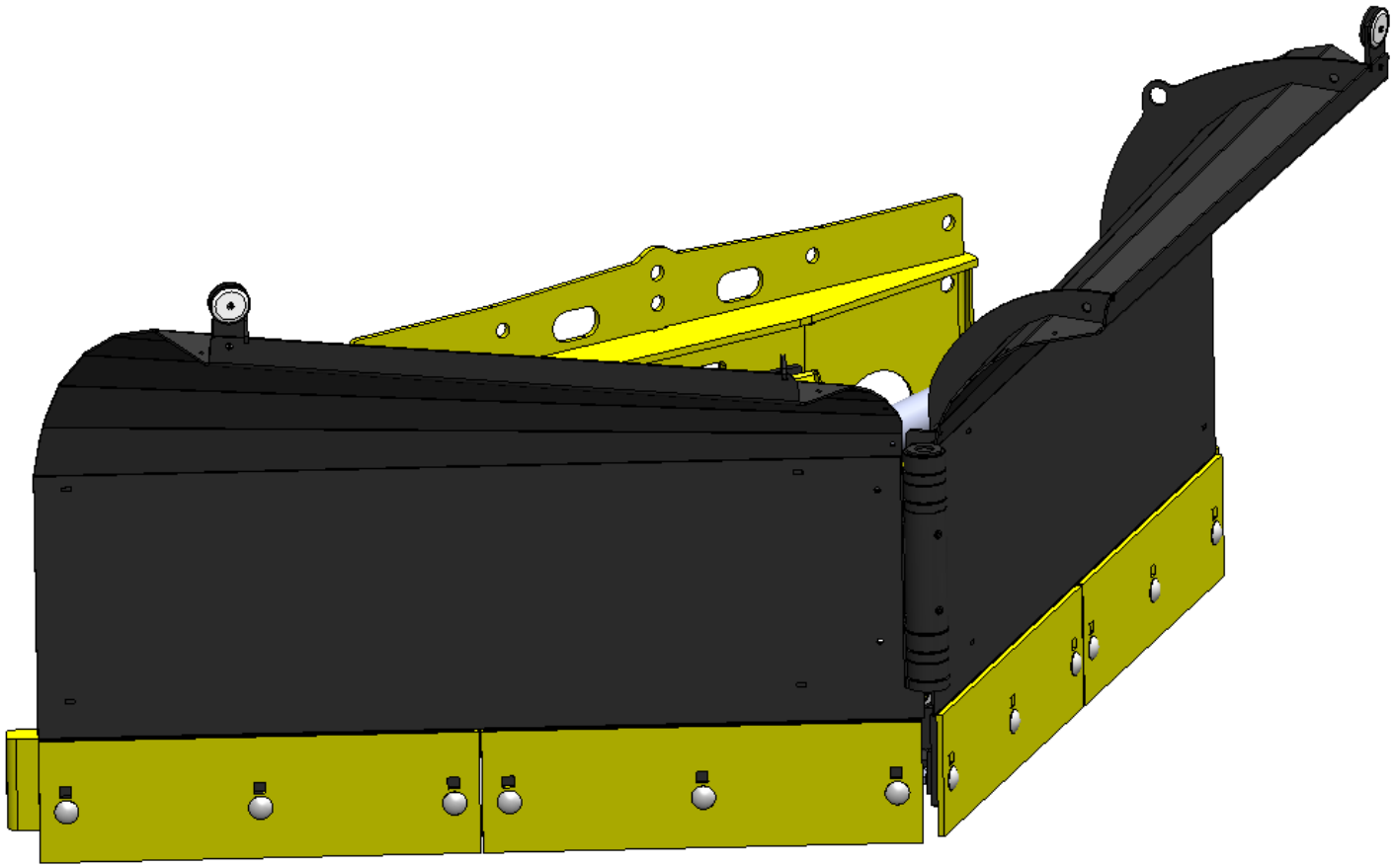
Original Instructions

User and Maintenance Manual

Articulated Plow



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Introduction

Congratulations for choosing STARK Articulated Plow!

We at the STARK want your plow to serve you the best possible way, efficiently and for a long time. Therefore, please read this manual before taking your new plow in use.

STARK products are designed and manufactured in Finland and each attachment is equipped to meet the customer's needs.

Make sure that everyone using and servicing the plow reads this manual beforehand! Always ensure safety while using and servicing the plow. Please keep this manual and make sure to pass it on to a possible new owner.

Development of STARK products is based on quality, durability and economical use. Products have been designed to be efficient, safe and durable in professional use. Feedback and customer experience are important to us for our future development. Also, if you have any questions regarding operation or maintenance of the plow please contact us by email: info@stark.fi

New innovations and all our products can be found on our website: www.stark.fi

Manufacturer reserves the right to structural and technical changes without notice. Information in the manual may therefore have changed after printing.

Read before use

Familiarise yourself with the attachment before taking it in use.

The plow should be operated only by proficient users.

People working with this attachment should be thoroughly introduced to operation and maintenance of it. People not acquainted with the plow may cause danger to themselves, environment or the attachment.

When connecting the attachment, please pay attention:

- that the locking pins and cotter pins are fine
- there is no pressure in the hydraulics system
- that the hydraulic hoses are intact
- when connecting the hydraulics avoid skin contact with hydraulic fluid
- do not pull from the hose, only from the coupling

While operating, please pay attention:

- safe and appropriate speed
- other traffic, people and animals
- danger zones and visual obstacles
- device should not be used when someone is in the danger zone
- be careful around children
- do not go under the attachment

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1. DECLARATION OF CONFORMITY

Original manufacturer Declaration of conformity:

Product name: Articulated plow

Models: STARK NL 3200, NL 3600, NL 4000, NL 1830R, NL 2440R, NL 2800R, NL 3100R, NL 3300R, NL 3600R, NL 4000R, NL 2250R

Manufacturer:

Lametal Oy

Kaskenviertäjäntie 2, FIN-73100 LAPINLAHTI

tel. +358 17 731 565

Hereby declare that the following machinery fulfils all the relevant requirements of EC Machinery Directive 2006/42/EC, and the following standards:

- SFS-EN ISO 12100-1,
- SFS-EN ISO 12100-2
- SFS-EN 1050

The Technical Construction File is maintained at Lametal factory.

The authorized representative located within the Community is:

Lassi Mehtonen

Managing Director

Kaskenviertäjäntie 2

73100 Lapinlahti, FINLAND

2. INTENDED USE

STARK Articulated Plows are designed for plowing and moving snow from yards and streets. Wide turning angles of the wings ensure articulated plow's usability in different kinds of areas.

Using to plow or move heavier material than snow is prohibited and will terminate warranty.

3. SAFETY INSTRUCTIONS

Familiarise yourself with the attachment before taking it in use. The plow should be operated only by proficient users.

Before connecting hydraulics to the plow, please check:

- there is no one between the attachment and base machine
- the base machine is turned off and the parking brake is on

When connecting the attachment to base machine, please pay attention:

- that the locking pins and cotter pins are fine
- there is no pressure in the hydraulics system
- that the hydraulic hoses are intact
- when connecting the hydraulics avoid skin contact with hydraulic fluid
- do not pull from the hose, only from the coupling

While operating, please pay attention:

- safe and appropriate speed
- other traffic, people and animals
- danger zones and visual obstacles
- device should not be used when someone is in the danger zone
- be careful around children
- use flashing light while plowing
- do not go under the plow

BEWARE pressurised hydraulic hoses and components!

While servicing the plow, the base machine's hydraulics must be switched off, the base machine turned off and the parking brake put on. The plow must be lowered on supports if going under the plow is required. Never go under the plow if it is not supported.

Daily maintenance:

- check the overall condition of structures, make repairs if needed
- check the condition of hydraulic hoses and couplings, change if damaged
- check the condition of wear blades, adjust or change if needed. See" Adjusting blades"

Maintenance every 50 hours:

- lubricate the lubrication points (locations are given in product specific section)
- check the tightness of the bolts and nuts

Check the tightness of bolts and nuts after first time in use!

If the plow is left unused for a long time, it needs to be cleaned well and lubricated before storage.

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4. IDENTIFICATION AND PARTS

4.1. Identification plate

The identification plate can be found on the upper section of the right wing. On the plate can be found the manufacturers contact info, type and model of the product, manufacturing year, serial number and weight.

The serial number's first four digits contain the manufacturing month and year (month before year: MMYY). The last five digits are the actual serial number, which is registered at the manufacturer (example below: 13971). Below a picture of an identification plate:

Picture 1. Identification plate.

Please write below the product type and serial number of your plow:

Product _____Serial number_____

4.2. Maintenance and parts service

Only original parts should be used when making repairs. By using original parts, you can ensure proper operation and warranty coverage. When inquiring and ordering parts please give the product type and serial number from the identification plate to facilitate service.

STARK maintenance and parts service as well as your dealer can answer your questions on maintenance and parts.

Please contact your dealer or

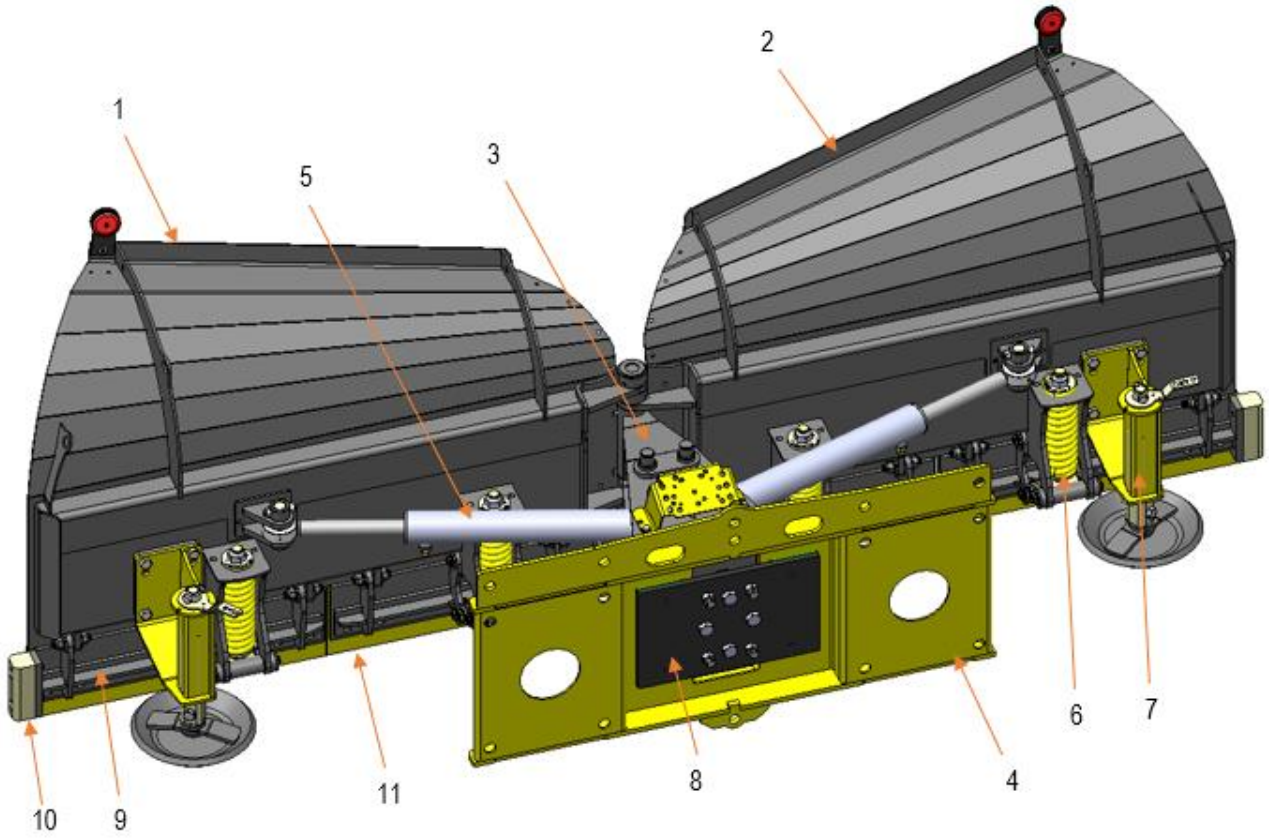
STARK maintenance service:

tel. +358 (0)17 731 565, email info@stark.fi

STARK parts service:

tel. +358 (0)44 758 6221, email parts@stark.fi

5. MAIN PARTS OF THE PLOW



Picture 2. Main parts of the plow

1) Left wing
2) Right wing
3) Turning frame
4) Fitting/flotation frame
5) Hydraulic cylinder
6) Blade frame spring (NL-models) / Blade frame RELAX-spring (NLR-models)
7) Support leg
8) Reflector module
9) Blade frame
10) Side wear blade
11) Wear blade

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6. ATTACHING THE PLOW

When attaching the plow for the first time, make sure it is compatible with the base machine by following the instructions below. Always check the compatibility when attaching the plow to a new base machine.

6.1. Attaching the plow to a base machine

The plow is attached to the base machine by welded or bolted STARK FIT quick hitches. The machine is connected to a hydraulic system. Hydraulic circuit diagrams can be found in a later section in this manual. Ask your retailer for available STARK FIT quick hitches.

