Assembly Instruction
Hydraulic Lateral Device

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1 General

Lateral stays (top bracing) are installed where countermeasures against dynamic effects are necessary (for indications refer to the Marine Installation Manual (MIM), chapter Engine Dynamics). The main function is to shift the natural frequencies to a higher speed range if resonance is expected. For stays arrangement and details refer also to the relevant marine installation drawings (MIDS) of the corresponding design group 9715. It is vital that the stays are fitted correctly to ensure proper operation and to prolong the lifetime of the components.

2 Description

Single-acting hydraulic stays according to WinGD design are to be fitted between the engine and the ship hull on fuel pump side and on exhaust gas side (min. two stays per side). They transmit lateral forces from the engine via round bars to the ship hull. During loading and unloading, the stays are able to adapt the deformations of the ship's hull within its stroke. The oil in the hydraulic cylinder provides in this regard a good damping effect and the finally transmitted force is reduced (limited static reaction force).

The hydraulic lateral fixation device mainly consists of (refer to figure 1 and figure 2):

- Hydraulic cylinder with filling- and throttling valve either according to design 200 or design 201

  Design 200: Compact execution with attached hydro accumulator

  Design 201: Hydro accumulator detached for separate installation (fittings included, but connection steel pipe ø 10 x 2 delivered by the yard)

- Stays (round bars) for transmission of lateral forces between engine and ship's structure (to be prepared by the shipyard)
- Adjusting screws

Required equipment (tools) needed for installation of the stays:

- A crane, for lifting and positioning the components in the engine room
- Tester and pressuriser for nitrogen (refer to chapter 10.2)
- Hand pump for hydraulic oil (contained in the standard engine tool set)

