INSTRUCTION MANUAL

FTLG 807 marine level gauges

MARINE INSTRUMENTATION

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1 Introduction

IMO resolution A.212 (VII) and resolution A.328 (IX) give the following definition for a "closed type" liquid level gauge:

> "Closed devices, which penetrate the cargo tank, but which form part of a closed system and keep the cargo (-tank contents) from being released, such as float type systems."

The HSH FTLG 807 series marine level gauge is a float type level gauge with a linear spring-motor to provide power for measuring liquid level in cargo tanks.

The FTLG 807 series marine level gauge can be used on all types of ships carrying liquefied gases in bulk.

The HSH marine level gauging system provides standard local digital level read-out, manual float hoisting and locking, automatic float descent control and further possibilities for centralized cargo handling with intrinsically safe level transmission and electronic digital read-out, integral level alarms and a variety of electronic signal outputs.

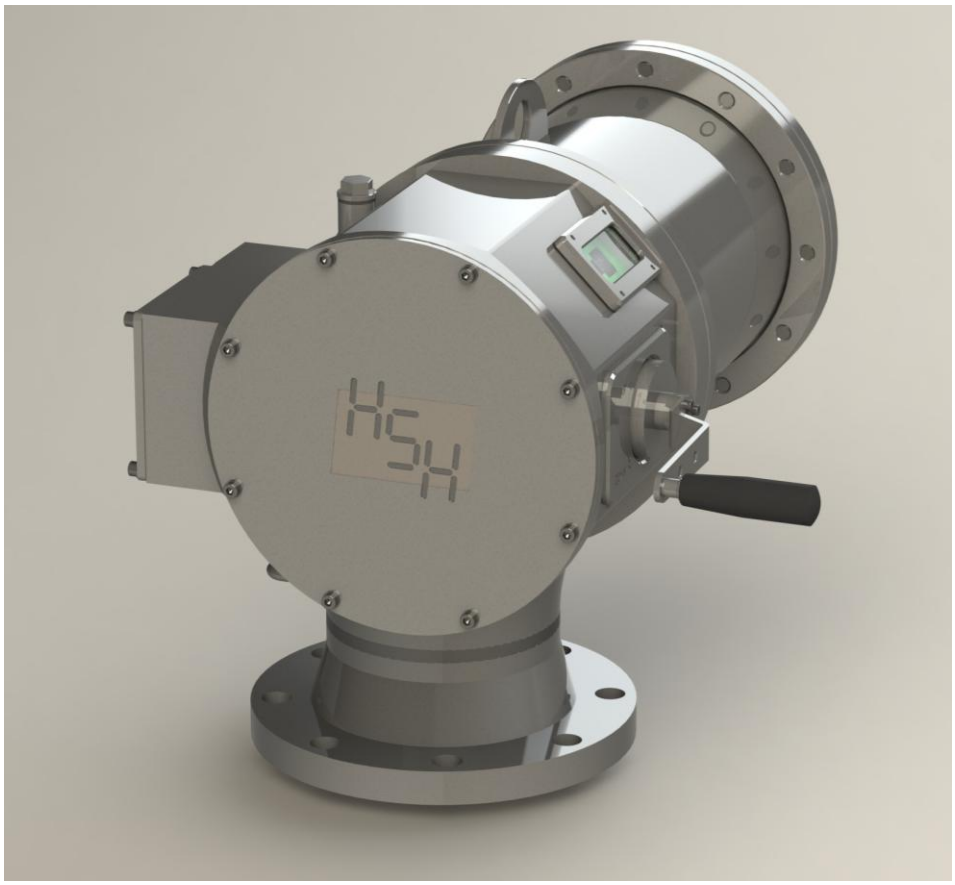

Figure 1 The HSH Float Type Level Gauge 807

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1.1 Level gauge construction and working principle

The gauge head of the 807 series level gauge is made of two completely separated and closed compartments. The communication between both compartments is indirect by means of a magnetic coupling. One of the compartments, the so-called measuring drum compartment, communicates directly with the tank, and is thus part of the closed system.
The measuring drum compartment houses an accurately machined measuring drum on which a flexible multi-stranded measuring cable is wound in a fine, screw-thread like groove. The float is fitted to the measuring cable and serves as level sensing element.
The measuring drum is coupled through a magnetic coupling to the spring-motor, housed in the second compartment, the so-called spring-motor compartment. The spring-motor provides a constant torque via the magnetic coupling to the measuring drum in the rotation direction for winding-up the measuring cable. Under influence of the float weight a counter directed torque is applied from the measuring drum to the spring-motor via the magnetic coupling.

The torque of the spring-motor is lower than the torque caused by float weight and measuring wire. The difference in torque allows the float to descent, but with the float at the cargo equilibrium will be reached as the float apparently obtains a lower weight in cargo. In this situation the spring-motor maintains a constant pull in the measuring cable. When the cargo level raises or lowers the float follows the level changes and causes the measuring drum to wind-up cable or to release cable. The rotation of the measuring drum and spring-motor is a measure for the amount of level change. To indicate the measured levels, a digital counter mechanism is fitted at the spring-motor to "translate" the measuring drum rotation in mm's level.

The spring-motor basically consists of a storage drum, a torque output drum and a length of flat spring material.
Each position of the flat spring material is preset to the same curvature in such a way that it can be completely straightened without deformation. Because of this presetting the spring material curls up and forms a coil.
By mounting the coil on a free rotating storage drum and by uncoiling it reverse-bent on a torque output drum, a constant torque drive is constructed as the tendency of the spring material is to recoil to its preset curvature, thus imparting a constant torque to the shaft of the torque output drum.

The 807 series marine level gauges are accurate level read-out instruments which are used during loading or discharging of tanks. During the voyage the floats must be hoisted to uppermost position. If, after loading, the cargo loading lines are blown empty, the floats must be hoisted first. Failure to do so may cause considerable damage to the instruments.

The level gauge is provided with a float hoisting mechanism with magnetic slip-clutch that prevents over-winding. In uppermost position of the float the measuring drum is automatically locked. After unlocking of the measuring drum, the float descents with constant speed to the cargo surface or tank-bottom. The float descent speed is controlled by a regulator (paddle wheel) which rotates in the oil of the spring-motor compartment. This compartment is filled with approx.7 liters of oil. The oil serves not only the regulator, but also lubricates the spring-motor, provides a condense-free level display window and inhibits corrosion.

1.2 Level gauge identification code

Position : 1 2 3 4 56 7

Example : FTLG 807 SUS / TA 39

Pos. 1 : FTLG = Float Type Level Gauge

Pos. 2 : 807, marine level gauge

Pos. 3 : SUS = Stainless Steel (316) Measuring Drum and Measuring Wire
INV = Invar 36 Measuring Drum and Measuring Wire

Pos. 4) : / (slash)

Pos. 5) : T, with intrinsically safe level transmitter

Pos. 6) : A, with 2 integral level alarm switches

Pos. 7) : 39, measuring range 0 – 39 m
19, measuring range 0 – 19 m

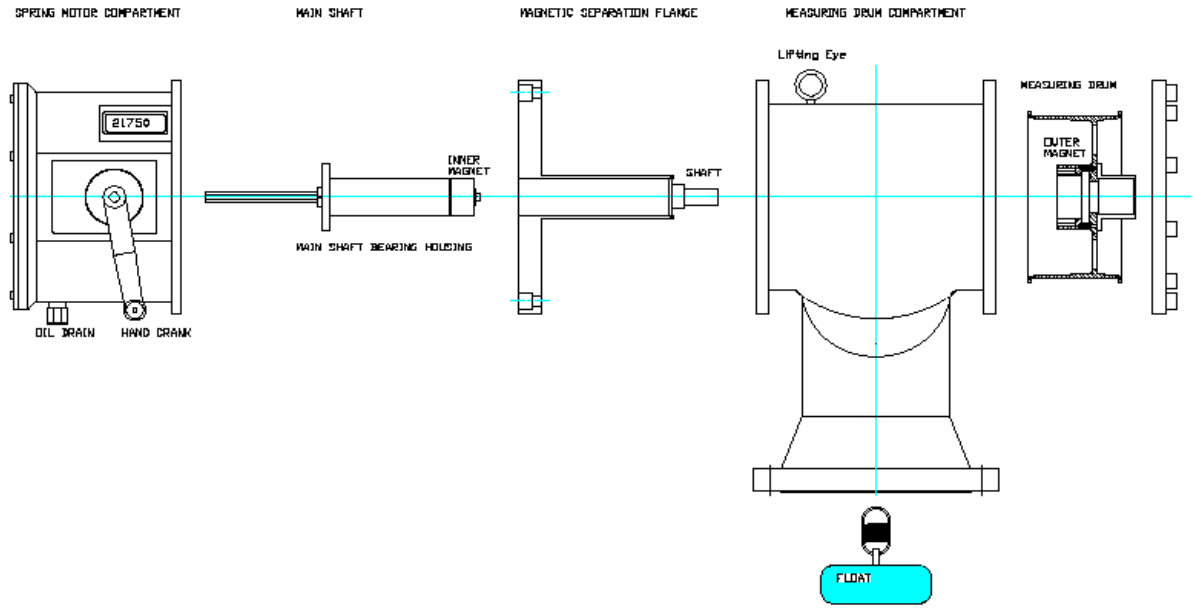

Figure 2 Two compartment gauge housing

1.3 Accuracy

The accuracy of the 807 series marine level gauges is determined by the following factors:

a) The accuracy of the circumference of the measuring drum. The effective circumference of the measuring drum is 600 mm with a tolerance of ± 0.02 mm.
b) The accuracy of the measuring cable diameter. The measuring cable is multi-stranded with a central core. The diameter has a max. tolerance of ± 0.02 mm.
c) The weight of the suspended amount of measuring cable. The measuring cable has a weight of approx. 1.3 g/m.
d) The hysteresis of the measuring system. The hysteresis is the total friction of bearings, regulation, indicator, etc. The parts housed inside the spring-motor compartment add very little to the hysteresis as they run under optimal conditions under oil, i.e. well lubricated, no corrosion influence. The measuring drum runs under more severe conditions which require a suitable approach. Depending on the type of tanker or application, measuring drum bearings will be selected for their typical operational conditions. Depending on the selection of the type of measuring drum bearings, the hysteresis may vary from a maximum allowable 40 g (measured at the measuring cable as top-top-value) to only 10 g.
e) The accuracy of constant torque output of the spring-motor. The spring-motor has a linear character with a tolerance of ± 10 g (measured at the measuring cable).
The density of the cargo influences the buoyancy of the float or the displacer. In light cargoes the float will sink deeper than in heavy cargoes. See float immersion diagram.
f) The size and type of float used. Small diameter floats are more influenced by change of density than larger diameter floats. See also float immersion diagram.
g) The cargo- and tank temperature can influence the accuracy of the measuring system, particularly if the tank material is different of that of the measuring cable and measuring drum. The difference in thermal expansion co-efficient of different materials causes measuring errors, but these may be partly compensated by way of mounting construction.
h) The temperature compensation diagram indicates maximum possible measuring errors, caused by measuring wire expansion.

Considering only the factors a., b., c., d. and e. the accuracy of the measuring system can be expressed in the following formula:

$$\Delta L = \pm (2.0 + 0.15\ l)\ mm$$

ΔL = Accuracy
l = Suspended length in meters

(l is the amount of suspended measuring cable in meters). For factor d. the maximum allowable hysteresis has been used.

For initial adjustment of the level gauge it is recommended to set the local indicator so, that the float or displacer is set for average immersion level (see float immersion diagram).

Tankers carrying cryogenic cargoes (LNG etc.) may be fitted with level gauges with Invar (36% nickel steel) measuring drum and measuring cables.

2 Mounting

2.1 Mounting of level gauges, general

The mounting flange of the HSH 807 series marine level gauge is compatible to:
- 6" 150 lbs ASA r.f. flange
- DN 150 PN 16 flange (DIN 2502)
- 10K DN 150 JIS flange
- other flanges, such as 6" 300 Lbs, DN 150 PN 25/40 or JIS 20K DN150 are optional

The display window of the local indicator should face aft, same as the hand-crank of the float hoisting mechanism.
To have free access to the level gauge internals, for maintenance and calibration, it is recommended to have a free area with a radius of at least 1.5 to 2 meters around the level gauge.

Trim or list of the ship has practically no influence on the accuracy of the level gauge.

2.2 Liquefied gas tankers

According IMO resolution A.328 (IX) each cargo tank should be fitted with at least one liquid level gauging device.
Where only one liquid level gauge is fitted, it should be arranged so, that "any necessary maintenance" can be carried out while the cargo tank is in service.
For float-type liquid level gauges, "any necessary maintenance", includes inspection of the float and therefore it is recommended to mount the level gauge on a full bore ball valve or gate valve, which allows free passage of the float (see fig. 19).
By using a float with a diameter of 125 mm the valve size can be generally limited to 6" ASA 150 lbs R.F. (or NW 150 ND 16). In most cases a perforated pipe will be required for float guiding. With a level gauge mounted above a ball- or gate valve it must be checked that the float is above the valve before closing the valve. Failure to do so will result in damage of float and/or measuring wire.

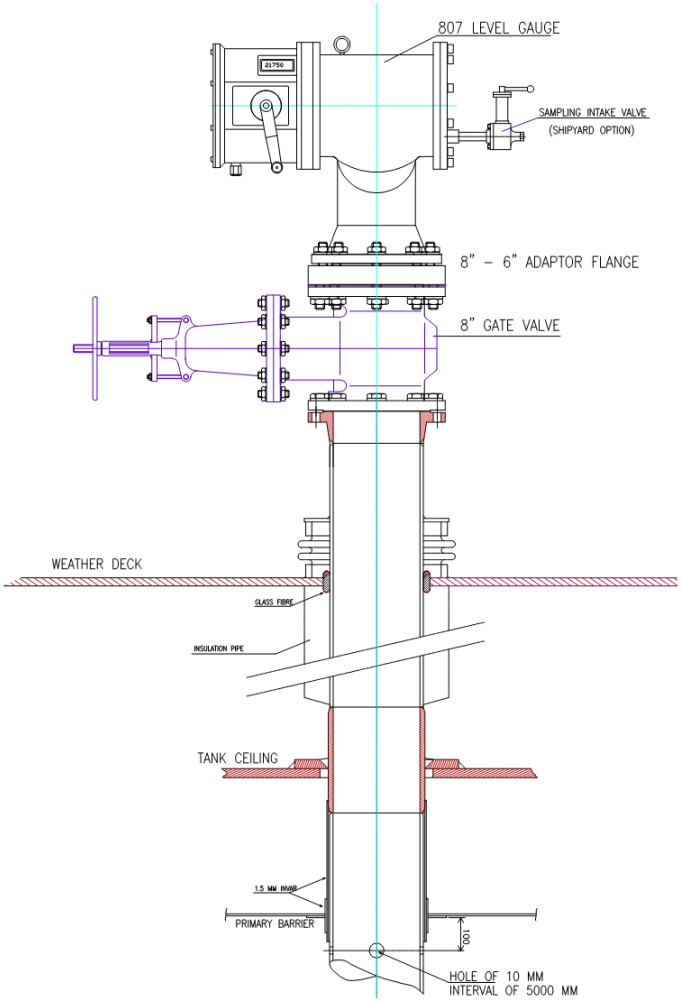

Figure 3 Typical gas tanker installation

3 Commissioning

3.1 Spring motor adjustment

Next, check the correct operation and setting of the spring-motor. Release the float, applying a braking force to the spring-motor manually, all the way down until it reaches the tank bottom. Meanwhile, check that the torque output drum (fig. 5 item 46) rotates anti-clockwise (facing the spring-motor compartment) and the spring-storage drum rotates clockwise (fig. 5 item 45). If the float stops during its downward movement before it reaches the tank bottom, check that sufficient spring tape is left on the storage drum.