Before using the plow, MAKE SURE all locking cotters and pins are secured and intact.

When coupling the plow to the base machine, please pay attention to the instructions on the use of the base machine.

1. Make sure that the attachment and the base machine are compatible in terms of mechanical solutions, hydraulics and electricity.

2. Apply parking brake. The plow is attached to the coupler on the base machine (e.g. a loader). Attach the plow to the base machine, and make sure the locking cotters and pins are secured.

3. Turn off the base machine and make sure the parking brake is applied.

4. Make sure there is no pressure in the base machine hydraulic system. When connecting, always make sure the hydraulic connectors are clean and the hoses are intact

5. Check carefully the attachment's, the base machine's and the fitting's trajectory for collision. Do a test run using the base machine and the loader in extreme position to check that the plow won't collide with base machine. Make sure that the hydraulic hoses and attachments have enough space. If needed change the location of hoses in the base machine.

6. During first hours of operating the attachment, bolts, nuts and connectors might loosen up. **Retighten them** after the first day of operating the attachment.

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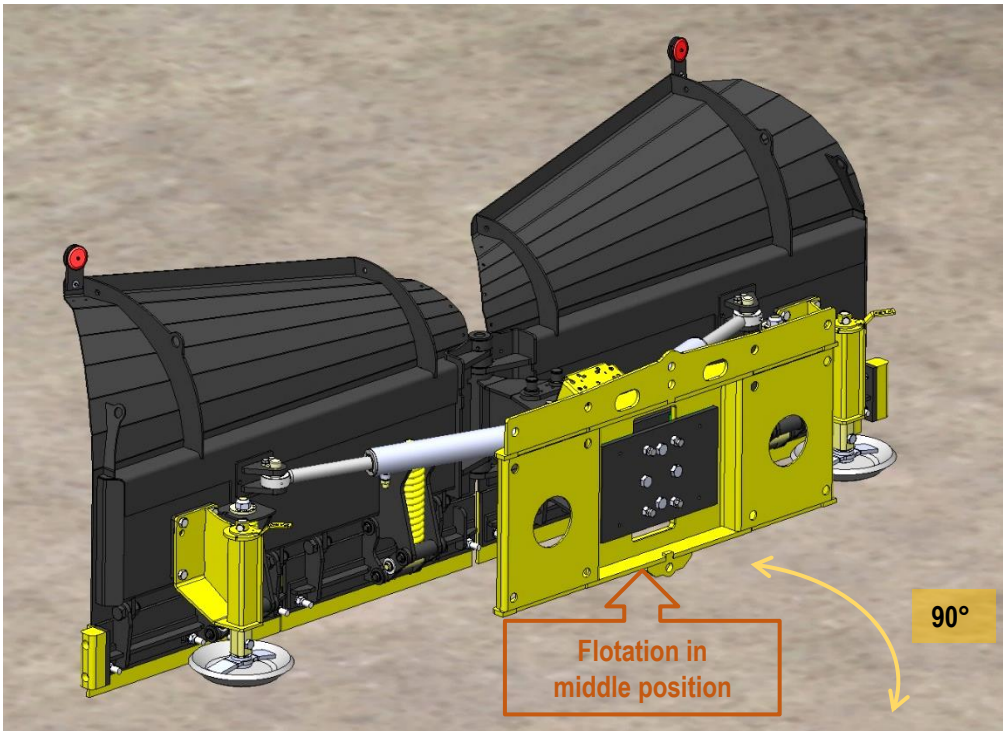
7. USING THE PLOW

Before using the plow make sure:

- the plow is installed correctly
- all locking pins are in place
- hydraulic hoses are connected properly
- hoses are intact
- there are no oil leaks
- all functions are working properly

7.1. Operating instructions

1) Make sure that the attachment and the base machine are compatible in terms of mechanical solutions, hydraulics and electricity
2) The plow is attached to the coupler on the base machine (e.g. a loader). Attach the plow to the base machine, and make sure the locking cotters and pins are secured.
3) Turn off the base machine and make sure the parking brake is applied.
4) Make sure there is no pressure in the base machine hydraulic system. When connecting, always make sure the hydraulic connectors are clean and the hoses are intact.
5) Check the attachment's, the base machine's and the fitting's trajectory for collision. Make sure that the hydraulic hoses and attachments have enough space.
6) Stay alert for any abnormal behavior and oil leaks also during driving. The optimal position for plowing: flotation in middle position and plow perpendicular to the ground (picture 3).
7) Comply with the applicable laws and regulations when operating the plow.
8) Keep in mind, that rocks and other dangerous objects can be catapulted from the plow when operating. Keep an appropriate operating speed.
9) In a fast or rough operating loaders support shaft must be used. Stay alert for any abnormal behavior and oil leaks also during driving.



Picture 3. Optimal position for plowing, flotation in middle position and plow perpendicular to the ground

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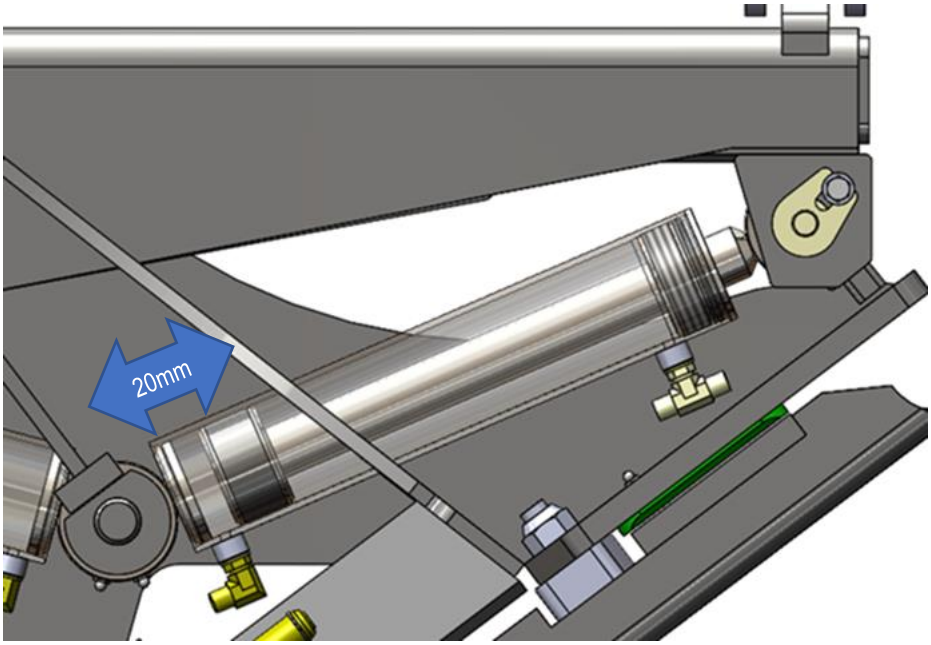
7.2. Permitted driving directions for the plow in different positions

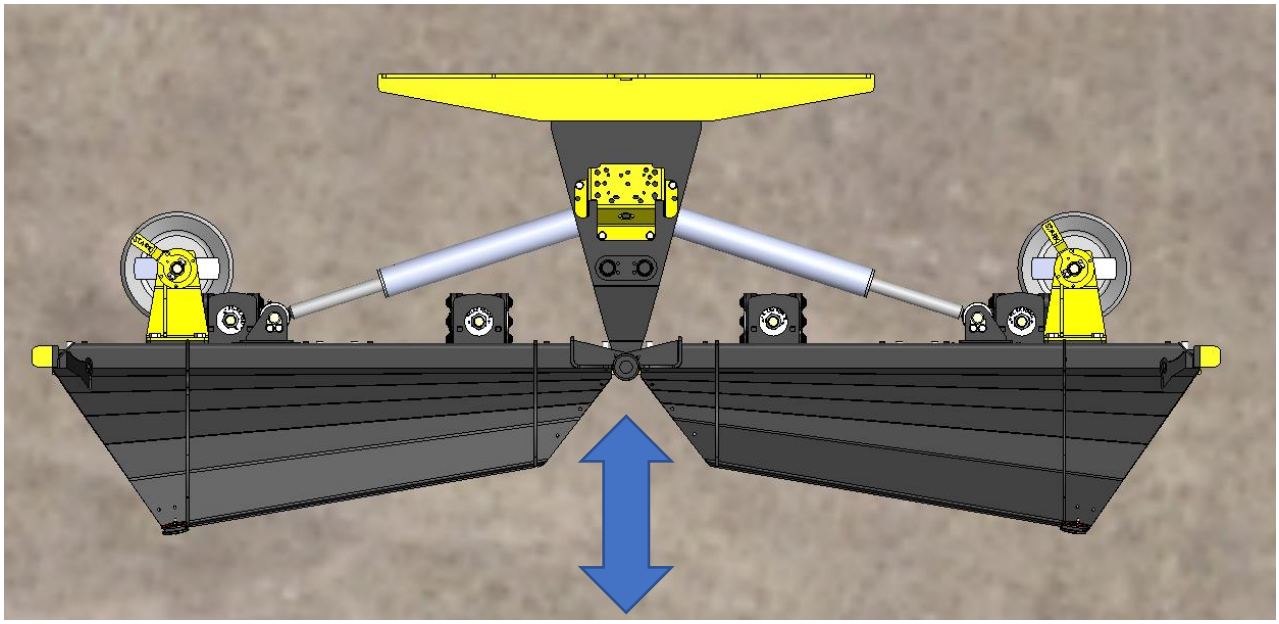
Pay attention to the functioning of the relief valve when turning the wings. If plow is driven with the wings in extreme position, the cylinder piston is at the end of the chamber and the relief valve cannot function. When operating the plow, leave approx. 20mm of space inside the cylinder, so the relief valve will work as intended (picture 4).



Picture 4. Cylinder piston is at the bottom in extreme positions

Plow with the wings open (picture 5) and close them a little when snow accumulates (picture 6Picture). Just before reaching the embankment turn the wings fully upfront (picture 7) to pack the snow and ”lift” the snow on top of the embankment with the front loader.

NOTE! The plow may be raised to the top position, before reversing tilt the plow towards the embankment (downwards) to keep the plow in control when lowering it within flotation.



