

Speed Switch Unit (-D)
MDP-REV-D
Instruction Manual

Article

This is prepared for Main Diesel Generator engine from the standard manual Q7LT333430FA.
Output contact of "13" may be used for Low speed detection.

(29 pages including the front page)

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Speed Switch Unit-D Safety Precautions

This manual describes precautions for safety installation and operation of the speed switch unit-D. Operate equipment following these precautions.

Hazards and damage likely to result from incorrect wrong use or, neglecting of the indicated precautions, is explained below in this Manual using the following symbol marks shown below. The symbols:



... CAUTION = State likely to cause damage of light or intermediate damage.



1. Caution against electric shock

- (1) Voltage remains in the internal terminal block even after POWER is turned OFF. See page 24(Fig.17).
- (2) When using 100 or 200 VAC for signal output contacts, be aware of possible electrical shock from the terminal block.



2. Caution against current leakage

- (1) To prevent current leakage, be sure to ground equipment properly. See page 24(Fig.17).

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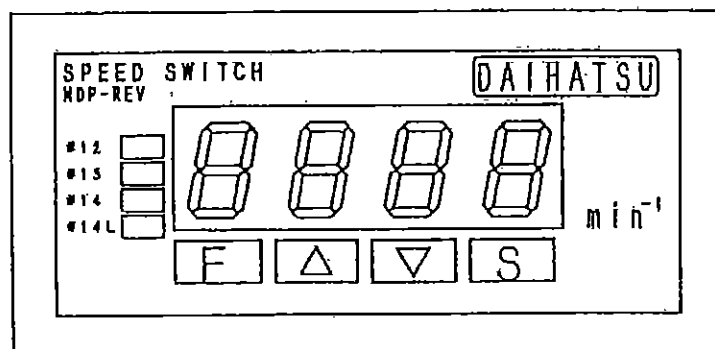


Fig. 1 Speed switch unit-D panel display

1 Overview

This product is a revolution detector available with a digital display function. It is a new type of speed switch unit, compact in size and highly functional, that indicates measurements digitally by a micro computer, ensuring high precision, flexible setting that meet a wide range of applications.

2 Features and functions

- High measurement precision by digital measurement (0.05% (at F.S.) \pm 1 digit)
- Revolution speed displayed digitally to a maximum of 4 digits.
- Three-point revolution detection and one-point contact for start-up interlock.
- High resist pressure semiconductor contact output (resist pressure 1500V, AC 100V, 0.1A)
- 4 ~ 20mA analogue output
- Revolution speed frequency output (1 Hz per revolution)
- Input specification and revolution range can be set at any value.
- Detachable terminal block is used.

3 Specifications

Item		
Speed detection	Number of detection points	3 speeds (#12, #13, #14) (#14L: contact for start-up interlock)
	Detection speed range	100~9990min ⁻¹ (#14L:1~999min ⁻¹)
	Measurement precision	0.5min ⁻¹ when it is 1000min ⁻¹ (0.05% (at FS.) ± 1 digit)
	Setting method	Detection point is set by key operation
	Response time	Contact output response 0.3 seconds
	Hysteresis	Standard 3.0% (0.0 ~ 1.0% at F.S. setting changeable)
Display	Display range	0~9999
	Display	4-digit red digital display (brightness adjustable)
	Display update	Approx. 0.5 sec.
Pulse input	Puls input range	2~20kHz
	Setting method	Set number of pulses and reduction gear ratio per revolution
	Input pulse	Dedicated pulse sensor (AC 2Vpp ~ 288Vpp (AC 0.7 ~ 100Vrms))
Frequency output (pulse output)	Output signal	1Hz, 0/15V (5kΩ) per revolution Allowable load resistance 5 KΩ or more, non-insulated with the power supply
	Output potential range	1~9999 Hz (1~9999min ⁻¹)
	Output error	0.1% (2000Hz or higher)
Analogue	Output signal	Current signal 1 output 4~20mA load resistance 500 Ω
	Output precision	±0.5%(FS)
	Full scale	100~9990min ⁻¹
Contact output	Output contact	3 contact points (#12: Overspeed, #13 low speed, #14, low speed) 1 contact points (#14L: for start-up interlock)
	Contact feature	set up with Contact output mode (Reference for P18)
	Contact capacity	No-voltage semi-conductor contact point, AC/DC 100V 0.1A, pressure resistance 1500V
Power supply	Voltage	DC24V -25~+30% (18.0V~31.2V)
	Power consumption	2.5W
Environmental conditions	Working temperature	5 ~ 55° C (Max. 95% RH, with no dew condensation)
	Storage temperature	-20~65°C (MAX 95%RH, with no dew condensation)
	Ambience	No corrosive gas
	Vibration/impact	5 ~ 13.2Hz:± 1mm, 13.2 ~ 100Hz:0.7G Impact: max. 10G
Case	Dimension	72×36×133
	Weight	0.2Kg
	Color	Black

4 Outline

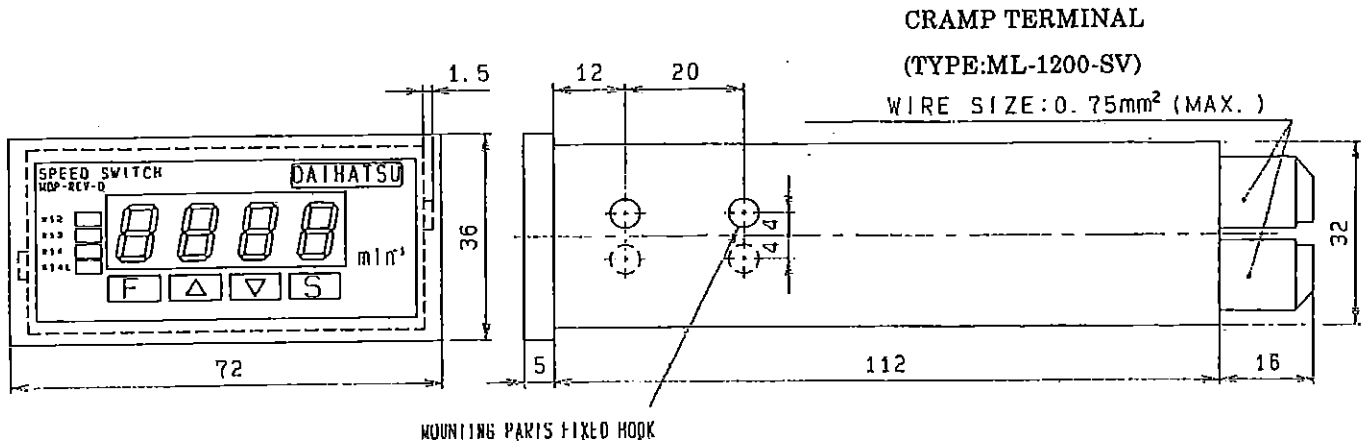


Fig. 2 Outline drawing

5 Configuration

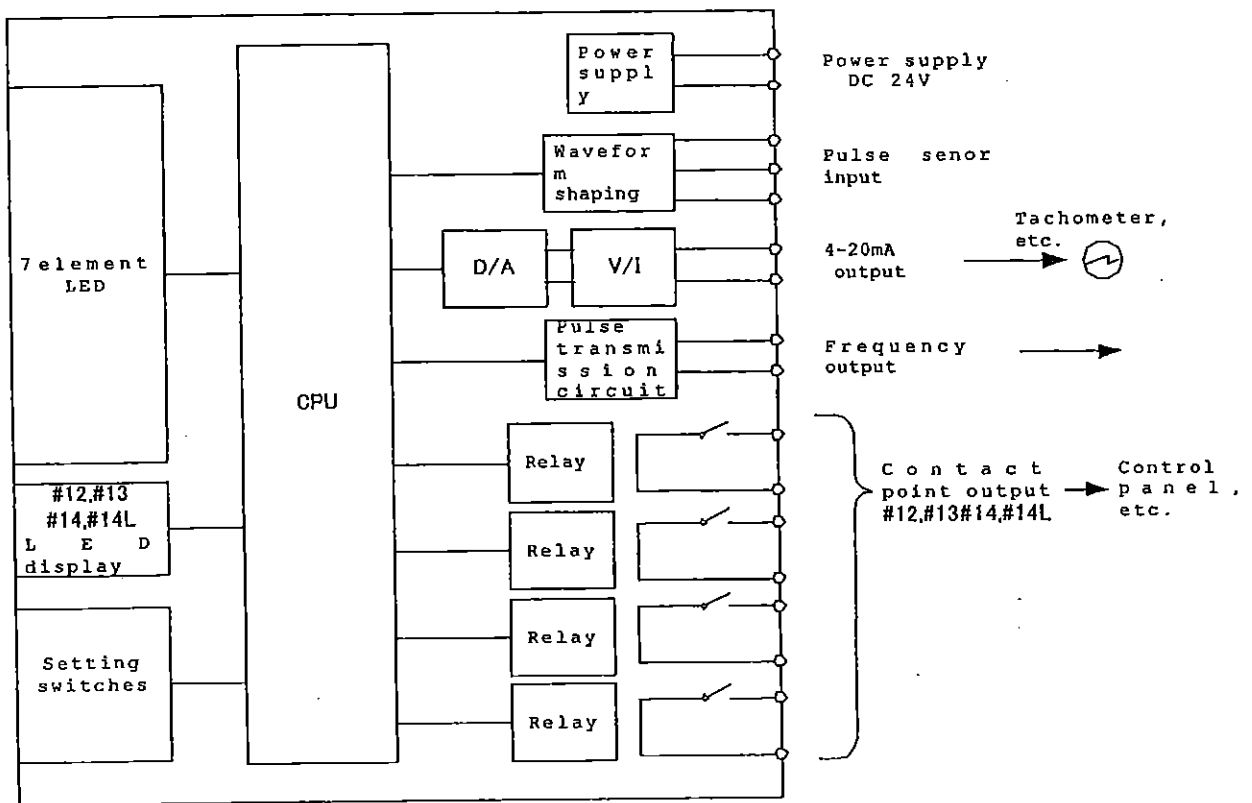


Fig. 3 Internal block diagram

6 Operation and modes

6.1 Display and operation

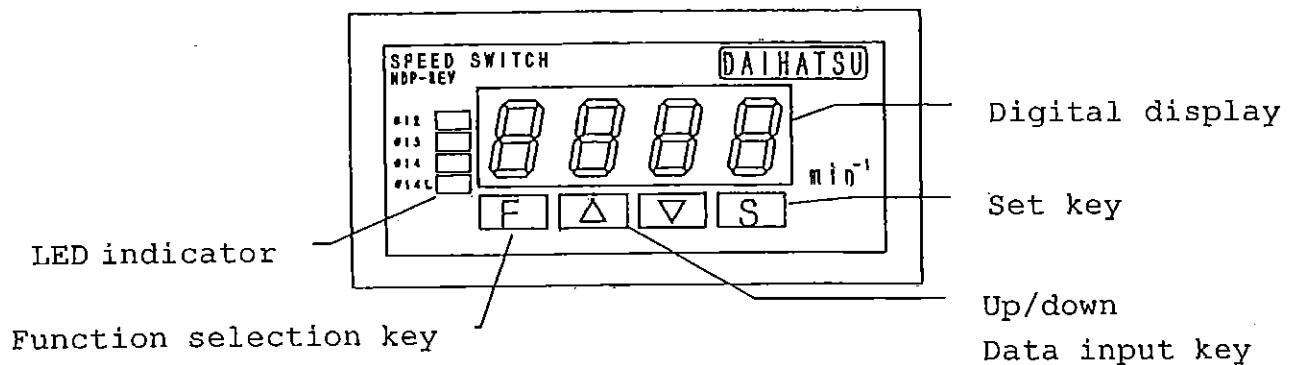


Fig. 4 Panel display

<Display function>

Digital display: Engine revolution speed is indicated digitally on the 4-digit digital LED display.
Set values, etc. are displayed, during various setting operations.

<LED indicator>

- # 1 2 : Means over-speed detection and indicates that the engine is rotating faster than the rated speed.
- # 1 3 : Means Low-speed detection and indicates that the engine speed has passed over the low-speed set value.
- # 1 4 : Means Low-speed detection and indicates that the engine speed has passed over the low-speed set value.
- # 1 4 L : Indicates that the conditions for start-up interlock have been met. It is applicable in start-up interlock circuits as it can detect complete stop of the engine.

<Input>

[F] Function selection key:

Switch for changing the mode and items. Pressing this key during normal mode changes the mode to setting display/setting mode.

Pressing and holding this key for more than 3 seconds changes the mode to initial setting display/setting mode.

[Δ][▽] Data input key:

Allows you to increase and decrease the set value.

[S] Set key:

Starts the setting of items and also enters and saves the set value.

6.2 Actions when the power supply is turned on

When the power supply is turned on, all LEDs turn on for about 1 second and normal mode starts. During the above action, revolution detection, output and error detection functions are suspended whether or not input signal exists.

Note) Before using the speed switch unit for the first time, various settings must be made to enable normal function, as initially set values are only temporary values set for shipment. Please set each parameter correctly reading this instruction manual to enable correct use of the unit.

The units delivered, as the accessories of diesel engine will be suitably set up.

6.3 Normal state/display (normal mode)

During normal mode, the revolution speed presently detected is displayed. When the revolution speed exceeds the detection set values, the relevant contact output operates and at the same time the relevant LED indicator lights. This mode is displayed except when the setting change mode is selected.

During normal mode, the display brightness setting can be changed by the [▲][▼] data entering keys. (The initial setting value is set at the maximum brightness of 31, and normally it is not particularly necessary to change it.)

The next time the power supply is turned, the brightness is displayed at the value preciously saved.

▲	Increase the brightness.
▼	Decrease the brightness
S	Pressing this button for more than 3 seconds saves the present brightness.

6.4 Initial set values

Note) To use this product, it is necessary to pre-set various set values correctly.
Using this unit without setting these values may cause critical problem in engine operation and control.

For the initial set values the following values are entered before shipment.

To encourage setting by the users, the values set in the initial setting are normally impractical values.

Refer to the table below and set items that have no ※ mark attached.

The units delivered, as the accessories of diesel engine will be suitably set up.

※ marked items can be used without changing the initial set value.

