TEREX®

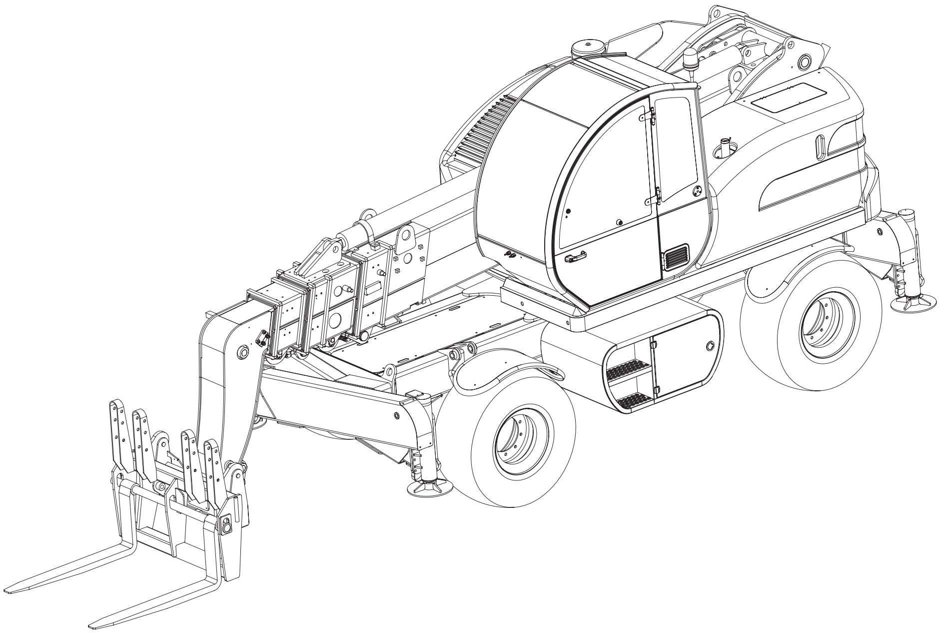
SERVICE MANUAL

Code 57.4402.8200 - 1st Edition 03/2007

Handler with telescopic boom

Gyro 4020 *(From serial n. 12888)*

Gyro 4518 *(From serial n. 12508)*



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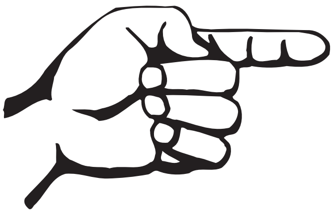

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LIST OF REVISED PAGES

Revision		Revised pages	Notes	Issued by
No.	Date			
1	03-2007		Publication	
2				
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MANUAL CONTENTS

Machine denomination	Literature valid up to serial number
Gyro 4020	12888
Gyro 4518	12508

INTRODUCTION

Important

Read, understand and obey the safety rules and operating instructions in the **Gyro 4020 and Gyro 4518 Operator's Handbook** before attempting any maintenance or repair procedure.
This manual provides the machine owner and user with detailed information on the scheduled maintenance. It also provided qualified service technicians with infromation on troubleshooting and repair procedures.
Basic mechanical, hydraulic and electrical skills are required to perform most procedures. However, several procedures require specialized skills, as well as specific tools and equipment.
In these instances, we strongly recommend letting service and repair the machine at an authorized TEREXLIFT service center.

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DESCRIPTION OF THE MACHINE OPERATION

