

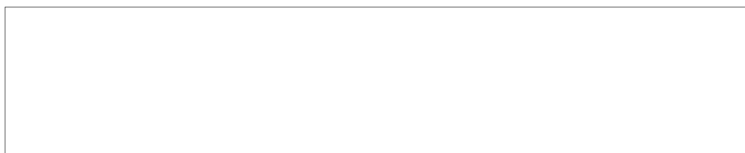
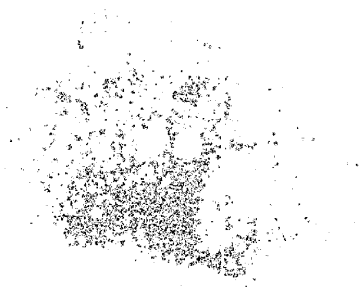
50X1-HUM

~~_____~~
SHIP'S FUEL SYSTEM

**Description and Maintenance
Instructions**



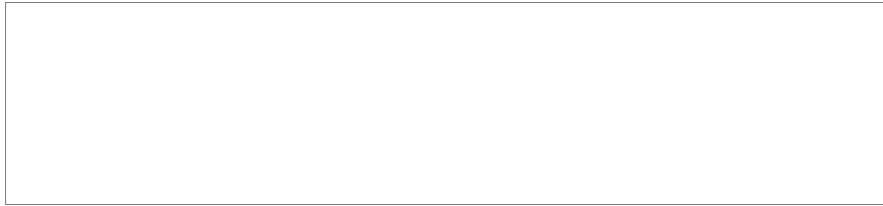
50X1-HUM



50X1-HUM

50X1-HUM

Page Denied



50X1-HUM

C O N T E N T S

DESCRIPTION

 A. Purpose and Basic Specifications

 B. Description of Individual Units

 C. Control and Measuring Instruments

MAINTENANCE INSTRUCTIONS

 A. General Supervision and Care

 B. Preparation for Action

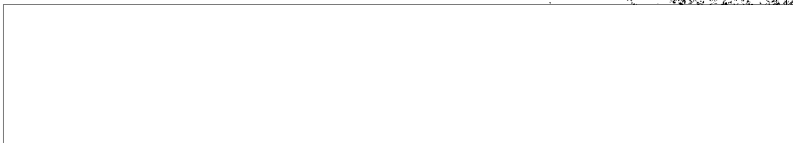
 C. Starting, Operation and Stopping

 D. Maintenance During Long-Term Inaction 27

 E. Troubles and Remedies 27

 F. Preventive Maintenance and Repairs 28

APPENDICES



50X1-HUM

I. DESCRIPTION**A. PURPOSE AND BASIC SPECIFICATIONS**

The ship's fuel system is designed for filling and storing the fuel reserve, for delivery of fuel to service tanks of Diesels and compressors and for transferring the fuel to another ship or base. The fuel system comprises fuel tanks and the following pipe lines: fuel filling and transfer, fuel compensating, venting, sampling and collecting. Fuel reserve on the submarine amounts:

(a) normal useful fuel reserve in inner and outer fuel tanks is 238.0 tons;

(b) increased useful fuel reserve when filling fuel-tanks Nos 2, 4, 7, 8 and 9 additionally is 440.0 tons.

Time taken for fuel filling through two feed deck pipes at a pressure and at a fuel temperature of not less than 5°C in flooded tanks should not exceed:

(a) when filling normal useful fuel reserve at a pressure behind the intake sea cock equalling 20 m H₂O - 5 hours;

(b) while filling increased useful fuel reserve at a pressure behind the intake sea cock equalling 15 m H₂O - 9 hours.

Note: Useful fuel reserve means a fuel reserve less 2 per cent used for spreading and dead reserve. For fuel tanks Nos 4, 5, 6 the useful reserve is given with lead ballast trimmings taken into account.

The fuel system pipe line is assembled of pipes:

(a) steel, seamless, of diameters: 108x4; 89x4; 89x2.5; 57x3.5; 44.5x4; 44.5x2.5 - with flanged connections and of diameters: 44.5x2.5; 32x2; 22x3; 22x2; 14x1.5 - with pipe connections;

(b) red copper, of diameters: 110x5; 90x3.5; 55x2.5; 45x2 - with flanged joints, and of diameters: 32x2; 9x1.5; 6x1.5 - with pipe connections.

All the gaskets are made of paronite. The fittings are made of steel and brass. The fittings of pipe lines are made of:

(a) steel - for fuel filling and transfer, venting and sampling pipe lines;

(b) bronze - for compensating pipe line;

(c) brass - for collecting pipe line.

The fuel system pipe lines in assembly are subject to testing by a hydraulic pressure:

(a) fuel filling and transfer pipe line, outer fuel tanks and sampling and venting pipe lines up to the second valves - by 38 kgf/cm²;

(b) inner fuel tanks compensating line, the collecting pipe line and the pipe lines of fuel tanks Nos 1 and 2 up to the first valves in compartment 111 - by 12.5 kgf/cm²;

(c) fuel lines of fuel tanks up to the first shut-off valves in compartment 111 - by the pressure of the respective tank;

50X1-HUM

(d) the pipes with open ends of all the pipe lines located in the fuel and fuel-ballast tanks as well as the collecting pipes - by flooding.

B. DESCRIPTION OF INDIVIDUAL UNITS

1. Tanks

To store fuel on the submarine, there are two inner tanks Nos 1 and 2, and seven outer tanks Nos 3, 4, 5, 6, 7, 8, 9, besides, five ballast tanks Nos 1, 2, 3, 4 and 5 (fuel-ballast tanks).

To drain fuel and water out of the collecting pipe line, there is a fuel collecting tank which has an open ventilation, depth gauge and is communicated with the drain pipe line.

To prevent fuel flowing from the system overboard while filling or when the submarine submerges, there is a pressure equalizing tank located on the port side in the region of frames 85-87. Through it the system is communicated with overboard.

To reduce the liquid load (water and fuel) free surface effect on the stability of the submarine, the fuel tanks are provided with several bulkheads:

- each outer fuel tank (Nos 3, 4, 5 and 6) is separated by a longitudinal bulkhead along the centre line and by a lateral one - in four parts - fore, port side and starboard, and aft, port side and starboard;
- fuel tanks Nos 1, 7 and 8 are separated by a longitudinal bulkhead along the centre line in two halves - port side and starboard;
- fuel tank No. 9 is separated by a longitudinal bulkhead along the centre line and by a lateral one in three parts: fore port side, fore starboard and aft part;
- inner fuel tank No. 1 is separated by a longitudinal bulkhead along the centre line;
- inner fuel tank No. 2 consists of two halves - port side and starboard.

Separate parts of each fuel tank communicate with one another via by-pass pipes running from the bottom point of the tank on the side of fuel filling and transfer to the top point of another part of the tank. In a similar way by-pass pipes are installed on all the parts of the tank.

In the fore parts of port side and starboard tank No. 5 there are pipe crosspieces between projections formed by recesses to accommodate the sea cocks of ballast tank No. 5.

The covers of all the outer fuel tanks on the side of fuel filling and transfer have protruding parts called "rings" to which venting pipes and filling and transfer pipe lines are led.

The "rings" are designed to reduce "dead" capacity of the outer fuel

tank, except tank No. 2, consists of two halves: port and starboard, communicating with each other via a by-pass pipe.

50X1-HUM

50X1-HUM

The capacity of fuel tanks, the amount of fuel to be filled and the location of tanks are indicated in Table 1.

Table 1

No.	Name of tank	Capacity in m ³ (net weight)	Amount of fuel to be filled, tons	Location	
				compartment	Region
1	Inner fuel tank No.1	22.13	18.3	II	31-4
2	Inner fuel tank No.2	10.38	8.5	IV	61-7
3	Outer fuel tank No.3	22.12	18.3	VII	31-4
4	Outer fuel tank No.4	54.75	44.35	II-III	31-4
5	Outer fuel tank No.5	54.58	41.4	III-IV	31-4
6	Outer fuel tank No.6	41.83	32.32	V-VI	31-4
7	Outer fuel tank No.7	34.83	28.8	VI-VII	31-4
8	Outer fuel tank No.8	16.44	13.6	VII	31-4
9	Outer fuel tank No.9	39.23	32.5	VII or 2	31-4
10	Fuel-ballast tank No.2	43.62	36.1	I	31-4
11	Fuel-ballast tank No.4	58.88	48.8	II-III	47-50
12	Fuel-ballast tank No.7	51.45	42.6	V	31-4
13	Fuel-ballast tank No.8	33.86	28.0	VI	31-4
14	Fuel-ballast tank No.9	56.88	47.1	VI-VII	31-4
15	Fuel collecting tank	0.73	-	V	73-74
16	Diesel service tank	1.19	1.01	V	31-4

Note: Column "Amount of fuel" indicates the useful fuel reserve.

Fuel tank No.6 is a service one for all the fuel tanks. The purpose of this service tank is to prevent penetration of water into the Diesel service tank when transferring fuel out of the tanks is over.

2. Fuel Filling and Transfer Pipe Line

The fuel filling and transfer pipe line serves to deliver fuel to all the fuel tanks, to feed it from fuel tanks to Diesel and Diesel-compressor service tanks, as well as to transfer fuel to another ship or base.

Fuel is filled through four feed sockets three of which are located on deck between frames 37-38, 64-65 and 79-80, and one in the front part of the fairwater between frames 47-48.

The fuel filling and transfer pipe line consists of two lines: filling line and filling and transfer line.

7

50X1-HUM

50X1-HUM

(a) Filling Line

The filling line runs through the superstructure. It communicates four feed sockets 44 through sea cocks 43 and 53 with the filling and transfer line. To disconnect the feed sockets from each other, valve 52 is installed on the line.

(b) Filling and Transfer Line

The filling and transfer line is laid inside the strength hull in all the compartments of the submarine. In compartment V the line are valves 17 and 20 which disconnect the former in two branches fore and aft. These valves are installed to ensure independent fuel transfer from fore and aft branches of the line.

The line has the following branches:

- In compartment I - to sea cocks 1 and 64 of fuel-ballast tank No.1
- In compartment III - to sea cocks 4, 6 and 8 of fuel tank No.3 and of fuel-ballast tank No.4, to valve 5 from which through valve 58 the pipe is laid to fuel tank No.1 as well as to valve 55 from which through valve 56 the pipe is laid to fuel tank No.2 (port side).
- In compartment IV - to sea cock 53 on the branch pipe, then an extension piece with cock 11 to pressure gauge 54.
- In compartment V - between valves 17 and 20 to sea cock 43 from which consecutive fuel transfer through fuel tank No.6 and to valve 16 from which the pipe is laid to sea cock 18 of fuel tank No.6 and to valve 21 of fuel supply to the Diesel service tank.
Behind valve 20 to sea cock 43 the branch pipe is provided with an extension piece with valve 15 and pressure gauge 15.
To sea cocks 23 and 39 of fuel-ballast tank No.7
- In compartment VI - to sea cocks 24, 25, 36 of fuel tank No.7 and fuel-ballast tank No.8.
- In compartment VII - to sea cocks 27, 30, 31, 32, 34 of fuel tanks Nos 3, 8, 9 and fuel-ballast tank No.9.

The pipes running from all the valves and sea cocks of fuel filling and transfer are brought to the upper points of the tanks.

Fuel service tank No.6, apart from the fuel filling and transfer sea cock, is connected with the filling and transfer line through fuel successive transfer sea cock 19 from which a pipe is brought to the tank bottom point.

Each fuel-ballast tank (Nos 2, 7, 8 and 9) is connected to the filling and transfer line through two sea cocks on port side and starboard.

Each outer fuel tank is connected to the filling and transfer line through a sea cock.

50X1-HUM

Each inner fuel tank (Nos 1 and 2) is connected to the filling and transfer line through two shut-off valves.

