

# **Steering Gear Manual**

February 2001

# CONTENTS

<b>STEERING GEARS FROM SCAN-STEERING.....</b>	<b>3</b>
<b>1. Installation of Scan-Steering Hydraulic Steering Gear .....</b>	<b>5</b>
1.1 Base Plate.....	5
1.2 Tiller.....	6
1.3 Cylinder.....	6
1.4 Wheel pump.....	7
1.5 Non-Return Valve.....	7
1.6 PSU Pump Unit(s).....	8
1.7 P10 + PV20/PV30 Power unit.....	8
1.8 Pipes/Flexible Hoses.....	9
1.9 Hydraulic oil.....	9
<b>2. Testing and Air Bleed procedure. ....</b>	<b>10</b>
<b>3. Maintenance. ....</b>	<b>11</b>
<b>4. Trouble-Shooting. ....</b>	<b>12</b>

## STEERING GEARS FROM SCAN-STEERING

Scan-Steering can deliver steering gear for almost any type of vessels.

The steering gears are ram type and can be delivered as hand-hydraulic or power operated with one or more pump units, or as a combination of both systems.

The power units can be driven either by electrical motor or mechanically driven by V-belt from Main Engine.

Steering gears from Scan-Steering can be delivered with various types of valves. The type and numbers of valves can vary according to various demands from Classification Authorities, numbers of wheel pump, power units, oil tanks, etc. Further the type of rudder to be operated by the steering gear might influence on the type of valves used.

The following types of valves can be included in scope of delivery or mounted on steering gear/power unit(s):

### **A. Non-Return Valve.**

Will be delivered when steering gear is supplied with wheel pump. Depending on type of wheel pump the non-return valve will be delivered build into pump or as a separate valve to be mounted on the pipes connecting the wheel pump with the steering gear.

Function: Prevent the wheel from turning when forces act on rudder and keeps rudder locked in chosen position.

### **B. Shut-Off Valves (1)**

4 pcs. of shut-off valves are mounted on steering gear distributor block (cylinder hose connection) (2-cylinder type steering gear).

Function: Corresponding valves must be closed in case of internal or external leak in a cylinder, or burst hose. This will make it possible to continue operation of steering gear with 1 cylinder in operation. Note: Air bleed valves must be opened on faulty cylinder.

### **Shut-Off Valves (2)**

Shut-off valves mounted on steering gear distributor block (pump unit connection). Number of valves varies according to number of pump units.

Function: To be closed in case of leakage in pipes or malfunction of pump unit(s)/wheel pump.

Will prevent drainage of complete system during repair.

**Shut-off Valves (3)**

Mounted on oil tank(s)

Function: Same as above.

**C. Shock/Overload Valve**

Mounted on steering gear distributor block.

Function: Prevents overload of system. The valve is preset according to rule of Classification Authority and will by-pass ram unit in case of chock/overload.

Adjustment: Loosen nut and turn clockwise for higher pressure setting. Turn counter-clockwise for lower pressure setting. Tighten nut after adjustment.

**D. By-pass Valve**

Mounted on steering gear distributor block.

Function: When opened the valve will by-pass oil flow in ram unit allowing emergency mechanical steering in case of total break down of pump unit(s).

**E. Solenoid Valve**

Mounted on PSU Power unit or PV20/30 Control Valve Unit.

Function: Controls Rudder movements by means of autopilot or FFU/NFU rudder control

The valve can be activated manually by pressing pin in center of solenoid.

**F. Counter Balance Valve**

Mounted on PSU Power unit or PV 20/30 Control Valve Unit.

Function: Locks rudder in chosen position and controls return oil flow from ram unit.

Adjustment: Loosen nut and turn clockwise for lower pressure setting. Turn counter-clockwise for higher pressure setting. Tighten nut after adjustment.

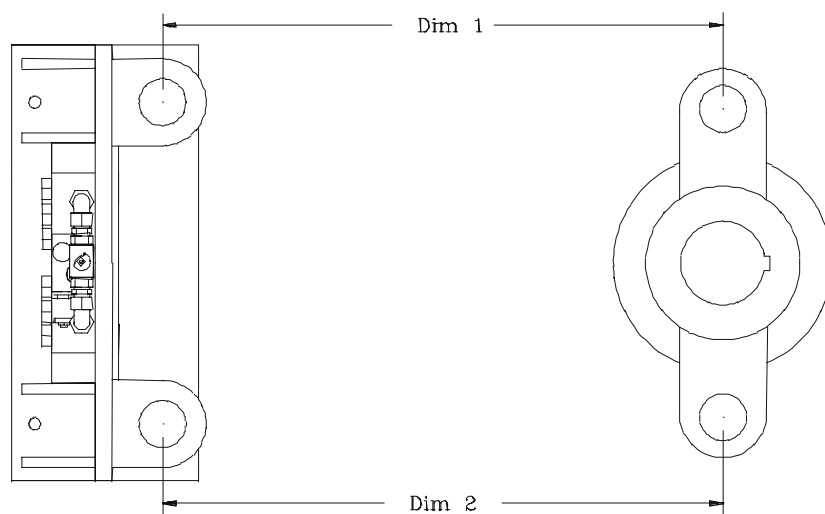
## 1. Installation of Scan-Steering Hydraulic Steering Gear

