td>-</td>
<td>30.0</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>635B28103R</td>
<td>635B28137R</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>G2</td>
<td>*500</td>
<td>635C28103R</td>
<td>635C28137R</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td></td>
<td>600</td>
<td>635C32103R</td>
<td>635C32137R</td>
<td>-</td>
<td>-</td>
<td>29.5</td>
</tr>
<tr>
<td>G3</td>
<td>*600</td>
<td>635E32103R</td>
<td>635E32137R</td>
<td>-</td>
<td>-</td>
<td>29.5</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>635E39103R</td>
<td>635E39137R</td>
<td>-</td>
<td>-</td>
<td>29.0</td>
</tr>
<tr>
<td>G4</td>
<td>800</td>
<td>635E39103R</td>
<td>635E39137R</td>
<td>-</td>
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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
### Friction torque limiters FFV

**FFV22**
adjustable setting, coil springs

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>432000031R08</td>
<td>Bolt</td>
<td>M8 x 75 mm</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>351015001R08</td>
<td>Coil springs</td>
<td>f = 6 mm</td>
</tr>
<tr>
<td>3</td>
<td>G1</td>
<td>2530B1A05R</td>
<td>Flange yoke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>2530C1A05R</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G3-G4</td>
<td>2530E1A05R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>258005320R02</td>
<td>Bushing</td>
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</tr>
<tr>
<td>5</td>
<td></td>
<td>247006151R08</td>
<td>Friction linings</td>
<td>D = 124 ; d = 67 mm</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>513850307R</td>
<td>Hub with push pin</td>
<td>1 3/8” Z6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>513853707R</td>
<td></td>
<td>1 3/8” Z21</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>403000001R10</td>
<td>Push-pin kit</td>
<td>1 3/8” Z6 - Z21</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>2481A0007R02</td>
<td>Inner plate</td>
<td>Thickness = 4 mm</td>
</tr>
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<td>9</td>
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<td>Pressure plate</td>
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# Friction torque limiters FFV

**FFV32**

adjustable setting, coil springs

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
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<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
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<tbody>
<tr>
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</tr>
<tr>
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<td></td>
</tr>
<tr>
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<td>*1100</td>
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</tbody>
</table>

*Recommended settings for a 1000 min⁻¹ velocity*

**Driveline codes FFV32**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
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</thead>
<tbody>
<tr>
<td>900</td>
<td>OS1</td>
<td>OS6</td>
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</tr>
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<td>1000</td>
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**FFV32 codes as spare parts**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
<th>h mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>G4</td>
<td>*900</td>
<td>635E41203R</td>
<td>635E41237R</td>
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<td>635E44203R</td>
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<td>G5</td>
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<td>635G41237R</td>
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<td>-</td>
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<td></td>
<td>1000</td>
<td>635G44203R</td>
<td>635G44237R</td>
<td>-</td>
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<td>*1100</td>
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<td>635G46237R</td>
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<tr>
<td>G7</td>
<td>900</td>
<td>635H41203R</td>
<td>635H41237R</td>
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<td>635H46203R</td>
<td>635H46237R</td>
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</tbody>
</table>

⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

22.6
### Friction torque limiters FFV

**FFV32**
adjustable setting, coil springs

---

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>432000006R08</td>
<td>Bolt</td>
<td>M10 x 85 mm</td>
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<td>2</td>
<td></td>
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<td>Coil springs</td>
<td>f = 6 mm</td>
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*BONDIOLI & PAVESI*
Friction torque limiters FFV

**FFV42**
adjustable setting, coil springs

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*Recommended settings for a 1000 min⁻¹ velocity

**Driveline codes FFV42**

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**FFV42 codes as spare parts**

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## Friction torque limiters FFV

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

### FFV42
adjustable setting, coil springs

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Friction torque limiters FFV

FFV34 adjustable setting, coil springs

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*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FFV34

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FFV34 codes as spare parts

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22.10

BONDIOLI & PAVESI
### Friction torque limiters FFV

#### FFV34

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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
Friction torque limiters FFV

FFV44
adjustable setting, coil springs

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</tr>
</tbody>
</table>

*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FFV44

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1800</td>
<td>0J1</td>
<td>0J9</td>
<td>0K7</td>
<td>0W5</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>0J2</td>
<td>0J0</td>
<td>0K8</td>
<td>0W6</td>
</tr>
<tr>
<td></td>
<td>2200</td>
<td>0J3</td>
<td>0K1</td>
<td>0K9</td>
<td>0W7</td>
</tr>
</tbody>
</table>

FFV44 codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
<th>h (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G8</td>
<td>1800</td>
<td>635L58503R</td>
<td>635L58537R</td>
<td>635L58504R</td>
<td>635L58538R</td>
<td>30.0</td>
</tr>
<tr>
<td>G9</td>
<td>*1800</td>
<td>635M58503R</td>
<td>635M58537R</td>
<td>635M58504R</td>
<td>635M58538R</td>
<td>30.0</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>635M60503R</td>
<td>635M60537R</td>
<td>635M60504R</td>
<td>635M60538R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2200</td>
<td>635M62503R</td>
<td>635M62537R</td>
<td>635M62504R</td>
<td>635M62538R</td>
<td>29.6</td>
</tr>
</tbody>
</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side.
All rotating parts must be guarded.
Friction torque limiters FFV

FFV44 adjustable setting, coil springs

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>432000122R08</td>
<td>Bolt</td>
<td>M10 x 105 mm</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>351013370R08</td>
<td>Coil springs</td>
<td>f = 7 mm</td>
</tr>
<tr>
<td>3</td>
<td>G8 G9</td>
<td>2530L8710R</td>
<td>Flange yoke</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2530M1E05R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>258005320R02</td>
<td>Bushing</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>247006351R08</td>
<td>Friction lining</td>
<td>D = 162 ; d = 85 mm</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>248737702R02</td>
<td>Driving disc</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>2481E0007R02</td>
<td>Inner plate</td>
<td>Thickness = 4 mm</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>515900305R</td>
<td>Hub with taper pin</td>
<td>1 3/8” Z6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>515903705R</td>
<td></td>
<td>1 3/8” Z21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>515900405R</td>
<td></td>
<td>1 3/4” Z6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>515903805R</td>
<td></td>
<td>1 3/4” Z20</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>408000047R02</td>
<td>Taper pin</td>
<td>1 3/8” Z6 - Z21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>408000046R02</td>
<td></td>
<td>1 3/4” Z6 - Z20</td>
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<td>10</td>
<td></td>
<td>248230006R02</td>
<td>Pressure plate</td>
<td></td>
</tr>
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</table>
FT friction clutches are equipped with Belleville springs, designed to apply nearly constant pressure, self-compensating for friction lining wear. Therefore the setting is maintained without adjustment over the life of the linings.

FT friction clutches are non-adjustable. Torque is determined by the thickness of the Belleville spring.

Five models of FV friction clutches are available, with different diameters and number of friction linings.

All versions are available with treated hubs and driving plates to reduce corrosion and help prevent seizure. All versions are available with Release System.

The chart below indicates the diameter D, number of linings, and the standard settings for each model, corresponding to each driveline size. Maximum settings recommended for use at 1000 min⁻¹ are marked (*)..

### Standard settings (Nm)

<table>
<thead>
<tr>
<th>Model</th>
<th>D (mm)</th>
<th>Plates</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>G5</th>
<th>G7</th>
<th>G8</th>
<th>G9</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT22</td>
<td>155</td>
<td>2</td>
<td>*400</td>
<td>500</td>
<td>*500</td>
<td>600</td>
<td>*600</td>
<td>800</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>FT32</td>
<td>180</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*900</td>
<td>900</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>FT42</td>
<td>202</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1200</td>
<td>*1200</td>
<td>1450</td>
<td>*1450</td>
</tr>
<tr>
<td>FT34</td>
<td>180</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1200</td>
<td>*1200</td>
<td>1450</td>
<td>*1450</td>
</tr>
<tr>
<td>FT44</td>
<td>202</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1800</td>
<td>*1800</td>
</tr>
</tbody>
</table>
The torque setting of FT friction clutches is determined by the Belleville spring. The tables below show the spring codes for each friction clutch and standard setting.

### FT22 - FT22R friction clutches

<table>
<thead>
<tr>
<th>Setting Nm</th>
<th>Spring code</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>367FT220A</td>
</tr>
<tr>
<td>500</td>
<td>367FT220C</td>
</tr>
<tr>
<td>600</td>
<td>367FT220D</td>
</tr>
<tr>
<td>800</td>
<td>367FT220E</td>
</tr>
</tbody>
</table>

### FT32 - FT32R friction clutches

<table>
<thead>
<tr>
<th>Setting Nm</th>
<th>Spring code</th>
</tr>
</thead>
<tbody>
<tr>
<td>900</td>
<td>367FT320A</td>
</tr>
<tr>
<td>1000</td>
<td>367FT320C</td>
</tr>
<tr>
<td>1100</td>
<td>367FT320D</td>
</tr>
</tbody>
</table>

### FT42 - FT42R friction clutches

<table>
<thead>
<tr>
<th>Setting Nm</th>
<th>Spring code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200</td>
<td>367FT420A</td>
</tr>
<tr>
<td>1450</td>
<td>367FT420C</td>
</tr>
<tr>
<td>1800</td>
<td>367FT420D</td>
</tr>
</tbody>
</table>

### FT34 - FT34R friction clutches

<table>
<thead>
<tr>
<th>Setting Nm</th>
<th>Spring code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200</td>
<td>367FT340A</td>
</tr>
<tr>
<td>1450</td>
<td>367FT340C</td>
</tr>
<tr>
<td>1800</td>
<td>367FT340D</td>
</tr>
</tbody>
</table>

### FT44 - FT44R friction clutches

<table>
<thead>
<tr>
<th>Setting Nm</th>
<th>Spring code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800</td>
<td>367FT440A</td>
</tr>
<tr>
<td>2200</td>
<td>367FT440C</td>
</tr>
</tbody>
</table>
FT clutches are equipped with a metal band to be used as reference to properly compress the Belleville spring.

Proper compression occurs when the Belleville spring is evenly compressed to the height of the metal band.

To do this properly, tighten the bolts until the Belleville spring contacts the metal band. Then back off each nut 1/4 turn.

Do not over-tighten bolts; this may endanger the function of friction clutches.

To avoid excessive wear to the implement, driveline or tractor Bondioli & Pavesi recommends that the setting not be changed.