3. Fuel Compensating Pipe Line

The fuel compensating pipe line serves to deliver compensating water to all the fuel and fuel-ballast tanks while transferring fuel, to displace water when delivering fuel, to equalize pressure in the outer fuel and fuel-ballast tanks with the overboard pressure while the submarine is submerged.

This pipe line is also used for draining the tanks and for transferring fuel to another ship.

The fuel compensating pipe line consists of a common compensating pipe, outer tanks fuel compensating line and inner tanks fuel compensating line as well as of a pressure equalizing pipe.

(a) Common Compensating Pipe

The common compensating pipe is laid in compartment V from the exhaust cooling pipe through reducing valve 14 and shut-off valve 42 to valve 12 of inner fuel tanks compensating line and valve 50 of outer fuel tanks compensating line.

Installed on the common compensating pipe are safety valve 40 and pressure gauge 41.

(b) Inner Fuel Tanks Compensating Line

The inner fuel tanks compensating line runs from compartment III to compartment V where it terminates in valve 12.

The line has a branch:

In compartment III - to valves 5 and 9 of fuel tanks Nos 1 and 2 and to valve 7 for connection to the drainage pipe line hose.

Installed on the pipes between valves 5 and 9 and the fuel tanks are safety valves adjusted for a popping pressure of 2.5 kgf/cm^2 to relieve overpressure out of the tanks while pressing the submarine hull.

In compartment V - to valve 51 to drain water from the inner fuel tanks, when the strength hull of the submarine is pressed in a submerged position, and to safety valve 13, adjusted for a popping pressure of 2.5 kgf/cm^2 to relieve excessive pressure from the inner fuel tanks compensating line.

Each inner fuel tank is connected to the line via a valve, whose pipe is connected to the tank.

50X1-HUM

(c) Outer Fuel Tank Compensating Line

The outer fuel tank compensating line runs through all the compartments of the submarine.

The line has branches:

- In compartment I - to sea cock 2 of fuel-ballast tank No.2 and to valve 63 for connection with a hose of the drainage pipe line.
- In compartment III - to sea cocks 59, 60, 62 of fuel tanks Nos. 5 and fuel-ballast tank No.4 as well as to valve 57 for connection with a hose of the drainage pipe line.
- In compartment IV - to a water pipe of the garbage ejection pump.
- In compartment V - to sea cock 49 of pressure equalizing pipe, sea cocks 48 and 22 of fuel tank No.6 and fuel-ballast tank No.7 and to valve 50.
- In compartment VI - to sea cocks 26, 37 and 38 of fuel-ballast tanks Nos. 8 and 9 and fuel tank No.7.
- In compartment VII - to sea cocks 28, 29, 35 of fuel tanks Nos. 8 and 9 and to valve 33 for connection with a hose of the drainage pipe.

Each outer fuel and fuel-ballast tank is connected to the line through one sea cock whose pipes are brought to the bottom point of the tank.

(d) Pressure Equalizing Pipe Line

The pressure equalizing pipe line starts in compartment V from the outer tank fuel compensating line and via sea cocks 49 is brought to the top part of the pressure equalizing recess which is communicated via its bottom part with the overboard space.

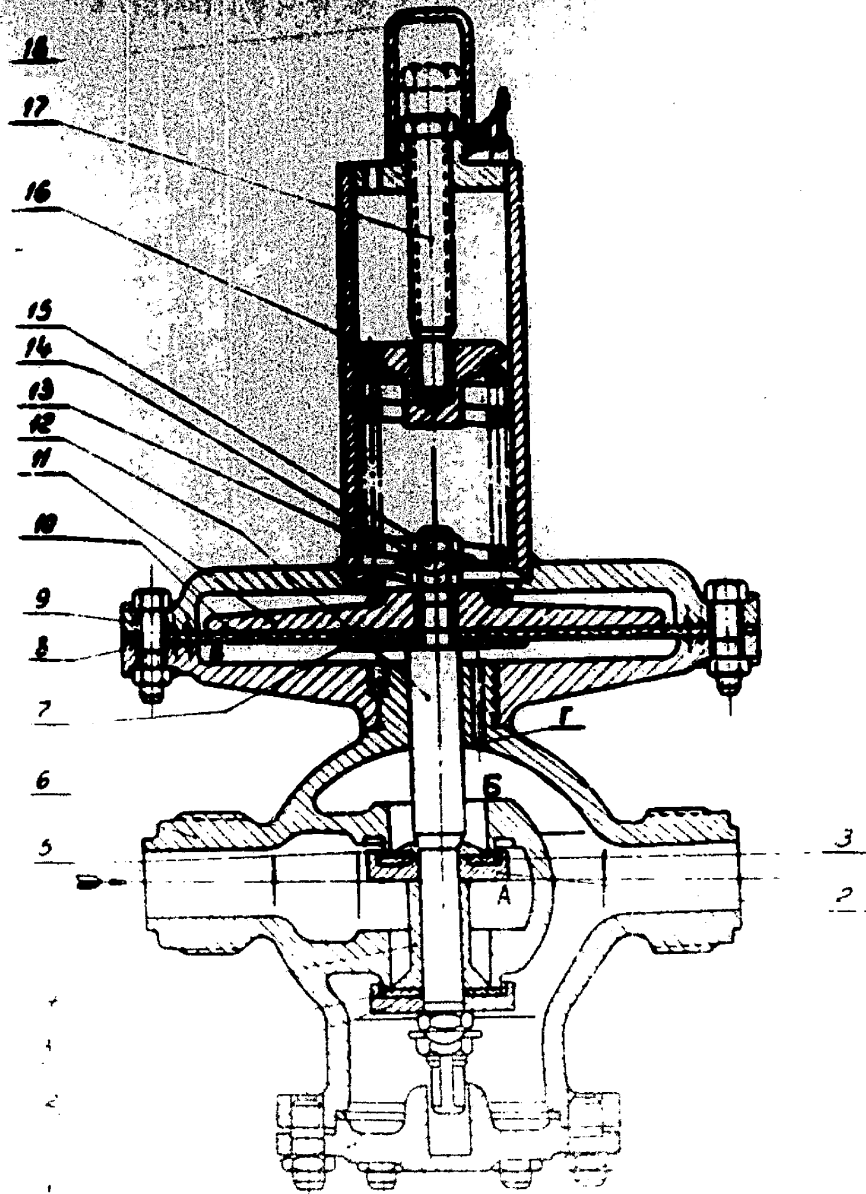
3. Venting Pipe Line

The venting pipe line serves to ventilate the fuel and fuel-ballast tanks, to determine the cessation of fuel transfer or that of the tanks filling while feeding fuel into drained or scavenged tanks, to ventilate and drain fuel from the pressure equalizing recess as well as to deliver air to the fuel tanks. Venting pipes from hull and shut-off valves 70, 72, 73, 75, 76, 81, 83, 87, 88, 89, 90, 94, 97, 99, 102, 105, 107, 110, 114, 115, 116, 118, 121, 124, 127, 128, 132, 134, 135, 137, 140, 145, 146, 150, 151, 152, 153, 157 are led to the upper point of each part of the fuel tanks.

Fitted on the venting pipes of outer fuel and fuel-ballast tanks are shut-off valves which are common to the sampling pipe line. The venting pipes of each outer fuel tank between the first and second shut-off valves are used for the purpose of fuel filling as well as on the venting pipes of fuel tanks Nos. 5 and 6, there are branch pipe connections. The venting pipes are closed by the use of a pneumatic tool.

50X1-HUM

50X1-HUM



50X1-HUM

50X1-HUM

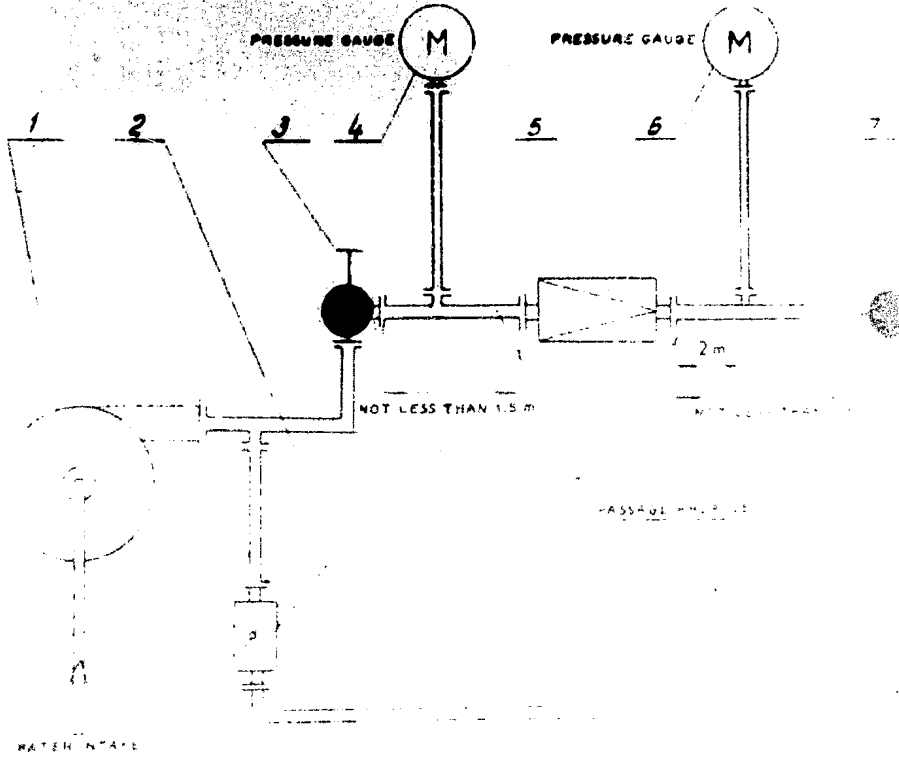


FIG. 1. DIAGRAM OF DEVICE FOR TESTING AND
 RETAINING VALVE

1. pump with delivery pressure not less than 1 kgf/cm²; 2. shut-off valve, dia. 20, 1/2" (1/2" shut-off valve, dia. 20); 3. shut-off valve, dia. 20, 1/2" (1/2" shut-off valve, dia. 20); 4. pressure gauge for 10 kgf/cm²; 5. shut-off valve, dia. 20, 1/2" (1/2" shut-off valve, dia. 20); 6. pressure gauge for 1 kgf/cm²; 7. shut-off valve, dia. 20, 1/2" (1/2" shut-off valve, dia. 20).

50X1-HUM

50X1-HUM

Installed on the venting pipes of inner fuel tanks Nos 1 and 2 up to valves 75 and 87 are pressure gauges 71 which serve to determine the pressure in the tanks.

The pipe line for transferring fuel out of tank No.3 by compressed air is led to the venting pipe of fuel tank No.3 between valves 125 and 127.

4. Sampling Pipe Line

The sampling pipe line serves to determine the cessation of fuel filling while receiving fuel under pressure and complete draining of the fuel tanks in drying them by air.

The pipes of the sampling pipe line from hull and shut-off valves 77, 79, 81, 103, 104, 108, 113, 124, 126, 130, 131, 139, 141, 147, 148 are connected to the bottom point of those parts of the fuel tanks which receive pipes from the fuel compensating valves or sea cocks.

Also, the sampling pipes of the outer fuel and fuel-ballast tanks, and shut-off valves common to the venting pipe line.

5. Collecting Pipe Line

The collecting pipe line is designed to drain water and fuel into the collecting tank from all the sampling and venting valves.

The collecting pipe line is led along the whole length of the submarine to the collecting fuel tank.

The collecting pipe line is fitted with drain funnels 84 with cocks 82. The level in the collecting tank is measured by means of a float gauge employed to measure the level in the collecting tank.

6. Fittings

The fittings of the valves of a special design are fittings of the same type as those used in the fuel tanks.