Section	Set Items	Settable range	Initial Set Value	Set Value
8. 2	Number of gear teeth	1~300	1	
8. 2	Reduction gear ratio	1~20	2	
8. 3	Analogue value full scale	10~999	10	
8. 4	Output mode	0~15	0	
7. 2	#14L	ON revolution speed	1~999	1
7. 2		OFF revolution speed	1~999	1
7. 2		Off delay timer	0~300	0
7. 3	#14 ON (OFF) revolution speed	100~9999	100	300
7. 4	#13 OFF (ON) revolution speed	100~9999	100	300
7. 5	#12 ON (OFF) revolution speed	100~9999	100	
7. 6	#14, 13, 12 contact hysteresis	0~10.0	3	※
8. 5	Analogue output zero setting	-9.9~0~9.9	0	※
8. 5	Analogue output span setting	-9.9~0~9.9	0	※
6. 3	Display LED, brightness adjustme	1~31	31	※

※ marked items basically require no change

6.5 Set value display/setting mode and initial set value display/ setting mode

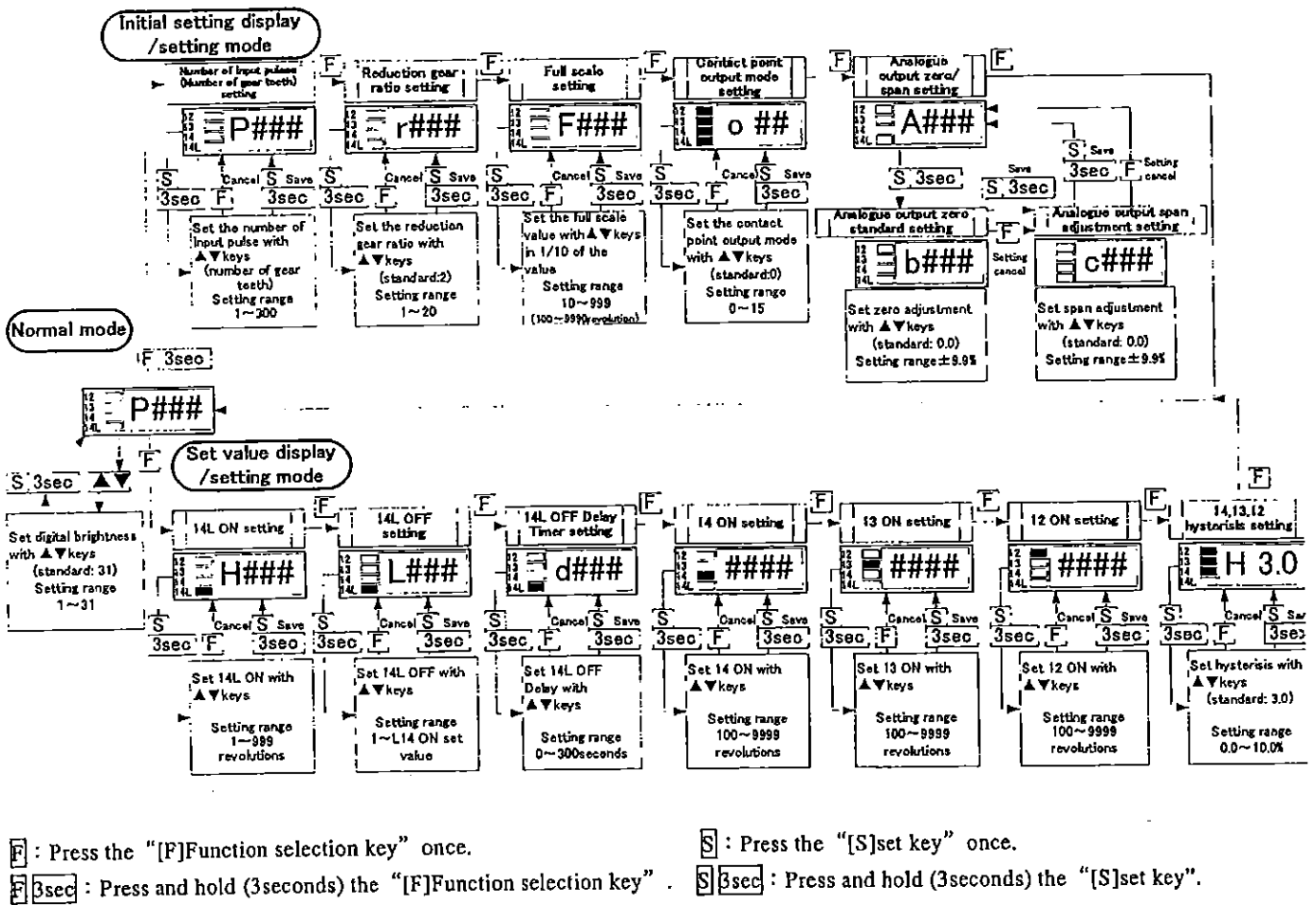


Fig. 5 Setting procedure list

To change the set values, it is necessary to perform setting change work using the "Set value display/setting mode" and "Initial setting value display/setting mode".

"Set value display/setting mode":

A mode for setting mainly items concerning speed detection.

"Initial setting value display/setting mode":

A mode for setting constants that should be pre-set such as number of gear teeth and full scale value, etc.

To change from the "Normal mode" to "Set value display/setting mode" or "Initial setting value display/setting mode", press the "[F] function selection key" at normal mode.

To change to each mode, press the "[F] function selection key" as follows. Please refer to Fig. 5 Setting procedure list.

- ① To change to the "Set value display/setting mode", press the "[F] function selection key" once.
- ② To change to the "Initial setting value display/setting mode" press and hold (3 seconds) the "[F] function selection key".

To increase or decrease the set values by pressing the [▲][▼] keys, pressing the key once increases/decreases the value by ± 1 step, but pressing and holding the same key changes the mode to repeat mode and the values can be entered continuously. Keep pressing even further, changes the mode to fast forward and values can be changed in 10-fold, 50-fold steps.

7 Set value display/setting mode

7.1 Mode and setting items

Pressing the “[F] function selection key” from “Normal mode”, changes the mode to “Set value display/setting mode”.

In this mode, each time the “[F] function selection key” is pressed, the table below is displayed sequentially and pressing the “[F] function selection key” once again at the last item, returns the mode to “Normal mode”. (Refer to Fig. 5)

The set value display/setting mode consists of the following setting items.

- ① Setting #14L ON:
Revolution detection for start-up interlock, ON point revolution speed
- ② Setting #14L OFF:
Revolution detection for start-up interlock, OFF point revolution speed
- ③ Setting #14L OFF Delay:
Contact start-up interlock, OFF DELAY TIMER (second)
- ④ Setting #14 ON:
Low speed detection ON point revolution speed
- ⑤ Setting #13 OFF:
Low speed detection OFF point revolution speed
- ⑥ Setting #12 ON:
Overspeed detection ON point revolution speed
- ⑦ Hysteresis (#14, #13, #12):
ON-OFF width of #14, #13, #12 (% at FS)

Pressing and holding the “[S] set key” during the item display changes the mode to the set value change mode of the applicable item.

When it enters into the set value setting mode, measurement is suspended and external output and external contact point are frozen temporarily.

(When it returns to the normal mode again, it restarts but with a delay of about 1 to 2 seconds)

To add, when no operation is made for 3 minutes when any set value is being displayed or set, it will automatically return to normal mode.

When the brightness degree had been decreased in normal mode, the maximum brightness will be displayed temporarily in set value display mode but will display the original brightness again when returned to normal mode.

7.2 Start-up interlock contact point (#14L)

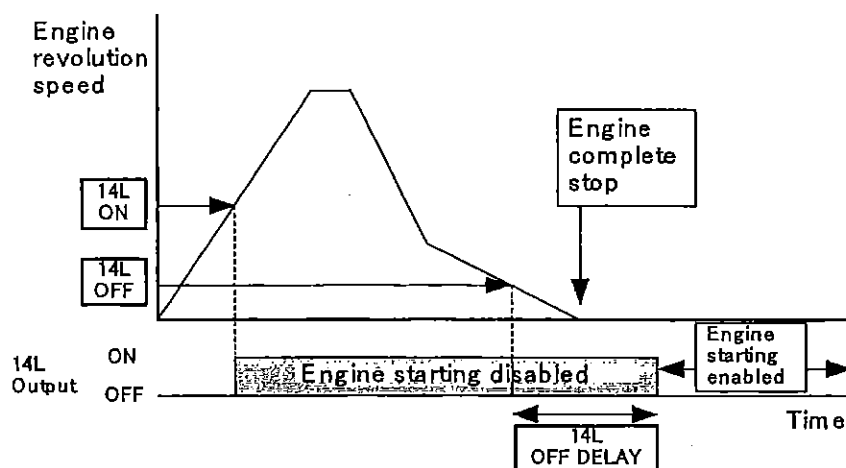


Fig. 6 14L OFF DELAY TIMER contact point operation outline

Internal combustion engine employs fly wheel (inertial mass) at the output axis to reduce output fluctuation. Therefore, when the engine is stopped, revolution remains longer than expected due to inertia of fly wheel, and even when the users stop the machine, the output axis may not be stopped completely. When start-up command is given to the engine under such situation, it may trigger unexpected accidents.

Contact for start-up interlock outputs a condition that can block restarting of engine when the output axis is rotating, with the following 3 conditions combined, so as to enable secure detection of engine stop (refer to Fig. 6 "Engine Activation Disabled" part).

- (1) "#14L ON detected revolution speed" as engine operating condition,
- (2) "#14L OFF detected revolution speed" as engine condition immediately before stopping,
- (3) Time counter timer from (2) to complete stop "#14L DELAY TIMER"

For using the start-up interlock contact (#14L), the following 3 values must be set.

- ① #14L ON setting
H = 1 ~ 999
- ② #14L OFF setting
L = 1 ~ "#14 ON set value"
- ③ #14L OFF Delay setting
d = 0 ~ 300 sec.

Description:

- ① is an operation point setting for start-up interlock contact and when the engine revolution speed exceeds this set value, #14L contact output operates.
- ② #14L starts the OFF DELAY timer when the engine revolution speed becomes below this set value.
- ③ is a set value of #14L OFF DELAY timer and sets the delay time in seconds. #14L contact point output turns off when the time set by this timer is up.

7.3 Low speed detection contact (#14)

To use the low speed detection contact (#14), the following value must be set.

When the engine revolution speed increases above this set value, #14 contact output operates.

④ #14 ON setting

#14 = 100 ~ 9999

7.4 Low speed detection contact (#13)

To use the low speed detection contact (#13), the following value must be set.

When the engine revolution speed increases above this set value, #13 contact output operates.

⑨ #13 OFF setting

#13 = 100 ~ 9999

7.5 Overspeed detection contact point (#12)

To use the overspeed detection contact (#12), the following value must be set.

When the engine revolution speed increases above this set value, #12 contact output operates.

⑩ #12 ON setting

#12 = 100 ~ 9999

7.6 Hysteresis (#14, #13, and #12)

Hysteresis is provided to secure stability in detection operation even when the revolution speed sways. At the point of time the revolution speed exceeds the set value (detected revolution speed), the contact turns on and at the point of time the revolution speed become less than set value (return revolution speed) for the amount of hysteresis, the contact turns off.

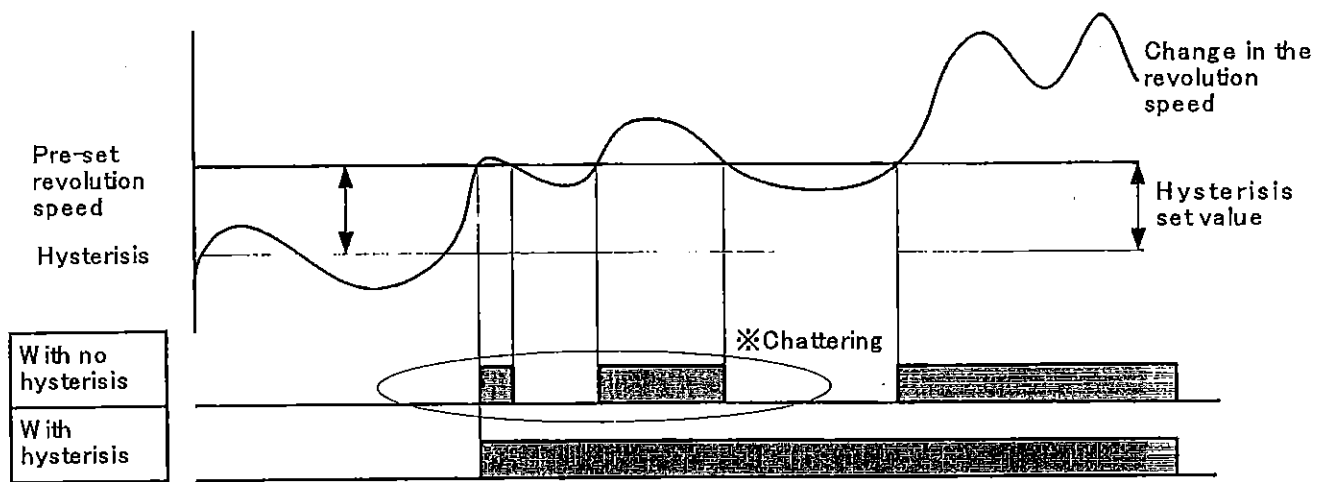


Fig. 7 Hysteresis

※Chattering may generally cause relay contact depositing by contacts repeating ON/OFF in a short time.

Detection revolution speeds for #14, #13 and #12 are set individually, but for return revolution speed, this hysteresis value will be applied to all.

- ① Hysteresis (#14, #13, and #12)
0.0 ~ 10.0% (at FS)

- ※ 3.0% is registered as initial set value.
- ※ It is not particularly necessary to change.

Hysteresis means the range between (detection revolution speed) – (return revolution speed), and this value is set by the percentage value of the full scale set value in § 8.3.

[Ex. 4] When it is $F = 150$, $\#12 = 1020$, $H = 3.0$,

(F: analogue full scale set value, #12: overspeed detection set value, H: hysteresis set value)

$$\text{Hysteresis} = 1500 \times 3.0/100 = 45 \text{min}^{-1}$$

#12 ON point (detection speed) ----- 1020min^{-1}

#12 OFF point (return speed) ----- 975min^{-1}

8 Initial setting display/setting mode

8.1 Mode and setting items

Pressing and holding (keep pressing for 3 seconds) the “[F] function selection key” from “Normal mode” or “Set value display/setting mode” changes the mode to “Initial setting display/setting mode”.

In this mode, each time the “[F] function selection key” is pressed, the following display will be displayed sequentially and pressing the “[F] function selection key” at the last item returns the mode to normal mode. (Refer to Fig. 5)

Initial set value display/setting mode consists of the following setting items.

- ① Pulse setting:
Pulse number per revolution (number of teeth)
- ② Reduction gear ratio setting:
Reduction gear ratio from the crank shaft
- ③ Full scale setting:
Scale range of analogue output
- ④ Output mode setting:
N/C, N/O modes of output contacts
- ⑤ Analogue output zero/span adjustment:
For analogue output range adjustment

Pressing and holding the “[S] set key” during display of each item changes the mode to set value changing mode of the relevant item.

When it changes to the initial setting mode, measurement is suspended and external output and external contact points are frozen temporarily.

(When it returns to the normal mode again, it restarts but with a delay of 1 to 2 seconds).

To add, when either of the set value displayed or set is left for 3 minutes without any operation, automatically returns to normal mode.

When the brightness degree had been decreased in normal mode, the maximum brightness will be displayed temporarily in set value display mode but will display the original brightness again when returned to normal mode.

8.2 Pulse setting/reduction gear ratio set values

Engine revolution speed (or revolution speed of rotor) is calculated from the frequency of pulse signal impressed on the sensor input terminal based on the pulse specification set and is displayed.

For the calculation of revolution speed, it is necessary to set the following pulse specifications.

- ① Number of pulses per revolution (number of gear teeth)

$$P = 1 \sim 300$$

- ② Reduction gear ratio

$$r = 1 \sim 20$$

① is the number of pulses generated per revolution of the rotation axis (gear) installed with a pulse sensor.

② is the reduction gear ratio to set when the engine revolution speed and the rotation axis installed with a pulse sensor are not the same.

For instance, when the revolution of the engine output axis is detected by pulse sensor in the original condition, the reduction gear ratio of ② becomes $r = 1$.

[Ex. 1] Engine output axis direct measurement: when the number of gear teeth is 142.

$$P = 142, \quad r = 1$$

When the pulse sensor is attached to the gear that interlocks with the cam shaft of 4 cycle engine, r becomes 2. (Cam shaft only rotates 1/2 revolutions per engine revolution, so the reduction gear ratio becomes 2).

[Ex. 2] Cam shaft measurement: number of gear teeth 75

$$P = 75, \quad r = 2$$

Also when the number of pulses per revolution is not an integral number, set a value 10-times

① and at the same time set a value 10 times large also for ②.

[Ex. 3] Cam shaft measurement: tacho generator 7.5 pulse

$$P = 75, \quad r = 20$$

(Reference)

The pulse frequency to be impressed is expressed by the following formula.

$$\text{Frequency} = \text{Revolution speed} \times \text{number of pulses} \\ \div \text{reduction gear ratio} \div 60$$

On the contrary, when calculating the revolution speed from the frequency, it is expressed by the following formula.

$$\text{Revolution speed} = \text{Frequency} \times \text{reduction gear ratio} \times 60 \\ \div \text{number of pulses}$$

8.3 Full scale set value

The revolution speed can be output by the analogue signal of DC 4 ~ 20mA.

