GESTRA® Industrial Electronics

Oil and Turbidity Detector TURBISCOPE OR 42, OR 52

Issue Date: 4/01

ORS 42, 52 **B1**

Purpose and Application

Continuous monitoring of transparent liquids to detect any penetration of insoluble foreign matter causing turbidity, such as emulsified oils and greases. Measuring of turbidity and signal evaluation for indication, recording and control. Tripping of alarms, control valves etc.

Steam boiler plants: Monitoring of condensate returned to the boiler for oil contamination, in particular for boilers operating without constant supervision (TRD 604).
Raw-Water monitoring and water treatment: Sand filters, demineralization plants, reverse-osmosis plants.

Waste-water monitoring
Breweries and the beverage industry: Filtration, monitoring of wort, quality assurance etc.
Salad oil production: Monitoring of filtering process.

15 ppm oil-content alarm in accordance with IMO
To prevent the pollution of the sea by oil, in accordance with IMO (International Maritime Organization) bilge water must be pumped through filtering equipment before being discharged overboard. For monitoring the filtering equipment, the oil and turbidity detector type OR 52 was submitted to a type-test in accordance with IMO resolution A.393 (X) by Germanischer Lloyd. The international certificate of type-test of the Federal Republic of Germany was issued on November 20, 1986 by See-Berufsgenossenschaft (Germany) and deposited at the IMO headquarters. Further type-approvals were granted by the competent authorities of other IMO member states.

NOTE:
Filtering equipment consists in most cases of an oily water separator and a filter (coalescer). Gravity coalescer systems cannot split up stable water/oil emulsions which may be formed with certain cold cleaning agents and then collect in the bilge. We therefore recommend the use of suitable cleaning agents that split up easily.

Design

The GESTRA TURBISCOPE consists of a sensor and a measuring transducer.

Sensor

The sensor is a photometric measuring device with separate light emitter and light receiver and a glass cylinder serving as sightglass. The sensor is provided with three connections fitted with ball valves: for the inlet and outlet of the liquid to be monitored (with flow reversal) and for the discharge of the rinsing water or for sampling. The upper and lower cover flanges can be interchanged and turned through 90° or 180°. It is possible to clean the inside of the glass cylinder during operation with the aid of the cleaning plunger.

Two different designs are available:
ORG 12, all metal parts in contact with fluid made of grey-cast iron GG-25 and
ORG 22, all metal parts in contact with fluid made of stainless steel X 6 CrNiMoNb 17 12 2 (DIN No. 1.4580).

Measuring Transducer

Two types of measuring transducers are available:
ORT 4 and ORT 5, both in a field case for wall installation. The cover of the case is provided with an inspection glass so that all indicators are visible. The difference between the ORT 4 and ORT 5 lies in greater operating and indicating facilities of the ORT 5.

Operation

The GESTRA TURBISCOPE is a continuous measuring device of turbidity as produced by foreign matter that is not dissolved in transparent liquids. The system operates on the Tyndall effect (concerning the scattering of light by suspended particles) which provides a high sensitivity of measurement for emulsified oils and greases and other suspended particles.

The light emitted by the light emitter of the sensor is focused by diaphragms fitted in the tube of the light emitter. The light beam penetrates through the glass cylinder into the liquid to be monitored where it is divided into a beam which passes through the liquid and a beam scattered at the foreign particles whose light intensity depends on the concentration of the foreign particles. The light intensity is transformed by a photo-electric cell in the light receiver into a proportional electric current fed to the measuring transducer which determines the concentration of foreign particles.

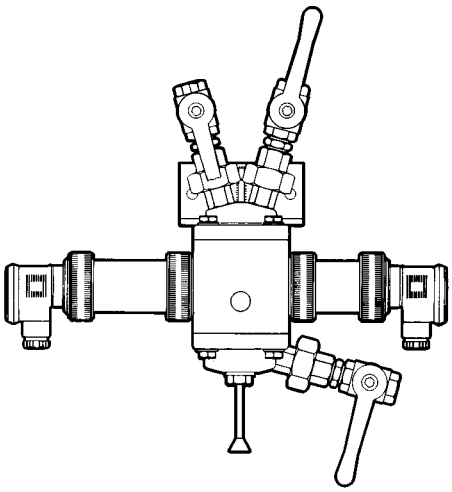
The light beam passing through the liquid is received by a second photo-electric cell. If the light intensity received deviates from a reference value in the measuring transducer the light intensity of the light emitter is correspondigly readjusted. Extinction and lamp aging are thus compensated. If the deviation can no longer be compensated, for example, because of breaking of lamp filament, heavy contamination of glass cylinder or too high turbidity a switch in the measuring transducer immediately de-energizes a relay. Simultaneously the lamp MALFUNCTION lights up and the output current returns to zero.