(a) Reducing Valve

(Fig.3, Appendix 1, Ref. No.14)

The reducing valve is fitted on the compensating pipe line and serves to reduce the pressure in the compensating line up to 0.7-0.9 kgf./cm².

The body 1 of the reducing valve has in the bottom a sealing flange 2, a bottom retaining lower cover 1, and on the top - a sealing flange and a retaining upper cover 3 to secure cup 8.

The seal between cup 8 and cover with sleeve 9 is rubber diaphragm 10. The rod 11 through the diaphragm is rod 12 which has two guides: one - in the lower part of the body 1, and the other - in the upper part of body 1.

The pressure cavity A and cavities B and C is effected by the diaphragm 10.

The cavities A and B are connected with each other by channel 7.

13

50X1-HUM

50X1-HUM

Upper packing ring 3 is secured on rod 12 between valve disk 2 and pressure washer 5. Lower packing ring 3 is fastened to rod 12 between valve disk 2 and pressure bush 4.

The packing of the rod is effected by diaphragm 10 pressed between diaphragm washer 7 and spring bottom disk 11 by two nuts 15 with locking washer 14.

Located in the cover with sleeve 9 is spring 13 which is pressed between the top and bottom disks. The adjustment of the spring is effected by pressure screw 17.

After the adjustment, pressure screw 17 is closed by cap 16 which is screwed on the sleeve of cover 9 and then is sealed.

Under the action of the spring, the valve is opened and the water flowing to cavity A passes to cavities B and B and affects diaphragm 10.

As the pressure in cavity B and consequently in cavity B increases, the diaphragm will be deflected and displaces rod 12 and the passage above the disks will be reduced.

As the pressure decreases, the diaphragm under the action of spring will be deflected and will displace the rod so that the passage above the disks will be increased.

The change of fuel consumption above the disks will depend on the pressure in cavity B.

To test and adjust the reducing valve on a stand, a device is arranged as shown in Fig.2.

In this device the water is fed to the reducing valve through shut-off valve 3. The pressure after valve 3 should change from 14 kgf/cm^2 to 1.8 kgf/cm^2 .

To make it possible to change the pressure of the water before the tested valve and to close valve 3 without changing the pressure of the operating pump, throttle valve 2 is installed.

The pressure of the conducting medium before the tested valve and behind it is checked by pressure gauges 4 and 6 which are placed in a place convenient for watching their readings by one person.

At the beginning of the testing, fully press the spring and fully close, set the working pressure equal to 14 kgf/cm^2 . In this case the outlet pressure of the tested valve is to be 0.35 kgf/cm^2 and after 5 minutes it for 5 minutes it should not be increased. Then, gradually loosening the spring of the reducing valve, bring the outlet pressure to 1 kgf/cm^2 .

When the working pressure changes from 14 kgf/cm^2 to 1.8 kgf/cm^2 and when the maximum output changes from $15 \pm 10\%$ litres per minute to minimum output 0.25 litres per minute, the reduced pressure should be within the limits from 0.9 to 0.55 kgf/cm^2 .

When fuel transferring ceases, the valve outlet pressure should not exceed 1.2 to 1.4 kgf/cm^2 with a spring adjusted at zero consumption for a reducing pressure of 1 kgf/cm^2 .

A reducing valve satisfying the above-indicated requirements is considered to be serviceable.

50X1-HUM

50X1-HUM

(b) Safety Valve**(Fig.3, Appendix 1, Ref. Nos 3, 10, 13, 40)**

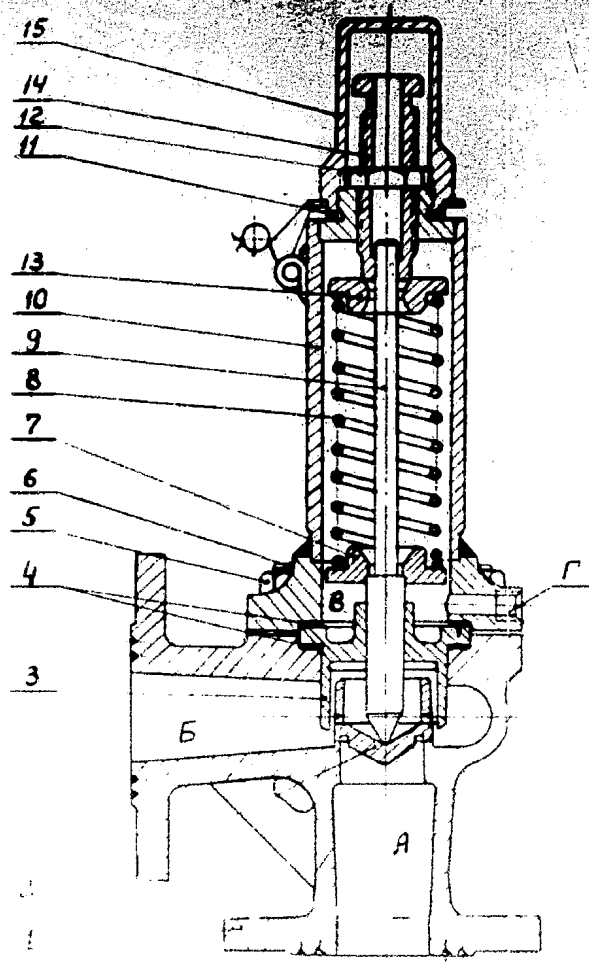
The safety valve consists of cast body 1, spindle 9 with adjusting bush 14 and disk 2, spring 8 and guide bush 3. The adjustment of the valve for opening pressure is effected by adjusting bush 14, which changes the spring compression. After the adjustment the bush is fixed by special nut 12 and is closed by cap 15, which is sealed.

As the pressure in the pipe line (and hence in cavity A) fitted with a safety valve increases above the specified value valve disk 2 rises and the water is discharged to cavity

When the pressure in cavity A is brought to normal, the disk under the action of the spring seats and closes the valve. The water entrapped in cavity B through the clearance between guide bush 3 and spindle 9 is removed via channel

50X1-HUM

50X1-HUM



C. CONTROL AND MEASURING INSTRUMENTS

FIG. 3. EMPTY VALVE D_{conv}50
 1-body; 2-valve disk; 3-guide bush; 4-gasket;
 5-nut; 6-stud; 7-spring disk; 8-spring;
 9-rod; 10-cover; 11-gasket; 12-special nut;
 13-spring disk; 14-adjusting bush; 15-cap.

50X1-HUM

50X1-HUM

C. CONTROL AND MEASURING INSTRUMENTS

Table No.2

Nos of Schematic Diagrams	Name and purpose of instrument	Type of instrument and scale	Normal working pressure	Location	Note
			Maximum working pressure (red line)		
15, 34	Pressure gauge for measuring fuel pressure while delivering fuel behind the intake sea cock	MTK-100Ex x4/2.1	$\frac{2.0}{2.1}$	Compartments IV and V	
41	Pressure gauge for measuring compensating pressure behind the reducing valve	MTK-100Ex x 1.6/1.0	$\frac{0.7 - 0.9}{1.0}$	Compartment V	
71	Pressure gauge for measuring pressure in inner fuel tanks	MTK-100Ex x4, 2.7	$\frac{2.5}{2.7}$	Compartment III	

47

50X1-HUM

50X1-HUM

II. MAINTENANCE INSTRUCTIONS

A. GENERAL SUPERVISION AND CARE

1. See to it that the pipe lines, sealed connections and fittings are in good condition.
Eliminate the found faults.
Care should be exercised to see that the seals on the pressure gauges, safety valves and the reducing valves are intact. Watch fastening of the hull fittings to the sockets and weld-in bosses.
2. Every week turn over all the valves.
3. ~~Once a month check the operation of the safety valves.~~
4. See that the fuel tanks are clean. Cleaning of fuel tanks is effected at the next docking.
5. Check the availability of the pressure gauge checking certificates for the current year.

B. PREPARATION FOR ACTION

6. In the initial position while the submarine is at riding, all the fittings of the fuel system should be in position CLOSED (ЗАКРЫТО).
7. Before the submarine puts to sea, the fittings of the fuel system must be set to the following initial position:
 - on the filling and transfer pipe line valves 17, 20 and 52 should be open;
 - on the fuel compensating pipe line valves and sea cocks 2, 5, 9, 22, 26, 28, 29, 35, 37, 38, 48, 59, 60, 62 should be open.

Note: It is allowed to open compensating sea cocks of fuel-ballast tanks 2, 22, 26, 38, 60 only in case these tanks contain increased fuel reserve. While using the fuel-ballast tanks as ballast ones, the compensating sea cocks of these tanks should be kept closed.

Caution! While at sea, it is strictly prohibited to cut off the submarine fuel and fuel-ballast tanks (when filled with fuel) after the fuel transfer i.e. to close sea cocks 2, 22, 26, 28, 29, 35, 37, 38, 48, 59, 60, 62. Non-observance of this requirement will cause damage of the tanks while the submarine submerges.

- On the collecting pipe line valve 143 is open;
- all the rest valves and sea cocks are shut off and they are opened only to perform the required operations and then again closed;

Note: Valves 17, 20, 52 and 143 are shut off only in emergency cases when the pipe line is damaged.

- deck sockets 44 are closed by hinged covers;
- fuel tanks are filled with fuel (or water). The fuel-ballast tanks

50X1-HUM

50X1-HUM

containing the increased reserve are filled with water or fuel and containing the normal reserve are disconnected from the submarine fuel system (sea cocks 2, 22, 26, 38 and 60 are closed) and are employed as ballast tanks;

- the collecting fuel tank must be drained;
- the pressure equalizing recess must be filled with water.

C. STARTING, OPERATION AND STOPPING

(a) Filling the Tanks with Fuel

Fuel is delivered under pressure into the submarine tanks filled with water. It is possible to deliver fuel to the tanks drained in advance, both under pressure and by gravity.

Preparation for Fuel Filling

Prior to filling the fuel proceed as follows:

8. Unscrew the union nuts from deck sockets 44. To ensure filling at a predetermined time, it is necessary to make use of deck sockets located in the region of frames 64-65 and 79-80.
9. Connect elbow 46 and hoses 47 to the deck sockets.
10. Open sea cocks 43, 53 and valves 16, 17, 20, 52 and 143.
11. In case of simultaneous filling the fuel tanks together with the Diesel service tanks open valve 21 and proceed in compliance with the Maintenance Instructions of Fuel Pipe Line of Main Engines and Diesel-Compressors LR-2.

Note: Prior to filling fuel into the fuel-ballast tanks check the shut-off valves of the low pressure system for tightness. To this end, perform appropriate operations in accordance with the Low Pressure System Maintenance Instructions.

Filling Fuel into Tanks Filled with Water

Fuel may be filled aboard submarine either into all the tanks at a time under a pressure at the intake sea cocks equalling 1.5 kgf/cm^2 , or into the fuel tanks under a pressure at the intake sea cocks equalling 1.5 kgf/cm^2 , and after filling thereof, into the fuel-ballast tanks under a pressure at the intake sea cocks equalling 1.5 kgf/cm^2 .

Open valves 12, 50 and sea cock 49.

Open respective cocks 82 on the collecting pipe line depending upon tanks to be filled with fuel.

Open the valves and sea cocks according to Table No.3 depending upon tanks to be filled with fuel.

In taking fuel into the scavenged fuel-ballast tanks, periodically ventilate the compartments into which the tanks are ventilated.

50X1-HUM

50X1-HUM

Table 3

Nos	Name of tanks	Nos of sea cocks and valves to be opened on pipe lines	
		filling and transfer	sampling
1	Fuel tank No.1	58, 61	79
2	Fuel tank No.2	55, 56	87
3	Fuel tank No.3	34	124, (122)
4	Fuel tank No.4	6	77, (78)
5	Fuel tank No.5	8	147, (144)
6	Fuel tank No.6	18	139, (138)
7	Fuel tank No.7	24	130, (129)
8	Fuel tank No.8	32	160, (159)
9	Fuel tank No.9	30	113, (112)
10	Fuel-ballast tank No.2	1, 64	154, (153)
11	Fuel-ballast tank No.4	4	148, (147)
12	Fuel-ballast tank No.7	59	93, (92)
13	Fuel-ballast tank No.8	25	131, (132)
14	Fuel-ballast tank No.9	31	98, (99)

Note: Valves, given in brackets (second shut-off valves), should be periodically opened to check filling the tanks with fuel.