The oil-pressure system of this machine consists of two macro sections, namely turntable and undercarriage, corresponding to the machine's main parts. From an oil-pressure point of view, these two sections are connected with one another by the 13-way hydraulic rotary joint (**9**).
The source of mechanical energy of this machine is a Deutz turbo-compressed diesel engine (**1**), model BF4M2012, which supplies 74.9 kW at 2300 rev/min and with a max torque of 390 Nm at 1500 rev/min.
On the flywheel side of the engine, and connected to this engine by a Technodrive coupler with elastic joint and with a 1-to-1 ratio, there is a Linde closed-loop pump for hydrostatic drives, model HPV 75-02RE112V (**2**) with electroproportional adjustment valves.
The max displacement of this swashplate pump is 75 cm^3 and the max calibration pressure is 445 bar.
This pump is used to supply hydraulic power under form of pressure and flow rate which is then used for moving the machine.
This pump is used to supply hydraulic power under form of pressure and flow rate which is then used for moving the machine.
On the through-shaft of such drive pump there is a Bosch-Rexroth variable displacement piston pump with swashplate suitable for open lopp circuits, model A10VO45DFR (**3**), equipped with flow and pressure control valve.
The displacement of this pump is 45 cm^3. The function of this pump, through the “load sensing” priority valve (**6**) is to provide hydraulic power, under form of pressure and flow rate to the steering cylinder of the machine (priority side of the valve) and to the telescopic boom and slewing turntable circuits (secondary side of the valve).
This "load sensing" pump is adjusted through an adequate piloting line which provides the pump a pressure signal corresponding to the max load of all the users fed by this pump.
Between pump (**3**) and priority valve (**6**), a one-way valve (**5**) is placed to avoid that oil at pressure, produced by the power-driven emergency pump (**48**), may escape from pump (**3**) when this is stopped.
The assembly of the two pumps involves they have a rotation velocity equal to the speed of the diesel engine.
A third Casappa fixed displacement gear pump suitable for open loop circuits (**4**) with a displacement of 25 cm^3, is installed on the PTO of the engine located on the distribution side.
This pump feeds the servo-assisted braking system (**35**) and the hydraulic motor (**42**) of the heat exchanger fan (**43**) used to cool down the diesel engine and the hydraulic circuit.

The circuit of pump (**4**) is protected by a pressure relief valve **33**) calibrated to 160 bar.
The suction lines of the open-loop pumps (**3-4**) and the power-driven emergency pump (**48**) are not protected by filters and are conveyed to a single port on the hydraulic fluid tank (**32**).
Between this port and the suction lines of the aforesaid pumps, there is a gate valve (**31**) that allows to perform important maintenance interventions on the oil-pressure circuit of the machine without emptying the oil tank. This tank has a capacity of 230 litres.
On the contrary, the drive pump (**2**) is protected by a special filter (**45**), placed on the discharge line of pumps (**3-4**). This filter purifies the oil from the open circuits of the machine (boom-turntable control circuit and service and parking brake feeding circuit) and allows to have an additional oil port for the drive suction line with a minimum pressure of 0.5 bar.
This construction feature of the filter guarantees significant advantages in terms of absence of cavitation in the drive suction line, especially when the machine is started from cold.
The one-way valve (**34**) set to 1.5 bar protects the pump housing against high pressures and guarantees a certain circulation of the drain oil to the hydrostatic motor reducing, in this way, the temperature.
From port "X" of the drive pump (**2**) low-pressure oil is taken (25-30 bar). This oil is first conveyed to the undercarriage through port 11 of the hydraulic rotary joint (**9**), and then used for the two-speed mechanical gearbox circuit (**51**), for the adjustment of the hydrostatic drive motor (**50**) and for the differential anti-slip circuit through the mechanism placed inside the front axle (**57**).
The hydraulic energy produced by the drive pump (**2**) and conveyed to the undercarriage through ports n.1 and n.2 of the hydraulic rotary joint (**9**), is converted into mechanical power by a closed-loop hydrostatic motor, model Linde HMV 75-02E112V (**50**) equipped with an electroproportional adjustment valve and with a flush valve for reducing the max temperatures inside the drive circuit.
In addition to the high-pressure connections with pump (**2**) throughj ports n. 1 and n. 2 of the hydraulic rotary joint (**9**), the motor (**50**) is hydraulically connected to the turntable through port n.12 of the aforesaid joint from which it receives the flow from the drain circuit of the drive pump (**2**), through port n. 7, to which it conveys all the drain flow, and through port n. 11, from which it takes the low pressure needed for its adjustment.
The electroproportional valves of pump (**2**) and motor (**50**) are controlled by a dedicated electronic control unit (Linde) which is connected to the remaining control devices of the machine through the digital network.