Friction clutches may become hot during use. Do not touch! Keep the area around the friction clutch clear of any material that could catch fire, and avoid prolonged slipping that will generate excess heat and wear.
Friction torque limiters FT

FT22
non-adjustable
setting

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>*400</td>
<td>92</td>
<td>92</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G2</td>
<td>*500</td>
<td>100</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G3</td>
<td>*600</td>
<td>101</td>
<td>101</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G4</td>
<td>800</td>
<td>101</td>
<td>101</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FT22

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>400</td>
<td>Q05</td>
<td>Q08</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>Q00</td>
<td>Q02</td>
<td>-</td>
<td>-</td>
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<tr>
<td></td>
<td>600</td>
<td>Q06</td>
<td>Q09</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>Q07</td>
<td>Q10</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

FT22 codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>*400</td>
<td>663B24103R</td>
<td>663B24137R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>663B28103R</td>
<td>663B28137R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G2</td>
<td>*500</td>
<td>663C28103R</td>
<td>663C28137R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td>663C32103R</td>
<td>663C32137R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G3</td>
<td>*600</td>
<td>663E32103R</td>
<td>663E32137R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>663E39103R</td>
<td>663E39137R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G4</td>
<td>800</td>
<td>663E39103R</td>
<td>663E39137R</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
### Friction torque limiters FT

**FT22**

non-adjustable setting

---

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>432000047R08</td>
<td>Bolt</td>
<td>M8 x 75 mm</td>
</tr>
<tr>
<td>2</td>
<td>G1</td>
<td>2530B8503R</td>
<td>Flange yoke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>2530C8503R</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G3-G4</td>
<td>2530E8503R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>258005320R02</td>
<td>Bushing</td>
<td>D = 124 ; d = 67 mm</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>247006151R08</td>
<td>Friction lining</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>403000001R10</td>
<td>Push-pin kit</td>
<td>1 3/8” Z6 - Z21</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>513850307R</td>
<td>Hub with push pin</td>
<td>1 3/8” Z6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>513853707R</td>
<td></td>
<td>1 3/8” Z21</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>2481A0002R02</td>
<td>Pressure plate</td>
<td>Thickness = 4 mm</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>240001059R02</td>
<td>Adjustment band</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>367FT220A</td>
<td>Belleville spring</td>
<td>400 Nm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>367FT220C</td>
<td></td>
<td>500 Nm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>367FT220D</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>367FT220E</td>
<td></td>
<td>800 Nm</td>
</tr>
</tbody>
</table>
Friction torque limiters FT

FT22R
non-adjustable setting, release system

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>*400</td>
<td>92</td>
<td>92</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>500</td>
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<tr>
<td>G2</td>
<td>*500</td>
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<tr>
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</tr>
<tr>
<td>G3</td>
<td>*600</td>
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<td>101</td>
<td>-</td>
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<tr>
<td></td>
<td>800</td>
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<tr>
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<td>800</td>
<td>101</td>
<td>101</td>
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</tr>
</tbody>
</table>

*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FT22R

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>*400</td>
<td>H05</td>
<td>H08</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G2</td>
<td>*500</td>
<td>H00</td>
<td>H02</td>
<td>-</td>
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</tr>
<tr>
<td></td>
<td>600</td>
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<td></td>
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</tr>
<tr>
<td>G3</td>
<td>*600</td>
<td>H06</td>
<td>H09</td>
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<tr>
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<td>800</td>
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</tr>
<tr>
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</table>

FT22R codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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</thead>
<tbody>
<tr>
<td>G1</td>
<td>*400</td>
<td>663B24A03R</td>
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<td>-</td>
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<tr>
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<td>500</td>
<td>663B28A03R</td>
<td>663B28A37R</td>
<td>-</td>
<td>-</td>
</tr>
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<td>G2</td>
<td>*500</td>
<td>663C28A03R</td>
<td>663C28A37R</td>
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</tr>
<tr>
<td></td>
<td>600</td>
<td>663C32A03R</td>
<td>663C32A37R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>G3</td>
<td>*600</td>
<td>663E32A03R</td>
<td>663E32A37R</td>
<td>-</td>
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</tr>
<tr>
<td></td>
<td>800</td>
<td>663E39A03R</td>
<td>663E39A37R</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
### Friction torque limiters FT

**FT22R**

non-adjustable setting, release system

<table>
<thead>
<tr>
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Friction torque limiters FT

**FT32**
non-adjustable
setting

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<tr>
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<th>1 3/4” Z20</th>
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*Recommended settings for a 1000 min⁻¹ velocity

**Driveline codes FT32**

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**FT32 codes as spare parts**

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<th>1 3/8” Z21</th>
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⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

23.8
# Friction torque limiters FT

**FT32**

non-adjustable setting

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
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<th>Description</th>
<th>Technical data</th>
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<td>432000054R08</td>
<td>Bolt</td>
<td>M10 x 85 mm</td>
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<td>247006251R08</td>
<td>Friction lining</td>
<td>D = 141 ; d = 77 mm</td>
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<td>Hub with taper pin</td>
<td>1 3/8” Z6</td>
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<td>1 3/8” Z21</td>
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<td>Taper pin</td>
<td>1 3/8” Z6 - Z21</td>
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<td></td>
<td>248860005R02</td>
<td>Pressure plate</td>
<td>Thickness = 8 mm</td>
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Friction torque limiters FT

FT32R
non-adjustable setting, release system

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<th>1 3/4” Z20</th>
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*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FT32R

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<th>Setting</th>
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<td>1100</td>
<td>H15</td>
<td>H20</td>
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</table>

FT32R codes as spare parts

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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
Friction torque limiters FT

FT32R
non-adjustable setting, release system

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
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<th>Description</th>
<th>Technical data</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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<td>432000054R08</td>
<td>Bolt</td>
<td>M10 x 55 mm</td>
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<td>2</td>
<td>G4</td>
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<td>D = 141 ; d = 77 mm</td>
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<td>1 3/8&quot; Z21</td>
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Friction torque limiters FT

FT42
non-adjustable setting

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*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FT42

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FT42 codes as spare parts

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<td>663L58437R</td>
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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
# Friction torque limiters FT

**FT42**
non-adjustable
setting

---

## Ref. | Size | Spare part code | Description | Technical data
---|---|---|---|---
1 | | 432000054R08 | Bolt | M10 x 55 mm
2 | G5 | 253058701R | Flange yoke |
   | G7 | 253069001R |
   | G8 | 253078702R |
3 | | 258005320R02 | Bushing |
4 | | 247006351R08 | Friction lining | D = 162 ; d = 85 mm
5 | | 515870305R | Hub with taper pin | 1 3/8” Z6
   | | 515873705R | 1 3/8” Z21
   | | 515870405R | 1 3/4” Z6
   | | 515873805R | 1 3/4” Z20
6 | | 408000047R02 | Taper pin | 1 3/8” Z6 - Z21
   | | 408000046R02 | 1 3/4” Z6 - Z20
7 | | 248870005R | Pressure plate | Thickness= 8 mm
8 | | 240000214R02 | Adjustment band |
9 | | 367FT420A | Belleville spring | 1200 Nm
   | | 367FT420C | 1450 Nm
   | | 367FT420D | 1800 Nm

---

**Friction torque limiters FT**

**Ref.**

**Size**

**Spare part code**

**Description**

**Technical data**
Friction torque limiters FT

FT42R
non-adjustable setting, release system

<table>
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<th>1 3/4&quot; Z20</th>
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*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FT42R

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FT42R codes as spare parts

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<th>1 3/4&quot; Z6</th>
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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
# Friction torque limiters FT

**FT42R**  
non-adjustable setting, release system

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Friction torque limiters FT

**FT34**
non-adjustable setting

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*Recommended settings for a 1000 min⁻¹ velocity

**Driveline codes FT34**

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**FT34 codes as spare parts**

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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

23.16
## Friction torque limiters FT

### FT34

**non-adjustable setting**

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# Friction torque limiters FT

## FT34R

**non-adjustable setting, release system**

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*Recommended settings for a 1000 min⁻¹ velocity*

### Driveline codes FT34R

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### FT34R codes as spare parts

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⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
# Friction torque limiters FT

## FT34R

**non-adjustable setting, release system**

---

## Technical Data

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Friction torque limiters FT

**FT44**
non-adjustable setting

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**Setting**

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*Recommended settings for a 1000 min⁻¹ velocity

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**Driveline codes FT44**

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<tr>
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<td>663M58537R</td>
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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side.
All rotating parts must be guarded.

23.20
## Friction torque limiters FT

**FT44**  
non-adjustable setting

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
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<tbody>
<tr>
<td>1</td>
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<td>432000100R08</td>
<td>Bolt</td>
<td>M10 x 70 mm</td>
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<tr>
<td>2</td>
<td>G8</td>
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<td>Flange yoke</td>
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<td>253089001R</td>
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<td>Bushing</td>
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<tr>
<td>4</td>
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<td>247006351R08</td>
<td>Friction lining</td>
<td>D = 162 ; d = 85 mm</td>
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<tr>
<td>5</td>
<td></td>
<td>248737702R02</td>
<td>Driving disc</td>
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</tr>
<tr>
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<td></td>
<td>248870011R02</td>
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<td>Thickness = 4 mm</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>515900305R</td>
<td>Hub with taper pin</td>
<td>1 3/8” Z6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>515903705R</td>
<td></td>
<td>1 3/8” Z21</td>
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<tr>
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<td>1 3/4” Z6</td>
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<td></td>
<td>515903805R</td>
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<td>1 3/4” Z20</td>
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<td></td>
<td>408000047R02</td>
<td>Taper pin</td>
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<td>408000046R02</td>
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<td>1 3/4” Z6 - Z20</td>
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<td>9</td>
<td></td>
<td>248870005R</td>
<td>Pressure plate</td>
<td>Thickness = 8 mm</td>
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<tr>
<td>10</td>
<td></td>
<td>240000219R02</td>
<td>Adjustment band</td>
<td></td>
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<tr>
<td>11</td>
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<td>Belleville spring</td>
<td>1800 Nm</td>
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<td></td>
<td></td>
<td>367FT440C</td>
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<td>2200 Nm</td>
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Friction torque limiters FT

FT44R
non-adjustable setting, release system

<table>
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<th>B (mm)</th>
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<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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<td>G9</td>
<td>*1800</td>
<td>149</td>
<td>149</td>
<td>154</td>
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*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FT44R

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<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1800</td>
<td>H37</td>
<td>H39</td>
<td>H41</td>
<td>H43</td>
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<td>H38</td>
<td>H40</td>
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FT44R codes as spare parts

<table>
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<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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</thead>
<tbody>
<tr>
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<td>663L58G37R</td>
<td>663L58G04R</td>
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<td>G9</td>
<td>*1800</td>
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<td>663M58G37R</td>
<td>663M58G04R</td>
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</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side.
All rotating parts must be guarded.
## Friction torque limiters FT

**FT44R**
non-adjustable setting, release system

---

### Reference Table

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>432000100R08</td>
<td>Bolt</td>
<td>M10 x 70 mm</td>
</tr>
<tr>
<td>2</td>
<td>G8</td>
<td>2530L8705R</td>
<td>Flange yoke</td>
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<tr>
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<td>G9</td>
<td>2530M8705R</td>
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<td></td>
<td>310001301R04</td>
<td>Special socket head set screw</td>
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<td>4</td>
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<td>258005320R02</td>
<td>Bushing</td>
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<tr>
<td>5</td>
<td></td>
<td>247006351R08</td>
<td>Friction lining</td>
<td>D = 162 ; d = 85 mm</td>
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<tr>
<td>6</td>
<td></td>
<td>248737702R02</td>
<td>Driving plate</td>
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<tr>
<td>7</td>
<td></td>
<td>248870013R02</td>
<td>Inner disc</td>
<td>Thickness = 4 mm</td>
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<td>5159000305R</td>
<td>Hub with taper pin</td>
<td>1 3/8” Z6</td>
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<tr>
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<td>515903705R</td>
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<td>1 3/4” Z6</td>
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<td>Taper pin</td>
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<td>248870005R</td>
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<td>Thickness = 8 mm</td>
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<td>11</td>
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<td>Adjustment band</td>
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<td>12</td>
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<td>Belleville spring</td>
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<td></td>
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<td>367FT440C</td>
<td></td>
<td>2200 Nm</td>
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</table>
FK friction clutches are equipped with Belleville springs, designed to apply nearly constant pressure, self-compensating for friction lining wear. Therefore the setting is maintained without adjustment over the life of the linings.

