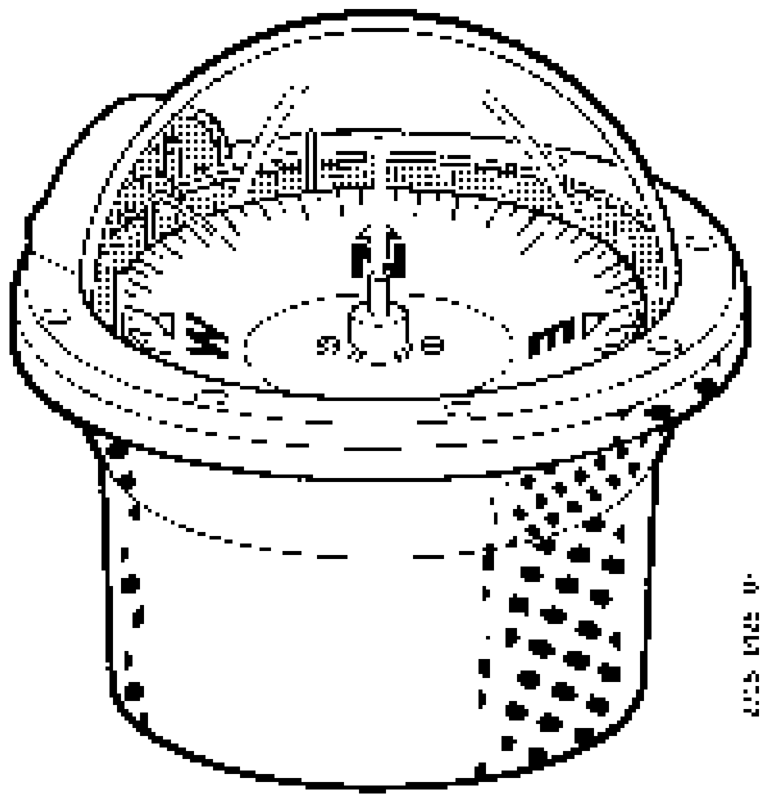
C. PLATH
NAVIGATION · AUTOMATION

056162

OPERATOR'S MANUAL



VENUS

Magnetic Compass

12 JUNE 95 REV B

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C. PLATH
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Table of contents

PART	TITLE	PAGE
1	Introduction	1-01
1.1	The 4 versions of the Magnetic Compass VENUS	1-01
1.2	Technical Data	1-03
2	The basic functional facts of the Magnetic Compass	2-01
2.1	General	2-01
2.2	Deviation	2-01
2.3	Ship's Magnetism	2-02
3	Installation of the Magnetic Compass VENUS	3-01
3.1	General	3-01
3.2	Choosing the best Place of Location	3-02
3.3	Installation of the Magnetic Compass VENUS H (flush mounted)	3-04
3.4	Installation of the Magnetic Compass VENUS HC, VENUS HS and VENUS HL (in cylindrical housing)	3-07
3.5	Compass Correction with the C. PLATH Compass Corrector	3-09
4	Illustrated Parts Catalogue	4-01

1. INTRODUCTION

The magnetic compass "VENUS" is a liquid-filled spherical compass designed for application on smaller vessels, such as yachts and motor boats.

The fully gimbaled compass card suspension and the orientation of the lubber line on the gimbaled compass card suspension result in extremely high accuracy during extreme ship movement. Freedom of roll and pitch is unlimited.

The compass housing is manufactured from sea-water resistant aluminium alloy. The glass dome is of an impact resistant mineral glass.

The magnification effect of the liquid-filled spherical dome results in an apparent compass card diameter of 150 mm. Volume fluctuations of the compass liquid caused by changes in the ambient temperature are compensated by a membrane located in the base of the compass.

Dazzle-free illumination is an integral feature of the compass.

1.1. The Four Versions of the Magnetic Compass "VENUS"

(see Fig. 1-01)

The magnetic compass "VENUS" is available in the following versions.

a) VENUS H

This version is intended for flush mounting in steering stands, overhead consoles, in the vessel's deck, and in bridge consoles.

b) VENUS HC

The HC version of the "VENUS" magnetic compass is mounted in a cylindrical housing, either in matt black or matt white, for installation on steering stands and consoles.