15. Perform fuel filling.

While filling fuel, watch the pressure in the filling pipe line by pressure gauges 15 and 54. See to it that the pressure in the fuel tanks does not exceed 2 kgf/cm^2 , and in the fuel-ballast tanks - 1.5 kgf/cm^2 . When the pressure exceeds the permissible value, close sea cocks 43 and 53.

16. Watch filling the tanks. For this purpose periodically open the valves on the sampling pipe line according to Table 3 (valves given in brackets). As the fuel appears from the open ends of the pipes of these valves, close the valve or sea cock of fuel filling and transfer pipe line as well as the sampling valves of the given tank.

17. Periodically by opening the pressure equalizing recess venting valve 140 and pressure equalizing recess sampling valve 141, see that the fuel doesn't penetrate therein.

When the fuel penetrates into the pressure equalizing recess, stop for a time the delivery of fuel, drain fuel into the collecting line and at the same time determine which of the tanks is filled with fuel and shut it off.

18. After filling the fuel is over, set all the fittings to the initial position.

50X1-HUM

50X1-HUM

Filling the Drained Tanks with Fuel

Fill the previously drained fuel and fuel-ballast tanks in two motions by groups:

Group I - fuel tanks Nos 1, 2, 3, 4, 8, 9 and fuel-ballast tanks Nos 2, 4, 9.

Group II - fuel tanks Nos 5, 6, 7 and fuel-ballast tanks Nos 7 and 8.

Note: For fuel tank draining, see Section II, Para B (c).

When full fuel, proceed as follows:

1. Open respective cocks 82 on the collecting pipe line, depending upon the tanks to be filled with fuel.

2. Open the valves and sea cocks in compliance with Table No.4 depending upon the tanks to be filled with fuel.

Note: In filling the drained tanks with fuel, ventilate the compartments into which the tanks are ventilated.

Table 4

Nos	Name of tank	Nos of valves and sea cocks to be opened on pipe lines	
		filling and transfer	venting
1	Fuel tank No.1	58, 61	75, 153
2	Fuel tank No.2	55, 56	87, 88
3	Fuel tank No.3	34	102, 101, 105, 106, 123, 122, 127, 125
4	Fuel tank No.4	6	73, 74, 76, 78, 152, 151, 149
5	Fuel tank No.5	8	80, 83, 85, 146, 145, 144
6	Fuel tank No.6	18	89, 90, 91, 136, 137, 138
7	Fuel tank No.7	24	96, 97, 128, 129
8	Fuel tank No.8	32	107, 109, 121, 120
9	Fuel tank No.9	30	114, 112, 175, 116, 117
10	Fuel-ballast tank No.2	1, 64	70, 157, 156
11	Fuel-ballast tank No.4	4	72, 74, 150, 149
12	Fuel-ballast tank No.7	23, 39	134, 135, 94, 95
13	Fuel-ballast tank No.8	25, 36	99, 100, 133, 132
14	Fuel-ballast tank No.9	27, 31	113, 120, 110, 111

21. Carry out fuel filling into fuel tanks.

22. Appearance of fuel at the open ends of the vent valves indicates that the appropriate part of the tank is filled with fuel. In this case close the vent valve. As to filling the whole tank, close the respective valve or the sea cock of fuel filling and transfer pipe line in compliance with Table No.4.

21

50X1-HUM

50X1-HUM

23. After fuel filling aboard the submarine set the system to the initial position.

(b) Filling of Diesel and Diesel Compressor Service Tanks with Fuel

The delivery of fuel from the tanks into the service tank of the Diesels and Diesel-compressors is effected under compensating water pressure, created by gas-exhaust cooling pumps or from overboard through the pressure equalizing recess.

Fuel should be transferred from the fuel tanks in strict compliance with the Instructions on fuel transfer and compensating variable loads.

In delivering fuel into the Diesel service tank, proceed in accordance with the Maintenance Instructions for Diesel Fuel Pipe Line.

The procedure of fuel transfer from the outer and inner tanks is different.

Fuel Transfer from Outer Fuel Tanks and Fuel-Ballast Tanks

Fuel transfer from the outer fuel and fuel-ballast tanks is effected alternately from each tank via service tank No.6 from which fuel is transferred at the end to the service tank.

To deliver fuel, proceed as follows:

24. Open sea cocks 18, 19 and valve 21 as well as cocks 82 depending upon the tank connected for transferring fuel.

25. Close sea cock 48.

26. Open the valves or sea cocks according to Table 5 depending upon the tank from which the fuel is transferred.

Table 5

Nos	Name of tank	Nos of valves or sea cocks to be opened on pipe lines	
		filling and transfer	venting
1	Fuel tank No.3	34	127, (125)
2	Fuel tank No.4	6	151, (149)
3	Fuel tank No.5	8	83, (85)
4	Fuel tank No.6	18	90, (91)
5	Fuel tank No.7	24	96, (97)
6	Fuel tank No.8	32	121, (120)
7	Fuel tank No.9	30	116, (117)
8	Fuel-ballast tank No.2	1, 64	70, 157, (156)
9	Fuel-ballast tank No.4	4	72, (74)
10	Fuel-ballast tank No.7	23, 39	93, (95) 134, (136)
11	Fuel-ballast tank No.8	25, 36	99, (100) 133, (135)
12	Fuel-ballast tank No.9	27, 31	110, (111) 118, (120)

50X1-HUM

50X1-HUM

Note: Valves, given in brackets (second shut-off valves), should be opened periodically to check the cessation of transferring the fuel from the tank or a part of its content.

27. Open the following valves or sea cocks:

- (a) while snorkeling - sea cock 49;
- (b) while surface running - valves 42 and 50.

Connect the reducing valve to the line of gas exhaust cooling pipe line in accordance with the Maintenance Instructions on Sea Water Cooling Pipe Line of Engine gas Exhaust, Diesel-Compressors, Coolers and Shaft Lines. Attach the pressure gauge 41 the pressure in the compensating pipe line which should not exceed 0.7 to 0.9 kgf/cm².

Upon completion of fuel transferring from the connected tank, set the settings of the tank to the initial position and connect the next tank for transferring the fuel.

The appearance of water from the vent pipes open ends is indication of cessation of transferring fuel from the whole tank or its part.

Periodically check to see that there is no water in fuel tank No.6

by opening valves in the following sequence:

- (a) check the lowest point of the fore port side;
- (b) check the highest point of the fore port side;
- (c) check the highest point of the aft port side;
- (d) check the highest point of the aft starboard;
- (e) check the highest point of the fore starboard.

Start to check the next part of fuel tank No.6 only when water is observed in the previous part.

After completing fuel transfer from all the tanks, connect fuel line for fuel transferring. To do this, open sea cock 48 and close sea cock 49. Water appearance in the highest part of the fore starboard shows that fuel from tank No.6 is completely transferred. In this case set all the valves to the initial position.

31. When transferring fuel from any tank directly to the service tank, proceed as follows:

- (a) check sea cock 19 for closing;
- (b) open valve 16;
- (c) perform operations in compliance with Items 26 and 27.

Fuel Transfer from Inner Fuel Tanks

To deliver fuel to the service tank from fuel tank No.3 via fuel service tank No.6, proceed as follows:

- 32. Carry out the operations in compliance with Items 24 and 25.
- 33. Open valves 55, 56.

50X1-HUM

50X1-HUM

34. Open valves 42 and 12. Connect the reducing valve to the gas exhaust cooling pipe line in accordance with the Maintenance Instructions of the Sea Water Cooling Gas Exhaust Pipe Line of Engines, Diesel-Compressors, Coolers and Shaft-Lines and watch by pressure gauge 41 the pressure in the pipe line which does not exceed 0.7 to 0.9 kgf/cm².

Caution When snorkeling and when fuel is transferred from the inner fuel tanks, check carefully valve 50 for closing. Watch carefully during fuel transfer by pressure gauge 41 the pressure in the fuel compensating pipe line. In case the pressure exceeds 0.9 kgf/cm², immediately close valve 12, disconnect the reduction gear from the gas exhaust cooling pipe line.

35. Periodically open valve 87 to check complete transfer of fuel from fuel tank No.2. Water appearance from the open ends of the pipes of vent valves 87 and 88 indicates that the fuel is transferred from the respective half of the tank.

When the fuel is completely transferred from tank No.2, set the fittings to the initial position.

The fuel from inner fuel tank No.1 is transferred in strict compliance with the instructions on transfer and compensation of variable loads by two ways:

- by delivery of compensating water along the compensating line of the inner fuel oil tanks. To do this, proceed as follows.

36. Open valves 58 and 51 and then fulfil the operations according to Items 24, 25, 34.

37. Periodically open valve 153 to check the cessation of fuel transfer from fuel tank No.1. Appearance of water from the venting pipe open ends of valves 75 and 153 indicates that the fuel has already been transferred from the respective half of the tank.

After the fuel is transferred completely, set all the fittings of fuel tank No.1 to the initial position:

- by delivering compensating water displaced from fuel tank No.3 by air. To do this, perform the following operations according to Item 36 (less Item 34).

38. Open valves 50 and 12.

39. Check sea cock 49 and valve 42 for closing.

40. Deliver air to fuel tank No.3 in compliance with the maintenance instructions on air medium pressure system.

41. Check the amount of the displaced water by the quarters of fuel tank No.3. To do this, periodically open valves 103, 102, 101, 104, 105, 106, 124, 123, 122.

42. Fulfil the operations according to Item 37.

(c) Draining of Fuel and Fuel-Ballast Tanks

Draining of fuel and fuel-ballast tanks is effected as follows:

(a) outer fuel tanks - by pneumatic tool or by bilge pumps;

50X1-HUM

50X1-HUM

(c) fuel-ballast tanks - by high-pressure air, low-pressure air (or by exhaust gases of Diesels) or by bilge pumps via the compensating pipe line. While draining the fuel tanks, strictly observe the instructions on emergency and initial stability according to which the draining of the fuel tanks is affected by groups:

- group I: fuel tanks Nos 1, 2, 3, 4, 8 and 9;
- group II; fuel tanks Nos 7 and 8.

Simultaneous draining of tanks pertaining to different groups is not allowed, as an exception, is draining of one of the fuel tanks. In case start draining a tank of another group only after filling the previously drained tank with water or fuel.

(d) While draining, proceed the operations with the tank fittings in accordance with Table No.6 according to the tank to be drained.

In opening the sampling and vent valves, open respective cocks 82 on the venting pipe line.

Table No.6

Name of tank	Nos of valves and sea cocks to be opened on pipe lines		
	fuel compensating	ventilating while draining by bilge pump	sampling
Fuel tank No.1	5	75	79
Fuel tank No.2	9	87	(86)
Fuel tank No.3	35	127,125	124, (122)
Fuel tank No.4	62	151,149	77(78)
Fuel tank No.5	59	83,85	147,(144)
Fuel tank No.6	48	90,91	139,(138)
Fuel tank No.7	37	96,97	130,(129)
Fuel tank No.8	30	121,120	108,(109)
Fuel tank No.9	28	116,117	113,(112)
Fuel-ballast tank No.2	2	70,156,156	154,(155)
Fuel-ballast tank No.4	60	72,74	148,(149)
Fuel-ballast tank No.7	22	134,135	83,(85)
Fuel-ballast tank No.8	38	99,100	131,(132)
Fuel-ballast tank No.9	26	118,119	98,(100)

Note: The valves, given in (second shut-off valves) should be periodically opened to check the cessation of draining the tanks.