If this is not the case, rotate the torque output drum (main shaft) 3 revolutions in clock-wise direction by hand and lock the spring-motor by the engaging the float hoist mechanism. While rotating the torque output drum, check that the storage drum rotates anti-clock-wise (1800 mm on the local indicator). After the spring-motor has been locked, rotate the measuring drum in a clock-wise direction (facing the drum compartment) until the float reaches the tank bottom. Because the magnetic coupling of the measuring drum provides a counter force to the manually applied rotation force, it may be necessary to remove the drum from the shaft in order to prevent too high radial forces on the shaft. When the float has reached the tank bottom, dis-engage the float hoisting mechanism and check that the float is still resting on the bottom.

Hoist the float and release it once again, adjusting the speed carefully by hand. The vertical speed should be almost constant.

3.2 Local level indicator setting

To set the local level indicator, the float must be placed at a known level (tank-bottom, liquid level or valve top). Compare the known level with the actual read-out of the local level indicator (fig. 4 item 61). During initial installation it is obvious that the factory setting is not similar to the required setting. To obtain an accurate setting the fixing screw of the local indicator (fig. 4) must be unscrewed. Pull out the local indicator and set it (approx.) to the required setting and fit it back into its position, so that the drive gear and indicator gear are not yet engaged. Now make the final setting (setting accuracy 2.5 mm) and fix the local indicator home, making sure that the gears are correctly engaged. Fasten the local indicator by tightening the screw.

3.3 Reference switch and level alarm switch (if fitted)

Level gauges with intrinsically safe level transmission and digital remote level readout can be fitted with 2 level alarm switches and a reference switch. The reference switch is required when a level transmitter is fitted. The reference switch gives the "start" signal for the remote level indicator and ensures, during operation of the level gauge, synchronization of the local read-out and the remote read-out. Reference switch and level alarm switches are designed for NC (normally closed) circuit. The level alarm switches are optional when level transmission is fitted and can be connected to several types of HSH AMTG series remote level indicators.

3.4 Switch operation

The reference switch must always be set to open when the float reaches the highest point (against float stops, against the mounting flange or above the valve). This means that the switch is closed from the moment the float is released and the level gauges thus in operation.
A high level alarm switch must be set to open when the cargo level has reached the required level. Under this level the switch must be closed.
A low level alarm switch must be set to open when cargo level has reached the required level. Above this level the switch must be closed. (This is contrary to the high level or reference).
The construction of reference switch, high- and low level alarm switches is identical: a magnetically actuated "reed" contact. The "reed" contact is fitted on a printed circuit board. The complete print board is fitted at the switch frame. A small magnet is fixed in the last digit wheel (at the 2 o' clock position).
During non-alarm condition the magnet must be positioned directly in front of the embedded "reed" contact. In this position the switch is closed (normal condition). At the required level setting the magnet turns away from the "reed" contact, thus opening the switch.

Remark: The turning direction of the spring-motor for setting high level alarm and reference is clockwise. For low level alarm the turning direction is anti clockwise.

3.5 Switch setting

Turn the spring-motor by hand until the local read-out shows the required level alarm setting (for level alarm switches) or until the float has reached the highest point (just about to touch the float stops or mounting flange or just above the valve). Hold the level gauge spring-motor at this level. Slack the fixing screw of the switch.

Pull out the switch from its fixed position by turning it slightly to the left. (Bayonet fitting).
Turn the driving (first) digit wheel so that the magnet in the last digit wheel is just on the point of turning away from the embedded "reed" contact.
Turn the driving digit wheel always in the same direction as if it would be driven by the spring-motor: for reference and high level spring-motor clockwise; for low level spring-motor anti clockwise.

Fit the switch in place, making sure that the gears are correctly engaged. Tighten the fixing screw and check the setting. Turn the spring-motor so that the float moves up and down.

For reference and high level the switch must be closed when the float is below the required level setting and open above this point. For low level the switch must be closed when the float is above the required level setting and open below this point.
The maximum setting accuracy is ± 2.5 mm. When the setting is not yet correct, slack fixing screw and pull the switch so far out that the gears are just disengaged. Turn the driving digit wheel just as many gear teeth as is required (observe correct turning direction) and fix the switch again.

Location of the switches inside the spring-motor compartment:

Reference switch	- approx. 11o'clock position
High level switch	- approx. 8 o'clock position
Low level switch	- approx. 5 o'clock position
Transmitter	- approx. 12 o'clock position.

3.6 Level transmitter (if fitted)

The intrinsically safe level transmitter is designed to provide HSH AMTG series remote level indicators with level information. The level transmitter consists of a gear driven rotor disc and three inductive proximity switches.
The level transmitter does not require adjustments or setting.
The synchronization between local read-out and remote read-out is arranged by the reference switch in the level gauge and reference program in the remote level indicator.

3.7 Oil filling

First fit the spring-motor compartment cover (fig. 3 item 7), making sure that no tools or dirt remain in this compartment. Check that the oil drain plug is tightened (fig. 3 item 11) and fill the spring-motor compartment with oil up to the oil fill plug level (oil fill plug fig. 3 item 11).
At this level the oil can be seen through the read-out window. Close the oil fill plug and fit the measuring drum cover. The level gauge is now ready for operation.

3.8 Starting-up

The measuring drum and float are already fitted in the factory and after the adjustment of local indicator and, if fitted, the reference switch and the level alarm switches, the level gauge can be closed and the instrument is ready for operation.

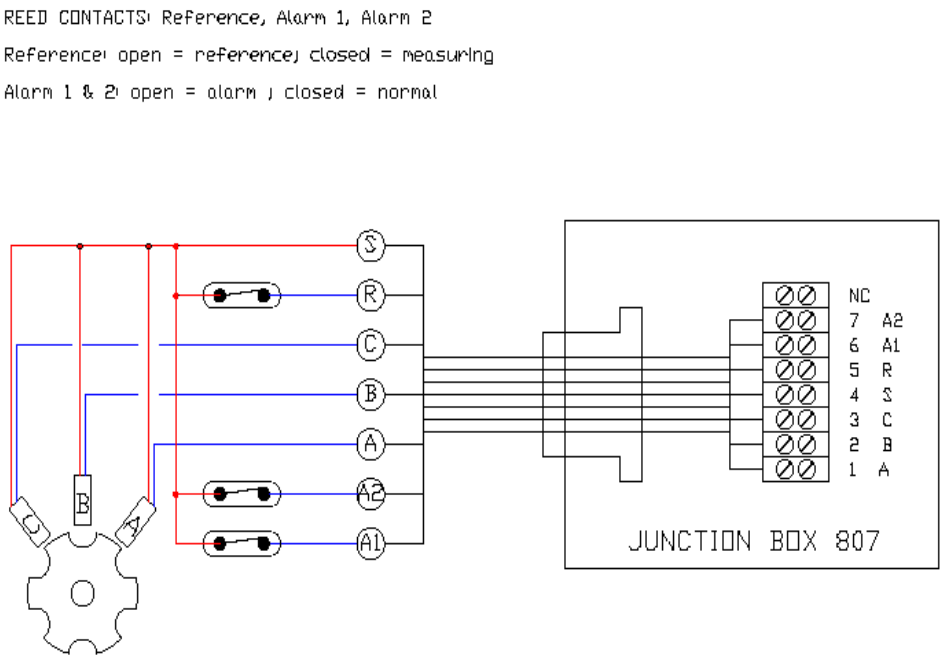

Figure 4 Level transmitter and internal wiring

3.9 Recommended oils for level gauges

	Maker	Viscosity Index	Pour Point	Viscosity @ 40°C (mm2/s)	Flash point
1	Shell Tellus oil T 15	159	- 45°C	14.0 cSt	154°C
2	Mobil DTE II	150	- 40°C	15.8 cSt	165°C
3	B.P. Energol SHF 22	173	- 54°C	21.3 cSt	165°C
4	Gulf Hydraulic oil A	140	- 54°C	15.8 cSt	160°C
5	Esso Univis HP 22	171	- 45°C	20.0 cSt	196°C
6	Fina Hydran HV 15	156	- 46°C	15.0 cSt	180°C
7	Elf Hydref 22	182	- 40°C	21.0 cSt	190°C
8	Total Equivis ZS 15	151	- 42°C	14.7 cSt	174°C
9	Castrol Hyspin AWH 15	151	- 51°C	14.8 cSt	165°C
10	Chevron LPS 15	153	- 51°C	15.0 cSt	160°C
11	Texaco Rando HD-Z	151	- 42°C	15.0 cSt	150°C
12	Idemitsu Daphne Super Hydro X 15	144	- 50°C	15.4 cSt	178°C

Other hydraulic oil types may be used when the following specifications are met :

Viscosity index : ≥ 140°C
Pour point : ≥ - 40°C
Viscosity @ 40°C : ≥ 14,0 cSt
Flash point : ≥ 150°C
Oil color : clear

Oil capacity per level gauge: approx. 7 L.

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4 Operation

4.1 Operation with manual float hoisting mechanism

The operation of the level gauge is very simple. To hoist the float, simply place the hand crank (see fig. 3 item 90) on the shaft at the spring motor compartment and rotate slowly clock-wise. The magnetic coupling of hand crank and hoisting mechanism prevents over-winding. When the float has reached the highest point (against float stops) the hand crank slips through the magnetic coupling.
Check the local read-out level. At the highest point of the float the level gauge is automatically locked. After the float is hoisted the hand crank must be removed. To start measurement the float must be released from the hoisted position. Engage the hand crank and turn 1 (one) revolution anti clock-wise. Remove the hand crank when the float is released. Float release is visible at the local read-out.

Check the oil level at regular intervals (e.g. every month). A too low oil level will result in an excessive float descend speed. Normally the oil level is visible through the local read-out window.

5 Maintenance

The oil filling of the level gauge should be renewed preferably once every 5 years. Always use clean oil for filling. The minimum and maximum oil level can be checked by removing the oil fill plug. Minimum level is at the lower edge, maximum is at the upper edge of the fill pipe stud.

Once every 5 years the terminal box should be checked for moisture. If silica gel sachets are present, either renew or regenerate these.

The bearings of the level gauge should be checked, and if necessary renewed, every 5 years. At the same time check the measuring cable and float for corrosion.

WARNING

- Never remove a measuring drum before locking the spring-motor. Failure to do so will unwind the spring-motor and cause severe damage. The oil in the spring-motor compartment does not have to be drained in order to lock the spring-motor. Fit the measuring drum in exactly the same position as it was taken out, e.g. with the float at the same level. If this is done correctly, re-adjustment of the level gauge is not required.

- DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.

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6 Trouble shooting

Failure	Diagnosis
a. The level gauge runs irregular	1. Dirty measuring drum bearing and/or magnet separation cap.
b. The float does not descend after releasing	1. Dirty measuring drum bearing and/or magnet separation cap. 2. Valve below level gauge closed. 3. Local level indicator, reference switch or alarm switch not correctly fitted. 4. Obstacles in travel range of float.
c. Level gauge indicator suddenly shows erroneous reading	1. Measuring cable broken. 2. Measuring cable off the measuring drum.
d. Float cannot be hoisted	1. Obstacles in float travel range.
e. Float returns to cargo level after being hoisted	1. Hand crank not taken off.
f. Float is difficult to hoist	1. Hand crank not correctly fitted at shaft. 2. Weak magnets
g. Float descends too fast after releasing	1. Check oil level in spring-motor comp.
h. Local indicator shows "impossible" reading	1. Measuring cable broken.
i. Float submerges in cargo or remains at tank bottom with cargo in the tank	1. Leaking float.

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7 Parts list 807 series marine level gauges

Pos.	Fig.	Description	Part No.	Remarks
1	3/13	Measuring drum compartment	807.010	SS 316L (SUS)Flange DN150PN16
1	3/13	Measuring drum compartment	807.011	SS 316L (SUS)Flange 6”150 LBS ANSI
1	3/13	Measuring drum compartment	807.012	SS 316L (SUS)Flange DN150PN25
1	3/13	Measuring drum compartment	807.013	SS 316L (SUS)Flange 6”300 LBS ANSI
1	3/13	Measuring drum compartment	807.014	SS 316L (SUS)Flange DN150PN40
2	13	Cover drum compartment	807.021	Stainless steel 316 (SUS)
2A	13	Plug 5/8"	0807.02A	for drum compartment
3	13	O-ring drum compartment	807.030	
4	13	Bolts drum cover	807.040	
4A	13	Sealing bolt drum cover	807.041	
5	13	Spring lock washer drum cover	807.050	
6	3 ~ 9	Spring motor compartment	807.060	Stainless steel 316 (SUS)
7	3	Cover motor compartment	807.070	Stainless steel 316 (SUS)
8	3	Gasket motor compartment	807.082	
9	3	Bolts motor compartment	807.090	
9A	3	Sealing bolt motor compartment	0807.09A	
10	3	Spring lock washer motor comp.	807.100	
11	2/3	Oil fill, oil drain plug	807.110	
11A	3	Gasket Oilplug	0807.11A	
12	10/11	Magnetic separation flange	807.120	Stainless steel 316 (SUS)
13	10	O-ring drum side	807.130	
14	9	O-ring motor side	807.141	
15	10	Bolts separation flange	807.150	
16	10	Spring lock washer sep.flange	807.160	
18	13/14	Measuring drum SUS 316	807.180	
19	14	Outer magnet measuring drum	807.190	Complete encapsulated (SUS)
20	14	Housing bearings measuring drum	807.200	Stainless steel 316 (SUS)
21	14	Ball bearings measuring drum	807.210	
22	14	Spacer measuring drum	807.220	
23	14	Bolts bearing housing	807.230	
24	14	Washers bearing housing	807.240	
26	13/14	Measuring wire SUS 316	807.260	
27	18	Float set complete 127x45mm	807.270	Including float spring (28)
28	18	Float spring	807.301	Pre-tensioned
29	11	Main shaft assembly	807.290	
30	12	Main shaft housing	807.300	
31	12	Ball bearings main shaft	807.310	
32	12	Inner magnet main shaft	807.320	Complete encapsulated (SUS)
33	12	Ring main shaft	807.330	
34	12	Bolt main shaft	807.340	
35	12	Key main shaft	807.350	
36	12	Main shaft	807.360	
37	12	Set ring main shaft	807.370	
38	12	Set ring screw main shaft	807.380	
39	12	Ring main shaft	807.390	
40	15	Screw transmitter	807.400	
41	11	Bolt main shaft	807.410	
42	11	Spring washer main shaft	807.420	
43	15	Screw transmitter	807.430	
44	15	Bolt transmitter	807.440	
45	5	Spring motor storage drum	807.450	
46	5	Spring motor drum (main shaft)	807.460	
47	5	Bush spring motor	807.470	
48	5	Bolt spring motor	807.480	

49	5	Key spring motor	807.490	
50	15	Rotor house transmitter	807.500	
501	15	Transmitter housing	807.501	
51	7	Feed through wire 807	807.510	
52	7	O-ring Feed through	807.520	
53	7	Rail with terminals	807.531	
54	15	Transmitter shaft	807.540	
55	7	Cover Junction Box	807.550	
56	7	Gasket Junction Box	807.560	
57	7	Bolt Junction Box	807.570	
58	7	Washer Junction Box	807.580	
59	15	Ring Junction Box	807.590	
60	7	Cable gland	807.600	
61	4	Local indicator Innage	807.611	
62	4	Reference / alarm switch	807.620	
64	8	Window local indicator	807.641	
65	8	Gasket Window local indicator	807.650	
66	8	Window frame local indicator	807.660	
67	4	Bolt to fix indicator/ switch	807.670	
68	4	Bolt to fix transmitter	807.680	
69	17	O-ring hoist\lock mechanism	807.691	
70	6	Nut for hoist\lock mechanism	807.700	
70	6	Nut special hoist\lock mechanism	807.701	
71	4	Transmitter complete	807.710	
72	5	Flange for spring	807.721	
73	15	Pulse rotor transmitter	807.730	
731	15	Ball Bearing transmitter	807.731	
74	15	Connector with switches	807.740	
75	5	Bolt to fit motor spring end	807.750	
76	5	Screw to fit motor spring end	807.760	
77	5	Set ring assembly	807.770	
777	5	Oil brake complete	807.777	
78	5	Gear wheel main shaft	807.780	
79	5	Bolt main shaft	807.790	
80	5	Washer main shaft	807.800	
81	6/7	Float hoisting mechanism	807.810	
82	17	Float hoist mechanism base plate	807.820	
83	17	Bolt hoist\lock mechanism	807.830	
84	17	Gear frame hoist\lock mechanism	807.840	
85	17	Carrier coupling hoist\lock mechanism	807.850	
86	17	Conical gear hoist\lock mechanism	807.860	
87	17	Magnet hoist\lock mechanism	807.904	
88	17	Positioning magnet hoist\lock mechanism	807.904	
89	17	Shaft hoist\lock mechanism	807.890	
90	2/3	Hand crank	807.901	
91	16	Contact print reference switch	807.910	
92	16	Screw reference switch	807.920	
92	16	Screw reference switch long	807.921	
94	9	Bolt to fix motor compartment	807.940	
95	11/12	O-ring on main shaft (absorber)	807.950	
96		Nameplate 807	807.961	
97		Nut to fix window	807.970	

7.1 Recommended spare parts for level gauges

Pos.	Fig.	Description	Qty.	Art. #
3/13	3/13	O-ring drum compartment	2 pcs	807.030
8	3	Gasket motor compartment	2 pcs	807.082
14	9	O-ring motor side	1 pcs	807.141
21	14	Ball bearings measuring drum	2 pcs	807.210
26	18	Measuring wire	2 pcs	807.260
27	15	Float set complete	1 pcs	807.270
45	5	Spring motor storage drum	1 pce	807.450
61	4	Local indicator Innage	1 pce	807.611
62	4/16	Reference or alarm switch	2 pcs	807.620
64	4	Window replacement set	1 pce	807 window
65	8	Gasket window local indicator	2 pcs	807.650
69	17	O-ring hoist/ lock mechanism	1 pcs	807.691
71	4/15	Transmitter complete	2 pcs	807.710
90	3	Hand crank	1 pcs	807.901

7.2 How to order spare parts

When ordering spare parts, always state type and serial number.