c) VENUS HS

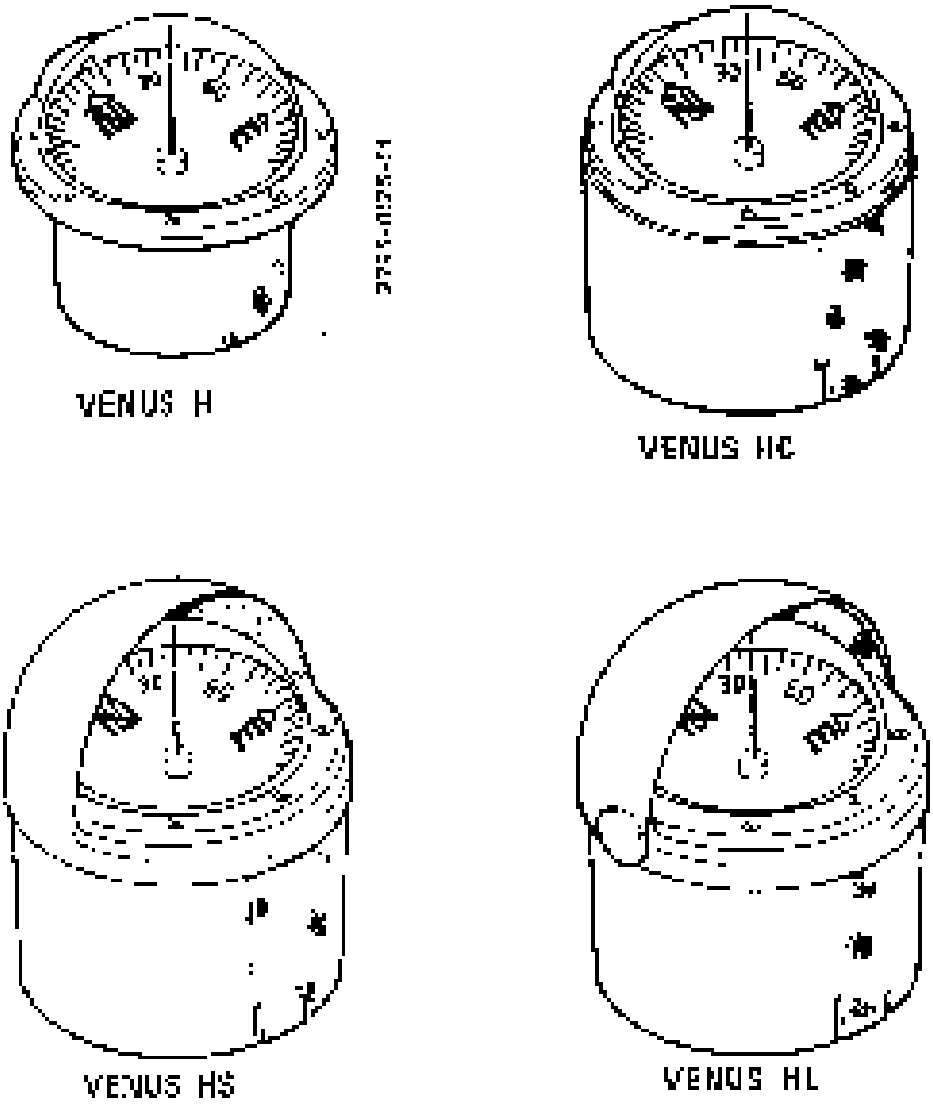
Basically the same version as the VENUS HC, but has a removable hood.

d) VENUS HL

Basically the same version as the VENUS HS, except that the hood is fitted with a visor.

e) Compass Corrector

For correction of the B and C components a compass corrector can be attached to the case of the compass (VENUS H) or in the cylindrical housing (VENUS HC, HS and HL).



The Four Versions of the Magnetic Compass "VENUS"

Figure 1-01

1.2. Technical Data

Rubber line error	≤ 1°
Directional error	≤ 1°
Lag error	≤ 2°
Unit period	> 4,7 sec.
Operational temperature range	– 30°C – 60°C

The following data are in accordance with ISO Standards for merchant shipping.

Vibration	exceeds Germer Hydrographic Institute requirements,
Freedom of roll and pitch	unlimited
Illumination	12 V and 24 V
Compass card graduation	marked every 5° or marked every 1°

Dimensions

VKN.15 F

Compass flange diameter	181,3 mm
Installation depth	93 mm
Installation depth with compass corrector	100 mm
Height above installation surface	75 mm
Diameter of installation cutout	152 mm
Weight≈	2,1 kg

VENUS II (in cylindrical housing)	
Diameter	131,5 mm
Overall height	[illegible] mm
Weight of cylindrical housing	[illegible] kg
Total weight	[illegible] kg
VENUS IS (with hood)	
Overall diameter	[illegible] mm
Overall height	[illegible] mm
VENUS IL (with head and visor)	
Overall diameter	[illegible] mm
Overall height	[illegible] mm

2. THE BASIC FUNCTIONAL FACTS OF THE MAGNETIC COMPASS

2.1 General

The needle of a magnetic compass will point to the magnetic north pole when the earth's magnetic field around the compass remains uninfluenced by local causes. If the earth's magnetic field around the compass is disturbed by magnetic interference, the compass needle will no longer point to magnetic north. The difference between magnetic north and the setting of a compass needle due to such magnetic disturbance is called deviation.

On board a ship the earth's magnetic field is always slightly disturbed, particularly on an steel vessel, because the influences from other sources, such as electrical devices on board, cause the ship to generate its own magnetic field, which overlaps the earth's field and produces deviation of the setting of the compass needle.

2.2 Deviation

Deviation comprises several components:

A is a constant, which is applicable to all compass settings. This constant exists when a line linking the lubber line and the center point of the compass card is not exactly parallel to the keel line of the ship.

B is deviation caused by longitudinal magnetism. The greatest effect caused by this deviation is on east and west courses; on north and south courses the effect is totally absent.

C is deviation caused by athwartships magnetism. The greatest effect is experienced on north and south courses; it has no effect on east and west courses.