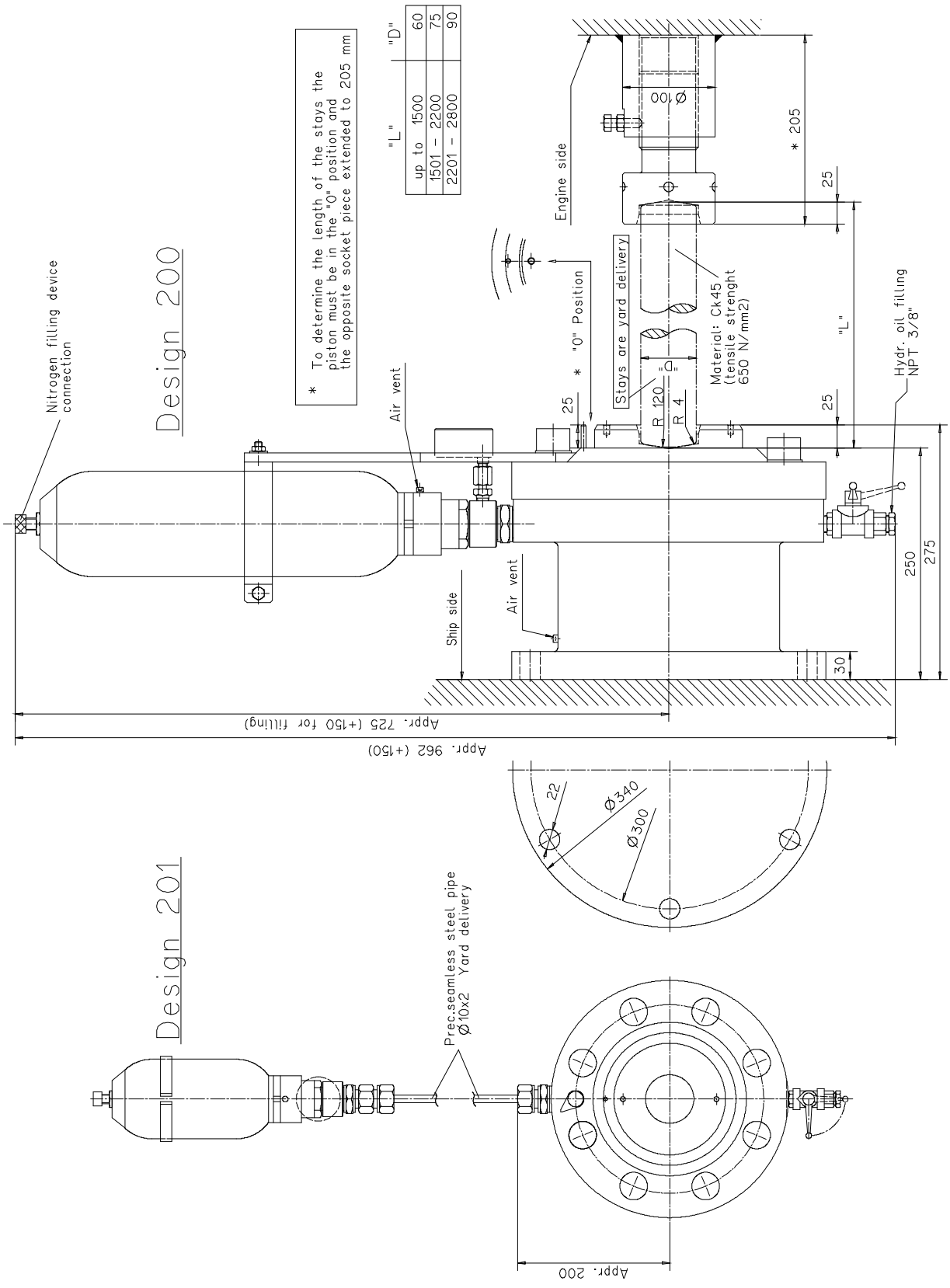

Figure 1: Hydraulic lateral device assembly parts

Substitute for:										PC	Q-Code	X	X	X	X	X
Modif	A	7-14.240	08.03.1995	B	7-14.418	10.11.1999	C	EAAD085876	23.04.2015							
		Number	Drawn Date		Number	Drawn Date		Number	Drawn Date		Number		Drawn Date			

Winterthur Gas & Diesel	Product **W-2S**	**HYDRAULIC LATERAL DEVICE** **Assembly Instruction**			
Made 23.08.1984 M.Lüthi	Main Drw.	Page 3 / 15	Material ID **107.165.820.500**		
Chkd 23.08.1984 M.Lüthi	Design Group **9715**	Drawing ID **107.165.820**		Rev **C**	
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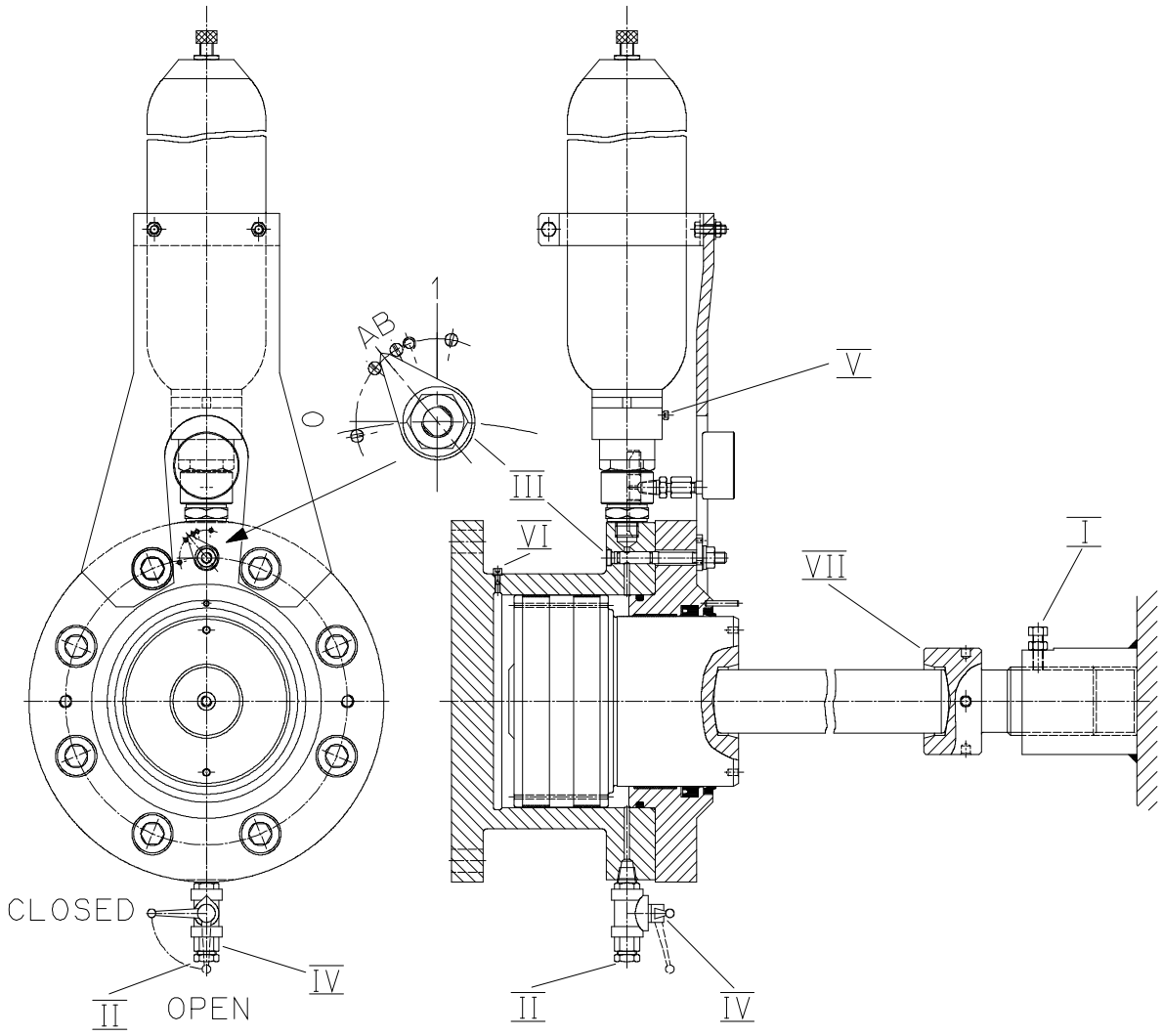