Zero point and measuring range can be adjusted on the measuring transducer. The zero-point adjuster (0 %) is used to compensate stray light which might vary from sensor to sensor. The 100 % adjuster permits the calibration of the measuring range to the specific turbidity of the plant (see also under "Important Notes").

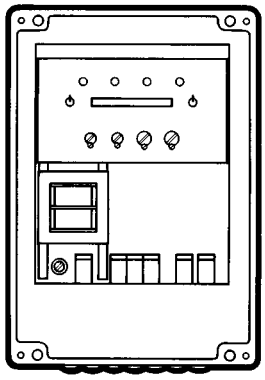
Measuring Transducer ORT 4

The ORT 4 is mainly used as max.-min. limit detector. The switchpoint can be adjusted over the complete measuring range of 0 to 20 ppm. If the scattered light or the turbidity value exceeds the adjusted switchpoint the output relay is de-energized after a time lag of 10 s. The time lag can be annulled by providing an external wire link. Malfunction causes the immediate de-energizing of the relay.

Malfunction is indicated by a red light-emitting diode. Exceeding of the limit value is indicated by the lighting-up of another red light-emitting diode and simultaneous extinguishing of the green light-emitting diode provided. The connection of a remote indicator 0 to 1 mA to the measuring transducer is recommended.



Sensor types ORG 12, ORG 22



Measuring transducer type ORT 5

Measuring Transducer ORT 5

The ORT 5 serves as transmitter for measuring and control purposes. A stabilized current of 0 to 20 mA is available at the output. The ORT 5 is provided with a switch permitting the choice between two measuring ranges of 0 to 20 and 0 to 100 ppm. The switchpoint is continuously adjustable. If the scattered light or turbidity value exceeds the adjusted switchpoint the corresponding relay is immediately de-energized. Simultaneously a time-lag step is triggered which in turn de-energizes a second relay after expiration of the preset time lag (adjustable between 0.5 to 15 minutes).

Malfunction causes the immediate de-energizing of the delayed-action relay and is indicated by a red light-emitting diode. Exceeding of the limit value is indicated by the lighting up of another red light-emitting diode and simultaneous extinguishing of a green light-emitting diode provided.

The measured values are indicated on a light-emitting diode analogue display. Depending on the position of the switch provided for this purpose the display will indicate the measured value or the selected switchpoint.

Equipment Specification

Parts supplied for	TURBISCOPE OR 42/1	OR 42/2	OR 52/1	OR 52/2	Order No.
Measuring transducer type	ORT 4	ORT 4	ORT 5	ORT 5	056040 (ORT 4), 056156 (ORT 5)
Sensor type (inclusive of)	ORG 12	ORG 22	ORG 12	ORG 22	077670 (ORG 12), 077671 (ORG 22)
Ball valves	3	3	3	3	077135 (ORG 12), 077142 (ORG 22)
Screwed unions	3	3	3	3	077133 (ORG 12), 077140 (ORG 22)
Drying cartridge (not fitted)	1	1	1	1	077139
Vent nipple (screwed in)	1	1	1	1	077213
Turbidity standard	1	1	1	1	077701
Spare lamp	1	1	1	1	051116
Spare glass cylinder	1	1	1	1	076755
Spare cleaning disc	1	1	1	1	189022

Technical Data

Sensors ORG 12, ORG 22

Nominal size
DN 10 mm, connections G $^3/_8$" to DIN ISO 228 ($^3/_8$" BSP)

Nominal pressure
PN 10 bar (145 psi)

Flowrate
0.5–50 l/min

Pressure drop
at a flowrate of 2 l/min and V-shaped flow through the sensor with a pipe length of 1 m (DN 10 mm) and 4 bends: approx. 5 mbar

Fluids
Water, condensate, drinks etc.

pH values
up to 10.5 pH (a pH value of 11 and above will lead to wear of the glass, depending on the temperature)

Fluid temperature ranges
0...60 °C with drying cartridge
40...120 °C with vent nipple