FK friction clutches are non-adjustable. Torque is determined by the thickness of the Belleville spring. The calibrated screws and cap nuts prevent over-compression of the spring.

Five models of FK friction clutches are available, with different diameters and number of friction linings. All versions are available with treated hubs and driving plates to reduce rust and help prevent seizure.

The chart below indicates the diameter D, number of linings, and the standard settings for each model, corresponding to each driveline size. Maximum settings recommended for use at 1000 min⁻¹ are marked (*).
Calibration of FK friction clutches is determined by the characteristics of the spring, the correct compression of which is assured by the use of special bolts and cap nuts.

The adjacent tables show the codes for the spring and special bolt for each clutch model, setting and shaft size. The spring code is stamped on each spring for identification purposes.

### FK22 Friction Clutches

<table>
<thead>
<tr>
<th>Setting Nm</th>
<th>Spring Code</th>
<th>Bolt Code</th>
<th>Bolt h</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>367FT220A</td>
<td>G1</td>
<td>432000148R08</td>
</tr>
<tr>
<td>500</td>
<td>367FT220C</td>
<td>G1</td>
<td>432000149R08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G2</td>
<td>432000149R08</td>
</tr>
<tr>
<td>600</td>
<td>367FT220D</td>
<td>G2</td>
<td>432000149R08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G3</td>
<td>432000151R08</td>
</tr>
<tr>
<td>800</td>
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<td>G4</td>
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### FK32 Friction Clutches

<table>
<thead>
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<th>Setting Nm</th>
<th>Spring Code</th>
<th>Bolt Code</th>
<th>Bolt h</th>
</tr>
</thead>
<tbody>
<tr>
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<td>432000154R08</td>
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<tr>
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<td>G5</td>
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<td>367FT320C</td>
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<td>432000140R08</td>
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### FK42 Friction Clutches

<table>
<thead>
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<th>Bolt h</th>
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<tbody>
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<td>432000144R08</td>
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<td>1800</td>
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<td>G8</td>
<td>432000147R08</td>
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</table>

For clutch: FK22

For clutches: FK32 - FK42 - FK34 - FK44
Friction torque limiters FK

FK friction clutches are equipped with special screws and cap nuts. Spring compression is correct when the screws are fully tightened.

Recommended tightening torques:
- 25 Nm for FK22
- 50 Nm for FK32, FK42, FK34 and FK44.

To avoid excessive wear to the implement, driveline or tractor Bondioli & Pavesi recommends that the setting not be changed.

Friction clutches may become hot during use. **Do not touch!** Keep the area around the friction clutch clear of any material that could catch fire, and avoid prolonged slipping that will generate excess heat and wear.

### FK34 Friction clutches

<table>
<thead>
<tr>
<th>Setting Nm</th>
<th>Spring Code</th>
<th>Bolt Code</th>
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</tr>
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<tbody>
<tr>
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<tr>
<td>1450</td>
<td>367FT340C</td>
<td>G7 432000142R08</td>
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### FK44 Friction clutches

<table>
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<th>Spring Code</th>
<th>Bolt Code</th>
<th>h</th>
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<tr>
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<td>G8 432000157R08</td>
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<td>G9 432000158R08</td>
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Friction torque limiters FK

FK22
non-adjustable setting

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
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<th>1 3/4” Z20</th>
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</tr>
<tr>
<td>G2</td>
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<td>100</td>
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</tr>
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*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FK22

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<td>7A7</td>
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FK22 codes as spare parts

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<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
<th>Bolt Code</th>
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<td>60KB28137R</td>
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<td>432000149R08</td>
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<td>60KC28103R</td>
<td>60KC28137R</td>
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<td>432000149R08</td>
</tr>
<tr>
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<td>*600</td>
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<td>60KE32137R</td>
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<td>432000151R08</td>
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<tr>
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<td>800</td>
<td>60KE39103R</td>
<td>60KE39137R</td>
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<td>432000152R08</td>
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<tr>
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<td>800</td>
<td>60KE39103R</td>
<td>60KE39137R</td>
<td></td>
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<td>432000152R08</td>
</tr>
</tbody>
</table>

⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
# Friction torque limiters FK

**FK22**

*non-adjustable setting*

---

## Ref. | Size | Spare part code | Description | Technical data
--- | --- | --- | --- | ---
1 | | 432000148R08 | Bolt | M8 x 40.7 mm
| | 432000149R08 | M8 x 41.0 mm
| | 432000151R08 | M8 x 41.5 mm
| | 432000152R08 | M8 x 41.7 mm
2 | G1 | 2530B8510R | Flange yoke
| G2 | 2530C8510R |
| G3-G4 | 2530E8510R |
3 | | 258005320R02 | Bushing |
4 | | 247006151R08 | Friction lining | D = 124 ; d = 67 mm
5 | | 403000001R10 | Push-pin kit | 1 3/8” Z6 - Z21
6 | | 513850307R | Hub with push-pin | 1 3/8” Z6
| | 513853707R | 1 3/8” Z21 |
7 | | 2481A0002R02 | Pressure plate | Thickness = 4 mm
8 | | 367FT220A | Belleville spring | 400 Nm
| | 367FT220C | 500 Nm
| | 367FT220D | 600 Nm
| | 367FT220E | 800 Nm
---
Friction torque limiters FK

FK32
non-adjustable setting

*Recommended settings for a 1000 min⁻¹ velocity

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
</tr>
</thead>
<tbody>
<tr>
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<td>113</td>
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<td>*1100</td>
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*For primary drivelines, always install any torque limiter or overrunning clutch on the implement side.
All rotating parts must be guarded.
### Friction torque limiters FK

**FK32**  
non-adjustable  
setting

---

<table>
<thead>
<tr>
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<th>Technical data</th>
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Friction torque limiters FK

FK42
non-adjustable setting

*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FK42

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<tr>
<th>Setting Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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FK42 codes as spare parts

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<td>G7 *1200</td>
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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
Friction torque limiters FK

FK42
non-adjustable setting

<table>
<thead>
<tr>
<th>Ref.</th>
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<td>M10 x 52.5 mm</td>
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<td>M10 x 53.0 mm</td>
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<td>G8</td>
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<td></td>
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<td>D = 162 ; d = 85 mm</td>
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Friction torque limiters FK

**FK34**
non-adjustable setting

![Diagram of FK34]

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*Recommended settings for a 1000 min⁻¹ velocity

**Driveline codes FK34**

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**FK34 codes as spare parts**

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For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
## Friction torque limiters FK

**FK34**  
non-adjustable setting

---

### Table of Parts

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
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<th>Technical data</th>
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**BONDIOLI & PAVESI**

24.11
Friction torque limiters FK

FK44
non-adjustable setting

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
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<th>1 3/4” Z6</th>
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*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FK44

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<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
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FK44 codes as spare parts

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<th>S = 1 3/8” Z6</th>
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⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
### Friction torque limiters FK

**FK44**

**non-adjustable setting**

---

**Ref.** | **Size** | **Spare part code** | **Description** | **Technical data**
---|---|---|---|---
1 | | 432000157R08 | Bolt | M10 x 69.0 mm
2 | G8 | 2530L8710R | Flange yoke | M10 x 69.5 mm
2 | G9 | 2530M9010R | | |
3 | | 258005320R02 | Bushing | |
4 | | 247006351R08 | Friction lining | D = 162 ; d = 85 mm
5 | | 248737702R02 | Driving disc | |
6 | | 248870011R02 | Inner disc | Thickness = 4 mm
7 | | 515900305R | Hub with taper pin | 1 3/8” Z6
7 | | 515903705R | | 1 3/8” Z21
7 | | 515900405R | | 1 3/4” Z6
7 | | 515903805R | | 1 3/4” Z20
8 | | 408000047R02 | Taper pin | 1 3/8” Z6 - Z21
8 | | 408000046R02 | | 1 3/4” Z6 - Z20
9 | | 248870005R | Pressure plate | Thickness = 8 mm
10 | | 367FT440A | Belleville spring | 1800 Nm
10 | | 367FT440C | | 2200 Nm
Combination friction torque limiters and overrunning clutches

Friction clutches combined with overrunning clutches are generally used on implements with high inertia (i.e. those with flywheels or other heavy rotating masses). These implements include mower conditioners and square balers.

During overloads, due to abrupt starting or blockages, torque transmission can be limited by the slipping of the friction clutch. Possible reverse torques, generated during sudden deceleration or stopping, will be eliminated by the overrunning clutch.

The setting of friction torque limiters is usually 2 to 3 times the median torque M.

Three versions of combination friction torque limiter and overrunning clutch are available: FNV (adjustable), FFNV (adjustable), FNT (non-adjustable). They have two different diameters:
- 34 (D = 180 mm),
- 44 (D = 202 mm).

All versions are available with treated hubs and driving plates to reduce corrosion and help prevent seizure.

Drivelines with FFNV clutches (with coil springs) are not EU marked because the shield does not cover the entire inner yoke as required by Machinery Directive 2006/42/CE.

FNT friction clutches are available with Release System. This system permits the spring pressure to be reduced during storage, without requiring disassembly of the torque limiter.
Combination friction torque limiters and overrunning clutches

**pv Factor**
The reliable function of a friction clutch is highly dependent on many different parameters. Temperature is important. When slipped frequently and for long periods, friction clutches may become hot. This can impair the condition of the clutch, and alter the torque setting drastically. Temperature increases rapidly with longer slipping cycles. It is recommended to select a setting suitable for each specific application, allowing only occasional and brief slipping (only a few seconds per cycle should be permitted).

After the setting has been chosen in accordance with the conditions of the application (median torque $M$, torque limit of driveline), one must select the proper type of friction clutch in regards to diameter and number of plates or friction linings.

When selecting a suitable type of friction clutch, pressure $p$ and slipping velocity $v$ must also be taken into account.

The pressure on the friction linings is determined by the force exerted from the springs, and their surface area. Slipping velocity is influenced by overloads (starting, stopping or blockages of the implement) and is related to the speed of rotation for the driveline.

The influence of pressure $p$ and velocity $v$ on the clutch is considered by factor $p \cdot v$, equal to their product. The maximum value of factor $p \cdot v$, suggested for reliable function of a friction clutch, is usually determined by experimentation. Maximum recommended torque settings for 1000 min$^{-1}$ speed are determined in accordance with this limiting value and shown on the opposite page (marked with *).

Friction clutches may become hot. **Do not touch!**

Keep the area around the friction clutch clear of any material that could catch fire, and avoid prolonged slipping that will generate excess heat and wear.
FNV clutches are equipped with special Belleville springs, designed to apply pressure that varies with the amount of compression.

