



vetus MTC30 Series Hydraulic Steering System Instruction Manual

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Installationshandbuch
Hydraulische Ruderanlagen

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MTC30 Series Hydraulic Steering System

Installation manual

Hydraulic Steering Systems

30 – 175 kgm

MTC30 – MTC52 – MTC72 – MTC125 – MTC175

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Introduction

A hydraulic steering system basically consists of one or more pumps and a cylinder. See diagram 'A' *.

When the steering system includes just one pump, a non-return valve can be installed between the cylinder and the pump. This prevents pressure on the rudder being felt at the helm.

This non-return valve can be fitted separately or a pump with built-in non-return valve can be fitted. N.B. A pump with built-in non-return valve is also fitted with a pressure release valve.

See diagrams 'B1' and 'B2' *

When a separate non-return valve is fitted, the unused connection, for a second pump, must be sealed off.

When a hydraulic steering system with 2 pumps is used, a non-return valve must be fitted. This ensures that the one pump can automatically take over from the other, and also prevents unnecessary rotation of the unused steering pump. See diagrams 'C1', 'C2', 'D1' and 'D2'. Either a separate dual non-return valve can be fitted or use two pumps with built-in non-return valves.

For the reasons given above a hydraulic steering system with 3 pumps must also be fitted with non-return valves. Examples are given in diagrams 'E1' and 'E2' of systems with an Electro-Hydraulic Pump (EHP) (with non-return valve) and 2 manually operated pumps.

The VETUS EHP type 'R' is already equipped with a built-in non-return valve. Examples are given in diagrams 'F1' and 'F2' of systems with an Electro-Hydraulic Pump (EHP) (without non-return valve) and 2 manually operated pumps.

The EHP (with reversible motor) is shown in diagrams 'F1' and 'F2' connected via a separate (dual) non-return valve.

For the manually operated pumps diagrams 'E1' and 'F1' show a separate dual non-return valve and diagrams 'E2' and 'F2' show pumps with built-in nonreturn valves.

A by-pass valve must be fitted when emergency steering with a tiller is required.

With an open by-pass valve, the oil can flow easily from one side of the piston to the other and the hydraulic system will not interfere with the emergency (tiller) steering. See Diagram 'G'.

Following the recommendations below will ensure a longer life and better performance for your hydraulic steering system.

- Only use one type of hydraulic oil, as specified in the Technical Data
- Carry out maintenance regularly.

Fitting

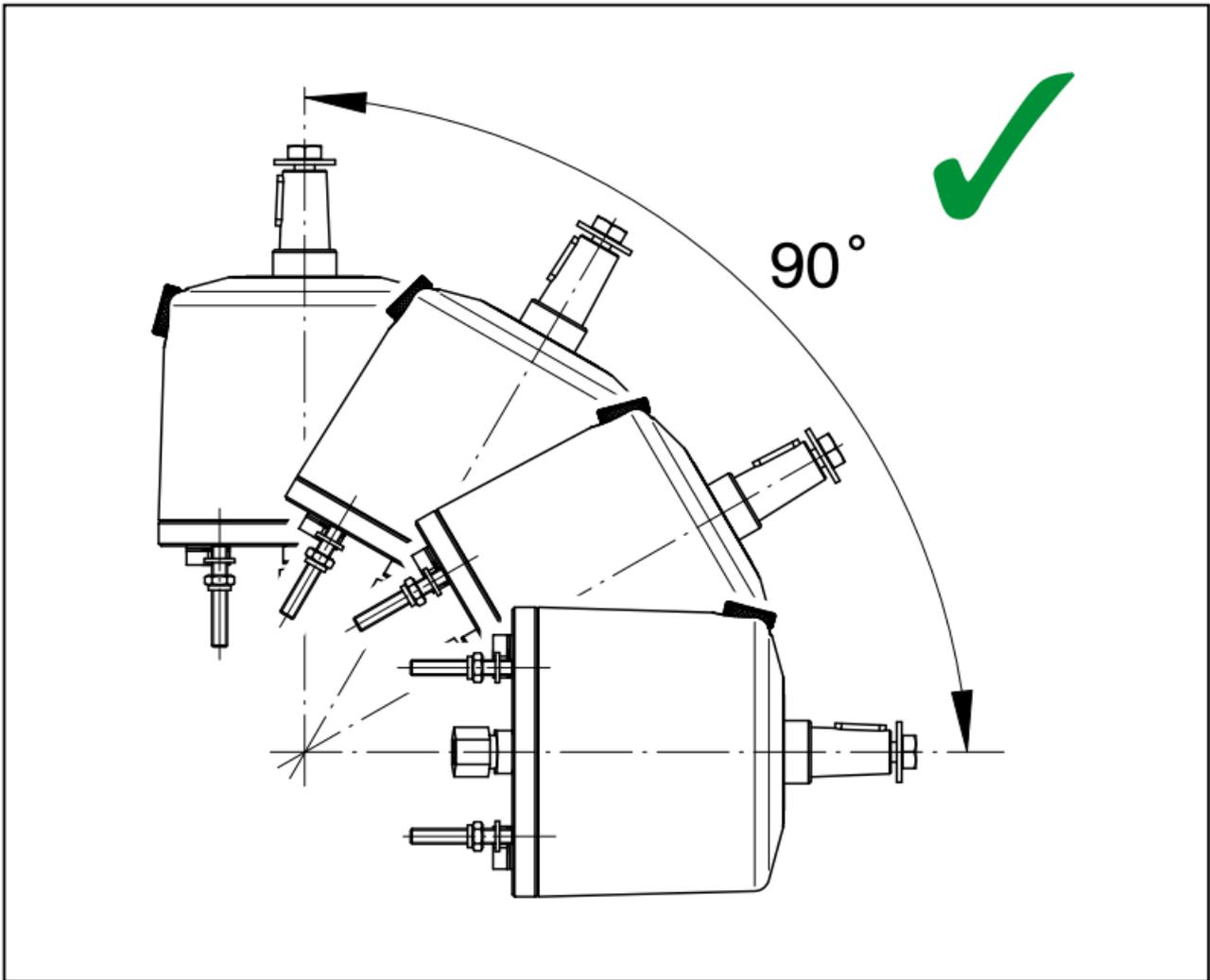
During assembly, prevent welding spatters, paint splashes and damage to the steering pump shaft and piston rod. Damage can destroy the oil seals and cause leaks.

2.1 Steering Pump

The filler cap and balance tube must always be on top of the unit, at the highest point.

*) When more than one pump is fitted, all oil reservoirs must be connected by balance tubes.

The steering pump may be installed in any position between horizontal and vertical.



Fit the threaded rods supplied into the steering pump using Loctite®.

The steering pump is fitted with a filler plug without air hole as standard. Single station system (1 steering pump): a filler plug with air hole should be fitted.

Dual station system (2 steering pumps): a filler plug with air hole should be fitted in the upper steering pump.

A filler plug with air hole is supplied separately.

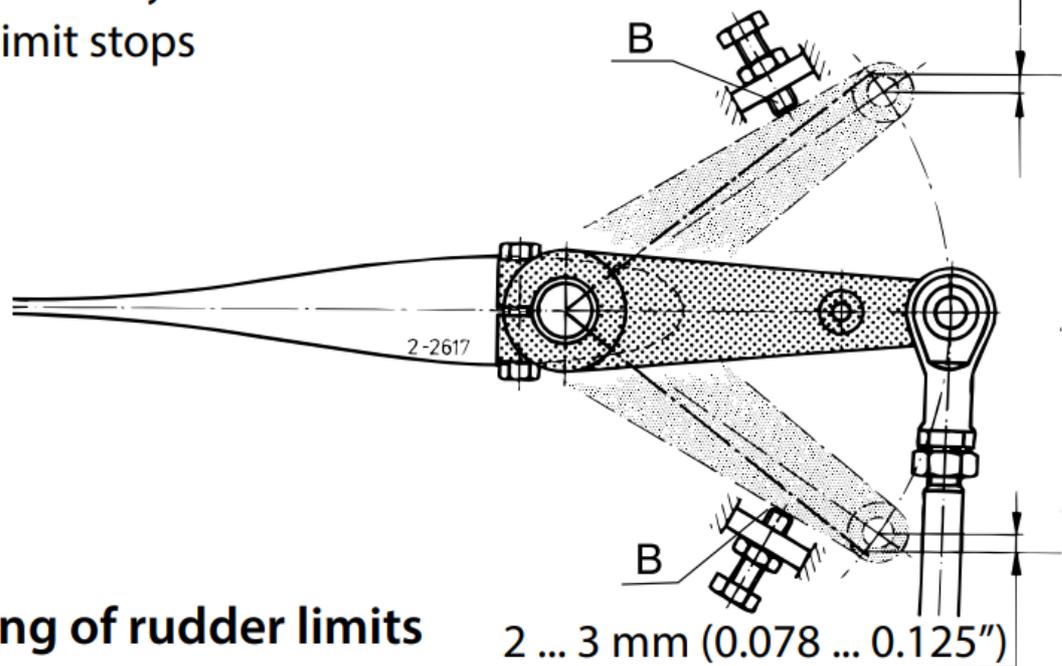
2.2 Cylinder

The cylinder air bleed nipples should point upward to ensure effective bleeding.