D and E are deviations caused by the induction of the earth's magnetism in horizontal iron parts of the ship. They reach their highest values on NE, SE, NW and SW courses.

K is deviation caused by vertical magnetism of the ship. This deviation force increases with the amount of heel of the ship and disappears when the ship is on an even keel. The greatest effect is experienced on north and south courses.

2.3 Ship's Magnetism

Ship's magnetism has two causes:

a) The effect of the earth's magnetic field on the iron parts of the ship.
b) Electrical devices on board which produce magnetic fields.

Induction of the earth's magnetic field turns iron parts into magnets, the magnetic fields of which bring about deviation of the compass.
The effect of magnetism from these iron parts becomes greater as their distance from the compass is reduced.
For example:

Steel hull and superstructure
Steering chains and control linkages
Motors
Anchors
Steel canisters
Steel fittings *

The use of electrical devices on yachts is on the increase. Many such devices produce powerful magnetic fields.
For example:

Radio receivers and transmitters
Generators
Windscreen wipers
Depth sounders
Radar installations
Switching units
Indicator instruments of all descriptions.

* Stainless steel is normally antimagnetic.

Particular attention is drawn to three-phase generators, which produce extremely strong interference fields.

Current carrying cables also produce magnetic fields, particularly when a steel hull is used as a return line (mirror pole to ground). All electric cables should therefore be double-poled. Outgoing and return lines should be laid parallel to each other so the, the magnetic fields of the individual lines are more or less neutralized.

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3. INSTALLATION OF THE MAGNETIC COMPASS "VENUS"

3.1 General

The magnetic compass "VENUS" is supplied in a shock-resistant transport box. When possible, store the compass in this box until it is to be installed.

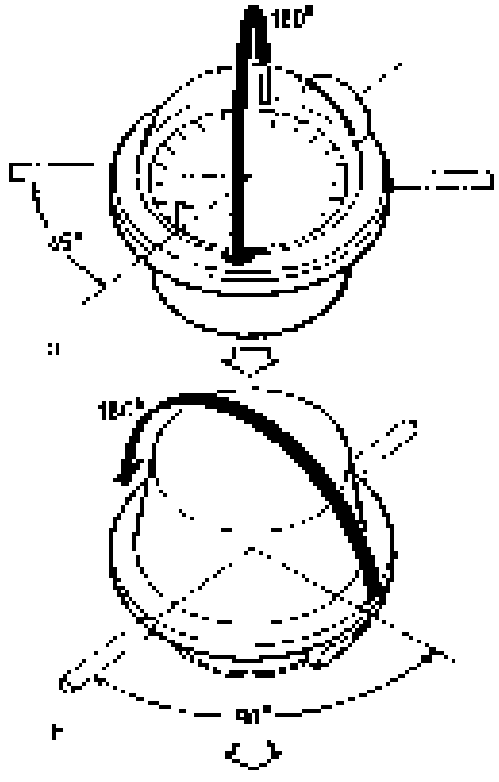
When the compass is removed from the transport box, it is possible that the lubber line will not be in its correct position below the lampholder. If the lubber line is not in the ahead position below the lampholder, proceed as follows to bring the lubber line into the correct ahead position below the lampholder. (see fig. 3-01).

1. Turn the compass over onto the dome about an imaginary axis set off 45° to the lubber line,
2. Return the compass to the upright position about an imaginary axis 90° to the lubber line,
3. The lubber line will now be in the ahead position below the lampholder.

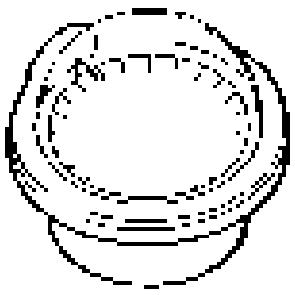
If the lubberline is not in ahead position, proceed as follows:

1. Turn compass over onto the dome about an imaginary axis set off 45° to lubber line.

2. Return compass to the upright position about an imaginary axis 90° to lubber line.



5. The rubber line is now in the above position.



Correct Positioning of the Rubber Line
Figure 3.07

3.7 Choosing the Best Place of Location

If you intend to use your compass for point to point navigation, there is only one proper place for it to be installed - in a direct line forward of the helm station. It should also be close enough to the helmsman to be easily read and in a position slightly lower than the helmsman's line of sight to the horizon. With the compass in this location, it is most convenient to shift your eyes from the water to the compass and back again. If you had to look to either

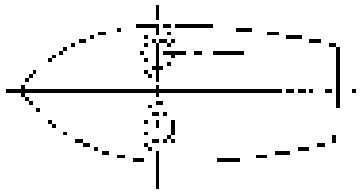
side to view the compass and then look forward to check for water hazards, you would find it quite inconvenient. The exact placement of the compass must, by necessity, vary from boat to boat because of differences in design and in magnetic influences nearby. Sometimes it may be necessary to shift the compass from the most ideal location to a point of compromise because of visual interferences or adjustment problems.

If your need for a compass is for recreational use only, and not for very much long-range cruising, you might select a spot on the boat's dashboard or on the gunwale.

We suggest temporarily putting the compass in position for a Deviation check. This could also apply in selecting the most convenient location for viewing. It goes without saying that the place selected for permanent mounting of the compass should be a spot where it can be easily read by the helmsman.