Two models of FNV friction clutches are available, with different diameters and settings.

- **FNV34** diameter $D = 180$ mm
- **FNV44** diameter $D = 202$ mm

All versions are available with treated hubs and driving plates to reduce corrosion and help prevent seizure.

The chart below indicates the diameter $D$, number of linings, and the standard settings for each model, corresponding to each driveline size. Maximum settings recommended for use at 1000 min$^{-1}$ are marked (*).

**FNV34** Combination friction torque limiter and overrunning clutch, adjustable setting

<table>
<thead>
<tr>
<th>Standard settings (Nm)</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>G5</th>
<th>G7</th>
<th>G8</th>
<th>G9</th>
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<tr>
<td>$D = 180$ mm</td>
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<td>2 plates</td>
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<td></td>
<td></td>
<td></td>
<td>*1450</td>
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<td>1800</td>
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<tr>
<td>* Recommended settings for a 1000 min$^{-1}$ velocity</td>
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<td>1800</td>
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<td><strong>FNV44</strong></td>
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</table>
Combination friction torque limiters and overrunning clutches FNV

FNV friction torque limiters have an adjustable torque setting. The torque setting of FNV friction clutches varies with different compression (h) of the Belleville spring. The compression of the Belleville springs used on FNV friction clutches must be adjusted to compensate for wear of the friction linings and to maintain the desired setting.

The tables below set out spring codes, thicknesses “t” and compression “h” measured as shown in the figure for standard settings. The height of the spring is measured next to each bolt and may be ± 0.2 mm of the listed value.

The tables also show the amount of rotation of each bolt required to achieve the next higher or lower setting, relative to the nominal setting (listed with no rotation noted on the bolt).

In addition to the listed settings, intermediate settings may be obtained by tightening or loosening the bolts proportionately.

⚠️ Do not over-tighten the bolts; this may endanger the function of friction clutches.

⚠️ To avoid excessive wear to the implement, driveline, or tractor, Bondioli & Pavesi recommends that the defined setting not be altered.

---

### FNV34 Friction clutches
4 plates, diameter 180 mm

<table>
<thead>
<tr>
<th>Spring code</th>
<th>t (mm)</th>
<th>Setting Nm</th>
<th>h (mm)</th>
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</thead>
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<tr>
<td></td>
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<td>2000</td>
<td>16.5</td>
</tr>
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### FNV44 Friction clutches
4 plates, diameter 202 mm

<table>
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<th>t (mm)</th>
<th>Setting Nm</th>
<th>h (mm)</th>
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<td></td>
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<td>2200</td>
<td>18.6</td>
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</tbody>
</table>
Combination friction torque limiters and overrunning clutches FNV

Overrunning clutches mounted on FNV34 and FNV44 versions are incorporated onto the hub. A locking ring separates them from the friction clutch, so that the lubricating grease will not contaminate the friction linings.

Lubricate overrunning clutches every 50 hours and after storage.

Do not approach the implement before all parts have reached a complete stop.

Friction clutches may become hot during use. Do not touch! Keep the area around the friction clutch clear of any material that could catch fire, and avoid prolonged slipping that will generate excess heat and wear.
Combination friction torque limiters and overrunning clutches FNV

### FNV34

**adjustable setting**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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<tbody>
<tr>
<td>G5</td>
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<td>G7</td>
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<td>172</td>
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<tr>
<td>*1450</td>
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<tr>
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</tr>
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*Recommended settings for a 1000 min⁻¹ velocity

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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</tr>
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<td>--</td>
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</tr>
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<td>2B2</td>
<td>--</td>
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<td>2B3</td>
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**Combination friction torque limiters and overrunning clutches FNV**

**Setting**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
<th>h (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G5</td>
<td>1200</td>
<td>665G48103R</td>
<td>665G48137R</td>
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<td>--</td>
<td>18.0</td>
</tr>
<tr>
<td>G7</td>
<td>*1200</td>
<td>665H48103R</td>
<td>665H48137R</td>
<td>--</td>
<td>--</td>
<td>18.0</td>
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<td>1350</td>
<td>665H51103R</td>
<td>665H51137R</td>
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</tr>
<tr>
<td></td>
<td>1450</td>
<td>665H53103R</td>
<td>665H53137R</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>G8</td>
<td>1350</td>
<td>665L51103R</td>
<td>665L51137R</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>*1450</td>
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<td>665L53103R</td>
<td>665L53137R</td>
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<td>665L58137R</td>
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<td>17.0</td>
</tr>
<tr>
<td>G9</td>
<td>*1800</td>
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<td>665M58137R</td>
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<td>665M60137R</td>
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<td>16.5</td>
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Combination friction torque limiters and overrunning clutches FNV

**FNV34**

adjustable setting

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>432000114R08</td>
<td>Bolt</td>
<td>M 10 x 75 mm</td>
</tr>
<tr>
<td>2</td>
<td>G5</td>
<td>2530G1L01R</td>
<td>Flange yoke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G7</td>
<td>2530H1L01R</td>
<td>Friction lining</td>
<td>D = 140 ; d = 85 mm</td>
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<tr>
<td></td>
<td>G8</td>
<td>2530L1L01R</td>
<td>Driving plate</td>
<td>Thickness = 4 mm</td>
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<td></td>
<td>G9</td>
<td>2530M1L01R</td>
<td>Inner plate</td>
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<td>3</td>
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<td>Locking plate</td>
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<td>367008860R</td>
<td>Belleville spring</td>
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<tr>
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<td>1 3/8&quot; Z6</td>
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**Combination friction torque limiters and overrunning clutches FNV**

**FNV34**

adjustable setting

<table>
<thead>
<tr>
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<th>Description</th>
<th>Technical data</th>
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<td>M 10 x 75 mm</td>
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<td>Flange yoke</td>
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<td>2530H1L01R</td>
<td>Friction lining</td>
<td>D = 140 ; d = 85 mm</td>
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<td>G9</td>
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Combination friction torque limiters and overrunning clutches FNV

FNV44
adjustable setting

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<thead>
<tr>
<th>Setting Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
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<td>175</td>
<td>175</td>
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<td>175</td>
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<tr>
<td>G9 *1800</td>
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<td>177</td>
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<tr>
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*Recommended settings for a 1000 min⁻¹ velocity

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<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
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<td>2C5</td>
<td>2D3</td>
<td>2E1</td>
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<td>2C6</td>
<td>2D4</td>
<td>2E2</td>
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</table>

<table>
<thead>
<tr>
<th>Setting Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
<th>h</th>
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<tbody>
<tr>
<td>G8 1800</td>
<td>665L58203R</td>
<td>665L58237R</td>
<td>665L58204R</td>
<td>665L58238R</td>
<td>19.0</td>
</tr>
<tr>
<td>G9 *1800</td>
<td>665M58203R</td>
<td>665M58237R</td>
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<td>665M58238R</td>
<td>19.0</td>
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<td>665M62204R</td>
<td>665M62238R</td>
<td>18.6</td>
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26.6
Combination friction torque limiters and overrunning clutches FNV

**FNV44**
adjusted setting

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
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<td>432000114R08</td>
<td>Bolt</td>
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<td>2</td>
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<td>G9</td>
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<td></td>
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<td>3</td>
<td></td>
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<td>D = 160 ; d = 97 mm</td>
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<td>348017000R20</td>
<td>Grease fitting</td>
<td>Thickness = 8 mm</td>
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<td>10</td>
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<td>367FT420D</td>
<td>Belleville spring</td>
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<td>13</td>
<td></td>
<td>5151M0351R</td>
<td>Hub, plug and taper pin kit</td>
<td>1 3/8&quot; Z6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5151M3751R</td>
<td>Grid</td>
<td>1 3/8&quot; Z21</td>
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<td>Taper pin</td>
<td>1 3/4&quot; Z6</td>
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<td>1 3/8&quot; Z6 - Z21</td>
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<td></td>
<td>408000046R02</td>
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<td>1 3/4&quot; Z6 - Z20</td>
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</table>
FNV friction clutches are equipped with helical (coil) springs, that apply pressure in proportion to the amount of compression. Two models of FNV friction clutches are available, with different diameters and standard setting.
- FFNV34 diameter D = 180 mm
- FFNV44 diameter D = 202 mm.
All versions are available with treated hubs and driving plates to reduce corrosion and help prevent seizure.
The chart below indicates the diameter D, number of linings, and the standard settings for each model, corresponding to each driveline size. Maximum settings recommended for use at 1000 min⁻¹ are marked (*).
Drivelines with FNV clutches are not EU marked because the shield does not cover the entire inner yoke as required by Machinery Directive 2006/42/CE.
An implement with an FNV clutch on the primary driveline must have a shield that overlaps the driveline guard by at least 50 mm overlap as specified by UNI EN ISO 4254-1 and ANSI/ASABE S604.1.

<table>
<thead>
<tr>
<th>Standard settings (Nm)</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>G5</th>
<th>G7</th>
<th>G8</th>
<th>G9</th>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1450</td>
<td>*1450</td>
<td>1600</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1800</td>
<td>*1800</td>
<td></td>
<td>2000</td>
</tr>
<tr>
<td>FFNV44 D = 202 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>2000</td>
<td>2200</td>
</tr>
</tbody>
</table>

* Recommended settings for a 1000 min⁻¹ velocity
Combination friction torque limiters and overrunning clutches FFNV

FFNV friction clutches have an adjustable torque setting. The torque setting varies with different thickness (f) and compression (h) of the springs. The compression of the springs must be adjusted to compensate for wear of the friction linings and to maintain the desired torque setting.

The tables below show the spring code, diameter “f” and compression height “h” for standard settings. Check the compression of each spring using a sliding caliper as shown below. The height of the spring may be ± 0.2 mm of the “h” value shown.

The tables also show the amount of rotation of each bolt required to achieve the next higher or lower setting, relative to the nominal setting (listed with no rotation noted on the bolt).

In addition to the listed settings, intermediate settings may be obtained by tightening or loosening the bolts proportionately.

Do not over-tighten the bolts; this may impair the function of friction clutches.

To avoid excessive wear to the implement, driveline, or tractor, Bondioli & Pavesi recommends that the defined setting not be altered.

### FFNV34 Friction clutches
4 plates, diameter 180 mm

<table>
<thead>
<tr>
<th>Spring code</th>
<th>f (mm)</th>
<th>Setting Nm</th>
<th>h (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>351022370</td>
<td>6</td>
<td>1200</td>
<td>29.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1450</td>
<td>29.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1800</td>
<td>28.5</td>
</tr>
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</table>

### FFNV44 Friction clutches
4 plates, diameter 202 mm

<table>
<thead>
<tr>
<th>Spring code</th>
<th>f (mm)</th>
<th>Setting Nm</th>
<th>h (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>351013370</td>
<td>7</td>
<td>1800</td>
<td>30.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2200</td>
<td>29.6</td>
</tr>
</tbody>
</table>
Combination friction torque limiters and overrunning clutches FFNV

Overrunning clutches mounted on FFNV34 and FFNV44 versions are incorporated onto the hub. A locking ring separates them from the friction clutch, so that the lubricating grease will not contaminate the friction linings.