A Max. stroke of cylinder

B Rudder limit stops

2 ... 3 mm (0.078 ... 0.125")



Positioning of rudder limits

2 ... 3 mm (0.078 ... 0.125")

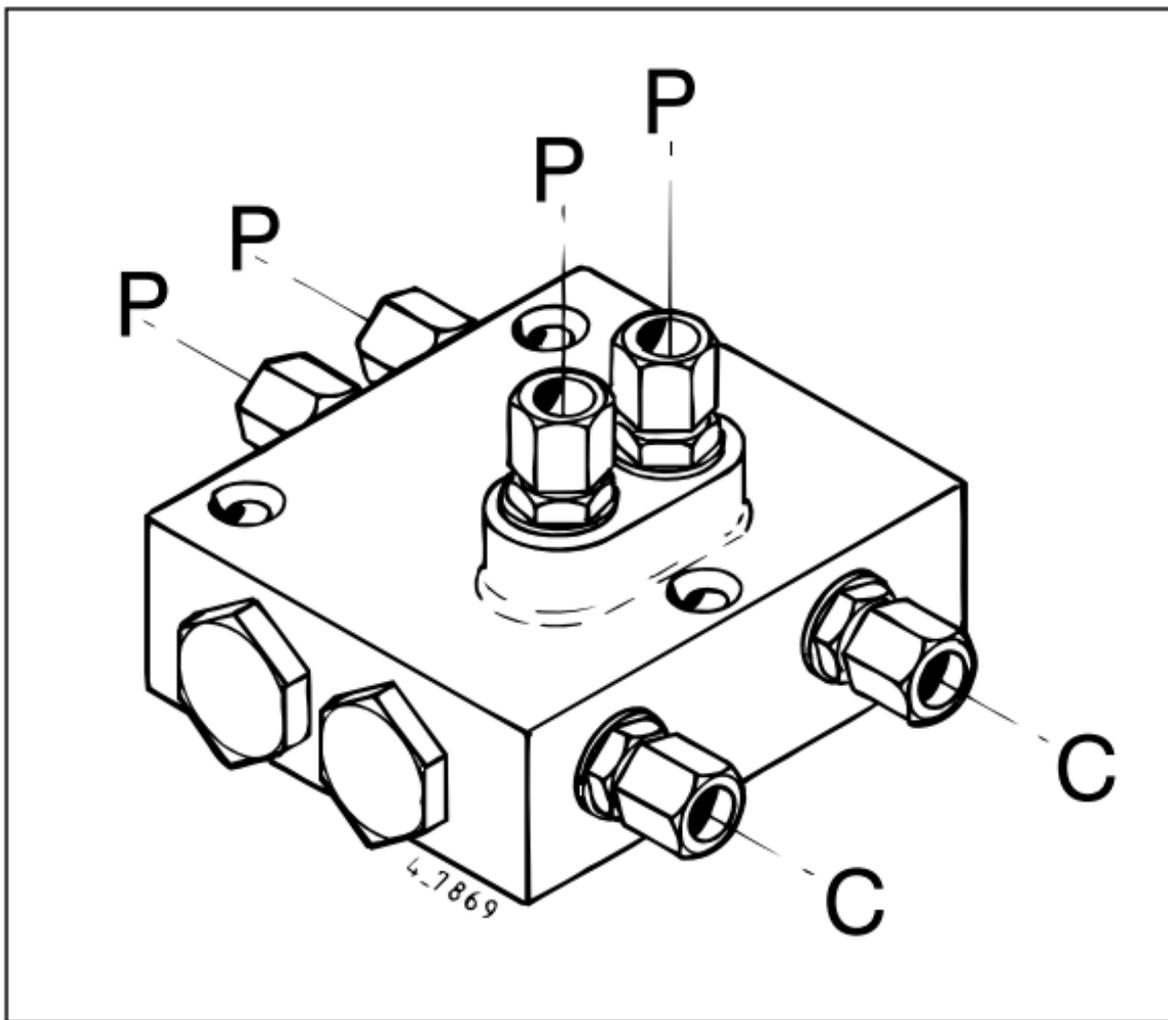
Rudder limit stops must be fitted to prevent over stressing the cylinder when the piston is at top dead centre. Fix the base of the cylinder to a sufficiently sturdy foundation; this must be strong enough to accommodate the force (push and pull) of the rudder on the cylinder. It is best to install the cylinder in a dry, well ventilated space. If this is not possible, take measures to ensure that the cylinder rod is protected from damp, dirt and sea water.

Dual Non-return Valve

If a separate dual non-return valve is fitted this must be as close to the steering cylinder as possible; the pressurised tubing between the non-return valve and the cylinder remains under pressure and should be made as short as possible.

Mount the dual non-return valve on an absolutely flat surface.

Connections marked 'P' are for the steering pump; connections marked 'C' are for the cylinder.



2.3 Oil Expansion Tank

A part of the hand steering pump serves as an oil expansion tank. The expansion capacity required depends upon the amount of oil in the whole steering system and the expected maximum and minimum ambient temperatures. If the capacity is insufficient, oil will escape out of the breather hole in the top pump filler cap.

Therefore, install an extra oil expansion tank when:

- the steering system consists of hand two steering pumps and an electro-hydraulic pump;
- the total length of the tubes system is very large;
- large temperature differences can be expected during operation;
- if you expect considerable movement during operation, it is recommended that an extra oil expansion tank be fitted.

Furthermore, an extra oil expansion tank simplifies filling the system and checking the oil level.

Fit the oil expansion tank above the top steering pump.

Block the breather hole in the top steering pump filler cap.

Connect the oil expansion tank to the topmost steering pump connector tube using a hose and hose pillar.

N.B. This part of the steering system is virtually pressure-free (the pressure depends upon the height of the fluid column between expansion tank and steering pump).

The VETUS oil expansion tank has a breather, when another make of tank is used, ensure that an air breather is fitted.

2.4 Connections

Never use Teflon tape for sealing the screw connections; liquid sealants must be used with great care, sealant in the hydraulic system will create problems.

Steering Pump:

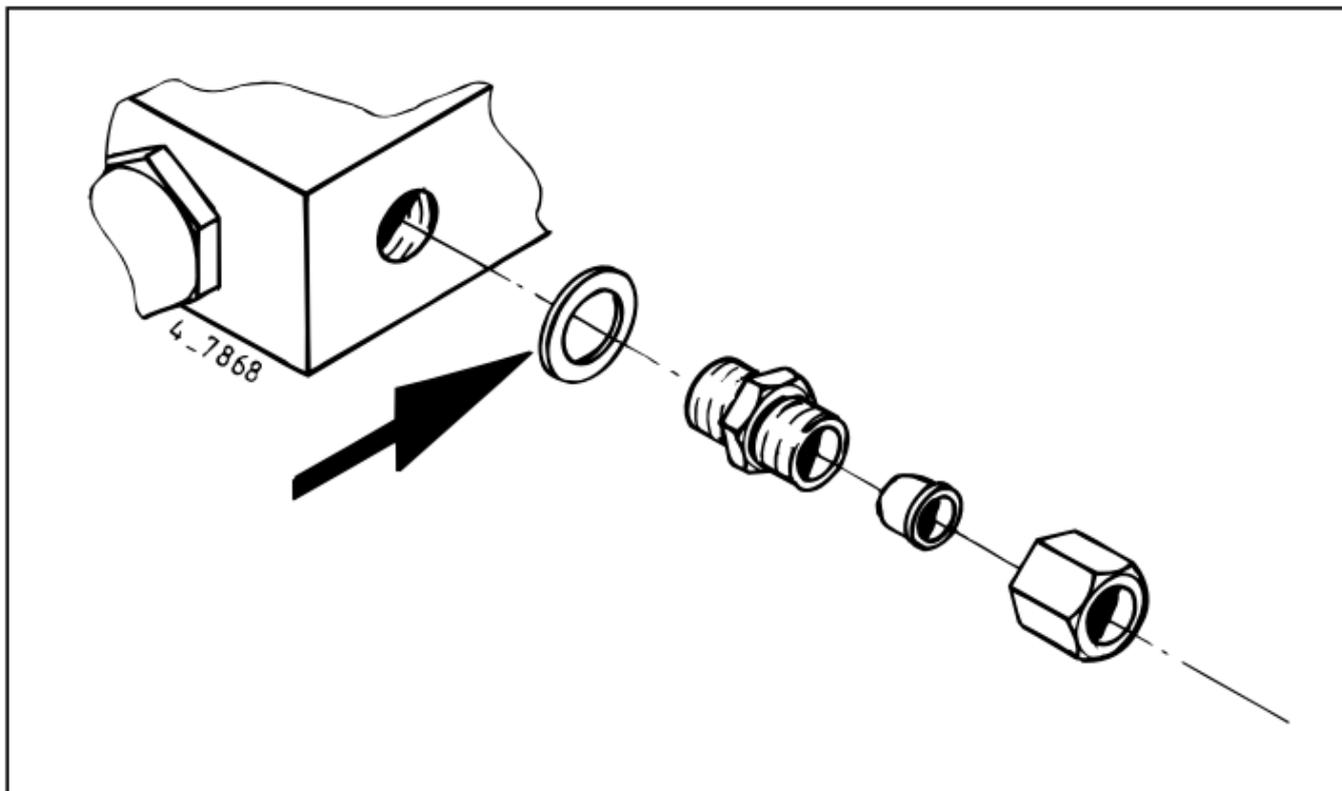
Tube connections to the cylinder are already fitted. When a balance tube has to be fitted, the connectors (G 1/4) must be assembled with aluminium or copper sealing washers.

Cylinder:

The tube connections to the steering pumps are already fitted; a liquid sealant is used. When the connectors are refitted the old sealant must be removed and new liquid sealant applied carefully.

Non-return Valve:

Assemble the parts in the non-return valve using copper or aluminium sealing rings.



Hose and Tube Installation

The hydraulic steering components are connected with nylon tubes (MTC30 only!), nylon hoses or copper or steel tubes for the other models.

Hydraulic system with double controls, both pumps without built-in non-return valve:

Connect the tubes from both pumps with the cylinder via the separate dual non-return valve.

See diagrams 'C1' and 'D1'.

Always keep the connecting tubes as short as possible in order to restrict the internal resistance.

Hydraulic system with double controls, both pumps with built-in non-return valves:

Connect the tubes from both pumps with the cylinder via T-pieces.

See diagrams 'C2' and 'D2'.

Always keep the connecting tubes as short as possible since they are under pressure and this restricts the internal resistance.

It is recommended that the horizontal tubes be fitted at an angle of about 3 cm per metre / 3/8 in per ft (pump side higher than cylinder side) to ensure satisfactory bleeding.

Install the tubes or hoses in such a way that the risk of external damage and corrosion (for metal tubes) or the effects of chemicals and high temperature (nylon hose or tube) is reduced to the minimum.

Hoses or tubes which pass through a partition must be protected with bulkhead sleeves, or bulkhead connectors.