### 1.1 Base Plate.

Scan-Steering steering gears can be delivered with either full base plate with built-in rudder stock bearing or with foundation plate for cylinder only.

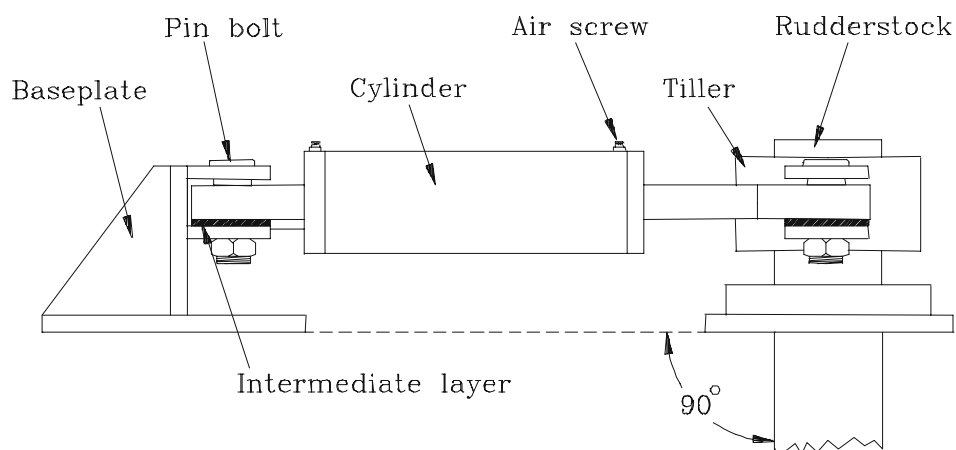
Install steering gear such that the angle between rudder stock and base plate will be exactly 90 degree. (Fig. No.1)

The distances between Centers are to be found on assembly drawing.



The steering gear can be installed at any angle to centerline of vessel. Please notice that keyway in rudder stock must be machined according to installation angle of steering gear.

Make sure that distance from center of rudder stock to center line of pin bolts on foundation plate is correct if steering gear is delivered with cylinder foundation only.



## 1.2 Tiller

Install tiller on top of rudder stock.

The tiller will be delivered with cylindrical or conical bore according to requirement and with keyway machined according to requirement of Classification Authority.

## 1.3 Cylinder

Mount cylinder on base plate and tiller such that air bleed valves are at top position and hose connections are pointing at center line of steering gear. Please notice that cylinder support must be mounted under cylinder bearings.

**Notice:** The pin bolts (Fig. No. 1) for mounting cylinder(s) onto tiller/foundation plate is made in such a way that the part of the bolt fitting to the bearing is made with a very close tolerance while the parts fitting to the plates are slightly conical. Make sure that cylinder bearing is situated very precise when mounting pin bolt. If possible freeze pin bolt before mounting as this might ease installation.

Mount hoses according to drawing (Fig. No. 2) and in such a way that air can escape either to cylinder or distributor block.