Lubricate overrunning clutches every 50 hours and after storage.

Do not approach the implement before all parts have reached a complete stop.

Friction clutches may become hot during use. **Do not touch!**

Keep the area around the friction clutch clear of any material that could catch fire, and avoid prolonged slipping that will generate excess heat and wear.
## Combination friction torque limiters and overrunning clutches FFNV

### FFNV34

**adjustable setting, Coil spring**

![Diagram of FFNV34](image)

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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</thead>
<tbody>
<tr>
<td>G5</td>
<td>1200</td>
<td>158</td>
<td>158</td>
<td>-</td>
<td>-</td>
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<tr>
<td>G7</td>
<td>*1200</td>
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<td>166</td>
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<td></td>
<td>1450</td>
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<tr>
<td>G8</td>
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<tr>
<td></td>
<td>*1450</td>
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<td>1600</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>1800</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G9</td>
<td>*1800</td>
<td>174</td>
<td>174</td>
<td>-</td>
<td>-</td>
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<td>2000</td>
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</table>

*Recommended settings for a 1000 min\(^{-1}\) velocity

### Driveline codes FFNV34

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8&quot; Z6</th>
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<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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<td>1350</td>
<td>2F1</td>
<td>2F9</td>
<td>-</td>
<td>-</td>
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<tr>
<td></td>
<td>1450</td>
<td>2F2</td>
<td>2G0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1600</td>
<td>2F3</td>
<td>2G1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1800</td>
<td>2F4</td>
<td>2G2</td>
<td>-</td>
<td>-</td>
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<td></td>
<td>2000</td>
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<td>2G3</td>
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### FFNV34 codes as spare parts

<table>
<thead>
<tr>
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<th>Nm</th>
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<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
<th>h (mm)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>667G48137R</td>
<td>-</td>
<td>-</td>
<td>29.5</td>
</tr>
<tr>
<td>G7</td>
<td>*1200</td>
<td>667H48103R</td>
<td>667H48137R</td>
<td>-</td>
<td>-</td>
<td>29.5</td>
</tr>
<tr>
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<td>1350</td>
<td>667H51103R</td>
<td>667H51137R</td>
<td>-</td>
<td>-</td>
<td>29.0</td>
</tr>
<tr>
<td></td>
<td>1450</td>
<td>667H53103R</td>
<td>667H53137R</td>
<td>-</td>
<td>-</td>
<td>29.0</td>
</tr>
<tr>
<td>G8</td>
<td>1350</td>
<td>667L51103R</td>
<td>667L51137R</td>
<td>-</td>
<td>-</td>
<td>29.0</td>
</tr>
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<td>*1450</td>
<td>667L53103R</td>
<td>667L53137R</td>
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<td>667L56137R</td>
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</tr>
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<td>667L58137R</td>
<td>-</td>
<td>-</td>
<td>28.5</td>
</tr>
<tr>
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<td>*1800</td>
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<td>667M58137R</td>
<td>-</td>
<td>-</td>
<td>28.5</td>
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</table>
Combination friction torque limiters and overrunning clutches FFNV

FFNV34 adjustable setting, Coil spring

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<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
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</thead>
<tbody>
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<td>432000007R08</td>
<td>Bolt</td>
<td>M10 x 100 mm</td>
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<td>Coil spring</td>
<td>f = 6 mm</td>
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<td>3 G5</td>
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<td>2530G1L05R</td>
<td>Flange yoke</td>
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<td></td>
<td>G7</td>
<td>2530H1L05R</td>
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<td></td>
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<td></td>
<td>G8</td>
<td>2530L1L05R</td>
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<td></td>
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<tr>
<td></td>
<td>G9</td>
<td>2530M1L05R</td>
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<td>4</td>
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<td>Friction lining</td>
<td>D = 140 ; d = 85 mm</td>
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<td>Driving plate</td>
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<td></td>
<td>5151L0351R</td>
<td>Hub, plug and</td>
<td>1 3/8&quot; Z6</td>
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<tr>
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<td></td>
<td>5151L3751R</td>
<td>taper pin kit</td>
<td>1 3/8&quot; Z21</td>
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<td></td>
<td>408000047R02</td>
<td>Taper pin</td>
<td>1 3/8&quot; Z6 - Z21</td>
</tr>
</tbody>
</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
Combination friction torque limiters and overrunning clutches FFNV

FFNV44
adjustable setting,
Coil spring

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
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<td>2000</td>
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<td>2200</td>
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</table>

*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FFNV44

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
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<td>2J2</td>
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<td>2H6</td>
<td>2J4</td>
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FFNV44 codes as spare parts

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
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<tbody>
<tr>
<td>G8</td>
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<td>667L58203R</td>
<td>667L58237R</td>
<td>667L58204R</td>
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<td>30.0</td>
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<td></td>
<td>*1800</td>
<td>667M58203R</td>
<td>667M58237R</td>
<td>667M58204R</td>
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<td>30.0</td>
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<td>G9</td>
<td>2000</td>
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<td>667M60237R</td>
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<td>29.6</td>
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<td>2200</td>
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<td>667M62237R</td>
<td>667M62204R</td>
<td>667M62238R</td>
<td></td>
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</tbody>
</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side.
All rotating parts must be guarded.
Combination friction torque limiters
and overrunning clutches FFNV

FFNV44
adjustable setting,
Coil spring

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
</tr>
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<td>taper pin kit</td>
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</table>
Combination friction torque limiters and overrunning clutches FNT

Friction clutches combined with overrunning clutches are generally used on implements with high inertia (i.e. those with flywheels or other heavy rotating masses). These implements include mower conditioners and square balers.

During overloads, due to abrupt starting or blockages, torque transmission can be limited by the slipping of the friction clutch. Possible reverse torques, generated during sudden deceleration or stopping, will be eliminated by the overrunning clutch.

Two versions of combination friction torque limiter and overrunning clutch are available:

- FNT34 (D = 180 mm, 4 plates)
- FNT44 (D = 202 mm, 4 plates).

All versions are available with treated hubs and driving plates to reduce rust and help prevent seizure.

FNT friction clutches are available with Release System. This system permits the spring pressure to be reduced during storage, without requiring disassembly of the torque limiter.

Letter “R” in the shaft code identifies versions with Release System.

The chart below indicates the diameter D, number of linings, and the standard settings for each model, corresponding to each driveline size. Maximum settings recommended for use at 1000 min⁻¹ are marked (*).

### Standard settings (Nm)

<table>
<thead>
<tr>
<th></th>
<th>G1</th>
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<th>G3</th>
<th>G4</th>
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<td>1200*</td>
<td>1450</td>
<td>1450*</td>
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<tr>
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<td>1800*</td>
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<td>2200</td>
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</tr>
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</table>

* Recommended settings for a 1000 min⁻¹ velocity
Combination friction torque limiters and overrunning clutches FNT

FNT friction clutches are equipped with Belleville springs, designed to apply nearly constant pressure, self-compensating for friction lining wear. Therefore the setting is maintained without adjustment over the life of the linings.

The torque setting of FNT friction clutches is determined by the Belleville spring. The tables below show the spring codes for each friction clutch and standard setting.

For identification, each spring is marked with a code.

FNT clutches are equipped with a metal band to be used as reference to properly compress the Belleville spring.

To do this properly, tighten the bolts until the Belleville spring contacts the metal band. Then back off each nut 1/4 turn.

Do not over-tighten bolts; this may impair the function of friction clutches.

To avoid excessive wear to the implement, driveline or tractor Bondioli & Pavesi recommends that the setting not be changed.

<table>
<thead>
<tr>
<th>Setting Nm</th>
<th>Code</th>
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<table>
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<th>Code</th>
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</tr>
<tr>
<td>2200</td>
<td>367FT440C</td>
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</table>
Combination friction torque limiters and overrunning clutches FNT

Overrunning clutches mounted on FNT34 and FNT44 versions are incorporated onto the hub. A locking ring separates them from the friction clutch, so that the lubricating grease will not contaminate friction linings.

Lubricate overrunning clutches every 50 hours and after storage.

Do not approach the implement before all parts have reached a complete stop.

Friction clutches may become hot during use. **Do not touch!** Keep the area around the friction clutch clear of any material that could catch fire, and avoid prolonged slipping that will generate excess heat and wear.
Combination friction torque limiters and overrunning clutches FNT

FNT34

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
<th>S = 1 3/8” Z6</th>
<th>1 3/8” Z21</th>
<th>1 3/4” Z6</th>
<th>1 3/4” Z20</th>
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*Recommended settings for a 1000 min⁻¹ velocity

Driveline codes FNT34

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FNT34 codes as spare parts

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⚠️ For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.
### Combination friction torque limiters and overrunning clutches FNT

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
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<th>Description</th>
<th>Technical data</th>
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<td>Taper pin</td>
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**Combination friction torque limiters and overrunning clutches FNT**

**FNT34R**
release system

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</tr>
<tr>
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*Recommended settings for a 1000 min⁻¹ velocity

**Driveline codes FNT34R**

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**FNT34R codes as spare parts**

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**For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.**
Combination friction torque limiters and overrunning clutches FNT

**FNT34R**

release system

<table>
<thead>
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<th>Size</th>
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<th>Description</th>
<th>Technical data</th>
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<td></td>
<td>310001301R04</td>
<td>Special socket head set screw</td>
<td>M 10 x 40 mm</td>
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</table>
Combination friction torque limiters and overrunning clutches FNT

FNT44

<table>
<thead>
<tr>
<th></th>
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<td>175</td>
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Driveline codes FNT44

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FNT44 codes as spare parts

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<tr>
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</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

28.8
## Combination friction torque limiters and overrunning clutches FNT

### FNT44

![Combination friction torque limiters and overrunning clutches FNT](image)

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Size</th>
<th>Spare part code</th>
<th>Description</th>
<th>Technical data</th>
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<tbody>
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<td>432000100R08</td>
<td>Bolt</td>
<td>M10 x 70 mm</td>
</tr>
<tr>
<td>2</td>
<td>G8</td>
<td>2530L1M01R</td>
<td>Flange yoke</td>
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</tr>
<tr>
<td></td>
<td>G9</td>
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<td></td>
<td></td>
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<td>3</td>
<td></td>
<td>240000219R02</td>
<td>Adjustment band</td>
<td>D = 160 ; d = 97 mm</td>
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<tr>
<td>4</td>
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<td>247000061R08</td>
<td>Friction lining</td>
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<td>5</td>
<td></td>
<td>2481M0001R02</td>
<td>Driving plate</td>
<td></td>
</tr>
<tr>
<td>6</td>
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<td>240000748R05</td>
<td>Locking plate</td>
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</tr>
<tr>
<td>8</td>
<td></td>
<td>4271M0101R</td>
<td>Overrunning clutch plug</td>
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</tr>
<tr>
<td>9</td>
<td></td>
<td>348017000R20</td>
<td>Grease fitting</td>
<td></td>
</tr>
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<td>10</td>
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<td>367FT440A</td>
<td>Belleville spring</td>
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<td>12</td>
<td></td>
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<td></td>
<td>4211L0001R06</td>
<td>Pawl + springs kit</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>5151M0351R</td>
<td>Hub, plug and</td>
<td>1 3/8&quot; Z6</td>
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<tr>
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<td></td>
<td>5151M3751R</td>
<td>taper pin kit</td>
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<td></td>
<td>1 3/4&quot; Z6</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>408000046R02</td>
<td></td>
<td>1 3/4&quot; Z6 - Z20</td>
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</table>

**Combination friction torque limiters and overrunning clutches FNT**

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BONDIOLI & PAVESI

28.9
Combination friction torque limiters and overrunning clutches FNT

FNT44R
release system

<table>
<thead>
<tr>
<th>Setting</th>
<th>Nm</th>
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<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
<th>1 3/4&quot; Z20</th>
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</thead>
<tbody>
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<td>175</td>
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Driveline codes FNT44R

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<th>1 3/4&quot; Z20</th>
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FNT44R codes as spare parts

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<th>1 3/8&quot; Z21</th>
<th>1 3/4&quot; Z6</th>
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<td>658M58403R</td>
<td>658M58437R</td>
<td>658M58404R</td>
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<td>658M62404R</td>
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</table>

For primary drivelines, always install any torque limiter or overrunning clutch on the implement side. All rotating parts must be guarded.