It is necessary to set the full scale value so it meets the specification of the equipment to which this output is connected.

To add, hysteresis (on-off difference) at the time of speed detection is calculated based on this full scale value.

③ Analogue full scale setting range

$$F = 100 \sim 9990 \text{ min}^{-1}$$

The set value is determined by defining the revolution speed necessary at the time of 20mA output to meet the specification of the equipment to be connect to and the value dividing the revolution speed by 10 shall be the set value. 4mA is equivalent to 0 revolution speed.

[Ex. 4] Full scale = 2500 min^{-1}

$$F = 250$$

8.4 Contact output mode

Contacts that operate when the contact output and the conditions of (start-up interlock contact (#14), low-speed detection contact (#14), low-speed detection contact (#13) and over-speed detection contact (#12)) are met can be specified whether it should be ON during operation or OFF by the following setting.

④ Output mode setting range

$$o = 0 \sim 15$$

Note) As a standard setting, it is set at [0] (all contacts are A contact operation) at the time of shipment from the plant.

This value is expressed by the mode numbers from 0 to 15 and is applied to each contact, #14L, #14, #13 and #12, as follows:

No.	#14L	#14	#13	#12
0	A	A	A	A
1	A	A	A	B
2	A	A	B	A
3	A	A	B	B
4	A	B	A	A
5	A	B	A	B
6	A	B	B	A
7	A	B	B	B
8	B	A	A	A
9	B	A	A	B
10	B	A	B	A
11	B	A	B	B
12	B	B	A	A
13	B	B	A	B
14	B	B	B	A
15	B	B	B	B

A : N/O (On when over the value) mode
 B : N/C (Off when over the value) mode

8.5 Analogue output zero/span adjustment

When there is a slight deflection in the analogue output range (4 ~ 20mA), this range can be corrected by the adjustment of zero output (4mA) and full output (20mA).

Note 1)

The speed switch unit has been adjusted at the time of shipment to ensure that correct analogue output can be made.

Normally, it is not necessary to change this setting.

Note 2)

Do not attempt to adjust the deflection in the revolution speed caused by the error in the equipment (for instance tachometer) connected to the analogue output by this function of speed switch unit.

⑤ Analogue zero output/full output adjustment setting range

- 9.9 ~ 0.0 ~ + 9.9 % (no correction when it is 0.0%)

When you enter into this mode, "A" is displayed on the leftmost side of the numerical value display and the present output on the right side.(Continuous lighting)

Under this condition the following keys are accepted.

F
S

changes to normal mode

Pressing and holding this for 3 seconds changes to "Analogue output adjustment".

[Analogue zero output adjustment]

When you enter into this mode, "b" is displayed on the leftmost side of the numerical value display in continuous display and the present zero correction value on the right side by flashing. The analogue output will be fixed at "4.00mA".

The correction value is the % value added to the standard state.

Here, with the following keys, fine adjustment of output value (4mA) will be made.

F	Cancels the setting and changes to "full output adjustment".
▲	Raises the correction value (output rises at the same time)
▼	Lowers the correction value (output declines at the same time)
S	Pressing and holding for 3 seconds sets and saves the present indicated value.

To add, the setting range will be $\pm 9.9\%$ and no correction value when it is 0.0%.

[Analogue full output adjustment]

When you enter into this mode, "c" is displayed on the leftmost side of the numerical value display in continuous display and the present zero correction value on the right side by flashing. The analogue output will be fixed at "20.00mA".

The correction value is the % value added to the standard state.

Here, with the following keys, fine adjustment of output value (20.00mA) will be made.

F	Cancels the setting and changes to "full output adjustment".
▲	Raises the correction value (output rises at the same time)
▼	Lowers the correction value (output declines at the same time)
S	Pressing and holding for 3 seconds sets and saves the present indicated value.

To add, the setting range will be $\pm 9.9\%$ and no correction value when it is 0.0%.

9 Installation

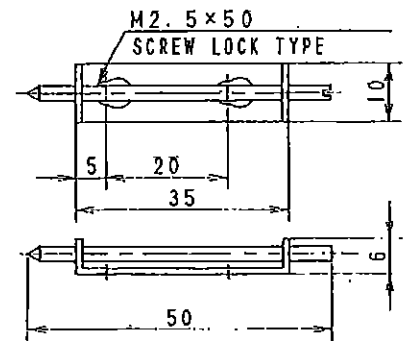
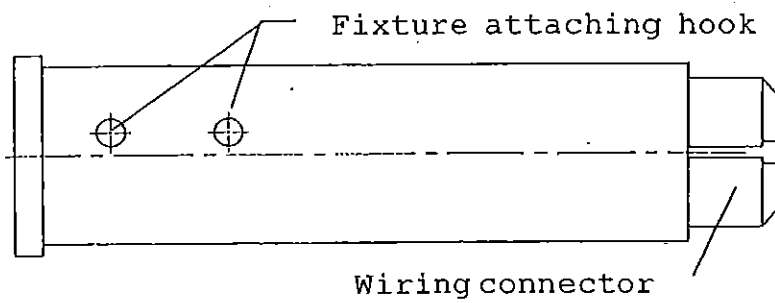


Fig. 8 Speed switch unit-D side face

Fig. 9 Fixture (accessory)

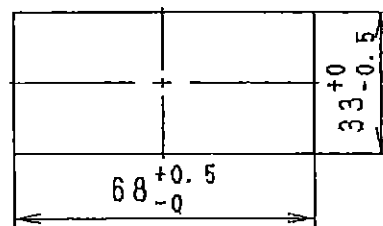


Fig. 10 Panel cut dimension

- ① Cut the panel of the place to install into in the panel cut size (Fig. 10).
- ② Insert speed switch unit-D from the front side of the panel cut hole. (Fig. 11)
- ③ After inserting, hook the attached fixture to the fixture installing hook and screw in metal fitting screw with a slotted screwdriver to securely fasten to the panel side. (Fig. 12)

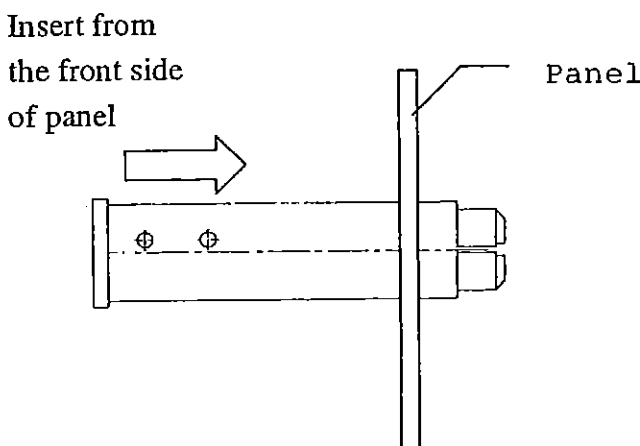


Fig. 11 Installation (insertion)

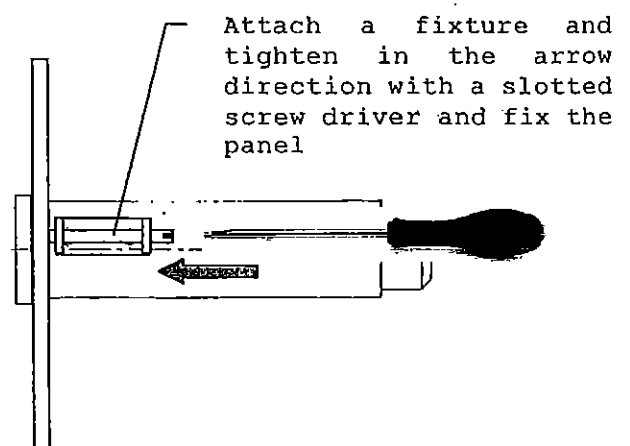


Fig. 12 Installation (fixing)

- ① When there is vibration on the installation panel face, you can use "bracket: panel installation (NN00262007A)" (option) which can be installed more securely.
- ② When converting the conventional speed switch unit and speed switch unit 2 to speed switch unit-D during maintenance, etc., you can use the speed switch unit-D available with a compatible case attached with a bracket that fit each unit,

10.2 Wiring installation to I/O connector



Fig. 14 Connector

Peeling allowance 9mm



Fig. 15 Peeling allowance of wiring

1) Electric wires to connect to the connector must satisfy the following specification.

Recommended: Single wire: ϕ 1.0mm (AWG 18)

Twisted wire: 0.75mm^2 (AWG 20)

Strand diameter: Min. ϕ 0.18mm

Usable electric wire range

Single wire: ϕ 0.4 ~ 1.0mm (AWGF 26 ~ 18)

Twisted wire: $0.3 \sim 0.75\text{mm}^2$ (AWG 22 ~ 20)

Strand diameter: Min. ϕ 0.18mm

2) Secure 9mm for peeling allowance of wiring. Twist it lightly so it will not spread out. Solderless terminal is not necessary.

Electric wire insertion hole

Electric wire insertion/release
operating unit

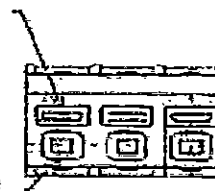


Fig. 16 Connector ele

3) Insert and release wiring to the connector by pressing the wire insertion/release operation unit located at the side of the wiring insertion hole, with a slotted driver or the like. Insert it fully and release the driver from the electric wire insertion/release operation unit. Wiring is grasped inside the connector and fixed securely.

4) Connector can be inserted, only one line to one pin. Should it become necessary to insert multiple wirings into one pin, a separate terminal block will be necessary to bundle the wiring into one before connecting to the wiring.

5) Connector itself can be removed easily by pulling it out. If it is difficult to install wiring, remove the connector to make installation easier. Also at the time of speed switch unit-D replacement, wirings can be removed in a lump at the connector, and there is no need to remove wirings one by one.

6) After completing installation, be sure to check that the wiring is correct and that no short circuiting has occurred due to spreading of wiring. Also pull the wirings to see that they do not come off.

10.3 External wiring

External wiring example of speed switch unit-D is given below.

1) Standard connection

A combination of one unit of pulse sensor and one unit of speed switch.

There are one analogue output system, three contact output systems, frequency (pulse) output and start-up interlock contact output. The contact signal is connected to the engine control panel for control.

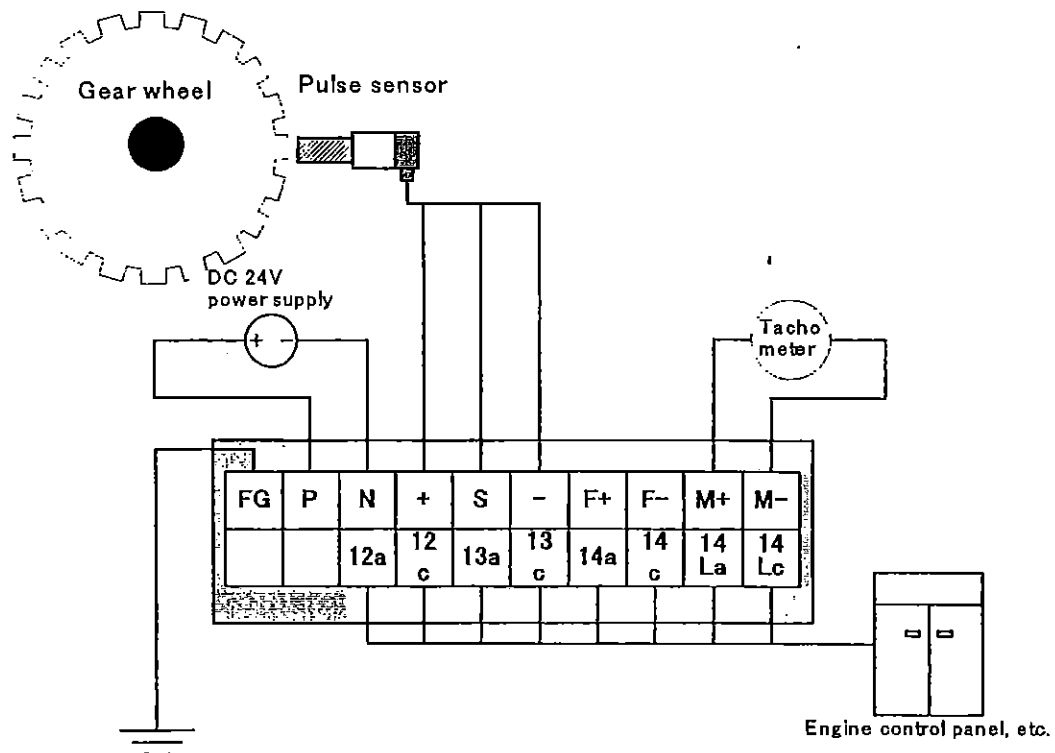


Fig. 17 Standard connection with one unit of pulse sensor and one unit of speed switch

2) Driving two units of speed switch

One unit of pulse sensor can drive up to two units of speed switches.

By parallel driving, the number of outputs can be expanded to 2-fold. (2 systems of analogue output, 6 systems of contact output).

To connect from the first speed switch to the other, do so via separate relay terminal block.

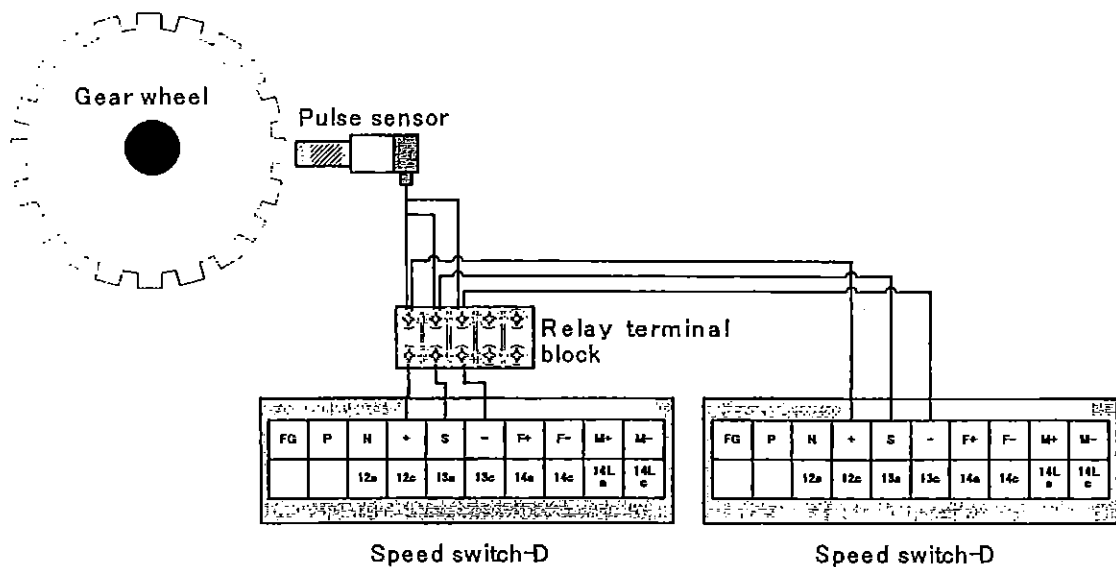


Fig. 18 Parallel driving connection by one unit of pulse sensor and two units of speed switches.