7.3 Tools

No special tools are required.
With the following tools the level gauges can be completely serviced:

- 1 set of Allen keys, metric, 1 Allen key 3 mm extra long (140 mm)
- 1 open/ring wrench 10 mm.
- 1 ring wrench 18-19 mm1 screw driver no. 3
- 1 set Philips screw drivers.
- 1 Multimeter

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8 Specifications

Performance:

Measuring range	: 0 – 39 m
Accuracy*	: ΔL = ± (2,0 + 0,15L) mm (L is the meas. Level)
Repeatability	: ± 2,0 mm
Sensitivity*	: ± 1,5 mm
Max. working pressure	: 2,0 MPa (20 bar)
Minimum cargo temperature	: - 165 °C
Maximum cargo temperature	: + 90 °C
Ambient temperature	: - 20 °C ~ + 60 °C

* = @ max. inclination of 22,50°

Materials:

Gauge head	: AISI / SUS 316
Measuring drum	: AISI / SUS 316 or INVAR 36
Measuring wire	: AISI / SUS 316 or Invar 36
Magnet separation	: AISI / SUS 316 (welded, no seals)
Coupling magnets	: Stainless steel encapsulated SmCo
Float	: AISI / SUS 316
Weight	: ± 65 kg

Electrical:

Sensor output circuits (terminal 1-a and 4S, 2-b and 4S, 3-c and 4S)

in type protection intrinsic safety EEx ia IIB, only to be connected to remote level indicator model AMTG 821/02 or certified intrinsically safe circuits, with the following maximum values for each circuit:

Ui	=	16	V
Ii	=	52	Ma
Pi	=	169	mW
Ci	=	30	nF
Li	=	50	µH

Alarm output (terminal 5-R and 4S, 6-A1 and 4S, 7-A2 and 4S)

in type protection intrinsic safety EEx ia IIB only to be connected to remote level indicator model AMTG 821/02 or certified intrinsically safe circuits, with the following maximum values for each circuit:

Ui	=	16	V
Ii	=	52	Ma
Pi	=	169	mW
Ci	=	0	nF
Li	=	0	µH

The sensor output circuits and the alarm output circuits have one connection in common.

9 Drawings of FTLG 807 series marine level gauges

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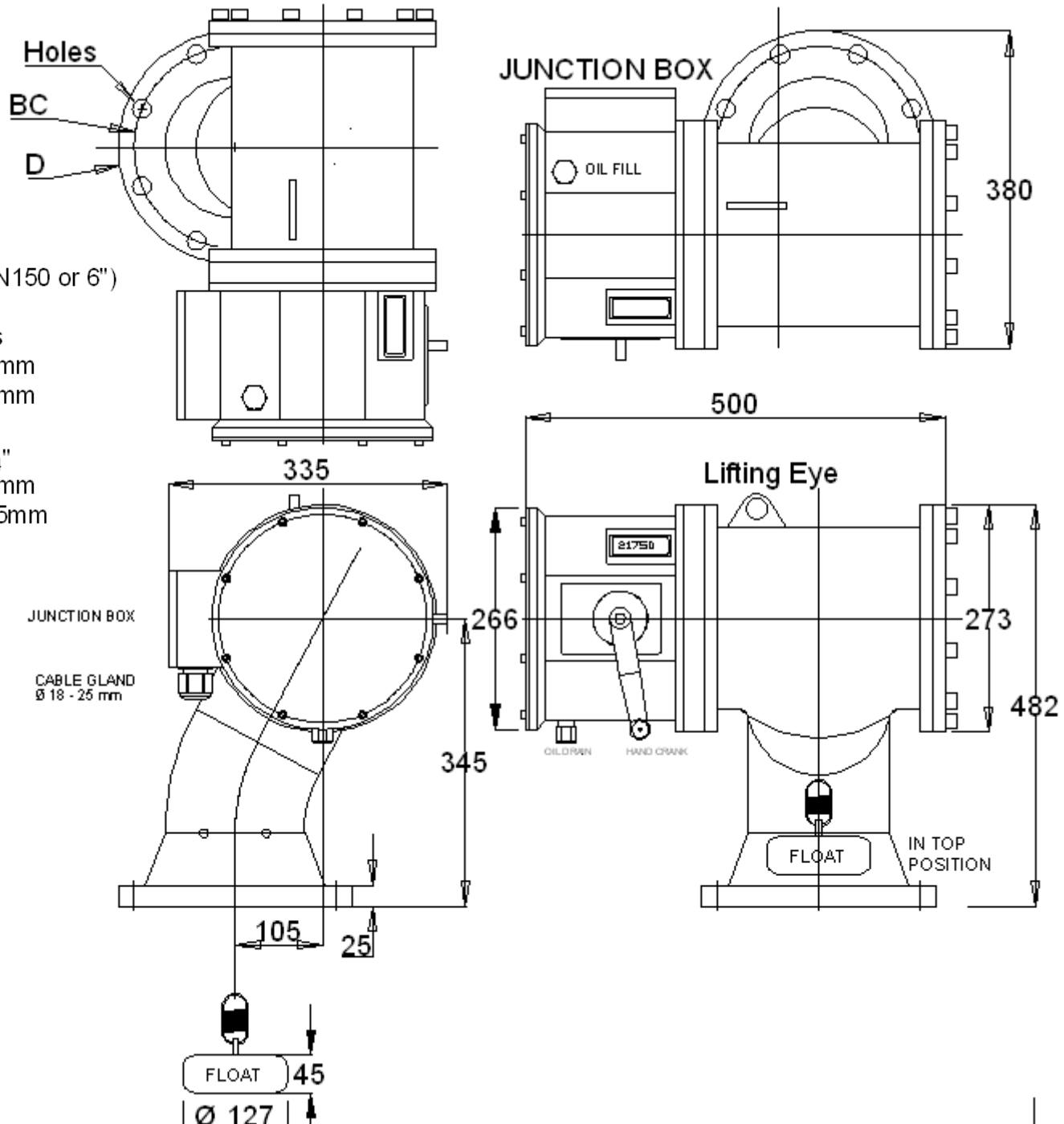
Fig 1 : Dimensions of level gauge



FTLG 807 MARINE LEVEL GAUGE FLANGES (DN150 or 6")

	D	BC	Holes
DIN PN16	285	240	8×22mm
DIN PN40	300	250	8×26mm
ANSI 150LBS	11"	9 ½"	8×¾"
ANSI 300LBS	12 ½"	10 ⅝"	12×¾"
JIS 10K	280	240	8×23mm
JIS 20K	305	260	12×25mm

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Fig 2 : Layout of main components

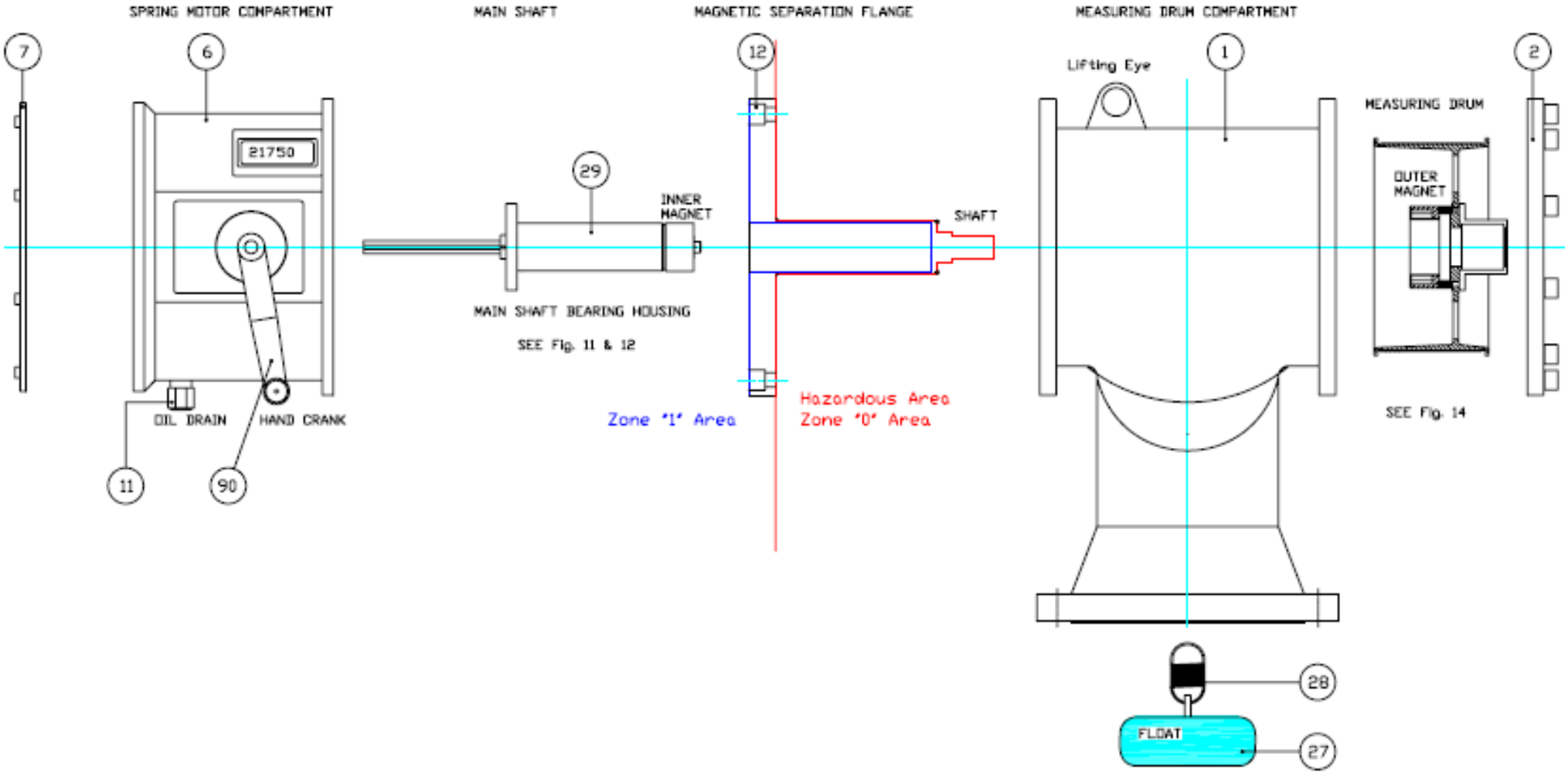

Fig 3 : Open view of spring motor compartment

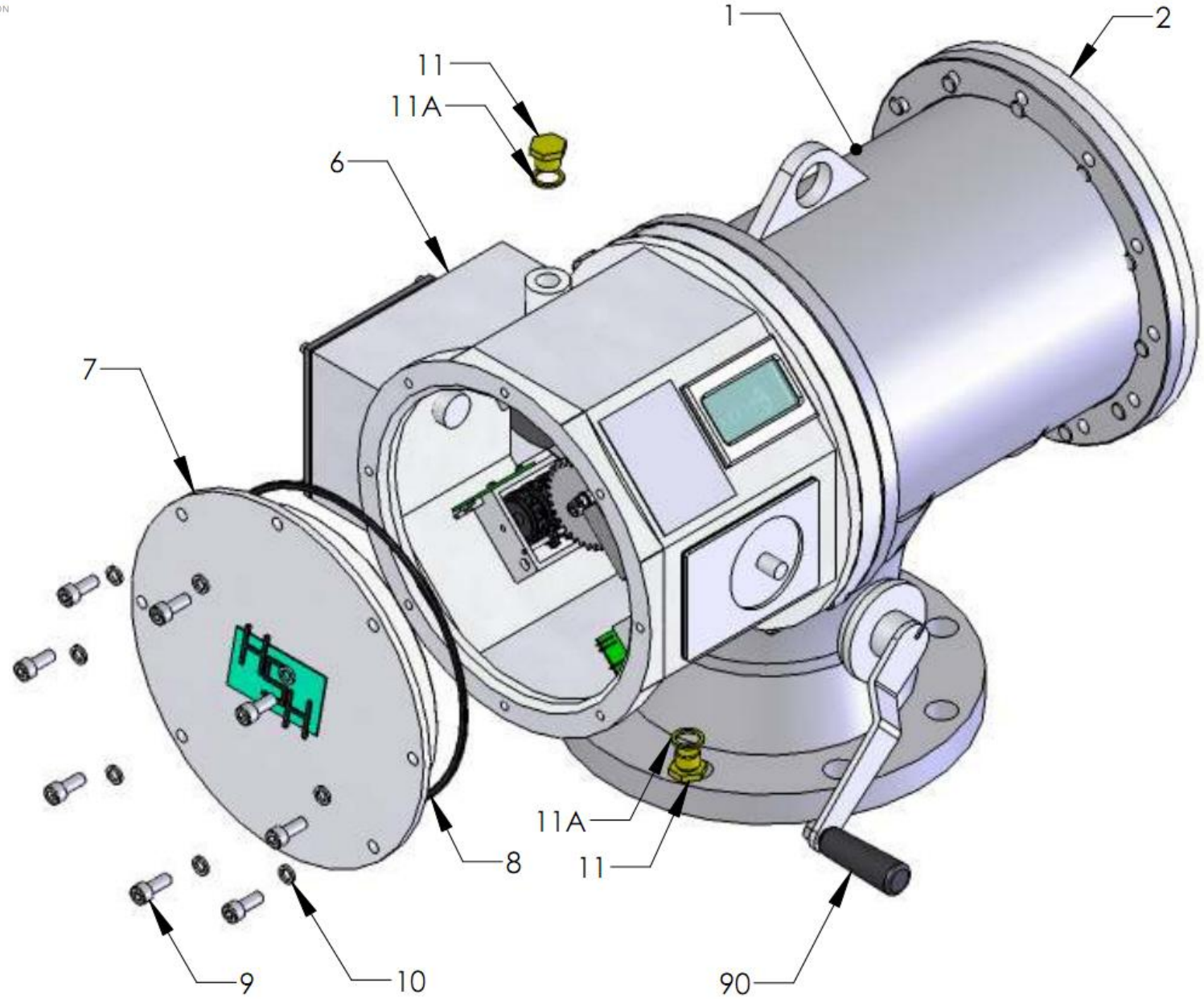

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Fig 4 : Local indicator, reference/alarm switches and transmitter