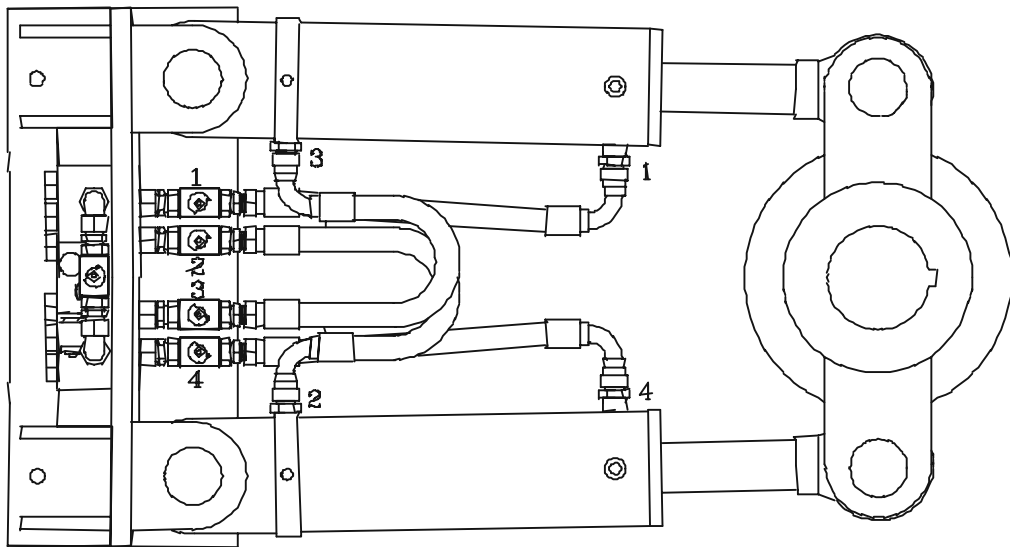


Fig. No. 2

## 1.4 Wheel pump

The wheel pump is an axial piston pump and comes in different sizes according to the size of the steering gear. The wheel pump can be used as main pump in a hand-hydraulic steering system or as an emergency pump in a power operated steering system.

Connect Wheel pump to ram unit distributor block by means of steel pipes. The wheel pump is fitted with 18 mm pipe connectors.(Fig. No. 3)  
Connect wheel pump to power unit tank outlet if system is supplied with power unit.(Fig. No. 4)

Connect top of wheel pump to tank if tank is required.

Please notice that tank must be installed higher than wheel pump.

The wheel pump can be mounted in a steering column or it can be panel mounted. The pump can be placed in wheel house, engine room or steering gear room.

**Notice:** The wheel pump must be mounted higher than the steering gear.

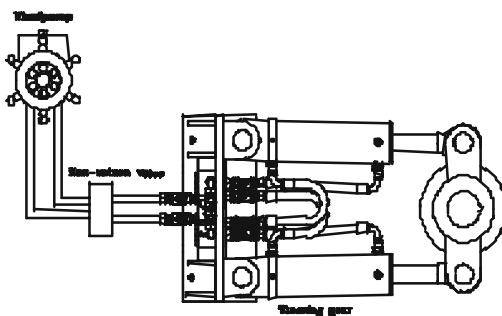


Fig. No. 3

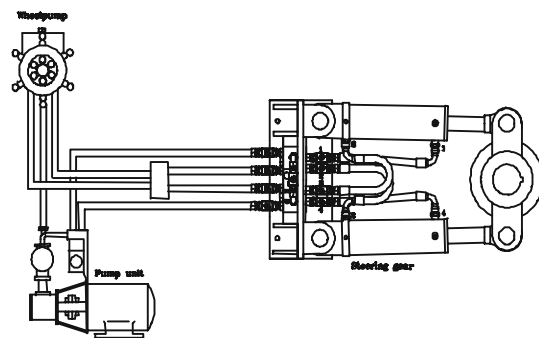


Fig. No. 4

## 1.5 Non-Return Valve

The non-return valve must be mounted on the two pipes connecting wheel pump to steering gear.(Fig. No. 3) Preferable the valve should be mounted as close to the ram unit as possible.

**Function:** Prevents steering wheel from turning when power unit(s) is in operation by locking oil flow from power unit(s) and keeps rudder locked in chosen position.

## 1.6 PSU Pump Unit(s)

The steering gear can be delivered with 1, 2, or more PSU electro-hydraulic pump unit(s).

The PSU power unit is delivered as a complete unit with electrical motor, pump, filter, solenoid valve, and counter balance valve.

The power unit can be installed in steering gear compartment or engine room.

Connect Outlets on top of pump unit distributor block to ram unit and outlet on side of distributor block to wheel pump/oil tank.

Connect electrical motor to starter unit according to starter unit manual and check that motor is running in correct direction (see arrow on clutch).

Connect solenoids to autopilot/rudder control unit according to corresponding manual.

**Notice:** The pump must be mounted lower than wheel pump/oil tank and in such a way that air can escape or be bled out of the system.

## 1.7 P10 + PV20/PV30 Power unit.

Install P10 oil pump such that pulley on main engine can be used for driving pump and make sure that revs. of pump will be between 900 - 3000 RPM when engine is idling/going full speed.

**Notice:** the V-belt must not be tightened to hard as this can damage pump bearings.

Check that pump is turning in correct direction (see arrow on pump).

Install PV20/PV30 control valve unit above oil pump and connect to pump by means of hydraulic hoses or steel pipes avoiding unnecessary twist and bends so that no air pockets will occur in system.