Max. ambient temperature
60 °C

Approx. weight
ORG 12: 6.8 kg
ORG 22: 6.8 kg

Materials of	ORG 12	ORG 22
Cover flanges	GG-25	DIN No. 1.4580
Parts in contact with fluid	0.6025 galvanized	1.4580
Ball valves	Ms 58	1.4436
Screwed unions	St	1.4571
Glass cylinder	Duran 50	Duran 50
Gaskets	Silicone	Silicone
Oil seal rings	Perbunan	Perbunan
Housing	0.6025 galvanized	0.6025 galvanized
Cleaning disc	EPDM (sponge rubber)	

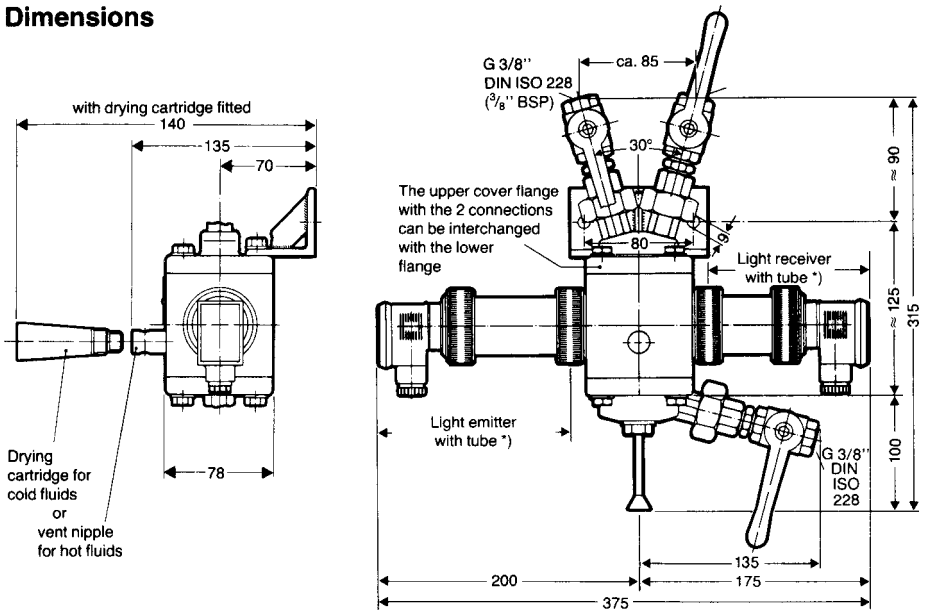
Light emitter
Glow lamp 12 V/10 W,
cable connection via 4 pole connector,
protection IP 65,
tube of galvanized steel,
fitted to sightglass with union nut

Light receiver
2 silicon photo-electric cells,
cable connection via 4 pole connector,
protection IP 65,
tube of galvanized steel,
fitted to sightglass with union nut