Bends must be completely free of kinks; a kink in the tubing restricts the free flow of hydraulic oil.

When the installation uses copper or steel tubes, they must be of the 'internally cleaned' type.

When fitting copper or steel tubes, avoid long straight sections; the length of the tube is affected by ambient temperature.

The cylinder must always be connected with 2 lengths of flexible nylon tube or hose, so that it can move freely.

These 2 sections of flexible nylon tube or hose should each have a length of at least 50 cm and be fitted with a large bend radius.

After installation, blow through the piping with nitrogen or compressed air (never use water!) to check for blockages and to remove any dirt.

The minimum bend radius of nylon tubing is:

– 50 mm (nylon tubing 6 mm I.D., 8 mm. O.D.)

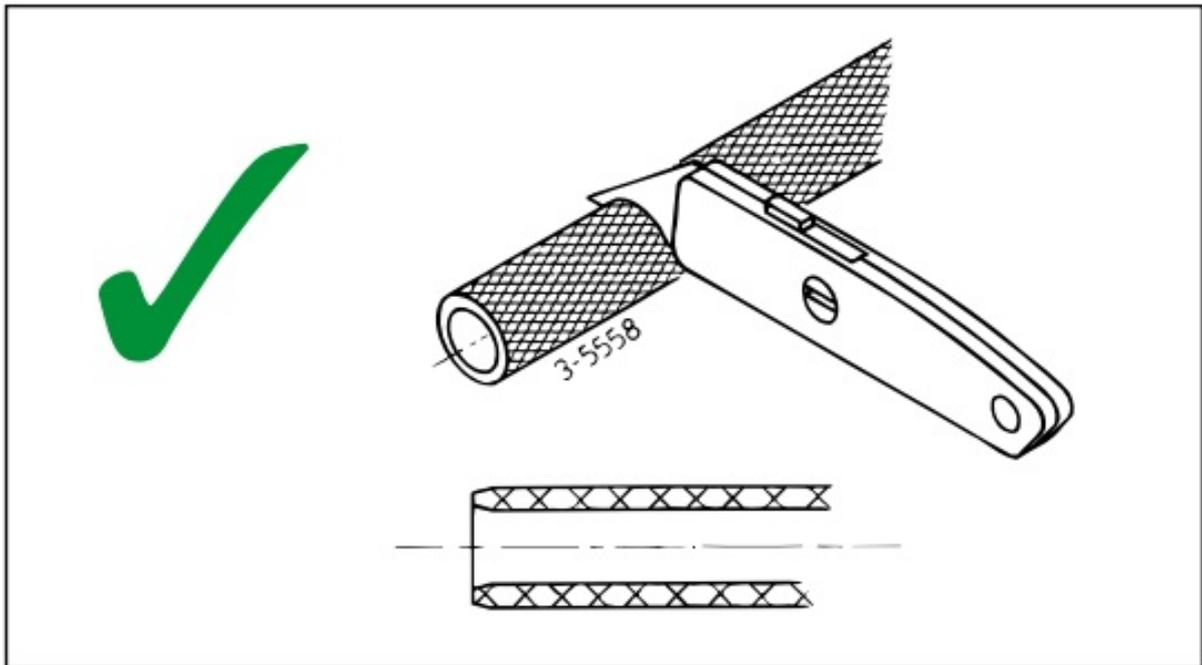
The minimum bend radius for nylon hose is:

– 75 mm (nylon hose 6 mm I.D., 10 mm O.D.)

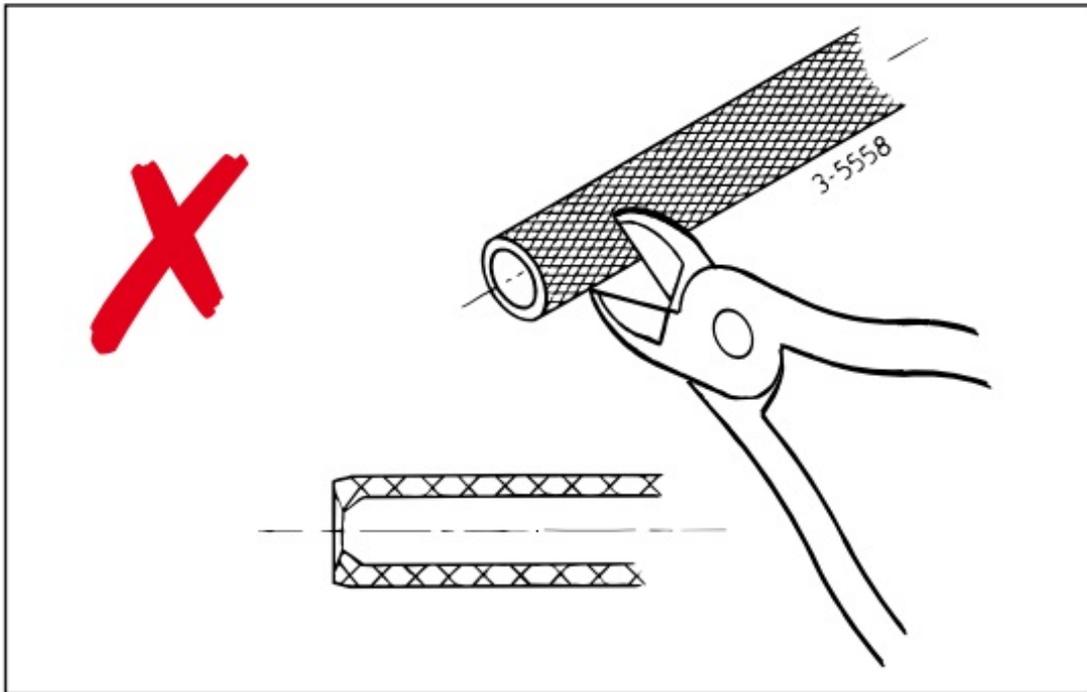
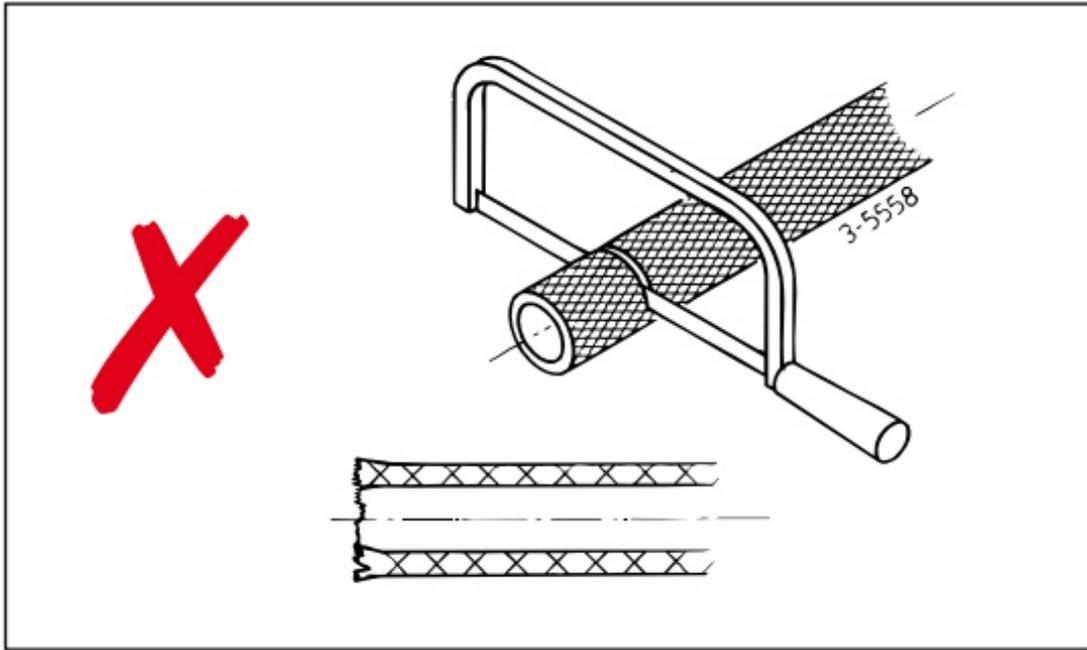
– 90 mm (nylon hose 8 mm I.D., 12 mm O.D.)

Always secure the hose or tubes with brackets; distance between brackets about 60 cm.

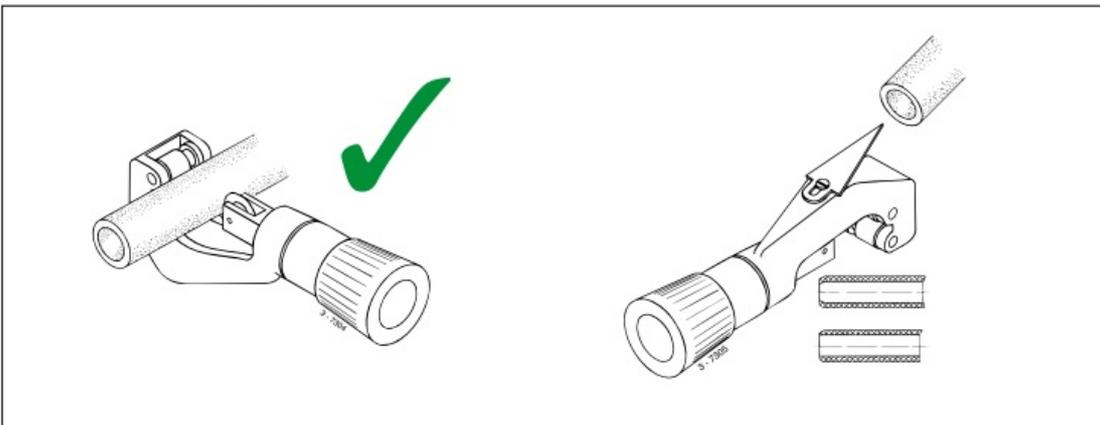
Always cut the tube or hose with a sharp knife.



Never cut off piping or tubing by using a saw (to prevent sawdust from entering the hydraulic system, which will invariably cause problems) or by shearing (since this will cause excessive tube deformation).