Figure 2: Hydraulic cylinder detail view

I	Set bolt
II	Plug
III	Throttling valve
IV	Filling valve
V	Vent screw
VI	Vent screw
VII	Adjusting screw

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Modif	A	7-14.240	08.03.1995	B	7-14.418	10.11.1999	C	EAAD085876	23.04.2015										
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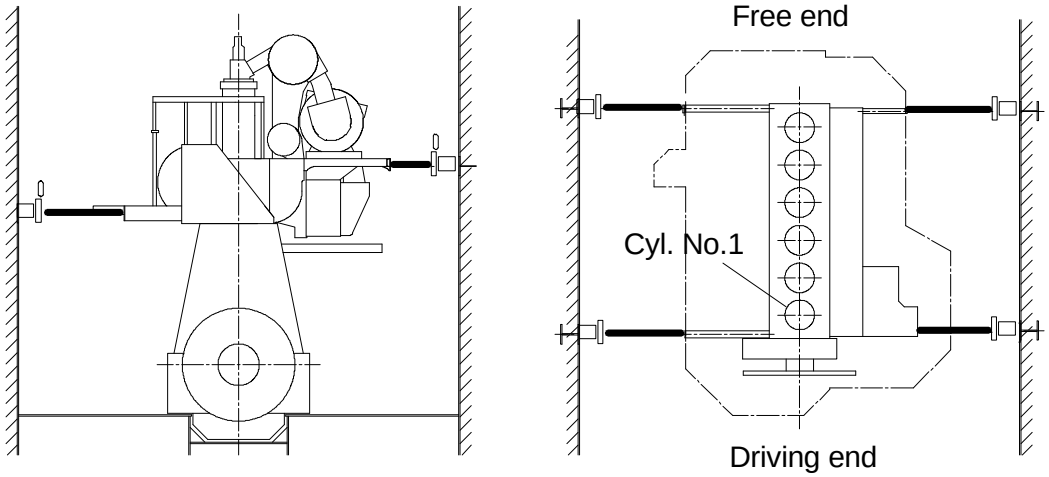

Figure 3: Principle of lateral stays assembly
(For details see drawing DG9715, ENGINE STAYS, HYDRAULIC TYPE of the relevant engine)

3 Function

Transverse vibrations of the engine cause rapid pressure fluctuations in the hydraulic cylinder. Thereby the unit behaves like a strong spring. By using the throttling valve (pos. III in figure 2), the spring rate can be adjusted such that the rapid pressure fluctuations are practically filtered off and do not continue into the hydro accumulator. The hydraulic cylinder nevertheless adjusts itself to the slow deformations of the ship's hull.

4 Installation

The hydraulic cylinders are to be bolted to the reinforced attachment points on the ship’s structure. The adjusting screws are welded on the engine at the position shown on the relevant arrangement drawing from the engine builder (DG9715, ENGINE STAYS). The stay’s length 'L' shown on figure 1 is to be determined by the shipyard and the related diameter 'D' has to be taken from the table on the stays arrangement drawing (DG9715, ENGINE STAYS).

5 Commissioning

Commissioning of the hydraulic cylinders should be carried out as follows shortly before the sea trial (refer to figure 2):

- The stay is to be fitted between the hydraulic cylinder and the adjusting screw on engine side and secured against dropping.

The adjusting screw is to be set as shown in figure 2 (axially: piston face and indicator pin to be on same plane; radially: pin and holes in line). Set bolt pos. I to be secured.

- The hydro accumulators are delivered pre-pressurised to 10 bar. The pressure is to be raised according to the specification in table 1 with support of the test pressuriser (see chapter 10.2).
- The plug (pos. II) is to be removed for filling in hydraulic oil and the flexible hose connected to the hand pump. Throttling valve (pos. III), filling valve (pos. IV) as well as vent screws (pos. V) on the hydro accumulator (pos. IV) and on the hydraulic cylinder must be open (throttling valve switched to mark '1').

  Hydraulic oil to be pumped slowly into the hydraulic cylinder (oil to be warmed when engine room is cold). After perfect venting, first close vent screw (pos. IV) on the hydraulic cylinder and then vent screw on the hydro accumulator (pos. V). The four hydraulic cylinders must then be pumped up to service pressure as follows:

  Attention: Check that the pump is always full and the filling hose completely filled with oil before connecting up.