Measuring Transducers

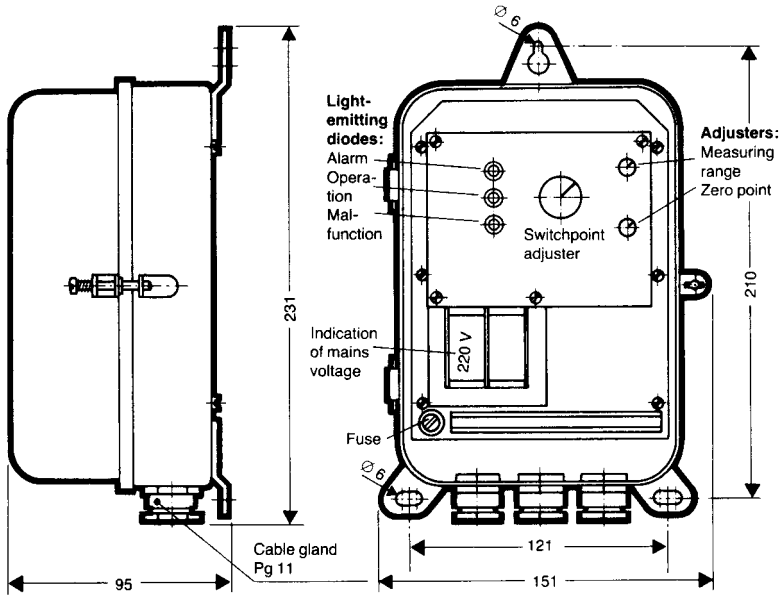
	ORT 4	ORT 5
Measured quantity	Turbidity	
Measuring range	0...20 ppm	0...20 ppm or 0...100 ppm, switch-selected
Reference fluid	50 TU/F corresponding to 20 ppm indication (TU/F = turbidity units of Formazin suspension)	
Output		
Current output	0...1 mA	0...20 mA 4...20 mA on request
Load	0...120 Ω	0...500 Ω
Signalling contacts	potential-free change-over contacts for Alarm, delay of response 10 or 0s (by wire link)	Alarm, 1. instantaneous, 2. delayed continuously adjustable between 0.5 and 15 min
Contact rating	250 V, 500 W, 3 A ohmic with a life of 4 x 10^5 switching cycles or 0.35 A inductive with a life of 2 x 10^6 cycles; the contacts ensure radio-interference suppression	
Indication	3 l.e.d.s for Alarm, Operation, Malfunction lamp circuit	1 l.e.d. analogue display, resolution 3 %, 4 l.e.d.s for Malfunction lamp circuit, Alarm (delayed) Alarm (instantaneous), Operation
Adjusters	1 for switchpoint, continuously adjustable over complete measuring range, 2 for calibration of zero point and measuring range	1 for delay of response
Lamp voltage for light emitter	12 V, 10 W, no-load voltage 14 V	
Mains supply	220 V a.c. (110 V on request) admissible deviation + 10/−15 % 48...62 Hz	
Fuse	M 0.1 A	M 0.2 A
Power consumption	15 VA	25 VA
Permissible ambient temperature	0...55 °C	0...55 °C
Case	Sheet steel, in hammertone finish	Die-cast aluminium, blue enamel finish
Protection	IP 54	IP 65
Connection	3 cable glands Pg 11, screw-type terminals, max. conductor size 1.5 mm^2	7 plugs for Pg 11, screw-type terminals, max. conductor size 1.5 mm^2
Approx. weight	1.6 kg	5.4 kg

Dimensions

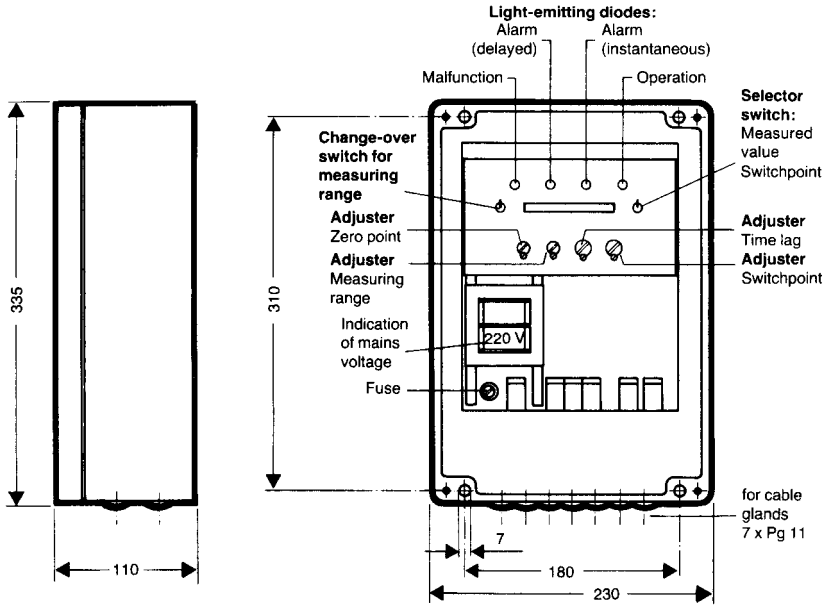


*) can be interchanged so that the light receiver is on the accessible side to facilitate visual inspection of the fluid

Dimensions for sensor types ORG 12, ORG 22

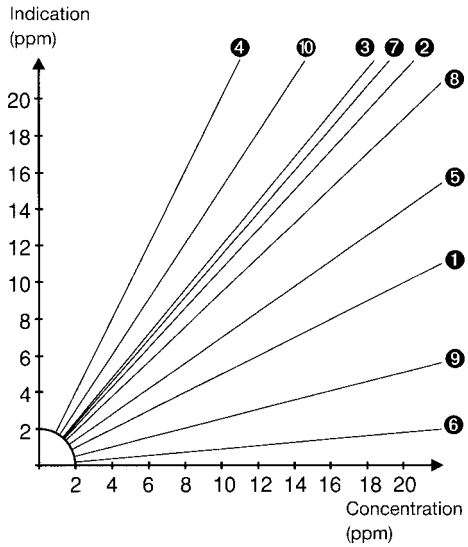


Dimensions for measuring transducer type ORT 4 (field case for wall installation)