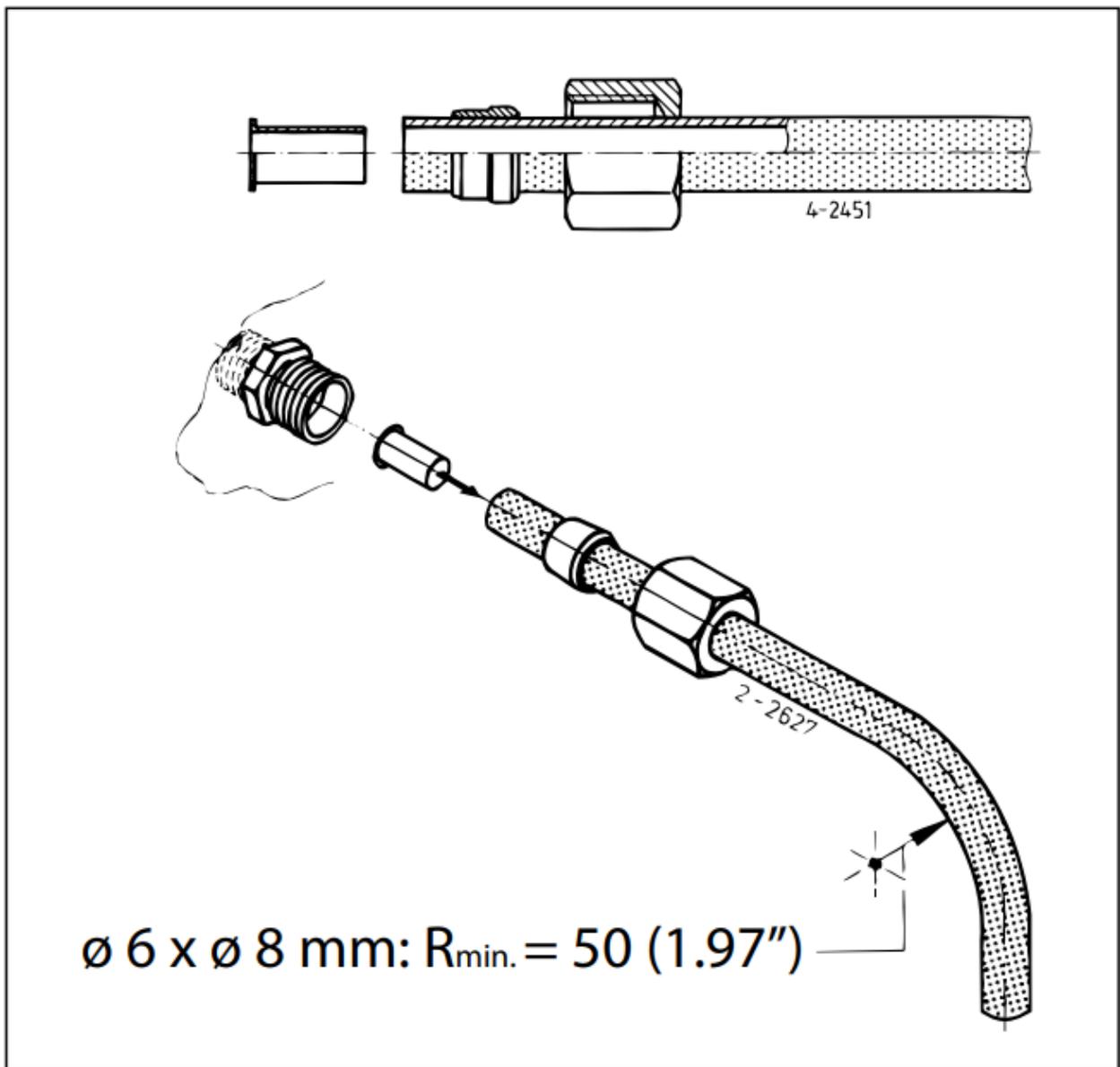
After cutting off copper or steel pipe sections, remove the burrs.



Installation of nylon tube/ hose into the connection

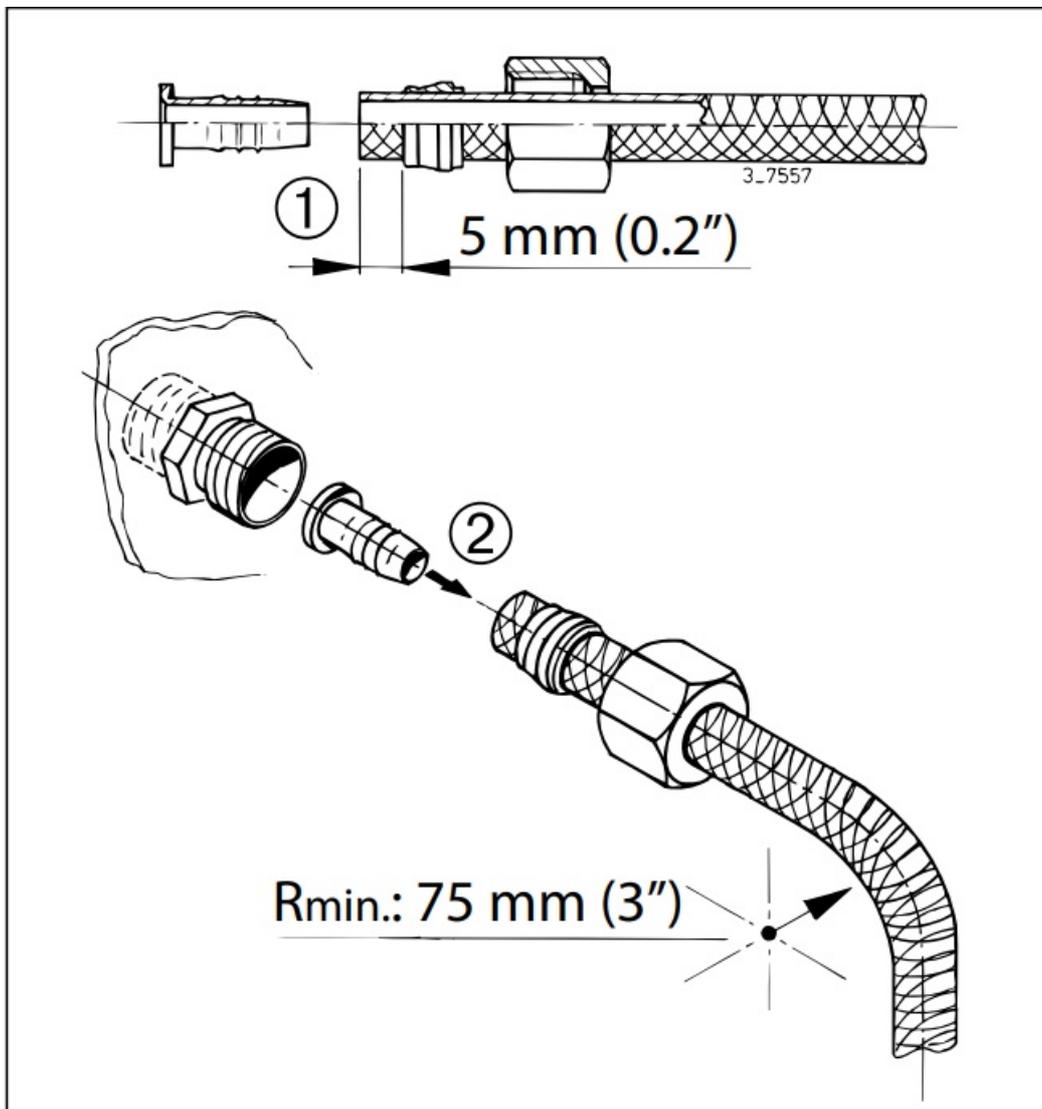
- Nylon tube (6 mm I.D., 8 mm O.D.)

After cutting the nylon tube, fit the coupling nut and olive on the tube and fit the support sleeve inside the tube.



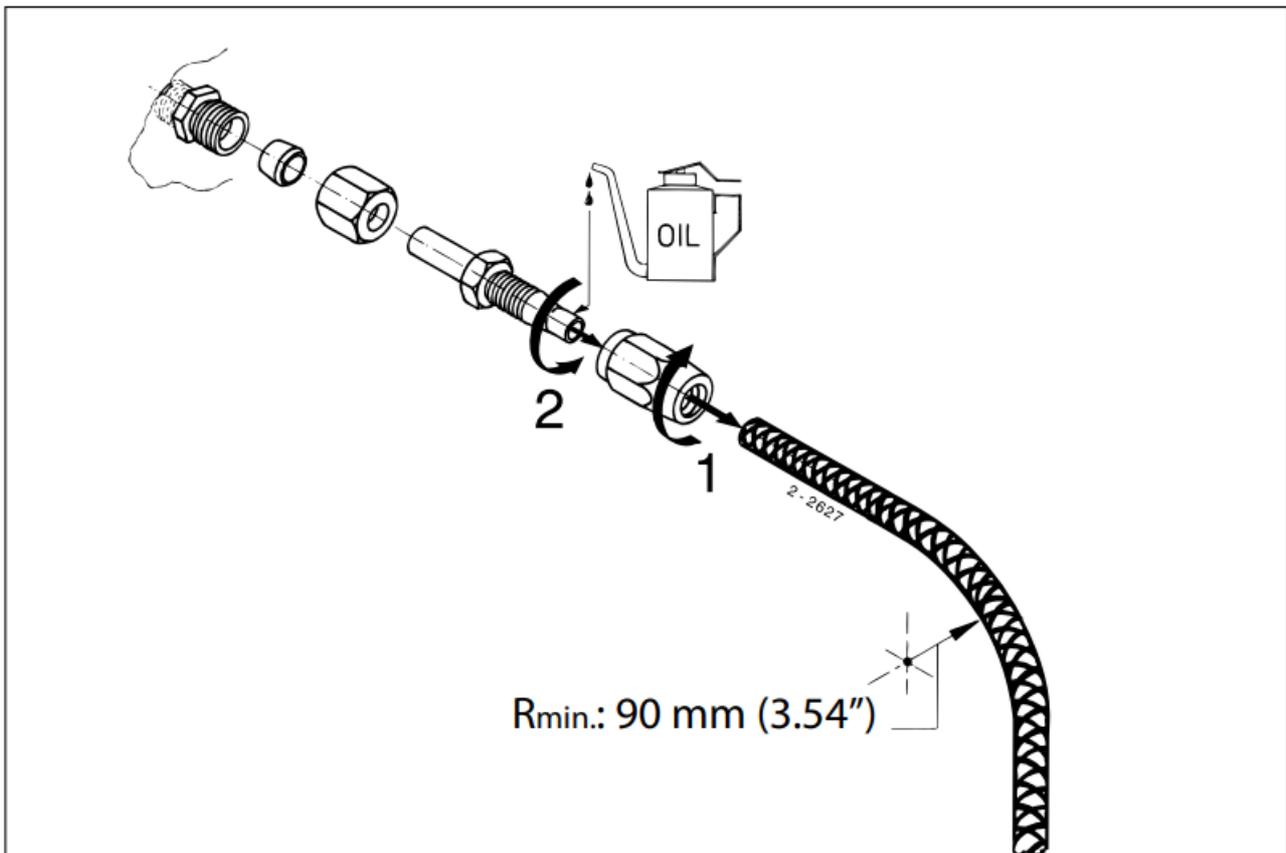
- **Nylon hose (6 mm I.D., 10 mm O.D.)**

After cutting the nylon hose, fit the coupling nut and olive on the hose (check that it is properly positioned in relation to the end of the hose 1) and push the support sleeve 2 into the hose.