Also regardless of the location on your boat, your compass must be aligned exactly parallel to the fore and aft center line of your boat. (To repeat because this is essential to understand: parallel to the center line, or on the center line if that happens to be where you want to mount your compass.)

Establishing this line parallel to your boat's center line is quite simple, but it almost always takes a little more patience and time than the skipper anticipates. Find the center of the transom using a metal measuring tape, and accurately mark that center on a piece of masking tape (so as not to permanently mark the boat). This is usually easy. Next you need a second center point at some convenient location forward of the compass position.



With help from some additional pairs of hands, stretch a string tightly between the two center points. Accurately measure out (forwartship) to the location you selected for your compass, and after marking off this distance at your transom and forward line, move the string to this new pair of points. If the string is higher than the area where the compass base will be, use a plumb bob to transfer the line. Off course the boat must be on an even keel if a plumb bob is used. Once you have checked to make sure that you accurately established your compass mounting line parallel to the boat's center line you might just want to permanently scribe or mark a short line for future reference.

This alignment is extremely important, because an improperly aligned compass can never be properly adjusted for deviation, and will have a constant error (in addition to Deviation) no matter what direction your boat is pointed.
If you suspect that there may be magnetic influences near the compass position selected, such as radio speakers, steel cored steering wheels, wiring, etc., it would be well to place the compass temporarily in the position selected and check for Deviation as you swing the boat. With the internal compass compensators neutralized, you should not have a Deviation of more than 3 degrees in any one one heading in the compass location selected. Deviation greater than this will be almost impossible to correct, making it necessary to either change the compass location or move the equipment, wiring, etc., causing the problem.

3.3 Installation of the Magnetic Compass VENUS II (Flush mounted)
(see fig. 3-02)

NOTE: The magnetic compass VENUS II is intended for flush mounting. Therefore, before cutting the 152 mm diameter hole required for installation, make certain that damage will not be caused to structural members and the like after the hole is cut.
Read carefully section 3.2 "Choosing the Best Place of Location" of this manual before proceeding with installation work.

NOTE: Before proceeding with installation work, make certain that below the mounting surface sufficient space is available for flush mounting the compass, see figure 3-01.

1. Cut a hole 152 mm in diameter in the mounting surface.
2. Unscrew the lampholder retaining screw and remove the lamp holder complete with cable.
3. Place the compass in the hole cut for installation of the compass.

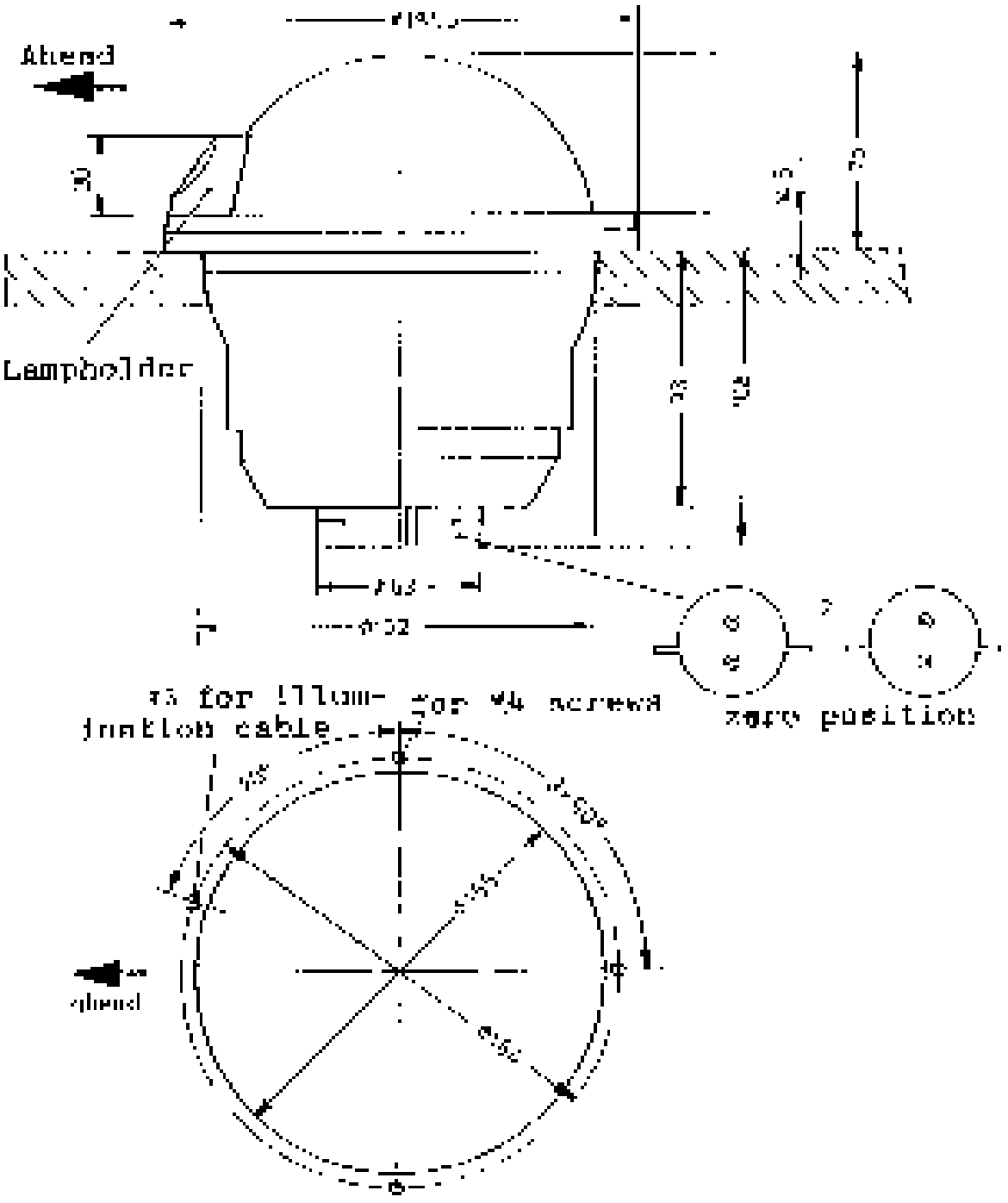
4. Align the compass exactly parallel to the fore-aft center line of the boat, see 3.2,
5. Mark through onto the mounting surface the three attachment holes and the hole for the illumination cable and remove the compass.
6. In a metal mounting surface, drill and tap three M4 attachment holes. In mounting surfaces of other materials, drill three plain 4.3 mm diameter attachment holes.
7. Drill a 8 mm diameter hole for the illumination cable.
8. Fit the lampholder to the compass and attach it with the retaining screw.
9. If a compass corrector is to be fitted, turn the adjuster screws of the compass corrector to obtain the zero position of the magnets as shown in figure 3-03, item 2.
10. Attach the compass corrector to the base of the compass with the screws provided so that the adjuster screws of the corrector will face astern when the compass is installed.
11. Check the position of the lubber line within the compass, see 3.1.
12. NOTE: If the adjuster screws of the compass corrector will be inaccessible when the compass is installed, the compass is to be corrected before it is permanently installed, refer to the Instruction book for the compass corrector.

