DRINKING, WASHING AND SANITARY WATER SYSTEM

Description and Maintenance Instructions

M641-A76-198

C O N T E N T S

This Book contains 38 pages and 6 appendices (Nos. 2-6 being unclassified) between pages 36 and 37.

I. DESCRIPTION

A. PURPOSE AND BASIC SPECIFICATIONS

The drinking, washing and sanitary water system consists of the following pipe lines:

1. Drinking water pipe line.
2. Fresh washing water pipe line.
3. Sea washing water pipe line.
4. Sanitary water pipe line.

The fresh washing water pipe line serves:

(1) to fill the fresh water tanks with fresh water;

(2) to supply fresh water to the wash-basins, sink, electric water heater, water boil tank, air-foam fire-extinguishing system and diesel cooling system.

The drinking water pipe line serves to supply fresh water from fresh water tank No.1 through the dechlorinating filter to the drinking water breakers, galley electric water heater, hose used to fill up caldrons and to the drinking water valve in compartment III.

The sea washing water pipe line is intended:

(1) to supply sea water from the air-conditioning pipe line to the electric water heater, sink, wash-basins and urinals;

(2) to supply sea water from the depth gauge pipe line in compartment I to the shower space in compartment II;

(3) to supply sea water from the diesel gas exhaust cooling pipe line to the wash-basins, sink, shower spaces, urinals and W.C. arrangements inside the pressure hull;

(4) to supply hot water from the electric water heater in compartment VI to the shower spaces in compartments II and VI, to the sink and wash-basins inside the pressure hull;

(5) to supply sea water from overboard or from the diesel gas exhaust cooling pipe line to the wash-basin and shower space in the conning tower fairwater.

The sanitary water pipe line serves to drain sanitary water from the sink, wash-basins, shower spaces and to drain condensate from the air-conditioning system air coolers and

from drain pans into the sanitary tanks inside the pressure hull, and overboard inside the conning tower fairwater.

Specifications for pipe lines used in the system are listed in Table 1.

Table 1

Description	Pipe size	Pipe material	Types of connections	Fittings material	Gasket material
1	2	3	4	5	6
Drinking water and fresh washing water pipe lines	57x3 45x2 32x2.5 25x2.5 14x2 10x2	Steel	Flange	Brass	Paronite
	18x1.5	Copper-nickel alloy	Union	Brass	Paronite
	14x2	Copper	Union	Bronze	Paronite
Sea washing water pipe line	14x2 24x2	Copper	Union	Bronze	Paronite
Sanitary water pipe line	45x2.5 38x3 24x2 9x1.5	Copper	Flange Union	- -	Paronite Paronite

Test pressures of the pipe lines are given in Table 2.

Table 2

Pipe group	Test pressure for tightness, kgf/cm^2	Remarks
1	2	3
Pipes from fresh water intake lock sockets 49, 57 to valves 48, 52	38.0	By water
Drinking water, fresh washing water and sea washing water mains with branches up to first stop valves to consumers	12.5	By water
Pipes from valves 13, 16, 17, 19, 68 and 30 to cocks at sink, wash-basins, drinking water heat exchangers and water mixers in shower spaces	1.25	By water
Pipes from valve 56 to valves 27, 26, 58	1.25	By water
Pipes from fresh water tanks to stop valves	1.0	By air; to be tested together with tank
Pipes from depth gauge pipe line and from sea water pipe line of air-conditioning system to pressure-reducing valves	38	By water
Pipes inside tanks		By filling
Pipes delivering cool water from air-conditioning system to drinking water heat exchangers	38	By water
Pipes from intermediate pressure air pipe line to assembly	35.0	By air

Pipe group	Test pressure for tightness, kgf/cm^2	Remarks
1	2	3
(3d) of pressure-reducing valves		
Pipes from electric boil tank		By filling
Medical mixer in compartment II		
Sanitary pipes and sanitary		By filling
[illegible] pipes		

[illegible] GENERAL DESCRIPTION AND DESCRIPTION OF INDIVIDUAL UNITS

[illegible] Washing Water Pipe Line

[illegible] fresh water mains with branches to consumers and to [illegible] water tanks Nos. 1-5 runs the whole length of the sub-[illegible] inside the pressure hull along the port side.

[illegible] capacity and location of the tanks are tabulated below.

Table 3

[illegible]	Description	Capacity, m^3	Location		
			compart-ment	side	frame
[illegible]	2	3	4	5	6
1	Fresh water tank No.1	6.77	I	C.L.	19-22
2	Fresh water tank No.2	3.41	III	Stbd.	48-51
3	Fresh water tank No.3	20.0	IV	Stbd. Port	65-74
4	Fresh water tank No.4	4.53	VII	Port	107-111
5	Fresh water tank No.5	3.95	VII	Stbd.	107-110

Fresh water stock is taken for the whole endurance cruise and, as a rule, is used for drinking and cooking purposes. Water for these purposes is supplied from service tank No.1 only.

After water has been completely consumed, tank No.1 is filled with fresh water delivered from fresh water tanks Nos 2-5 which, in turn, are filled with distilled water supplied by the distilling plant.

For the sequence of consuming the water from the tanks, refer to the Variable Weights Control Manual.

From fresh water tanks Nos. 2-5 distilled water is delivered along the fresh washing water pipe line to the consumers for washing purposes.

At the beginning of the endurance cruise, when the stock of distilled water is not yet available, fresh water for washing purposes is supplied to the consumers from fresh water tank No.3.

Water from the fresh water tanks is supplied to the consumers with the help of compressed air under a pressure of 1.0 kgf/cm^2. Compressed air is fed from the intermediate pressure air pipe line through assembly (38) of pressure-reducing valves and air-cleaner used to clean air from dust and oil vapours.

Each tank is equipped with pipings and fittings for tank ventilation, air supply, water filling and supply.

The vent pipe line mounts pressure gauges 1, type MTK-100Б 1.6/1, with a red line at 1.0 kgf/cm^2 to read air pressure in the tanks. To prevent pressure in the fresh water tanks from rising above 1.1 kgf/cm^2 the vent pipe line is fitted with safety valves 2 adjusted to P_{work} = 1.1 kgf/cm^2.

The compressed air is also fed to the distilled water tanks in compartment I and through valve 23 to the storage battery cooling system in compartment III.

The amount of water contained in the fresh water tanks is determined by water gauge columns 6.

The tanks are filled with fresh water through the filling funnels by gravity or under pressure not exceeding

1.5 kgf/cm^2. A filling elbow may be used to conveniently take in water under pressure. Fresh water tanks Nos. 1, 2, 4, 5 are filled with fresh water through deck socket 49 located on the superstructure deck on the port side between frames 72-73, and through hull valve 48. Fresh water tank No.3 is filled with fresh water through deck socket 57 located on the superstructure deck between frames 59-60, and through hull valve 56.

The time of filling the tanks with water by gravity is not more than 4 hours.

The fresh water tanks may be drained either by compressed air through deck sockets or by means of a bilge pump through non-return stop valve 63 in compartment III to which the drain system hose is joined. In this case compressed air under pressure of 1.0 kgf/cm^2 is delivered to tanks to build up the backwater when draining by the bilge pump or to force out water when draining the tanks by compressed air.

To agitate sediments while draining tanks, the compressed air supply pipes touch the bottom of the tank.

The shower spaces, wash-basins and galley sink, as a rule, are supplied with distilled water, and only at the beginning of the endurance cruise these services may be fed with fresh water.

Wash-basins are located in compartments II, III and VI.

Fresh water to the wash-basins in compartments II, III, VI and to the sink in compartment IV is supplied through stop valves 17.

A medical elbow mixer is installed in a wash space of compartment II. Cold fresh water is fed to this mixer through valve 17, hot fresh water is delivered from the water boil tank through straight-way cock 12; the water boil tank is filled with fresh water through cock 69.

The electric water heater in the shower space is supplied with fresh water through stop valve 43, hose 45 and non-return stop valve 30.

To take distilled water from distilled water tanks Nos. 1, 2, valve 74 with a screw plug is mounted in com-

partment I. The fresh water pipe line in end compartments is provided with branches to feed water to the air-foam fire-extinguishing system. In order to supply this system with fresh water at all times, the constant stock of water in the fresh water tanks in compartments I and VII should be at least 0.5 m^3.

Drinking Water Pipe Line

The drinking water pipe line is laid inside the pressure hull from compartment I to IV along the port side.

Drinking water is delivered to the consumers only from fresh water (service) tank No. 1 located in compartment I. Compartments II and IV are equipped with heat exchangers to cool drinking water down to a temperature of about 12°C.

The drinking water is cooled by the air-conditioning system cold water fed through valves 14.

The drinking water runs to the heat exchangers via valves 16.

The electric heater, type NB3-240, is placed in the galley to fill the galley caldrons with drinking water supplied through non-return stop valve 53.

The pipe running from valve 53 to the electric water heater is provided with a branch connection and a screw plug to drain the electric water heater when the submarine is at anchor for a long time or is sent to repairs.

The galley caldrons are filled with hot water through a hose and with cold water through hose 52.

The drinking water pipe line is fitted with a valve to deliver drinking water to compartment III.

To disinfect fresh water received at base and to remove taste and odour resulted from prolonged storage in tanks, it shall be subjected to chlorination in fresh water tank No.1. The water shall be chlorinated with 3-per cent solution of chloride of lime or calcium hypochlorite (0.5 litre of solution per 1 m^3 of water) prepared in the chlorinator.

Water on its way to the consumers passes through the dechlorinating filter with a charge of active birch charcoal

that absorbs excess of active chlorine and oxidation products.

Since the chloride of lime solution loses its disinfectant properties in 7-8 days, water in the service tank shall be chlorinated again upon expiration of the said period.

Sea Washing Water Pipe Line

The sea washing water mains with branches to consumers runs the whole length of the submarine inside the pressure hull.

Sea water is supplied into the mains from the shaft line cooling pump through the air-conditioning system water pipe line, stop valves 33 and 41 and pressure-reducing valve 42 which is used to reduce the sea water pressure to 2.0 kgf/cm^2.

The water pressure after the pressure-reducing valve is read by pressure gauge 39, and its fault is signalled by the safety valve adjusted to the pressure of 2.7 kgf/cm^2.

When the submarine is surfaced in cold weather, the mains may be supplied with warm sea water delivered through valves 28 from the diesel gas exhaust cooling pipe line.

Sea water is fed to the wash-basin and shower space in the conning tower fairwater from the gravity tank (the tank is filled in accordance with the W.C. maintenance instructions).

The following branches with valves run from the mains:

- branches with valves 13, 19 - to supply water to the wash-basins and sink;
- branch with valve 31 - to supply water to the electric water heater;
- branch with valve 62 - to supply fresh water into the mains from fresh water tank No.3.

The ПМВЗ-240 type electric water heater mounted in compartment VI serves to supply the submarine with hot washing water.

For the principle of operation of the electric water heater see description and maintenance instructions of the

ПМВ3-240 type water heaters. The electric water heater is fed with water delivered through valve 32 reducing pressure down to 1 kgf/cm^2.

Non-return stop valve 30 mounted on the water-to-electric water heater supply pipes prevents water leakage from the electric water heater. When not in use for a long time or during repairs the electric water heater is drained through the branch pipe union with a screw plug located between the electric water heater and valve 30.