The motor is flanged to a two-speed mechanical gearbox, model 357 (**51**) manufactured by Dana. Speeds are engaged by a special oil-dynamic cylinder (**52**) located inside the gearbox, while the selection of the first and second speed is controlled by a 4-way/3-position solenoid valve (**53**) of the on/off type.
The mechanical torque at the gearbox output is transmitted to the front axle (**57**) and the rear axle (**58**), both model 212HY manufactured by Dana, through Cardan shafts.
The hydraulic drive (**7**) of "load sensing" type with a displacement of 315 cm^3, receives oil from the priority valve (**6**) in relation to the "load sensing" signal sent by the hydraulic drive and connected to such valve with function of pilot signal. In this way, the input flow to the hydraulic drive will be exactly the one needed for the instantaneous steering functions; any excess flow of the valve will be available for the functions of the telescopic boom asn other auxiliary functions.
The steering circuit is protected against input overpressures by a pressure reducing valve set to 140 bar. On the two delivery lines, there are other two reducing valves with anti-shock function set to 200 bar. The scope of these two valves is limiting possible shocks on the steering wheel due to overstress on the steering cylinders. The three pressure reducing valves are installed in the hydraulic drive (**7**) and cannot be regulated from the outside.
The steering circuit is completed by the front steering cylinder (**55**), the rear steering cylinder (**56**) (these cylinders being integral part of the front axle (**57**) and the rear axle (**58**) respectively) and by a 4-way/3-position solenoid valve (**54**) for the selection of the three different steer modes (rear wheels straight, co-ordinate front/rear steering and independent front/rear steering).
When the solenoid valve (**54**) is not energised, the front steering cylinder is fed by the hydraulic drive and the rear cylinder is blocked. When one magnet or the other of the solenoid valve (**54**) is energised, the chambers of the cylinders are connected in a different manner thus causing the desired effect on the steering mode.
The connection of the steering circuit between the section integral of the turntable and the one integral of the undercarriage is done through ports n.8 and n. 9 of the hydraulic rotary joint (**9**).
The Bucher/Tecnord electro-proportional distributor (**8**), with 5 modular sections, receives oil from the secondary line of the priority valve (**6**) and feeds all of the movements of the telescopic boom and the turntable and provides an oil flow to the auxiliary lines for the secondary functions such as turntable lock, outriggers and frame levelling.
This main valve consists of an input head with 3-way pressure compensator used as a flow regulator for the user which works at max load (load sensing), and as a

discharge valve when the pump flow is not used for the boom movements, and of 5 modules.
Four of these modules control specific functions of the telescopic boom (lifting/lowering, attachment holding frame rotation, extension/retraction, attachment lock/ unlock) and the fifth module controls the rotation of the turntable of the machine.
In the head there is a pressure relief valve set to 300 bar which, acting on the line of the “load sensing” signal, limits the maximum pressure at the inlet of the main valve through such 3-way compensator.
On the main inlet head of the main valve, there is the pilot line head which includes an inlet safety filter, a pressure relief valve acting on the pilot line, and a safety solenoid valve which, when de-excited, discharges the input pilot pressure, thus preventing the main valve from working. This solenoid valve is used as a “dead man” control and is activated by the relevant button on the joysticks in the driving cab.
The pilot head delivers oil at pressure to the 5 pilot modules of the main valve. These modules operate the relevant main sliders in relation to the command signal they receive from the joysticks via the control unit.
Module 1 of the main valve controls the telescopic boom lifting cylinder (**12**). This cylinder has one single-acting compensation valve (**13**) with safety function. The control module of element 2 of the main valve is the electro-proportional type with electrical feed-back and integrated electronics. The 1,5-lt. accumulator prefilled at 35 bar (**14**) and located on the line of the differential chamber of the lifting cylinder (**12**), allows for damping the boom swings when the same boom is moved down.
Module 2 of the main valve controls the boom telescopes extension cylinder (**15**). This cylinder is equipped with a double-acting compensation valve (**16**) with safety function. The control module of this element of the main valve is the electro-proportional type with electrical feed-back and integrated electronics.
Module 3 of the main valve controls the cylinder operating the attachment holding plate of the telescopic boom (**17**). This cylinder is equipped with a double-acting compensation valve (**18**) with safety function. Paralleled to this cylinder we find the fork levelling cylinder (**19**) (or balancing cylinder) equipped with a special double-acting compensation valve (**20**). Inside this valve, the one-way valves are installed in a reverse manner with respect to the normal position to avoid the pressurisation of the cylinder when the rotation command of the attachment holding plate is operated.
Again inside this valve, there are other two one-way valves set to 5 bar with anti-cavitation function (**21**). These valves are used to deliver oil, sucked from the low pressure line coming from the pressure relief valve (**11**), to the fork levelling compensation circuit, when such