25

50X1-HUM

50X1-HUM

Draining Fuel Tanks by Bilge Pumps

44. To drain inner fuel tanks Nos 1 and 2, connect the drain pipe line hose to valve 7 and proceed with the operations according to Table No.6.

45. To drain the outer fuel and fuel-ballast tanks, connect the drain pipe line hoses to valves 33, 57, 63 (or to one of these valves), open them and perform operations in accordance with Table No.6.

46. To drain any of the tanks, close the valves and the compensating sea cocks of the undrained tanks and then proceed in accordance with the maintenance instructions for the submarine draining system

47. After draining is over, close the valves or the compensating sea cocks of the drained tanks and set all the rest fittings to the initial position.

Draining of Outer and Inner FuelTank No.2 by Air

48. To drain outer and inner fuel tank No.2 with air, open the compensating sea cocks and valves in compliance with Table No.6 depending upon the tank to be drained, remove the union nut-plug from hose connection 81 of the fuel tank to be drained, connect T-piece with a safety valve adjusted for a pressure of 2.7 kgf/cm^2 , connect it via the hose with the cross-piece of the pneumatic tool, open the hull vent valves of the respective tanks according to Table No.6 and further proceed in compliance with the maintenance instructions on the medium pressure pipe line, the pressure by the cross-piece pressure gauge being maintained not more than 2.7 kgf/cm^2 .

49. Periodically open the sampling valves of the tanks in accordance with Table No.6.

When the air appears from the pipe open ends of the sampling valve, close the throttle and compensating valves, open the vent valve and release the pressure in the pressure tank. After that, set all the fittings to the initial position.

Draining of Fuel-Ballast Tanks by Air

50. In scavenging the fuel-ballast tanks by high-pressure or low-pressure air, close the compensating sea cocks of the scavenged tanks in accordance with Table No.6 and proceed in compliance with the maintenance instructions for ballast tanks emergency scavenging pipe line with air under high pressure and maintenance instructions for the low-pressure pipe line while scavenging the tanks with air under low pressure.

Draining of Fuel Collecting Tank

51. The fuel collecting tank is drained as follows:

- (a) water is drained by bilge pumps through the drain pipe line in accordance with the maintenance instructions for the drain system;
- (b) fuel is drained by a hand pump to the Diesel service tank in compliance with the maintenance instructions for the fuel pipe lines of main engine-compressors.

50X1-HUM

50X1-HUM

Transferring Fuel to Another Ship or Base

Fuel can be transferred to another ship by means of discharging fuel from the tanks by compensating water or by pumping out the fuel with the aid of a bilge pump through the drain pipe line and by deck washing.

52. When discharging the fuel from the tanks by the compensating method, unscrew the hinged cover from any of deck sockets 44, connect to it an elbow 46 and hoses 47, open sea cocks 43, 53 or one of them and proceed with the operations according to Item 31 in transferring the fuel from the outer fuel tanks or according to Items 32, 33, 34, 35 - while transferring the fuel from the inner tanks.

53. Transferring the fuel by the bilge pumps via the drain pipe line and by deck washing is effected in much the same way as draining the tanks through the bilge pumps as described under Items 44, 45, 46 and 47.

54. Upon the cessation of the fuel transfer, set the whole system to its initial position.

(d) Preparation of the Fuel System for the Submarine Submergence

55. See to it that valves 12, 50 and 42 are closed.

56. Open sea cocks 49 and valve 51. All the rest fittings must be in their initial position as in the case when the submarine is at sea.

Caution! 1. When the submarine is submerging, watch the pressure in the inner fuel tanks by pressure gauge 71.

In case the pressure increases immediately, check the operations under Items 55 and 56.

2. In case the submarine submerges with pressure equalizing sea cock 49 being closed, the outer fuel and fuel-ballast tanks will be destroyed.

D. MAINTENANCE DURING LONG-TERM INACTION

Disassembly and Reassembly

57. While carrying out repair and disassembly of the system, make sure that there is no pressure in the pipe line section under repair.

Reassemble and disassemble the pipe connections by using two wrenches not to disturb the tightness of the adjacent connections.

E. TROUBLES AND REMEDIES

The troubles and remedies are given in Table No.7

50X1-HUM

50X1-HUM

Table No. 7

Nos	Trouble	Cause	Remedy
1	Rise of pressure in compensating line over 0.9 kgf/cm ² while reducing valve is operating	Diaphragm of reducing valve is broken or valve is mal-adjusted	Replace diaphragm and adjust valve
2	Untightness of fittings gland packings	Loosening of nuts, which tighten bushes of gland packings or wear of packings	Tighten up gland nuts or replace packing
3	Tightness of valves is disturbed	Non-uniform wear or damage of bearing surfaces of disks or seats	Reset valve disks
4	Air-tightness of the following connections is disturbed: (a) flanged joints	Loosening of nuts. Thread of bolts, nuts or studs is stripped. Gasket is punctured	Tighten up nuts. Replace nuts, bolts or studs. Replace gasket
	(b) pipe connections	Union nut is loosened. Gasket is punctured	Tighten up nut. Replace gasket

F. PREVENTIVE MAINTENANCE AND REPAIRS

Daily Inspection

58. Check to see that the pipe lines are tight and inspect the fittings and control and measuring instruments for good condition.

Make sure that the seals on the safety valves and the pressure gauges are available.

In case there is a leakage, tighten up the connections.

Weekly Inspection

Perform all the operations relating to the daily inspection and besides, do the following.

59. Turn all the valves and cocks. Make sure that the lines connection and the valves positions are correct.

50X1-HUM

50X1-HUM

60. Clean and lubricate the thread of valves, as to the valves rotating with difficulty work them up.

61. Check the gland sealings of valves for good condition. If necessary, tighten up or additionally pack the glands.

Monthly Inspection

(when the submarine is at base)

Perform all the operations relating to the weekly inspection and, besides, do the following.

62. Check the condition of the pipe lines, flange connections and protectors. In case of 50-per cent wear, replace the protectors.

63. Disassemble the line valves, examine them and eliminate the detected faults.

Inspection when Docking the Submarine

65. Examine and clean the inner surface of the fuel tanks.

Test the tanks for tightness by air pressure :

(a) fuel tanks Nos 1, 2, 4, 5, 6, 7, 8 and 9 - by 1.5 kgf/cm²;

(b) fuel tank No.3 - by 5 kgf/cm²;

(c) fuel-ballast tanks Nos 2, 4, 7, 8 and 9 - by 0.5kgf/cm².

Air leakage is not allowed.

Clean and test fuel tanks Nos 1 and 2 for tightness while replacing the storage battery.

66. Overhaul, repair and test all the hull valves and sea cocks for tightness.

Test the compensating system sections which communicate with the overboard space for working pressure.

66a. Check safety valves for opening on test bed at least once every 1 1/2 year.

Inspection during Running Repairs of the

Submarine

Perform all the operations relating to the monthly inspection

and, besides,

check the condition, overhaul and test

50X1-HUM

50X1-HUM

Table No. 8

Compart- ment	Position of fittings	Test medium	Pressure source	Pressure supply	Note
I - VI	All hull filling sea cocks are closed. Valves 55, 56, 58, 61 are closed. Filling sea cocks 43, 53 and valve 52 are open. Two valves 11 are closed. One valve 11 is re- valved and a portable pump is connected to the pipe. Covers of deck sockets are closed	Water	Portable hydraulic press	Via pipe of one of valves 11	Filled through deck socket 46 and filling hose
I - VII	All hull compensat- ing sea cocks are closed. Valves 5, 7, 9, 33, 57, 63 are clo- sed. Valve 42 is closed after the sys- tem is filled	Water	Portable hydraulic press	Via any boss of protector	Filled by means of en- gine cool- ing pumps
I - VII	All hull valves are closed	Water	Portable hydraulic press	Through valves 74, 78, 85, 91, 95 97, 100, 101, 106, 109, 111, 112, 117, 119, 120, 122, 125	

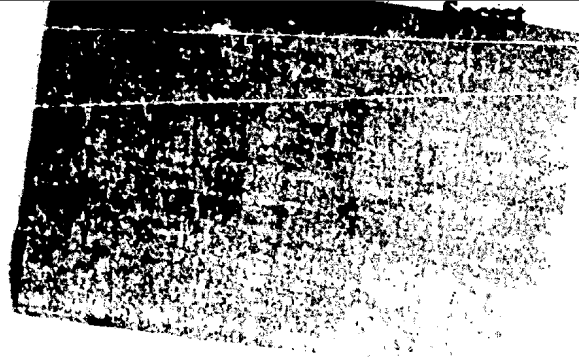
50X1-HUM

Page Denied

Next 1 Page(s) In Document Denied



50X1-HUM

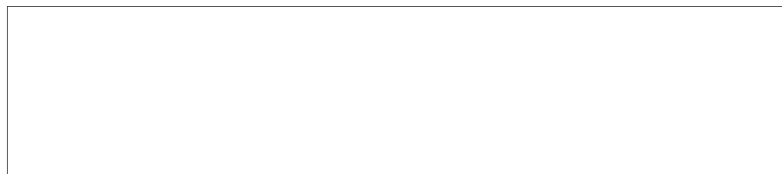


**MOTOR-DRIVEN COMPRESSOR
WATER COOLING PIPE LINES**

**Description and Operating
Instructions**



50X1-HUM



50X1-HUM

50X1-HUM

C O N T E N T S

	Page
I. DESCRIPTION	3
A. Purpose and Basic Specifications	3
B. General Description and Description of Individual Units . .	3
C. Control Instruments	5
II. MAINTENANCE INSTRUCTIONS	7
A. General Supervision and Upkeep	7
B. Preparatory Steps (for Putting to Sea)	7
C. Starting, During-Operation Maintenance and Stopping . . .	8
D. Maintenance during Protracted Shut-Down	12
E. Troubles and Remedies	13
F. Preventive Inspections and Repairs	13
G. Reference Data	16
APPENDICES	17

The Booklet contains 20 pages and 4 insets between pages 18 and 19, insets 2, 3 and 4 are unclassified.

50X1-HUM

50X1-HUM

I. DESCRIPTION

A. PURPOSE AND BASIC SPECIFICATIONS

The water pipe line is designed to supply water from outboard or from trim tanks Nos 3 or 4 to cool the motor-driven compressor.

Cooling water is supplied by the pump mounted on the compressor, in case of its failure, by the shaft line cooling pump.

The cooling line is worked in copper pipes 45x2 united by flanged joints on paronite gaskets. The pipe line is tested for tightness with hydraulic pressure.

The amounts of the hydraulic pressure are shown in Fig.1.

B. GENERAL DESCRIPTION AND DESCRIPTION OF INDIVIDUAL UNITS

The motor-driven compressor, type 3K10-I is installed in No.VI compartment.

The motor-driven compressor is used to recharge the high-pressure air banks when running on the surface or while snorting as well as to remove excess pressure from the compartments when running submerged.

When running on the surface and while snorting the motor-driven compressor is cooled with sea water. Sea water in this case enters the compressor through intake kingston valve 21, valves 18 and 4, strainer 5, the pump of the compressor and cools the latter. From the compressor water is drained through valve 17 and drain kingston valve 19. In case the pump of the compressor gets defective, cooling water may be fed through the emergency pipe line from the pump of the shaft line cooling system through valves 2, 6 and reserve branch 7 and futheron is discharged through valve 17 and drain kingston valve 19. When cooling water is fed through the reserve pipe line from the pump of the shaft line cooling system, automatic safety valve 6 is employed to protect the motor-

50X1-HUM

driven compressor from damage in case pressure of water in the reserve pipe line exceeds 2 kgf/sq.cm. The valve is mounted on the reserve pipe line and is designed to stop supply of water and simultaneously to stop the motor-driven compressor in case pressure exceeds 2 kgf/sq.cm.