Screw up finger tight and then use a spanner:

– Straight screw-in connector	4 turns
– T-screw connector	2 turns
– Intermediate connector	3 turns
– T-piece	2turns
– Right angle screw-in connector	2turns



• Nylon hose (8 mm I.D., 12 mm O.D.)

1. After cutting the nylon hose screw the socket onto the hose, anticlockwise, and stop when the hose is approx 1.5 mm protruding.
2. Apply some oil to the hose connector fitting and screw it into the socket. Take care that the inner tube not gets twisted during screwing the fitting in!

Also make sure that the internal sheathing of the tubing is not squeezed while tightening the screw.

Filling and bleeding

Note: The numbers in bold type point out to the drawing numbers on the pages X-2 and X-3 in the centre of this manual.

Use the diagrams on page X-2 for a hydraulic system with separate dual non-return valve and a pump, or pumps, without built-in nonreturn valves.

Use the diagrams on page X-3 for a hydraulic system with a pump, or pumps, fitted with built-in non-return valves. The hydraulic system should be filled at the highest point, i.e. the (top) steering pump or the extra oil expansion tank.

Remove the filler cap from the (top) steering pump or oil expansion tank.

Fit a hose pillar (G 3/8) with funnel to the filler opening.

Fill the steering head or expansion tank with hydraulic oil.

With dual operation system, remove the filler cap from the lower steering head and refit as soon as oil comes out of the filler opening. For the type of hydraulic oil, see 'Technical data'.

During filling, ensure that there is always sufficient oil in the steering head or expansion tank; if the steering pump sucks in air it will have to be bled again.

Fill the steering head or expansion tank slowly and carefully to prevent air being taken in with the oil.

1 Fit a length of hose, 8 mm. dia. (MTC30: 6 mm), to the air bleed nipples; open the nipple by turning the hexagonal nut to the left.

Steering System with 1 steering pump

2-1 Open air bleed nipple 'A'. Move the piston rod until the piston reaches the end cover 'A'.

Now slowly turn the control wheel on the steering pump in the direction shown. Stop turning as soon as the oil

from bleed nipple 'A' contains no more air.

Close the bleed nipple. DO NOT turn the control wheel in the opposite direction.

2-2 Open air bleed nipple 'B'. Turn the control wheel until the piston reaches the end cover 'B'.

2-3 Now slowly turn the control wheel in the direction shown.

Stop turning as soon as the oil from bleed nipple 'B' contains no more air. Close the bleed nipple.

Fill the steering pump or oil expansion tank to the correct level.

The oil level should be checked often during the first few days after filling to check the level and top up if necessary. The oil level can fall as minute air bubbles escape.

Steering System with 2 steering pumps

3-1 Open air bleed nipple 'A'. Move the piston rod until the piston reaches the end cover 'A'.

First, slowly turn the control wheel on the lower steering pump in the direction shown. Stop turning as soon as oil from bleed nipple 'A' does not contain any more air. Now, slowly turn the upper steering pump control wheel in the direction indicated. Stop turning as soon as no air can be seen in the oil coming from nipple 'A'. Close the air bleed nipple. DO NOT then turn either of the control wheels in the opposite direction.

3-2 Open air bleed nipple 'B'. Turn the control wheel on the lower steering pump until the piston reaches the end cover 'B'.

3-3 First, slowly turn the control wheel on the lower steering pump in the direction shown. Stop turning as soon as oil from bleed nipple 'B' does not contain any more air. Now, slowly turn the upper steering pump control wheel in the direction indicated.

Stop turning as soon as no air can be seen in the oil coming from nipple 'A'. Close the air bleed nipple.

Fill the top steering pump or oil expansion tank to the correct level.

Air in the steering pump can be recognised by a gurgling noise when the steering wheel is turned.

Technical data

Cylinder	MTC30	MTC52	MTC72	MTC1 25	MTC1 75
Type	Balanced cylinder				
Stroke	150 mm (5.91")	160 mm (6.3")	225 mm (8.86")	160 mm (6.3")	225 mm (8.86")
Volume	67 cm ³	104 cm ³	146 cm ³	253 cm ³	356 cm ³
	4.1 cu.inch	6.3 cu.inch	8.9 cu.inch	15.5 cu.inch	21.7 cu.inch
Max. ruddertorque	294 Nm	510 Nm	706 Nm	1226 Nm	1717 Nm
	30 kgm (216 ft.lb)	52 kgm (376 ft.lb)	72 kgm (521 ft.lb)	125 kgm (904 ft.lb)	175 kgm (1266 ft.lb)
Operating pressure	40 bar	56 bar			
	580 psi	797 psi			
	3923 kPa	5492 kPa			
Rudder torque at 35*	235 Nm	412 Nm	589 Nm	981 Nm	1373 Nm
	24 kgm (173 ft.lb)	42 kgm (304 ft.lb)	60 kgm (434 ft.lb)	100 kgm (723 ft.lb)	140 kgm (1013 ft.lb)
Connections	G 1/4 internal thread				
Weight	1.8 kg (4 lbs)	3.4 kg (7.4 lbs)	3.8 kg (8.4 lbs)	7.1 kg (15.7 lbs)	8 kg (17.6 lbs)

Steering Pump	HTP2O(R)	HTP3O(R)	HTP42(R)
Type	Axial plunger pump		
Number of plungers	5	5	7
Capacity	19.7 cm ³ /omw.	30.0 cm ³ /omw.	42.0 cm ³ /omw.
	1.2 cu.inch/rev.	1.8 cu.inch/rev.	2.6 cu.inch/rev.
Operating pressure	max. 40 bar (580 psi, 3923 kPa), at e 8 mm tube diameter		
	max. 56 bar (797 psi, 5492 kPa), at e 10 mm tube diameter		
Connections	G 1/4 internal thread		
Filler cap	G 3/8 internal thread		
Weight, without built-in non-return valve	3.3 kg (7.3 lbs)		
Weight, with built-in non-return valve	4.1 kg (9.0 lbs)		
Maximum wheel diameter	38 cm (15 ins)	38 cm (15 ins)	53 cm (21 ins)
Setting pressure relief valve (only by pumps with built-in no-return valve)	40 bar (580 psi, 4000 kPa) at o 8 mm tube diameter		
	70 bar (1015 psi, 7000 kPa), at e 10 mm tube diameter		

Non-return valves	Separate dual non-return valve	Built-in non-return valve
Type	Dual control non-return valve	Single control non-return valve
Ratio piston – non-return valve	4:01	4:01
Connections	G 1/4 internal thread	G 1/4 internal thread
Weight, excl. connections	2.2 kg (4.9 lbs)	0.6 kg (1.3 lbs)

Tubing

Steering pump Cylinder	HTP20(R)	HTP30(R)	HTP42(R)
MTC30	nylon tubing 6 mm I.D., 8 mm O.D. *		
MTC52	nylon hose 6 mm I.D., 10 mm O.D. * or soft annealed red copper/ steel tubing 8 mm I.D., 10 mm O.D. **		
MTC72			
MTC125			
MTC175			
* Maximum length, tube/ hose 6 mm I.D.	41 m (134 ft)	28 m (91 ft)	20 m (65 ft)
** Maximum length, tube/ hose 8 mm I.D.	100 m (328 ft)	67 m (220 ft)	48 m (157 ft)

No. of turns steering wheel H.O. to H.O.