Picture 5. Wings open

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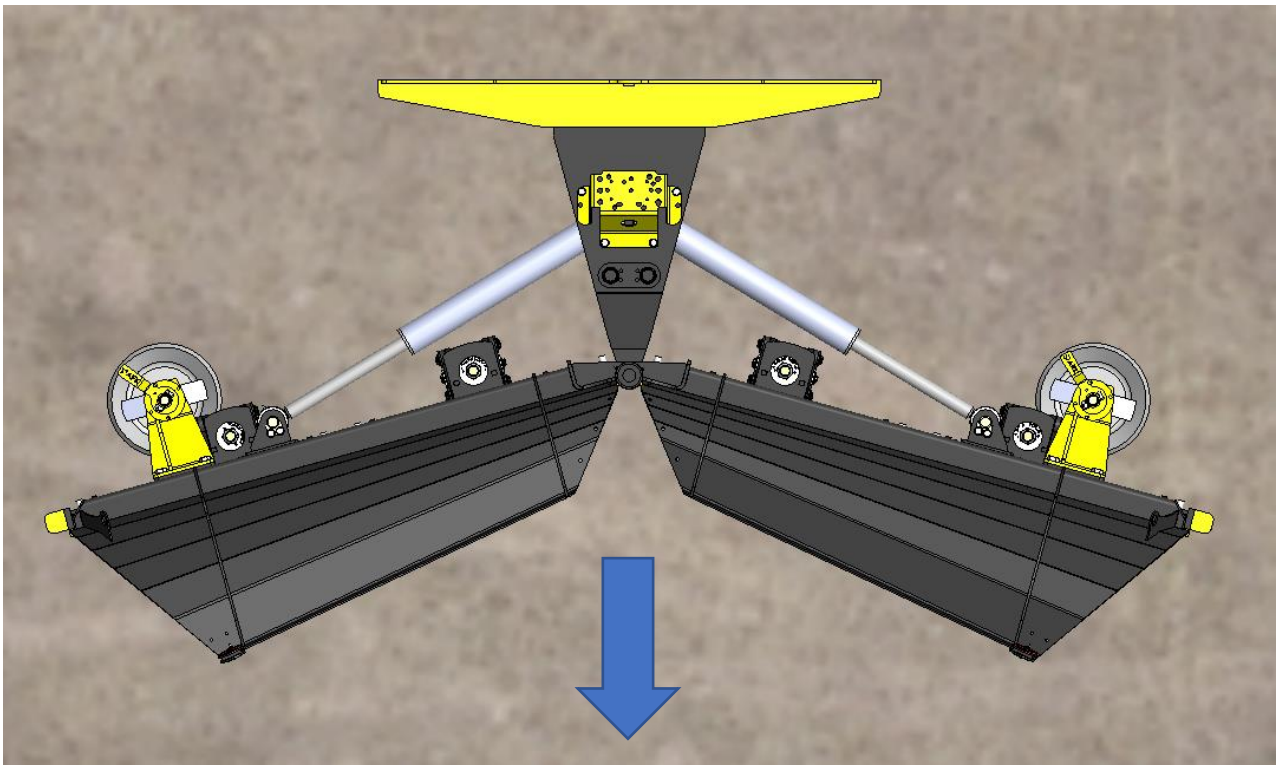
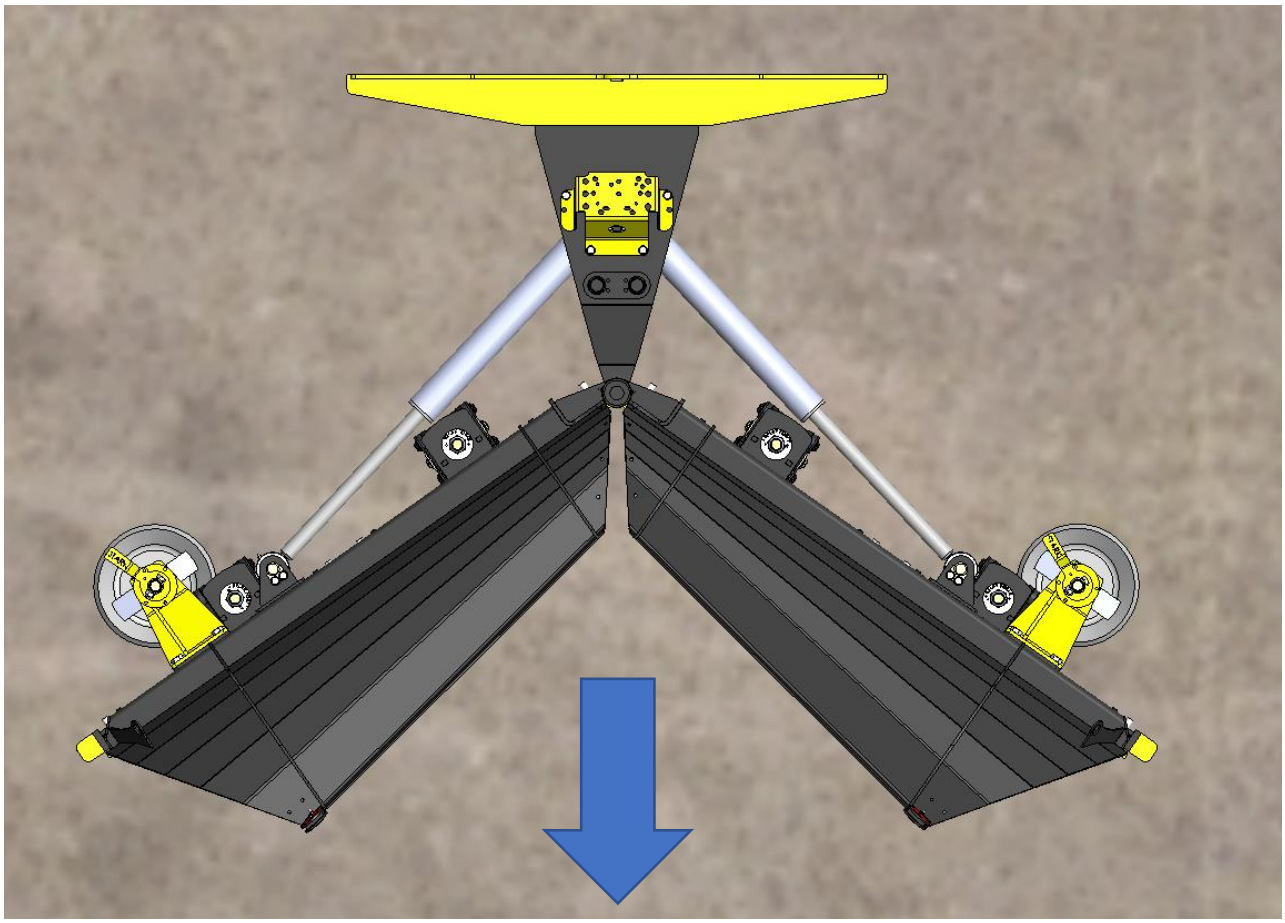


Picture 6. Gathering snow



Picture 7. Packing snow

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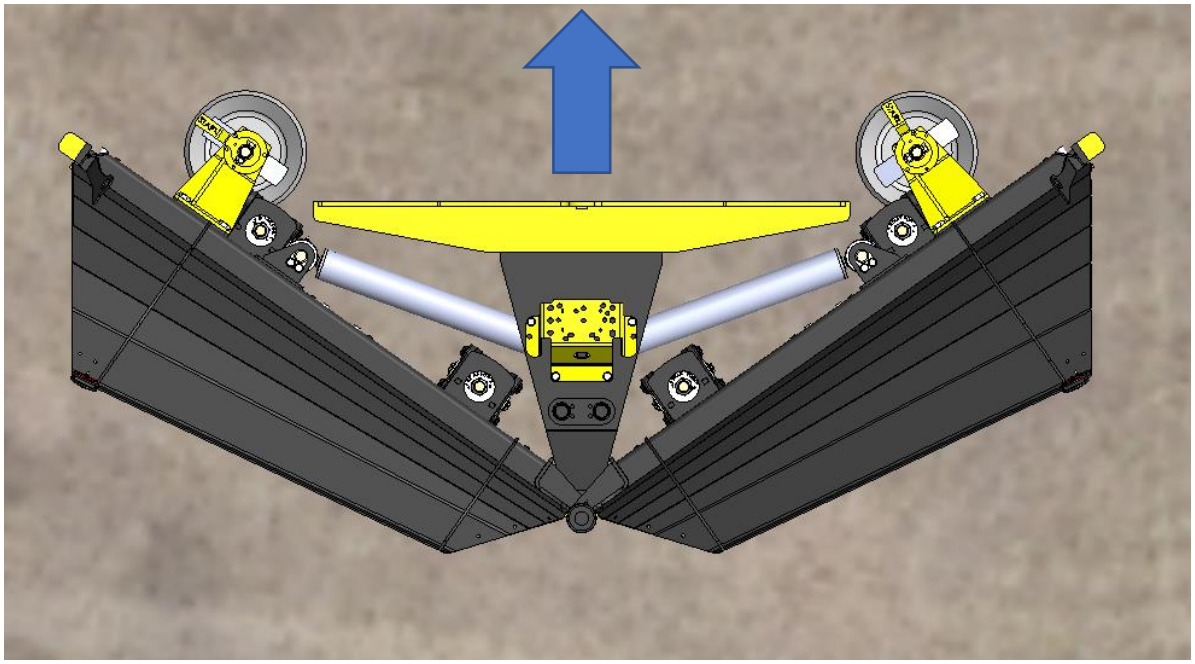
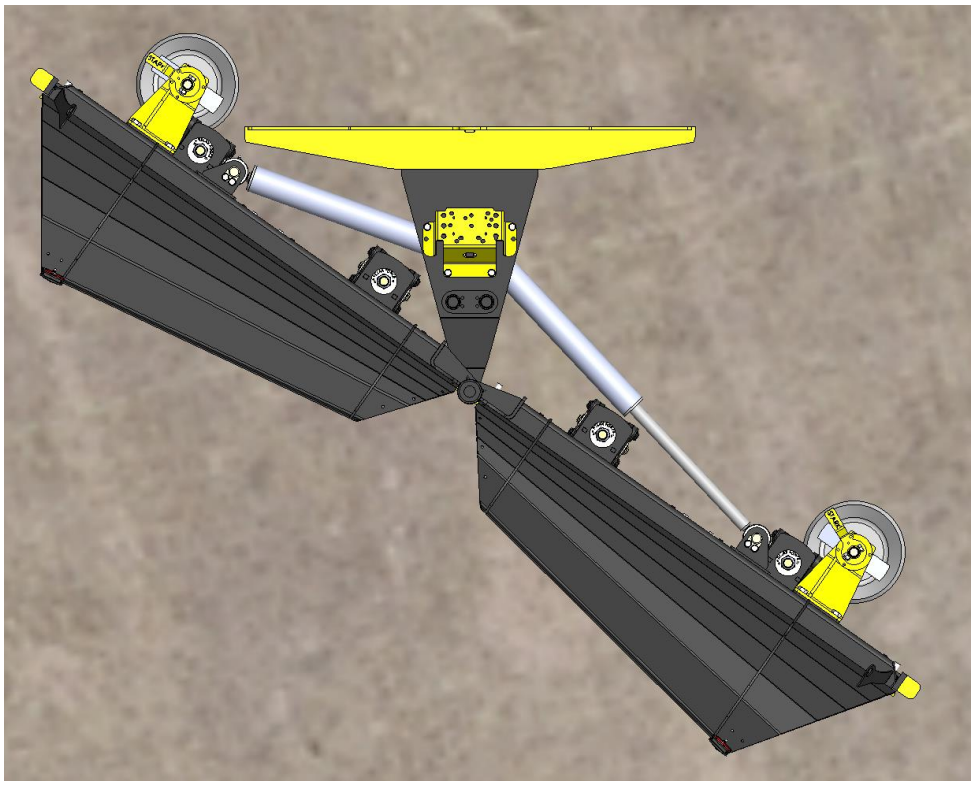


Picture 8. Gathering snow while reversing

NOTE! If the wings are turned back (picture 8) while gathering snow and driving backwards, the RELAX and ACS systems cannot function. **Drive carefully.**

When plowing to the side take into account the functionality of the safety valve (picture 9).



Picture 9. Plowing snow to the side

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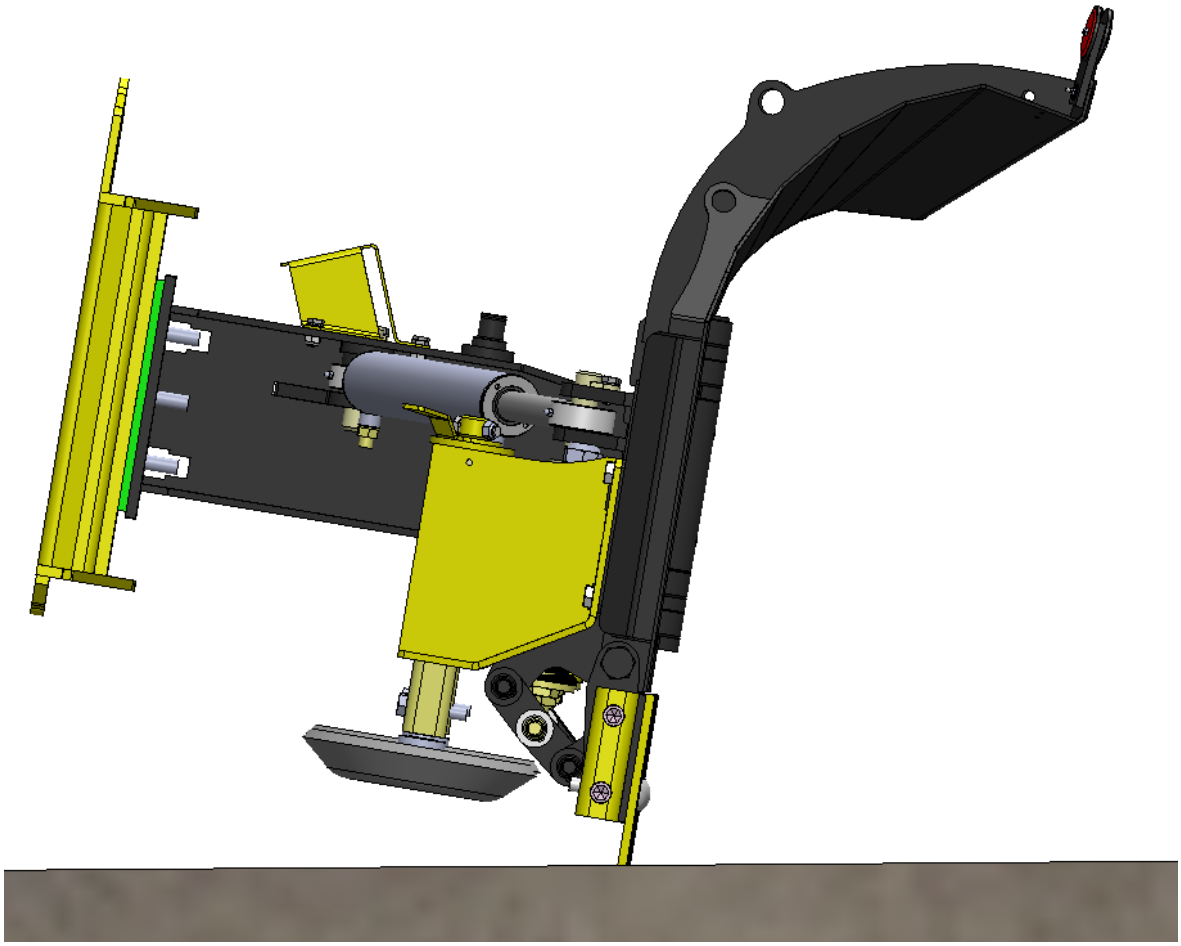
7.3. Removing packed snow

RELAX blade system can be used to remove packed snow. Turn wings straight and tilt the plow slightly forward (picture 10). Push flotation to the bottom, press slightly with the loader and drive slowly forward.