When running at a depth greater than the periscope depth, the cooling water is fed to the compressor from trim tank No.3 or No.4 through valves 10 or 11 respectively, valve 4 and strainer 5. Cooling water is discharged from the compressor to the trim tanks through valve 8 or 9.

Intermediate pressure air may be fed to the cooling pipe line through valve 22 to blow the intake pipe and intake kingston valve 21.

The specific fittings employed in the system are the automatic safety valve and the sea water strainer.

(a) Automatic Safety Valve.

This (see Fig.2 and Ref.6 in Fig.1) is meant to stop feeding the water to the compressor and to stop the latter in case pressure of water in the reserve pipe line exceeds 2 kgf/sq.cm.

When pressure of water is below 2 kgf/sq.cm, the valve is open and the cooling water is free to flow through it.

In case pressure of water in the reserve pipe line exceeds 2 kgf/sq.cm, pulse valve 30 opens and connects the chamber above the piston into the pipe line through pipe 29.

Under the action of water pressure piston 23 moves, this shifts the disc of valve 25 down and pressing it to the saddle of the body of valve 26, as a result the valve will be shut.

Simultaneously stem 27 on its way down compresses spring 28.

Lever 32 is displaced together with disc 25 and changes over limit switch 33, as a result, the supply circuit of the compressor electric motor is open and the compressor stops.

Furtheron, drop in pressure in the reserve pipe line causes the disc of pulse valve 30 to return to the original position, spring 28 will lift stem 27, disc 25 and piston 23 to the upper position and will open the

50X1-HUM

valve. As this takes place, water from the chamber above the piston is expelled to the bilge through drain branch pipe 31.

(b) Sea Water Strainer

The function of the strainer (see Fig.3 and Ref.5 in Fig.1) is to dislodge any particles of grit, scale, etc. which the pipe line may contain. The body of the strainer is steel.

Straining sleeve 38 is lined with brass mesh. Screwed into cover 39 and bottom 36 of the strainer are valve 40 and plug 35 intended to bleed the air and water from the strainer.

The valve is made of bronze, the plug of brass.

Corrosion protection of the strainer is effected through zinc protector 41 arranged on the strainer cover.

To clean the strainer, open cover 39 and remove straining sleeve 38 and the settler from the body.

(c) Branch Pipe

The branch pipe (see Fig.4 and Ref.8 in Fig.1) is used to connect the motor-driven compressor with the reserve pipe line, in case the pump of the compressor gets defective.

The branch pipe is connected to the cylinder of stages I and II, rows I, II, IV.

C. CONTROL INSTRUMENTS

Electric Thermometer

The resistance electric thermometer TCH-291 (Ref.15 in Fig.1) is mounted in No.VI compartment on the drain pipe of the compressor and is used to check the temperature of water escaping from the compressor.

50X1-HUM



50X1-HUM

Pressure Gauge

The pressure gauge MTK-100E-4/2 (Ref.1 in Fig.1) is installed in No.VI compartment on the reserve discharge pipe line running from the shaft line cooling system. The pressure gauge is designed to check the pressure of water fed to the motor-driven compressor.



50X1-HUM

50X1-HUM

II. MAINTENANCE INSTRUCTIONS

A. GENERAL SUPERVISION AND UPKEEP

1. Care should be exercised that the pipe lines are in good order, the fittings and the joints are perfectly tight. Immediately remove troubles whenever detected.

2. Check to observe that the seals on the pressure gauges and on the safety automatic valve are intact.

B. PREPARATORY STEPS (FOR PUTTING TO SEA)

3. The initial position with the motor-driven compressor inoperative assumes the shut position of the valves and kingston valves.

4. Prior to putting to sea before starting the motor-driven compressor, check to see that the suction pipe line is filled with water.

5. To fill the pipe with water when the submarine is running on the surface or while snorting (the pipe line in this case is filled with sea water), proceed as follows:

- check valves 10 and 11 to see that they are shut
- open kingston valve 21
- open valve 18, 4.

- check filling of the pipe line to see if from the cooling water cocks on the compressor, after water flows from the cocks, stop filling the pipe line.

The pipe line being filled, set the valves into the initial position.

6. When the submarine is running at the depth greater than the periscope one, the pipe line is filled with water under pressure from trim tanks No.3 or No.4. In this case proceed as follows:

- reduce pressure in the trim tank to 2 kgf/sq.cm using the valves of the trim pipe line (see the instructions for the trim system);
- open valve 4.
- open valve 10 or 11 depending on the tank to feed the water;

50X1-HUM

50X1-HUM

- by opening in turn the water cooling cocks mounted on the compressor make sure the pipe line is filled; after water shows from the cocks, stop filling the pipe line.

After filling the pipe line:

- shut the cocks on the compressor;
- shut valve 10 or 11;
- open valves 16, 9 or 8, relieve pressure from the cooling water pipe line to trim tank No.3 or No.4 under ventilation (see the instructions for the trim system);
- check reduction in pressure by the pressure gauge on the motor-driven compressor;
- shut valve 8 or 9;
- shut valves 16 and 4.

C. STARTING, DURING-OPERATION MAINTENANCE AND STOPPING

For maintenance of the compressor proceed in strict adherence to the Operating Instructions for the 3K10-I motor-driven compressor.

(a) When Cruising on the Surface and While Snorting

7. Open valves 17 and 18.
8. Set non-return shut-off valve 4 to the NO RETURN position.
9. Open kingston valves 19 and 21.
10. Open the cocks on the compressor and make sure that the cooling water pipe line is filled with water.

In case no water shows from the cocks on the compressor, close kingston valve 21 prior to starting the compressor and perform the procedures outlined under Item 5.

11. Register the readings of the cooling water pressure gauge to check the pressure and start the compressor.

12. Make sure that water is running through the line which shall be indicated by change in pressure (by 0.8 - 1.0 kgf/sq.cm) as read off the

50X1-HUM

50X1-HUM

pressure gauge. If no water flows through the line, immediately stop the compressor and eliminate the trouble detected.

CAUTION! If no water runs through the line, damage to the compressor may occur.

13. Watch the temperature of cooling water at the compressor outlet. When measuring the temperature, set the handle on the temperature alarm ACT-1 to the position "18".

14. In case temperature rises above 50°C , stop the compressor, find out the cause of overheating and eliminate the trouble.

15. After the compressor has been stopped, bring the fittings to the initial position.

(b) When Running at a Depth Greater Than Periscope Depth

Prior to starting the motor-driven compressor, connect the cooling system to the pressurized tank, for which purpose proceed as follows:

- Note:
1. See to it that the tank to be connected with the compressor contains 3 tons of water as a minimum.
 2. Bear in mind that when the compressor is in operation 1 ton of cooling water is heated 1°C for a minute, as a result, difference in inlet and outlet temperatures equals 20°C .

16. Reduce pressure in the tank to 2 kgf/sq.cm (see the operating instructions for the trim system).

17. Check Kingston valves 19, 21 and valves 17, 18 for closing.

18. Open valves 8 and 10 on the trim system when cooling with water from trim tank No.4 or No.9 and valve 11 when taking water from No.3 trim tank.

19. Set non-return shut-off valve 4 to the NO RETURN position.

20. Open the cocks on the compressor and ensure that the suction pipe line is filled with water. If no water shows from the open cocks, wait till air escapes from the suction line and from the water chamber of the compressor and till water shows from the cocks.

21. Shut the cocks on the compressor.

50X1-HUM

50X1-HUM

22. Open valve 16.

23. Start the compressor.

CAUTION! The trim tank when used to supply water for cooling the compressor shall not be used for the purpose it is intended.

24. Make sure that water is running through the cooling line which shall be indicated by rise in pressure from 0.8 to 1.0 kgf/sq.cm as read off the pressure gauge. In case no water is running through the cooling line, immediately stop the compressor and eliminate the trouble.

CAUTION! Damage to the compressor is likely to occur if no water is running through the line.

25. Every five minutes check the outlet temperature. When measuring temperature, set the handle on the temperature alarm ACT-1 to the position "18".

26. In case temperature rises above 50°C immediately stop the compressor and bring the fittings to the initial position.

27. If it is necessary to operate the compressor again, feed cooling water from another trim tank having performed the procedures outlined under items 16, 18-23.

28. After the motor-driven compressor has been stopped, bring the fittings to the initial position.

(c) In Case the Pump of the Motor-Driven
Compressor Gets Defective

In this case the compressor may be used for surface cruising and for snorting.

Cooling water is fed with the aid of the pump of the shaft line cooling system through the reserve pipe line.

To start the system into operation:

29. Remove the pipe connecting the pump on the motor-driven compressor with the cylinders of stages I and II, rows I-II-IV and remove the plug from the reserve pipe line.

10

50X1-HUM

50X1-HUM

30. Mount branch pipe 7.

31. Open valve 17.

32. Open drain kingston valve 19.

33. If cooling the motor-driven compressor is effected when the shaft line cooling system is not in use, first prepare it for action proceeding in accordance with the operating and maintenance instructions for the sea water cooling system of the diesel-engine and diesel-driven compressor exhaust lines, coolers and shaft lines.

34. By watching pressure gauge 1 slowly crack valve 2 until pressure in the discharge line rises to 2 kgf/sq.cm. In case pressure will not rise to 2 kgf/sq.cm, open valve 2 wide.

35. Start the compressor.

Note: 1. With the compressor in operation adjust valve 2 to maintain pressure in the discharge pipe line equal 2 kgf/sq.cm.

2. Check the temperature of water as indicated under Items 13 and 14.

36. After stopping the compressor, bring the fittings to the initial position.

If due to rise in pressure automatic safety valve 6 operates, for repeated starting the compressor proceed as follows:

37. Shut valve 2.

38. Relieve pressure through pressure gauge valve 3.

39. Perform the procedures outlined under Items 34 and 35.

CAUTION! In case increase in pressure in the system results from the submergence depth increased by more than 10 m as read off the depth gauge installed in the control room, immediately bring the fittings to the initial position and relieve pressure through valve 3.

50X1-HUM

50X1-HUM

(d) Checking the Automatic Safety
Valve for Adjustment

To check operation of valve 6, feed water to it under a pressure of 2.5 kgf/sq.cm from the shaft line cooling system, for which purpose proceed as follows:

40. See to it that the pipe running from valve 6 is plugged.
41. Open pressure gauge valve 3.
42. Open valve 2.
43. Watch pressure gauge 1 to make sure the pressure in the pipe line is equal to 2.5 kgf/sq.cm.
44. Check visually valve 6 for operation.
45. After inspection bring the system to the initial position.

(e) Blowing the Intake Pipe and the Intake
Kingston Valve

46. Open intake kingston valve 21.
47. Open valve 22.

CAUTION! Prior to opening valves 21 and 22 make sure that valve 18 is shut as this will cause damage to the motor-driven compressor and trim tanks.

48. After blowing, bring the fittings to the initial position.

D. MAINTENANCE DURING PROTRACTED SHUT-DOWN

Disassembly and Reassembly

49. Every time before disassembly, make sure that the pipe line is not under pressure, otherwise disconnect it and relieve pressure.

For disassembly and reassembly of the union connections use two wrenches not to impair tightness of the adjacent joints.

50X1-HUM

50X1-HUM

E. TROUBLES AND REMEDIES

No.	Symptom or difficulty	Condition may be due to	Correction
1	Valve gland packing leaky	Nuts tightening gland bushes loose Wear of gland packing	Tighten up gland nuts Replace gland packing
2	Valves leak	Uneven wear of or damage to valve fitting surface	Lap valve discs
3	Flanged joints leak	Nuts loose, thread of nuts and bolts damaged Gasket defective	Tighten up nut, replace bolts or nuts Replace gasket
4	No water flows through safety automatic valve	Pressure in pipe line before valve exceeds 2 kgf/sq.cm Damage to spring	Reduce pressure in pipe line before valve to 2 kgf/sq.cm Replace spring
5	Temperature of cooling water at compressor outlet exceeds 50°C; no or insufficient water flowing through compressor	Strainer clogged Intake kingston valve clogged Compressor pump defective	Clean strainer Blow kingston valve Shift to cooling the compressor from shaft line cooling pump

F. PREVENTIVE INSPECTIONS AND REPAIRSDaily Inspection

50. Inspect the external surfaces of the pipe lines, fittings and control instruments.

Remove leaks.