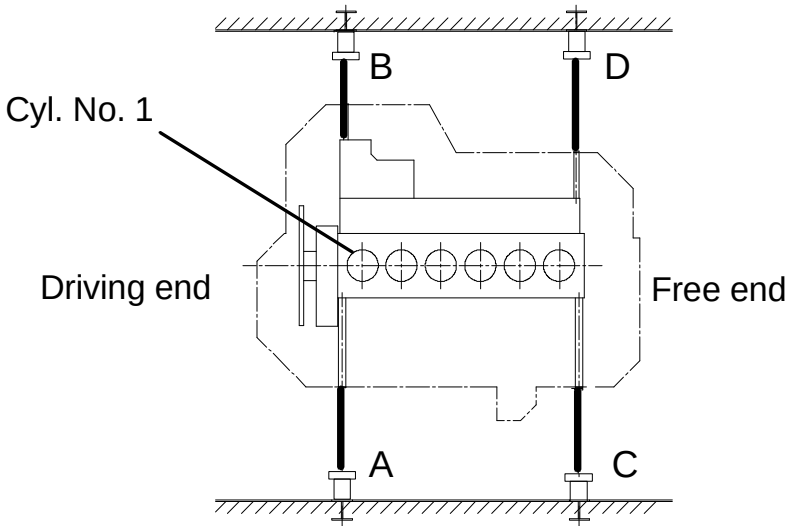

Figure 4: Lateral stays application

- On cylinder A the oil pressure is to be raised to half of the nominal pressure as provided by table 1. Pressure to be checked at the built-on pressure gauge below the hydro accumulator. Filling valve (pos. IV) is to be closed and the hand pump disconnected.
- On cylinder B the same preparation work can be carried out, however, the pressure has to be raised to 10 bar above nominal pressure. Filling valve (pos. IV) is to be closed and the plug (pos. II) fitted.

- The hand pump is to be reconnected to cylinder A and the pressure increased to 10 bar above nominal pressure. Filling valve (pos. IV) is to be closed and the plug (pos. II) fitted.
- Repeat the same procedure for cylinders C and D.
- After several hours, all hydraulic cylinders must be vented carefully by actuating the valves (pos. V and pos. VI) so that not too much pressure gets lost. The pressure must not drop below nominal value.
- The throttling valve (pos. III) is to be adjusted to mark 'A' and secured on all cylinders.

  Mark 'B' is used for reduced stiffness.

  At mark '1' the function is practically ineffective.

  Attention:
  The throttling valve (pos. III) must never be closed (mark '0') when in service because in this position the hydraulic piston cannot adjust itself to the movement of the ship's hull.

6 Sea Trial

The hydraulic cylinders must be checked frequently regarding oil pressure and general soundness.
On completion of the sea trial the following must be checked:

- Piston is in '0' position according to figure 2.
- The cylinder pressure is adjusted to nominal value (provided by table 1). If the pressure is too high it can be corrected by carefully opening the vent screw (pos. V). Where the pressure is too low, it has to be raised with the hand pump.

7 Ship Delivery (ballast draught condition)

Check the following when fully loading the ship for the first time:
The position of the piston relative to the cylinder is to be checked when the ship is fully loaded. Should it occur that the piston is almost touching the bottom of the cylinder (this situation is not permitted, but it will happen when the piston in reference to position '0' is pulled 15 mm further into the cylinder), then the hydraulic lateral fixation device is to be shortened by about 7 mm using the adjusting screw (pos. VII in figure 2).

8 Regular Checks

The oil pressures on the pressure gauges of the hydraulic cylinders are to be compared with each other at regular intervals. (The indicated oil pressure may not be identical with the nominal pressure, because it varies according to the loading of the ship).
If one of the cylinders shows a considerably lower pressure, which could be caused by a leaking seal, the opposite hydraulic cylinder must be released of its pressure until the leaking seal has been replaced.

Afterwards both cylinders are to be put again into service as mentioned under chapter 5 ‘Commissioning’.

9 Technical Data and Specification

Hydraulic cylinder 200/160

Mass: about 138 kg
Piston stroke: ± 15 mm
Oil Content: about 2.5 l
Oil Type: Hydraulic oil HL or HLP
Viscosity grade: ISO VG 32/46 (20 - 30 mm²/s at 50 °C)
Hydropneumatic
accumulator type: IHV 2,5 - 330/05 with bladder ref.: 105644-01120

Engine type:	**Engine bore size 60 – 96 mm**	**Engine bore size 35 – 60 mm**
Pre-pressurising pressure (gas)	40 bar	20 bar
Nominal oil pressure *1)	80 bar	50 bar
Nominal pre-tensioning force F_{vo}	160 kN	100 kN
Dynamic spring rate	about 320 kN/mm throttling valve pos.”A”	about 270 kN/mm
Minimum oil pressure	about 60 bar when piston is protruding 15 mm from cylinder	about 37 bar
Maximum oil pressure	about 115 bar when piston is retracted 15 mm in cylinder	about 80 bar

Table 1: Pressure specification and pre-tensioning forces

*1) Piston in position '0' (see figure 2): Po_{max} = Po + 10 bar

Po = above given nominal pressure

Safety regulations regarding pressure vessels have also to be adhered to.