Steering pump Cylinder	HTP20(R)	HTP30(R)	HTP42(R)
MTC30	3,4	2,3	–
MTC52	5,3	3,5	2,5
MTC72	7,5	4,9	3,5
MTC125	–	8,5	6,1
MTC175	–	–	8,5

Hydraulic fluid

Hydraulic oil	: In accordance with ISO VG 15
Viscosity	: 14 cSt at 40°C
Viscosity index	: Greater dan 380
Solidifying point	: Below -60°C

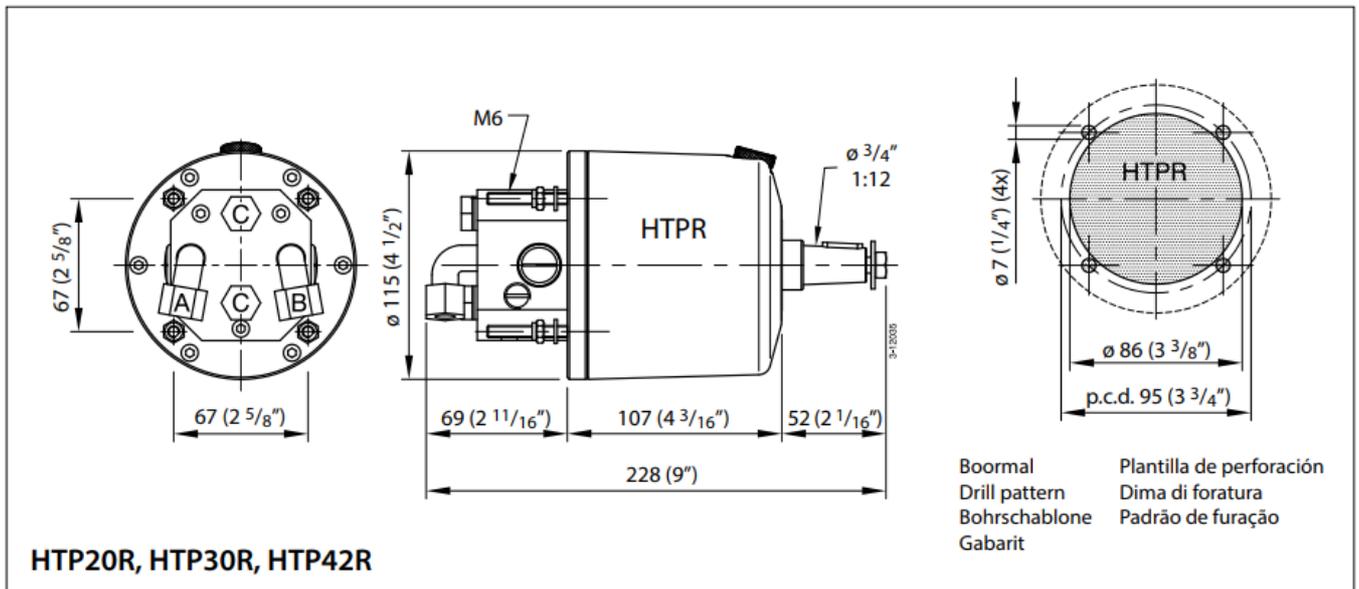
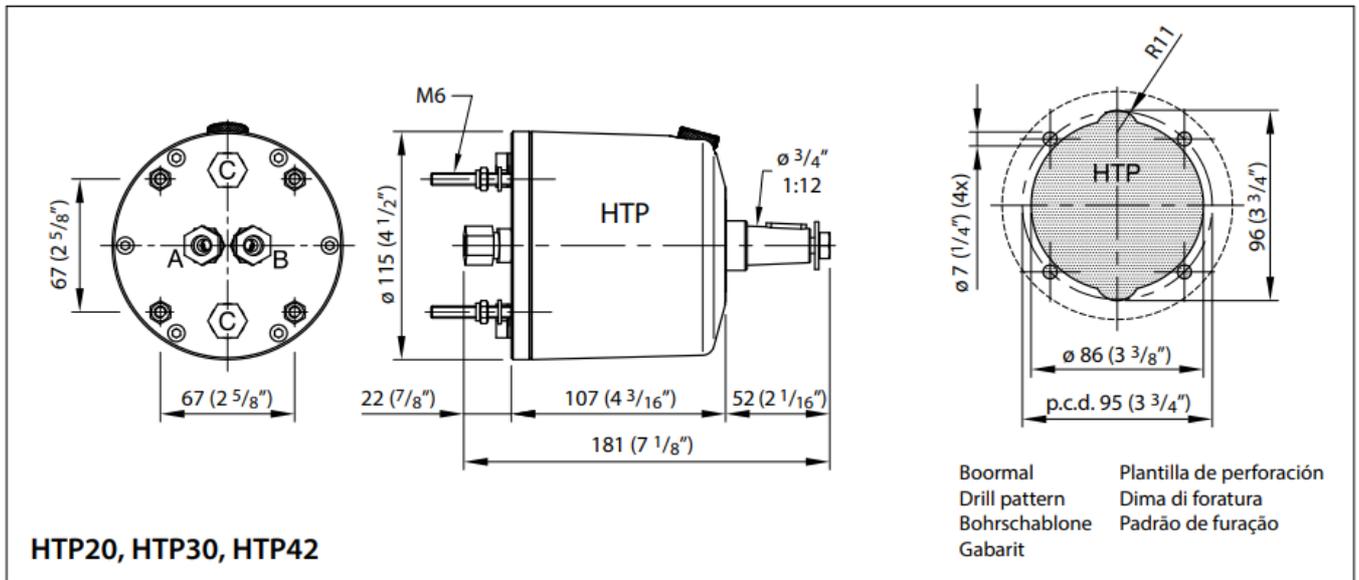
The following hydraulic oils fulfil the above specifications:

VETUS	Hydraulic oil HF15
Shell	Aeroshell Fluid 4
Chevron Texaco	Aircraft Hydraulic 5606G
Esso	Univis HVI 13
Exxon Mobil	Mobil Aero HFA

Maintenance

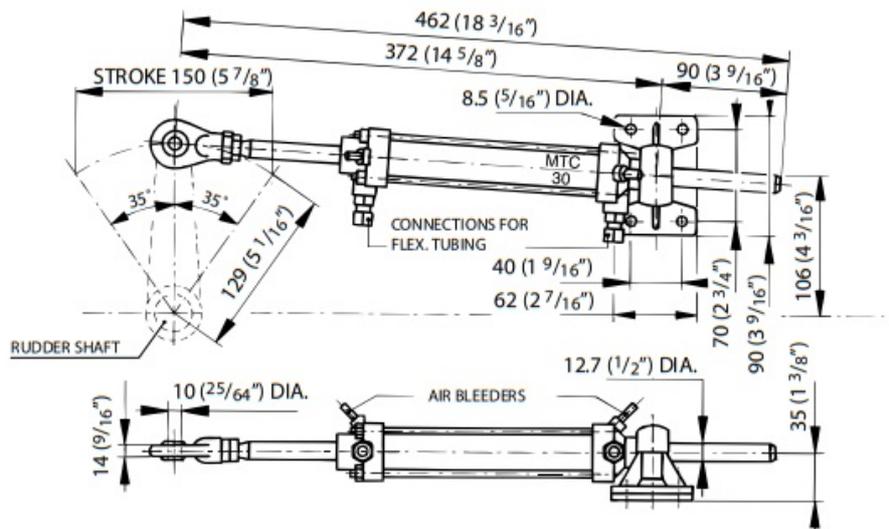
- Check the oil level in the top steering pump regularly. When the installation includes an extra oil expansion tank, the oil level should be halfway up this tank.
- Check regularly to ensure that the steering pump shaft and cylinder piston rod are not dirty; clean when necessary to prevent damage to the oil seal.
- Clean the piston rod regularly (with fresh water after sailing on salt water) and lubricate with a corrosion-resistant oil (not grease).
- At regular intervals, lubricate at the cylinder side both the pivots of cylinder support and clevis.
- Drain and replace the hydraulic oil once every 3 years, or after every 300 operating hours.

Overall dimensions

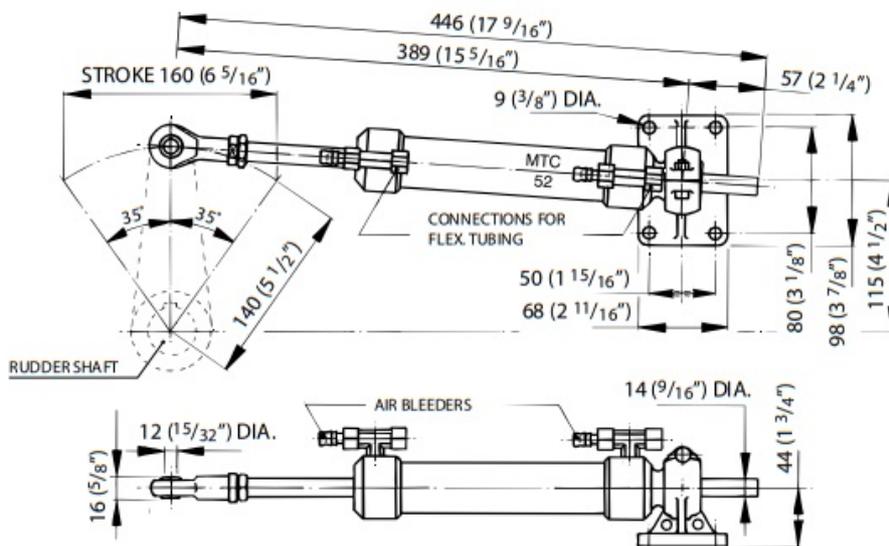


Connections

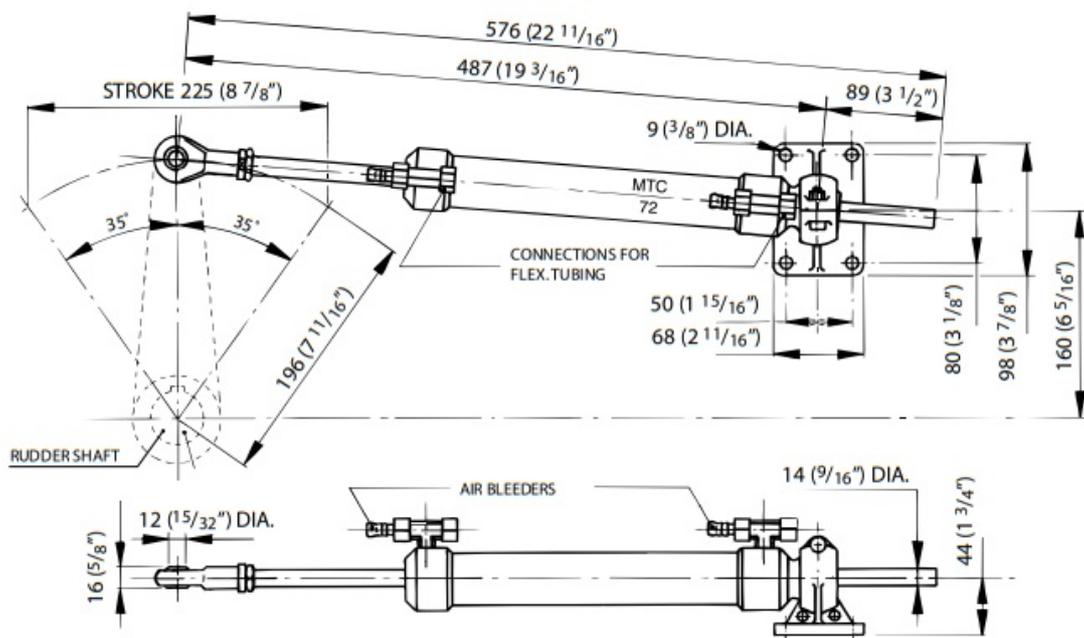
- A, B Cylinder connections
- C Balance tube connection