Picture 10. Removing packed snow

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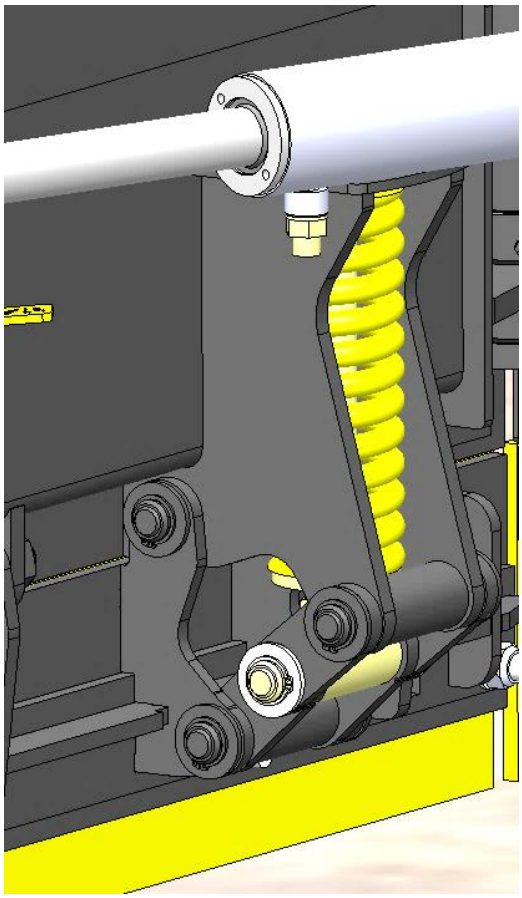
7.4. Adjusting RELAX -blade system (NLR-models)

RELAX -release mechanism keeps the blades locked. The plowing result is even and formation of packed snow is decreased. When the blade hits an obstacle the release mechanism opens allowing the blade frame to turn backwards and the blade to go over the obstacle. The system protects the driver, the plow and the base machine from damaging.

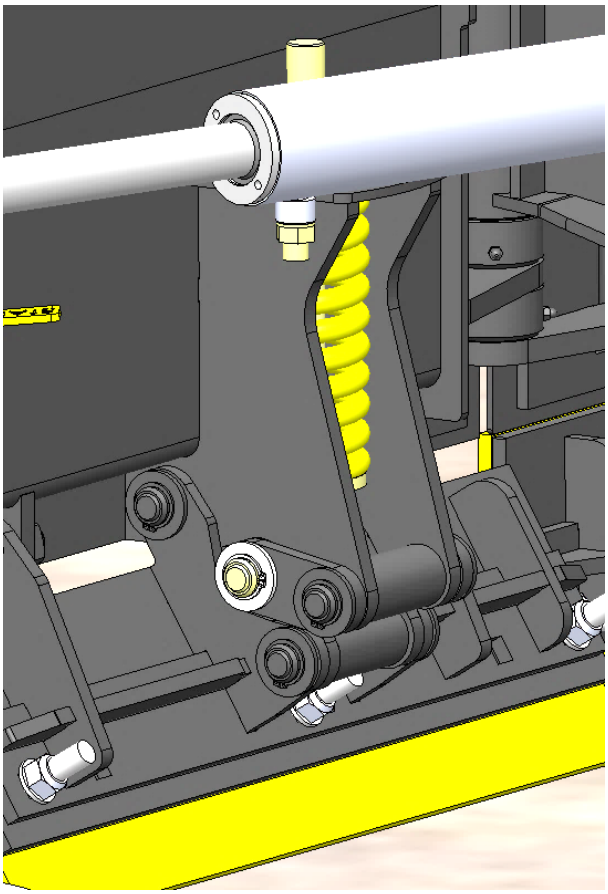
Plows with RELAX -blade system can be pressed down to remove packed snow.

Operation of the RELAX -blade system

- Blade frame is mechanically locked in position by three joints (picture 11)
- When the blade hits an obstacle, the increased pressure releases the lock and the blade frame swivels in a quick and wide motion over the obstacle (picture 12)
- When the obstacle is passed, and pressure returns to normal the spring pushes the blade frame back into the locked position (picture 11)



Picture 11. RELAX -mechanism



Picture 12. RELAX -mechanism released

The amount of pressure which releases the lock can be adjusted by changing the angle of the joints (picture 13Picture). Larger the angle, the more easily the lock releases. When the adjustment nut is tightened less pressure is required and when the nut is loosened more pressure is required. The angle between joints should be at least 5° (picture 14) to enable the release mechanism to function as designed. Never adjust the angle totally straight!

Rigidity of the spring can be adjusted by the tension nut under the spring (picture 15). Shortest permitted length for the spring is 175 mm when blade is released, then the spring is pre-strained by 25 mm. At the factory the spring is pre-strained by 15 mm.

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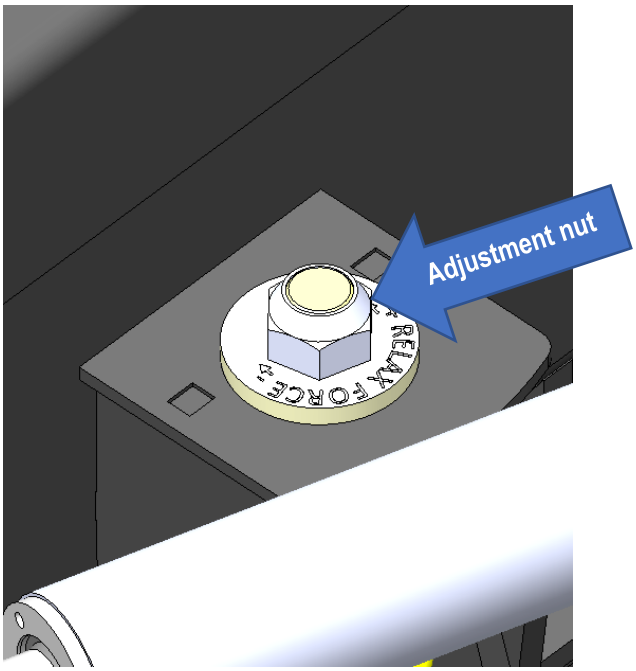
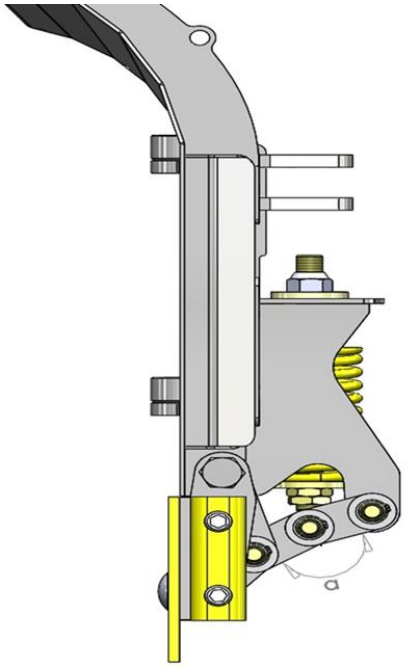
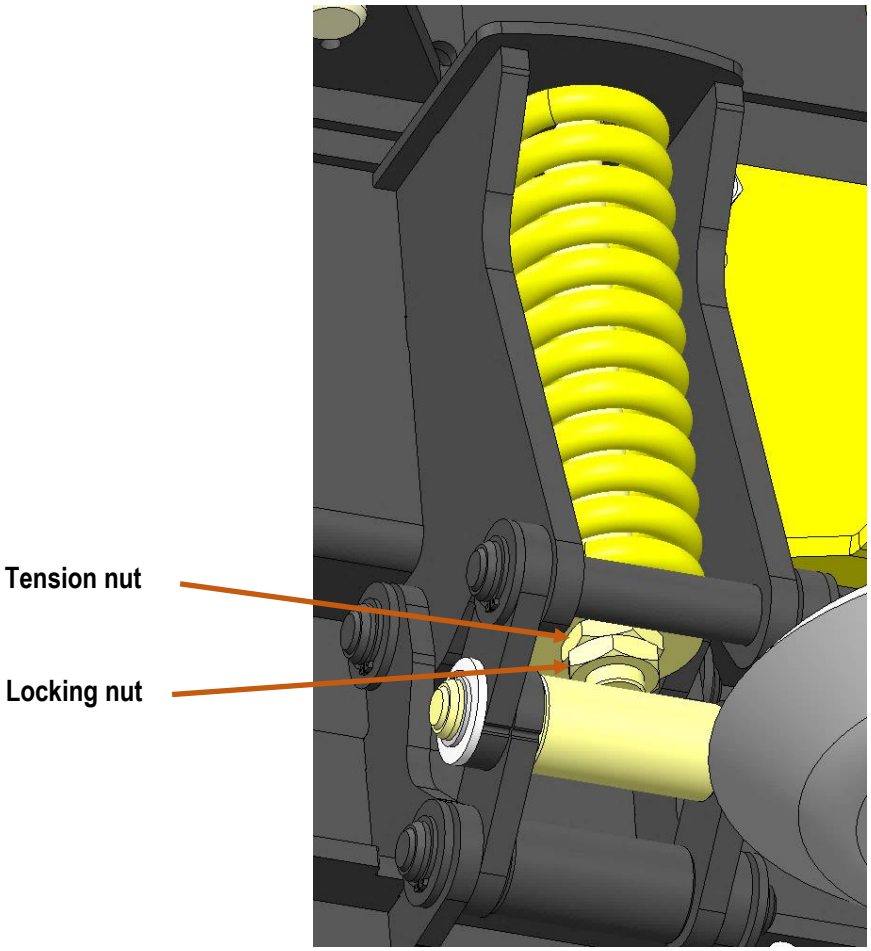


Picture 13. RELAX -mechanism minimum angle



Picture 14. Minimum α-angle of the joints must be at least 5°



Picture 15. Adjustment of the RELAX -spring

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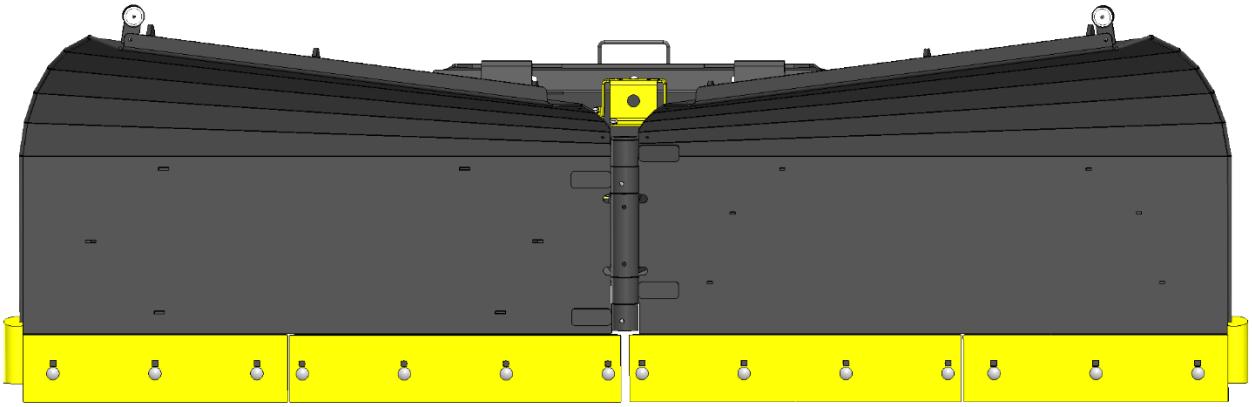
7.5. Adjusting ACS (Anti Collision System) -springs (NL-models)

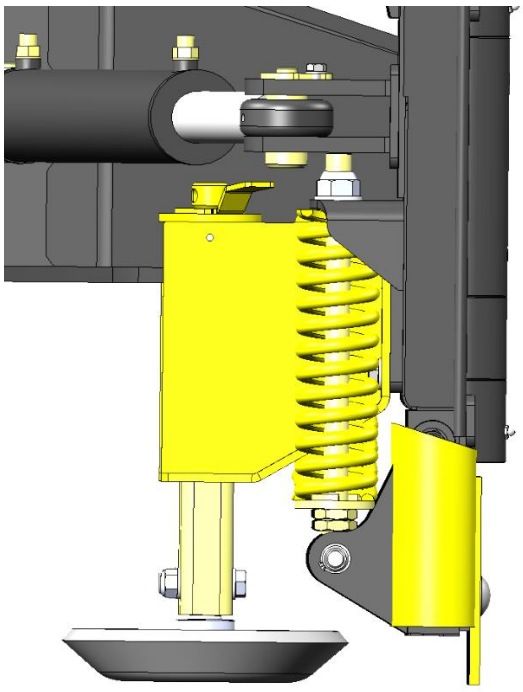
ACS -blade system of the plow protects the driver, attachment and the base machine from damaging when hitting an obstacle. Wear blades are bolted to blade frames (picture 16). When hitting an obstacle, the blade frame swivels. ACS -blade system increases safety but also reduces bouncing of the plow when hitting an obstacle because single blade frame swivels to pass the obstacle.