circuit cannot do it alone.
The control module of element 3 of the main valve is the electro-proportional type with electrical feed-back and integrated electronics.
On the two control lines of the cylinder (**17**), and integral to module 3, there are two pressure relief valves set to 320 bar which protect the automatic levelling system of the forks when the boom is moved up and down and in case of overload on the attachment holding plate (ex. use of the bucket).
Module 4 of the main valve controls the attachment locking cylinder (**23**). This cylinder has a double one-way valve with hydraulic release, acting as safety valve (**24**). The pilot module of element n. 4 of the main valve is the electroproportional type with integrated electric and electronic feedback.
On one of the two hydraulic control lines of this section of the main valve, there is a 3-way/2-position electric divider with on/off control (**22**).
When this divider is not energised, the oil at pressure coming from the module of the main valve, is sent to the attachment locking cylinder. On the contrary, when the divider (**22**) is energised, the oil at pressure from element n.4 of the main valve (**8**), is made available for the auxiliary feeding line of the turntable lock/unlock function and, through port n. 3 of the hydraulic rotary joint (**9**), for the operation of the outriggers and the frame levelling.
On the feeding lines of this cylinder and close to the terminal part of the end trunk, there are two quick-fit connectors (**25**) for the connection of the hydraulic lines of any optional equipment needing a hydraulic power for their operation (e.g. hydraulic winch and jib, mixing bucket, etc.).
Module n. 5 of the main valve controls the hydraulic slewing motor of the turntable (**26**), equipped with brake with internal mechanical block and external hydraulic release. The mechanical torque produced by this motor is transmitted to the turntable through an epicyclic reduction gear with two stages and a slewring with internal toothing.
The feeding line of this motor is equipped with a double-acting compensation valve (**27**), used also as safety and anti-cavitation valve.
The pilot module of this element of the main valve is of electroproportional type with integrated electric and electronic feedback.
Inside this module of the main valve, there is a two-way pressure compensator which keeps the proportionality of the slewing control of the turntable as the loads on this table and the pressure entering the main valve modules change. The pressure of the main valve is adjusted by the three-way compensator placed on the inlet head.
The main valve (**8**) is equipped with a pilot line of the “load sensing” type which, through the exchange valve (**10**), is connected to the priority valve (**6**), which, at

its turn, receives an analog pressure signal from the hydraulic drive (**7**). The exchange valve (**10**) is then connected to the "load sensing" port of pump (**3**), thus guaranteeing the adaptation of the pump adjustment to the maximum load on the various users served by this pump under any conditions.
The pressure relief valve (**11**) calibrated to 30 bar is placed upstream of the pressure inlet port of the main valve (**8**). This valve is used to deliver low-pressure oil (30 bar) to the anti-cavitation circuits of automatic fork levelling system and to feed the pilot line of the same main valve (**8**).
The block cylinder of the slewing turntable (**28**) is equipped with a double one-way valve (**29**) with hydraulic release, acting as safety valve, and is controlled by the 4-way/3-position solenoid valve of the on/off type (**30**).
As already mentioned, the turntable lock/unlock is possible through the simultaneous energisation of module n.4 of the main valve (**8**), the electric divider (**22**) and the solenoid valve (**30**).
The SAFIM S6 servo-assisted braking system with pedal (**35**) receives oil from the pump (**4**) and uses this oil to pressurise 3 hydraulic accumulators (**36**-**37**) connected to the same system.
The oil at pressure contained in these accumulator is then used to operate the service brakes of the two axles (**57**-**58**) and to release the parking brake located inside the rear axle (**58**).
The fill valve inside the braking system takes the flow from the feeding line so the pressure on the line of the accumulators reaches the calibration value of the cutout valve set to 140 bar. When this pressure is reached, the valve gradually releases all the flow to line B for other uses.
The brake pedal located in the driving cab, which is an integral part of the braking system S6, is connected to two proportional sliders which control the two separated lines of the service brake, one for each axle.
Such lines connect the part of circuit in the turntable with the one in the undercarriage through ports n. 5 and n. 6 of the hydraulic rotary joint (**9**). In relation to the stroke of these sliders, a gradual communication between the feeding line, connected to two accumulators (**36**) which, at their turn, are connected to ports R1 and R2 (the accumulators have 0.5-lt. capacity and 50 bar fill pressure), and the service brake lines is established so the flow is distributed to such lines and the discharge line increasing, in this way, the pressure (and as a result the braking force) on the lines of the service brakes. When the sliders are in the rest position, the lines of the service brakes are connected to the discharge.
The pressure switch (**38**) set to 2-10 bar, paralleled to on of the two lines of the service brake, sends an electrical signal when this brake is engaged.