10 Components

10.1 Pneumatic accumulator

P_0 = nitrogen pressurising pressure
P_1 = minimum working pressure
P_2 = maximum working pressure
V_0 = total nitrogen volume in the accumulator
V_1 = nitrogen volume at P_1
V_2 = nitrogen volume at P_2
$\triangle V$ = volume absorbed and/or returned beween P_1 and P_2

Figure 5: Hydropneumatic accumulator

10.1.1 Description

By means of an inert gas (nitrogen), which is capable of great compression, the bladder, enclosed in the accumulator body, is pre-pressurised to a pressure determined by the needs of the work to be done. During this pressurising operation, the bladder expands, progressively approaching the lower part of the accumulator, and presses against its sides, thus taking up the entire volume of the chamber (1).

When the circuit pressure generator causes the liquid to penetrate into the shell of the accumulator (2), the gas enclosed in the bladder is compressed, thus increasing the pressure. The process comes to an end when the pressure of the liquid and of the gas reach equilibrium (3). In the reverse process, the return commences when the resisting pressure of the liquids is less than the pressure of the gas in the bladder. The lateral deformation of the latter into three lobes, getting a shamrock shape with three noses, excludes rubbing and inertia and enables an efficiency of nearly 100 % to be attained.

10.1.2 Spare part list

1. Valve cap and gasket
2. Bladder
3. Nut
4. Bladder assembly
5. Anti-extrusion ring
6. Washer
7. Gland ring
8. Ring- nut
9. Venting screw and gasket
10. Fluid part sub-assembly
11. Set of gaskets
12. Fluid part assembly
13. Bladder kit
    contains: 4, 5, 9 and 11

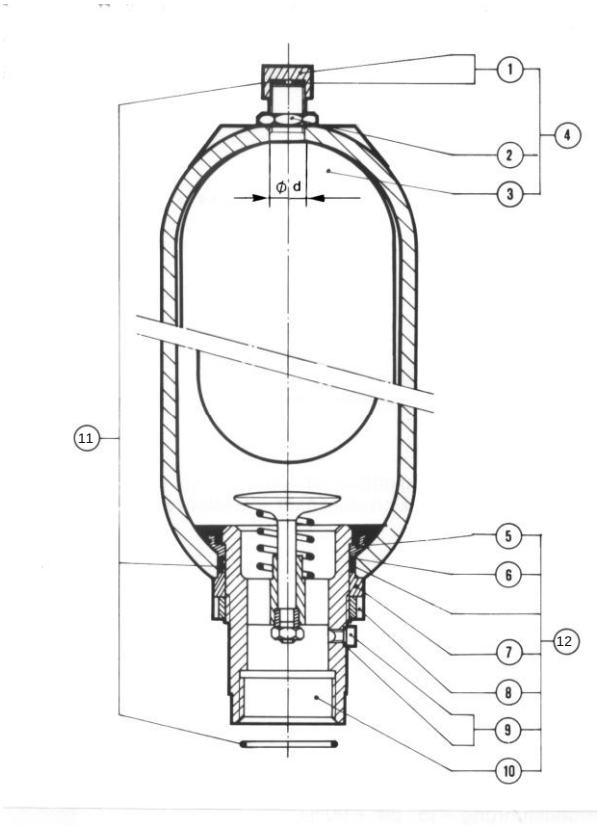

Figure6: Hydropneumatic accumulator parts

10.2 Tester and pressuriser

10.2.1 Description

The VGU tester and pressuriser is used for charging bladder, piston and membrane accumulators with nitrogen, and for testing or changing the pre-charge pressure. The instrument is suitable for all OLAER accumulators with $^{5}/_{8}$" flap valves, 'Schräder valves' or screw plugs. It is screwed onto the gas inlet valve of the hydropneumatic accumulator and connected to a standard nitrogen flask via a hose. If only the pre-charge pressure needs to be checked, the connection of the charging hose is not necessary.

Each unit comprises:

- Tester and pressuriser with manometer, return valve on the charging hose, built-in release valve
- Valve spindle for opening the gas inlet valve on the accumulator
- Charging hose, length 2.5 m

- Connections for the accumulator

  $^{7}/_{8}$" - 14 UNF

  $^{5}/_{6}$" - 18 UNF
  0.305" - 32 NFT
  M28 x 1.5

- Plastic protective case

KEY TO MODEL DESIGNATION

VG U - 250 - TS 3

Model
Tester and pressuriser

Charging hose
TS3: for Ch, D, N, S, A, FL, DK,GUS
Connector W24,32 x 1,814
245 bar
(for other countries see pos. 40, on part list, page 13)

Manometer
6,10,25,60,100,250,400 bar

10.2.2 Installation and use

Setting-up (refer to figure 7):
Before any pre-charge checks and/or nitrogen pressurising, the hydraulic fluid of the hydropneumatic accumulator must be discharged.