28.10
## Combination friction torque limiters and overrunning clutches FNT

**FNT44R**
release system

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### Combination friction torque limiters and overrunning clutches FNT

**Ref.** | **Size** | **Spare part code** | **Description** | **Technical data**
---|---|---|---|---
1 | | 432000100R08 | Bolt | M10 x 70 mm
2 | G8 | 2530L1M02R | Flange yoke | 
2 | G9 | 2530M1M02R | 
3 | | 240000219R02 | Adjustment band | 
4 | | 247000061R08 | Friction lining | D = 160 ; d = 97 mm
5 | | 2481M0001R02 | Driving plate | 
6 | | 2481M0003R02 | Inner plate | Thickness = 4 mm
7 | | 240000748R05 | Locking plate | 
8 | | 4271M0101R | Overrunning clutch plug | 
9 | | 348017000R20 | Grease fitting | 
10 | | 2481H0003R02 | Pressure plate | Thickness = 8 mm
11 | | 367FT440A | Belleville spring | 1800 Nm
12 | | 367FT440C | | 2200 Nm
13 | | 339002068R20 | Snap ring | 
14 | | 4211L0001R06 | Pawl + springs kit | 
15 | | 5151M0351R | Hub, plug and taper pin kit | 1 3/8" Z6
15 | | 5151M3751R | | 1 3/8" Z21
15 | | 5151M0451R | | 1 3/4" Z6
15 | | 5151M3851R | | 1 3/4" Z20
16 | | 408000047R02 | Taper pin | 1 3/8" Z6 - Z21
16 | | 408000046R02 | | 1 3/4" Z6 - Z20
16 | | 310001301R04 | Special socket head set screw | M 10 x 40 mm

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**BONIOLI & PAVESI**

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28.11
Proper lubrication of all rotating and sliding parts is essential for proper function, long life, and reliability. Insufficient lubrication, or contamination of the lubricant, is one of the most frequent causes of failure of cardan joint drivelines. The lubrication frequency and the type of grease used are important to the life of the driveline, as well as the shafts and bearings of the components to which they are connected.

Grease contains a soap base (lithium, calcium, or sodium based), lubricating oils, and additives (e.g., molybdenum disulphide). These additives are used for corrosion resistance, strength, adhesion at extreme pressures (EP), or other properties. The soap base can be compared to a “sponge”; it retains lubricating oils and gradually releases them to the components. Its efficiency diminishes with longer working periods and with higher pressures.

Greases are classified by the National Lubricating Grease Institute (NLGI) according to their consistency. Bondioli & Pavesi recommends NLGI #2 grease on all crosses, telescoping members and shields.

During assembly, the LR automatic torque limiters are greased with NLGI 2 molybdenum disulphide grease and do not require further lubrication throughout the normal period of use.

The standard lubrication frequency for all components of series Global cardan joint drivelines is 50 hours. This lengthens the lubrication interval from a daily chore to a weekly routine.

Heavy duty applications in aggressive environments may require more frequent lubrication.

The following instructions, that are also listed in the operator’s manual of the driveline, should be included in the manual provided by the implement manufacturer.

⚠️ Disengage the PTO, turn off the tractor engine, remove the key, and check that all rotating parts have come to a standstill before approaching the implement or performing maintenance work.

It is recommended to grease the components before their initial use.

Clean and lubricate the driveline before storage, and at the end of the season. When greasing cross kits, lubricate generously until the grease purges from all four bearing caps. Pump grease gradually. Avoid high pressures, especially those possible from pneumatic equipment.
Lubrication

Lubrication frequency (hours) and estimated grease volumes

<table>
<thead>
<tr>
<th></th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>G5</th>
<th>G7</th>
<th>G8</th>
<th>G9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crosses</td>
<td>4 g</td>
<td>7 g</td>
<td>10 g</td>
<td>13 g</td>
<td>18 g</td>
<td>22 g</td>
<td>26 g</td>
<td></td>
</tr>
<tr>
<td>Shields</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 g</td>
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<td>Telescoping members</td>
<td></td>
<td>12 g</td>
<td>20 g</td>
<td>32 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80° CV joint</td>
<td>20 g</td>
<td>30 g</td>
<td>40 g</td>
<td>50 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Manually operated grease guns provide approximately 0.8 – 1.0 grams of grease per pump. One (1) ounce of grease is approximately 28.3 grams.

When lubricating cross kits, pump grease until the grease purges from all four bearing caps. Pump the grease gradually. Avoid high pressures, especially those possible from pneumatic equipment.
Lubrication

RA1 Overrunning clutches
3 - 4 g

RA2 Overrunning clutches
5 - 6 g

SA Ratchet torque limiters
4 - 7 g

LN Ratchet torque limiters
4 - 7 g

LB Shear bolt torque limiter
1 - 2 g seasonal

FNT Friction torque limiter and overrunning clutch

FNV Friction torque limiter and overrunning clutch
5 - 7 g

FFNV Friction torque limiter and overrunning clutch
5 - 7 g
**Direct Greasing**

Direct Greasing is an optionally available system for telescoping members which facilitates lubrication with the transmission mounted to the tractor in the transport or working positions.

A grease fitting on the transmission shaft is easily accessed via a hole in the external shield tube and a slot in the internal shield tube.

To align the hole and the slot when the transmission is extended, simply rotate the shield tubes; you can now access the grease fitting.

The extension at which the grease fitting is accessible usually corresponds to the transport or working extension, and must be specified when ordering the Direct Greasing option.

The Direct Greasing system complies with international safety regulations.

The 25 mm diameter access hole is normally closed, but can easily be opened when the shaft is at the specified extension by rotating the shield tubes so that the hole is over the slot.

The standard slot length is 90 mm, but can be specified up to 120 mm.
Proper use and maintenance of the driveline and shield is of primary importance for operator safety. Missing or modified safety shields may cause accidents.

⚠️ All rotating parts must be guarded.

Shields applied to the Implement Input Connection (IIC) require special attention, because they must integrate with the driveline shields, they should not interfere with other components when operating the implement, and they should not hinder driveline installation and maintenance. Bondioli & Pavesi offers a complete range of implement input connection shields, designed with the drivelines in compliance with international safety standards. Due to the broad range of implements and applications, the specifications contained herein should be used as a general guide to the selection of an implement input connection shield.

The implement manufacturer is responsible for selecting suitable IIC shielding according to the application, the size and articulation range of the driveline, the type and size of any torque limiters installed on the driveline, access requirements for assembly or maintenance, and any applicable standards. **Thorough testing of the IIC shield by the implement manufacturer under actual field conditions is necessary and strongly recommended by Bondioli & Pavesi.**

SFT implement input connection (IIC) shields comply with international standards and are designed to complete an interactive guarding system along with the driveline guard and tractor master shield, even if the driveline is equipped with a CV joint, torque limiter, or an overrunning clutch. These shields are practical and can be opened to easily access the joints for installation and maintenance operations. SFT shields are not designed, nor intended to be used as steps.
Implement input connection shields

All rotating parts must be guarded. Contact with a rotating driveline can cause death or serious injury. The tractor master shield, driveline guards, and the implement input connection shield form an interactive guarding system.

The Machinery Directive (2006/42/CE) requires that the implement be equipped with an implement input connection shield fixed to the implement.
Standard UNI EN ISO 4254-1 requires the implement input connection shield completely encircle the shaft, but allow for installation and articulation of the driveline: Standards UNI EN ISO 4254-1 and ANSI/ASABE S604.1 requires the IIC shield provide at least 50 mm of overlap with the integral driveline guard in the straight position.
The tractor master shield, the integral driveline guard, and the implement input connection shield constitute an interactive guarding system according to ANSI/ASABE S604.1 standard.
Bondioli & Pavesi recommends the use of proper shields and guards for drivelines, tractors, and implements. Damaged or missing components must be replaced with original spare parts, correctly installed, before using the driveline.

Bondioli & Pavesi recommends the manufacturers of implements apply labels that clearly state the need to keep safety shields in place and in proper working order.
Manufacturers are also recommended to include in their operating manuals a list of the shields and safety labels, as well as their position on the machine and their code numbers for ordering replacements.
In compliance with ANSI/ASAE S493.1 standards, the implement manufacturer shall provide safety sign(s) and instructions stating that guards must be kept in place and the machine should not be operated with guards opened or removed. Standard UNI EN ISO 4254-1 requires a label be used to draw attention to possible risks when the guard is unlocked, opened, or removed.
Basic information for safe and correct use of the driveline and shielding are shown in the catalogs and on the instruction sheet included with the implement input connection shield.
Implement input connection shields

Use the implement only with the original driveline. The implement input connection shield must be compatible with the driveline and the application.

If the IIC shield is damaged by contact with other components of the implement, please consult your dealer.

Contact with a rotating driveline can cause serious injury or death. Do not open or remove safety shields while engine is running. Make sure that all driveline, tractor and implement shields are functional and in place before operation. Damaged or missing shields must be replaced with correctly installed original equipment spare parts.

Do not step or stand on the driveline or implement input connection shield. Do not step on, step over, or go under the driveline. Disengage the PTO, turn off the tractor engine, remove the key, and allow all moving parts to come to a complete stop before approaching the implement or doing maintenance work.

To open the SFT IIC shield, lift the lever with a screwdriver or a similar tool to release the two clips. Slide the implement input connection shield forward along the driveline to gain access to the joint, yoke, or clutch. The chain keeps the plastic shield attached to the metal plate when opened.

Make sure the driveline and implement input connection shields are securely attached to the implement before operating. Make sure that the plastic shield is properly seated on the metal plate and the lever clamps are securely closed before operating the driveline.
Implement input connection shields

SFT IIC shields are composed of a metal plate and a circular plastic shield. The function of the metal plate is to support the plastic shield and provide a means for attachment to the implement. It is made of metal to provide a rigid and solid support even if attached to a surface that will become hot (such as a gear box). The plastic shield completely encircles the implement input shaft as required by standard UNI EN ISO 4254-1, and is connected to the metal plate by two lever clamps.