    Fit the compass into its mounting location and pull through the illumination cable. Attach the compass with the three retaining screws.

13. Ensure that the correct voltage is available and connect the illumination cable to the power supply.

    NOTE: When installing wiring for the compass illumination, twist the wires to preclude any possibility of influencing the compass by the magnetic field set up by parallel wires carrying DC voltages.

    It is also recommended to twist any wiring in the vicinity of the compass carrying DC voltages to minimize the chance of interference.



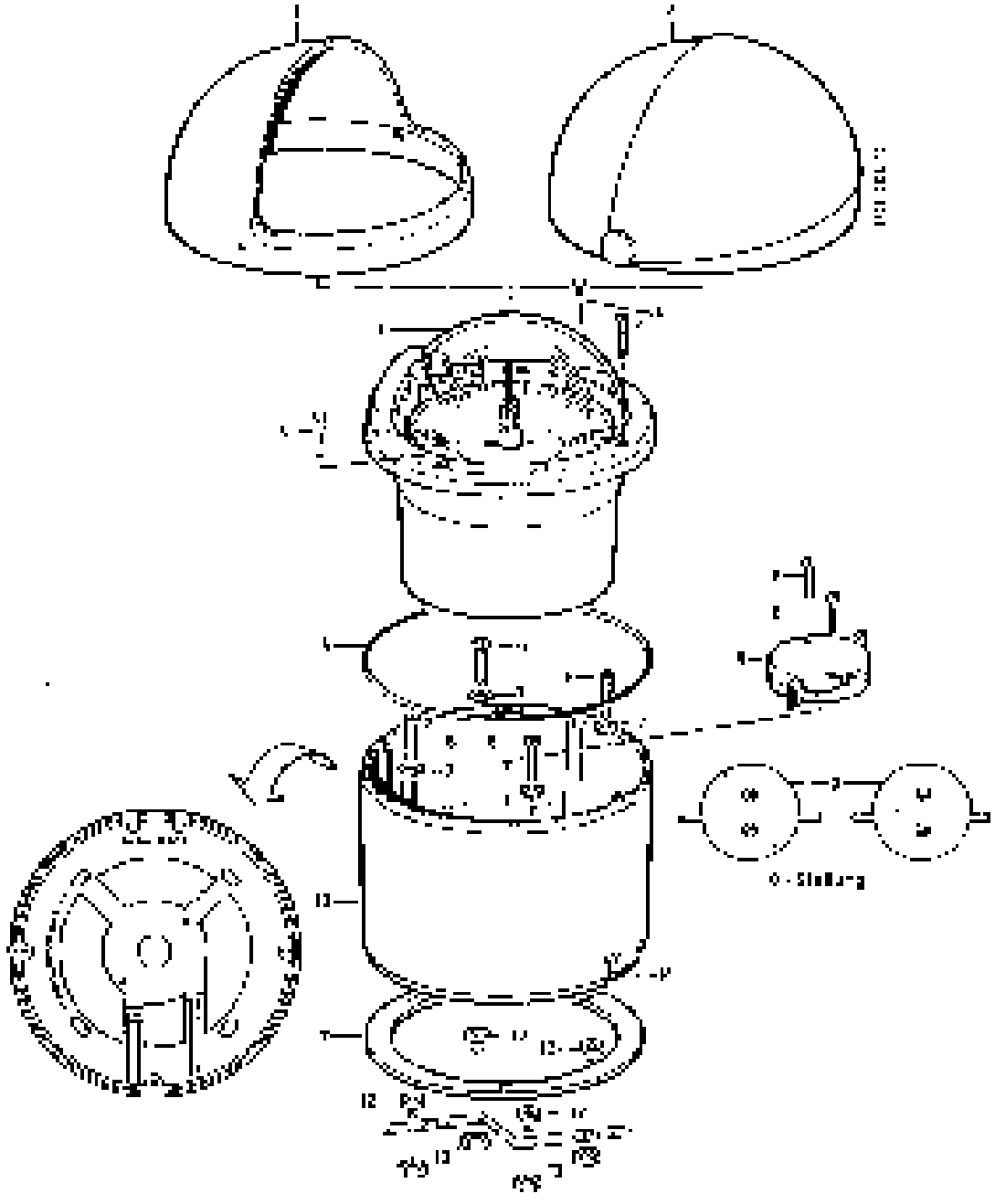
Installation Dimensions for the Magnetic Compass VENUS II