Dimensions for measuring transducer type ORT 5 (field case for wall installation)

Turbidity Curves



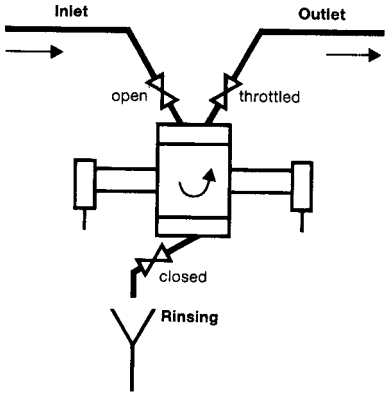
❶ Fuel oil "EL" at 15 °C, coarse emulsification
❷ Light fuel oil "EL" at 15 °C, fine emulsification
❸ Light fuel oil "EL" at 80 °C, fine emulsification
❹ Engine oil, (medium) at 15 °C, fine emulsification
❺ Xylene at 20 °C, fine emulsification
❻ Xylene at 80 °C, fine emulsification
❼ Vegetable oil at 15 °C, fine emulsification
❽ Red-berry juice, concentrated
❾ Black-berry juice, concentrated
❿ Skim-milk powder, fat content 0.1 %

The degree of turbidity depends on the concentration, size and composition of the suspended or emulsified particles in the fluid to be monitored.

In the case of oils, fats and greases the degree of emulsification is therefore a decisive factor. The influence of the temperature on the degree of turbidity depends on the fluid. These influences have been considered in the chart.

Example for Installation

Flow through the sensor, V-shaped (water treatment, filtration etc.).



For condensate monitoring mount sensor in a bypass (see "Installation and Service Instructions ORG").

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FLOWSERVE
Flow Control Division

Important Notes

Condensate Monitoring

Condensate monitoring is recommended upstream of condensate tanks, in particular in steam boiler plants operating in accordance with TRD 604 (Germany). Measurements are affected by the presence of live steam and by flashing. Care should therefore be taken that the sensor does not come into contact with steam. See Installation Instructions for OR 42, OR 52 for the best mode of installation.

Connection of Three-Way Valve

For condensate and bilge-water monitoring a three-way valve should be connected to the ORT, so that the contaminated condensate is discharged if the turbidity is too high (penetration of oil or start-up contamination).

Valves with a single-phase a.c. motor can be directly connected, max. power 50 VA. If three-phase actuators are used a reverse relay has to be inserted. Valves with pneumatic actuators can be triggered via solenoid valves.

Turbidity Standard

Formazin is used as reference fluid. For easy calibration a turbidity standard is supplied with the equipment which simulates a turbidity of 15 ppm. With the aid of the turbidity standard and the measuring-range adjustor (100 %) it is possible to calibrate the TURBISCOPE to half or double the sensitivity. For exact measurements a specific calibration curve has to be established for the fluid to be monitored to obtain the relation to Formazin.

Order and Enquiry Specifications

GESTRA oil and turbidity detector TURBISCOPE consisting of sensor and measuring transducer.

Available designs:

OR 42/1: Sensor type ORG 12 and measuring transducer type ORT 4 in a field case.
OR 42/2: Sensor type ORG 22 and measuring transducer type ORT 4 in a field case.
OR 52/1: Sensor type ORG 12 and measuring transducer type ORT 5 in a field case.
OR 52/2: Sensor type ORG 22 and measuring transducer type ORT 5 in a field case.
OR 52: Sensor type ORG 12 and measuring transducer type ORT 5 in a field case as 15 ppm oil-content alarm in accordance with IMO.

Mains supply of transducer . . . V.