The pressure switch (**39**) set to 70 bar and connected to port F, sends an electrical warning signal when the pressure inside the feeding circuit of the brake lines is too low to guarantee the minimum braking efficiency.
The accumulator (**37**) with 0.5-lt. capacity and 50 bar fill pressure is connected to port R of system S6 and is used to unlock the parking brake of the rear axle (**58**).
The connection of the part of this circuit placed in the turntable to the one of the undercarriage is done through port n. 13 of the hydraulic rotary joint (**9**).
The command of the parking brake is controlled by a special valve with lever control (**40**) located in the driving cab. In relation to the position of the lever, the release line of the parking brake is connected to the pressure line (parking brake unlocked) or the discharge line (parking brake locked).
The two pressure switches (**41**) set to 10-20 bar send an electrical warning signal when the parking brake is activated (brake locked).
The oil which is not used by the SAFIM S6 servo-assisted braking system with pedal, is sent to the Casappa hydraulic geared motor (**42**) with a displacement of 20 cm^3, for the operation of the cooling fan of the heat exchanger (**43**).
Inside the motor housing, there are an anti-cavitation valve and a pressure relief valve with by-pass function set to 140 bar, as well as a solenoid valve which, once electrically energised, directly sends the oil entering to the motor, to the drain.
The function of this solenoid valve, suitably controlled by a thermostatic circuit, is to avoid an operation of the cooling fan of the heat exchanger when the oil is cold. This allows reaching the ideal working temperature of the hydraulic oil faster.
The heat exchanger (**43**) is divided in two sectors; one absorbs heat from the cooling circuit of the diesel engine and the other absorbs heat from the hydraulic circuit of the machine.
The flows of pumps (**3**-**4**) and the partial flow of the drain circuit of the hydrostatic transmission are conveyed to this second sector.
The oil cooled down by the heat exchanger is sent back to tank (**32**).
A one-way valve (**44**) with an opening pressure of 5 bar is installed parallel to heat exchanger (**43**) to protect the same exchanger. In all the cases in which the pressure drop in the exchanger exceeds 5 bar (starts from cold, partial obstruction of the heat exchanger, etc.), valve (**44**) opens so that a part of the flow to the exchanger can be conveyed through this valve by reducing the maximum pressure inside the exchanger (**43**).
On the drain line from the drive motor (**50**), passing through port n.7 of the hydraulic rotary joint (**9**), there are two one-way valves (**46**-**47**) with an opening pressure of 0.5 bar and 1.5 bar, respectively.

The function of these valves is to avoid a pressure of the drain line of motor (**50**) above 1.5 bar which is the admissible limit for the seals placed on the motor shaft.
This circuit allows for the partial passage through the heat exchanger (**43**) of the flow from the pump drain circuit (**2**) and the drive motor (**50**) to keep within the pressure limits mentioned above. Any excess flow will pass through valve (**47**) to directly reach the tank (**32**).
Ports n.4 and n.10 of the hydraulic rotary joint (**9**) are used to connect some drain lines between undercarriage and turntable. In particular, port n.10 is the one which can guarantee the lowest counter-pressure values on the drain, being directly connected to tank (**32**).
The motor-driven pump (**48**), supplied with power by the battery, is used as emergency feeding pump in the event of a failure of the primary control circuit of the telescopic boom. Just downstream of the motor-driven pump (**48**) there is a one-way valve (**49**) which avoids that oil at pressure, produced by the main pump (**3**), may escape through pump (**48**) when this is stopped.
The movements of the front outriggers are controlled by four 4-way/3-position solenoid valves of the o/off type, installed on the oil-pressure block (**70**). This block, through port 3 of the hydraulic rotary joint (**9**), is fed by the simultaneous operation of the 4th element of the electro-proportional main valve (**8**) and of the electric divider (**22**).
The solenoid valve n. 1 of block (**70**) controls the cylinder (**71**) operating the front left stabilising foot. This cylinder is equipped with a double-acting compensation valve(**72**) used also as safety valve.
On the rod side of this cylinder, there is a pressure gauge (**73**) calibrated to 50 bar which detects when the outrigger is lowered to the ground.
The solenoid valve n. 2 of block(**70**) controls the extension cylinder (**74**) of the front left outrigger. This cylinder is equipped with a double one-way valve with hydraulic release, acting as a safety valve (**75**).
The solenoid valve n. 3 of block (**70**) controls the extension cylinder (**76**) of the front right outrigger.
This cylinder is equipped with a double one-way valve with hydraulic release, acting as a safety valve (**77**).
The solenoid valve n. 4 of block (**70**) controls the cylinder (**78**) operating the front right stabilising foot.
This cylinder is equipped with a double-acting compensation valve (**79**) used also as safety valve.
On the rod side of this cylinder, there is a pressure gauge (**80**) calibrated to 50 bar which detects when the outrigger is lowered to the ground.
The movements of the rear outriggers are controlled by four solenoid valves installed on the oil-pressure block (**81**).
This block, through port 3 of the hydraulic rotary joint (**9**), is fed by the simultaneous operation of the 4th element of the electro-proportional main valve (**8**) and of the electric divider (**22**).