10.4 Connection with the pulse sensor

1) When connecting the pulse sensor NN00006014A (new type) (DC series engine since 2005)

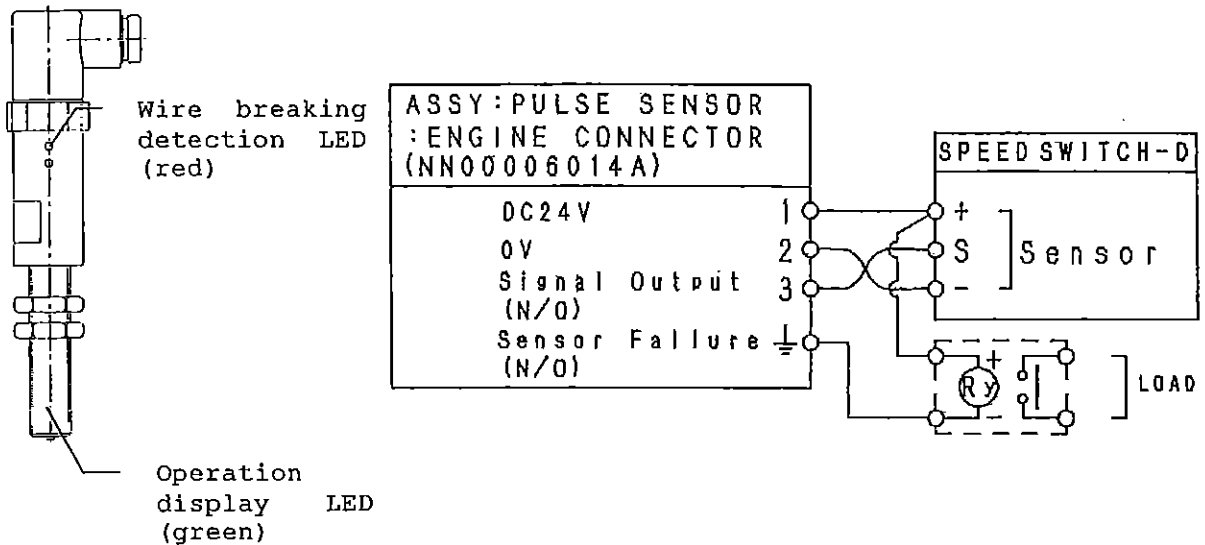


Fig. 19 Pulse sensor NN00006014A

Fig. 20 Pulse sensor speed switch connection diagram

When connecting this pulse sensor to the speed switch unit -D, refer to the connection diagram in Figure 20.

This pulse sensor is provided with a wire breaking detection function for coil and the red LED at the upper part of pulse sensor turns on when the coil wire breaks, to display the state of wire breakage and at the same time to output it outside. When using the coil breakage detection, prepare a separate relay as in the drawing above and connect it.

For the relay to be used in wire breaking detection, select the one with a coil rated current 30mA or below during operation.(Omron: MY 4-D equivalent)

This pulse sensor is compatible with the (2) pulse sensor (conventional type) in terms of the dimension at the installation section and electrically, it is possible to use it as an alternative model.

2) When connecting pulse sensor 50A, 100, 200 (L51131) (conventional type) (Except for the above)

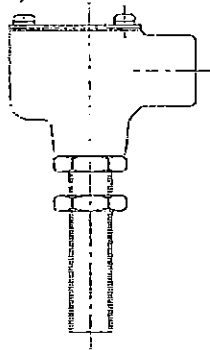


Fig. 21 Pulse sensor (L51131)

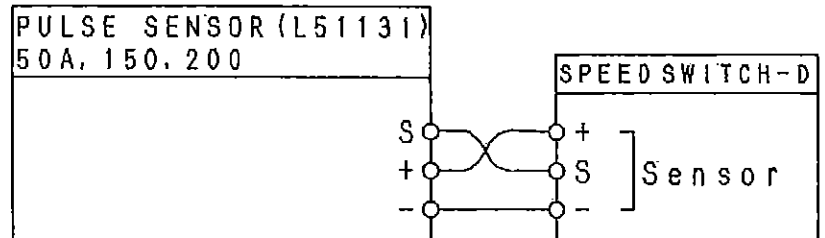


Fig. 22 Pulse sensor (conventional)
- speed switch connection diagram

When connecting this pulse sensor to the speed switch unit-D, refer to the connection diagram in Figure 22.

This pulse sensor has no display/output function for coil breaking detection.

10.5 Connection and branching of analogue output

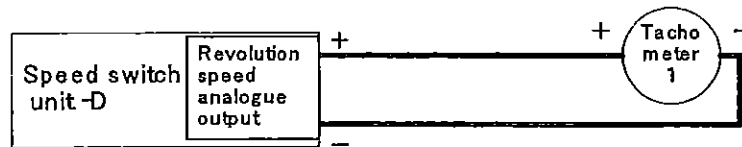


Fig. 23 Analogue output connection (one system)

The speed switch unit -D has one output of analogue output signal (4-20mA signal) that outputs the rotational speed. For the connection diagram, refer to Figure 23. The allowable load resistance of connecting instrument is 500Ω maximum.

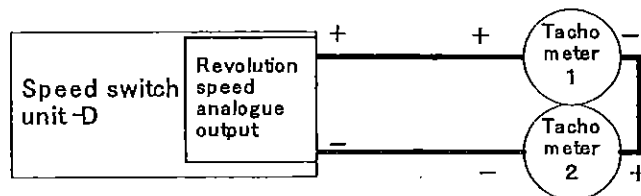


Fig. 24 Analogue output connection (two systems) part 1

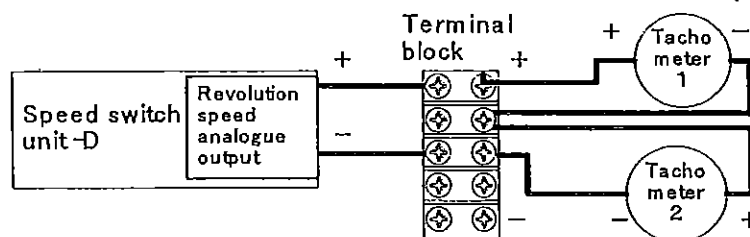


Fig. 25 Analogue output connection (two systems) part 2

When outputs of two systems are necessary for sending signals to the meter and data logger, connect the instrument in serial referring to Figure 24 and 25.

However, in the following cases, use an isolator and divide the analogue signal into two.

- ① When load resistance is set to over 500Ω in total.
- ② When floating of the input signal is not carried out in either instrument.

Note)

① When connecting to an instrument with a load resistance exceeding 500Ω, nonconformity may occur such as discrepancy between the actual revolution speed and the revolution speed indicated on the instrument.

② When negative terminal sides of two units of connecting instruments are grounded, current wraparound occurs through grounding and as a result, the input of equipment on the downstream side bypasses, causing disability in signal input to this instrument.

These incidents can be avoided by inserting an isolator and insulating the signal by direct current. For the isolator, select the insulator type with two-outputs (M system: W2YV-AAA-R2 equivalent).

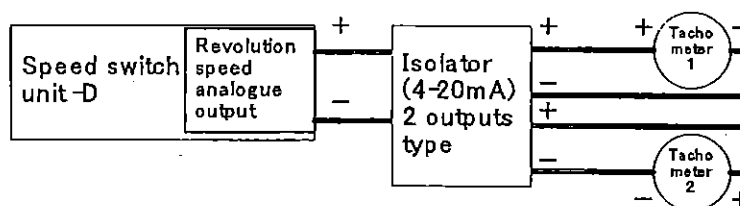


Fig. 26 Analogue output connection
(isolator used for dividing into 2)

10.6 Precautions in wiring handling

1) Wiring and shield handling

Wiring to the speed switch unit must be installed taking note of the following points.

- ① For power supply wirings, pair negative and positive wirings and twist them together.
- ② For the pulse sensor wiring, use three-wire shield wire.
- ③ For analogue output, use two-wire shield wire.
- ④ For frequency output, use two-wire shield wire.
- ⑤ Use the shield wire on the basis of single-point grounding. Make sure to connect grounding.
- ⑥ Keep wirings connected to the speed switch unit away from the power line and large size relays.

2) Twisted pair wiring

Twisted pair wiring means twisting 2 wirings. This is generally done on electric wires to improve the resistance to noise easily and reduce the effect of electromagnetic induction to the outside.



Fig. 27 Twisted pair wiring



Fig. 28 Normal parallel wiring

3) Grounding of shield wire (single-point grounding)

Grounding of three-core shield wire between pulse sensor speed switch units.

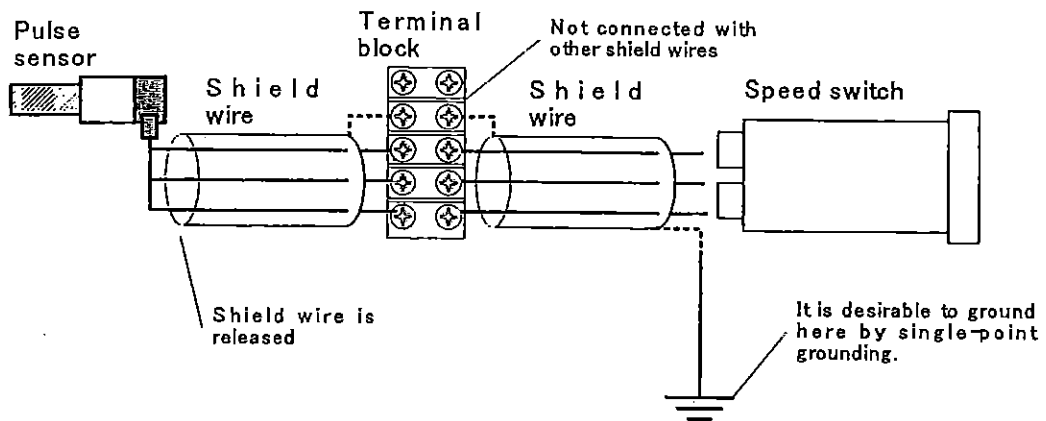


Fig. 29 Shield wire grounding (single-point grounding)

Single-point grounding is an effective connecting method for strengthening the noise resistance of wiring, using the weak signal and pulse, by grounding the shield wire at only single point as shown in the above diagram.

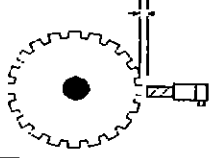
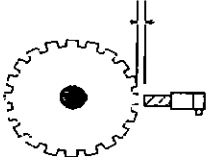
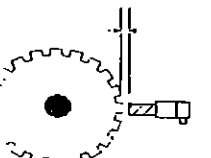
If the sensor side is also connected to the ground, two sides, the sensor side and speed switch side would be grounded. This would cause potential difference between the two points that would provide a good condition for the noise to adhere, it is normally not done.

But if neither grounding is available, there would be no place for noise ingredient to escape to when external noise ingredient adheres to the shield wire, making it possible for the noise to adhere to the signal line, which otherwise should be protected, impeding the effective use of shield wire.

The shield wire must be connected based on single-point grounding.

11 Troubleshooting

11.1 Troubleshooting table

	Phenomenon	Cause	Countermeasure
1	Display/LED does not light	The power is not supplied	Turn on the power supply
		Power supply mis-wired.	Redo wiring work.
		Mis-wired to pulse sensor	Redo wiring work.
2	Contact signal does not output The meter does not work	Wrong set value	Redo the setting work.
		Wrong wiring	Redo wiring work.
		Pulse sensor attaching gap inappropriate	Fix within the range of 1 to 2 turn return from the rotor. It can be checked if it is detected during operation of pulse sensor by the green LED. 
		This unit or pulse sensor failure	Check if either the unit or sensor is defective and replace with anew one if any defect is found.
3	Meter indication swings during constant rotation. Contact output turns off sometimes.	Pulse sensor attaching gap inappropriate	Fix within the range of 1 to 2 turn return from the rotor. It can be checked if it is detected during operation of pulse sensor by the green LED. 
		Looseness in pulse sensor lock nut	Retighten
		Pulse sensor failure	Replace the pulse sensor with a new one.
		Noise influence	Contact the person in charge of engineering
		Looseness, omission of wiring	Redo wiring work.
		4	Meter reading differs from the actual measurement Contact output differs from the revolution speed detected by the contact output.
		Analogue adjustment defect (Only for the phenomenon of meter reading being different from the actual measurement)	Make adjustment by analogue setting (Correctable up to $\pm 9.9\%$)
		Pulse sensor attaching gap inappropriate	Fix within the range of 1 to 2 turn return from the rotor. It can be checked if it is detected during operation of pulse sensor by 
		Analogue output load resistance exceeds 500 Ω	Lower the load resistance



INSTRUCTION MANUAL

J.W PRE-HEATING UNIT

D O C . N O	SS-IM-SSE25000
D A T E	2005.05.25
R E V . N O	1
P A G E	1/6

Instruction Manual for J.W. Pre-heating Unit

INDEX

1. Important information
2. Brief description
3. Installation
4. Initial operation
5. Heater maintenance
6. Heater troubleshooting
7. Control box maintenance
8. Pump service and maintenance
9. Pump troubleshooting
10. Temp. controller / safety cut-out



INSTRUCTION MANUAL

J.W PRE-HEATING UNIT

D O C . N O	SS-IM-SSE25000
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1. IMPORTANT INFORMATION

Read and observe the following point.

To ensure a correct and reliable operation, it must be installed and started up by qualified personnel with suitable equipment and carefully maintained.

The safety instruction of this operation manual should be attached to the unit and especially the safety regulations for the installation and operation of electric plants must be kept.

All operators have to observe the regulation of this operating manual in order to keep the best condition and safe operation.

The operating manual should be read carefully and thoroughly before beginning the installation work and before the initial start-up. Non-observation may result in death and injury of persons or damage of the unit.

If this operation manual proves inadequate in any case, please contact the manufacturer the below address.

Sinsueng Electric Co.,Ltd.
#400-7 Junglee Industrial Complex, Wongye-Ri Naeseo-Eup,
Masan-city , Kyung-nam, Korea
Tel : +82-55-231-6707
Fax :+82-55-231-6709

Standards and regulation.

The problem by the using environment of outside area of the industrial standards (KS, JIS, ICE, NEMA) and directives list in this manual doesn't be subject to our company's guarantee.

2. BRIEF DESCRIPTION

The preheating set is completely wired and piped for connection and components are ready to easy repair and replace.

A fresh water flows continuously through circulation pump and it was heated by Electric Heater after operation of the main switch and the pre-selection of the heating element.

The water temperature is regulated / limit by a Temp.controller / Thermostat located in the heater.

Pump and heater are logically interlocked.

3. INSTALLATION

The cooling water preheating unit must be installed by qualified personnel according to our operating manual and pertinent regulations.

The operating voltage and the main frequency must be same as the data on the manufacturer's name plate.

The incoming power supply cable must be sized in accordance with the total connected load.

Before connecting power supply to the unit, the equipment must be earthed at the marked earth terminal with appropriate regulations.



INSTRUCTION MANUAL

J.W PRE-HEATING UNIT

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Pump(Direction of rotation)

The direction of rotation of the pump shaft must be same as the arrows on the fan cover.
The direction of rotation of the pump can be changed by Exchanging 2 phases.

Piping system

Take care of the clean, contraction and expansion of the piping system.
Ensure sufficient space for repair and maintenance work (e.g. heater removal)

4. INITIAL OPERATION

- 1) Open the air vent valve to remove the air in the pre-heater , and then fill the unit with water. .
- 2) Turn the main switch. (At this moment the pump runs in Automatic mode).
- 3) Pre-select heating steps. (Heater1 & Heater2 & Both)

5. HEATER MAINTENANCE

Sludge deposits in the bottom of the pre-heater vessel can be washed out with suitable liquids via drain socket and feed pipes.

Solid deposits in the pressure vessel and between heating pockets or heating elements can only be removed by disassembling the electric heater.

In order to avoid damage to the tube surfaces, they should not be cleaned mechanically but with suitable solvents.

CAUTION!

Don't spill liquid cleaners or solvents into the electric heater head box.
It could cause short circuit.

Removing electric heater:

- 1) Turn off the power and then shut off inlet and outlet valves of the pre-heater vessel.
- 2) Remove the top of terminal box
- 3) Disconnect wiring from terminal strip.
- 4) Withdraw cables through the cable glands,
- 5) Remove sensors of the controllers and thermal cut-out from immersion tubes (make sure not to damage the capillaries) and than pull off terminal box.
- 6) Remove flange mounting bolts
- 7) Lift the heating element with lifting lug.