Shower spray heads with mixers are installed in shower spaces of compartments II and VI, and are used for washing purposes and for taking a refreshing shower-bath. The shower mixers are fed with hot and cold sea water. The hot sea water is supplied either from the electric water heater or from the diesel gas exhaust cooling pipe line (when diesels are running). The cold sea water is fed to the shower space of compartment VI from the mains, and to the shower space of compartment II (while submerged only) from the depth gauge water supply pipe line of compartment I through valves 70 and 73 and valve 42 that reduces the full pressure of sea water to 2.0 kgf/cm^2.

Sanitary Water Pipe Line

Dirty water from the wash-basins, sink, shower spaces, drain pans and condensate from the air coolers (in compartments IV and VI) of the air-conditioning cold and sea water system are discharged into the sanitary tanks.

Water from the wash-basin in compartment III is drained through valve 18 into the W.C. tank of compartment III. Water from the conning tower fairwater wash-basin is discharged overboard.

Capacity and location of the sanitary tanks are tabulated below.

Table 4

No.	Description	Capacity, m^3	Location		
			compartment	side	frame
1	2	3	4	5	6
1	Sanitary tank No.1	1.26	II	Stbd.	31 - 31
2	Sanitary tank No.2	1.17	IV	C.L.	77 - 79
3	Sanitary tank No.3	2.17	VI	C.L.	103 - 105

All the sanitary water sources are provided with settlers or hydraulic seals to prevent odours from coming into compartments. The tanks are ventilated through deodorizer filters (filter-cell ФК-У).

To prevent the deodorizer filters from flooding with water when the tanks are overflown the pipes connecting the sanitary tanks to the deodorizer filters form a loop; the upper end of this loop is over the wash-basins and the sink.

The water level in the sanitary tanks shall be checked with the sounding rods.

The sanitary tanks shall be drained by means of the ship draining system bilge pump in accordance with the draining system description and maintenance instructions.

Chlorinator

The chlorinator (see Appendix 2) is cylindrical welded casing 106 with a tapered bottom. Its upper part is provided with vent pipe 108. Water gauge glass 109 is fitted on the side surface of the casing and drain cock 100 is in the bottom. The casing incorporates batcher 110 for chloride of lime and delivery pipe 102 to feed water.

Water necessary to dissolve chloride of lime is supplied through valve 103, its solution is discharged through drain valve 101. The remaining solution is drained through drain cock 100.

[redacted]

Decolorinating Filter

The decolorinating filter (see Appendix 3) consists of a casing 117 with a flat bottom, spherical cover 120 and [illegible] for adsorbent.

Filter cell 119 is a thin-walled steel cylinder with a [illegible] bottom filled with active birch charcoal 118. The charcoal pieces are 2 to 5 mm in size. The filter cell is [illegible] between the casing and cover.

The lower part of the casing houses pipe union 115 to [illegible] chlorinated water, and the upper part of the cover [illegible] pipe union 121 to discharge filtered water.

When filled with active birch charcoal the filter can [illegible] evaporate 300-400 tons of water.

Air Cleaner

The air cleaner (see Appendix 4) is mounted on the air [illegible] before the fresh water tanks and is intended for [illegible] air of dust and oil vapours.

The air cleaner is comprised of steel welded casing 131 with detachable cover 130. The interior of the casing is divided into three sectors by strainers 129. These sectors are filled up with filtering elements: active charcoal 128 in the middle and cotton wool 127 in the end sectors.

Drinking Water Heat Exchanger

The heat exchanger (see Appendix 5) consists of casing 91 and cover 93 with insulation coating. The casing houses coil pipe 89 for circulation of cooling water (air-conditioning system cold water).

The cover is fitted with vent cock 95 to ventilate the heat exchanger when being filled with water.

Drain cock 87 used to drain the heat exchanger is mounted on its bottom.

To determine the temperature of drinking water in the heat exchanger, temperature gauge 88 is mounted on its face wall. Water temperature should be about 12°C.

Hydrants in compartments II and IV are provided with drain pans. Pipes from vent and drain cocks of the heat

[redacted]

[redacted]

...water run to the drain pans. The drain pans are equipped with water drain pipes.

Assembly of Pressure-Reducing Valves

The assembly of pressure-reducing valves (see Appendix) serves to reduce a pressure of air supplied to the ... water tanks from 35 kgf/cm^2 down to 1.0 kgf/cm^2.

... assembly consists of pressure-reducing valves 143 ..., which are essentially identical in design. When ... screw 145 clockwise, tension of spring 146 is transmitted via diaphragm 141 and tappet 140 to pressure-reducing valve 136.

When air flows through the gap between seat 137 and the ... in pressure is reduced to the required working value. ... the pressure exceed the set value, the air presses ... diaphragm 141, and valve 138 effected by the action of ... 139 reduces the air flow.

The assembly is adjusted so that pressure-reducing ... 143 reduces pressure down to 10 - 15 kgf/cm^2 and pressure-reducing valve 136, down to 1.0 kgf/cm^2 as read by pressure gauge I.

C. CONTROL AND MEASURING INSTRUMENTS

Table

Ref. No. in schematic diagram	Name and purpose	Type and scale	Normal value / Peak value	Location
1	2	3	4	5
1	Pressure gauge to measure air pressure in fresh water tanks	MTK 100B 0 - 2.5 kgf/cm^2 division value is 0.1 kgf/cm^2	0-1 kgf/cm^2 / 1.0 kgf/cm^2	On fresh-water tank vent pipes

[redacted]

	Name and purpose	Type and scale	Normal value / Peak value	Location
	2	3	4	5
6	Water gauge columns to measure amount of water in fresh water tanks	Division value is 100 litres		On each fresh water tank
-	Temperature gauge to measure temperature of drinking water in heat exchanger	TK-100-100; 0-100°C	12°C / -	On each drinking water heat exchanger
39	Pressure gauge to measure pressure after sea washing water pressure-reducing valves	MTK 100B 0 - 2.5 kgf/cm^2; division value is 0.1 kgf/cm^2	0-2 kgf/cm^2 / 2.5 kgf/cm^2	After pressure-reducing valves

IV. MAINTENANCE INSTRUCTIONS

A. GENERAL SUPERVISION AND CARE

1. Regularly check all the connections of the system [illegible] and see to it that all the fittings and [illegible] are in sound condition.

2. Check the amount of water in the tanks by the water [illegible] and sounding rods.

3. [illegible] sanitary tanks as they are filled.

4. [illegible] the temperature gauges on the drinking water [illegible] see that the temperature of water is [illegible]

5. [illegible] the electric water heaters and electric [illegible] are cut in only when they are filled with [illegible]

6. When an ambient temperature is below +5°C, drain [illegible] the pipe line in the conning tower fairwater [illegible] 11.

B. PREPARATION FOR OPERATION (CRUISE)

Initial Position

7. All the fresh water tanks are filled with water.

8. All the sanitary tanks are drained.

9. The electric water heaters in the shower space and galley are filled with water.

10. All the valves and cocks are shut, except vent valves on the drinking water heat exchangers. Three-way cocks 4 on fresh-water tanks Nos. 1,2,4 and 5 are set in the position 

11. Hoses are in positions shown in the schematic diagram (see Appendix 1).

12. In assembly 38 pressure-reducing valves 141 and 136 are adjusted, respectively, to pressures of 10-15 kgf/cm^2 and 1.0 kgf/cm^2.

Preparation for Operation

(a) Preparing the fresh washing water pipe line for service

16. Connect valves 58 and 60 by hose 59.

All the subsequent operations are tabulated below.

Table 6

	Operation	For tanks Nos.				
		2	3/stbd	3/port	4	5
		ref. Nos. of valves				
	2	3	4	5	6	7
	Set three-way cock in position to communicate with vent pipe	4	-	-	4	4
	Open air-to-tank delivery valve	61	61 24	61 25	37	37
	Open valves	22	26 60,58	27 60,58	40	36

17. Take readings of pressure gauge 1 to make sure that assembly (38) of pressure-reducing valves is adjusted to the pressure of 1.0 kgf/cm^2.

Adjust it, if necessary.

Warning! See that the stock of water in fresh water tanks Nos. 4, 5 intended to fill the air-foam fire-extinguishing system reservoir is at least 0.5 m^3 at all times.

(b) Preparing the drinking water pipe line for service

18. Set three-way cock 4 to position for communication with the vent pipe, and then open valve 75.

19. Open valves 7 and 71.

20. Perform an operation according to Item 17.

W a r n i n g! See that the stock of water in fresh water tank No.1 intended to fill the air-foam fire-extinguishing system reservoir is at least 0.5 m^3 at all times.

(c) Preparing the sea washing water pipe line for service

When the diesels are shut down:

21. Carry out operations to feed water into the shafting cooling piping in accordance with the shafting maintenance instructions.

22. Open valves 41 and 44.

When the diesels are running:

23. Open appropriate valve 28 and valve 44.

(d) Preparing the sanitary water pipe line

24. Screw out plugs of drain holes.

C. PUTTING INTO OPERATION.
DURING-OPERATION MAINTENANCE. SHUT-DOWN

The operations have been carried out, valves and cocks [illegible] in accordance with instructions stated in this section should be shut.

Drinking Water

Filling Heat Exchangers with Drinking Water

25. Open valve 16 in compartment II or IV and fill the heat exchangers with water. The heat exchanger is considered filled if water starts leaking out of its vent pipe.

26. Cool the drinking water in the heat exchangers, if necessary. For this purpose, open valves 14. The recommended temperature of drinking water is about 12°C.

Filling the Galley Caldrons with Water

27. Open valve 51.

28. Open the cock on hose 52 and fill the galley caldrons with water.

Filling the Galley Caldrons with Hot Water

29. Cut in the heater of the electric water heater and immediately open valve 53.

30. Fill the caldrons through the hose.

Filling Fresh Water Service Tank No.1 with Water from Fresh Water Tanks Nos. 2-5

31. Close valve 75.

32. Open valves 3 and 72.

33. Carry out operations 14-17 for the appropriate tank.

Water Chlorination

34. Open cover 107 and fill batcher 110 with chloride of lime or calcium hypochlorite up to its upper level.

35. Close cover 107 and tighten a wing nut.

36. Screw out the screw plug and connect chlorinator valve 103 to valve 5 by means of the hose.

37. Open valve 103 on the chlorinator.

38. Open valve 5 and fill the chlorinator with water. The chlorinator is considered filled if water starts leaking out of vent branch pipe 108.

39. The chlorinator being filled with water, close valve 103, and let the solution settle for 10 - 15 minutes.

40. Shut valve 75.

41. Open valve 3.

42. Set cock 4 in position to feed air into the tank for water agitation.

43. Disconnect the hose from valve 103 and connect it to valve 101.

44. Open valve 101 on the chlorinator and drain the required amount of the solution into the tank, then close valve 101. The amount of solution is taken at the rate 0.5 litre per m^3 of water.

45. Close valve 5.

46. Open valve 75 and supply compressed air into the lower portion of the tank to agitate water and the chlorine solution. The agitation period is 3-5 minutes.