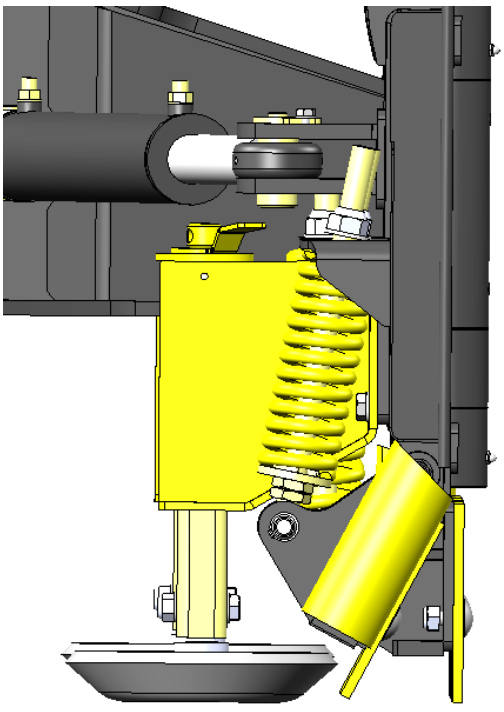
Picture 16. Wear blades are bolted to blade frames

Operation of the ACS -blade system

- In normal working position (picture 17) the blade easily digs into an uneven surface
- When hitting an obstacle, the ACS enables the blade frame to swivel backwards (picture 18) and jump over the obstacle.



Picture 17. Blade in normal position



Picture 18. Blade frame swivelling

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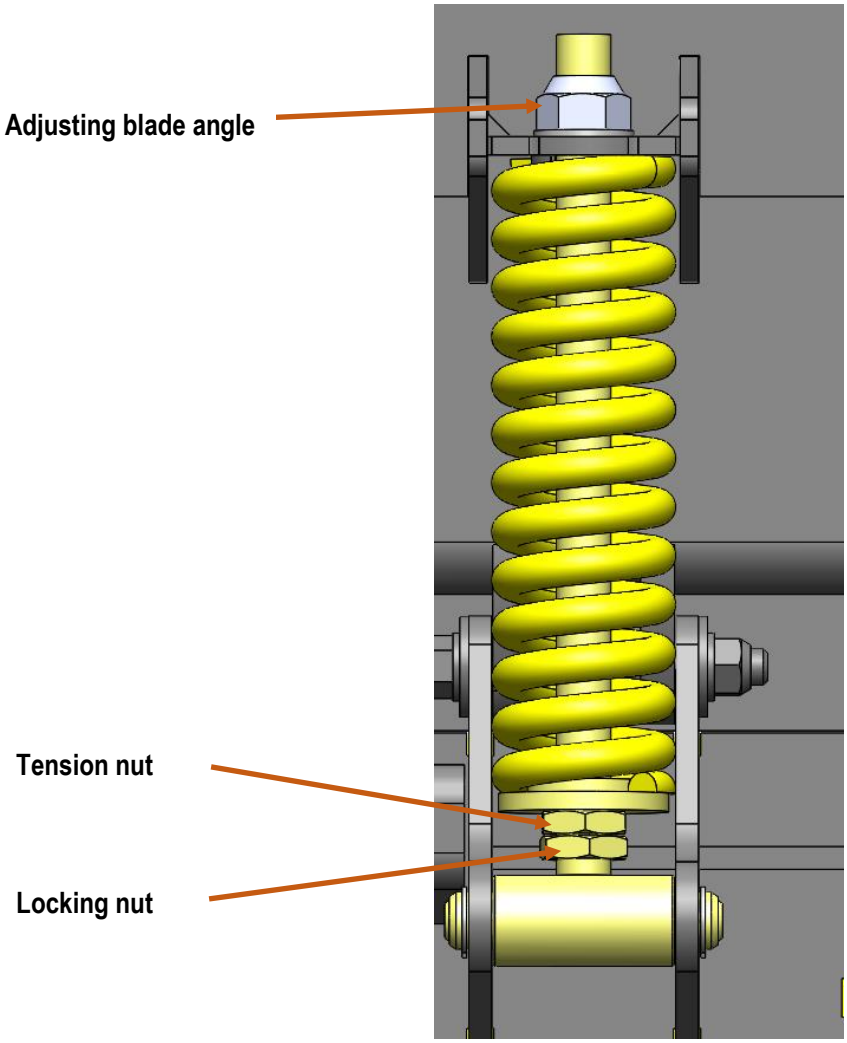
Rigidity of the blade frame can be adjusted by changing the rigidity of the spring. At the factory the spring is pre-strained by 15 mm which should not be changed without valid reason. It is possible to change the rigidity of the blade frame by adding max. 10 mm tension to the spring, the length of the spring will be then min. 275 mm while the blade is in direct line with the wing. If strained beyond this limit the yield point of the spring will be exceeded when the blade frame swivels, and the spring will be damaged and is required to replace.

Rigidity of the spring can be adjusted by the pre-straining nuts under the spring (picture 19). By turning the upper nut anti-clockwise the strain increases and by turning the lower nut it is locked in place. In double spring designs both springs must be adjusted to same pre-strain. Control the length of the spring during adjusting to avoid exceeding the minimum length.

The nut on top of the spring does not need to be adjusted. This nut affects the angle of the blade frame with the wing which has been set in line at the factory. By tightening the nut, the blade frame can be tilted backwards. If adjusting the angle of the blade frame the length of the spring needs to be controlled not to exceed the limit. Length of the spring needs to be 275 mm in minimum after all adjustments.



Picture 19. Adjusting the spring

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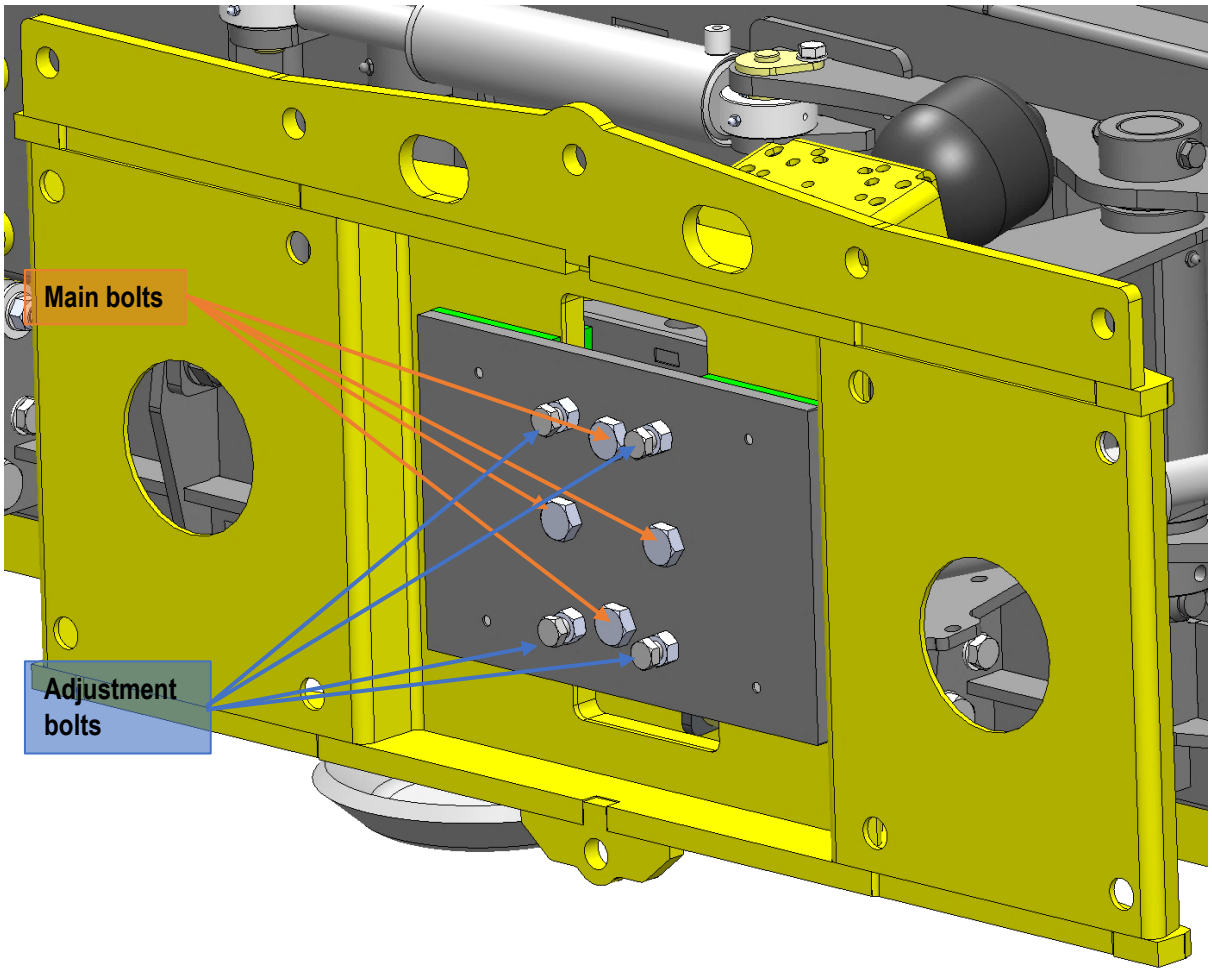
7.6. Adjusting flotation

U-plows have FLOATING FRAME -flotation system. FLOATING FRAME -technology enables the plow to closely follow the ground with vertical and horizontal flotation independent from the base machine. FLOATING FRAME -system is located by the fittings and this location together with the sliding plates reduce bouncing of the plow while working. The sliding plates need no lubrication.

Adjusting the flotation

1. first tighten the main bolts so that the sliding plates are pressed against the floating frame (main bolts 6 pcs in picture 20)
2. then tighten also the adjustment bolts all the way to the bottom (adjustment bolts 4 pcs in picture 20)
3. loosen the main bolts only and then tighten the adjustment bolts one round (360°) each
4. then lock this spacing of the sliding plates by tightening the nuts of the adjustment bolts
5. finally tighten the main bolts to torque 404 Nm
6. check the function of the floating frame, the frame should move by hand. Readjust if needed.

➔ Do this adjustment anytime the flotation begins to feel too loose while working.



Picture 20. Adjusting flotation

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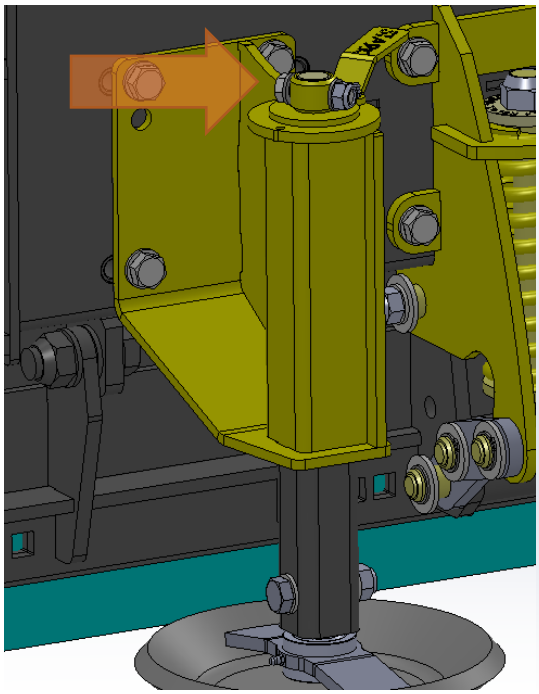
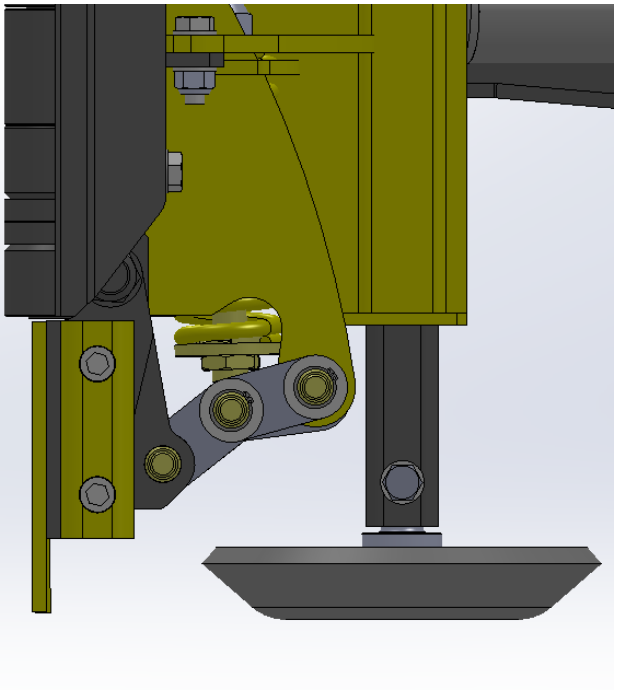
7.7. Adjusting support legs

Support legs are adjusted by the handle on top (picture 21). By turning the handle clockwise, the support leg will rise and anti-clockwise it will lower. Normal position can be seen in picture 22 where the support leg is in level with the blade. In the beginning of the plowing season adjust the support legs a little lower than blade to keep the blade from sinking into soft ground. Adjust the support legs a little higher than the blade to reduce formation of packed snow.