Pressure vessel and electric heater can be cleaned easily.
Check the heating elements, the temperature controller, the thermal safety cut-out, the terminals and the entire wiring.
Faulty parts must be exchanged. For exchange instructions see next page.
Reassemble the heater in reverse with a using new flange gasket.



INSTRUCTION MANUAL

J.W PRE-HEATING UNIT

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6. ELECTRIC HEATER TROUBLESHOOTING

In case the electric heater shows low or no heating power.

- 1) Check the setting point of controller.
When the setting value is too low, it is possible to cause.
- 2) Check the safety temperature cut-out tripped.
After eliminating the problem, press the red reset button on the temperature safety cut-out in the heater terminal box. (adjust the setting point higher about 20° then the setting point of controller)
- 3) Check fuses and automatic circuit breakers.
When the fuses are blown or circuit breakers are tripped, operator must switch on again after eliminating the defect.

7. CONTROL BOX MAINTENANCE

The control cabinet does not need special maintenance.

8. PUMP SERVICE AND MAINTENANCE

Maintenance

Pump and motor do not require maintenance.

If the pump is drained for a longer period of inactivity, apply a few drops of silicone oil to the shaft between the motor stool and coupling to prevent the seals from sticking together.

Shaft adjustment

If the motor has been removed during installation or repair of the pump, the pump shaft must be adjusted after the pump reassembling. Ensure that the shaft pin is correctly fitted in the pump shaft.

1. Remove the coupling covers using a screwdriver.
2. Fit the motor hexagon head bolts in the coupling. It shouldn't be tighten
3. Lift the coupling and pump shaft as far as possible until the Pump shaft touches the motor shaft.
4. Tighten the bolts.
5. Check the coupling parts on both sides for equal valance.
6. Tighten the bolts.
7. Fit the coupling covers



INSTRUCTION MANUAL

J.W PRE-HEATING UNIT

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9. PUMP TROUBLESHOOTING

CAUTION!!

Before opening the terminal box, switch off the power supply.

Motor doesn't run when the unit is started.

- 1) Check the power supply failure.
- 2) Check fuses and automatic circuit breakers.
- 3) Check the motor protection trip.
- 4) Check the contactor fault.
- 5) Check the motor fault.

Motor protection cuts out when pump is started or doesn't work.

- 1) Check fuses and automatic circuit breaker.
- 2) Check the motor protection fault
- 3) Check cable connection loose or faulty
- 4) Check the wiring of the motor.
- 5) Check the mechanically block of the pump.
- 6) Check the too low value of the overload setting.
- 7) Check the too high or low voltage periodically supplied.
- 8) Check the power supply failure.

When the motor protection works but the pump doesn't work.

- 1) Check voltage supply
- 2) Check fuse and automatic circuit breaker.
- 3) Check the contactor fault.

When the pump capacity isn't constant.

- 1) Check too low pump inlet pressure.
- 2) Check the suction pipe / pump partly blocked
- 3) Check the existence of air in suction line.

When the pump is running but doesn't deliver.

- 1) Check the suction pipe / pump partly blocked
- 2) Check the non - return flap.
- 3) Check a leakage and existence of air in suction line
- 4) Check the motor rotation direction

Pump turns reverse when switch off.

- 1) Check the leakage in suction line
- 2) Check the non -return flap blocked/faulty

Leakage on shaft seal.

- 1) Check the correct pump shaft position
- 2) Check the shaft seal defective

Noise

- 1) Check cavitation in the Pump
- 2) Check the correct pump shaft position
- 3) Check the blocking parts in the pump



INSTRUCTION MANUAL

J.W PRE-HEATING UNIT

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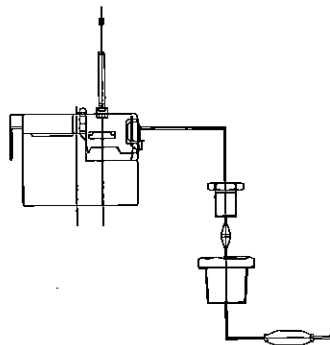
10. TEMP. CONTROLLER/SAFETY CUT - OUT

Description

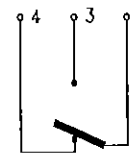
Temperature controller type

Limits thermostat

Thermostat is tripped if the pre-set temperature is reached.
If the temperature falls back below the pre-set value, the thermostat switches back to its normal position.
The temperature setting value can be adjusted by turning the knob.



Wiring diagram
in off position

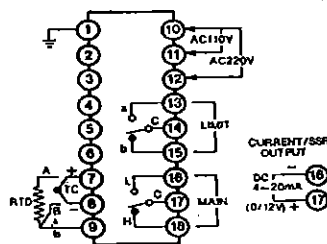


Exchange regulators and safety cut-out

- Remove the top of the terminal box
- Disconnect the control wiring
- Unlock sensor and withdraw it from immersion tube

Electrical connection

Connect the controller/safety cut-out according to the below diagrams





BOLLFILTER
Protection Systems

INSTRUCTION MANUAL

AUTOMATIC FILTER

6.46 series

Bollfilter Japan Ltd.

Toroo Kobe Bldg. 7F
4-2-14, Hachiman-dori, Chuo-ku, Kobe, 651-0085, Japan
Tel : +81-78-242-8550, Fax : +81-78-242-8515

Manufactured by
BOLL & KIRCH Filterbau GmbH

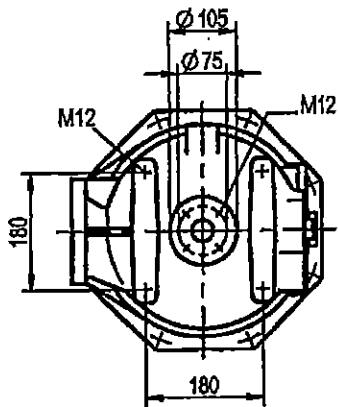


DESCRIPTION AND OPERATING INSTRUCTIONS
FOR BACK-FLUSHING FILTER TYPE 6.46

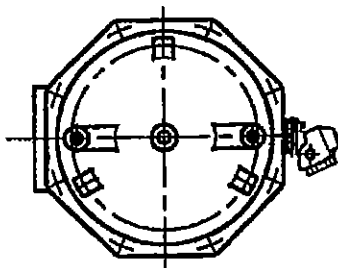
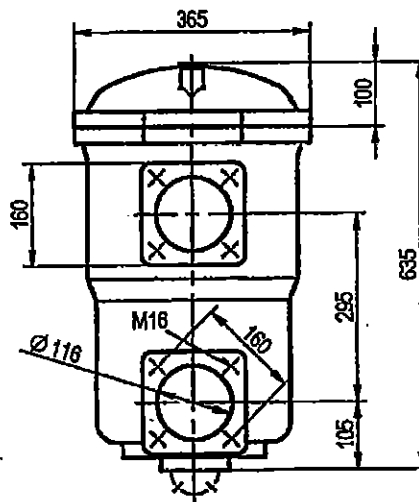
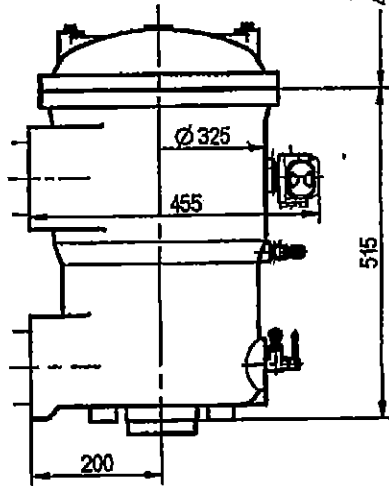
Order No.

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3. Installation of the filter
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4. Commissioning
5. Filtration phase
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6. Back-flushing phase
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7. Functioning of the overflow valves
Overflow valves Z39293 sheet 3
8. Maintenance
9. Filter candle inspection and cleaning
10. Technical Information BOLL CLEAN 2000
11. Sources of faults and their remedy
12. Spare parts drawing for type 6.46
13. Spare parts list for type 6.46
14. Type sheet differential pressure contact indicator
15. Spare parts drawing for the differential pressure indicator



DISMOUNTING THE FILTER ELEMENT



Alle Maßangaben in Millimeter DIMENSIONS ARE IN MILLIMETERS		Änderungen nur über CAD zulässig! MODIFICATION ONLY WITH CAD!		Schutzvermerk zur Beschränkung der Nutzung von Unterlagen DIN34-1-D PROTECTION MARK FOR RESTRICTING THE USE OF DOCUMENTS DIN34-1-E	
Projektionsmethode PROJECTION METHOD ISO-Methode E	Werkstückanten nach CORNERS PER DIN 6784 L0,5 ±0,5	Allgemeintoleranzen GENERAL TOLERANCES DIN ISO 2768-m Schweißkonstruktionen WELDED CONSTRUCT. EN ISO 13920-CF	Oberflächen Angaben nach SURFACE T. PER ISO1302 RZ nach DIN3141	Maßstab SCALE 1:10	Gewicht WEIGHT
		Bearb. DRAWN 01.06.05 Vietan	Name NAME Breitig	Benennung TITLE Automatic Backflushing Filter Type 6.46 DN100 (without Bottom Fastening)	
		BOLLFILTER Protection Systems		Zeichnung-Nr. DRAWING-NR. Z108192	BINNEN SHEET
Zus. INDEX	Änderung / REVISION	Datum DATE	Name NAME	BOLL & KIRCH Filterbau GmbH Stiemensstraße 10-14, 50170 Kerpen	
				Ursprung: ORIGIN:	Ersetzt durch: SUBSTITUTE:



2. **General notes on the automatic filter**



The back-flushing Filter type 6.46 satisfies the safety standard for ships' main propulsion units. It is registered by GL, LRS and other ship classification bodies.

The back-flushing filter type 6.46 is suitable for filtering oils with a viscosity of max. 50 cSt. and an operating pressure of min. 3 bar to max. 10 bar.

The filter works with permanent back-flushing using its own process fluid; the back-flushed fluid is fed back into the circulation tank or the oil trough again.

No external power is required to operate the automatic filter.

The function of the automatic filter is to protect the bearings, journals and shafts in the engine from noxious impurities in the oil.

Treating the lubricating oil, i.e. removing the solids discharge, is carried out by a separator, a centrifuge, a bypass filter or the attached flushing oil treatment unit.

The filter can be mounted both vertically and horizontally directly on the engine or on the base frame.

In order to satisfy the different requirements of the engine manufacturers, the filter type 6.46 can be combined with a wide variety of engine attachments.



The filter type 6.46 mainly consists of the following:

- the housing with the inlet and outlet flanges
- the filter element with the appropriate number of filter candles, depending on the nominal width
- the excess pressure safety devices
- the downstream second filter stage [protective filter (8)]
- the entire flushing facility
- the gear unit including drive turbine.

3. Installation of the filter


Care must be taken during installation of the filter to ensure that clean pipes are connected to the filter inlet and the filter outlet without any strain.

The Inlet and outlet of the filter are marked.

The flushing oil line is to be at least as large as specified in the Information sheet.

This line is to be laid without any shut-off device but with a gradient and vented to prevent any build-up in the pipe.

The potential-free contacts of the differential pressure indicator (24) installed (see "Differential pressure indicator, section 14) must be wired to monitor the degree of contamination of the filter elements (7) and the protective filter (8).

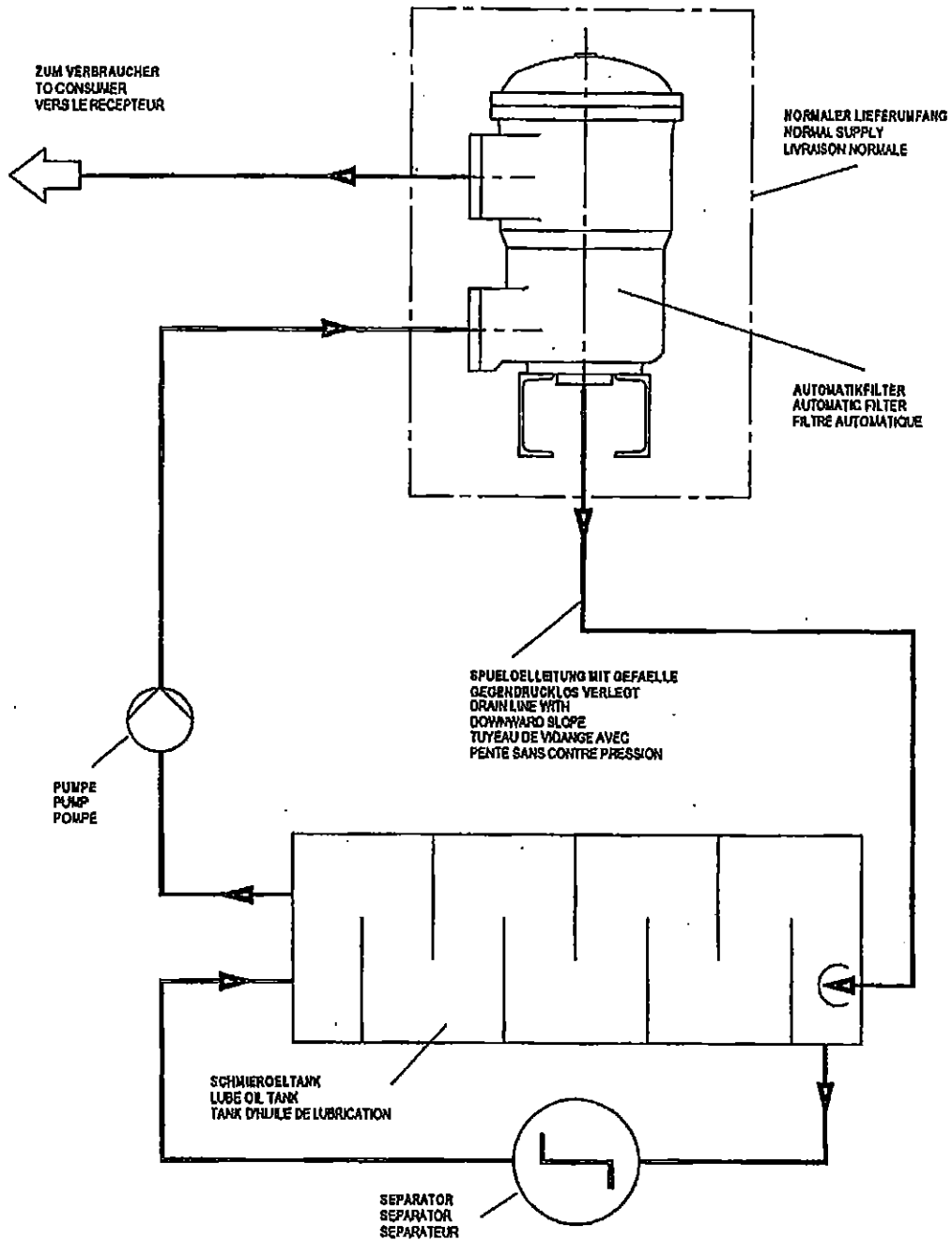


The filter housings are only designed for internal overpressure in accordance with the AD Information Sheets. Additional external forces and moments at the filter connection flanges are to be avoided (possibly by supporting the supply lines).

When installing the filters, make sure that any oil or fuel which leaks due to improper handling cannot result in a fire or injury.