47. Open cock 100 on the chlorinator, discharge the rest of the solution, then close valve 100.

48. Flush the chlorinator. To do this, fill the chlorinator with water and then drain water through cock 100.

Taking Fresh Water into Fresh Water Tanks Nos.1, 2,4,5

49. Remove the screw plug from deck socket 49 and fit a fill funnel on it when water is taken by filling, or an elbow piece, if water is delivered under pressure.

50. Connect hose 50 to the elbow piece for taking fresh water.

51. Open valve 48.

All the subsequent operations are tabulated below.

T a b l e 7

Operation No.	Operation	Tank Nos.			
		1	2	4	5
		ref. Nos. of valves			
1	2	3	4	5	6
2	Open tank vent valve	3	21	34	35
	Open fresh water intake valve	72	22	40	36

52. When water starts leaking out of the tank vent valves, close the appropriate water-intake and tank vent valves.

W a r n i n g! When filling the tanks with water, first close the water intake valve and then shut the tank vent valve.

Taking Fresh Water into Port and Starboard Fresh Water Tanks No. 3

55. Remove the screw plug from deck socket 57 and connect a fill funnel to it when taking water by filling, or an elbow piece and hose 50 when taking water under pressure.

56. Open vent valves 54, 55.

57. Open fresh water intake valves 27, 26.

58. Open valve 56.

59. If water begins to leak out of the tank vent valve, close valves 54, 55, 27 and 26.

Filling the Fresh Water Tanks with Distilled Water from Distilling Plant

60. Distilled water is taken into the fresh water tanks only when the fresh water from these tanks has been consumed.

Table 8

Operation	Tank Nos.				
	2	3,stbd	3,port	4	5
	ref.Nos. of valves				
2	3	4	5	6	7
Open tank vent valve	21	54	55	34	35
Open fresh water intake valve	22	26	27	40	36
Open valves	-	60,58	60,58	-	-

61. Carry out operations to supply distilled water to the fresh water pipe line in accordance with the distilled water system maintenance instructions.

Consumption of Drinking Water in Compartment III

65. Remove the screw plug from valve 20 and open the valve.

Fresh Water Tank Draining

(a) Draining the tanks by the bilge pump

66. Remove the screw plug from the pipe running from valve 63 and connect one end of the drain system hose to this pipe and the other one to the drain pipe line.

All the subsequent operations are tabulated below.

Table 9

Operation No.	Operation	Tank Nos.					
		1	2	3, stbd	3, port	4	5
		ref. Nos. of valves					
1	2	3	4	5	6	7	8
67	Place three-way cock in position to feed air into lower portion of tank	4	4	-	-	4	4
68	Open air-to-tank supply valve	75	61	61,24	61,25	37	37
69	Open valves	72	22	26,58, 60	27,58, 60	40	36

70. Read pressure gauge I to make certain that assembly 23 of pressure-reducing valves of the respective tank is adjusted to the pressure of 1.0 kgf/cm^2. Readjust it, if necessary.

71. Open valve 63 and perform operations in accordance with the drain system maintenance instructions.

(b) Drainage of tanks by intermediate pressure air through deck sockets

72. Remove the screw plugs from deck sockets 49 and 57.

73. Perform operations 67 - 70.

74. Open valves 48, 56.

Measuring Amount of Water in Fresh Water Tanks

75. To measure the amount of water in fresh water tanks, open top and bottom valves of water gauge column 6 and take the readings of the water column scale.

Feeding Intermediate Pressure Air into Storage Battery Cooling System

76. Open valves 61 and 23.

Fresh Washing Water

Feeding Fresh Washing Water to Wash-Basins

77. Open valves 17 in compartments II, III and IV.

Feeding Fresh Washing Water to the Sink

78. Open valve 17 in compartment IV.

Feeding Fresh Washing Water into the Electric Water Heater and Consumption of Hot Water

79. Connect valves 30 and 43 by hose 45.

80. Open valves 30, 43 and the mixer hot water cock. Fill the electric water heater with water. When water begins to drip out of mixer 29, the electric water heater is considered filled.

81. The electric water heater being filled, cut in the heater, warm up the water and using mixer 29 regulate the temperature to the required level.

W A R N I N G! Never cut in empty electric water heater.

Feeding Water to Electric Water Boil Tank and Consumption of Hot Water

82. Open valve 17 in compartment II.

83. Open cock 69 and fill the electric water boil tank with water.

84. When the electric water boil tank is filled, shut cock 69 and valve 17.

85. Cut in the heater and warm water to the required temperature.

86. Warming of water being completed, cut out the heater.

87. To consume hot water, open cock 12 and turn the lever of the medical mixer.

Transfer of Distilled Water from Distilled Water Tanks Nos. 1, 2 to Fresh Water Tanks Nos 2-5

88. Perform operations 60 - 63 for the appropriate tank.

89. Remove the screw plug from valve 74, connect the distilled water system hose to it and open valve 74. Further operations shall be carried out in accordance with the distilled water system maintenance instructions.

Sea Washing Water

Feeding Sea Washing Water to Wash-Basins

90. To feed water to the wash-basins of compartment II, open valve 13.

91. To feed water to the wash-basins of compartments III and VI, open valves 19 in these compartments.

Feeding Sea Washing Water to the Sink

92. Open valve 19 in compartment IV.

Feeding Sea Washing Water to Shower-Bath of Compartment VI

93. Remove the screw plug from valve 32.

94. Connect valves 30 and 32 with the help of hose 45.

95. Open the hot water cock mounted on mixer 29.

96. Open valves 30 and 31 and fill the electric water heater with water. When water begins to leak from the shower spray head, the electric water heater is considered filled.

97. The filling of the electric water heater is over, cut in the heaters and regulate the temperature of water to the required level by means of mixer 29.

Feeding Sea Washing Water to Shower-Bath of Compartment II

(a) When diesels are shut down:

98. Remove the screw plug from valve 32.

99. Connect valves 30 and 32 by hose 45.

100. Open the hot water cock mounted on mixer 29.

101. Open valves 30 and 31 and fill the electric water heater with water. When water begins to leak from the shower spray head, the electric water heater is considered filled.

102. Perform the operations to feed sea water to the depth gauge located in compartment I in accordance with the maintenance instructions of depth gauges, trim indicators and inclinometers.

103. Open valves 13, 46, 68 and 73.

104. Cut in heaters of the electric water heater and using mixer 67 regulate the temperature of water to the required level.

When diesels are running:

105. Carry out the operations to feed sea water to the depth gauge of compartment I according to the maintenance instructions of depth gauges, trim indicators and inclinometers.

106. Open valves 13, 68 and 73, and using the mixer regulate the temperature of water to the required level.

Feeding Hot Sea Washing Water to the Sink

107. Perform the operations listed in Items 98 - 101.

108. Cut in heaters of the electric water heater and open valves 46 and 19 in compartment IV.

Feeding Sea Washing Water to the Conning Tower Fairwater

109. To feed water to the gravity tank, carry out operations in accordance with the W.C. arrangement maintenance instructions.

110. Open valve 64 and fill the gravity tank with water.

111. In order to supply water to shower spray head 66, open valve 65.

Sanitary Water

112. Before making use of the wash-basin in compartment III, see that the W.C. tank vent valve is open, and open valve 18.

To shut down the system, return it to the initial position.

D. MAINTENANCE WHEN NOT IN USE FOR A LONG TIME

When the system is shut down for a long time, accomplish the following operations:

113. Drain the fresh water tanks and sanitary tanks.

114. Discharge water from the pipe lines through the valves and cocks. Drain the remaining water through disassembled joints located at the lowerest places. Then assemble the joints and blow the pipe lines by compressed air.

115. Overhaul, clean, repair valves and cocks if faulty and then place them home.

116. Inspect and clean the water gauge columns and [illegible] rods.

117. Clean and close the fresh water intake deck pipes with screw plugs.

118. Clean the outer unpainted surfaces of the fittings and components and coat them with anti-rust compound.

119. Clean and paint those places where coating is damaged.

To put the system in action after a long idle period, proceed as follows:

120. Work the stop valves and cocks, eliminate defects if any. Replace gaskets and gland packing, if necessary.

121. Overhaul, adjust and seal the safety valves.

122. Test the pipe lines for tightness according to [illegible].

E. TROUBLES AND REMEDIES

[illegible] corrective actions involving [illegible] of the pipings see that the piping is not under pressure, otherwise close valves to cut off the pipe line sections under repair, and discharge water.

Possible troubles and remedies are tabulated below.

Table 10

No.	Trouble	Cause	Remedies on board ship
1	2	3	4
1	Valve and cock glands leaky	Nuts tightening gland bushes get loose; wear of gland packing	Tighten gland nuts. Replace gland packing
2	Inadequate tightness of valves	Nonuniform wear or damage of seat surfaces of discs or saddles	Lap valve discs
3	Inadequate tightness of union connections	Nuts get loose, gaskets punctured	Tighten nuts, replace gaskets
4	Inadequate tightness of flange connections	Nuts on pipe fastenings get loose, gaskets punctured	Tighten nuts. Replace bolts and nuts with stripped threading. Replace gaskets
5	Water does not drain from sinks and wash-basins	1. Sanitary tanks overfilled	Drain sanitary tanks
		2. Gratings clogged	Clean gratings
		3. Settlers clogged	Clean settlers
6	With cock 100 open on chlorinator, sediments do not drain from chlorinator	Drain cock clogged with chloride of lime insoluble sediments	Open chlorinator cover, take out batcher and clean hole of cock 100 by means of a wire

No.	Trouble	Cause	Remedies on board ship
1	2	3	4
7	With cock 103 open on chlorinator, water does not drain from tank	Delivery pipe clogged with chloride of lime insoluble sediments	Open chlorinator cover, take out batcher and scrap delivery pipe with a wire

Troubles in electric water heaters are corrected in accordance with the electric water heater maintenance instructions.

Note: When troubles involving disassembling of piping have been corrected, test the latter for tightness according to Table 2.

2. PREVENTIVE INSPECTIONS AND REPAIRS

Daily Inspection

123. Make sure all the safety and pressure-reducing valves and pressure gauges have seals.

124. Measure the amount of water in the tanks.

Weekly Inspection

Perform operations pertaining to the daily inspection besides:

125. Inspect the system externally and clean its pipe fittings, as well as control and measuring instruments.

126. Check and work all the fittings of the system.

127. Clean and flush settlers mounted on wash-basins and on the galley sink.

Monthly Inspection

Carry out the operations pertaining to the weekly inspection and perform the following:

128. Check glands of valve stems for condition, and tighten them or add some packing material, if necessary.

129. Check the safety valves in action.

Quarterly Inspection

Perform the operations related to the monthly inspec- ... and then do the following:

... Clean the fresh water tanks of sediments.

... Examine tank water gauge columns, open and clean ... if necessary.

... Every three months and every time before ... raise replace filter-cel ... wash the ... with chlorine water

...pection During Running Repair of ...

... carry out all operations of the ... specified as follows:

... Overhaul and adjust the safety valves.

... Overhaul and test t ... fresh water-line ...

... Overhaul and repair some shut-off valves ... sary.

... Inspect the paint coating of the fresh ... and sanitary tanks, renew it, if necessary.

... Overhaul and clean the water gauge ...

... Once a year have the pressure gauges ... found.

... Replace charcoal in the dechlorinating filter ... operating the filter for 18 months.