Connect outlets on top of control valve unit distributor block to ram unit and outlet on side of distributor block to wheel pump/oil tank.

Connect solenoids to autopilot/rudder control unit according to corresponding manuals.

**Notice:** Pump and control valve unit must be mounted so that air can escape or be bled out of the system



### 1.8 Pipes/Flexible Hoses.

Connect outlets on ram units to outlet on Power unit/ wheel pump using steel pipe of proper dimension (preferable stainless steel).

The pipes must be installed in such a way that there is a smooth rise from pump unit to ram unit and from ram unit to wheel pump and no air pockets can occur in the system.

It is advisable to bend pipes instead of using V-fitting where possible as this will secure a more smooth oil flow with smaller pressure drop.

Make sure that pipes are properly cleaned inside before mounting

Flexible hose must be mounted according to drawing.

### 1.9 Hydraulic oil.

Fill system with oil through oil tank or wheel pump.

Open air bleed valves on cylinders and leave them open until no more air is coming out of the valves.

If system is supplied with wheel pump the pump must be turned from hard-over to hard-over until no more air is coming out of the bleed valves on cylinders.

Loosen hoses on P 20/30 to bleed pump and filter unit if system is supplied with P10 + PV20/30 power unit system

Bleed power unit by loosening pipe connections on top of distributor block if system is supplied with PSU power unit.

**Notice: Power units must be turned off during this bleeding procedure.**

Leave system 4 - 8 hours and bleed again.

#### **Recommended Type of Oil:**

BP:	HLP50
Calpham:	EP Hydraulic No. 12
Castrol:	Hyspin AWH15
Esso:	Nuto HP 15
Shell:	Tellus T-15
Statoil:	Hydraway HVXA-15
Texaco:	Rando HP-15

## 2. Testing and Air Bleed procedure.

If system is supplied with wheel pump turn pump and check that rudder is turning to the correct side. Interchange pressure pipes from wheel pump on ram unit if rudder is turning to the wrong side. Turn wheel pump until steering gear is in hard over position and keep pressure on pump. Now open air bleed valves on pressure side of cylinders and keep open until no more air comes out.

Turn wheel pump to the other side until steering gear is in hard over position and repeat air bleed procedure on pressure side of cylinder.

Repeat the whole procedure until no more air is coming out of the bleed valves.

If system is supplied with electrical power units only (without wheel pump) the following air bleed procedure must be followed:

Start one of the power units and check that pump is running in correct direction (see arrow on clutch)

Activate solenoid valve by pressing pin in center of solenoid until steering gear is in hard-over position.

Open cylinder bleed valve until no more air is coming out.

Repeat procedure to the other side.

Repeat procedure using other pump unit.

### 3. Maintenance

After the first voyage all connectors must be tightened when oil is still warm. Pipes and connectors must settle in new installations and it might be necessary to tighten all connectors several times.

All bearings in steering gear must be greased once every month.

Check frequently that oil level in wheel pump is correct, (ap 25 mm under oil fill thread). To low oil level might result in air being pumped into the system.

It is recommended that steering gear is smeared with water resistant grease if steering gear is placed such that it can be flushed by sea water.

## 4. Trouble-Shooting

- A. Check that all hoses, pipes and connections are tight without any leak.
- B. If wheel is turning when steering gear is activated either by autopilot or steering switch this will indicate that there is air in the system or that there is a failure (leak) in non-return valve.
- C. Turn steering gear to hard-over position by mean of wheel pump. When in hard-over position check that there is no elastic effect when pressing wheel. If so there is air in the system and air bleed procedure must be followed.  
If steering wheel does not lock when steering gear is in hard-over position there might be a leak in piston gasket or in one of the non-return valves.  
Repeat procedure to the other side.  
If air is coming out of top of wheel pump there might be to much oil in pump or air in the system.  
Check the oil level in pump and bleed system following the above mentioned bleeding procedure.
- D. Turn steering gear by mean of steering switch or autopilot. If this cannot be done then try to activate solenoid valve manually by pressing the small pin in center of solenoid end. If this results in turning of steering gear the malfunction is due to electrical failure.  
If steering gear is not moving when activating solenoid valves: Check that all valves are set correctly. Check that pump is running in correct direction. Check that pump is working correctly.  
If not Repair/Replace pump.  
Try to turn steering gear using wheel pump or other power unit. Install new solenoid valve if steering gear can be activated by either wheel pump or other pump unit.
- E. Check that chock/safety valve is working properly by activating steering pressing the small pin in center of solenoid end on power unit solenoid valve.