Recommended GESTRA Valves

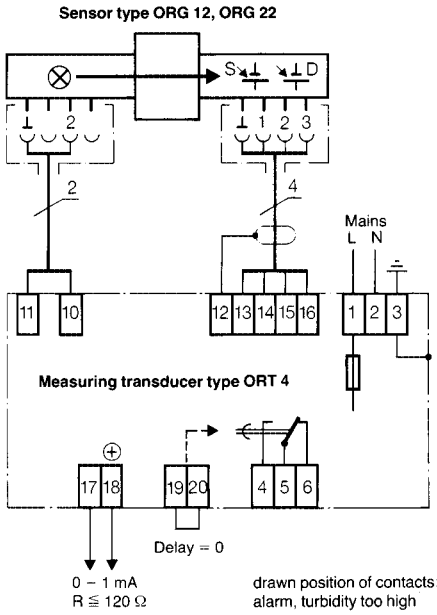
Three-way valve
motorized, series 200
pneumatic, series 500,
with three-way solenoid valve

Stop valve type GAV

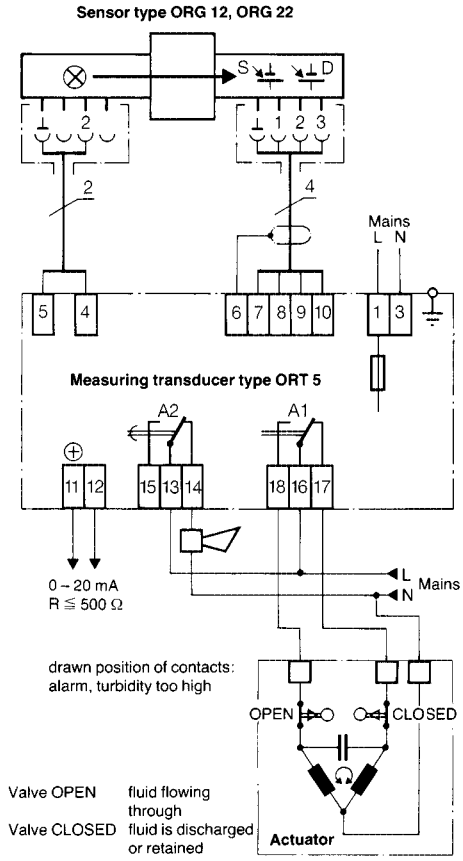
DISCO non-return valve type RK

Technical modifications reserved.

Wiring Diagrams

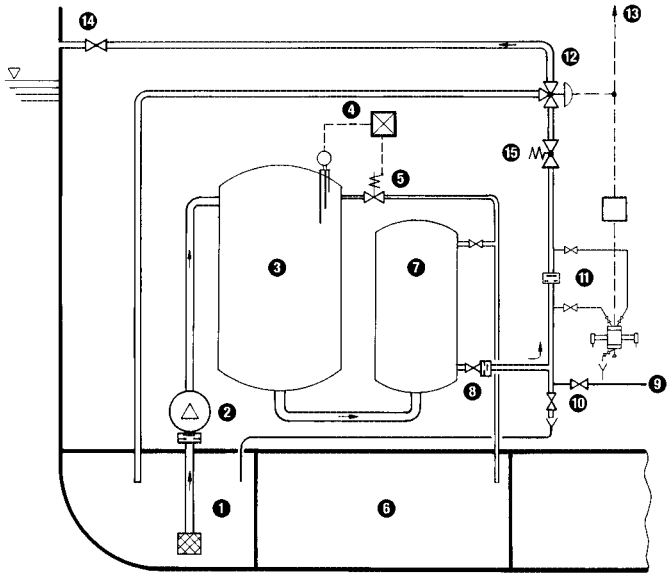


Wiring diagram for sensor type ORG 12 or ORG 22 and measuring transducer type ORT 4



Wiring diagram for sensor type ORG 12 or ORG 22 and measuring transducer type ORT 5, connection of three-way valve, see also under "Important Notes"

Example of Installation of 15 ppm Oil-Content Alarm



Schematic layout of oily water separation system for bilge water with the oil and turbidity detector type OR 52 as 15 ppm oil-content alarm

1. Bilge
2. Pump and GESTRA DISCO non-return valve type RK 44s, if required with protection against running dry provided by the GESTRA multiple level-control electrode type ER 50 and GESTRA amplifier type VR 16
3. Oily-water separator (gravitational separator)
4. Automatic oil discharge by means of GESTRA multiple level-control electrode type ER 50 and GESTRA amplifier type VR 16
5. Oil discharge line
6. Sludge oil tank
7. Filter (coalescer)
8. Discharge valve and GESTRA DISCO non-return valve type RK 44s
9. Wash-water inlet
10. Drainage, blowdown
11. 15 ppm oil-content alarm type OR 52
12. Three-way valve, electro-pneumatic
13. to alarm equipment via time-lag relay
14. Overboard discharge
15. Pressure-maintaining valve