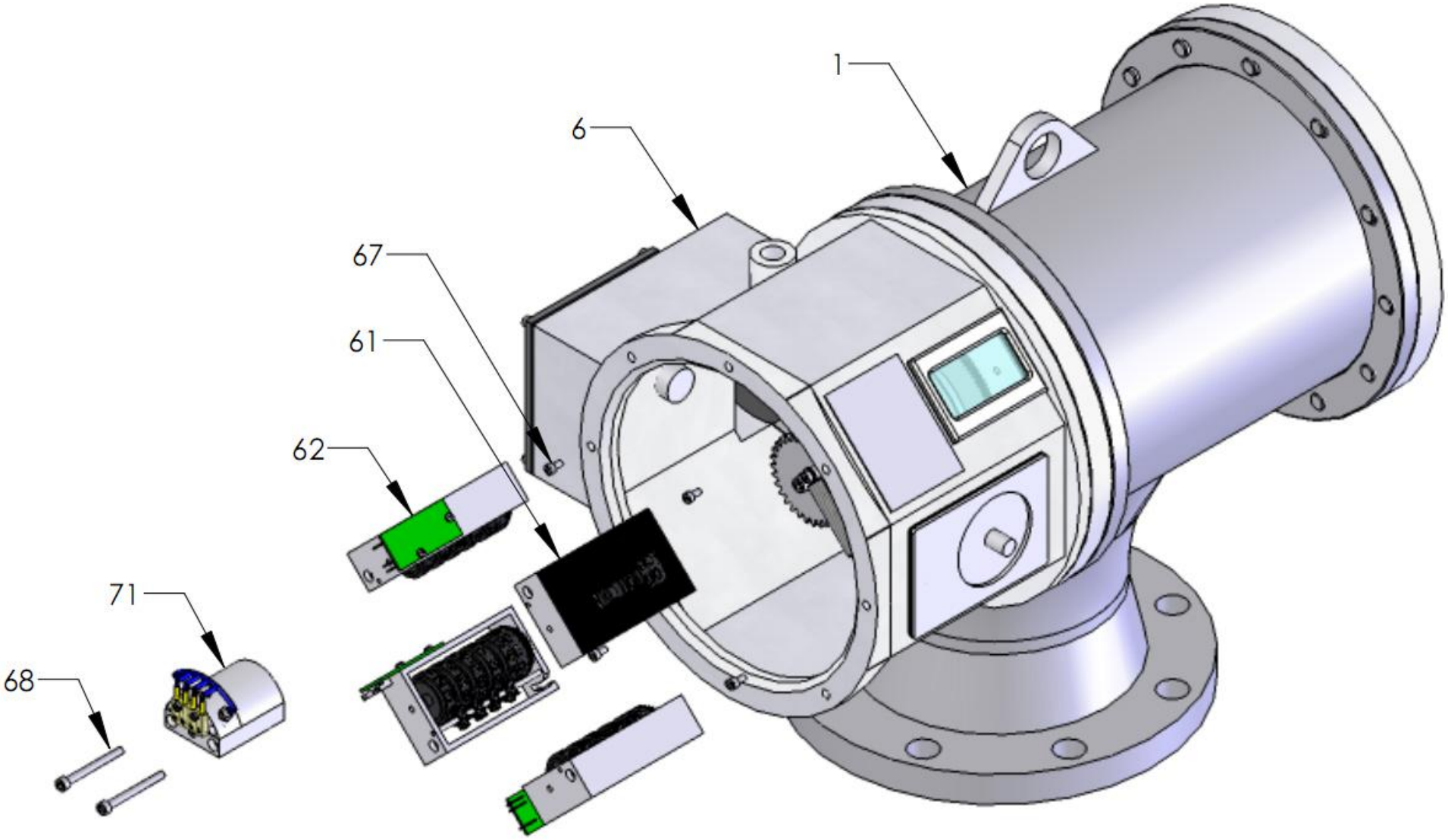

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Fig 5 : View of spring motor parts

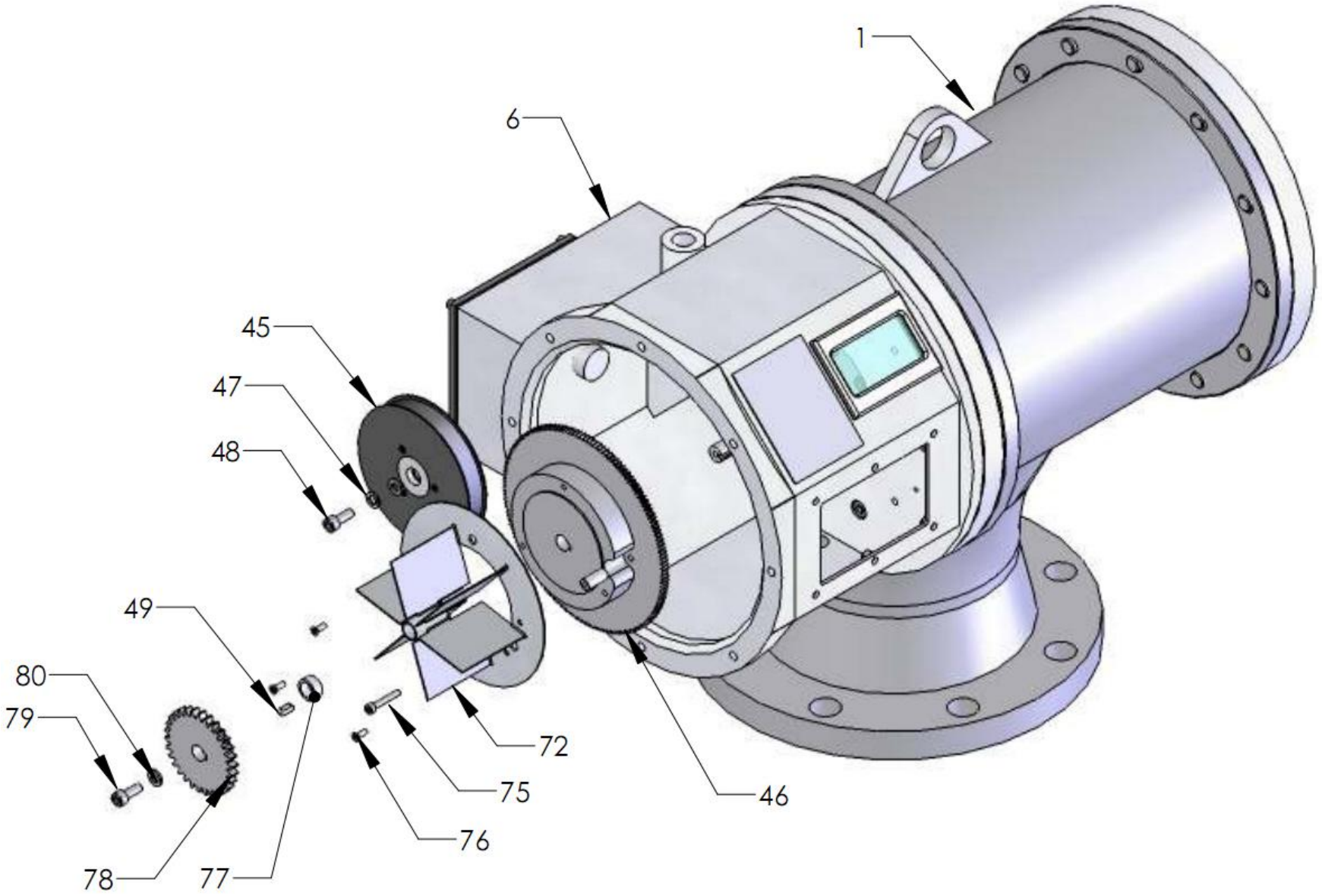

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Fig 6 : View of hoisting mechanism)

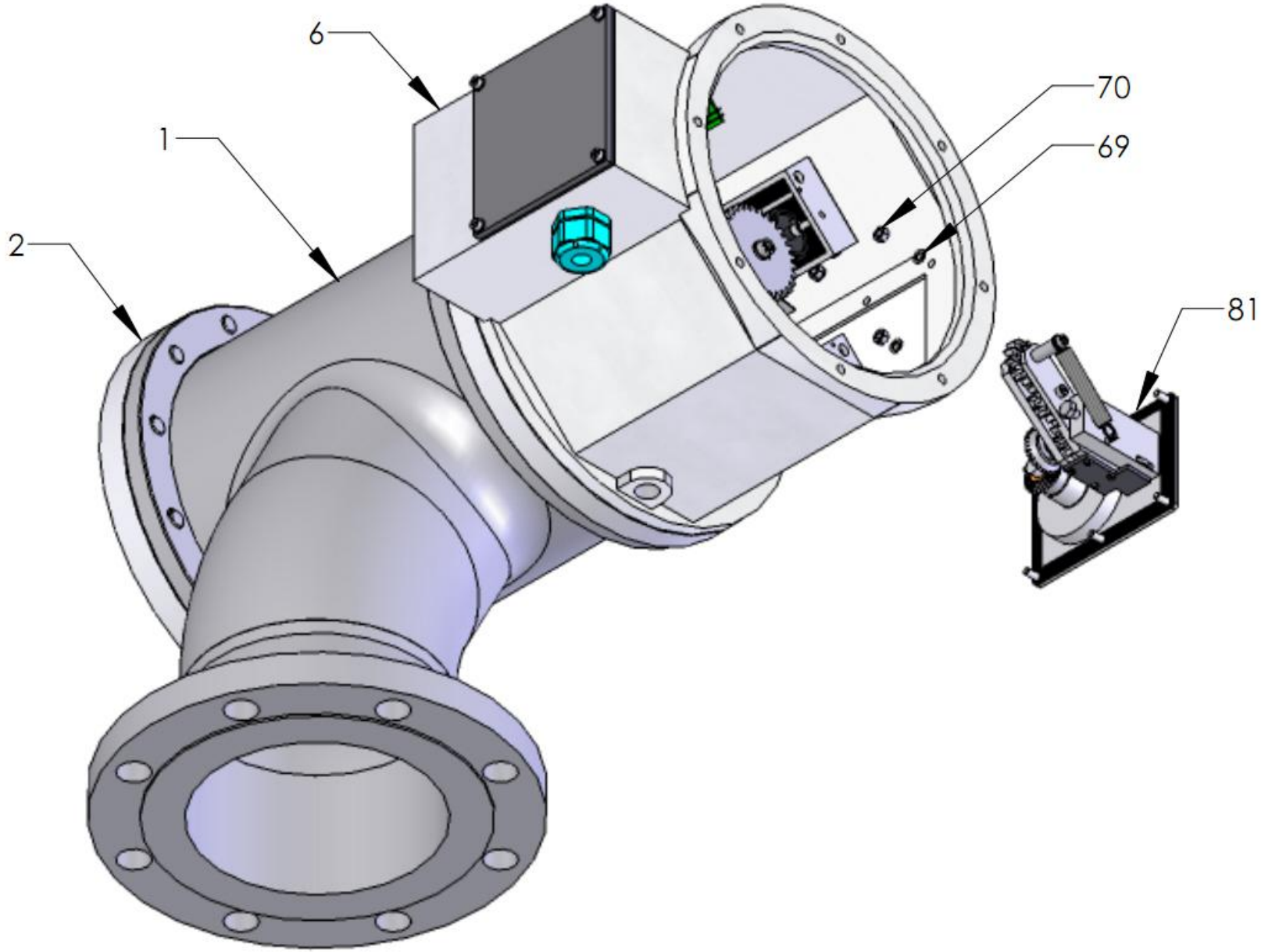

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Fig 7 : View of junction box

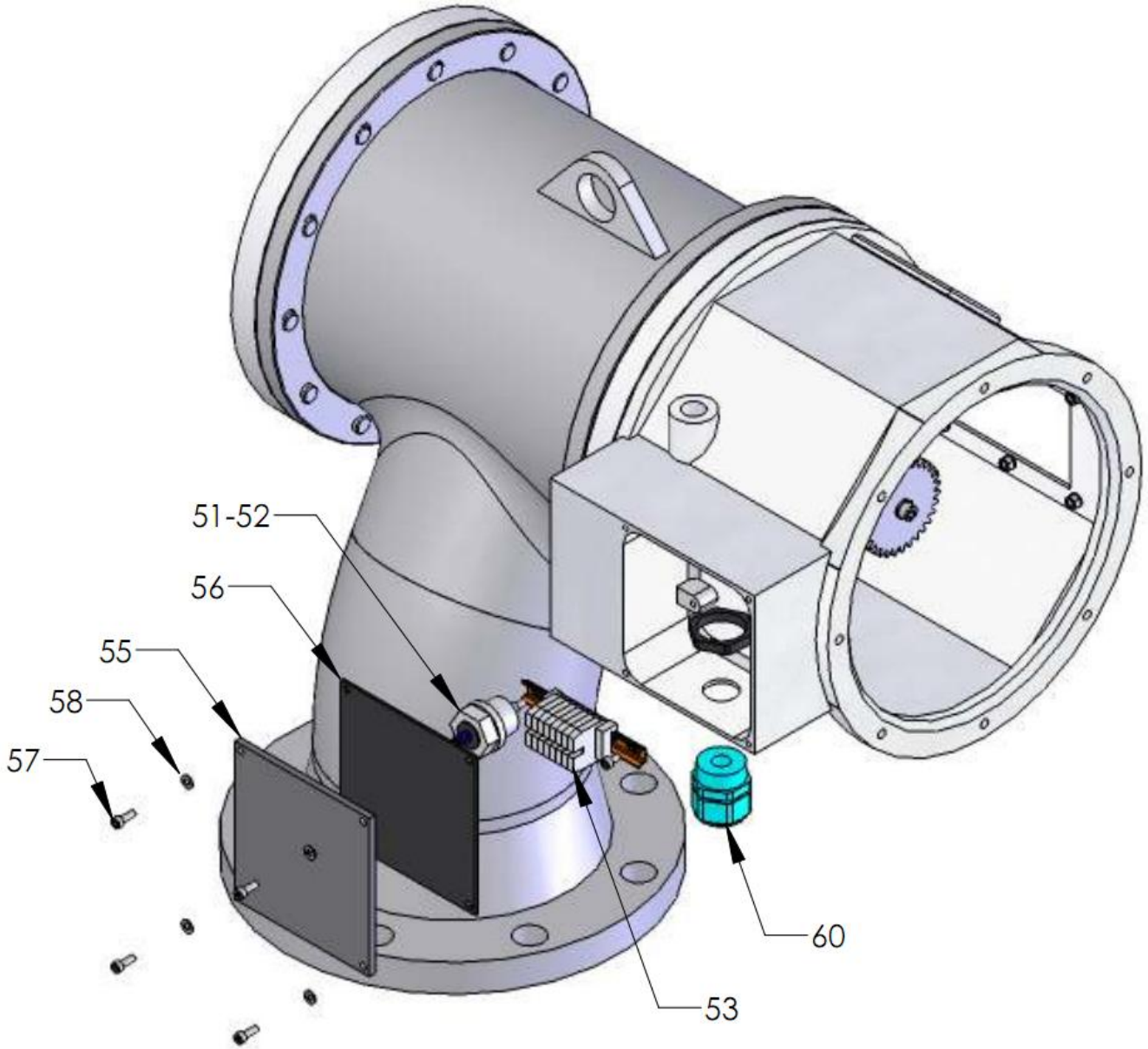

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Fig 8 : Window parts and location