... Once a year and after preventive repairs ... disassembly of the pipe lines test the latter for ... tightness according to Table 2.

Hydraulic Test for Tightness

The hydraulic test of the pipe lines for tightness shall be carried out with the help of a hand-operated piston pump.

(a) Fresh washing water pipe line

140. Remove the screw plug from deck socket 49, fill the pipes with water to valve 48, and join the pump to deck socket 49.

[redacted]

141. Using the pump, build up a pressure of
[redacted] kgf/cm^2 in pipes and test the pipe joints and fittings
[redacted] tightness.

[redacted]. When the tests are over, detach the pump, dis-
[redacted] water into the mains through valve 48 and fit a screw
[redacted] deck socket 49.

[redacted]. Remove the screw plug from deck socket [redacted] fit
[redacted] water to valve 56 and connect the pump to [redacted]

[redacted]. Build up a pressure of 30.0 kgf/cm^2 in the pipe
[redacted] and test the pipe joints and fittings for t[redacted]

[redacted]. After having finished the tests, detach the pump
[redacted] water through valve 56.

[redacted]. Take the screw plug off valve 50 and connect the
[redacted] the valve.

[redacted]. Subsequent operations are tabulated below.

Table [redacted]

Operation	Compartment Nos.					
	I	II	III	IV	VI	[redacted]
2	3	4	5	6	7	8
[redacted] valves	72	-	22 67	48	47	[redacted]
[redacted] valves	-	17	17 50	17	17	[redacted]

[redacted]. Fill the pipe line with water. While filling [redacted]
[redacted] it by successively opening the cocks of [redacted]
[redacted].

150. Using the pump, build up a pressure of
[redacted] kgf/cm^2 and test the pipe joints for tightness from
[redacted] 17 to cocks 11, 47, 69 and mixer 8.

151. Close valves 17 in compartments II, III, IV and [redacted]

152. Using the pump, build up a pressure of
[redacted] kgf/cm^2, and test the pipe joints and fittings for
[redacted] tightness.

[redacted]

[illegible]. The test being over, discharge water from the pipe line, disconnect the pump from valve 60, and set the screw plug on the valve.

[illegible]. Remove the screw plug from valve 58 and connect the pump to the valve.

[illegible]. With valves 27, 28 closed, fill the pipe line with water. The pipe line should be blown through hull valve 28 and deck socket 57.

[illegible]. The pipe line being filled, close valve 58, [illegible], build up a pressure of 1.25 kgf/cm^2 and test the pipe joints and fittings for tightness.

[illegible]. The test being accomplished, disengage the pump and place the screw plug on valve 58.

(b) Drinking water pipe line

[illegible]. Remove the screw plug from valve 18, connect the pump to it and open valve 20.

[illegible]. Fill the pipe line with water. While filling the line must be ventilated through valve 21 [illegible] mounted on the drinking water heat exchangers.

[illegible]. With valves 21, 23 and 71 closed and [illegible], build up a pressure of 1.25 kgf/cm^2, and test the pipe joints for tightness from valves 16 to cocks [illegible].

161. Close valves 16.

162. Using the pump, build up a pressure of [illegible] kgf/cm^2 and test the pipe joints and fittings for tightness.

163. After the test has been accomplished, discharge water from the pipe line, disconnect the pump and fit the screw plug on valve 20.

164. The cold water delivery pipes running to the drinking water heat exchangers are tested together with the air-conditioning system cold water pipe line.

(c) Sea washing water pipe line

165. Remove the screw plug from valve 62 and connect the pump to the valve.

166. Connect valves 30 and 31 by hose 45; screw plugs should be removed from these valves beforehand.

[redacted]

The further operations are tabulated below.

Table 12

Operation No.	Operation	Compartment Nos.					
		II	III	IV	V	VI	VII
1	2	3	4	5	6	7	8
167	Close valves	-	-	-	28	46	41
168	Open valves	13	19 62	19		19,30, 31,44	-
169	Close cocks on mixer	67				29	

170. Fill the pipe line with water. While filling, blow it by opening cocks mounted on wash-basins in turn.

171. Using the pump, build up a pressure of 1,25 kgf/cm^2 and check the pipe joints for tightness from valves 13, 19 to cocks 11, 47 and mixer 67 and from valve 30 to mixer 29.

172. Shut valves 13, 19, 31.

173. Using the pump, build up a pressure of 12,5 kgf/cm^2 and test the pipe joints and fittings for tightness.

174. The test being over, discharge water from the pipe line, disconnect the pump and fit valve 62 with a screw plug.

175. Detach the pipe from valve 73 and connect the pump to the latter.

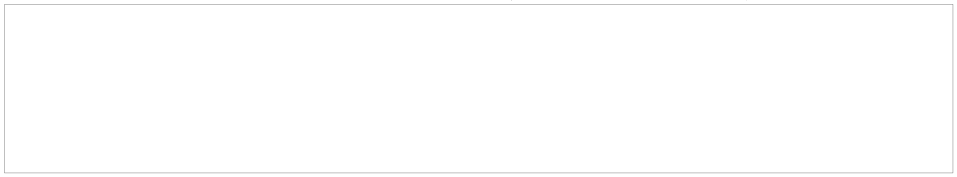
176. Open valves 73, 68 and fill the pipes with water up to mixer 67. When filling the pipes they shall be ventilated through mixer 67.

177. Using the pump, build up a pressure of 1.25 kgf/cm^2 and check the pipe joint for tightness from valve 68 to mixer 67.

178. Close valve 68.

179. Using the pump, build up a pressure of 12.5 kgf/cm^2 and test the pipe joints and fittings for tightness.

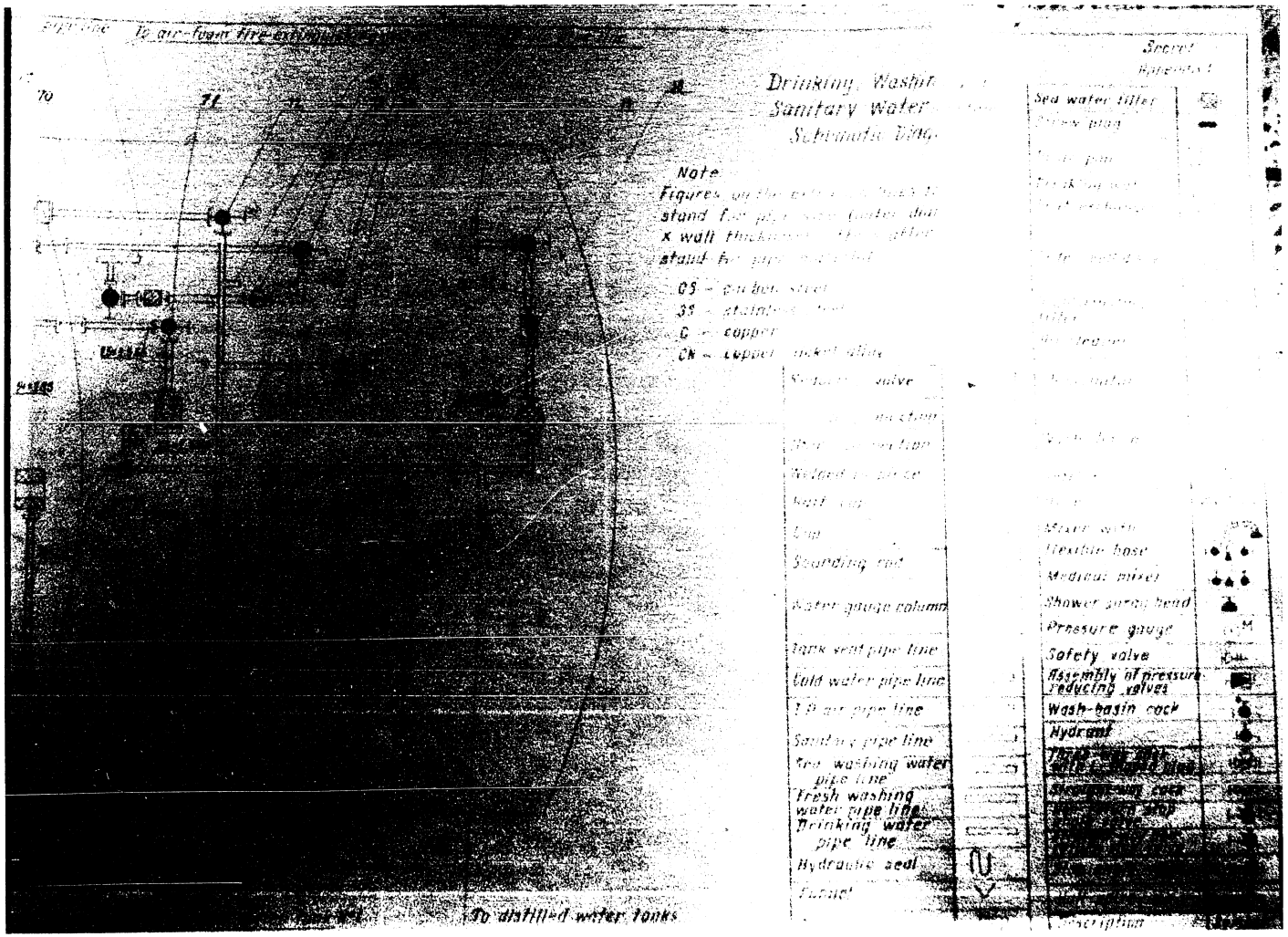
180. The test being completed, discharge water, disconnect the pump and connect the pipe to valve 73.