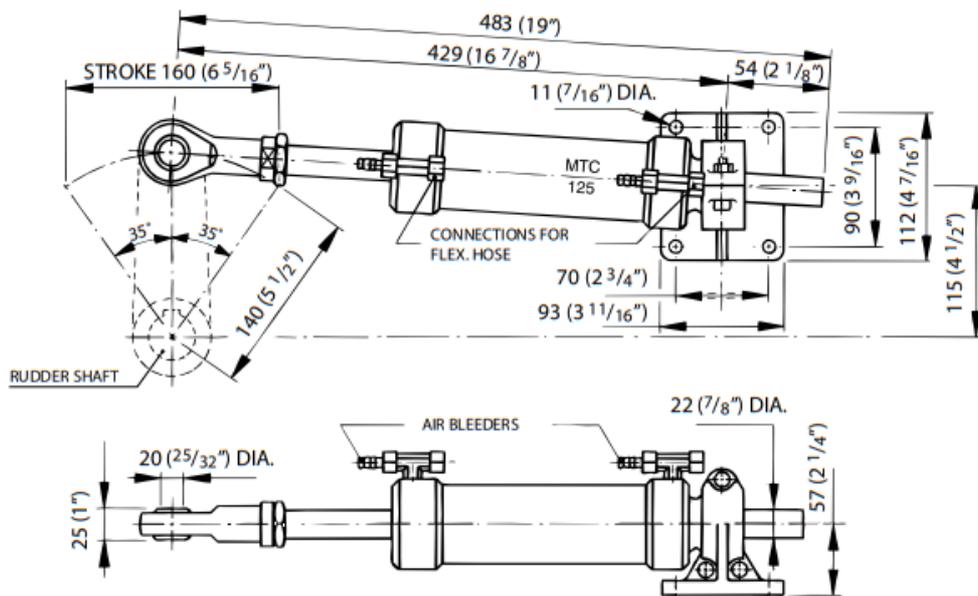
MTC30



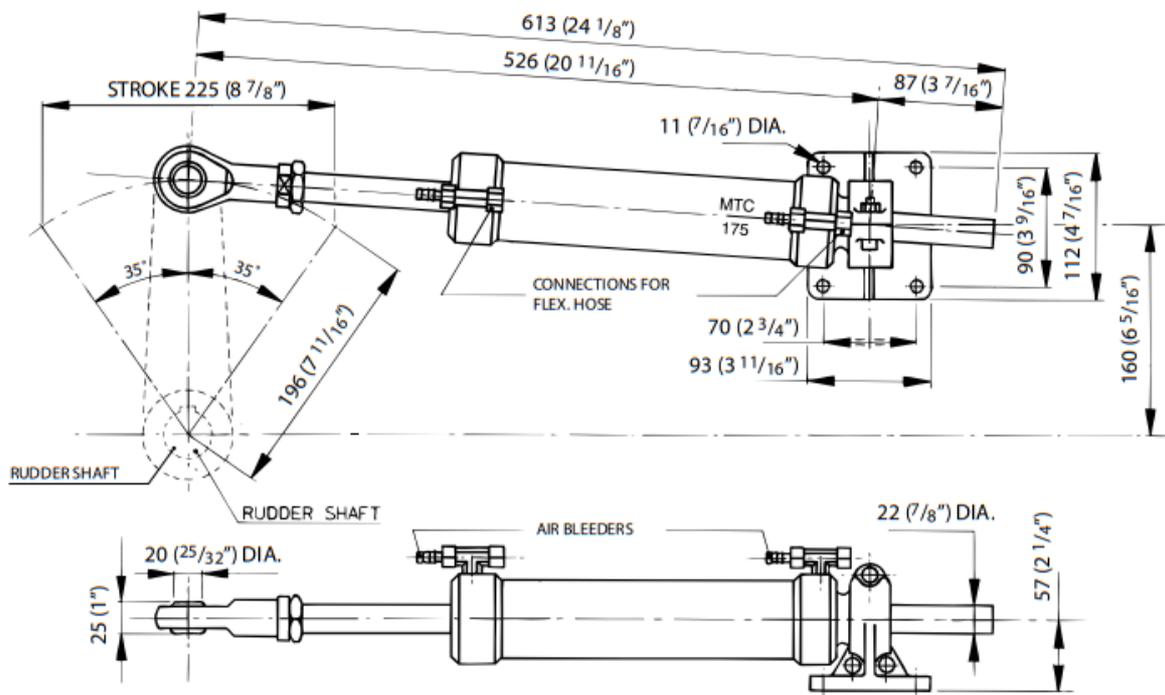
MTC52



MTC72



MTC125

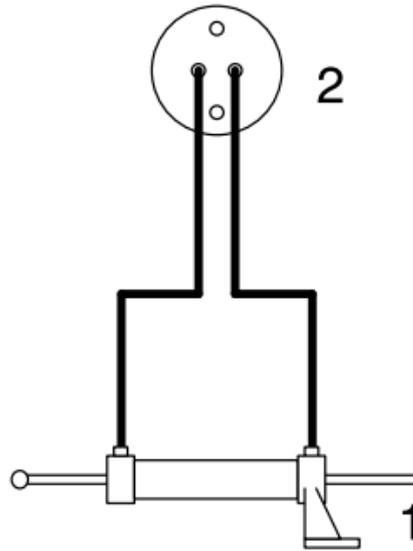


MTC175

Hydraulic diagrams

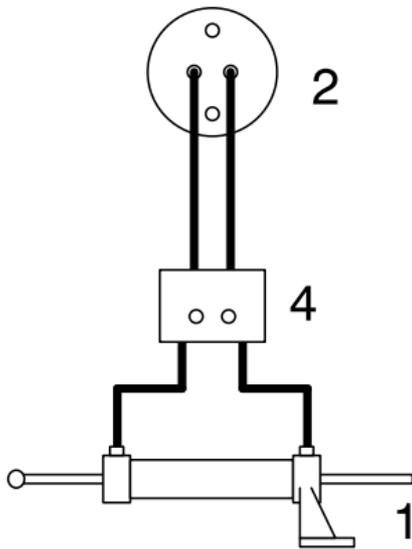
Hydraulic steering, single station

A

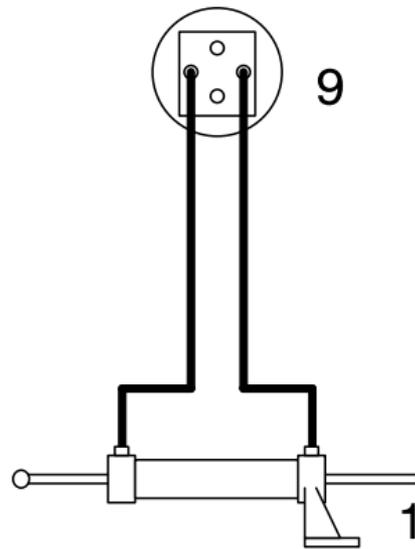


Hydraulic steering, single station with non-return valve

B1

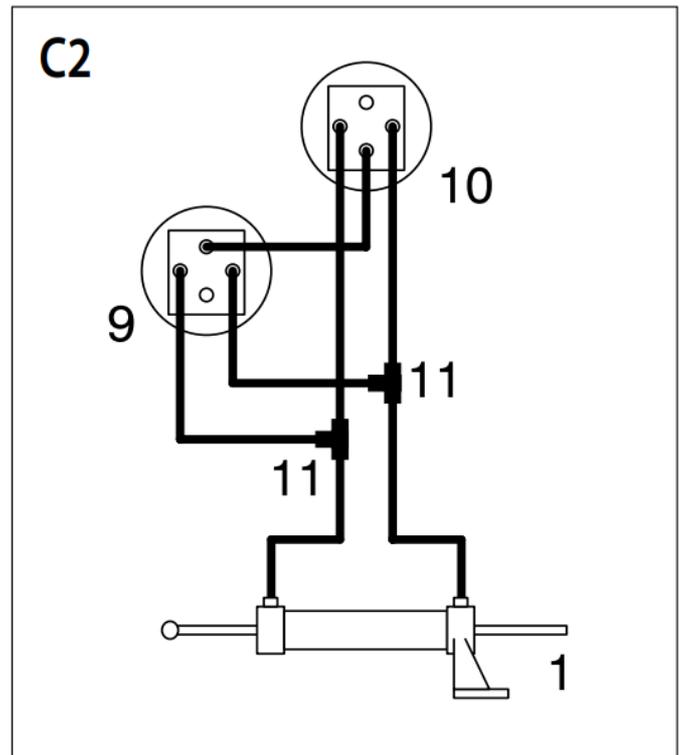
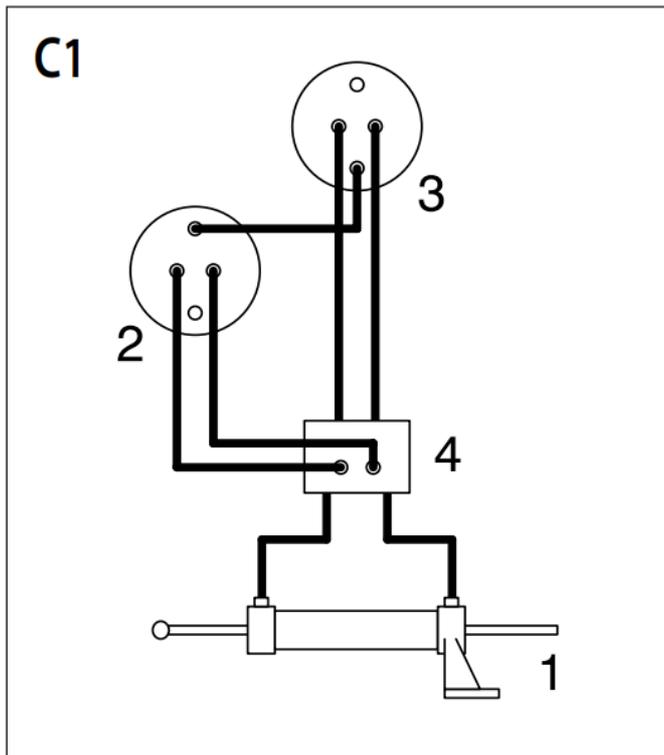