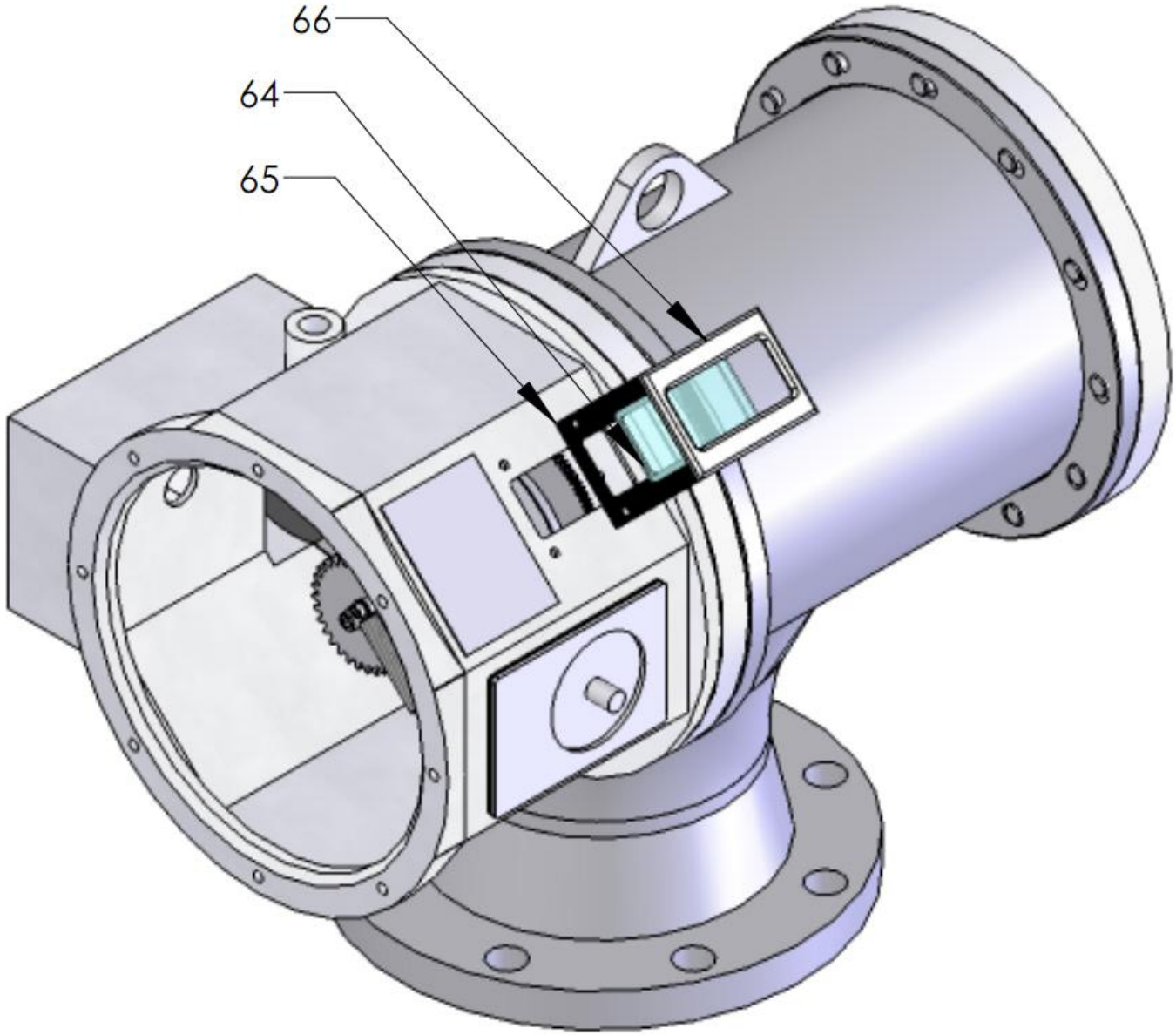

Fig 9 : Fitting spring motor compartment

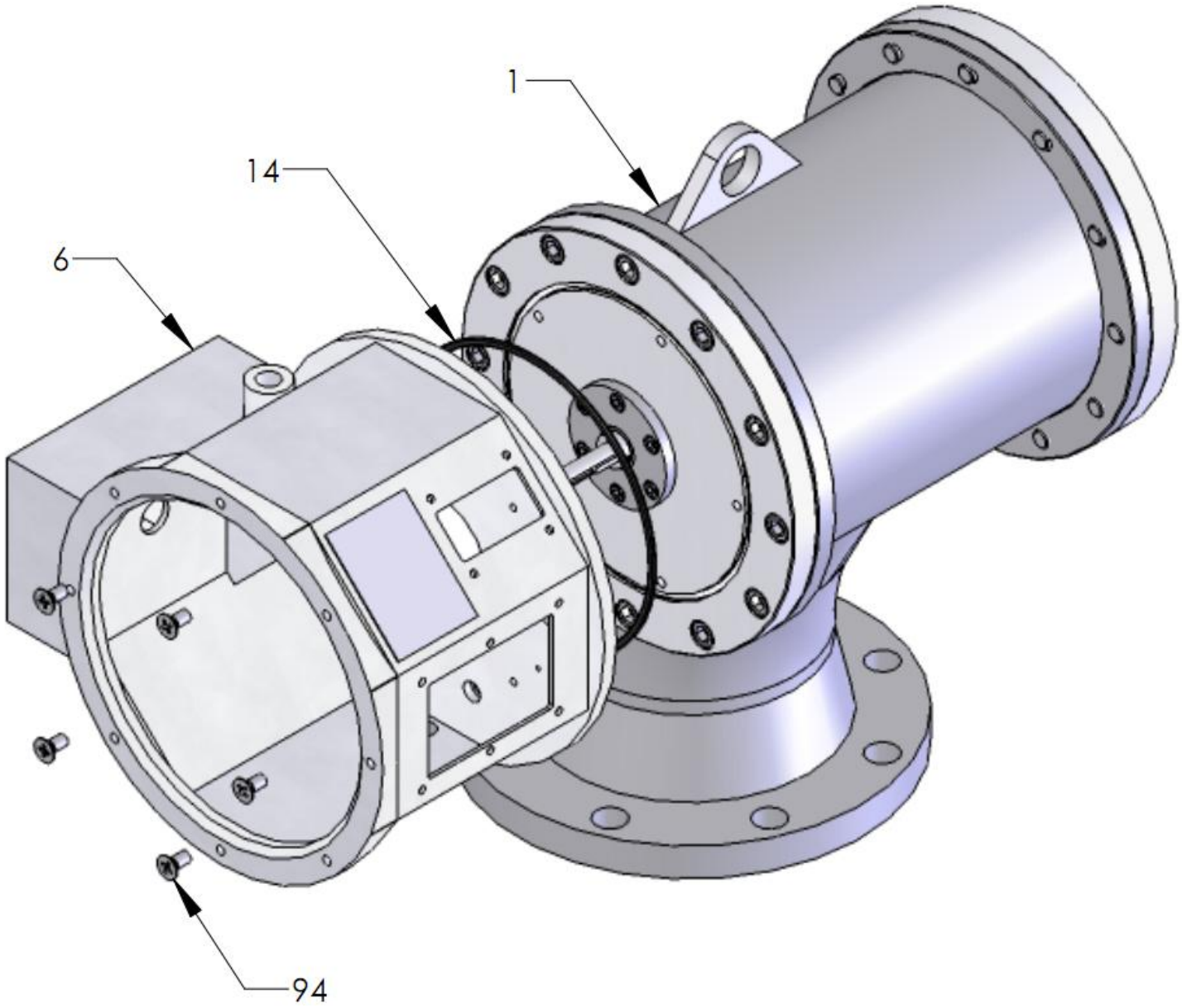

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Fig 10 : Fitting separation plate

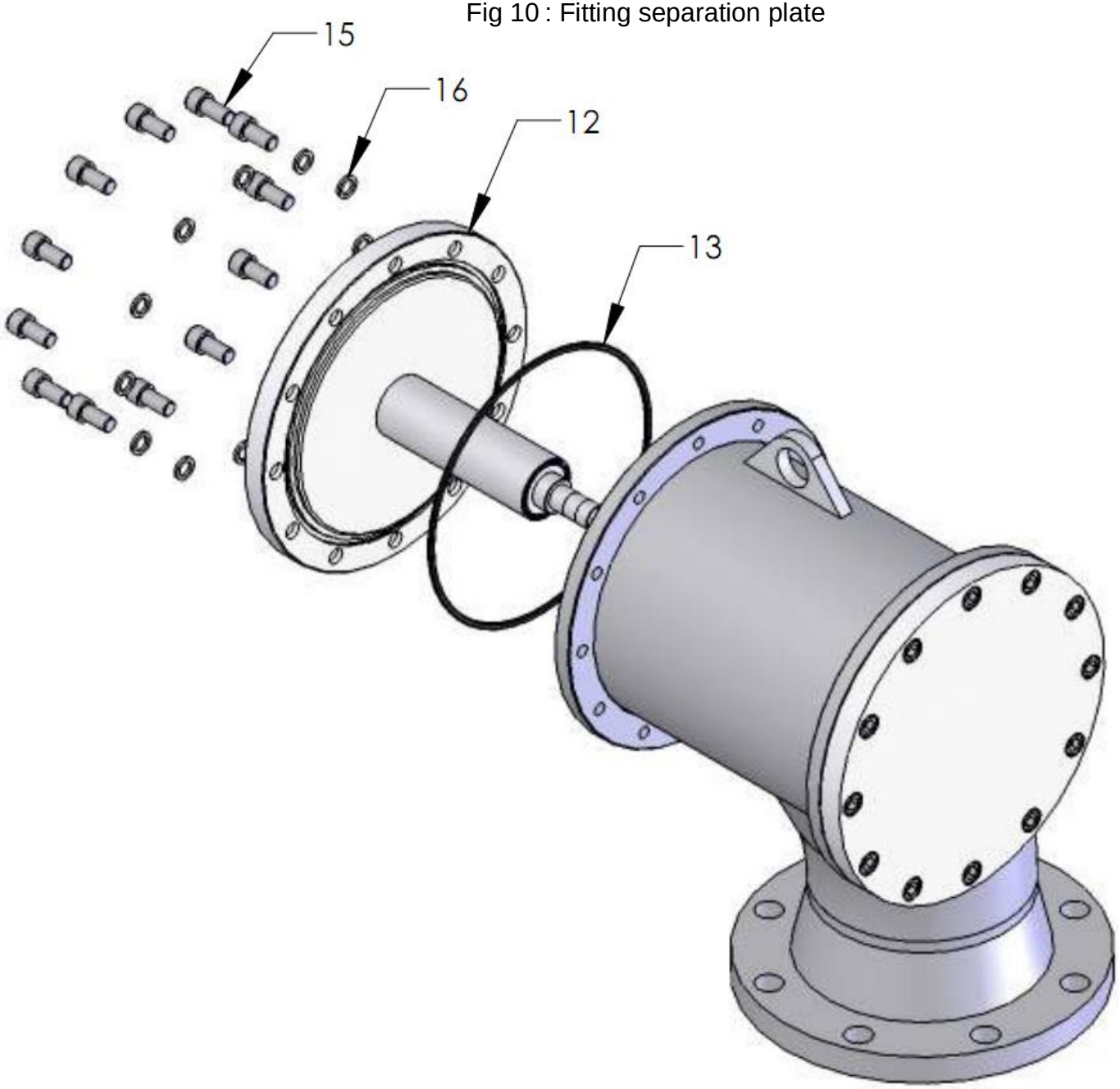

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Fig 11 : Fitting main shaft

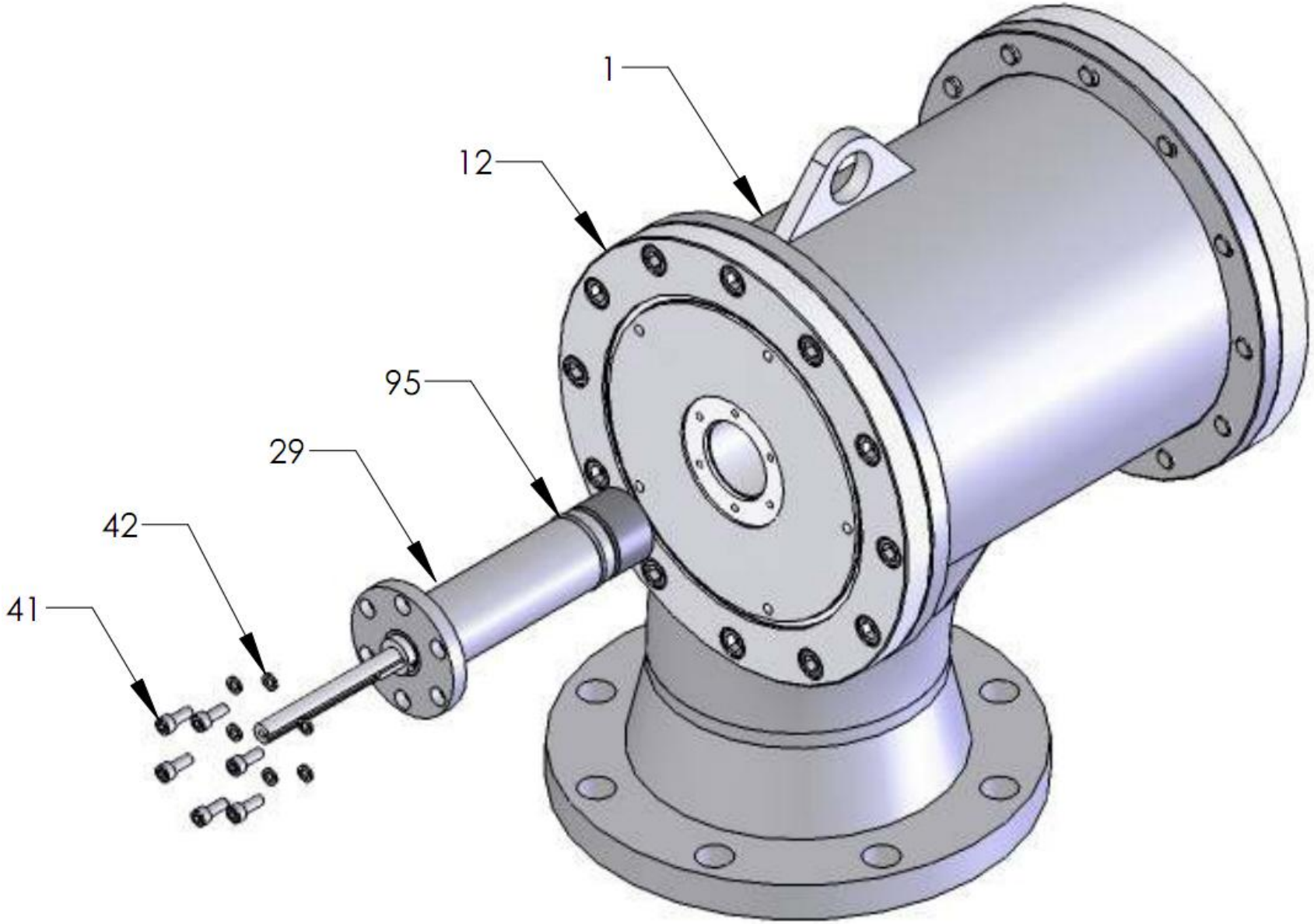

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Fig 12 : Main shaft parts

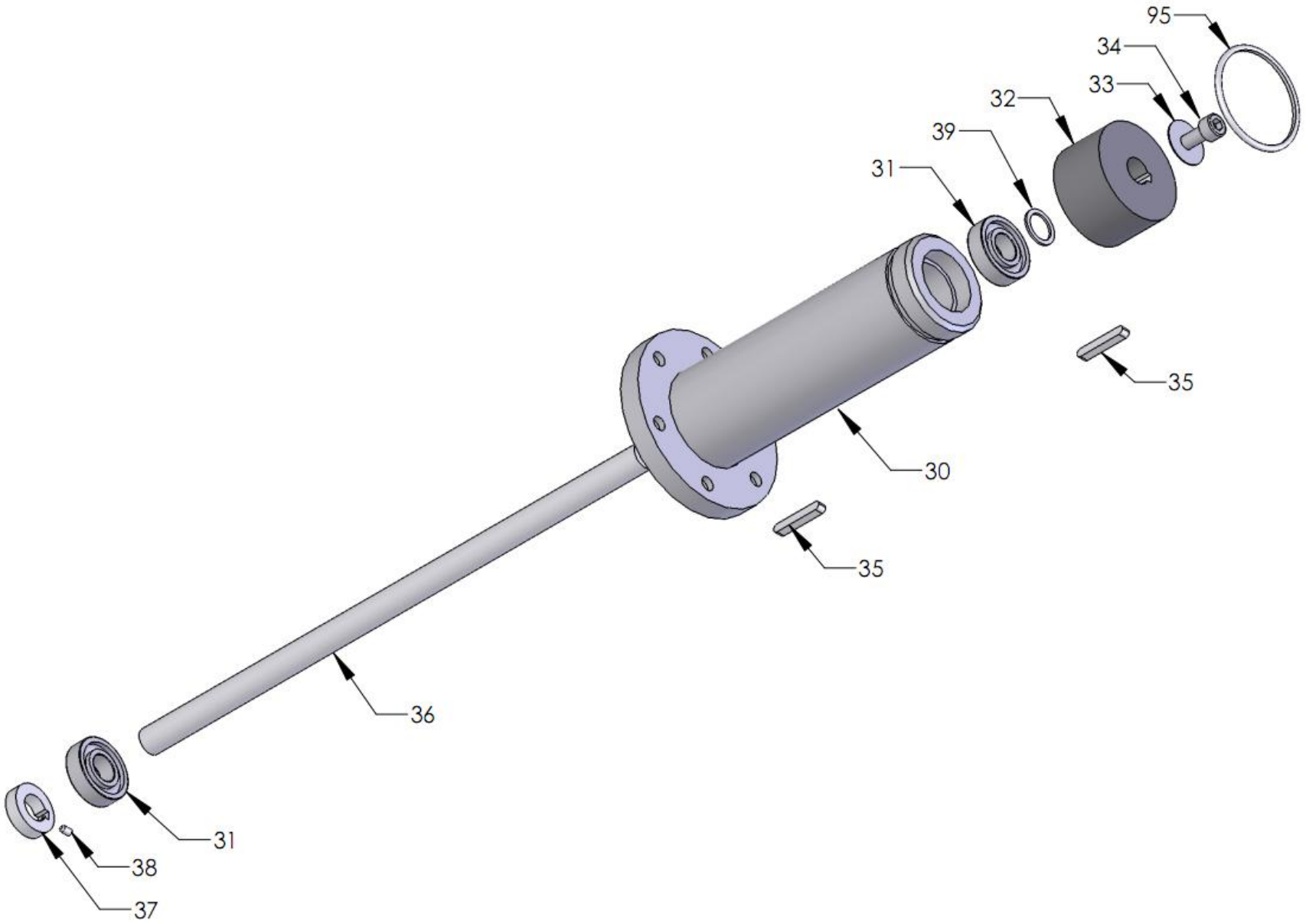

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Fig 13 : Open view measuring drum compartment