Z39347
TYP 6,46
26.10.99



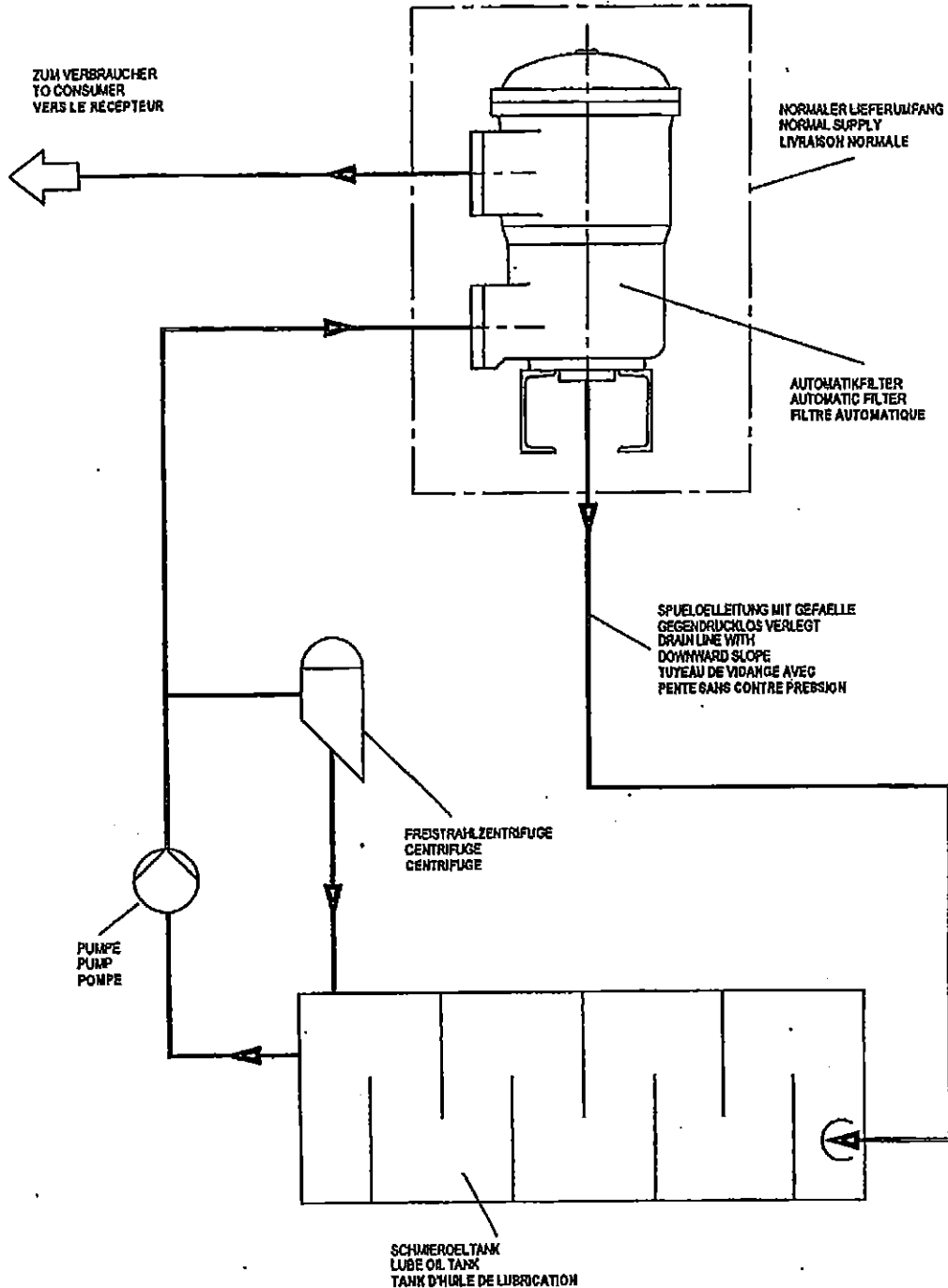
SCHEMA INSTALLATION

EINBAUSCHEMA ZUM TYP 6,46
MIT SEPARATOR

SCHEMA D'INSTALLATION



Z39349
TYP 6.46
26.10.99



SCHEMA INSTALLATION

EINBAUSCHEMA ZUM TYP 6.46
MIT FREISTRALHZENTRIFUGE

SCHEMA D' INSTALLATION



4. Commissioning

- 4.1 Check to see whether all connections have been made properly.
- 4.2 Check to see whether the ball cocks in the control line to the differential pressure indicator are open.
- 4.3 The following must be observed before switching on the pump:
- Close shut-off device in the bypass line
 - Open shut-off device at the filter outlet
 - Only partially open the shut-off device at the filter inlet and, after switching on the pump (to prevent pressure surges), slowly open it fully.
- 4.4 If the pressure downstream of the filter is less than 2 bar, the shut-off device downstream of the filter is to be regulated until the appropriate operating pressure has built up.
- 4.5 The rotary motion of the flushing facility can now be seen at the visible shaft end in the filter cover.



If there is an inadmissible rise in the differential pressure during commissioning (with new plants poss. greater initial contamination) In spite of perfect back-flushing, a signal is emitted via the differential pressure indicator. The Filter must be taken out of service (open the bypass line and close the shut-off devices on the Filter). Dismantle the Filter element completely and clean the Filter candles individually (observe section 9 "Filter candle inspection and cleaning").



5. Filtration phase

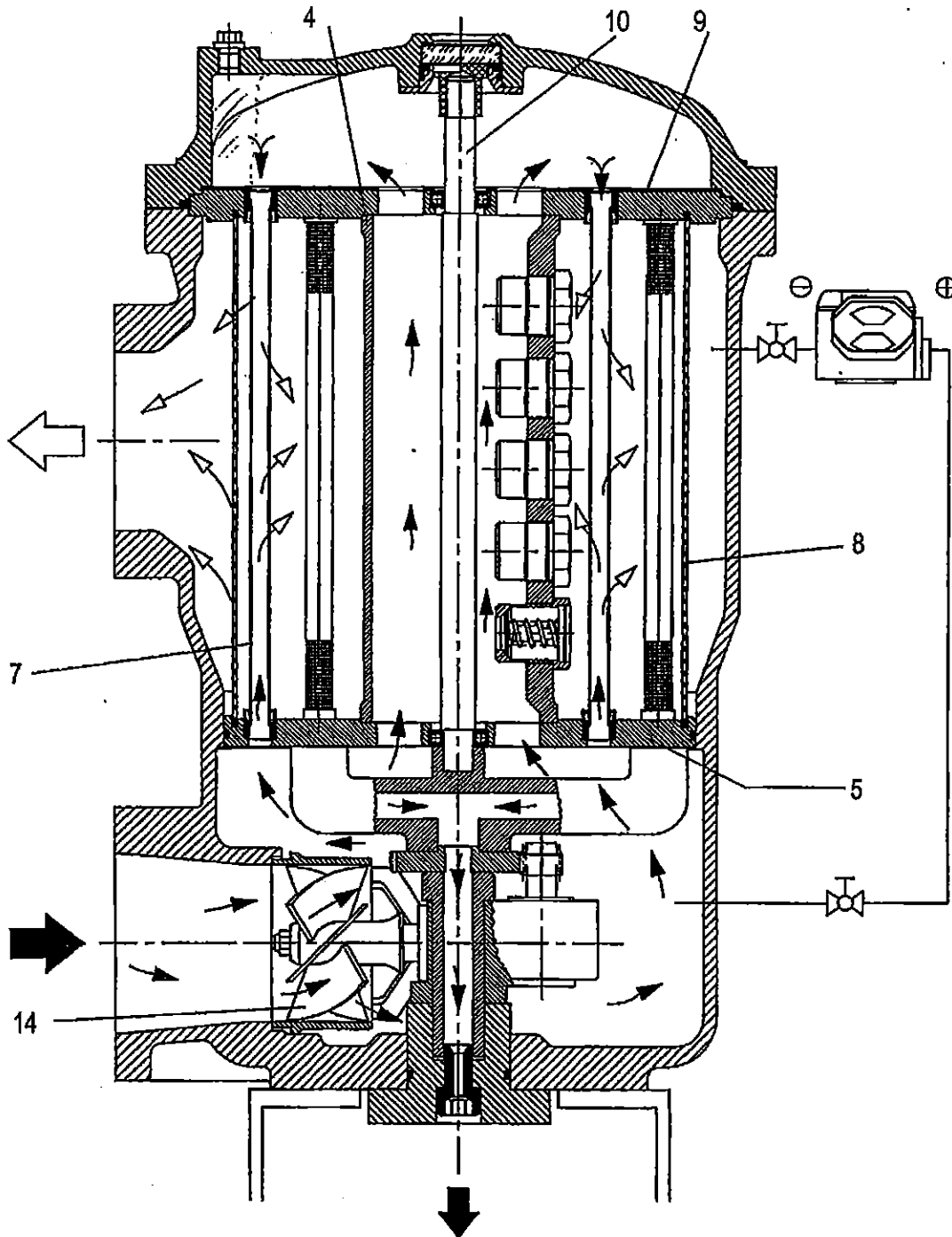
(see drawing Z39293 sheet 1 or Z101308 sheet 1)

The fluid to be filtered passes through the inlet flange and turbine (14) to the bottom end of the filter candles (7); a partial stream of about 50% is passed through the central connection tube (4) to the top end of the filter candles (7). This means that the fluid flows through the filter candles (7) at both ends from the inside outwards and most of the dirt particles are retained in the inside of the filter candles (7).

The fluid filtered in this way now passes through the protective filter (8) to the filter outlet.



Z106374BL.1
TYP 6.46
10.09.04



TYP 6.46
FILTRATIONSPHASE
FILTRATION-PHASE
PHASE DE FILTRATION



6. Back-flushing phase

(see drawing Z39293 sheet 2 or Z101308 sheet 2)

The back-flushing filter type 6.46 operates as a continuous flushing filter and does not require any external power to drive the back-flushing facility.

The flow energy drives the turbine (14) installed in the inlet flange. The high speed of the turbine (14) is reduced by the worm gear unit (13) and gear (15) to the lower speed required for turning the flushing arm (3).

The individual filter candles (7) are now connected successively to the atmosphere by means of the continuously rotating flushing arm (3), the flushing bush (17) and nozzle (21).

The pressure gradient thus produced (operating pressure to atmosphere) results in an extremely efficient cleaning action.

The unfiltered fluid passes through the optimally designed bores of the top cover plate (9) into the individual filter candles (7) from above. The resultant turbulent stream in the longitudinal direction of the filter candles (7) (cross-flow back-flushing) and the counter-flow back-flushing through the filter candles (7) result in a particularly effective and lasting back-flushing action.



Counter flow back-flushing:

The lower pressure in the interior of the filter candles (7) during the back-flushing operation (connected with the atmosphere) and the higher pressure (operating pressure) outside the filter candles (7) produce a counter-flow through the mesh from the clean filter side through the dirty filter side to the atmosphere.

This newly developed cross-flow back-flushing feature in conjunction with the time-tested counter-flow back-flushing principle means that the pressure drop at the filter remains constant for a longer period.



7. Functioning of the overflow valves

(see drawing Z39293 sheet 3 or Z101308 sheet 3)

Should for any reason the filter candles (7) (first filter stage) no longer be adequately cleaned, the overflow valves (19) are opened at a differential pressure of 2 bar upwards and some of the fluid is filtered through the protective filter (8) (second filter stage).

However, before this situation arises, the installed differential pressure indicator (24) emits a differential pressure warning (first contact). The cause must now be localised and remedied.

If this warning is not heeded, an alarm is emitted by the second contact of the differential pressure indicator (24).



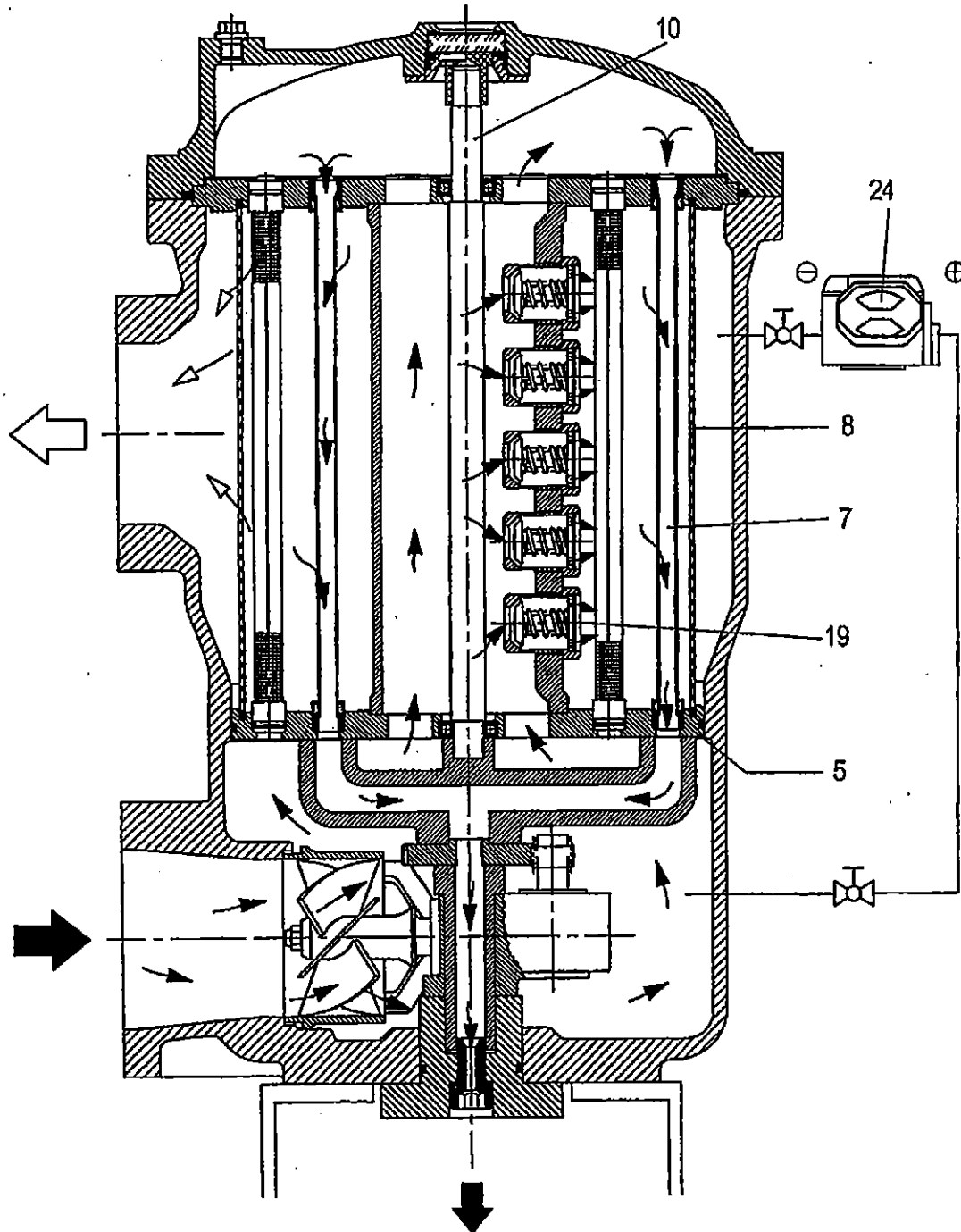
The filter may only be operated in this emergency condition for a short time (opened overflow valves and differential pressure warning). Prolonged operation in this mode can result in damage to downstream components.

The overflow valves are closed under normal operating conditions, even during start-up at lower fluid temperatures.



BOLLFILTER
Protection Systems

Z106374BL.3
TYP 6.46
10.09.04



TYP 6.46
WIRKUNGSWEISE UEBERSTROEMVENTIL
FUNCTION SPILL VALVE
FONCTIONNEMENT SOUPAPES ANTIREFOULEUSES



8. Maintenance

Section 9 - Filter candle inspection and cleaning - must also be observed.

Even with automatic filters inspections and maintenance must be performed at regular intervals.

It is extremely important to remember that in spite of constant back-flushing the mesh may become clogged over the course of time, depending on the quality of the fluid and whether a bypass treatment unit installed.