50X1-HUM

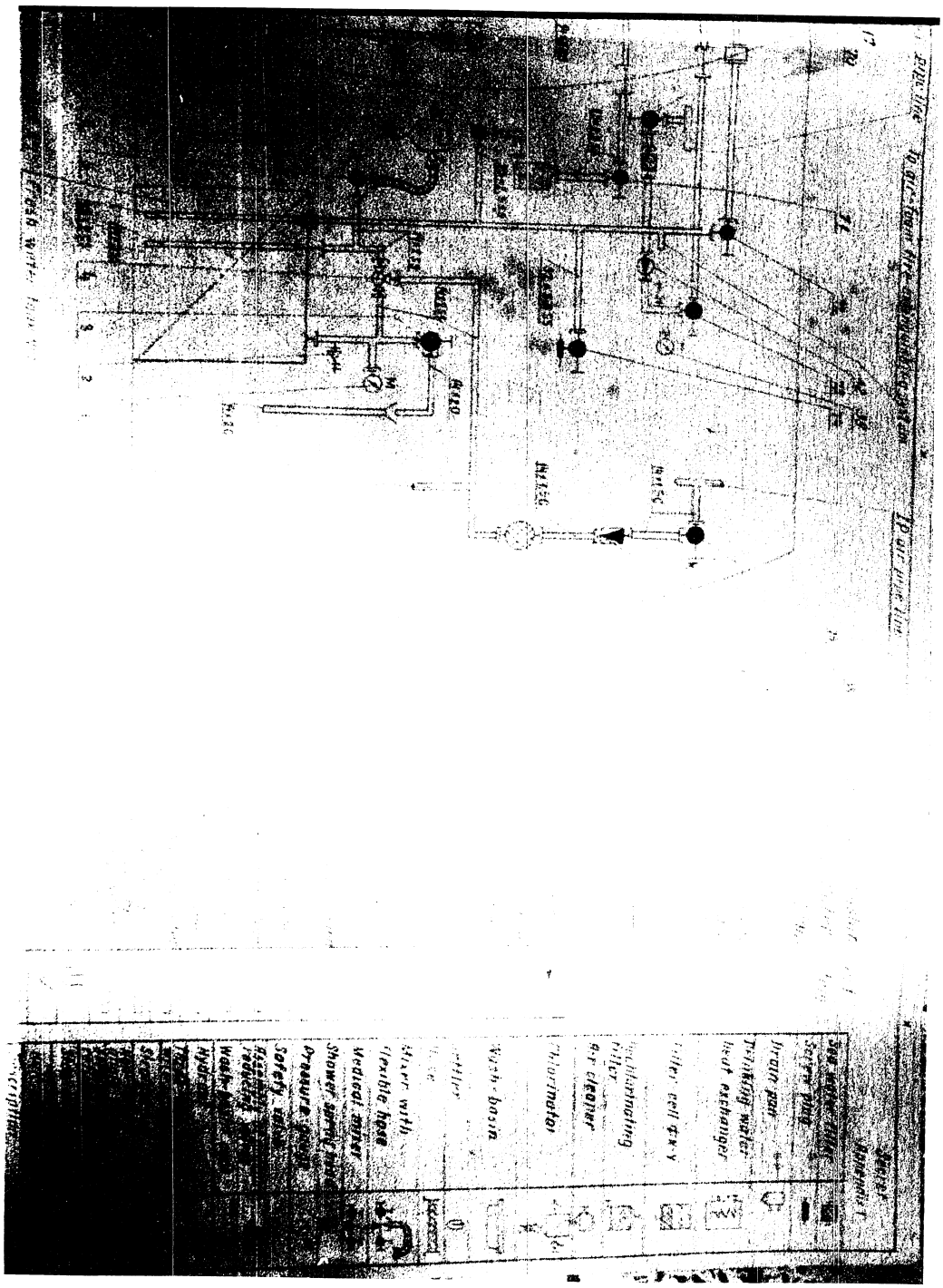
APPENDICES

50X1-HUM



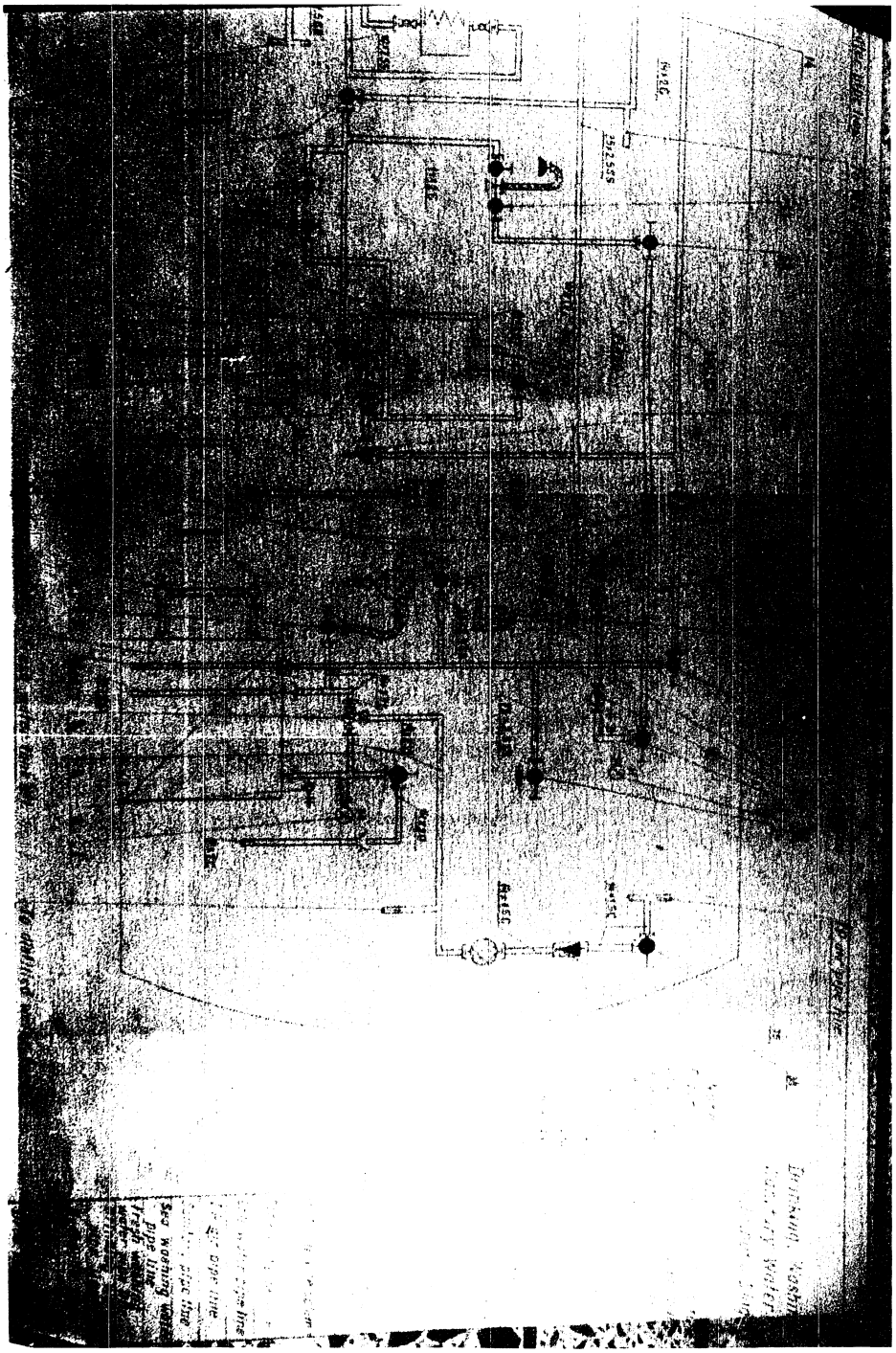
Sanitized Copy Approved for Release 2011/08/04 : CIA-RDP82-00038R002100060001-3