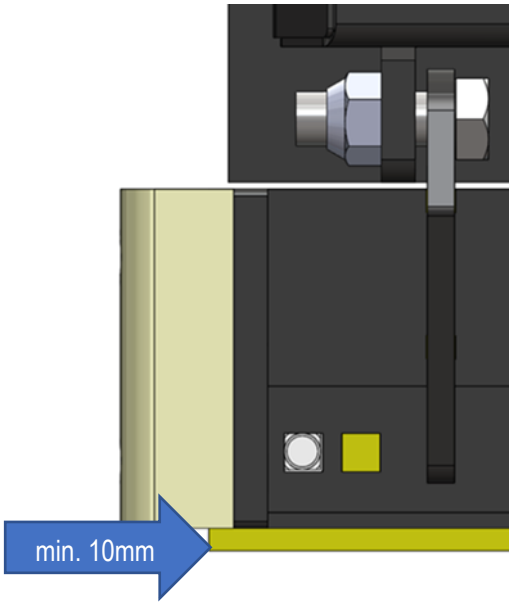
Picture 21. Adjustment handle of the support leg



Picture 22. Correct height of the support leg

7.8. Adjusting blades

Edge of the blade should be 15–45 mm lower than the blade frame. Blades need to be adjusted at the latest when the blade edge is less than 10 mm lower (picture 23) than the blade frame. Do not adjust the blades more than 50 mm lower than the blade frame.



Picture 23. Minimum distance of the blade edge from the blade frame

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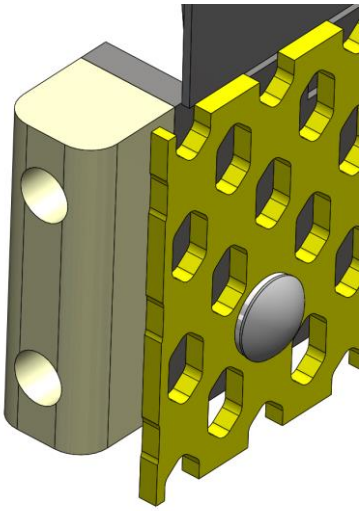
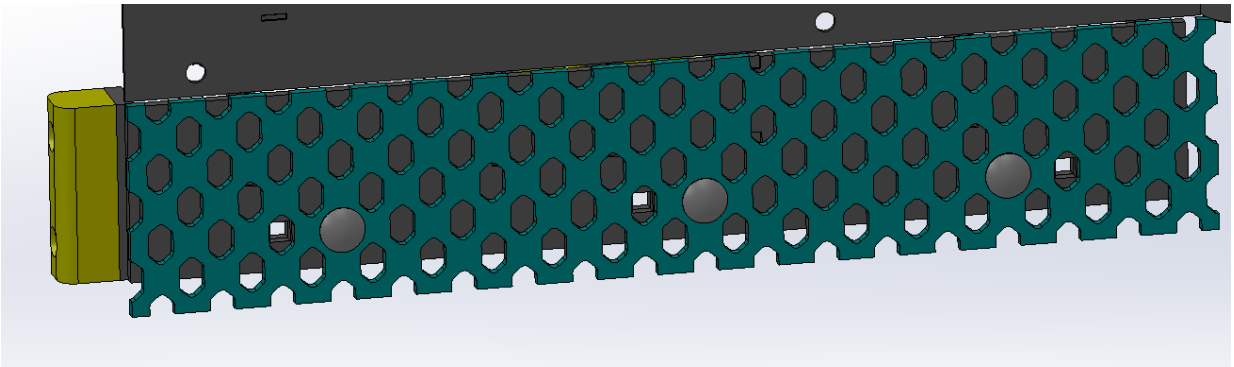
7.9. Adjusting perforated blades

When adjusting perforated blades, the bolts can be removed by holding the bolt head with locking pliers and loosening the locking nut behind the blade. Also, when tightening, the bolt head will need to be held to enable the nut to be tightened. M20 washer is added under the bolt for getting a better grip on it (picture 24).

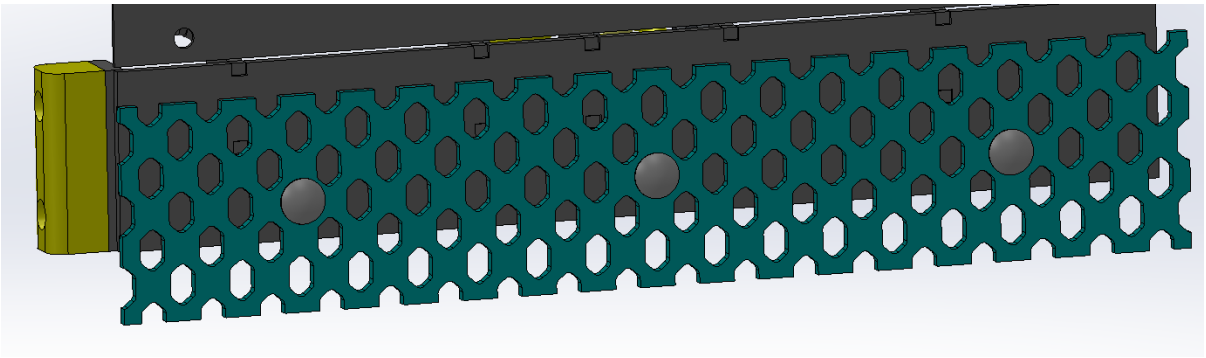
The bolts are removed, and the blade lowered until a hole on the blade frame can be seen again. The bolts are attached now to the holes next to the ones they were attached to before (picture 25). This enables the blade to be lowered appropriately (picture 26).



Picture 24. M20 washer is added under the bolt



Picture 25. The first position of perforated blade



Picture 26. Perforated blade after it has been lowered

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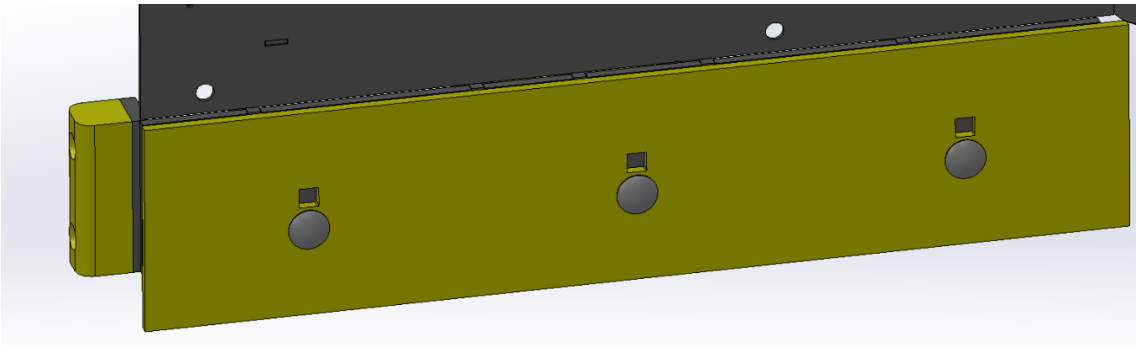
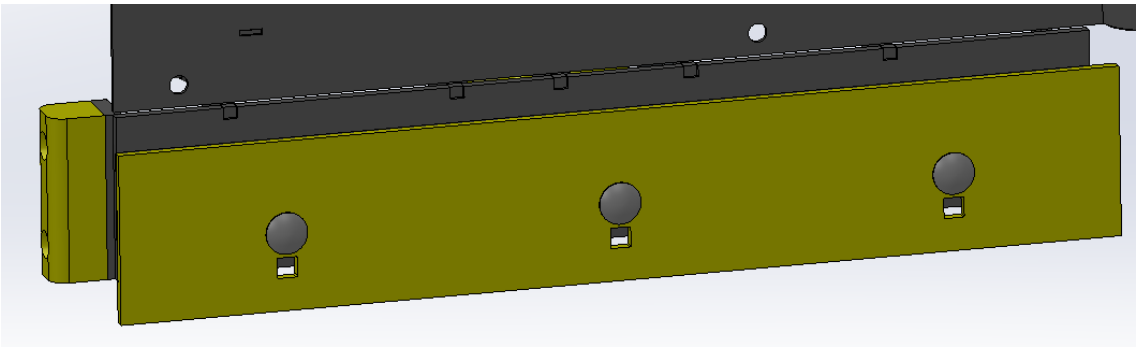
7.10. Adjusting flat blades

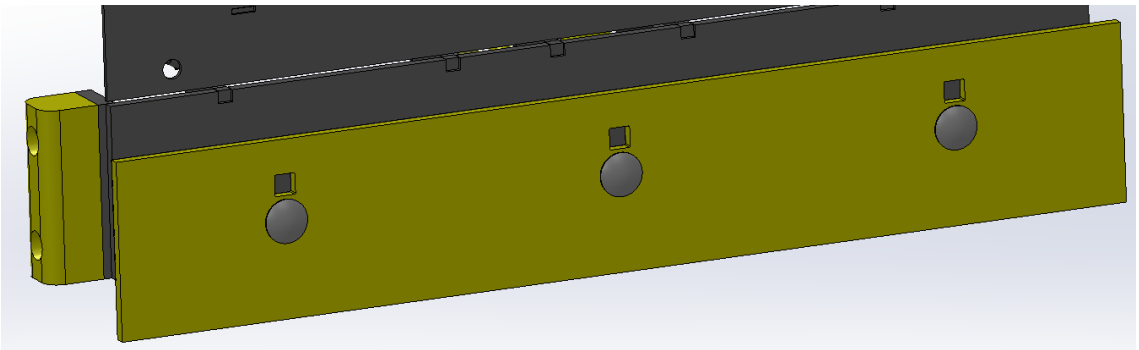
Flat blades can be adjusted three times. Each time there will be about 45 mm wear edge on the blade. First when the blade is new, it is in the position of picture 27. When the blade edge wears out it is lowered and attached from the upper holes of the blade (picture 28). Next time the blade is turned and again attached from the lower holes (picture 29). When the blade edge wears out again it is lowered by attaching it from the upper holes (picture 30). When the blade edge wears out in this position, it needs to be replaced.



Picture 27. New blade



Picture 28. Lowered blade



Picture 29. Turned blade

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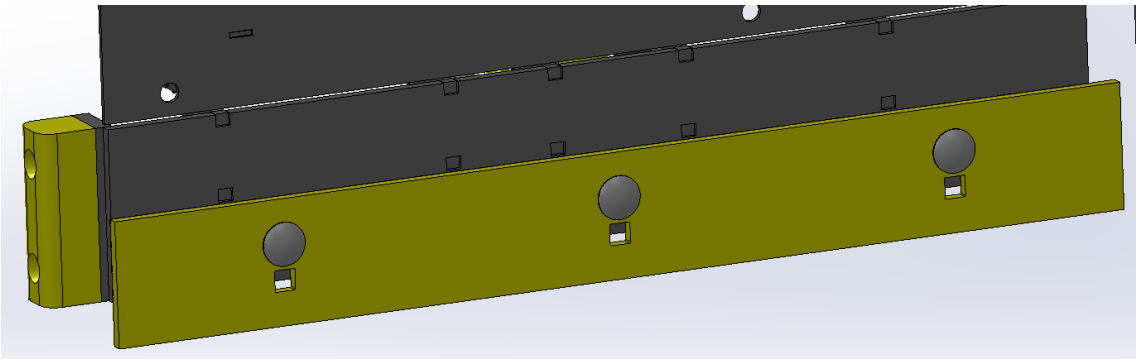

Picture 30. Turned and lowered blade

7.11. Detaching the plow

1. Lower the plow to an even ground.
2. Turn off the base machine, put on the parking brake and release pressure from the system
3. Detach the hydraulic hoses and protect the couplings with plugs
4. Open the mechanical lock and loosen the plow
5. If the plow is left unused for a long period of time, it needs to be clean and lubricated properly before storage.

7.12. Transferring the plow

Lift the plow high enough and reduce speed if needed, especially on bumpy, uneven roads. The plow or the base machine can be damaged due to excessive speed.

7.13. Plow accessories

The following accessories are available for the plow:

- LED -lights
- Control unit
- Support wheel
- Road equipment
- Snow rubber
- Flat- and perforated blade set

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8. USING AND MAINTAINING

8.1. General cautions concerning use and maintenance of the plow

- Comply with the applicable laws and regulations and the instructions in this manual.
- Never go under the plow if it is not supported.
- Always put on the base machine's parking brake before any servicing on the plow.
- Use only tools which are in good condition.
- Watch out for pressurised hydraulic hoses and components.
- Make sure there is no pressure in the hydraulic system. Take into account the pressure accumulator.
- Do not let hydraulic fluids or lubricants to the ground.
- Wear appropriate personal protective equipment.