In order to maintain trouble-free operation, the following aspects are to be observed during maintenance:

- 8.1 The filter must be switched off for all maintenance work.
- 8.2 Check filter and connections for leaks.
- 8.3 Conduct visual inspection of all filter candles (7) once a year.

Should a higher differential pressure occur beforehand, all the filter candles (7) and the protective filter (8) must be checked and, if necessary, cleaned.
Observe section 9 "filter candle inspection and cleaning".



A highly contaminated protective filter (8) is a sign of prolonged operation with defective or clogged filter candles (7) and thus (from a differential pressure of 2 bar upwards) opened overflow valves (19).
It is imperative to check these components.



- 8.4 Check the ease of movement of the worm gear unit (13), the turbine (14) including gear (15) with flushing arm (3).

To this end the cover (34) or the screw plug (34) must be removed. Now check the ease of movement with a suitable spanner (on the hexagon of the worm gear unit).

If movement is sluggish, refer to section "Sources of faults and their remedy".

- 8.5 Replace the dyn. loaded seals (66) as and when required.
It is advisable to replace all static seals during an overhaul.



9. Filter candle inspection and cleaning

(see drawing Z39293 sheet 2 or Z101308 sheet 2)

- 9.1 Open bypass line.
- 9.2 Close shut-off devices at the filter inlet and outlet.
- 9.3 Now drain the filter from the drain screw.
- 9.4 Pull the entire filter element incl. flushing arm (3) and gear (15) out of the housing.



Make sure that the exposed gear (15) is not damaged.

- 9.5 Remove the upper cover plate (9).
- 9.6 The filter candles (7) can now be pushed out from below or pulled out from above.
- 9.7 Place the filter candles (7) in the cold cleaner BOLL CLEAN 2000, max. soaking time 24 hours.
- 9.8 After immersing the filter candles (7), clean them from the outside inwards using high pressure.



It must be ensured that the filter candles are cleaned at a pressure of max. 60 bar and at a minimum distance of the cleaning nozzle of 20 cm. Otherwise, damage to the mesh is possible.

In our experience it is only possible to achieve an almost 100 % cleaning effect by hand with the high-pressure cleaning unit type 5.04 using BOLL CLEAN 2000.
Refer to the separate description "Filter cleaning unit type 5.04".



9.9 If operating an engine on heavy fuel

If operating on heavy fuel, the filter elements must be checked after 2 years at the latest and any damaged ones must be replaced.

We recommend the general replacement of all filter elements after 4 years.

If operating an engine on diesel oil

If operating on diesel oil, the filter elements must be checked after 4 years at the latest and any damaged ones must be replaced.

We recommend the general replacement of all filter elements after 6 years.

Defective filter candles (7) must not be used again.

Before installation of the entire filter element, the ease of motion of the flushing facility must be checked.

The flushing arm (3) must not grind against the bottom filter plate (5).

9.10 Now push the entire filter element into the housing.

By slightly turning the flushing shaft (10), the gear (15) is forced into the drive pinion of the gear unit (13).

Now re-assemble the filter in the reverse sequence to that described under points 9.1 - 9.9.



10. Technical information BOLL CLEAN 2000

Solvent-free cold cleaner

Product description

BOLL CLEAN 2000 is a liquid cleaning and degreasing agent for a wide range of applications. It can be used for virtually all cleaning and degreasing work.

BOLL CLEAN 2000 is miscible with any water - even sea water.

BOLL CLEAN 2000 cleans quickly and thoroughly and is extremely economical. Even mixed with water in concentration ranges of 1:50, it exhibits good cleaning and degreasing properties. When BOLL CLEAN 2000 is used, no safety precautions are needed. BOLL CLEAN 2000 exhibits these outstanding properties without having the disadvantages of solvent cleaners.

BOLL CLEAN 2000 is non-flammable
 does not need to be identified
 does not have a pungent smell
 is a non-irritant
 is physiologically safe
 is biodegradable

Federal Office of the Environment Reg. No. 04860019

BOLL CLEAN 2000 can become cold or hot during storage but can be readily used again at normal temperature.

Field of application

BOLL CLEAN 2000 is suitable for cleaning and degreasing all metals, plastics, highly adhesive paints etc. It removes oil, wax, grease, rust and numerous other kinds of dirt.

BOLL CLEAN 2000 is used, for example, in the automobile, engine, aviation, oil (for drilling equipment), food and drinks, and metalworking industries, in overhauling and machine workshops, shipping, diesel and electric locomotives, and in electricity works for cleaning the generators.



Mesh contaminated with heavy oil

Filters contaminated with heavy oil must be soaked in a commercially available solvent. After being soaked, the filters are cleaned in the BOLL & KIRCH cleaning unit type 5.04 with BOLL CLEAN 2000 and a high-pressure pump.

Instructions for use

The use of BOLL CLEAN 2000 does not involve any specific cleaning method. BOLL CLEAN 2000 can be employed in an immersion bath, in a spraying plant, in a steam jet cleaner or using a manual application process with a cloth, brush or sponge, depending on the circumstances.

It can be used either cold or warm.

BOLL CLEAN 2000 is miscible with water - even sea water.

Concentration for cleaning mesh: 1:2.5

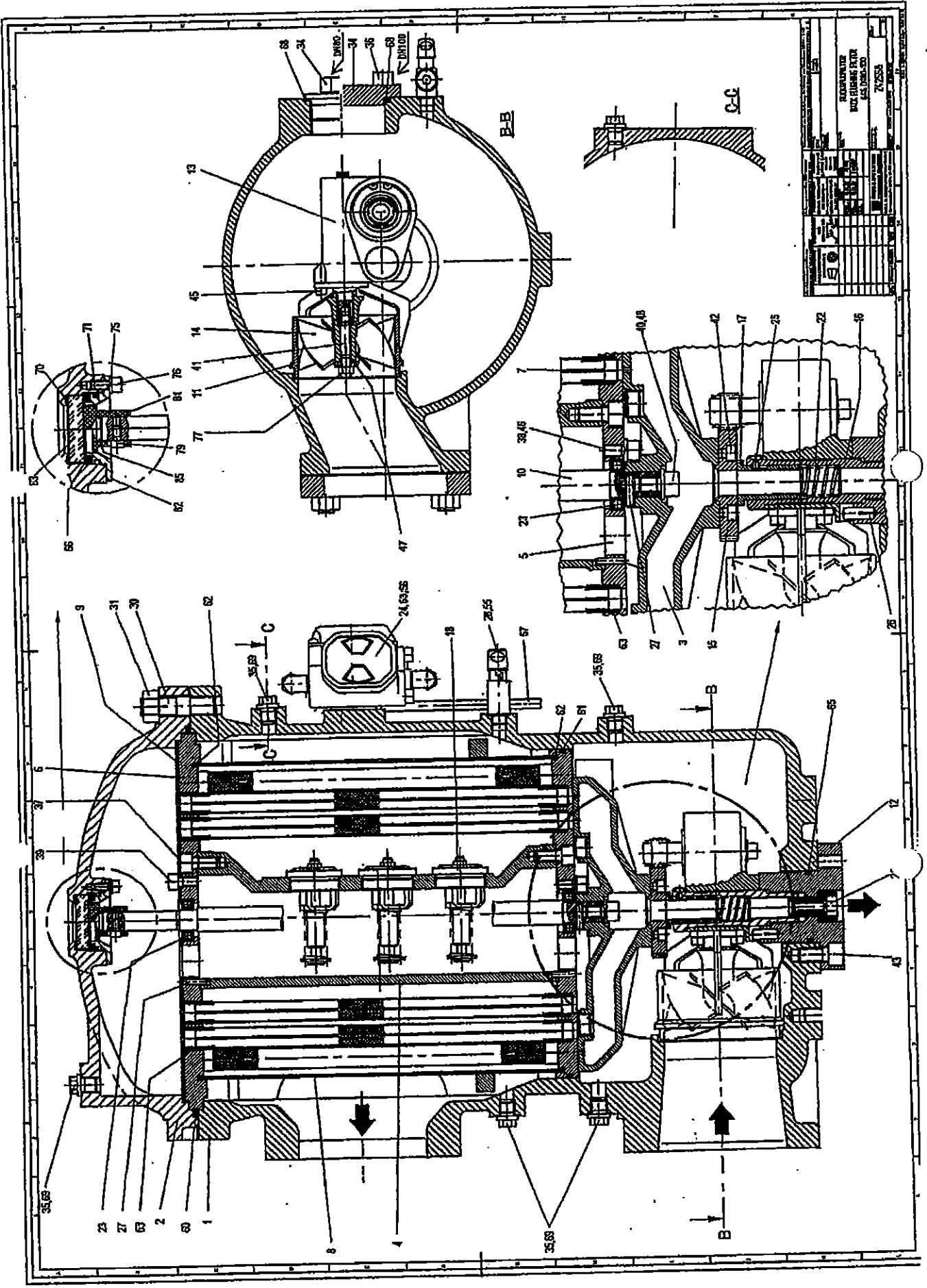
Temperature: up to max. 60°C

The concentration depends on the type and thickness of the adhering material to be removed. When used in a concentration of 1:30 and more, rinsing is not necessary. No visible film remains on the surface.



11. Sources of faults and their remedy

Fault	Cause	<u>Reasons and remedy</u>
Δp rises	Viscosity too high	Wait for normal operating conditions
	High volume of dirt	Check bypass treatment unit for operability
	Filter candles clogged	Clean candles
	Flushing volume too low	Check flow control device in outlet and sludge discharge line for clogging
	Shaft end does not turn	<u>Turbine jammed</u>
		Remove parts jammed between turbine and wall
		<u>Gear unit defective</u>
		Check for ease of movement (as per section 8 "Maintenance")
		Replace gear unit if necessary
		<u>Flushing arm (3) jammed</u> , Remove any foreign matter
		<u>Operating pressure < 2 bar</u>
		Run for prolonged period at higher pressure 5-6 bar and thus eliminate the blockage
		<u>Oil quantity too low / Increase oil quantity</u>



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BOLLFILTER

Protection Systems

UNTERLAGE LIST-NO	VERS	STUECKLISTE PARTS-LIST	DATUM DATE	BLATT PAGE
0639919	00		02.03.04	1
ZPOS IDENTNR IDENTITY		BENENNUNG-NENNMASS-NORM DESIGNATION-DIMENSIONS-STANDARD		MENGE ME QUANTITY ME
0000 0639919		6.46 NW 100 RUECKSP. 0639919 BACK FLUSHING FILTER		1.000 ST
.....				
		ZUSAMMENSTELLUNG : 242558 ASSEMBLY DRAWING		
		MASSBLATT : Z101080 DIMENSION PAGE		
		AUSLEGUNGSUEBERDRUCK: 10 BAR / 100 GRD C DESIGN PRESSURE		
		PRUEFUEBERDRUCK :1.5X AUSLEG. UEBERDUCK TEST PRESSURE :1.5X CALCULATION PRESS.		
.....				

0001 6537802		GEHAEUSE HOUSING		1.000 ST
0002 6330214		DECKEL COVER		1.000 ST
0003 6552600		SPUELARM FLUSHING CANAL		1.000 ST
0003 2007222		VERSCHLUSSSCHRAUBE SCREW PLUG		2.000 ST
0004 5151253		VERBINDUNGSROHR JOINING TUBE		1.000 ST
0005 5250045		SIEBPLATTE (UNTEN) SIEVE PLATE		1.000 ST
0006 5250046		SIEBPLATTE (OBEN) SIEVE PLATE		1.000 ST
0007 1365425		FILTERKERZE FILTER ELEMENT		78.000 ST
0008 5709912		SCHUTZSIEB SIEVE		1.000 ST
0008 7108805		LOCHBLECHZUSCHNITT PERFORATED PLATE		1.000 ST
0009 5107505		ABDECKPLATTE PLATE		1.000 ST
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				/ 2



BOLLFILTER

Protection Systems

UNTERLAGE LIST-NO	VERS	STUECKLISTE PARTS-LIST	DATUM DATE	BLATT PAGE
0639919	00		02.03.04	2
ZPOS IDENTNR IDENTITY		BENENNUNG-NENNMASS-NORM DESIGNATION-DIMENSIONS-STANDARD		MENGE ME QUANTITY ME
0010 5309685		SPOELARMWELLE FLUSHING CANAL SHAFT		1.000 ST
0011 6853849		TURBINENGEHAEUSE TURBINE HOUSING		1.000 ST
0012 5301235		FLANSCHBEFESTIGUNG FLANGE FASTENING		1.000 ST
0013 2709131		SCHNECKENGETR. KURZ A GEAR		1.000 ST
0014 2784402		FLUEGEL MIT NABE TURBINE WING WITH WH		1.000 ST
0015 2705519		ZAHNRAD TOOTHED WHEEL		1.000 ST
0016 5300723		BEFESTIGUNGSBUCHSE BUSH		1.000 ST
0017 5060722		SPOELBUCHSE BUSH		1.000 ST
0018 0209130		UEBERSTROEMVENTIL 6.46 D=34 VALVE	19130	6.000 ST
0021 5003166		DUESE NOZZLE		1.000 ST
0022 2310058		DRUCKFEDER PRESSURE SPRING		1.000 ST
0023 2703599		RILLENKUGELLAGER DEEP GROOVE BALL BEA		2.000 ST
0024 0550001		4.36.2 P = 0.8 DDA 09322 08 PRESSURE DIFFERENT. CONTACT INDICATOR		1.000 ST
0025 2000257		ZYL. -SCHRAUBE SLOTTED CHEESE HEAD		1.000 ST
0026 2301130		STECKERBSTIFT PIN		1.000 ST
0027 2300010		SPANNSTIFT SPRING TYPE STRAIGHT		3.000 ST
0028 2560063		WINKELKUGELHAHN ANGLE BALL COCK		2.000 ST



BOLLFILTER

Protection Systems

UNTERLAGE LIST-NO	VERS	STUECKLISTE PARTS-LIST	DATUM DATE	BLATT PAGE
0639919	00		02.03.04	3
ZPOS IDENTNR IDENTITY		BENENNUNG-NENNMASS-NORM DESIGNATION-DIMENSIONS-STANDARD		MENGE ME QUANTITY ME
0029 2806480		VKT.GEGENFL. FLANGE		2.000 ST
0030 2009088		STIFTSCHRAUBE STUD BOLT		8.000 ST
0031 2100007		SECHSKANTMUTTER HEXAGON NUT		8.000 ST
0032 2009088		STIFTSCHRAUBE STUD BOLT		8.000 ST
0033 2100007		SECHSKANTMUTTER HEXAGON NUT		8.000 ST
0034 6402865		DECKEL COVER		1.000 ST
0035 2000197		VERSCHLUSSCHRAUBE HEXAGON HEAD SCREW P		5.000 ST
0036 2000155		ZYL.-SCHRAUBE HEXAGON SOCKET HEAD		4.000 ST
0037 2000142		ZYL.-SCHRAUBE SLOTTED CHESSE HEAD		6.000 ST
0038 2000130		ZYL.-SCHRAUBE SLOTTED CHESSE HEAD		3.000 ST
0039 2000130		ZYL.-SCHRAUBE SLOTTED CHESSE HEAD		3.000 ST
0040 2000197		ZYL.-SCHRAUBE HEXAGON SOCKET HEAD		1.000 ST
0041 2003658		STIFTSCHRAUBE BOLT		1.000 ST
0042 2000122		ZYL.-SCHRAUBE HEXAGON SOCKET HEAD		2.000 ST
0043 2000154		ZYL.-SCHRAUBE HEXAGON SOCKET HEAD		4.000 ST
0044 2000121		ZYL.-SCHRAUBE HEXAGON SOCKET HEAD		2.000 ST
0045 2000121		ZYL.-SCHRAUBE HEXAGON SOCKET HEAD		3.000 ST