50X1-HUM



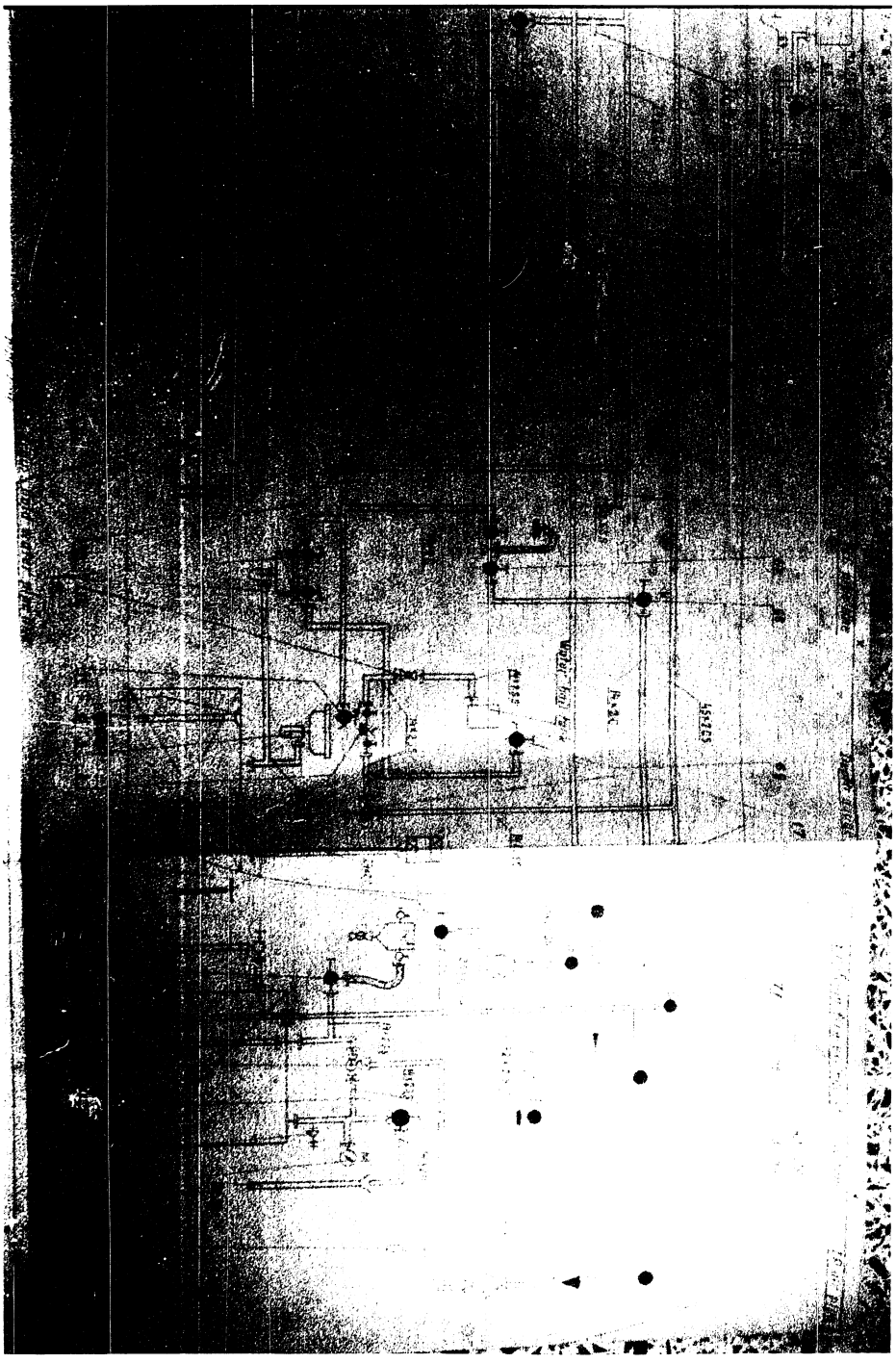
50X1-HUM

50X1-HUM



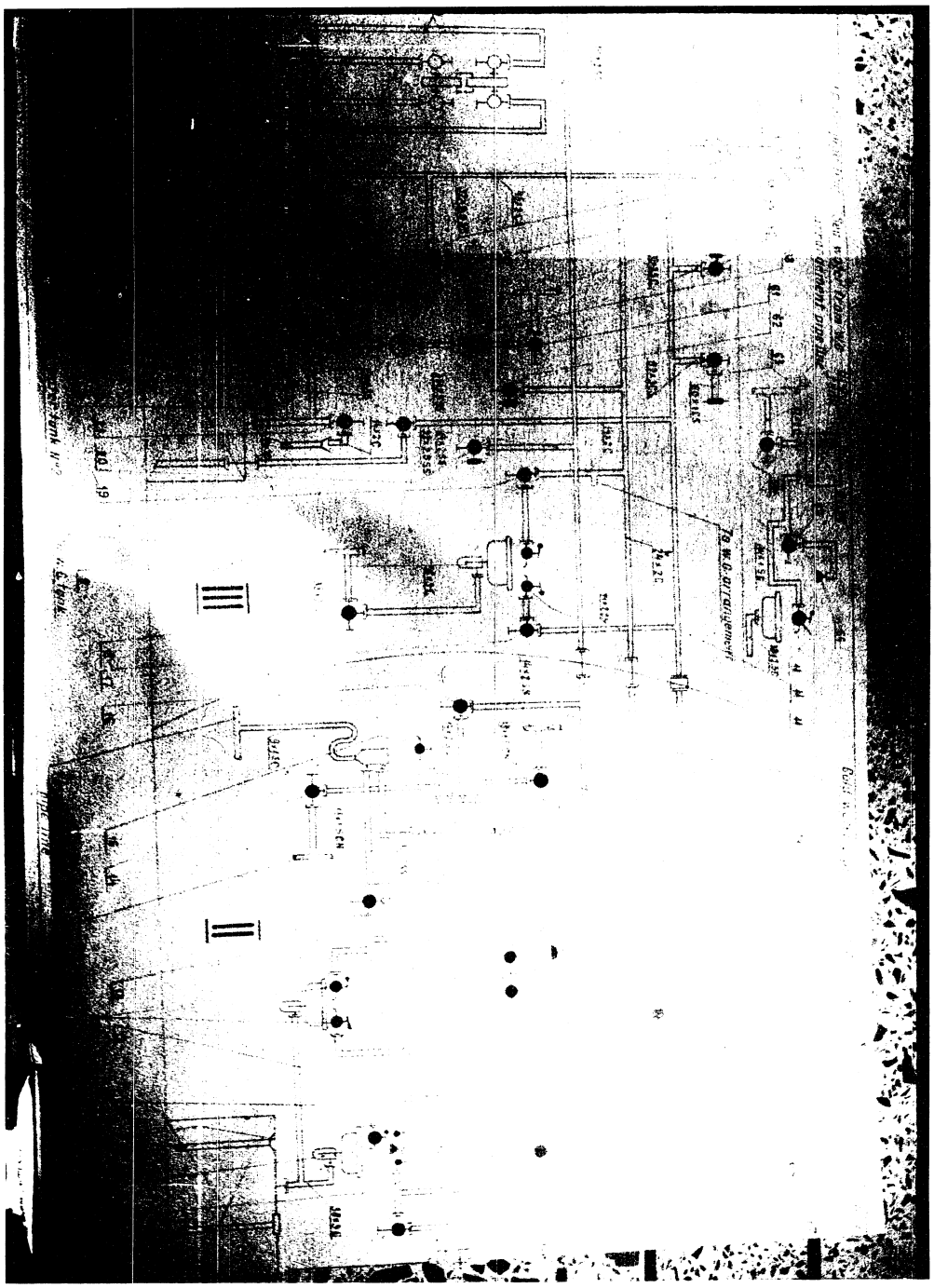
50X1-HUM

50X1-HUM



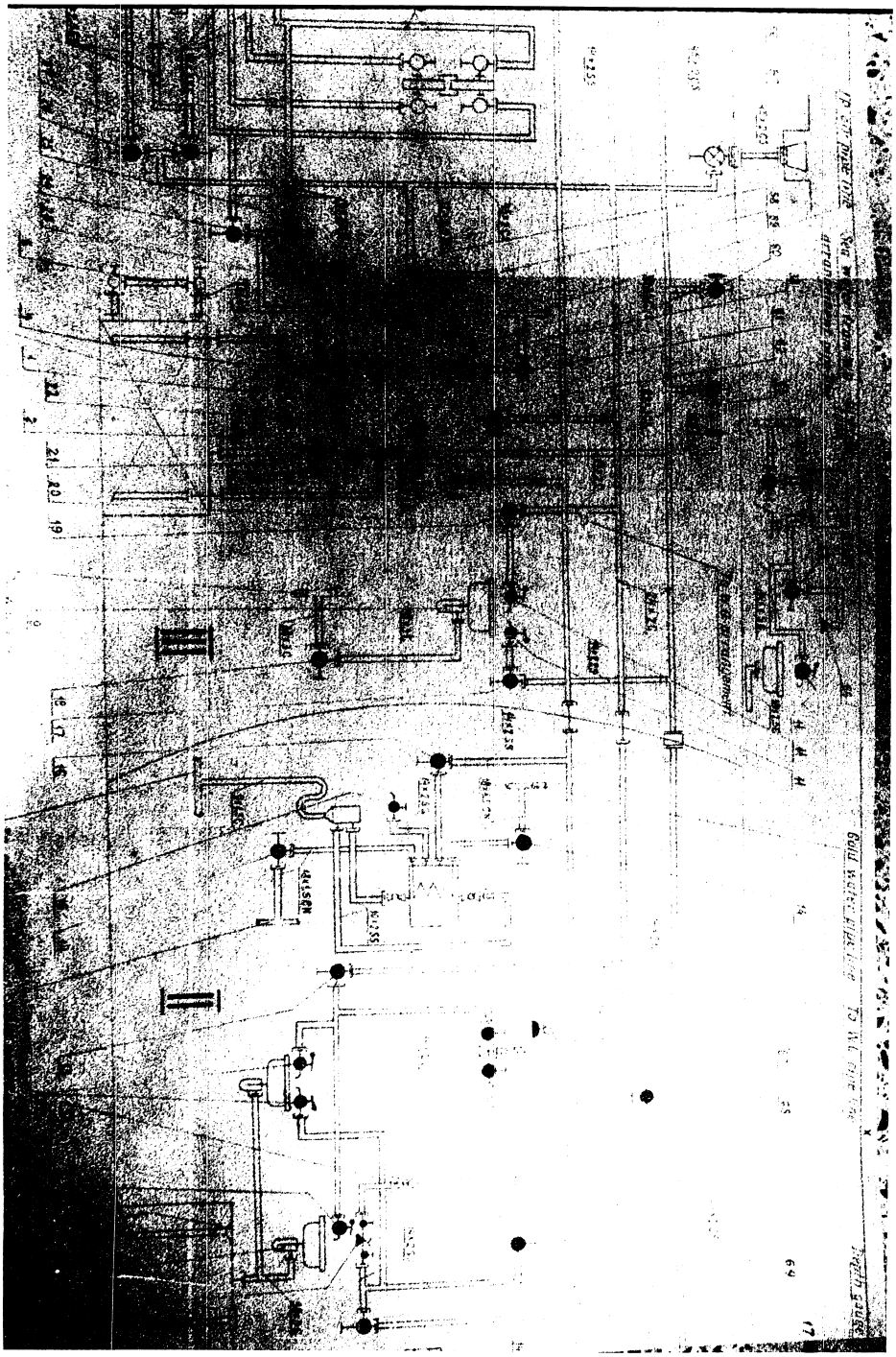
50X1-HUM

50X1-HUM