Figure 3-02

3.4 Installation of the Magnetic Compasses VENUS HL, VENUS HS and VENUS HL (in cylindrical housing) (see fig. 3-01)

The magnetic compass VENUS in the cylindrical housing is intended for attachment to a level surface of at least 150 mm in diameter. A suitable power supply will be required if illumination of the compass is required.

1. On a circle 101.6 mm in diameter, mark and drill four holes 6,5 mm in diameter as shown in figure 3-02, item 10, seen from above.
2. The cylindrical housing may be attached watertight with the sealing ring (11) supplied. If the sealing ring is not used, the spacers (12) are to be located on the screws between the cylindrical housing and the mounting surface.
   Attach the cylindrical housing (10) at the place of location with the retaining screws (6), the washers (7) and the sealing ring (11) or the spacers (12) and screw on but do not tighten the retaining nuts (13).
3. With the aid of the marking 'W' (see fig. 3-01), align the cylindrical housing exactly parallel to the bow and aft line of the boat (see 3.2) and tighten the retaining screws (6) and nuts (13).
4. If a compass corrector is to be fitted, turn the adjuster screws of the compass corrector to obtain the zero position of the magnets as shown in figure 3-02, item 9, and attach the compass corrector to the cylindrical housing (10) with the retaining screws (8).
5. Check the position of the lubber line within the compass, see 3.1.
6. Ensure that the correct voltage is available and connect the illumination cable in the cylindrical housing to the power supply.
   NOTE: When installing wiring for the compass illumination, twist the wires to preclude any possibility of interacting the



Installation of the Magnetic Compass VENUS HC, HS, HL
(in cylindrical housing)
Figure 3.03

compass by the magnetic field set up by parallel wires carrying DC voltages.

It is also recommended to twist any wiring in the vicinity of the compass carrying DC voltages to minimize the chance of interference.

7. Fit the compass into the cylindrical housing and attach it to the housing with the three retaining screws (4).

8. Fit the O-ring (5) into the groove between the compass (3) and the cylindrical housing (10). The O-ring retains the hood (1 or 2).

   NOTE: If a hood (1 or 2) is not supplied or is not to be fitted, do not dispose of the O-ring in case a hood is to be fitted at a later date.

9. Slide the hood (1 or 2) over the compass and allow it to engage on the O-ring.

3.3 Compass Correction with the C. PLATH Compass Corrector

If a C. PLATH compass corrector is fitted to the magnetic compass, refer to the instruction book supplied with compass corrector for correction instructions.

After correction of the compass, a deviation table is to compiled; this procedure is also explained in the instruction book supplied with the compass corrector.

If the magnetic compass is not fitted with a compass corrector, it is, however, also recommended that a deviation table be compiled, see 3.4.

3.4 Compiling a Deviation Table

Use of the so-called deviation post, around which the boat may be swung, is an excellent way of determining deviation. A deviation post may be found in most harbours. For determination of deviation the boat must be seaworthy. All moveable iron parts which have an effect upon the compass are to be located in the position they normally occupy when at sea.

On motor yachts the engine is to be running. On sailing boats it is to be determined whether the amount of deviation remains approximately the same with the engine running and with the engine not running. When a running engine greatly affects deviation, the deviation table is to be compiled with the engine switched off.
A second deviation table is to be compiled with the engine running.

Procedure
A suitable bearing object is required, the magnetic bearing of which is known. The boat is then to be swung through 360° at intervals of 10°.
At each step the compass heading and the bearing taken on the bearing object are to be recorded in the table. Deviation is the difference between the magnetic heading of the bearing object and the bearing read from the compass.
EXAMPLE: A ship is swung around a deviation post to determine compass deviation. A bearing is taken on a chimney, the magnetic heading of which is 68°. The following table results:

Compass course	Compass bearing	Magnetic bearing	Deviation*
0,0°	65,5°	68,0°	+ 1,5°
10,5°	66,0°	68,0°	+ 2,0°
20,0°	64,5°	68,0°	+ 3,5°
31,0°	65,5°	68,0°	+ 2,5°

* Sign is so that by addition the correct course may be obtained from the incorrect course.