8.2. Tightening torque

	Nm (Strength 8.8)
M4	3,3
M5	6,5
M6	11,3
M8	27,3
M10	54
M12	93
M14	148
M16	230
M18	329
M20	464
M22	634
M24	798
M27	1176
M30	1597
M33	2161
M36	2778
M39	3597

Figure 1. Tightening torque

8.3. Daily maintenance

It is important to perform a daily visual inspection of the plow for early detection of possible faults and to prevent further damage. Inspect the following items on the plow daily:

- Possible leaks of the hydraulic hoses and components
- General mechanical condition
- Installation of the blades and adjustment when necessary
- Adjustment of the support legs

8.4. Maintenance after 10 hours

- Lubrication, recommended quality NLGI-2 grade grease or equivalent, shown in the later section
- Check the bolts for the tightness (table 1)

8.5. Maintenance every 50 hours or weekly

- Lubrication, recommended quality NLGI-2 grade grease or equivalent, shown in the later section
- Check the mechanical condition of the plow for distortion or breach
- Check the bolts for the tightness (table 1)

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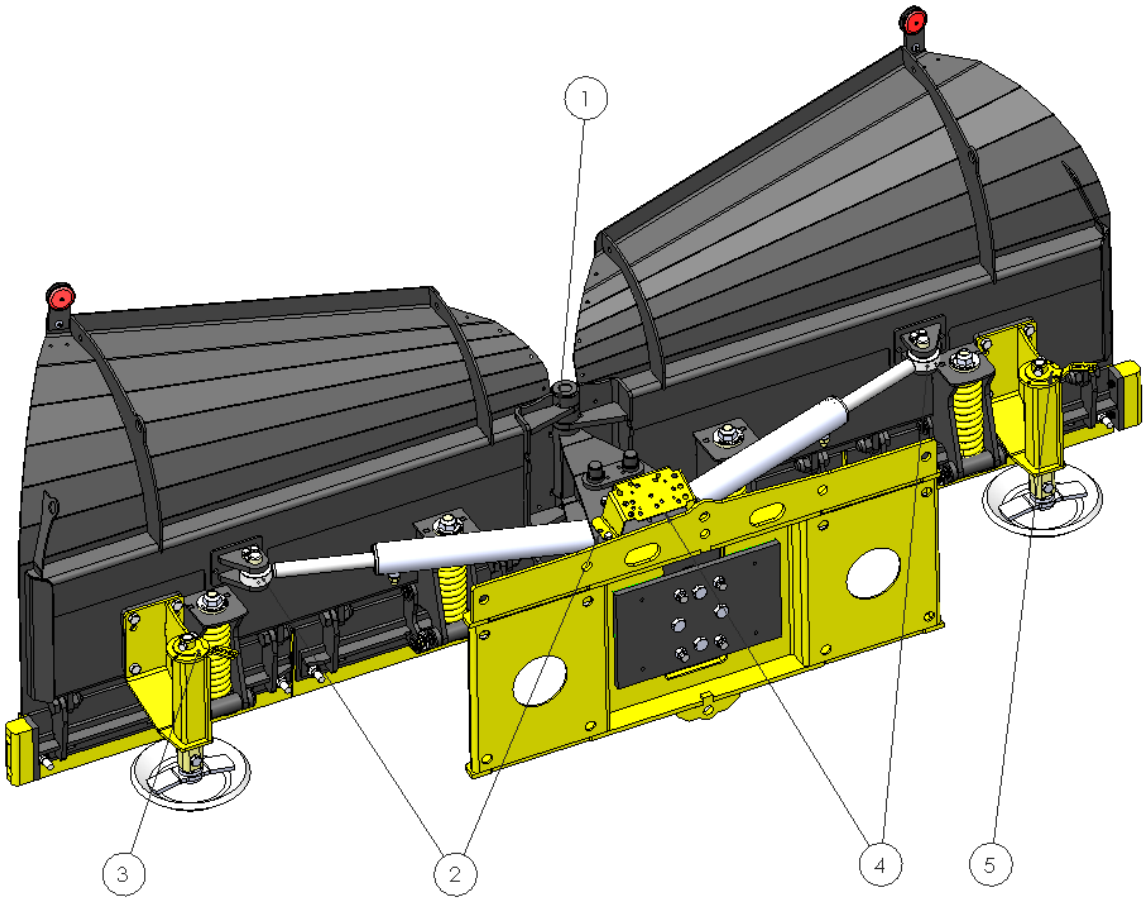
8.6. Lubrication points



Picture 31. Locations of the grease nipples

1) Turning pin, 4 pcs
2) Left turning cylinder, on both end 1 pc (total 2 pcs)
3) Support leg, 1 pc on the handle and 1 pc at the side (total 2 pcs)
4) Right turning cylinder, on both end 1 pc (total 2 pcs)
5) Support leg, 1 pc on the handle and 1 pc at the side (total 2 pcs)

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9. HYDRAULICS

The attachment has complicated closed hydraulic system which has been tested and adjusted at the factory. It is recommended to do repairs by changing one component at the time and by a professional. Any changes to the hydraulic system are on the responsibility of the customer.

The minimum requirement of U-plow for hydraulics is one double-acting hydraulic block and a return line which can be replaced by accumulator 2- or 3-hose hydraulic system). Alternatively, the plow can be connected by 4- or 5-hose hydraulic system. Hydraulic diagrams of these are below.

9.1. 2- and 3-hose hydraulics

Below diagram of the 3-hose hydraulic system. The 2-hose hydraulic system is otherwise the same but the return line (T) is replaced by accumulator (A).

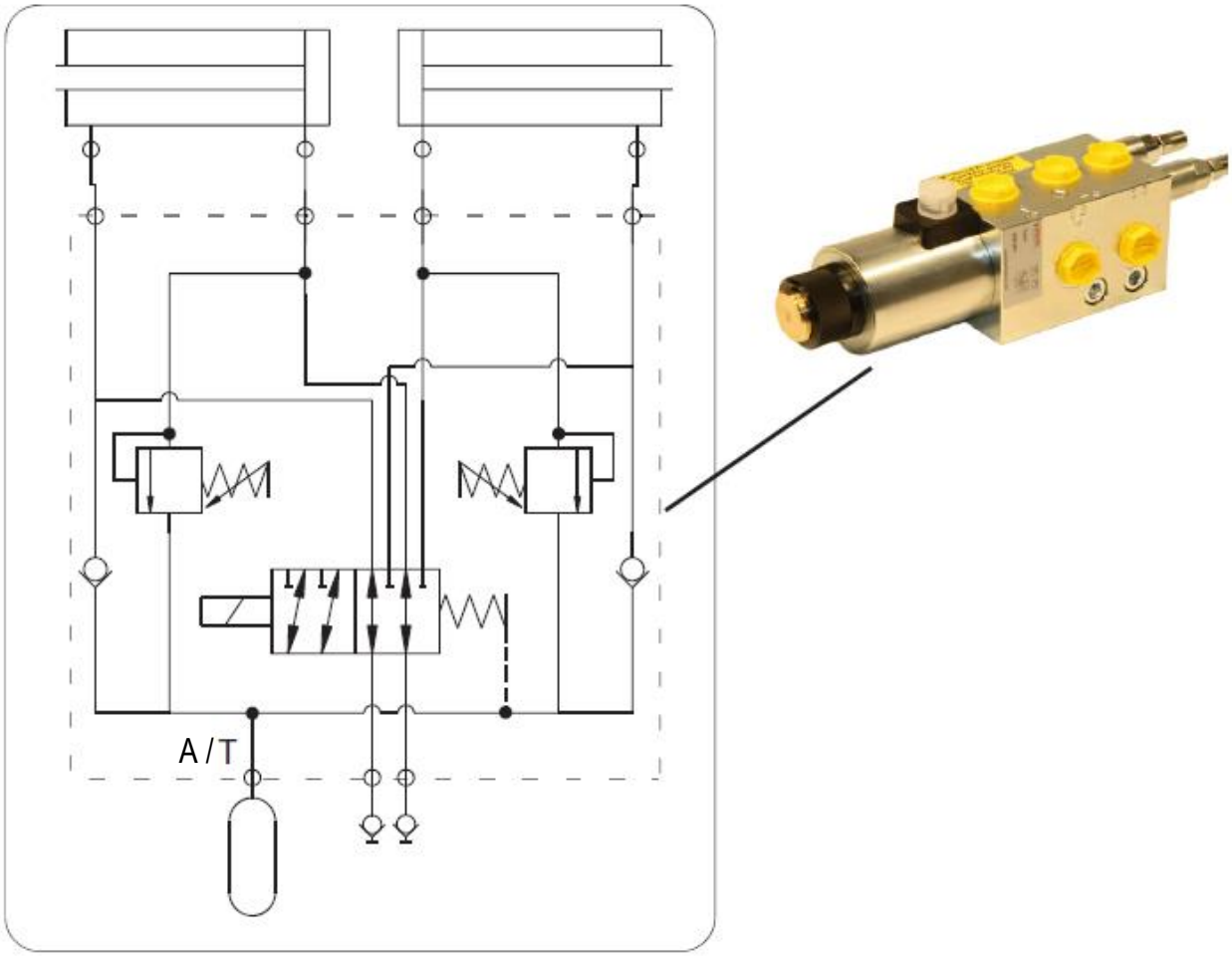

Figure 2. 2- and 3-hose hydraulics

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9.2. 4- and 5-hose hydraulics

Below diagram of the 5-hose hydraulic system. The 4-hose hydraulic system is otherwise the same but the return line (T) is replaced by accumulator (A).

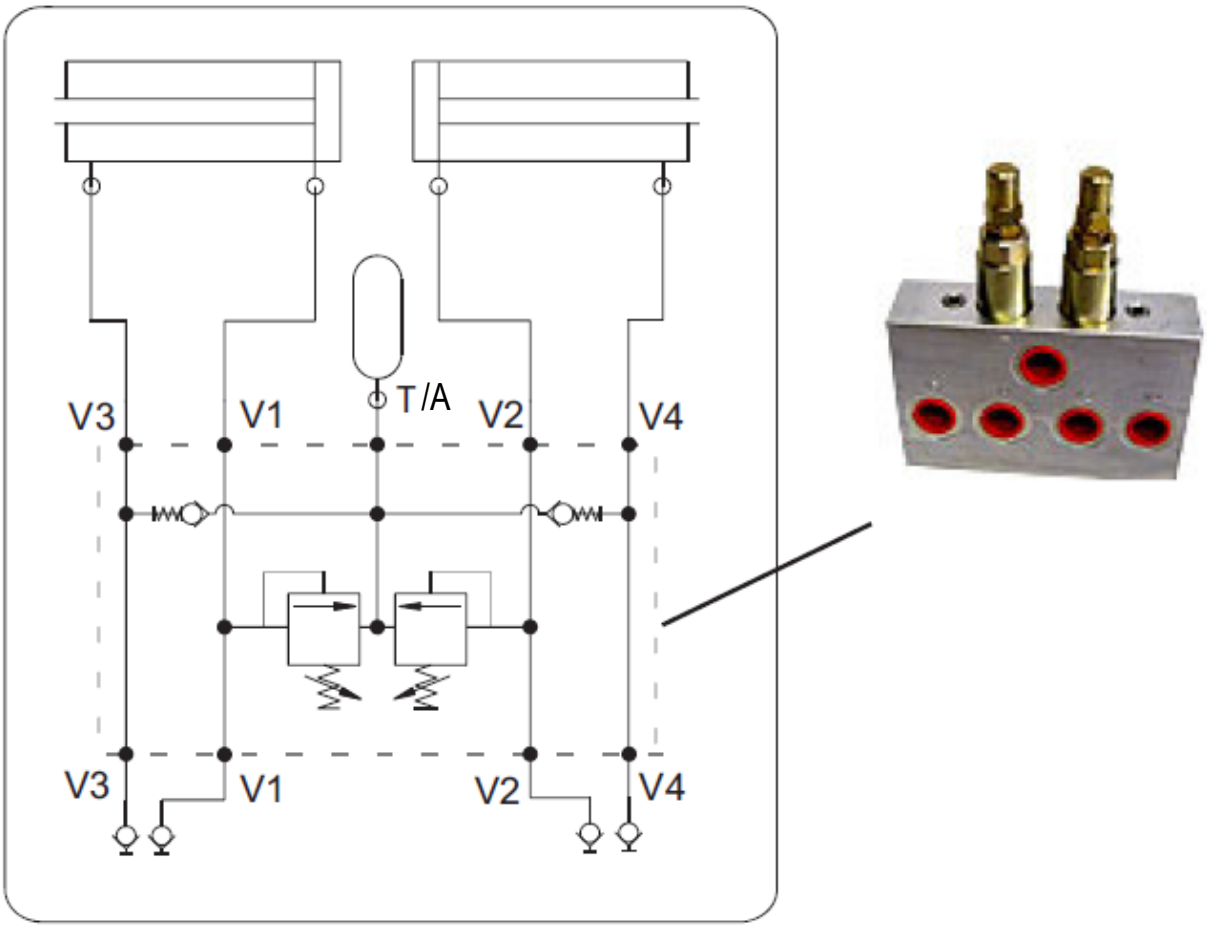

Figure 3. 4- and 5-hose hydraulics

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9.3. Diagonal valve (3/2 hoses)

Below diagram of the 3-hose hydraulic system. The 2-hose hydraulic system is otherwise the same but the return line (T) is replaced by accumulator (A).