The solenoid valve n. 1 of block (**81**) controls the cylinder (**82**) operating the rear left stabilising foot.
This cylinder is equipped with a double-acting compensation valve (**83**) used also as safety valve. On the rod side of this cylinder, there is a pressure gauge (**84**) calibrated to 50 bar which detects when the outrigger is lowered to the ground.
The solenoid valve n. 2 of block (**81**) controls the extension cylinder (**85**) of the rear left outrigger.
This cylinder is equipped with a double one-way valve with hydraulic release, acting as a safety valve (**86**).
The solenoid valve n. 3 of block (**81**) controls the extension cylinder (**87**) of the rear right outrigger.
This cylinder is equipped with a double one-way valve with hydraulic release, acting as a safety valve (**88**).
The solenoid valve n. 4 of block (**81**) controls the cylinder (**89**) operating the rear right stabilising foot.
This cylinder is equipped with a double-acting compensation valve (**90**) used also as safety valve. On the rod side of this cylinder, there is a pressure gauge (**91**) calibrated to 50 bar which detects when the outrigger is lowered to the ground.
The differential anti-slip circuit is controlled by the 3-way/2-position solenoid valve (**69**). When this valve is not energised, the service brake control line of the front axle (**57**), coming from the SAFIM braking system (**35**) through port 5 of the hydraulic rotary joint (**9**), is connected to the service brake ports of the front axle (**57**). On the contrary, when valve (**69**) is energised, a condition corresponding to the anti-slip control "ON", the service brake ports of the front axle (**57**) are connected to the 25-30bar low-pressure line and help the action of the differential anti-slip system.
The oscillation of the front axle (**57**) is controlled by two cylinders (**60-63**) equipped with block solenoid valves (**61-62**). The movement of cylinders (**60-63**), and thus the front axle oscillation (**57**), is only possible when solenoid valves (**61-62**) are energised.
The frame levelling is controlled by a 4-way/3-position ON/OFF solenoid valve (**59**) which feeds in a crossed manner the cylinders (**60-63**).
This solenoid valve, through port 3 of the hydraulic rotary joint (**9**), is activated by the simultaneous operation of the 4th element of the electro-proportional main valve (**8**) and of the electric divider (**22**).
The oscillation of the rear axle (**58**) is controlled by two cylinders (**65-68**) equipped with block solenoid valves (**66-67**). The movement of cylinders (**65-68**), and thus the rear axle oscillation (**58**), is only possible when solenoid valves (**66-67**) are energised.
The flow control valve (**64**) allows for the free passage of the oil coming from the drive drain circuit during the filling of the cylinders (**65-68**) (air venting) and avoids pressure peaks in the circuit of such cylinders when high oscillation speed conditions of the rear axle produce potentially dangerous overpressures in the drive drain

circuit.
As already mentioned, the undercarriage levelling function is possible through the simultaneous energisation of the two spools of the solenoid valve (**59**) and the spools of the solenoid valves (**61**-**62**-**66**-**67**).

Gyro 4020 - 4518 carrier hydraulic scheme