Accumulator with hydraulic valve:

- Completely screw the lobed hand-wheel (pos. 6) outwards.
- Unscrew the protective cap(s) of the accumulator gas inlet valve.
- Screw pressuriser with intermediary (pos. 23 or 26 + connector pos. 30) for 'Schräder valves') onto the hydraulic valve. Move the manometer into a convenient position for reading,then tighten the intermediary (pos. 5) by hand.
- Check that the release valve is closed. (close the lobed hand-wheel (pos. 18) by turning in clockwise direction)

Checking the charge pressure:

- Turn the lobed hand-wheel (pos. 6) in anti-clockwise direction. This causes the gas inlet valve or Allen screw to open. The pressure may now be read on the manometer.

Reducing the charge pressure:

- Rotate the lobed hand-wheel (pos. 18) of the release valve slowly in anti-clockwise direction. The nitrogen is released into the surrounding air.

Pressurising/raising the charge pressure:

- Connect the charging hose: one end to the return valve (pos. 7) and the other to a standard nitrogen flask.
- Open the stop valve on the nitrogen flask carefully. Allow the nitrogen to flow into the accumulator slowly, till the desired pre-charge pressure is reached.
- Close the stop valve on the nitrogen flask. After 5-10 minutes (temperature stabilisation), check the charge pressure again and correct where necessary.

Dismantling:

- Turn lobed hand-wheel (pos. 6) back.
- Screw lobed hand-wheel (pos. 18) outwards.
- Unscrew instrument.
- Tighten screw valve with Allen key (AF6).
- Check gas inlet valve seal with a foam-forming substance.
- Screw protective cap(s) back on and tighten by hand.

Caution:

- Never use oxygen to inflate the accumulator.
- Where the nitrogen flask pressure is higher than the permitted accumulator working pressure, a pressure limitation valve must be fitted.

10.2.3 Spare part list

Part No:	Quantity	Description	Rec'd spares
1	1	Valve body	
2	1	Valve spindle	
3	1	Bolts	
4	1	Split ring	
5	1	Spigot nut	
6	1	Lobed hand-wheel	
7	1	Return valve	
8	1	Hexagon nut	
9	1	Snap ring	
10	1	Stand. press. spring	
11	1	Retaining ring	
12	1	O-Ring	x
13	1	O-Ring	x
14	1	Centre-grooved dowel pin	
15	1	Name plate	
16	1	Connect. for manom. G ¼"	
17	1	Copper seal	x
18	1	Lobed hand-wheel	
19	1	Gland	
20	1	Valve spindle	
21	1	Valve ball	
22	1	Knurled cap	
23	1	Adapter SAE $^{7}/_{8}$" - 14UNF	
24	1	Valve spindle	
25	1	O-Ring	x
26	1	Adapter SAE $^{5}/_{8}$" - 18UNF	
27	1	Valve spindle	
28	1	O-Ring	
29	1	Flat seal	x
30	1	Connect. 0.305" - 32NFT	x
31	1	Gasket assembly (complete set)	x
32	1	Charging hose	
40	1	Connections for foreign nitrogen flasks	x
40b	GB/AUS	R $^{5}/_{8}$" external	
40c	USA	24.51 x $^{1}/_{14}$" external	
40d	Italy	21.7 x $^{1}/_{14}$" external	
40e	Japan	22 x $^{1}/_{14}$" internal	
40f	Japan	W23 x $^{1}/_{14}$" external	
40g	Brazil	R ½" internal	
40h	F, B, E	21.7 x $^{1}/_{14}$" internal	
40i	China	M22 x 1.5 internal	
40k	China	$^{5}/_{8}$" internal	
40l	Malaysia	G $^{7}/_{8}$" external	
40m	Trinidad	$^{7}/_{8}$" - 14UNF external	
40n	Bulgaria	¾" internal	
40o	Philippines	W23 x $^{1}/_{14}$" left	