51. Turn all the valves, check to see that they are shut.

Weekly Inspection

Perform the procedures of daily inspection and in addition do the following:

50X1-HUM

50X1-HUM

52. Clean and lubricate the valve thread, work out sticky valves.

53. Check the gland packings of the valves for condition, tighten up glands if necessary.

Monthly Inspection

Perform the procedures of weekly inspection and in addition do the following:

54. Check the pipe line and the joints for attachment.

55. Clean the strainer, blow the intake opening.

Quarterly Inspection

Perform the procedures of monthly inspection and in addition do the following:

56. Clean the protectors on the pipes at the kingston valves and inside the strainer. If the protectors are worn by more than 50%, replace them.

Check the safety automatic valve in operation.

Inspection during Docking the Sub

57. Disassemble, inspect and repair if necessary, adjust and test for strength and tightness all the shut-off valves, replace the gaskets and protectors.

Inspection during Running Repair

58. Depending on the technical condition of the shut-off valves, overhaul and lap some of them.

59. Check the strainer for condition, replace the mesh and the protector, if necessary.

60. Test the assembled pipe lines for tightness under pressures stipulated in Fig.1.

For carrying out the tests proceed in accordance with the Table below.

50X1-HUM

50X1-HUM

No.	Pipe line to be tested	Valve position	Pressure supply	Remarks
1	Pipes from kingston valves 19 and 21 as far as shut-off valves 17, 18, 22	Valves 17, 18, 22 and kingston valves 19 and 21 are shut	Through sockets receiving protectors	
2	Pipes from valves 17 and 18 as far as valves 8, 9, 10 and 11	Kingston valves 19 and 21 and valves 8,9,10,11 are shut. Valves 4 and 16 are open	Through sockets receiving protectors	Pipes running from motor-driven compressor to be disconnected and plugged
3	Pipes from trim tanks as far as valves 8, 9,10, 11	Valves 8, 9, 10, 11 are shut	Together with tank	
4	Pipes from shaft line cooling system as far as automatic safety valve 6 and valve 3	Valves 6 and 3 are shut. Valve 2 is open	Through shaft line cooling pipe line	
5	Pipe from automatic safety valve 6 as far as branch pipe 7	Valve 2 is shut. Both cocks of valve 3 are open	Through relief pipe and of valve 3	Pipe running from compressor is disconnected and plugged
6	Pipes from intermediate pressure air line as far as valve 22	Valve 22 is shut	Together with intermediate pressure air line	

CAUTION! When testing the pipe line under a pressure of 38 kgf/sq.cm, the pressure shall not be raised above 3 kgf/sq.cm shall be risen only after the safety valve has operated.

15

50X1-HUM



50X1-HUM

G. REFERENCE DATA

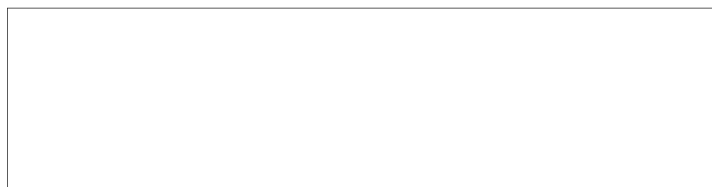
61. The documents to be used for **maintenance of the motor-driven** compressor cooling pipe line are listed below.

(1) **Trim System, Description and Maintenance Instructions.**

(2) **Description and Operating Instructions for Sea Water Cooling System of Diesel-Engine Gas Exhaust System, Diesel-Driven Compressors, Heat Exchangers and Shaft Lines.**

(3) **Motor-Driven Compressor 3K10-IM Description and Operating Instructions.**

62. Once a year the **pressure gauge** shall be subjected to the test check.



50X1-HUM



50X1-HUM

APPENDICES



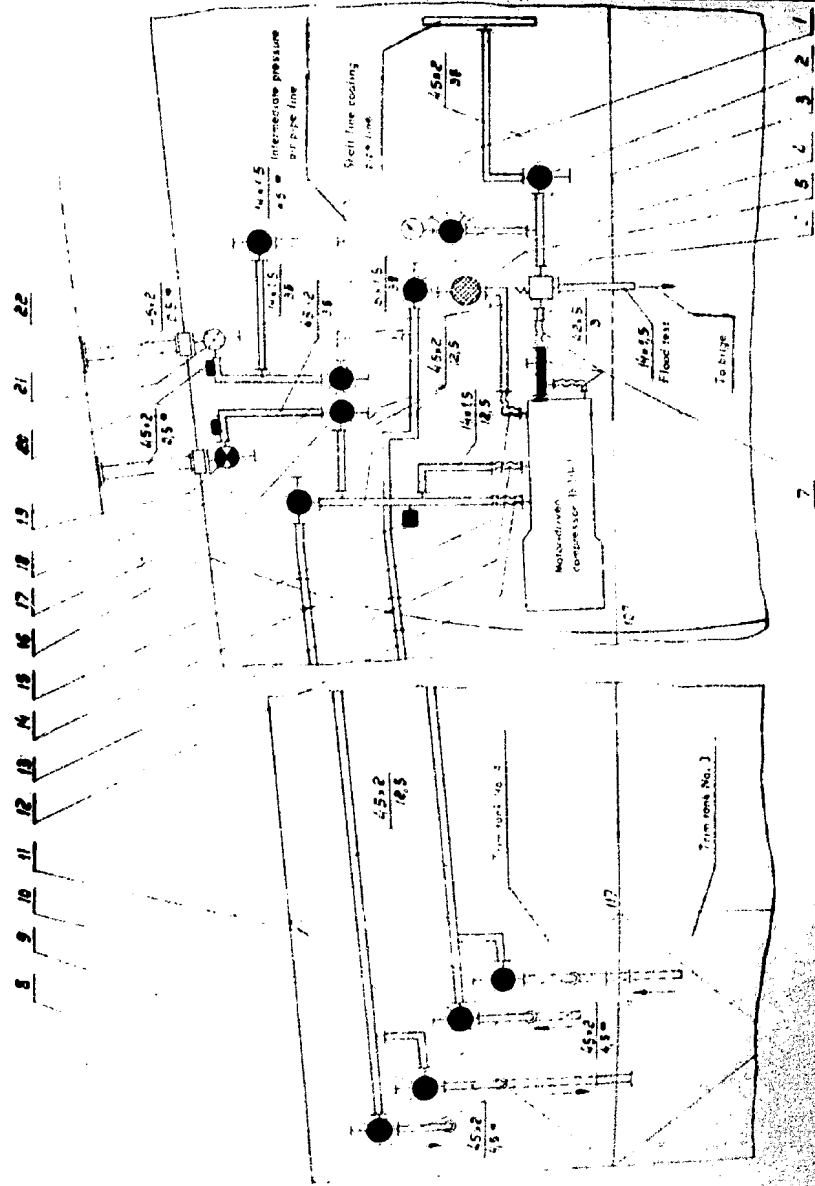
17
50X1-HUM

50X1-HUM

M641-A76-224

SECRET
INLET 1

Note: The numerals in the fractions appearing at the pipes indicate the size of the pipe while their denominators indicate the number of hydraulic and air (with an asterisk) lines for hydraulics in 1/2" diam.

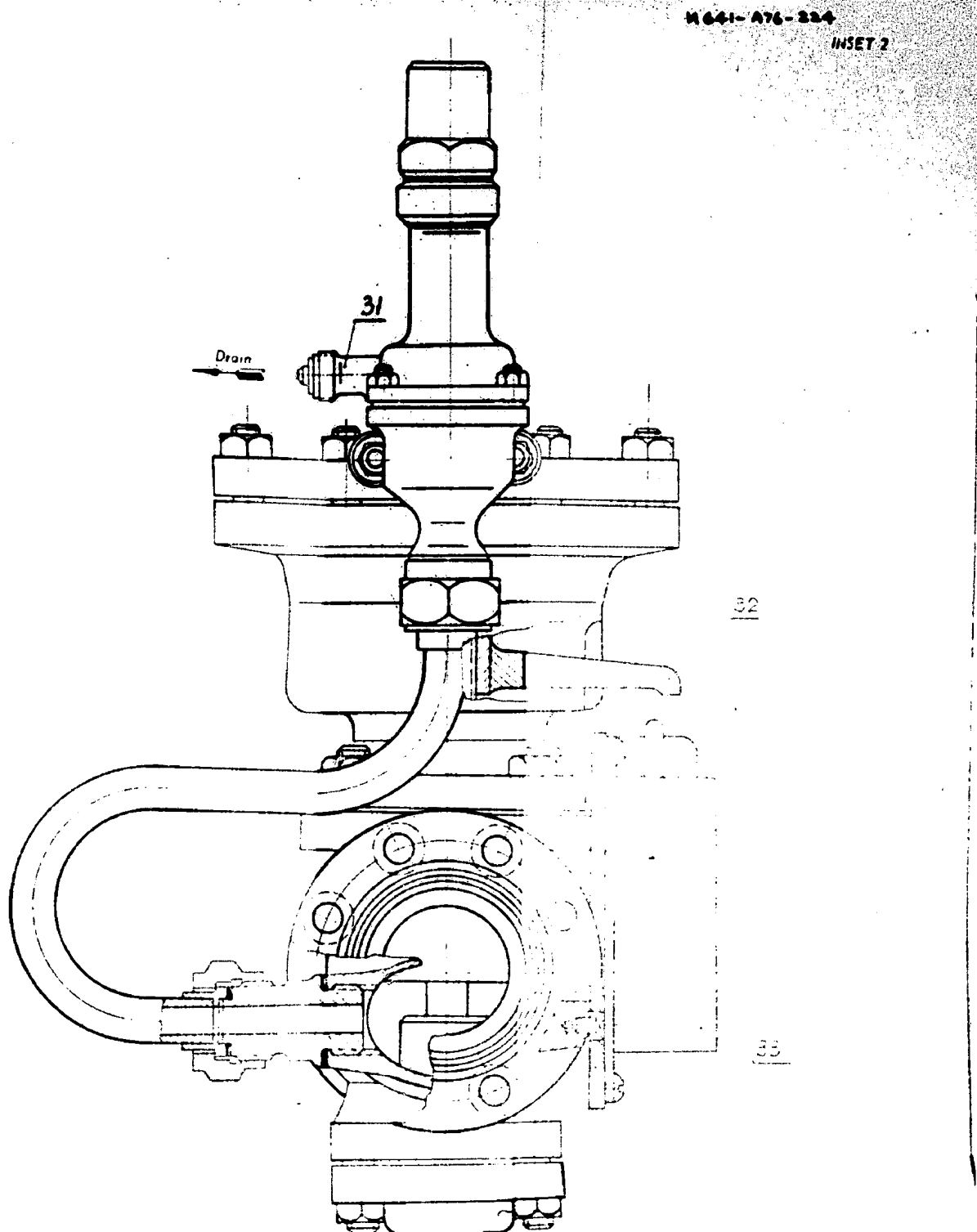


14		1/2" pipe line
13		Water pump line
12		Inlet bypass valve
11		Protractor
10		Discharge bypass valve
9		Electrical minimum flow valve
8		Special bypass valve
7		Pump line
6		Automatic shut-off valve
5		Manual shut-off valve
4		Pressure relief valve
3		To B-111
2		To B-112
1		To B-113