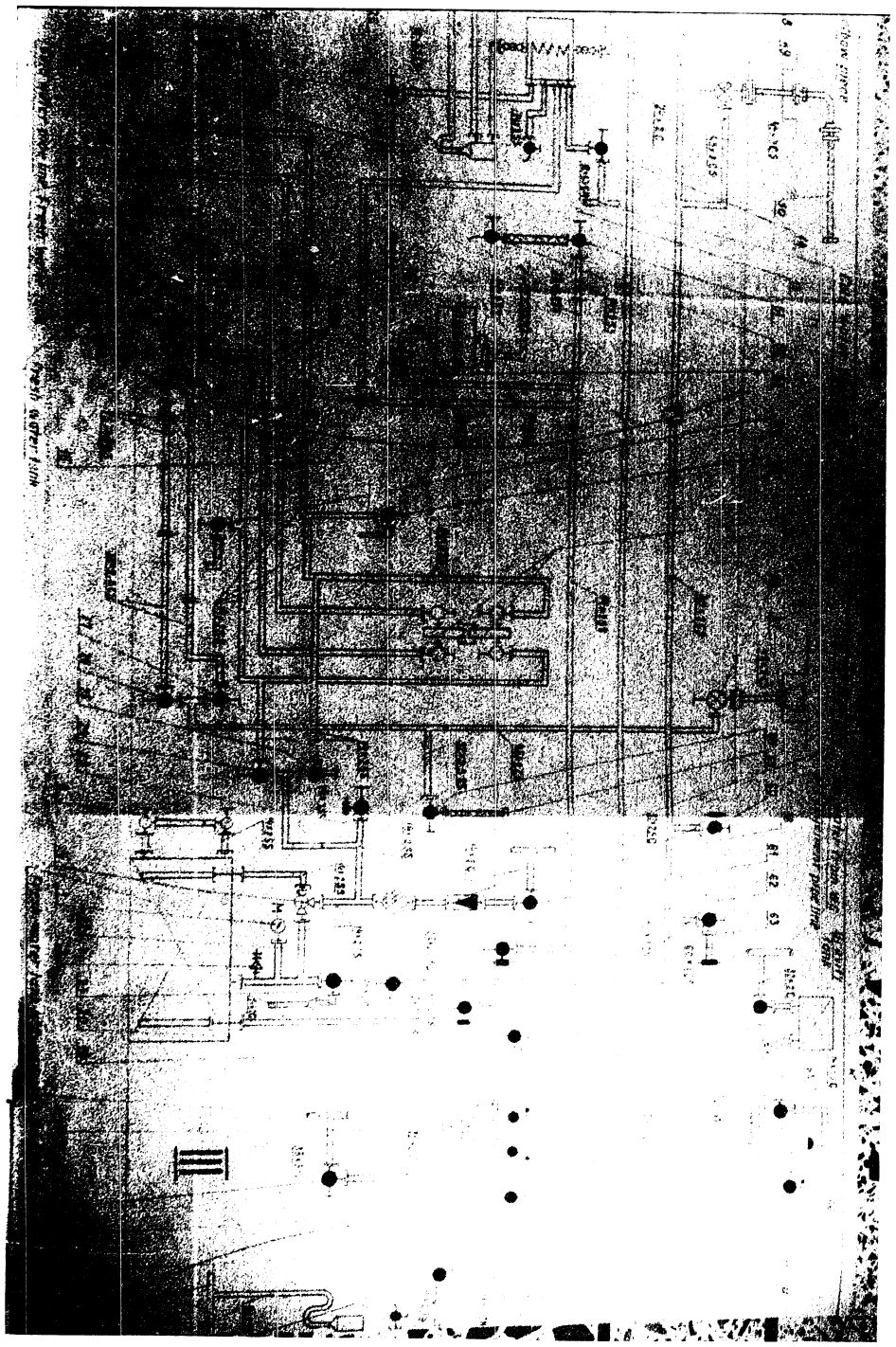
50X1-HUM

50X1-HUM



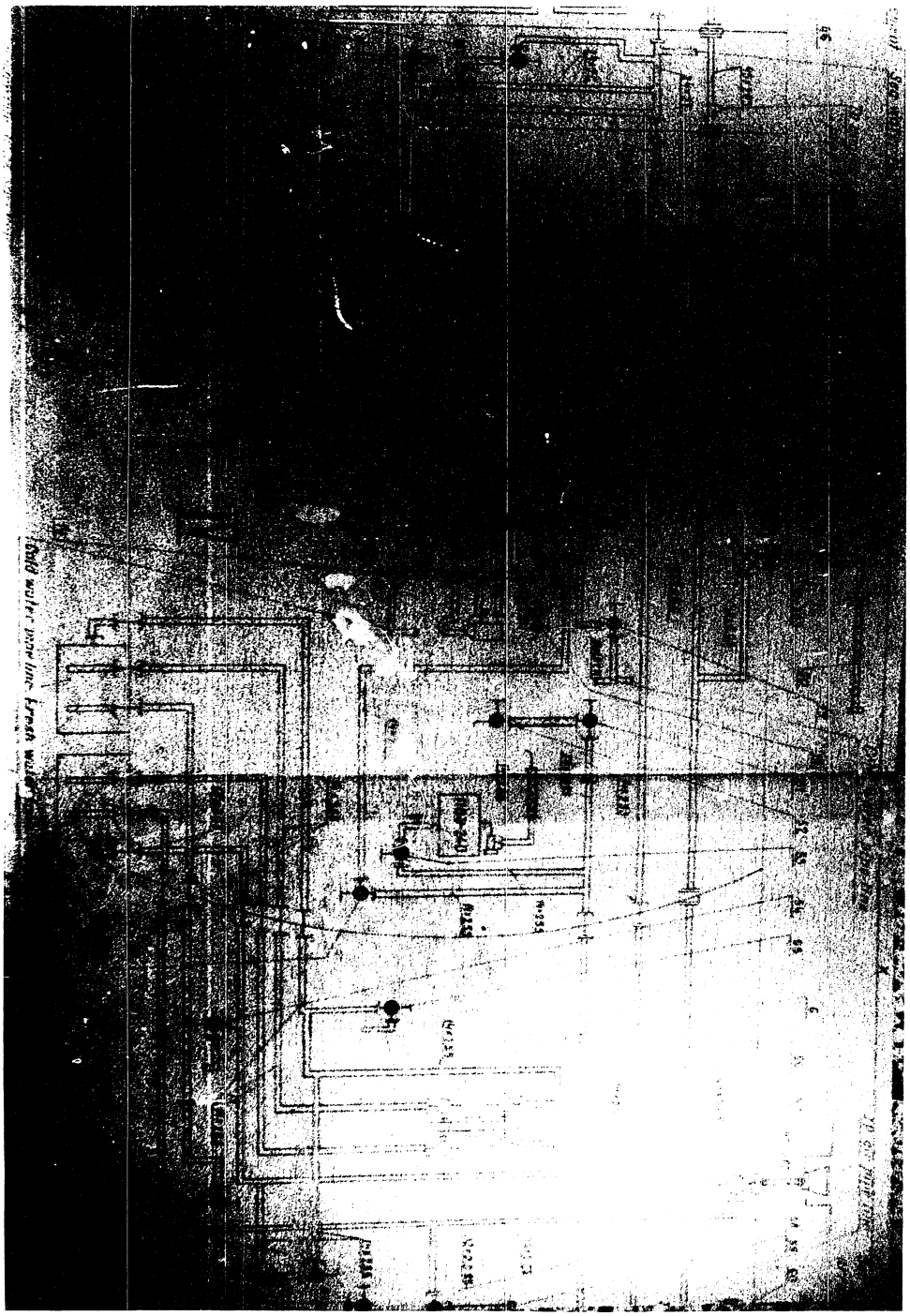
50X1-HUM

50X1-HUM



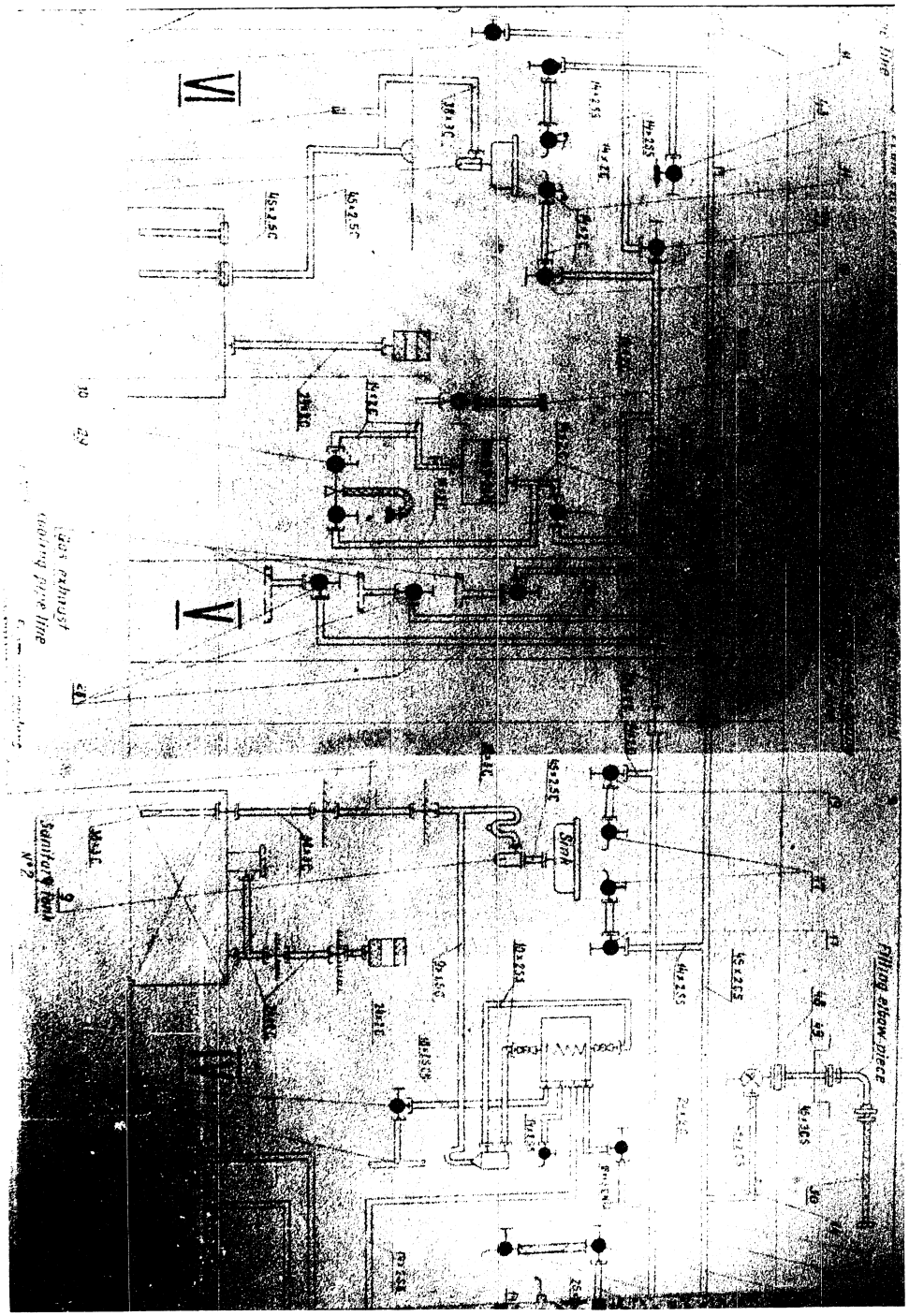
50X1-HUM

50X1-HUM



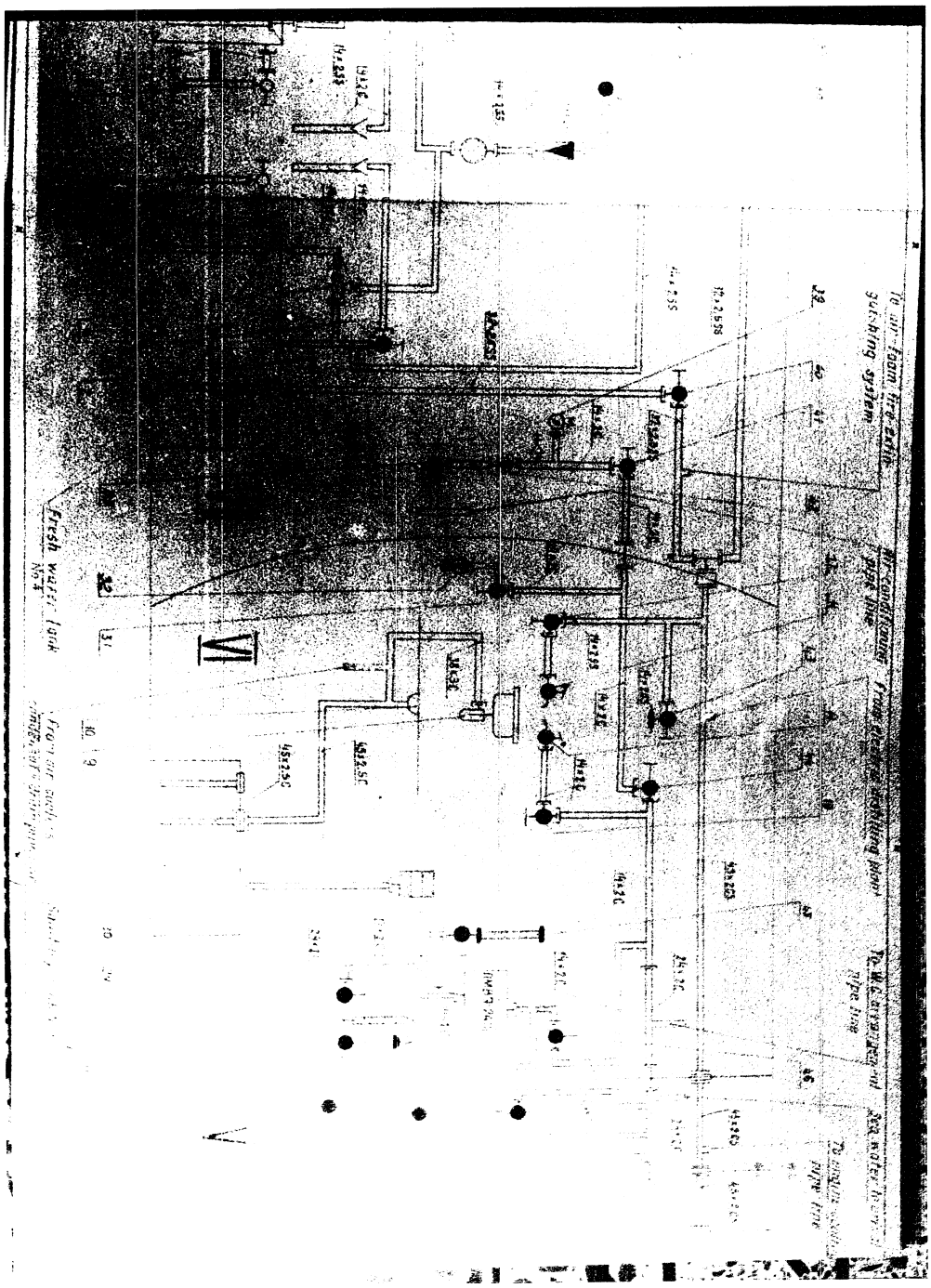