SFT IIC shields comply with ANSI/ASABE S604.1 and UNI EN ISO 4254-1 standards, which require a minimum overlap of 50 mm between the IIC shield and the driveline shield, in the straight position. To install or perform maintenance on the driveline, release the shield cone from the bottom plate and slide it along the shaft. The lever clamps are shrouded to prevent unintentional release. The clamps may be disengaged using a screwdriver or similar lever. Opening the clamps allows the plastic shield to slide along the driveline, providing easy and ample access for installation and maintenance of the joint, torque limiter or clutch.

A chain connects the metal plate to the plastic shield when it is released in accordance with standard ANSI/ASAE S493.1 and UNI EN ISO 4254-1.
Implement input connection shields

IIC shields should be chosen depending on their intended application, the yoke, torque limiter, or clutch to be covered, their dimensions, and on normal driveline movements during implement operations and maneuvers.

IIC shields, as well as driveline shields, should allow minimal access to revolving parts, but allow unhindered driveline movements.

Standard ISO 5673-1 defines a minimum 150 mm access.

SFT IIC shields are available with two types of shield cones, 00 and 10, which differ in shape, material and diameters. (17, 19, 21, 23 and 25).

Type 00 cones come in five different diameters and can be applied to end yokes, overrunning clutches, torsionally resilient joints, ratchet torque limiters, shear bolt torque limiters, and automatic torque limiters.

Type 10 cones come in three diameters and are made of heat-resistant plastic. They are recommended especially for protecting friction torque limiters, which are often used in heavy-duty applications and can reach high working temperatures.

<table>
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<th>Diameter code</th>
<th>Type 00</th>
<th>Type 10</th>
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<tbody>
<tr>
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<tr>
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<tr>
<td>25</td>
<td>259</td>
<td>207</td>
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</tbody>
</table>
Implement input connection shields

The size of the IIC shields should be sufficient to allow the cone to pass over the driveline’s outer cone. Diameter $D_1$ must therefore be larger than the diameter of the outer cone, or any type of torque limiter or clutch installed on the driveline. The table below shows appropriate IIC shield diameter codes (i.e. the diameter $D$ in centimeters) for various driveline attachments.

IIC shields and driveline shields should allow minimal access to revolving parts, while leaving the driveline easy to install and free to articulate.

```
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<tr>
<th>Driveline Attachment</th>
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<th>G3</th>
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<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>FV32 - FFV32 - FT32</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>FT34 - FFV34 - FT34</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>FV42 - FFV42 - FT42</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>FV44 - FFV44 - FT44</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>FNV34 - FNV34 - FNT34</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>FNV44 - FNV44 - FNT44</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>25</td>
<td>25</td>
</tr>
</tbody>
</table>
```
Implement input connection shields

The IIC shield length \( L \) is measured from the face of the metal plate to the end of the plastic shield. Standard shield lengths are shown in the table below and must be chosen to provide sufficient overlap with the driveline shield, while leaving the necessary space for shaft installation and movement. The IIC shield length \( L \) can be calculated by the following formula, according to the protrusion of the implement shaft \( X \), in order to achieve an overlap of 50mm as required by standards UNI EN ISO 4254-1 and ANSI/ASABE S604.1.

\[
L = X + B + 50 - F
\]

Length \( B \) is measured from the annular groove of the splined shaft to the center of the cross. These dimensions are listed within this catalog for each yoke, torque limiter, or clutch (see section for relevant size driveline). Length \( F \) is measured from the protrusion of the shield to the cross center. This dimension is also listed in the tables related to driveline sizes. The table below shows the length codes for each IIC shield. Always choose the next longer standard length above the calculated length to maintain a 50 mm overlap with the driveline shield.
Implement input connection shields

SFT implement input connection shields can be easily installed on the implement. The metal plate has four slots positioned at 90° to allow attachment with bolts to the implement frame. Bondioli & Pavesi recommends the implement manufacturer provide a solid and sturdy mounting, and advise the end user to periodically check that the shield is in place, undamaged, and properly secured.

The implement input connection shield is attached to, and becomes a part of the implement. Consequently, the implement manufacturer is responsible for selecting the proper shield according to applicable standards and, if required, obtaining CE certification for the machine. SFT IIC shields are provided of CE mark and instruction sheet (code 399CEE2CF) including the Conformity Statement required by the Machinery Directive. Instruction sheet 399CEE2CF is valid for all countries of destination.

---

<table>
<thead>
<tr>
<th>Diameter</th>
<th>A</th>
<th>S</th>
<th>F₁</th>
<th>F₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>code</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>17</td>
<td>40</td>
<td>9</td>
<td>56</td>
<td>98</td>
</tr>
<tr>
<td>19</td>
<td>40</td>
<td>9</td>
<td>56</td>
<td>98</td>
</tr>
<tr>
<td>21</td>
<td>52</td>
<td>11</td>
<td>66</td>
<td>126</td>
</tr>
<tr>
<td>23</td>
<td>52</td>
<td>11</td>
<td>66</td>
<td>126</td>
</tr>
<tr>
<td>25</td>
<td>52</td>
<td>11</td>
<td>66</td>
<td>126</td>
</tr>
</tbody>
</table>

Instruction sheet 399CEE2CF
**Implement input connection shields**

Codes for SFT IIC shields

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>9</td>
<td>5</td>
</tr>
</tbody>
</table>

SFT IIC shield

4 5

IIC shield type

- **00**: for yokes, ratchet torque limiters, shear bolt limiters, automatic limiters
- **10**: Zytel® material, recommended for friction torque limiters

6 7

IIC shield diameter

- 17, 19, 21, 23, 25 for type 00 cones
- 21, 23, 25 for type 10 cones

8 9

IIC Shield length

- 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75

10 11

CE

Example: **395 00 23 30 CE**
is the code for ordering a SFT IIC Shield with 00 cone, diameter D = 230 mm (code 23), length L = 185 mm (code 30), with an instruction sheet valid for all countries of destination.

Bondioli & Pavesi offers a wide range of shields for PTO’s, specifically designed for drivelines and fully compliant with international standards.

Due to the broad range of implements and applications, the specifications contained herein should be used as a general guide to the selection of an implement input connection shield.

The implement manufacturer is responsible for selecting suitable IIC shielding according to the application, the size and the articulation range of the driveline, the standards applicable for the country of destination.

Thorough testing of the IIC shield by the implement manufacturer under actual field conditions is necessary and strongly recommended by Bondioli & Pavesi.

---

All rotating parts must be guarded. The shields on the tractor and on the implement machine must form an integrated guarding system with the driveline guard.
The Machinery Directive (2006/42/CE) requires that the implement be equipped with an implement input connection shield fixed to the implement. Standard UNI EN ISO 4254-1 requires the implement input connection shield completely encircle the shaft, but allow for installation and articulation of the driveline. Standards UNI EN ISO 4254-1 and ANSI/ASABE S604.1 requires the IIC shield provide at least 50 mm of overlap with the integral driveline guard in the straight position. The tractor master shield, the integral driveline guard, and the implement input connection shield constitute an interactive guarding system according to ANSI/ASABE S604.1 standard.

Bonidioli & Pavesi recommends the use of proper shields and guards for drivelines, tractors, and implements. Damaged or missing components must be replaced with original spare parts, correctly installed, before using the driveline.

Damaged or missing components must be replaced with original spare parts, correctly installed, before using the driveline. Bonidioli & Pavesi recommends the manufacturers of implements apply labels that clearly state the need to keep safety shields in place and in proper working order.

Manufacturers are also recommended to include in their operating manuals a list of the shields and safety labels, as well as their position on the machine and their code numbers for ordering replacements. In compliance with ASAE S493.1 standards, the implement manufacturer shall provide safety sign(s) and instructions stating that guards must be kept in place and the machine should not be operated with guards opened or removed. Standard UNI EN ISO 4254-1 requires a label be used to draw attention to possible risks when the guard is unlocked, opened, or removed.
Implement input connection shields CF

Circular shape implement input connection shields
CF implement input connection shields with circular shape are available in three different sizes with or without fixing slots. The flat fixing surface has a diameter of 120 mm, the slots are 24 mm long and 9 or 11 mm large. It's recommendable that the implement manufacturer provide for a solid and sturdy mounting by screws and washers on the flat bottom surface. Flexible extensions, available in two different lengths, can be attached to the rigid body to increase the overlap with the driveline guard and allow joint articulation.

<table>
<thead>
<tr>
<th>Code</th>
<th>Rigid cone</th>
<th>Cone with medium band</th>
<th>Cone with long band</th>
</tr>
</thead>
<tbody>
<tr>
<td>without slots</td>
<td>21901CE</td>
<td>41701CE</td>
<td>41711CE</td>
</tr>
<tr>
<td>with slots</td>
<td>21900F09CE</td>
<td>51700F01CE</td>
<td>51700F02CE</td>
</tr>
<tr>
<td>9x24</td>
<td>21900F11CE</td>
<td>51700F03CE</td>
<td>51700F04CE</td>
</tr>
<tr>
<td>11x24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Rigid cone</th>
<th>Cone with medium band</th>
<th>Cone with long band</th>
</tr>
</thead>
<tbody>
<tr>
<td>without slots</td>
<td>21902CE</td>
<td>41702CE</td>
<td>41712CE</td>
</tr>
<tr>
<td>with slots</td>
<td>21900G09CE</td>
<td>51700G01CE</td>
<td>51700G02CE</td>
</tr>
<tr>
<td>9x24</td>
<td>21900G11CE</td>
<td>51700G03CE</td>
<td>51700G04CE</td>
</tr>
<tr>
<td>11x24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Rigid cone</th>
<th>Cone with medium band</th>
<th>Cone with long band</th>
</tr>
</thead>
<tbody>
<tr>
<td>without slots</td>
<td>21903CE</td>
<td>41703CE</td>
<td>41713CE</td>
</tr>
<tr>
<td>with slots</td>
<td>21900H09CE</td>
<td>51700H01CE</td>
<td>51700H02CE</td>
</tr>
<tr>
<td>9x24</td>
<td>21900H11CE</td>
<td>51700H03CE</td>
<td>51700H04CE</td>
</tr>
<tr>
<td>11x24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Implement input connection shields CF**

**Oval shape implement input connection shields**

CF IIC shields with oval shape are available in only one size with or without fixing slots. The flat fixing surface has a diameter of 134 mm, the slots are 31 mm long and 9 or 11 mm large.

It’s recommendable that the implement manufacturer provide for a solid and sturdy mounting by screws and washers on the flat bottom surface.

Flexible extensions, available in two different lengths, can be attached to the rigid body to increase the overlap with the driveline guard and allow joint articulation.

Oval shape IIC shields can be supplied with one or two windows that give access for the installation of the driveline or checking that is properly secured.