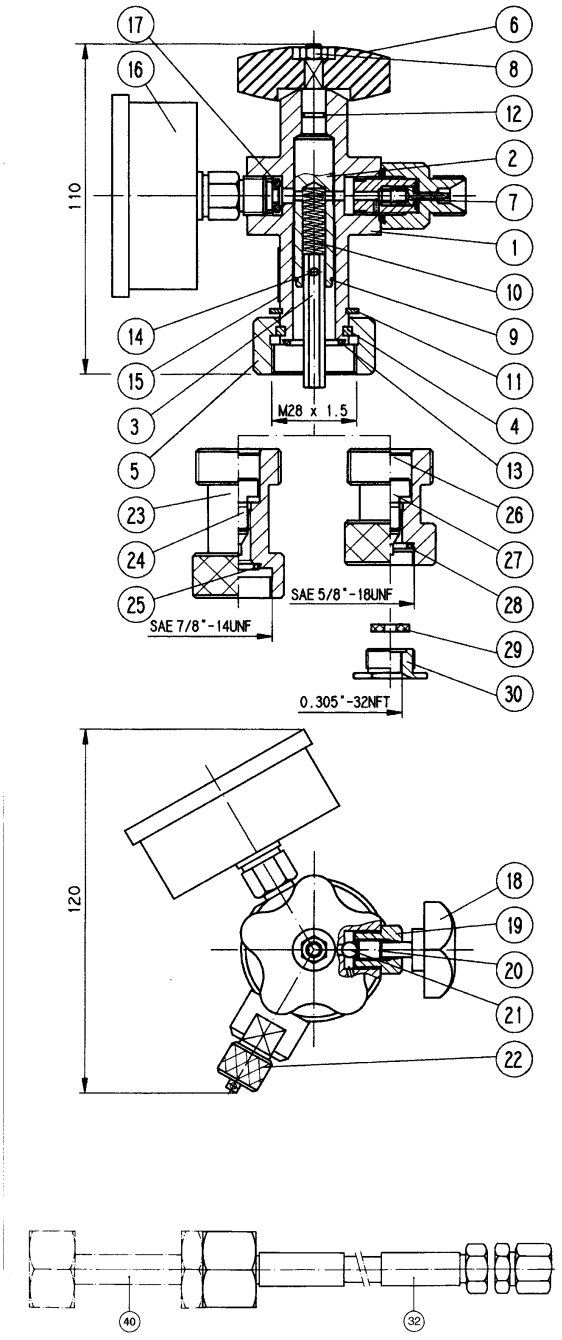

Figure 7: Tester and Pressuriser

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Appd 23.08.1984 M.Lüthi				

10.3 Hydraulic cylinder

10.3.1 Spare part list

Pos.	No. off	Item	Pos.	No. off	Item	Pos.	No. off	Item
01	1	Cylinder	21	2	Spring washer	41	1	Female union
02	1	Piston	22	2	O-Ring	44	1	Prec. seamless pipe
03	1	Cover	23	1	Sealing ring			
04	1	Valve spindle	24	1	Sealing ring			
05	1	Connecting piece	25	1	Sealing ring			
06	1	Pointer	26	1	Sealing ring			
07	1	Bearer	27	2	Piston guide			
08	1	Threaded sleeve	28	1	Guide tape			
09	1	Support	29	1	Grooved ring			
10	1	Ring	30	1	Scraper			
11	1	Ball valve	31	1	O-Ring			
12	2	Bolt	32	1	Pressure gauge			
13	6	Bolt	33	1	Reduction			
14	2	Bolt	34	1	Joint			
15	1	Bolt	35	1	Bladder accumulator			
16	1	Shoulder nut	36	1	Reduction			
17	1	Nut	37	1	Clamping strap			
18	2	Nut	38	1	Vent screw with joint			
19	8	Spring washer	39	1	Plug			
20	1	Spring washer	40	1	Male union			

When ordering spare parts, please always state the complete serial number!

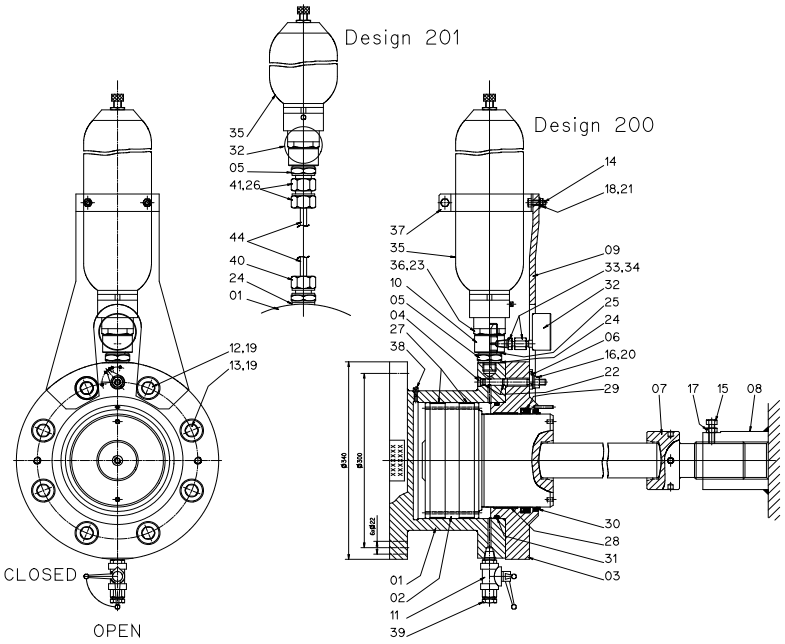

Figure 8: Hydraulic cylinder assembly parts

Substitute for:																PC	Q-Code	X	X	X	X	X
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Zeichnung E 3-107.165.817

The pressure test of the assembled hydraulic cylinder acc. to drawing No. 0-107.165.800 must be carried out in the following order:

1. Fill the bladder accumulator with nitrogen to a pressure of 40 bar using the testing and filling device drawing No. 4 107.165.818 as follows:

1.1 Unscrew the protective cap from the bladder accumulator gas filling valve and screw the filling device onto the valve by union nut "D". Bring the pressure gauge into such a position that it can be read easily and clamp it tight by hand with union nut "D".