BOLLFILTER

Protection Systems

UNTERLAGE LIST-NO	VERS	STUECKLISTE PARTS-LIST	DATUM DATE	BLATT PAGE
0639919	00		02.03.04	4
ZPOS IDENTNR IDENTITY		BENENNUNG-NENNMASS-NORM DESIGNATION-DIMENSIONS-STANDARD		MENGE ME QUANTITY ME
0046 2200235		FEDERRING SPRING RING		3.000 ST
0047 5008712		SCHEIBE DISC		1.000 ST
0048 2200007		SCHEIBE WASHER		1.000 ST
0049 2200008		SCHEIBE WASHER.		4.000 ST
0050 2008438		SECHSKANTSCHRAUBE HEXAGON SCREW		4.000 ST
0051 6024502		BODENBEF. BOTTOM FASTENING		1.000 ST
0052 5708316		BEFESTIGUNGSBLECH PLATE		1.000 ST
0053 2000122		ZYL.-SCHRAUBE HEXAGON SOCKET HEAD		2.000 ST
0054 2100003		SECHSKANTMUTTER HEXAGON NUT		2.000 ST
0055 2500024		VERSCHRAUB. SCREWING		2.000 ST
0056 2500025		VERSCHRAUB. SCREWING		2.000 ST
0057 7300002		PRAEZ.-ROHR NBK TUBE		1.000 M
0060 3040136		O-RING GASKET		1.000 ST
0061 3040018		O-RING GASKET		1.000 ST
0062 3041700		O-RING GASKET		2.000 ST
0063 3049400		O-RING GASKET		156.000 ST
0064 3040115		O-RING GASKET		1.000 ST



BOLLFILTER

Protection Systems

UNTERLAGE LIST-NO	VERS	STUECKLISTE PARTS-LIST	DATUM DATE	BLATT PAGE
0639919	00		02.03.04	5
ZPOS IDENTNR IDENTITY		BENENNUNG-NENNMASS-NORM DESIGNATION-DIMENSIONS-STANDARD		MENGE ME QUANTITY ME
0065 3031743		O-RING GASKET		1.000 ST
0066 3040115		O-RING GASKET		1.000 ST
0067 3382321		HOCHDRUCKDICHTUNG GASKET		2.000 ST
0068 3041106		O-RING GASKET		1.000 ST
0069 3270002		DICHTRING GASKET		5.000 ST
0070 3332814		FLACHDICHTUNG GASKET		1.000 ST
0071 3048235		O-RING GASKET		1.000 ST
0075 2209799		FEDERRING SPRING RING		3.000 ST
0076 2000122		ZYL.-SCHRAUBE HEXAGON SOCKET HEAD		3.000 ST
0077 2100047		SECHSKANTMUTTER HEXAGON NUT		1.000 ST
0079 2000115		ZYL.-SCHRAUBE HEXAGON SOCKET HEAD		1.000 ST
0080 9400997		SCHILD "EIN/IN LABEL " IN "		1.000 ST
0080 9407569		SCHILD "AUS/OU LABEL " OUT "		1.000 ST
0080 9402913		TYPENSCHILD WN26 NAME PLATE		1.000 ST
0081 3529686		ANZEIGEBUCHSE INDICATION BUSH		1.000 ST
0082 5209684		SPANNRING TENSION RING		1.000 ST
0083 4707080		SCHAUGLAS INSPECTION GLAS		1.000 ST

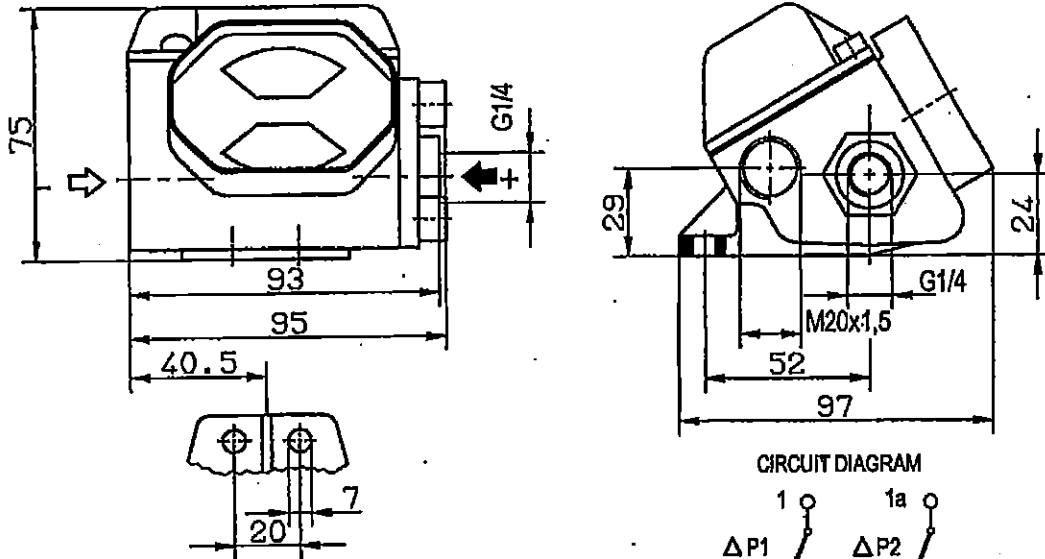


BOLLFILTER

Protection Systems

UNTERLAGE LIST-NO	VERS	STUECKLISTE PARTS-LIST	DATUM DATE	BLATT PAGE
0639919	00		02.03.04	6
ZPOS IDENTNR IDENTITY	BENENNUNG-NENNMASS-NORM DESIGNATION-DIMENSIONS-STANDARD		MENGE ME QUANTITY ME	
0085 2311117	WELLENFEDER SPRING		1.000 ST	
.....				

Z45550
TYP4.36.2
17.03.03



SPECIFICATION:
PROTECTION CLASS: IP 65

ELECTR. DATA:	SWITCHING VOLTAGE	V [≠] MAX.=	250	220
	FREQUENCY	HZ MAX.=	0-60	0-60
	SWITCHING CURRENT	A MAX.=	1	0.8
	MAKING AND/OR BREAKING CAPACITY	WVA MAX.=	60/60	40/60

MATERIAL : GD - ALUMINIUM
RATING : MAX. PRESSURE 100 BAR
MAX. TEMPERATURE 160°C

RANGES OF PRESSURE DIFFERENTIAL: DELTA P =

0 - 0.5 BAR	} TO BE SPECIFIED WHEN ORDERING
0 - 0.8 BAR	
0 - 1.2 BAR	
0 - 2.0 BAR	
0 - 3.0 BAR	

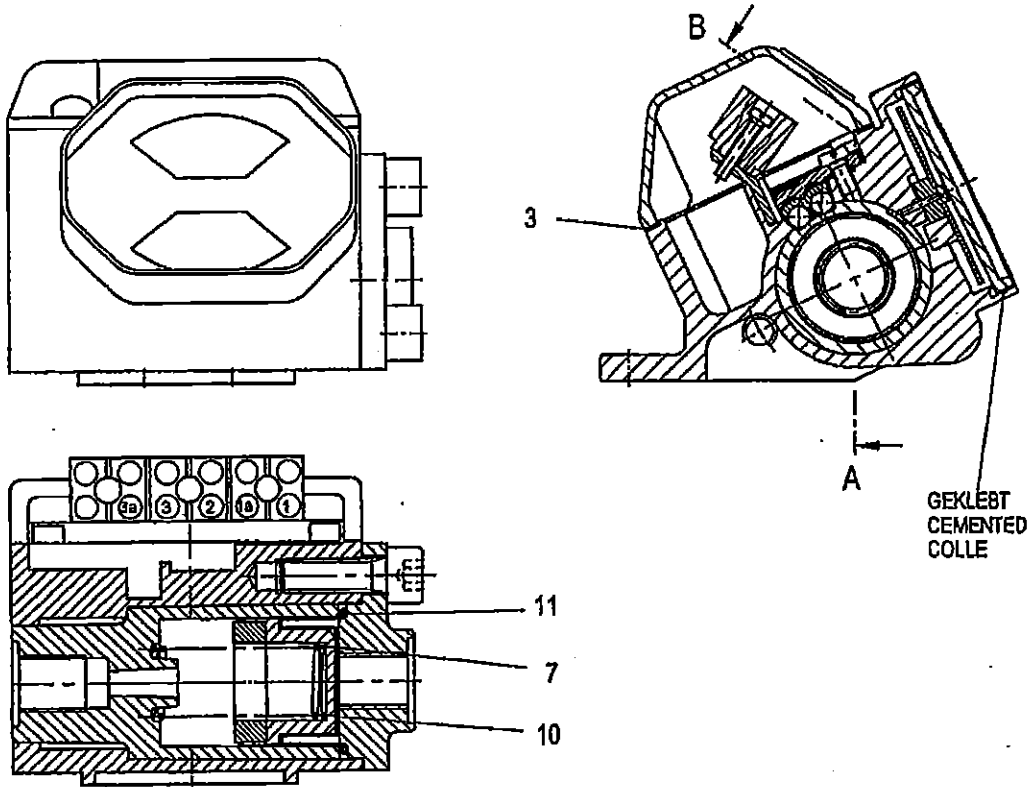
DESCRIPTION:
THE PURPOSE OF THIS DEVICE IS THE MEASUREMENT, AND VISUAL INDICATION OF THE DIFFERENCE IN PRESSURE BETWEEN TWO POINTS, AND THE ESTABLISHMENT OF AN ELECTRICAL CONTACT WHEN THE PRESSURE DIFFERENTIAL ATTAINS A SPECIFIED FIGURE.

METHOD OF OPERATION:
A PLUNGER SEALED BY A DIAPHRAGM SEPARATES THE SPACE UNDER PRESSURE INTO TWO CHAMBERS. A PRE-LOADED SPRING CAUSES THE PLUNGER TO TAKE UP ITS ZERO POSITION WHEN THE PRESSURE DIFFERENCE DELTA P IS ZERO. AS THE PRESSURE DIFFERENCE INCREASES (DELTA P > 0), THE PLUNGER IS FORCED TO MOVE AGAINST THE SPRING. AT THE SAME TIME, AN INDICATOR DISC IS MOVED MAGNETICALLY, AND THEREFORE VIRTUALLY WITHOUT FRICTION, AND THE TWO REED CONTACTS ARE ACTUATED.

THE RED SEGMENT OF THE INDICATOR DISC IS VISIBLE OVER A PRESSURE RANGE EQUAL TO APPROX. 60-100% DELTA P. THE FIRST REED CONTACT IS ACTUATED AT 75% DELTA P1, AND THE SECOND AT 100% DELTA P2.

DIFFERENTIAL PRESSURE CONTACT INDICATOR TYPE 4.36.2

Z21434
TYP4.36.2+4.46.2
11.02.94



A-B

BEI BESTELLUNG ANGEBEN
TO BE MENTIONED IN CASE OF ORDER
A MENTIONNER LORS DE LA COMMANDE

AUFR.NR.:
ORDER NO.
NO DE COMMANDE

TYP 4.36.2

11	ROLLMEMBRAN	DIAPHRAGM	DIAPHRAGME	
10	FEDER	SPRING	RESSORT	
7	KOLBEN	PISTON	PISTON	
3	DICHTUNG	GASKET	JOINT	
POS.NR.	BEZEICHNUNG	DESIGNATION	DESIGNATION	

SPARE PARTS
DRAWING

ERSATZTEILZEICHNUNG
ZUM TYP 4.36.2 UND 4.46.2

PLAN DES PIECES
DE RECHANGE



BOLLFILTER

Protection Systems

Bei Service- und Ersatzteilbedarf wenden Sie sich bitte an das Stammhaus oder an unsere Niederlassungen, Vertretungen oder Service-Stellen.
If you need service or spares for our products please contact our head office or our branch-offices, agencies or service-stations.

Europa / Europe

Deutschland/Germany
Zentrale / Headquarters

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Siemensstr. 10-14, D-50170 Kerpen
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Fax.: +49/2273/582-223
E-Mail: info@bollfilter.de

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Geschäftsstelle Nord
An der Strusbek 34
22926 D-Ahrensburg
Tel.: +49/4102/4740-0
Fax.: +49/4102/4740-22
E-Mail: ursula.klein@bollfilter.de

① IVG Pumpen- und Filtrationstechnik Gera
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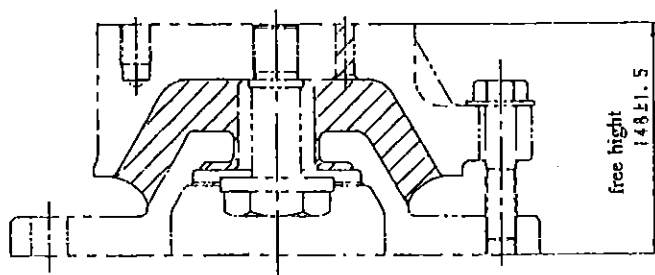
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Deflection ratio and replacement
basis of rubber mounting

DAIHATSU DIESEL MFG. CO., LTD.
TECHNICAL DEPARTMENT
OSAKA, JAPAN

SHIP No.		DRAWN BY	<i>R. Susami</i>
TYPE	YM5000E	CHECKED BY	
LIST No.	Q7LT325670FZ		
DATE	July. -14, 2000	APROVED BY	<i>M. Kinoshita</i>
REVISION			
ADK20-1877-9(10)		# 018	



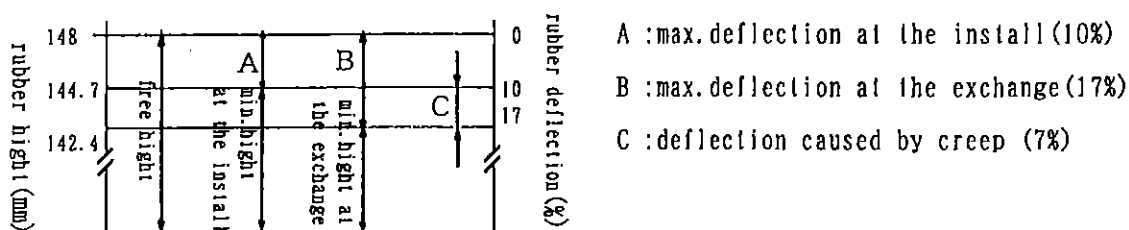
Rubber deflection ratio at the static load conditions

The maximum value of deflection ratio at the static load condition is 10%.
($33\text{mm} \times 0.1 = 3.3\text{mm}$)

Mean deflection ratio in calculation is different in the each vessel, and it is usually 6-10%.

If some difference of the deflection ratio among the rubbers would be found in a unit, the rubbers are safety enough so long as the deflection ratio is kept within the above limit.

An exchange limit of rubber, use and a life span



The rubber should be replaced with new one when the deflection ratio reaches 17% as given in the above.

In this case, in relation to the fatigue progresses with the lapse of time, you may be necessary to readjust the connections of the shipyard pipings to prevent the flexible tubes from break.

In general, the life of rubbers is about 10 years.

Bul, it is difficult to define the life, because the properties of a rubber make weak by environmental conditions, ozone heat, oil and etc. and those are different in each vessel.

Accordingly, every 5 years of the exchange of the rubber will be recommended from a view point of keeping the safety and the performance of elastic support system.

An inspection method of rubber mounting

An inspection method of rubber mounting is follows

1. An inspection of the outlook rubber (At intervals of 6 month)
 - (1) oil stick of the rubber
In case of oil stick of the rubber, clean it.
 - (2) rubber softening by the oil
In case of rubber softening by the oil, exchange rubber mounting as soon as possible.
 - (3) In case of crack presence of the rubber, exchange rubber mounting as soon as possible.
2. Measurement of rubber mounting height
(It is recommend to measure the rubber height every 2 months while 6 months after installed the rubber mounting.)
In case of less than limit of rubber mounting height, exchange rubber mounting as soon as possible.
limit of rubber mounting height : 142.4 mm