---

**Oval implement input connection shields without access windows**

<table>
<thead>
<tr>
<th>Code</th>
<th>without slots</th>
<th>with slots 9x31</th>
<th>with slots 11x31</th>
</tr>
</thead>
<tbody>
<tr>
<td>21904CE</td>
<td>219000A09CE</td>
<td>219000A11CE</td>
<td></td>
</tr>
<tr>
<td>41704CE</td>
<td>517000A01CE</td>
<td>517000A03CE</td>
<td>517000A04CE</td>
</tr>
</tbody>
</table>

**Oval implement input connection shields with one access window**

<table>
<thead>
<tr>
<th>Code</th>
<th>without slots</th>
<th>with slots 9x31</th>
<th>with slots 11x31</th>
</tr>
</thead>
<tbody>
<tr>
<td>2190401CE</td>
<td>219000C19CE</td>
<td>219000C21CE</td>
<td></td>
</tr>
<tr>
<td>4170401CE</td>
<td>517000C01CE</td>
<td>517000C03CE</td>
<td>517000C04CE</td>
</tr>
<tr>
<td>4171401CE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Oval implement input connection shields with two access windows**

<table>
<thead>
<tr>
<th>Code</th>
<th>without slots</th>
<th>with slots 9x31</th>
<th>with slots 11x31</th>
</tr>
</thead>
<tbody>
<tr>
<td>2190402CE</td>
<td>219000E19CE</td>
<td>219000E21CE</td>
<td></td>
</tr>
<tr>
<td>4170402CE</td>
<td>517000E01CE</td>
<td>517000E03CE</td>
<td>517000E04CE</td>
</tr>
<tr>
<td>4171402CE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Specific applications may require different shielding. The implement manufacturer should verify the suitability of the shielding according to the characteristics of the application and an applicable standard of the country where the machine is used. Bondioli & Pavesi supplies drivelines, gearboxes and implement input connection shields in many different configurations. Due to the broad range of implements and applications, the specifications container herein should be used as a general guide to the selection of an implement input connection shield.

The implement manufacturer is responsible for selecting suitable implement input connection shielding according to the application, the size and articulation range of the driveline, the type and size of any torque limiters attached to the driveline, access requirements for assembly or maintenance, and any applicable standard.

Thorough testing of the implement input connection shields by the implement manufacturer under actual field conditions is necessary and strongly recommended by Bondioli & Pavesi.

Do not step or stand on the implement input connection shield. Do not step on, step over, or go under the driveline.

The oval shape Implement input connection shields can be supplied in Zytel® upon customer request. This material maintains its strength at elevated temperatures. Shields made of Zytel® can be used to guard devices operating at temperatures higher than normal, such as friction torque limiters working in heavy duty conditions. Basic information for safe and correct use of the driveline and shielding are shown in the catalogues and on the instruction sheet included with the implement input connection shield.

Bondioli & Pavesi shaft cones come with a CE marking and an instruction sheet which includes a Declaration of Conformity in accordance with the Machinery Directive (2006/42/EC).
Implement input connection shields CF

Use the machine only with its original drive-line. The IIC shield must suit the application. If the IIC shield is damaged due to contact with machine parts, contact the dealer.

Before operation, make sure that the drive-line and the IIC shield are correctly fitted. The screw heads and washers must be within the flat portion of the cone for secure attachment.

Before operation, make sure that all the guards are in place and work properly. Damaged or missing components must be replaced with original spare parts and correctly installed.

Turn off the tractor engine and remove the key before performing any type of maintenance. Contact with rotating parts can cause serious injury or death.

Do not use the IIC shield as a step. Before operation, close any IIC shield doors.
### Power take offs (PTO’s)

#### 1 3/8” – Z6

![Diagram of 1 3/8” – Z6 PTO](image)

<table>
<thead>
<tr>
<th>Standard</th>
<th>D1 mm</th>
<th>D2 mm</th>
<th>T1 mm</th>
<th>D3 mm</th>
<th>D4 mm</th>
<th>T2 mm</th>
<th>R mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN 9611*</td>
<td>34.96</td>
<td>29.8</td>
<td>8.74</td>
<td>34.85</td>
<td>28.96</td>
<td>8.60</td>
<td>6.95</td>
</tr>
<tr>
<td>ISO 500 ANSI/ASABE AD500</td>
<td>34.95</td>
<td>29.80</td>
<td>8.76</td>
<td>34.87</td>
<td>29.00</td>
<td>8.64</td>
<td>7.05</td>
</tr>
</tbody>
</table>

*DIN 9611 standard has been revoked and never replaced.

#### 1 3/8” – Z21

![Diagram of 1 3/8” – Z21 PTO](image)

<table>
<thead>
<tr>
<th>Standard</th>
<th>D1 mm</th>
<th>D2 mm</th>
<th>D3 mm</th>
<th>D4 mm</th>
<th>R mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN 9611*</td>
<td>35.66</td>
<td>31.900</td>
<td>34.87</td>
<td>31.10</td>
<td>7.15</td>
</tr>
<tr>
<td>ISO 500 ANSI/ASABE AD500</td>
<td>34.96</td>
<td>31.900</td>
<td>34.874</td>
<td>31.10</td>
<td>7.05</td>
</tr>
</tbody>
</table>

*DIN 9611 standard has been revoked and never replaced.
Power take offs (PTO’s)

1 3/4” – Z20

<table>
<thead>
<tr>
<th>Standard</th>
<th>D1 mm</th>
<th>D2 mm</th>
<th>D3 mm</th>
<th>D4 mm</th>
<th>R mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN 9611*</td>
<td>45.26</td>
<td>40.280</td>
<td>44.53</td>
<td>39.21</td>
<td>8.65</td>
</tr>
<tr>
<td></td>
<td>45.03</td>
<td>40.130</td>
<td>44.13</td>
<td></td>
<td>8.15</td>
</tr>
<tr>
<td>ISO 500</td>
<td>44.488</td>
<td>40.350</td>
<td>44.425</td>
<td>39.21</td>
<td>8.65</td>
</tr>
<tr>
<td>ANSI/ASABE AD500</td>
<td>44.450</td>
<td>40.200</td>
<td>44.400</td>
<td>38.96</td>
<td>8.15</td>
</tr>
</tbody>
</table>

*DIN 9611 standard has been revoked and never replaced.

1 3/4” – Z6

D8x32x38
## Units of measurement

### LENGTH

<table>
<thead>
<tr>
<th>International unit of length</th>
<th>Symbol</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>millimetre</td>
<td>mm</td>
<td>1 mm = 0.001 m</td>
</tr>
<tr>
<td>centimetre</td>
<td>cm</td>
<td>1 cm = 0.01 m</td>
</tr>
<tr>
<td>inch</td>
<td>in</td>
<td>1 in = 0.0254 m = 25.4 mm</td>
</tr>
<tr>
<td>foot</td>
<td>ft</td>
<td>1 ft = 0.3048 m = 304.8 mm</td>
</tr>
<tr>
<td>yard</td>
<td>yd</td>
<td>1 yd = 0.9144 m</td>
</tr>
</tbody>
</table>

### ANGLE

<table>
<thead>
<tr>
<th>International unit of angle</th>
<th>Symbol</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>degree</td>
<td>°</td>
<td>1 ° = 0.017453 rad</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 rad = 57.296 °</td>
</tr>
</tbody>
</table>

### AREA

<table>
<thead>
<tr>
<th>International unit of area</th>
<th>Symbol</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>square millimeter</td>
<td>mm²</td>
<td>1 mm² = 0.000001 m²</td>
</tr>
<tr>
<td>square centimeter</td>
<td>cm²</td>
<td>1 cm² = 0.0001 m²</td>
</tr>
<tr>
<td>hectare</td>
<td>hectar</td>
<td>1 hectar = 10000 m²</td>
</tr>
<tr>
<td>acre</td>
<td>acre</td>
<td>1 acre = 4046.856 m²</td>
</tr>
</tbody>
</table>

### FORCE

<table>
<thead>
<tr>
<th>International unit of force</th>
<th>Symbol</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>kilogram-force or kilopond</td>
<td>kgf or kp</td>
<td>1 kp = 9.81 N</td>
</tr>
<tr>
<td>gram-force</td>
<td>g</td>
<td>1 g = 0.001 kp</td>
</tr>
<tr>
<td>quintal</td>
<td>q</td>
<td>1 q = 100 kp</td>
</tr>
<tr>
<td>ounce</td>
<td>oz</td>
<td>1 oz = 0.2780 N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 oz = 0.02835 kp</td>
</tr>
<tr>
<td>pound</td>
<td>lb</td>
<td>1 lb = 4.4482 N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 lb = 0.45359 kp</td>
</tr>
</tbody>
</table>
## Units of measurement

### Pressure

<table>
<thead>
<tr>
<th>International unit of pressure</th>
<th>Symbol</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>International unit of pressure</td>
<td>Pa o N/m²</td>
<td>Pascal</td>
</tr>
<tr>
<td>Unit of measurement</td>
<td>atm</td>
<td>1 atm = 101325 Pa</td>
</tr>
<tr>
<td>bar</td>
<td>bar</td>
<td>1 bar = 10⁵ Pa</td>
</tr>
<tr>
<td>kilopond per square millimeter</td>
<td>kp/mm²</td>
<td>1 kp/mm² = 9.8066 N/mm²</td>
</tr>
<tr>
<td>millimeter of mercury- mm Hg</td>
<td>Torr</td>
<td>1 Torr = 133.322 Pa</td>
</tr>
</tbody>
</table>

### Torque

<table>
<thead>
<tr>
<th>International unit of torque</th>
<th>N·m</th>
<th>Newton per meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit of measurement</td>
<td></td>
<td>Conversion</td>
</tr>
<tr>
<td>inch x pound</td>
<td>in·lb</td>
<td>1 in · lb = 0.1129 N·m</td>
</tr>
<tr>
<td>foot x pound</td>
<td>ft·lb</td>
<td>1 ft · lb = 1.3563 N·m</td>
</tr>
<tr>
<td>kilopond-meter</td>
<td>kp·m</td>
<td>1 kp · m = 9.8066 N·m</td>
</tr>
</tbody>
</table>

### Speed

<table>
<thead>
<tr>
<th>International unit of speed</th>
<th>m/s</th>
<th>meter per second</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit of measurement</td>
<td></td>
<td>Conversion</td>
</tr>
<tr>
<td>kilometer per hour</td>
<td>km/h</td>
<td>1 km/h = 3.6 m/s</td>
</tr>
<tr>
<td>feet per minute</td>
<td>fpm</td>
<td>1 fpm = 0.00508 m/s</td>
</tr>
</tbody>
</table>

### Rotation or Angular Velocity

<table>
<thead>
<tr>
<th>International unit of rotation</th>
<th>ω=rad/s</th>
<th>radiant per second</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit of measurement</td>
<td></td>
<td>Conversion</td>
</tr>
<tr>
<td>revolutions per minute</td>
<td>giri/min o min⁻¹</td>
<td>1 min⁻¹ = 2 · π/60 rad/s</td>
</tr>
</tbody>
</table>

### Power

<table>
<thead>
<tr>
<th>International unit of power</th>
<th>W</th>
<th>watt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit of measurement</td>
<td></td>
<td>Conversion</td>
</tr>
<tr>
<td>kilowatt</td>
<td>kW</td>
<td>1 kW = 1000 W</td>
</tr>
<tr>
<td>cavalli-vapore</td>
<td>CV</td>
<td>1 CV = 0.7355 kW</td>
</tr>
<tr>
<td>horsepower</td>
<td>HP</td>
<td>1 HP = 0.7457 kW</td>
</tr>
</tbody>
</table>