B2

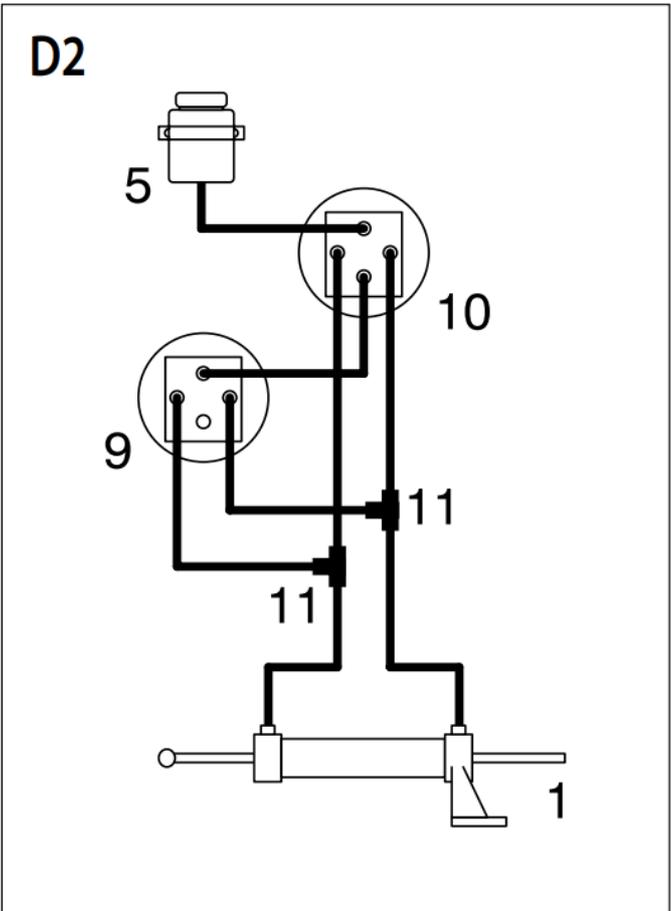
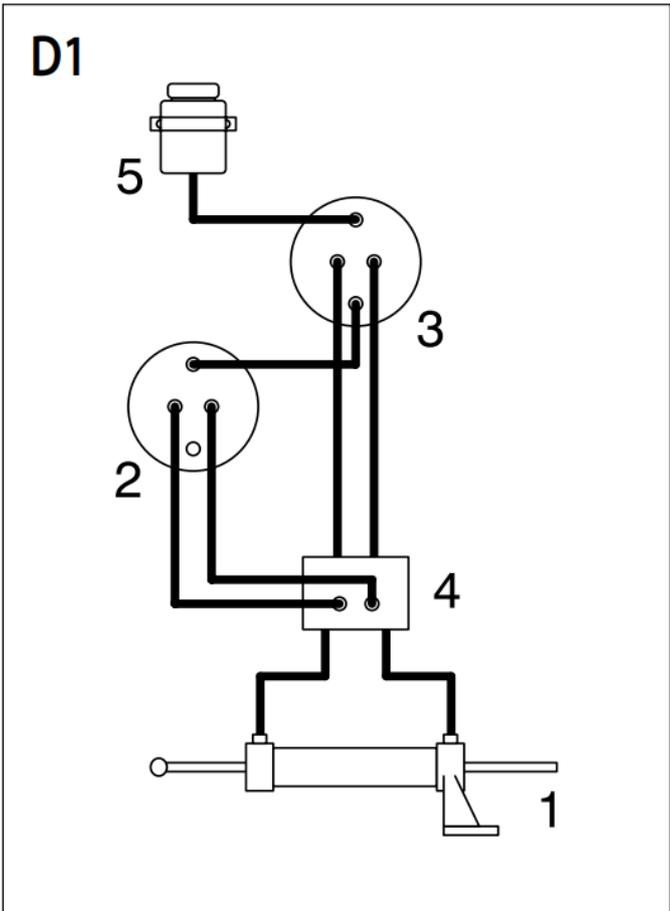


1	Cylinder
2	(Lower) steering pump
3	Upper steering pump
4	Separate dual non-return valve
5	Oil expansion tank
6	Electro-hydraulic pump with non-return valve
7	Electro-hydraulic pump, without non-return valve
8	By-pass valve
9	(Lower) steering pump with non-return valve
10	Top steering pump with non-return valve
11	T-piece

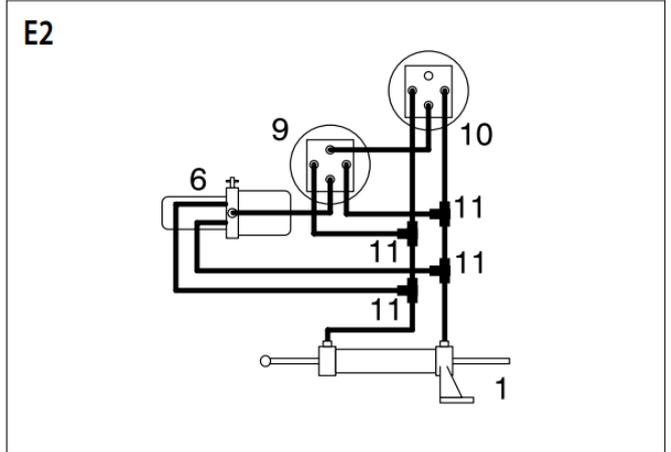
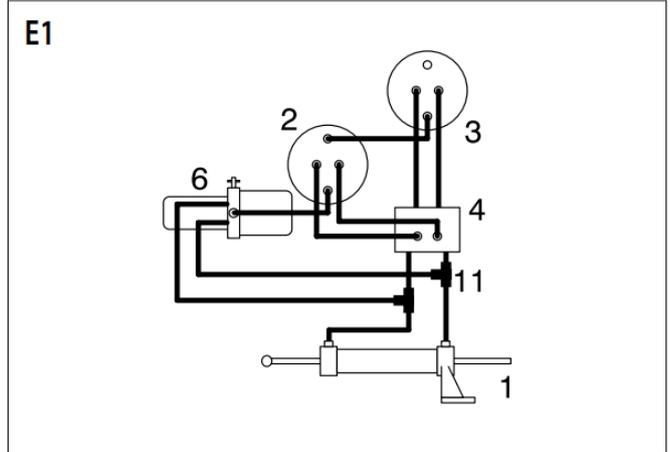
Hydraulic steering, dual station



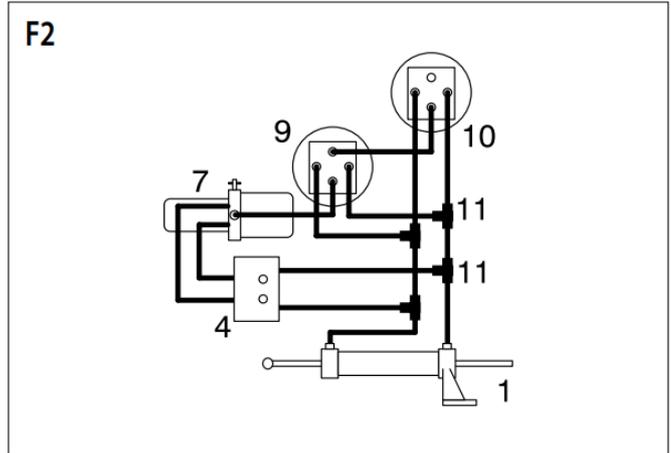
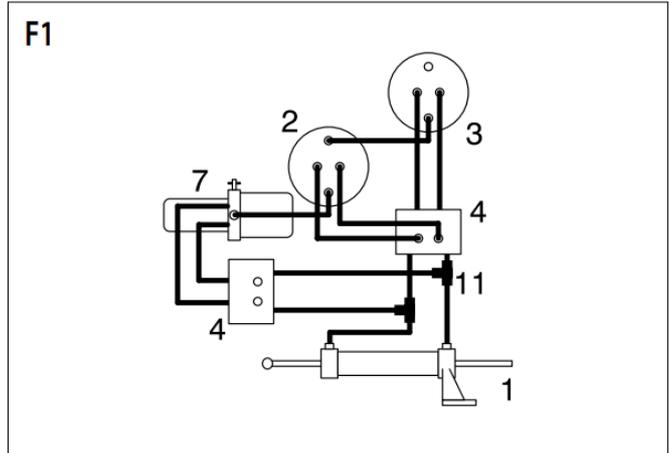
Hydraulic steering, dual station with oil expansion tank



Hydraulic diagrams

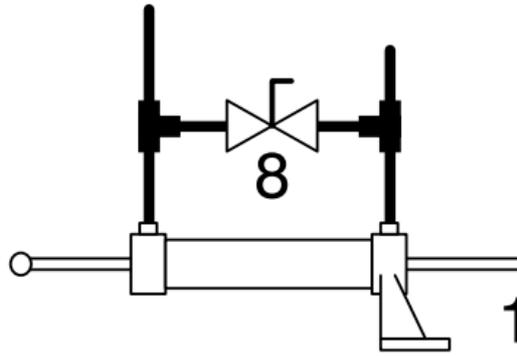


Hydraulic steering, dual station with electro-hydraulic pump (with non-return valve)



By-pass valve for emergency or tiller operation

G



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Documents / Resources

	<p>vetus MTC30 Series Hydraulic Steering System [pdf] Instruction Manual MTC30, MTC52, MTC72, MTC125, MTC175, MTC30 Series, MTC30 Series Hydraulic Steering System, Hydraulic Steering System, Steering System</p>
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References

- [\[V\] Making boating easy and carefree all over the world - VETUS](#)

[Manuals+](#)