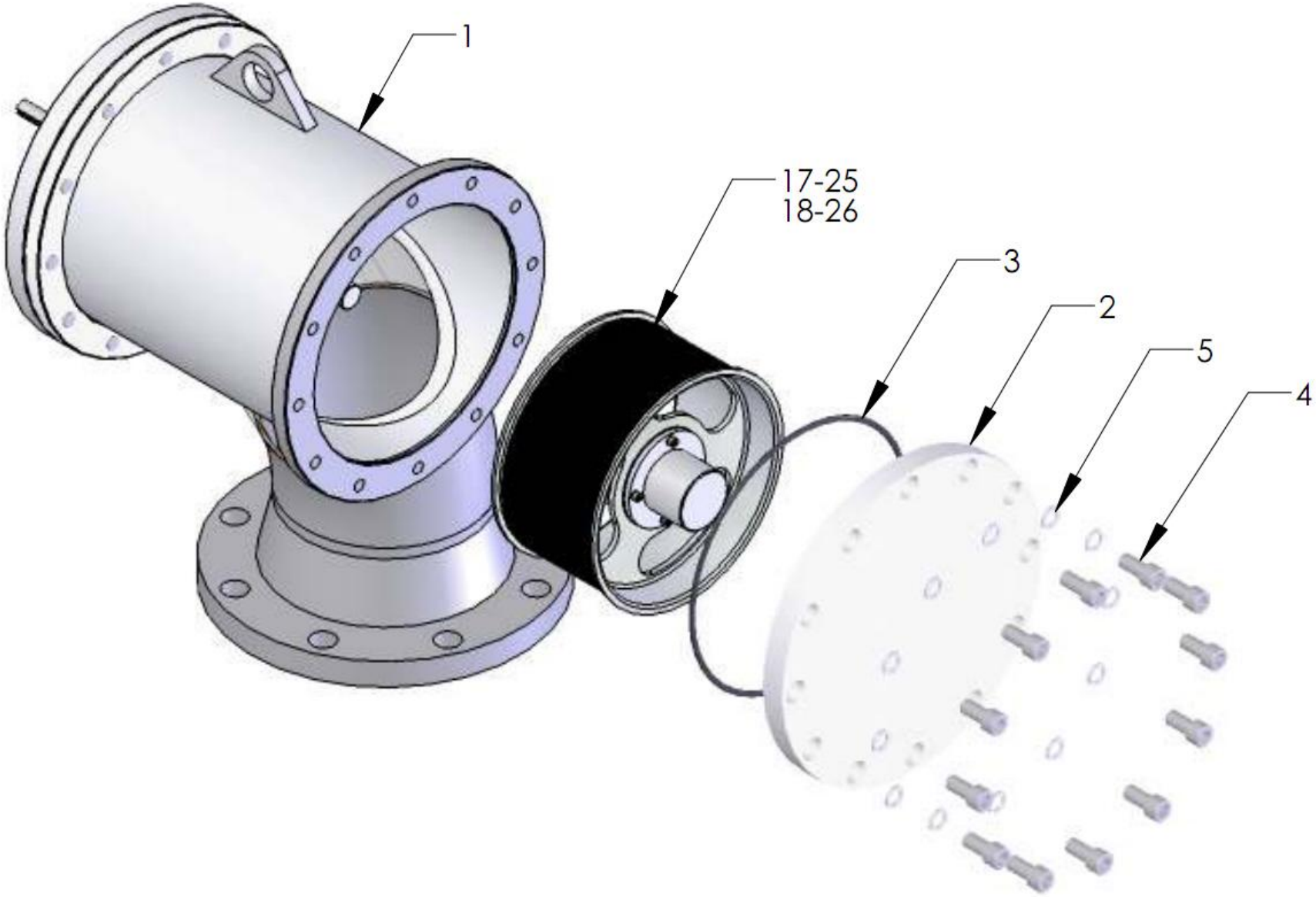

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Fig 14 : Measuring drum assembly

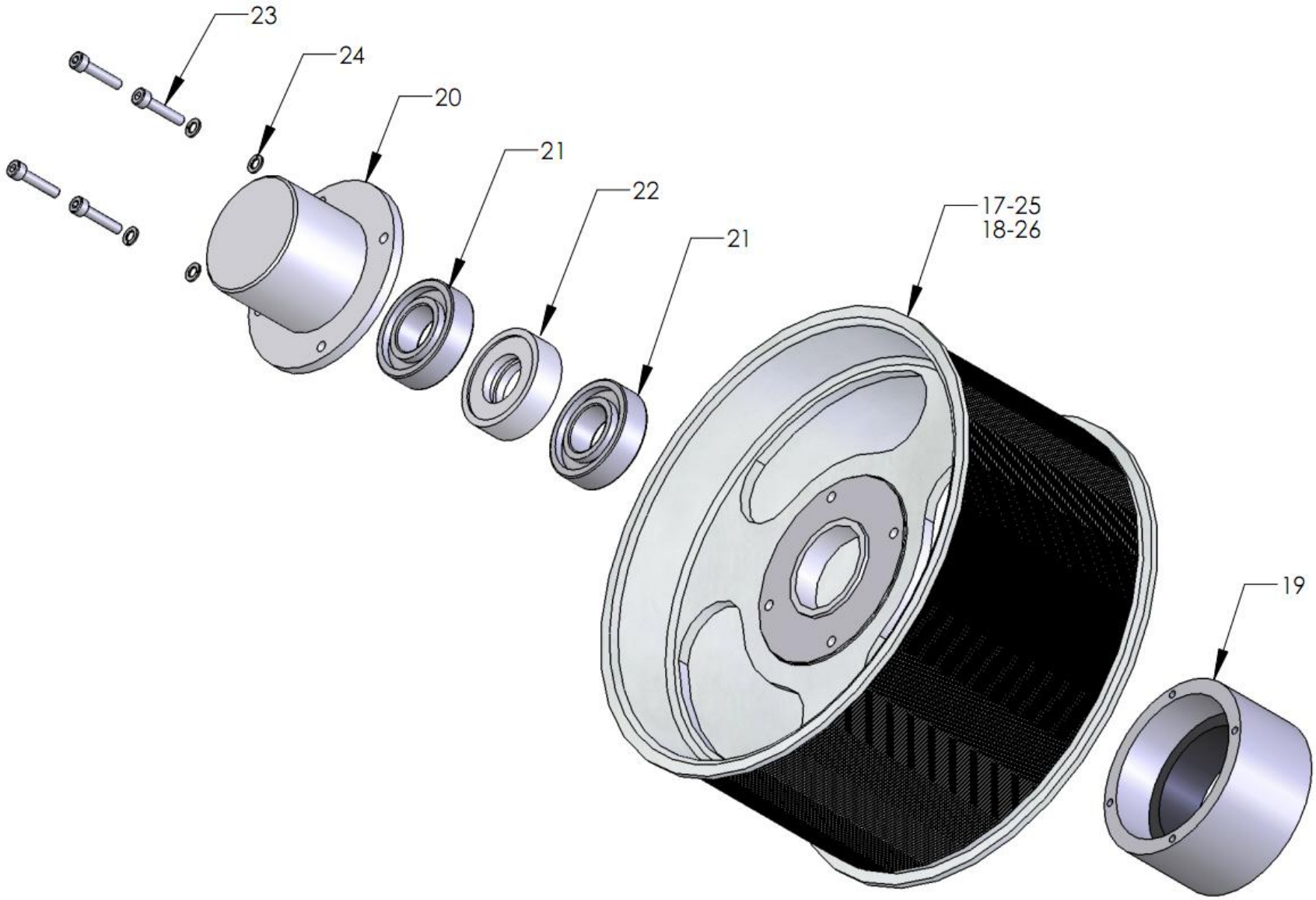

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Fig 15 : Level transmitter

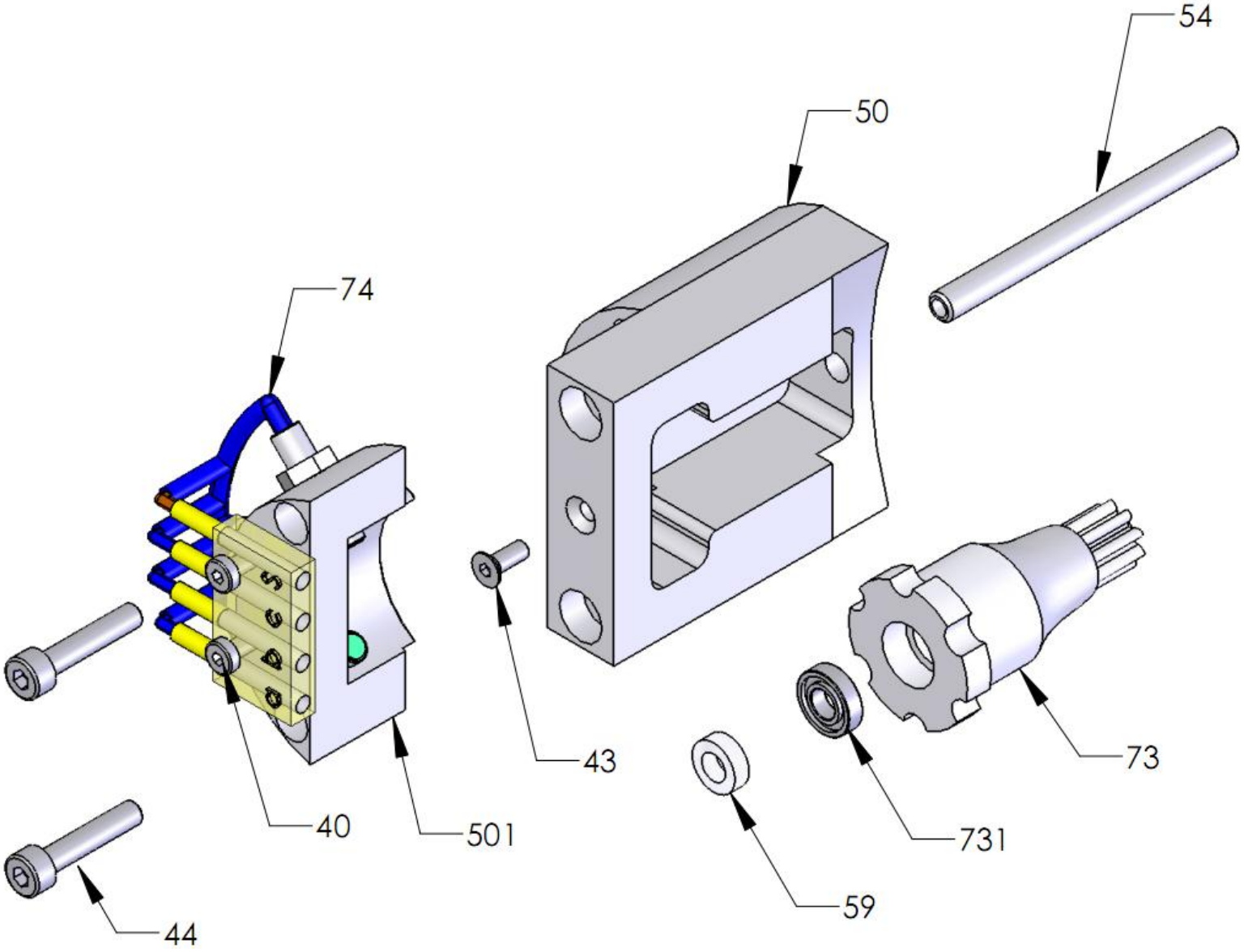

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Fig 16 : Reference or alarm switch