A graph should now be made where the deviation values are plotted against the associated compass courses. The resulting curve should run smoothly and be without abrupt variations. Bearing errors may be detected easily and corrected. The corrected deviation table.

DEVIATION TABLE		
Deviation	Magnetic course	Compass course
[illegible],5°	0°	355,5°
+ 2,0°	10°	2,0°
[illegible] 3,5°	20°	15,5°

Heeling Error

As long as a ship is lying on an even keel the vertical component K of the ship's magnetism does not cause compass deviation. This effect occurs when the ship heels. On sea-going yachts heeling error very seldom becomes an important factor. For regatta and steel yachts a heeling error table for all courses and heeling angles may be easily made.

Heeling error may be calculated on the basis of the following formula:

Error = K x heel x cos course

where K = $\frac{\text{error}}{\text{heel} \times \cos \text{course}}$

Starboard heel receives a positive sign and port heel a plus sign.

EXAMPLE: At 10° starboard heel a deviation of -5° is registered (magnetic course 180°, compass heading 185°). What is the deviation value at 20° port heel on a magnetic course of 30°.

a) $K = \frac{\text{error}}{\text{heel} \times \cos \text{course}}$

$= - \frac{-5°}{10° \times \cos 180°}$

$= - \frac{5°}{+ 10 \times (-1)}$

K = - 0,5

b) Error = - K x heel x cos course
= - (-0.5) x (-20°) x cos 30°
= - (- 0.5) x (-20) x 0.866
Error = - 8.7°

In this example the compass indicates a heading of 30,7° at 20° port heel. The magnetic course is then 38,7° (- 8,7°) = 30°.
In this way, heeling errors for all courses may be calculated and entered into a table.

Example:

HEELING ERROR

Port heel [°]	Course [°]	Starboard heel. [°]
	0	
	10	350
	20	340
	30	330
	40	320
	50	310
	60	300
	70	290
	80	280
	90	270
	100	260
	110	250
	120	240
	130	230
	140	220
	150	210
	160	200
	170	190
	180	

Permanence of Deviation

The ship's magnetism is not so permanent that it be only necessary to make one single compass correction. Even a well-corrected compass will not guarantee that a determined deviation value entered in the deviation table will apply over extended periods.

The ship's magnetism varies

a) with the geographic latitude
b) when vibration occurs, for example, when touching the ground
c) when stationary in the same position for long periods, in winter quarters for example
d) when the vessel's heading remains constant for long periods
e) when the ship is struck by lightening.

It is therefore extremely important that the deviation of the magnetic compass be checked at regular intervals and the deviation chart amended. It is however not necessary to correct the compass when a change in deviation is detected because these variations very often disappear after a short time.

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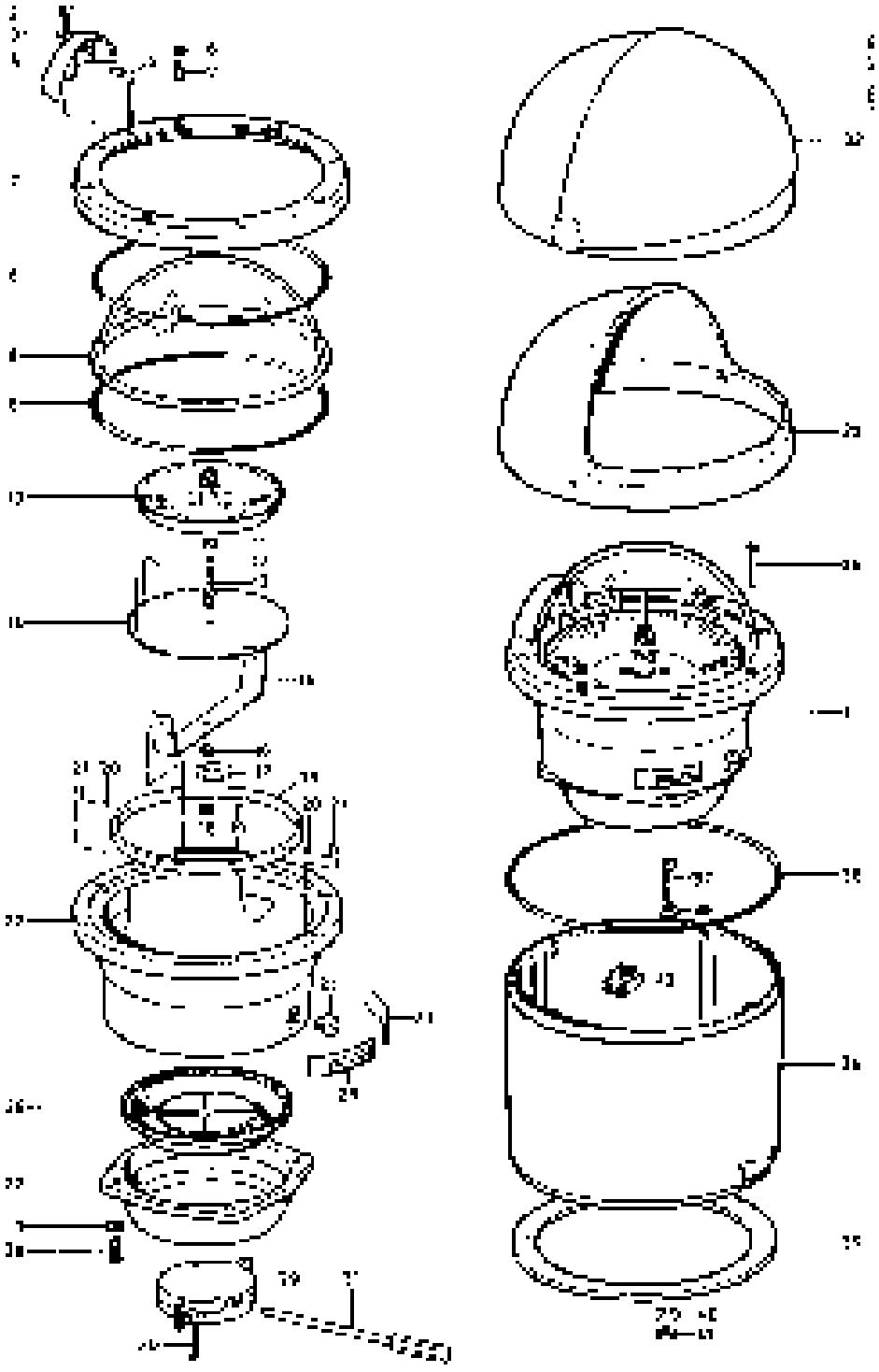
4. ILLUSTRATED PARTS CATALOGUE