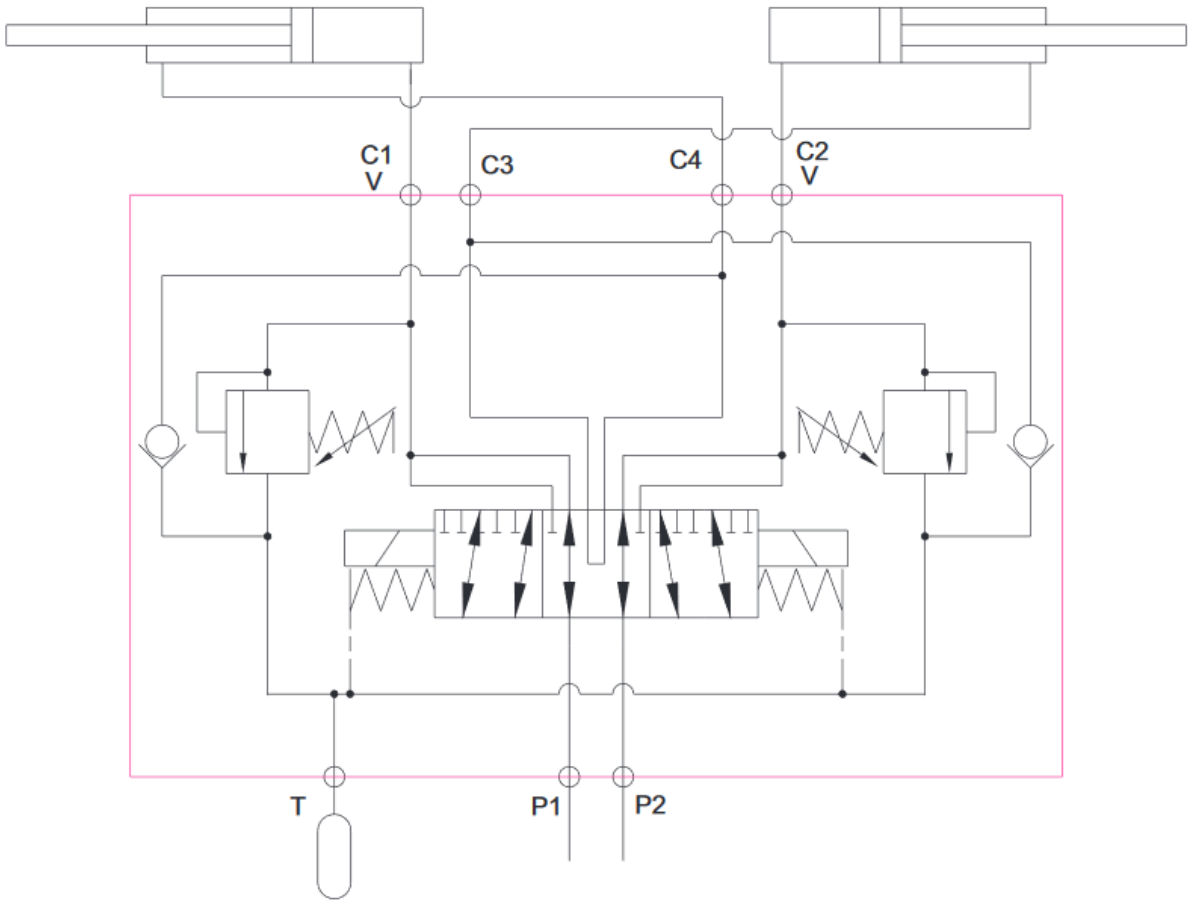

Figure 3. Diagonal valve circuit diagram.

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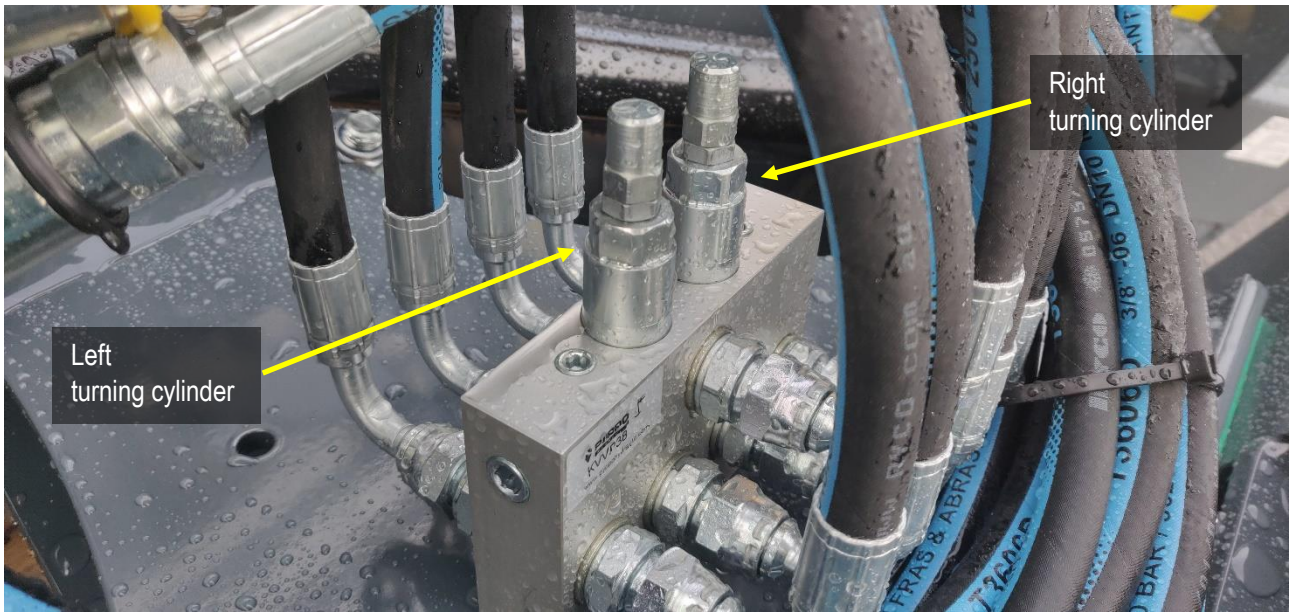
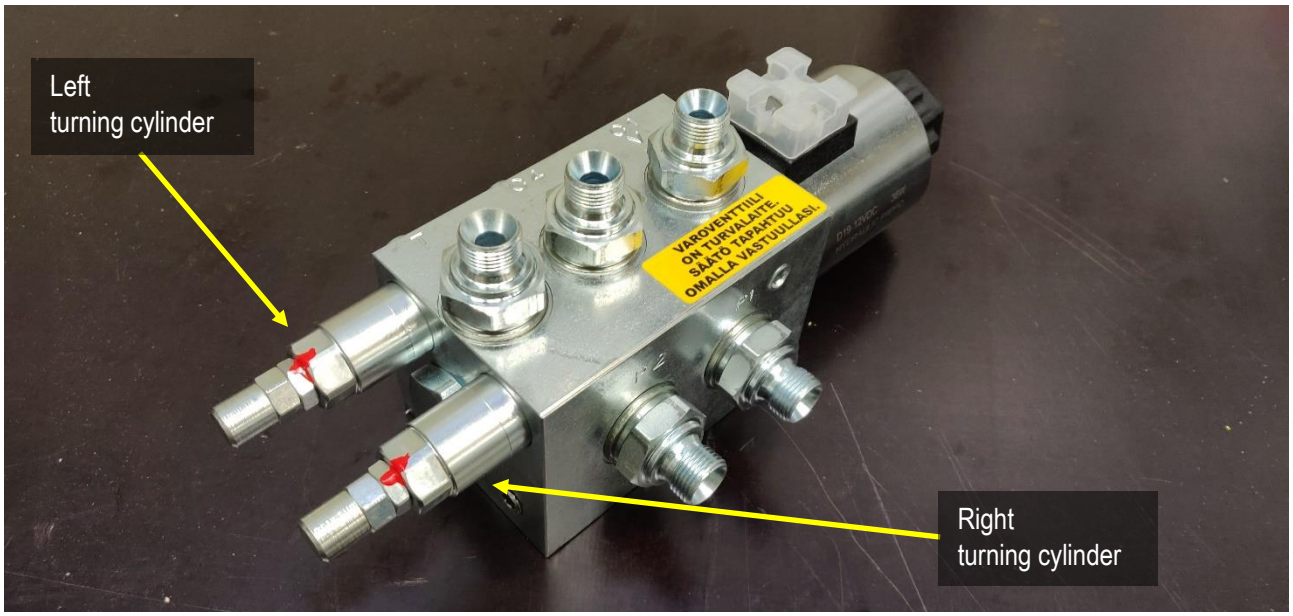
9.4. Relief valve

⚠	Relief valve is a safety device which is pre-set at the factory. Changes to this setting at customer's own risk!

Valve models vary by the type of the hydraulic system. The relief valves of the turning cylinders can be adjusted by removing the cap, loosening the locking nut with 13 mm spanner and adjusting the valve with 5 mm hex key. NOTE! Adjust only little, with ¼ round at a time and test function. (Pictures 32, 33 and 34)



Picture 32. 5-hose hydraulics relief valves



Picture 33. Relief valves of 6/2 -electric valve and double relief valve

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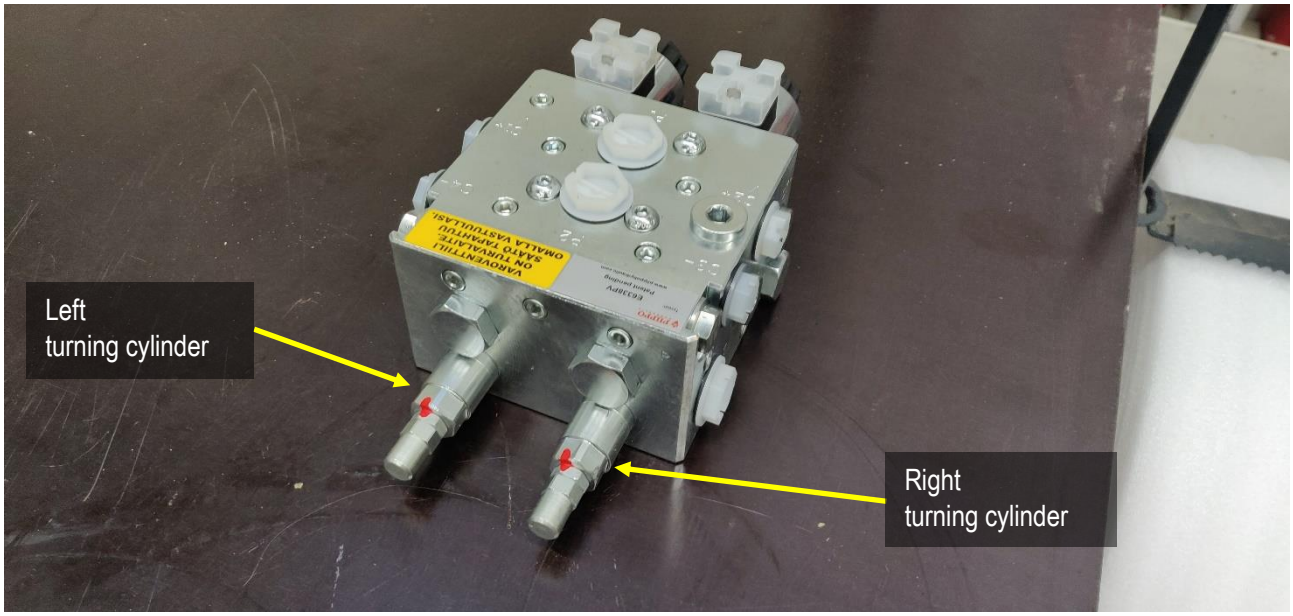

Picture 34. Relief valves of 8/4 -electric valve

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10. WARRANTY TERMS AND CONDITIONS

1. Warranty coverage

The manufacturer of STARK products Lametal Oy provides warranty to new products which covers material and manufacturing failures. The limitations of the warranty are in section 7.

2. Warranty begins

Warranty begins on the date of the product delivery has been approved or on the date when installation has been completed and product taken in use. The product is considered to be taken in use when the product is delivered to the end customer according to the agreement and registered as received by the end customer. The end customer shall inspect the product upon the delivery according to the instructions in the manual. Any claim for any defect in the quality or condition of the product shall be notified in writing to the manufacturer or retailer within eight (8) days of delivery or, where the defect was not apparent, of discovery of the defect, but, in any event within one (1) year of delivery.

3. Warranty duration

STARK warranty is valid for one (1) year. If necessary, the customer and manufacturer agree separately on the warranty for repair work and for the used spare parts in the repair.

4. Warranty repair work

Warranty repair work is carried out free of charge during normal business hours at the manufacturer's facility or in a workshop which is authorised by the manufacturer. If repairs are made in another facility than is approved by the manufacturer, the costs not included in the warranty, e.g. travel and waiting time, daily allowances, travel costs or uninstalling and reinstalling work, are not reimbursed by the manufacturer. Indirect costs resulting from the warranty repair work, e.g. lost working hours, are not reimbursed by the manufacturer. Parts replaced under warranty remain as manufacturer's property. The customer shall store the replaced parts for six (6) months unless otherwise agreed and deliver them on request back to the manufacturer with no delay.

5. Conditions for warranty repair work

- Manufacturer's instructions for use, installation and maintenance are complied with.
- The failure has occurred in normal circumstances for which the product is designed to be operated.
- Genuine parts have been used in the maintenance and repairs.
- Claim report provided by the manufacturer or reseller is filled in according to instructions and returned to the handler.

6. Product warranty after repairs

Warranty continues normally to the end of the original warranty period. Warranty repair work does not prolong the warranty period.

7. Limitations of warranty

Warranty does not cover

- consequential costs arising from the failure of the product
- indirect costs e.g. lost working hours
- damage caused to a third party
- product or components which has been altered or repaired by the customer
- damage caused by normal wear, faulty maintenance, neglect, accident, fastening error, overload, user inexperience or use of non-genuine spare parts

Warranty shall not exceed the price of the product.

8. Warranty process

Requirement for processing the claim report is that the claim report provided by the manufacturer or reseller is filled in according to instructions and returned to the handler. Warranty process is carried out in Finnish or English.

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