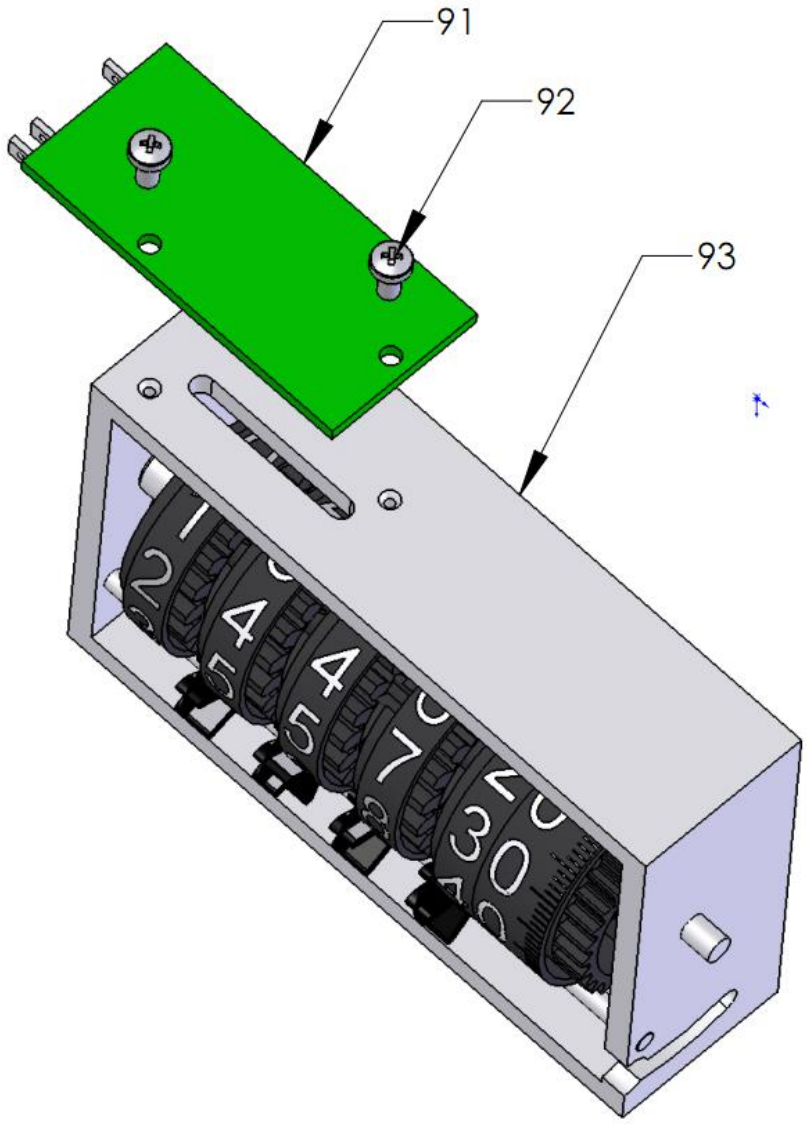


Fig 17 : Float hoisting mechanism

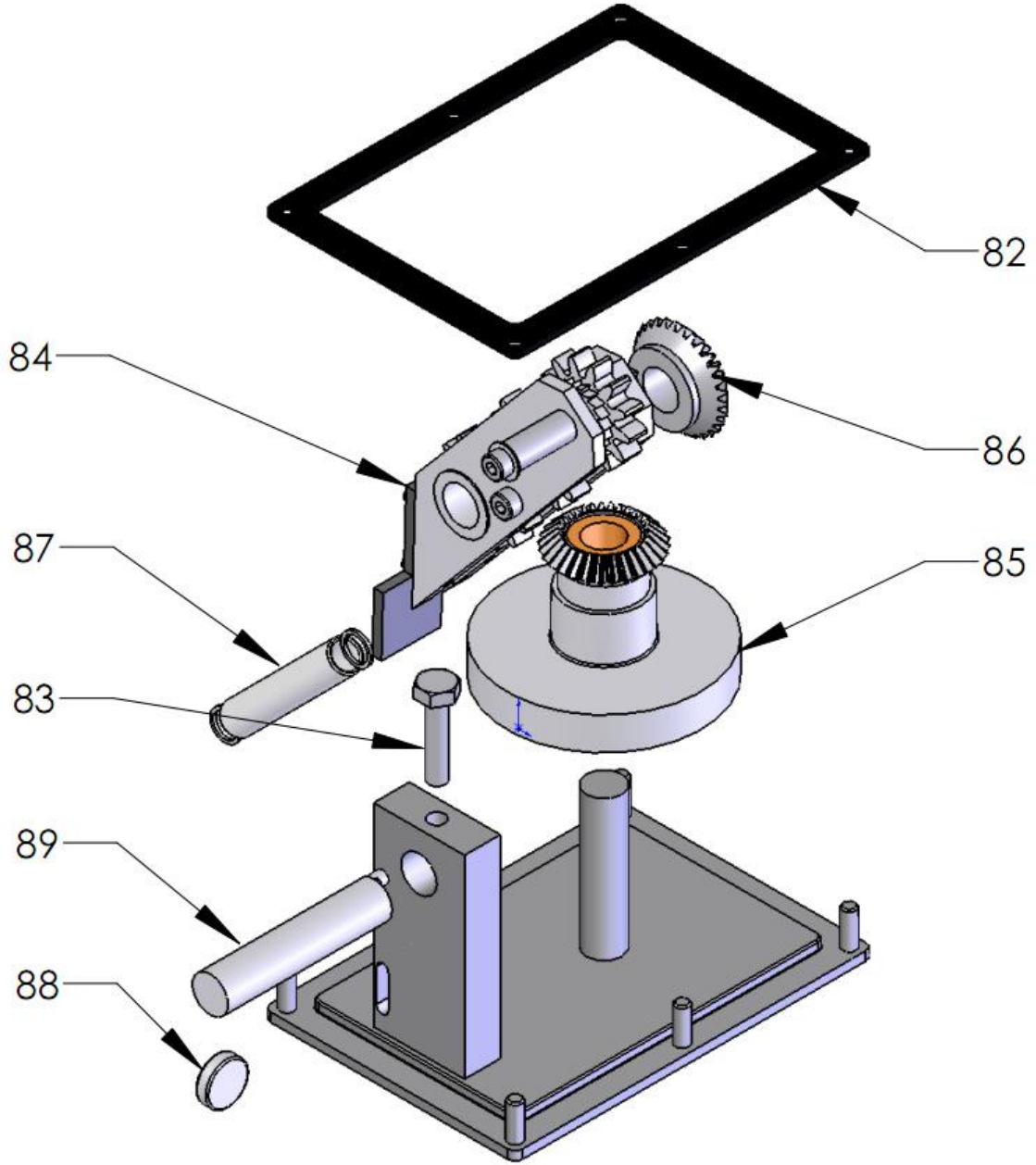
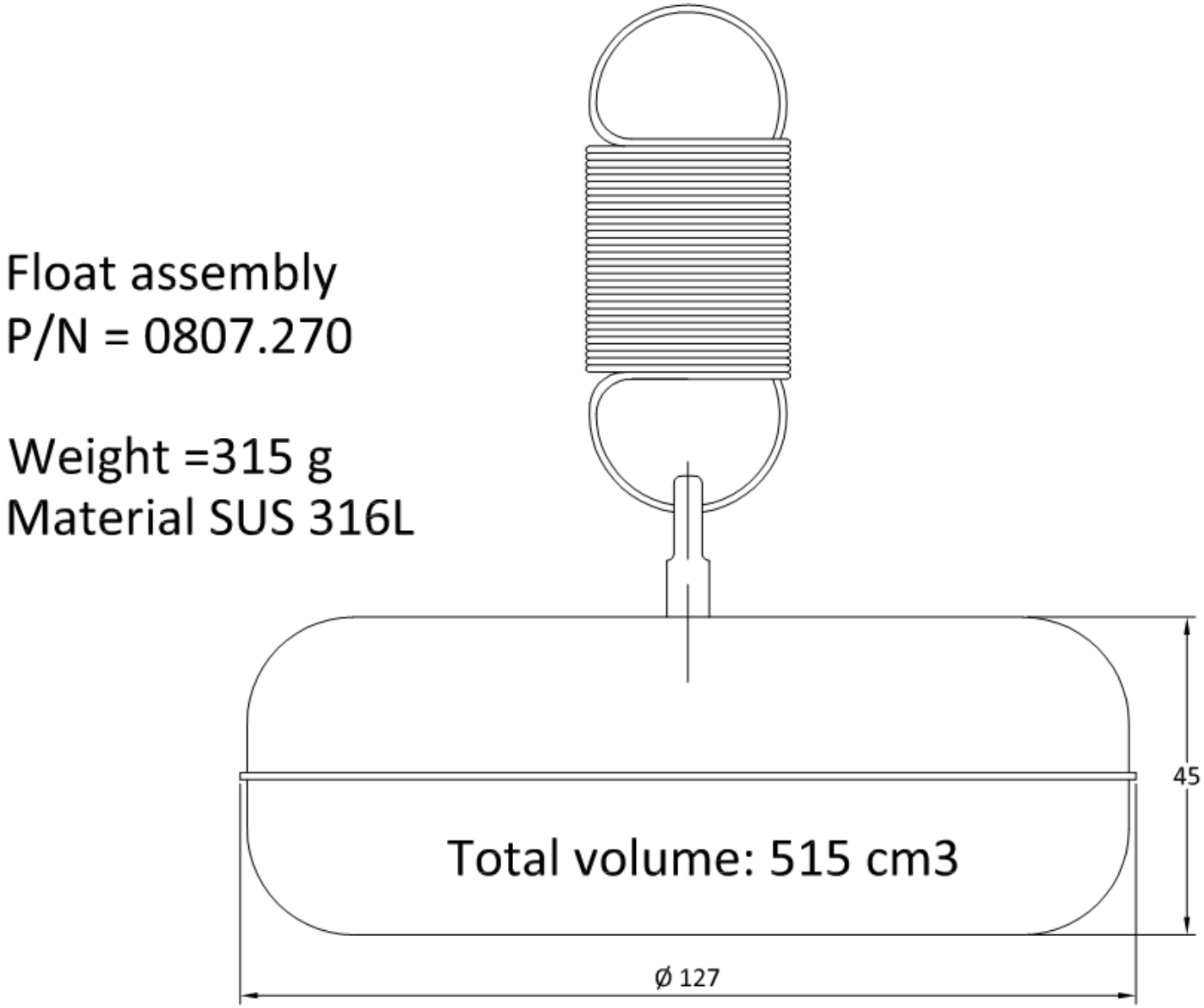


Fig 18 : Float



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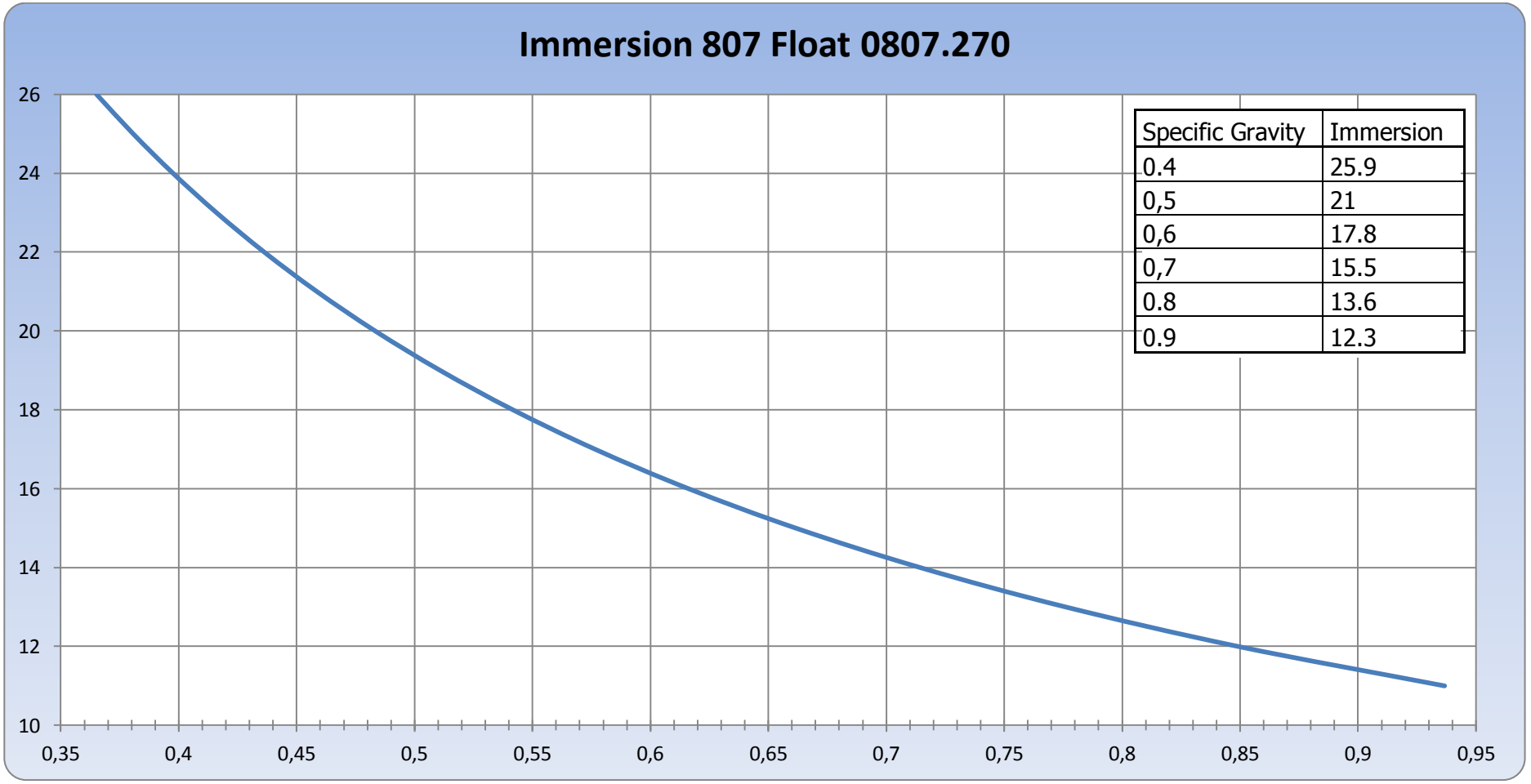
10 Technical information

10.1 Immersion table



Specific Gravity	Immersion
0.4	25.9
0,5	21
0,6	17.8
0,7	15.5
0.8	13.6
0.9	12.3

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10.2 Thermal expansion SUS measuring wire (mm/m / ºC)

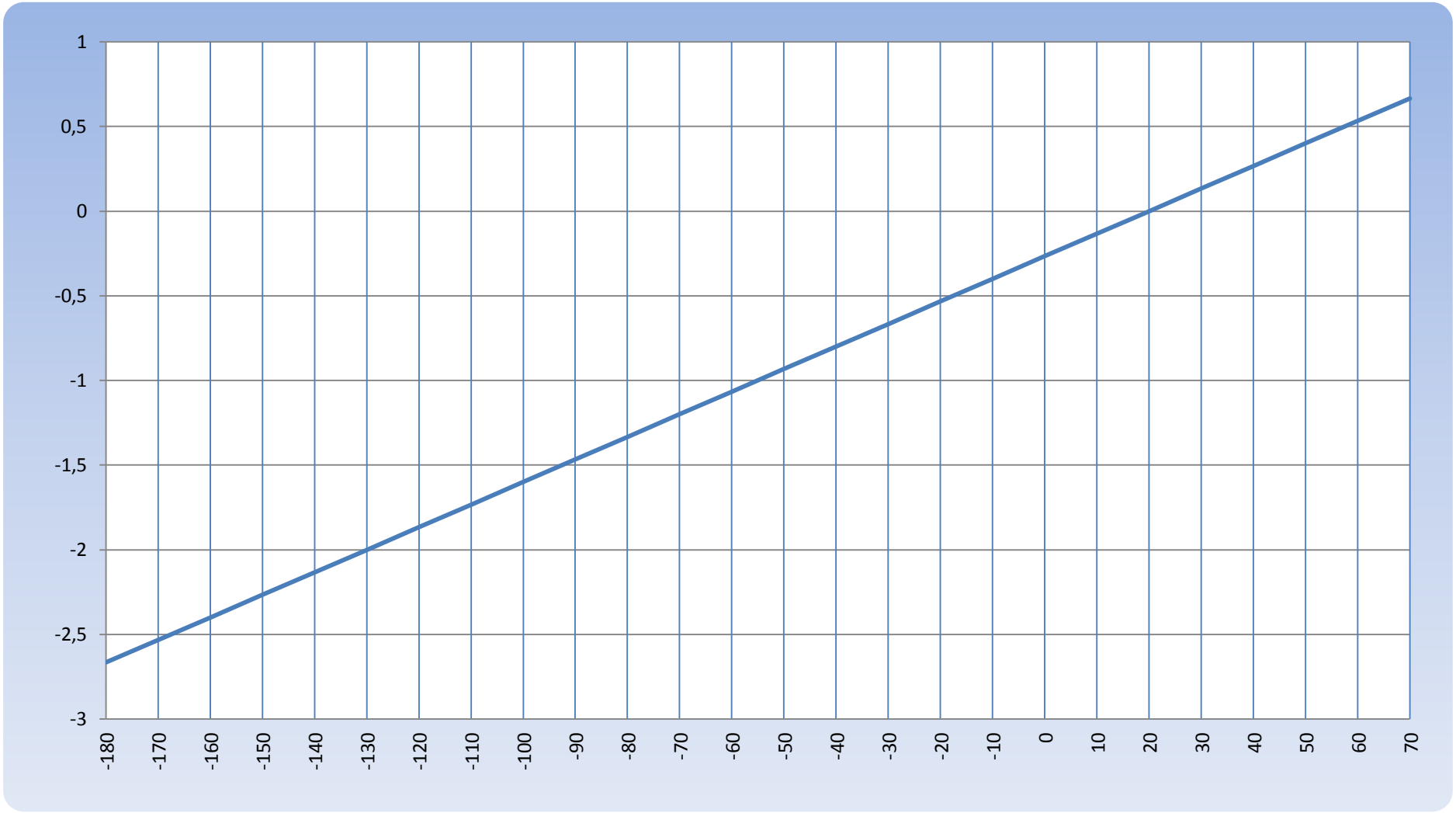

Figure 21

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10.3 Thermal expansion Invar wire (mm/m / ºC)