FIG. 1. COMPRESSOR WATER COOLING PIPE LINE
SCHEMATIC DIAGRAM

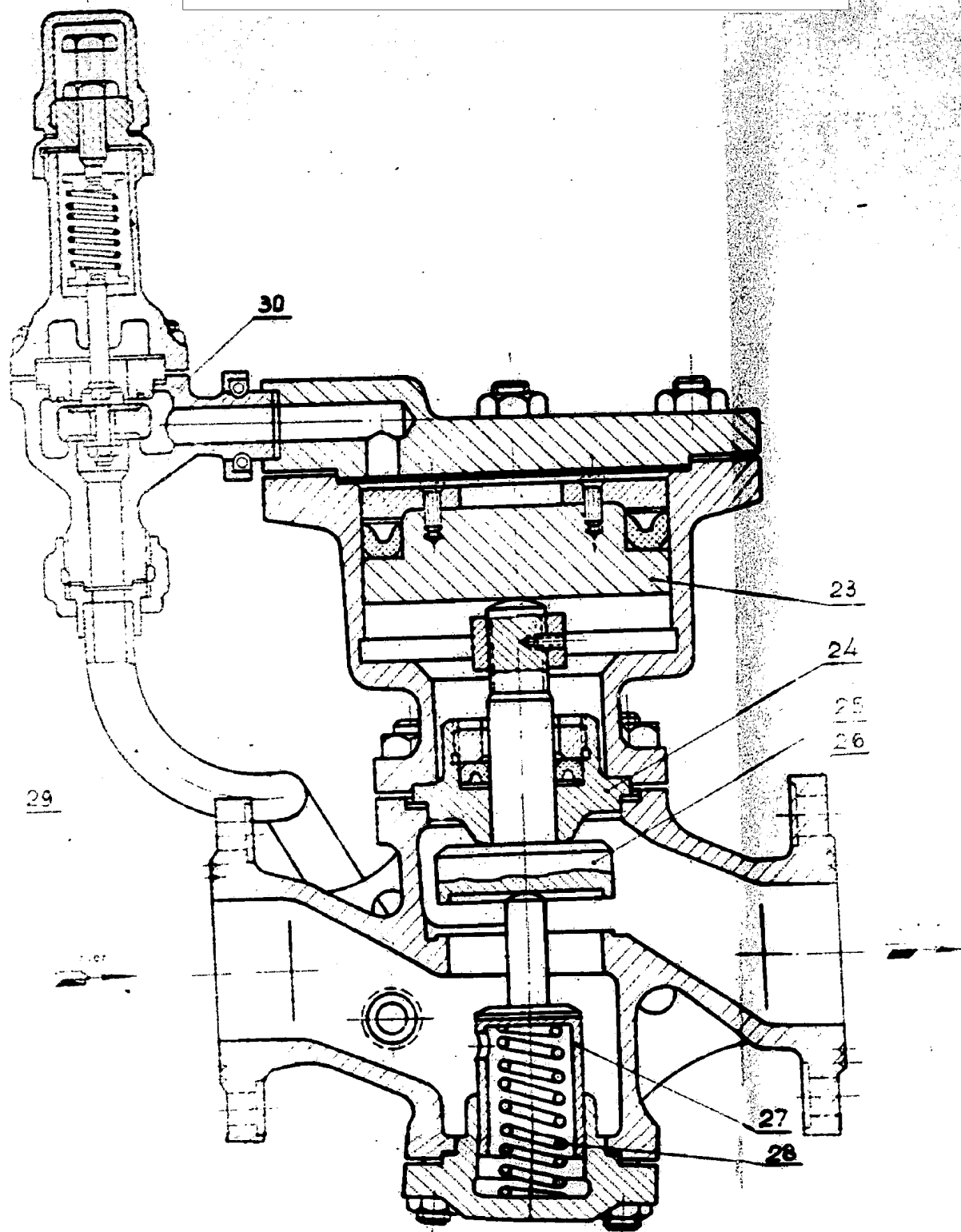
50X1-HUM

50X1-HUM



50X1-HUM

50X1-HUM



50X1-HUM

50X1-HUM

Page Denied

50X1-HUM

W44-476-254-2573

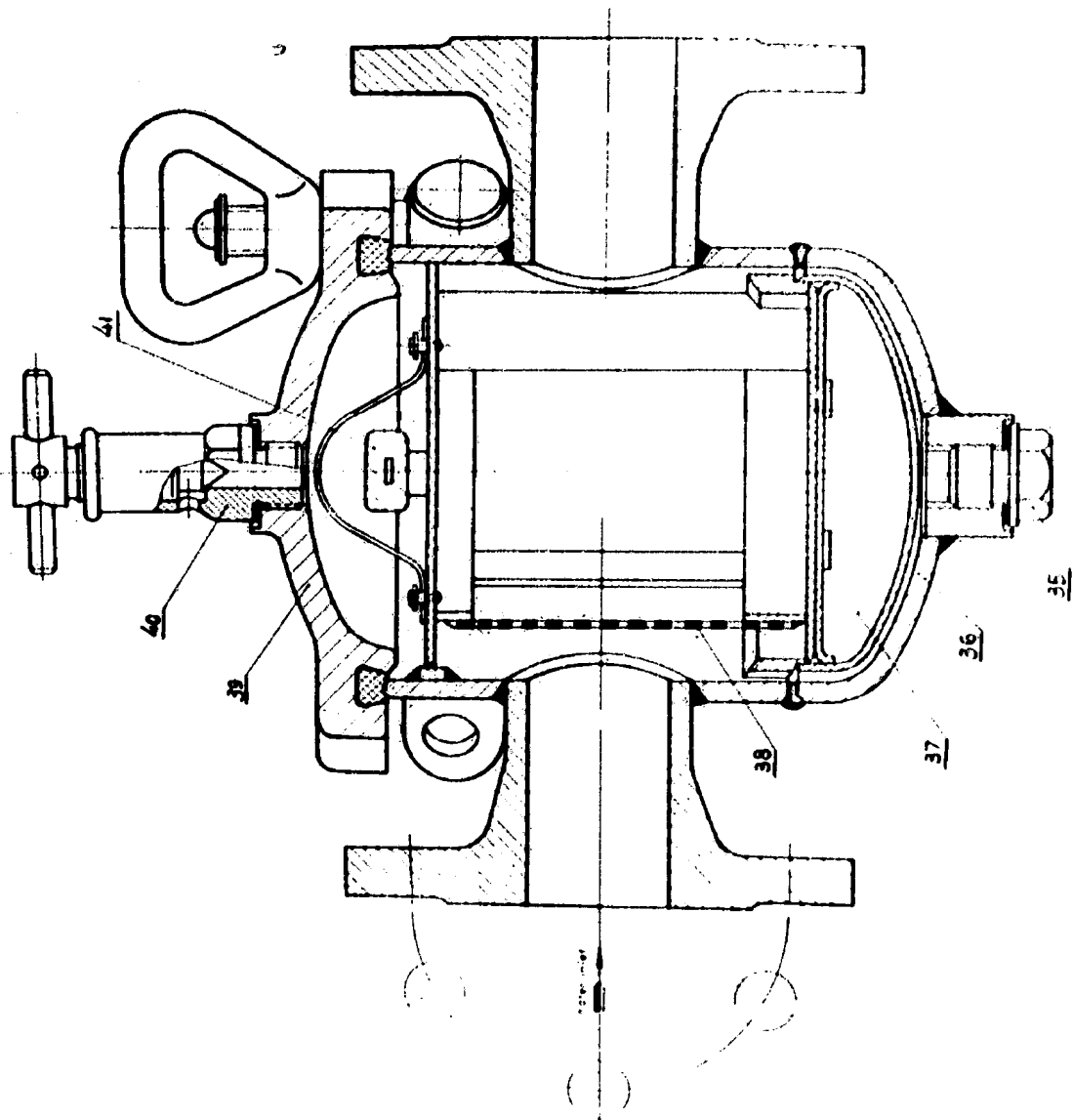


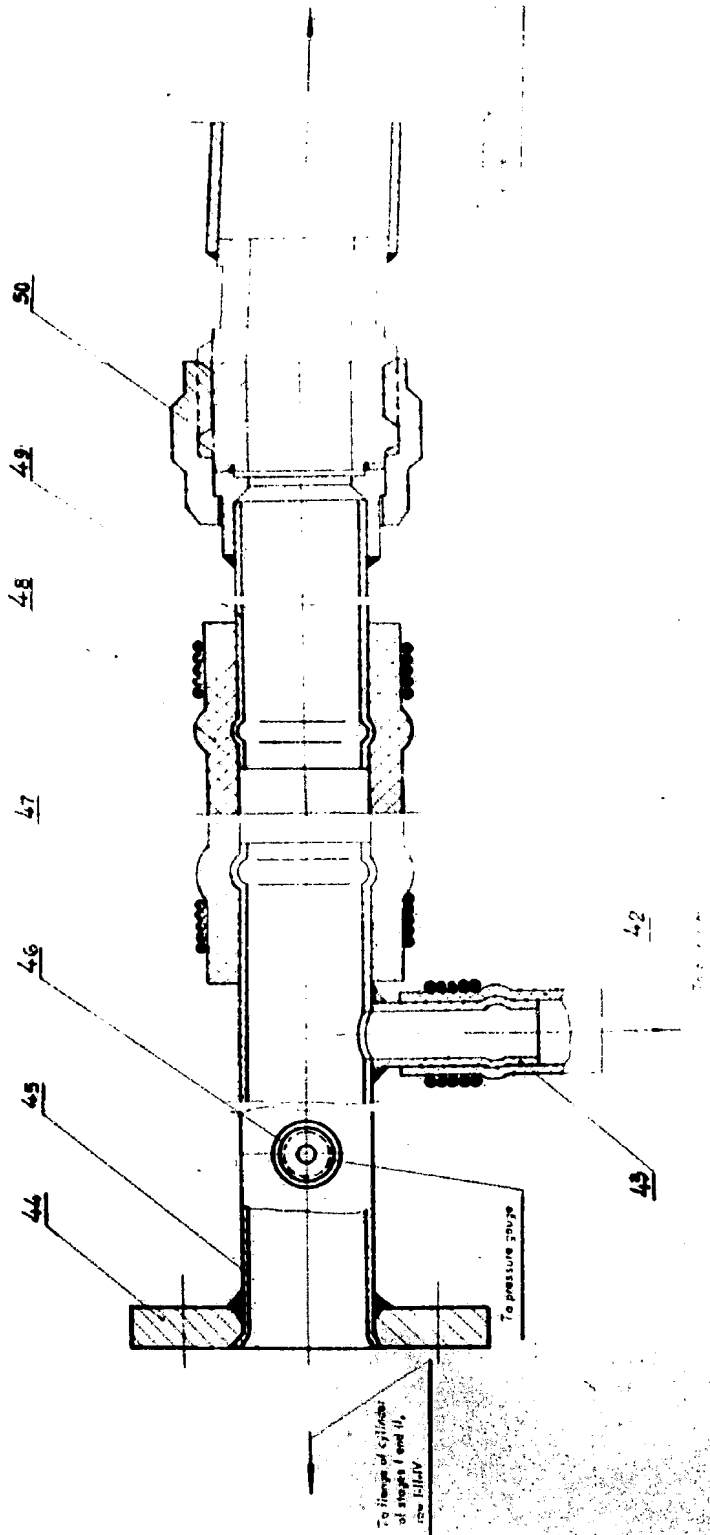
FIG. 3. SEA WATER STRAINER
35 - main body; 36 - top cover; 37 - bottom cover; 38 - central shaft; 39 - bearings; 40 - handwheel; 41 - valve

50X1-HUM

50X1-HUM

M 641-076-224

INSET 4



42-0
 43-0
 44-0
 45-0
 46-0
 47-0
 48-0
 49-0
 50-0

50X1-HUM

50X1-HUM

Page Denied