Repair of the magnetic compass VENUS is only to be carried out by the manufacturer, C. PLATH in Hamburg, West Germany, or C. PLATH, North American Division in Annapolis, Maryland, U.S.A. or an authorized service station.
On no account is the compass to be opened by any other than the aforementioned because correct filling of the compass with original C. PLATH compass liquid is necessary to guarantee the correct and safe function of the compass.

Ordering Instructions
All parts available as replacement parts carry a stock number.
When ordering replacement parts, please quote all data contained on the identification label (fig. 1-01, item 23) attached to the compass.
Address all orders for replacement parts to

C. PLATH
Stueckenstrasse 1-3
D-22081 Hamburg
Germany

C. PLATH
North American Division
222, Severn Ave.
Annapolis, MD 21403
USA



Magnetic Compass VENUS H, HC, HS and HL, Type 2795/10 and upwards, and Compass Corrector

Fig./Item	Designation	Stock No.	Units per assembly
4-01	Magnetic Compass VENUS, complete comprising:	75245	1
2	. Screw	21257	5
3	. Washer	25355	5
4	. Lampholder	45759	1
5	. Lamp 12 V	22770	1
6	. Cap	25132	1
7	. Verge ring	11032	1
8	. O-ring 137 x 3	40215	2
9	. Glass dome	55725	1
10	. Compass card system	95771	1
	. Gimbal system, complete comprising:		
11	.. Jewel holder	11761	1
12	.. Jewel	21541	1
13	.. Jewel support	55743	1
14	.. Mounting plate, complete	35729	1
15	.. Gimbal frame	75723	1
16	.. Nut M3	21681	2
17	.. Adjustment washer	35779	1
	. Gimbal ring, complete comprising:	75727	1
18	.. Gimbal ring with arms		1
19	.. Teflon tube 13 mm long	41562	2
20	.. Teflon tube 8 mm long	41562	2
21	.. Spindle	35734	2
22	. Bowl	71871	1
23	. Identification table	42453	1
24	. Filling screw, complete	57225	1
25	. Table, compass fluid information	15215	1
26	. Membrane	40421	1
27	. Base	25460	1
28	. Screw	27106	4
–	. Compass fluid Isopar M	41452	1.45 liter
	Compass corrector, complete comprising:	25243	
29	. Compass corrector		1
30	. Screw	21428	2
31	. Screwdriver, antimagnetic	20278	1
	. Instruction book, not illustrated		1
32	Hood for VENUS HL, white	75311	1
	Hood for VENUS HL, black	75253	1
33	Hood for VENUS HS, white	75110	1
	Hood for VENUS HS, black	75260	1
33	Hood for VENUS HS, stainless steel	73337	1
32	Hood for VENUS HL, stainless steel	75117	1
	Installation kit for VENUS HC, HL, HS, white, complete	73300	1
	Installation kit for VENUS HC, HL, HS, black, complete	73254	1
	Installation kit for VENUS HC, HL, HS, stainless steel, complete comprising:	73126	1
34	. Cylindrical housing, stainless steel		
	Cylindrical housing, white		1
	Cylindrical housing, black	26257	1
	. Attaching parts, complete comprising:	57326	1
35	.. Screw	21125	2
36	.. O-ring 173x2.5	40420	1
37	.. Screw	21323	4
38	.. Washer	21107	6
39	.. Sealing ring	27304	1
40	.. Tube washer	25547	6
41	.. Nut	21301	1
42	.. Terminal block	42527	1
–	.. Plastic bag (not illustrated)	25242	1

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