1.2 Check to ensure that bleed valve "B" is closed (handle "B" must be fully screwed in). Connect up filling hose to connection "C" and the nitrogen cylinder.

1.3 Screw in valve spindle "A" thus opening the gas filling valve and allowing the pressure to be read on the pressure gange.

1.4 Carefully open the shut-off valve. Slowly release nitrogen into the bladder accumulator until a pressure of 40 bar is reached.

1.5 Close the shut-off valve on the nitrogen cylinder. After 5 minutes (temperature equalization) check the charge pressure and, if too high, correct it by slowly opening the bleed valve "B".

1.6 Screw out valve spindle "A", open bleed valve "B", remove filling hose from the connection "C" and unscrew the filling device. Check the tightness of the gas filling valve with soapy water. Put the protector cap onto the gas filling valve and tighten it by hand.

2. Unscrew closing plug, item 039, and connect up the connecting hose of the delivery pump.

3. Push the piston, item 002, as far as it will go. Marking on the piston must coincide with the marking pointer on the cover. Piston marking pointer must lie at the middle of the pointer.

4. (A) Set valve item 004 "A" to marking 1 and open the ball valve item 011, open both vent screws item 035 (bladder) and item 038 (cylinder).

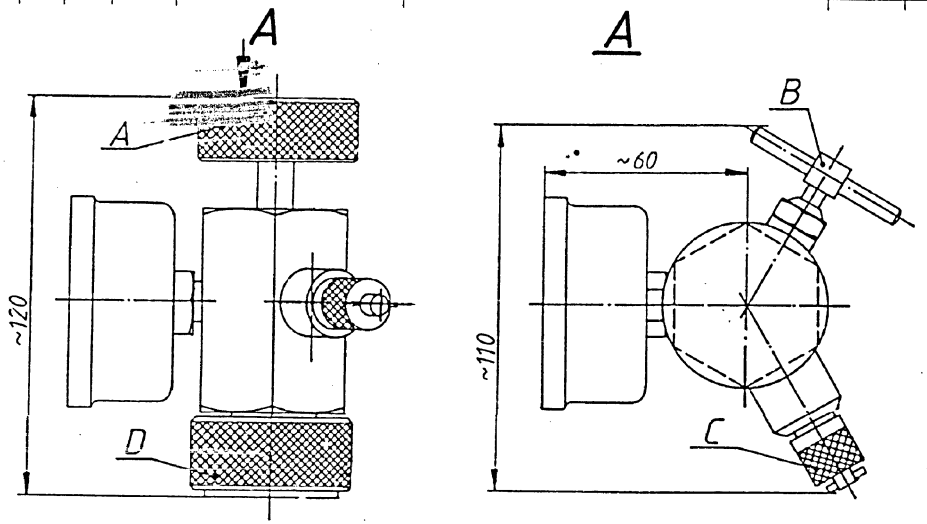
5. Pump hydraulic oil into the cylinder and close off the vent screws after complete venting. Continue pumping the hydraulic oil until a pressure of 250 bar can be held for approx. 10 mins. Check all joints for leakage.

6. (A) Release pressure back to 0 bar, drain the hydraulic oil, from the cylinder, close valve item 011, disconnect hose and screw on the closing plug item 039.

7. (A) Set valve item 004, "A" to marking "A" and lock valve with nut item 016.

8. Reduce the charge pressure in the bladder accumulator to 10 bar (see points 1,1, 1,3, 1,5 and 1,6).

Ausführungskennzahl	Pos Kennzahl	Artikelnummer	Benennung	Bezugsvermerk	And Buchst
	Pos Art	Zeichnungsnummer	Werkstoff und Bemerkungen	Masse ca kg/Stk	
Stückzahl *	001	107.165.817.500	Instr. for pressure test	—	
		E 3-	250 bar	—	



A Valve spindel
B Bleed valve
C Filling conn.
D Union nut (Raccord)

E3-107.165.817000000

Änderungen	Name	Datum	Name	Datum	Name	Datum	Name	Datum
A	A. Horsfjord	2.2.83						

Sep. Stückverzeichnis ja/nein | Konstruktionsgruppe

Ersetzt durch | Ersatz für | Org.-Maßstab —

WINGD Winterthur Gas & Diesel

Instruction for pressure test 250 bar

Gezeichnet Haughton 11.2.83
Geprüft Pipa 24.2.83
Norm-geprüft Li 1.3.83

E 3-107.165.817

Mikrofilm A

Abml. Zeitg

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ASSEMBLY-INSTRUCTION_WinGD-2S_HYDRAULIC STAYS

TRACK CHANGES

DATE	SUBJECT	DESCRIPTION
2016-10-25	INSTRUCTION	First web upload