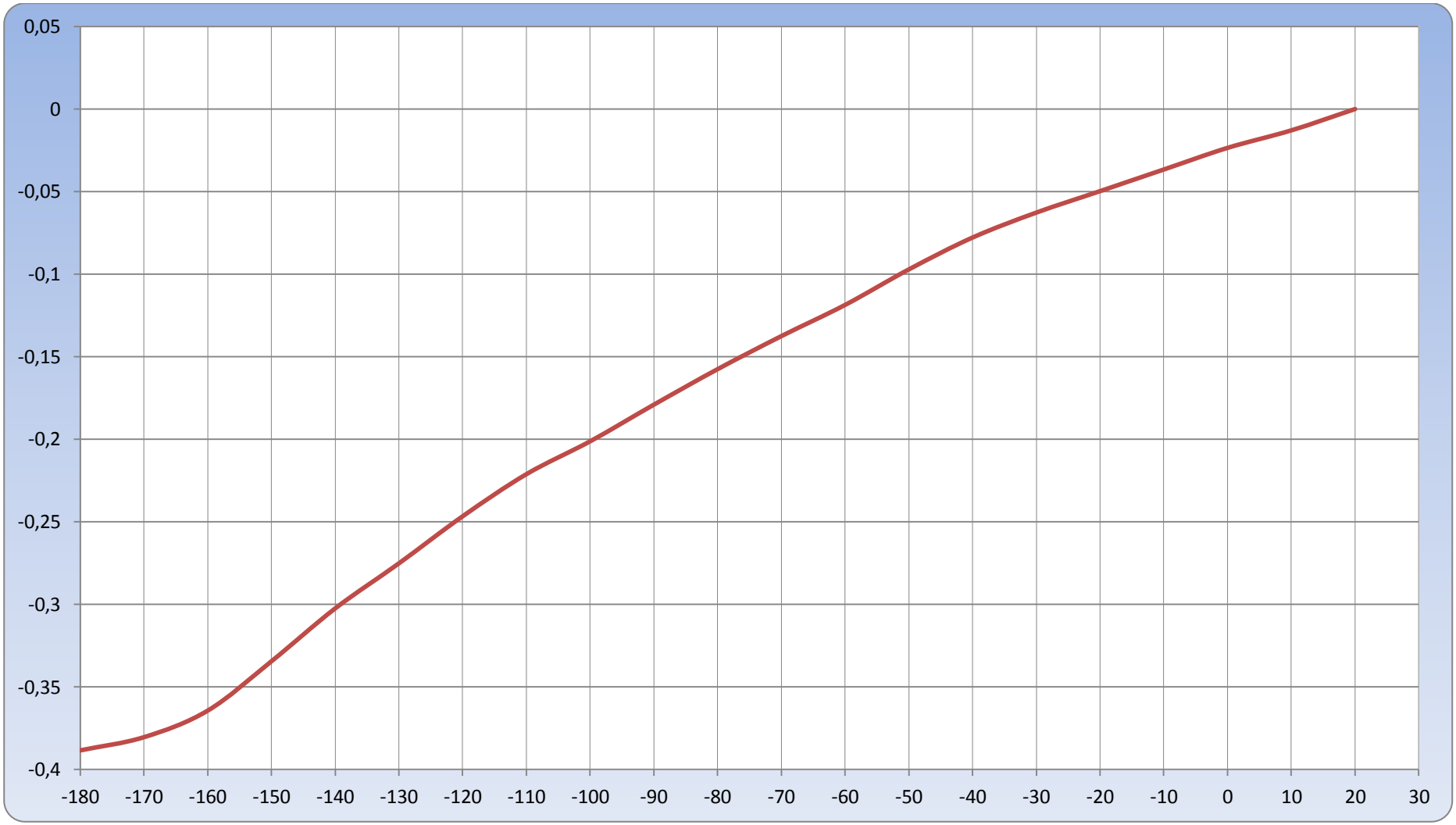

Fig. 22

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10.4 General mounting

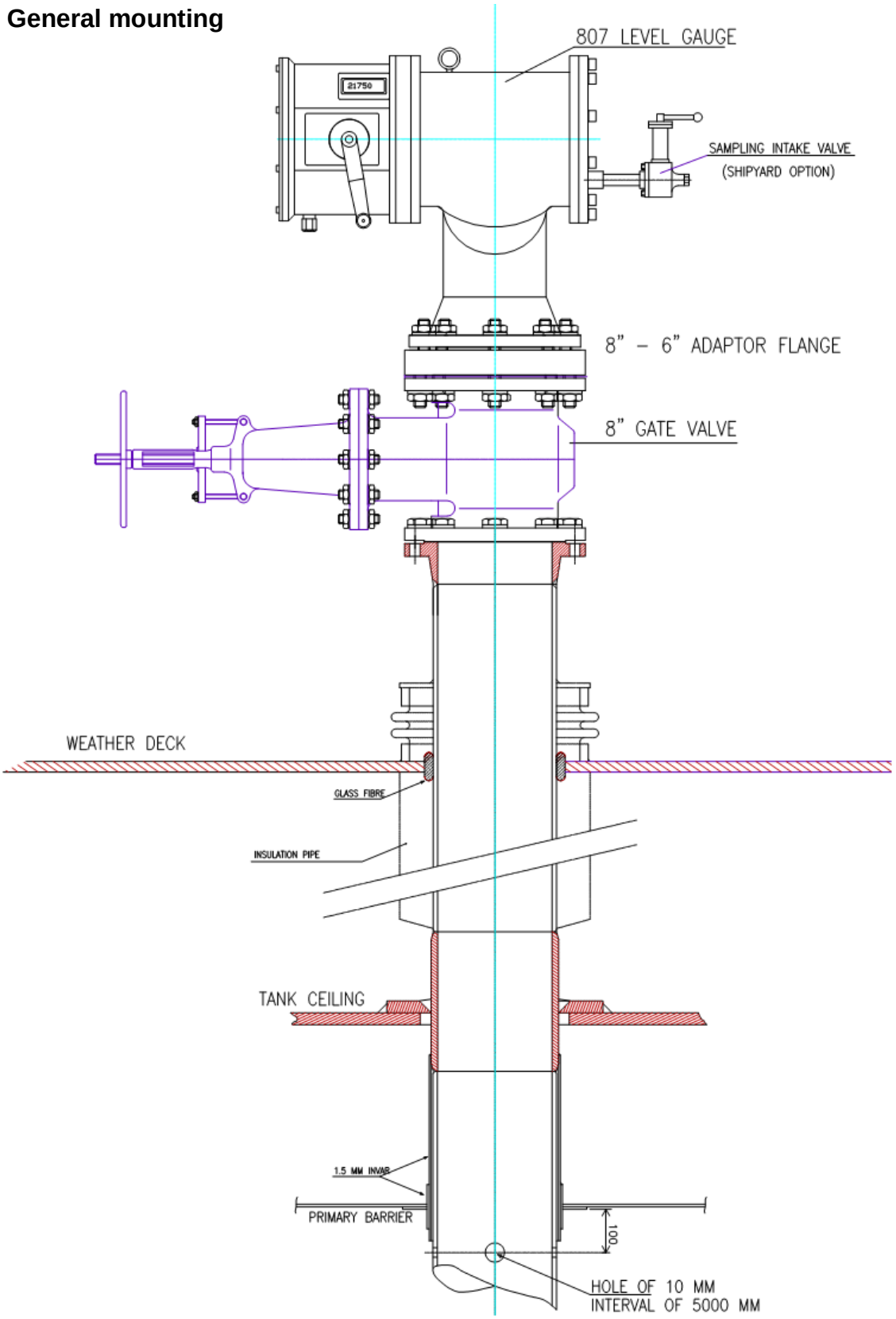
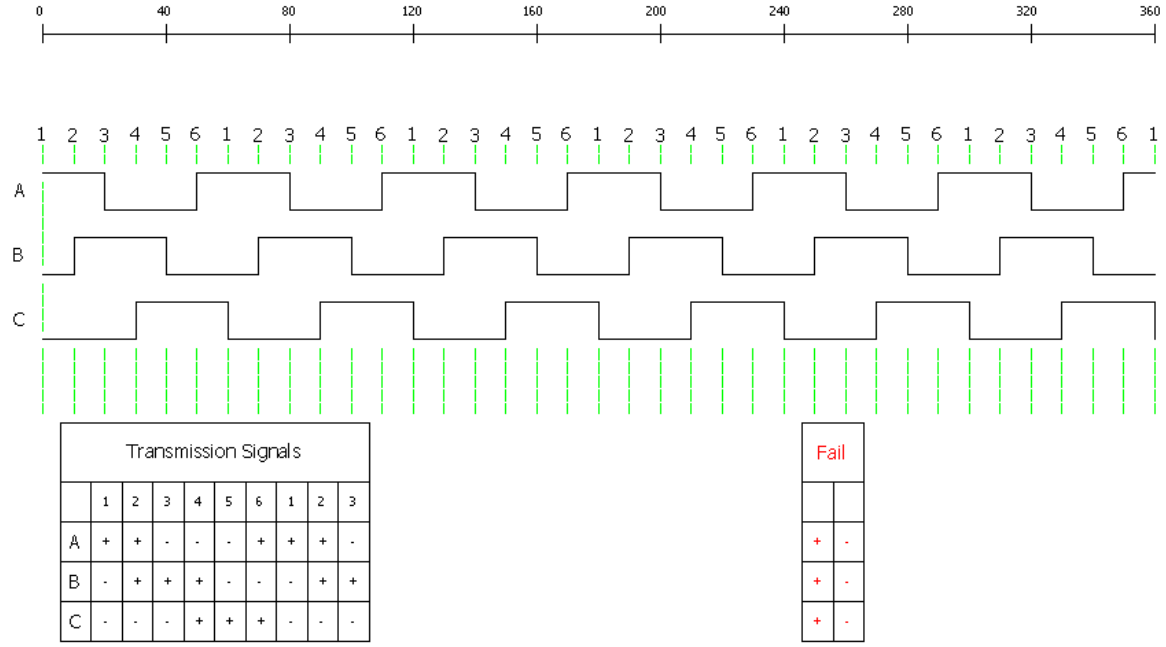


Fig. 20

10.5 Transmitter and internal wiring diagram



Transmission Signals

	1	2	3	4	5	6	1	2	3
A	+	+	-	-	-	+	+	+	-
B	-	+	+	+	-	-	-	+	+
C	-	-	-	+	+	+	-	-	-

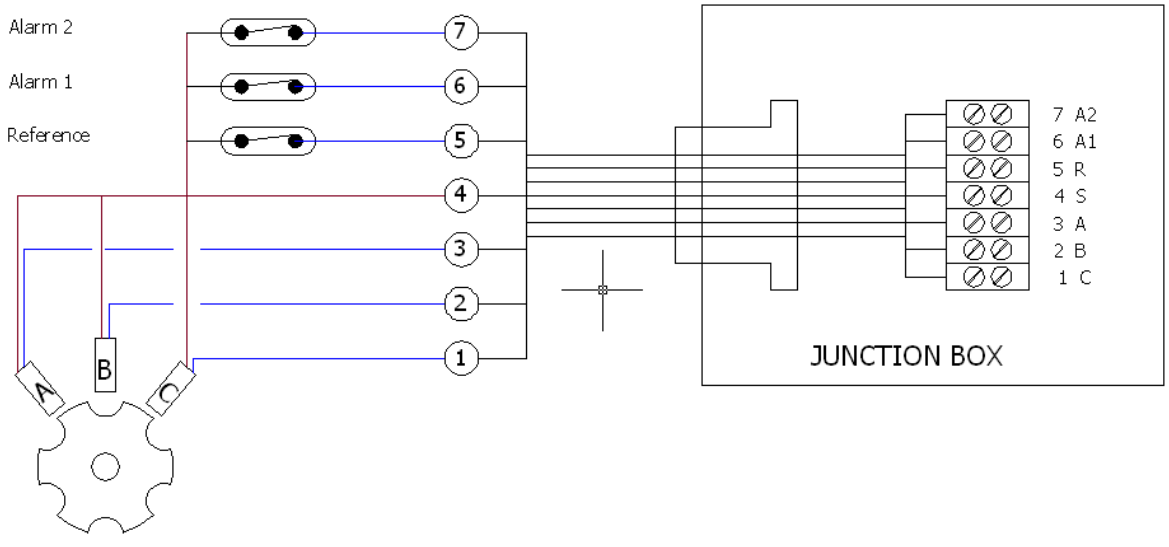
Fail

+	-
+	-
+	-

REED CONTACTS: Reference, Alarm 1, Alarm 2

Reference: open = reference; closed = measuring

Alarm 1 & 2: open = alarm ; closed = normal



Transmitter

Fig. 23

KEMA Examination certificate

KEMA

(1) # EC-TYPE EXAMINATION CERTIFICATE

(2) **Equipment and protective systems intended for use in potentially explosive atmospheres - Directive 94/9/EC**

(3) EC-Type Examination Certificate Number: **KEMA 06ATEX0155 X** Issue Number: **1**

(4) Equipment: **Float Type Level Gauge FTLG Model 807**

(5) Manufacturer: **Henri Systems Holland B.V.**

(6) Address: **Scheepmakersstraat 33, 3334 KG Zwijndrecht, The Netherlands**

(7) This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) KEMA Quality B.V., notified body number 0344 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the directive.

The examination and test results are recorded in confidential test report number 2087693.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014 : 1997 **EN 50020 : 2002** **EN 13463-1 : 2001**
EN 13463-5 : 2003 **EN 13463-8 : 2003**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-Type Examination Certificate relates only to the design, examination and tests of the specified equipment according to the Directive 94/9/EC. Further requirements of the directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

Ex **II 1/2 G EEx ia c k IIB T4**

This certificate is issued on 15 November 2006 and, as far as applicable, shall be revised before the date of cessation of presumption of conformity of (one of) the standards mentioned above as communicated in the Official Journal of the European Union.

KEMA Quality B.V.

C.G. van Es
Certification Manager

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(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 06ATEX0155 X** **Issue No. 1**

(15) **Description**

The Float Type Level Gauge FTLG 807 is a mechanical float type level gauge for measuring liquid levels. The Level Gauge is provided with a local read out and three sensors for remote read-out. Three switches are present as alarm outputs.
The enclosure is made of cast steel or stainless steel.
The measuring drum compartment consists of mechanical parts only and is equipment category 1. The remaining part consists of mechanical parts and electronic circuits and is equipment category 2. The electronics is in type of protection intrinsic safety EEx ia IIB.

Ambient temperature range -20 °C ... +60 °C.

Electrical data

Sensor output circuits ..... (terminals 1-a and 4-s, 2-b and 4-s, 3-c and 4-s)

in type of protection intrinsic safety EEx ia IIB, only to be connected to Remote Level Indicator Model AMTG 821/02 or certified intrinsically safe circuits, with the following maximum values for each circuit:

U_i	=	16	V
I_i	=	52	mA
P_i	=	169	mW
C_i	=	30	nF
L_i	=	50	µH

Alarm outputs ..... (terminals 5-R and 4-s, 6-A1 and 4-s, 7-A2 and 4-s)

in type of protection intrinsic safety EEx ia IIB, only to be connected to Remote Level Indicator Model AMTG 821/02 or certified intrinsically safe circuits, with the following maximum values for each circuit:

U_i	=	16	V
I_i	=	52	mA
P_i	=	169	mW
C_i	=	0	nF
L_i	=	0	µH

The sensor output circuits and the alarm output circuits have one connection in common.

Installation instructions

In order to prevent voltage and/or current addition, the intrinsically safe circuits shall be wired such, that the separation between the circuits, in accordance with EN 50020, is maintained.

Alternatively, if separation is not maintained, then the mentioned maximum values U_i, I_i and P_i apply to the combination of all the sensor and alarm circuits together. In this case, the maximum internal capacitance C_i = 90 nF and the maximum internal inductance L_i = 100 µH.

(16) **Test Report**

KEMA No. 2087693.

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 06ATEX0155 X** **Issue No. 1**

(17) **Special conditions for safe use**

For ambient temperature range and electrical data, see (15).

The apparatus shall not be used in applications where a high risk of mechanical danger exsists.

(18) **Essential Health and Safety Requirements**

Assured by compliance with the standards listed at (9).

(19) **Test documentation**

As listed in Test Report No. 2087693.