50X1-HUM

50X1-HUM



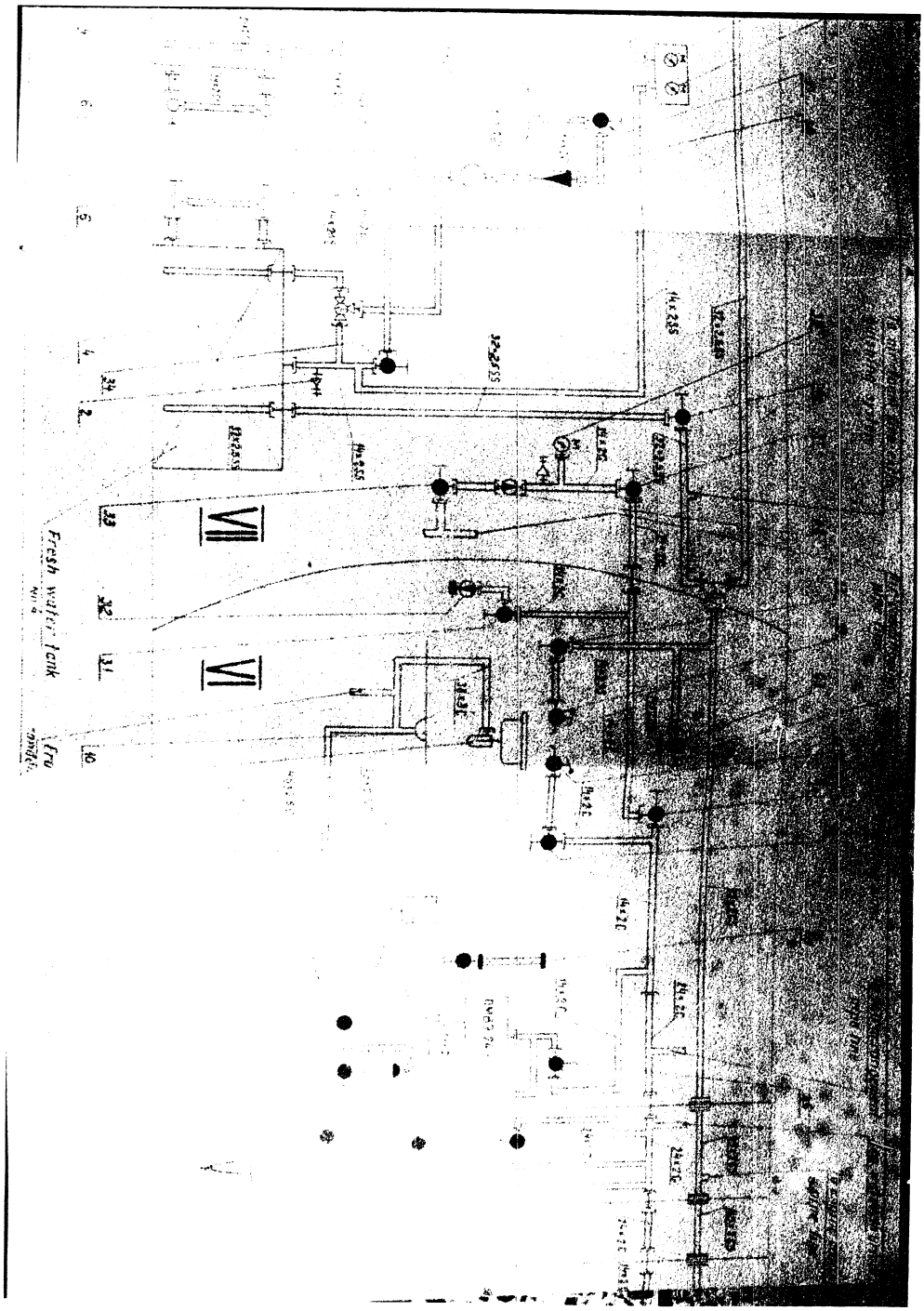
50X1-HUM

50X1-HUM



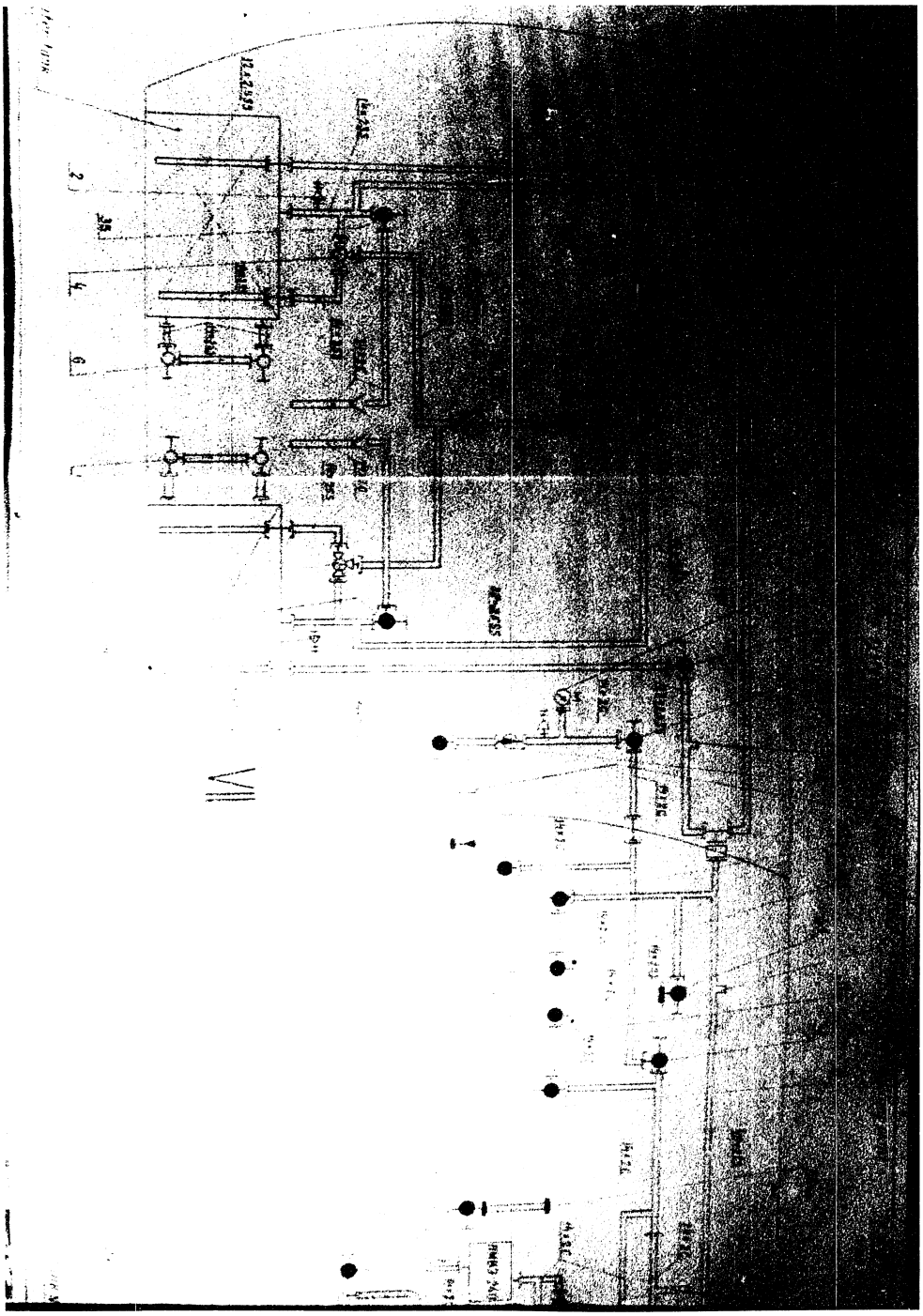
50X1-HUM

50X1-HUM



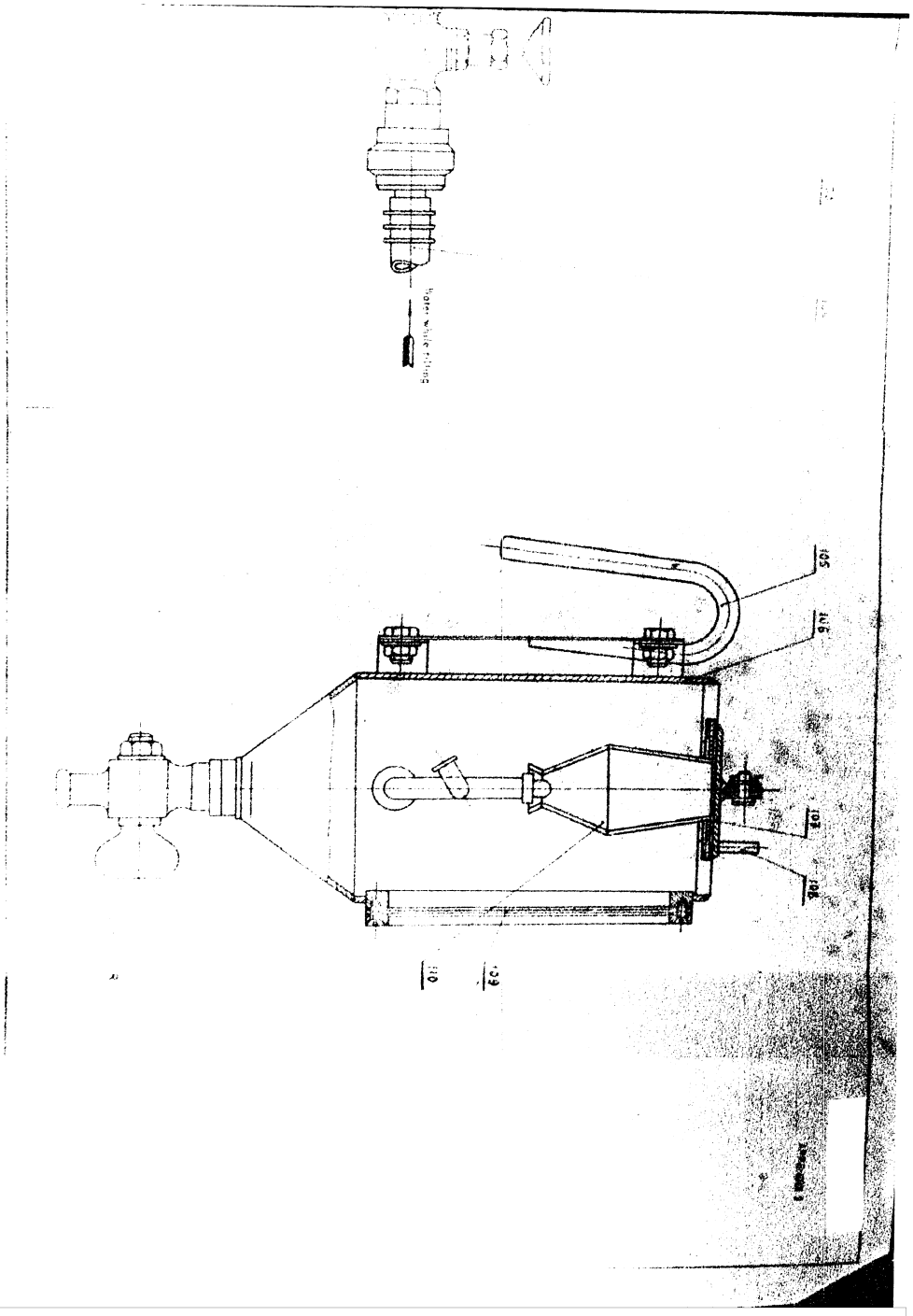
50X1-HUM

50X1-HUM



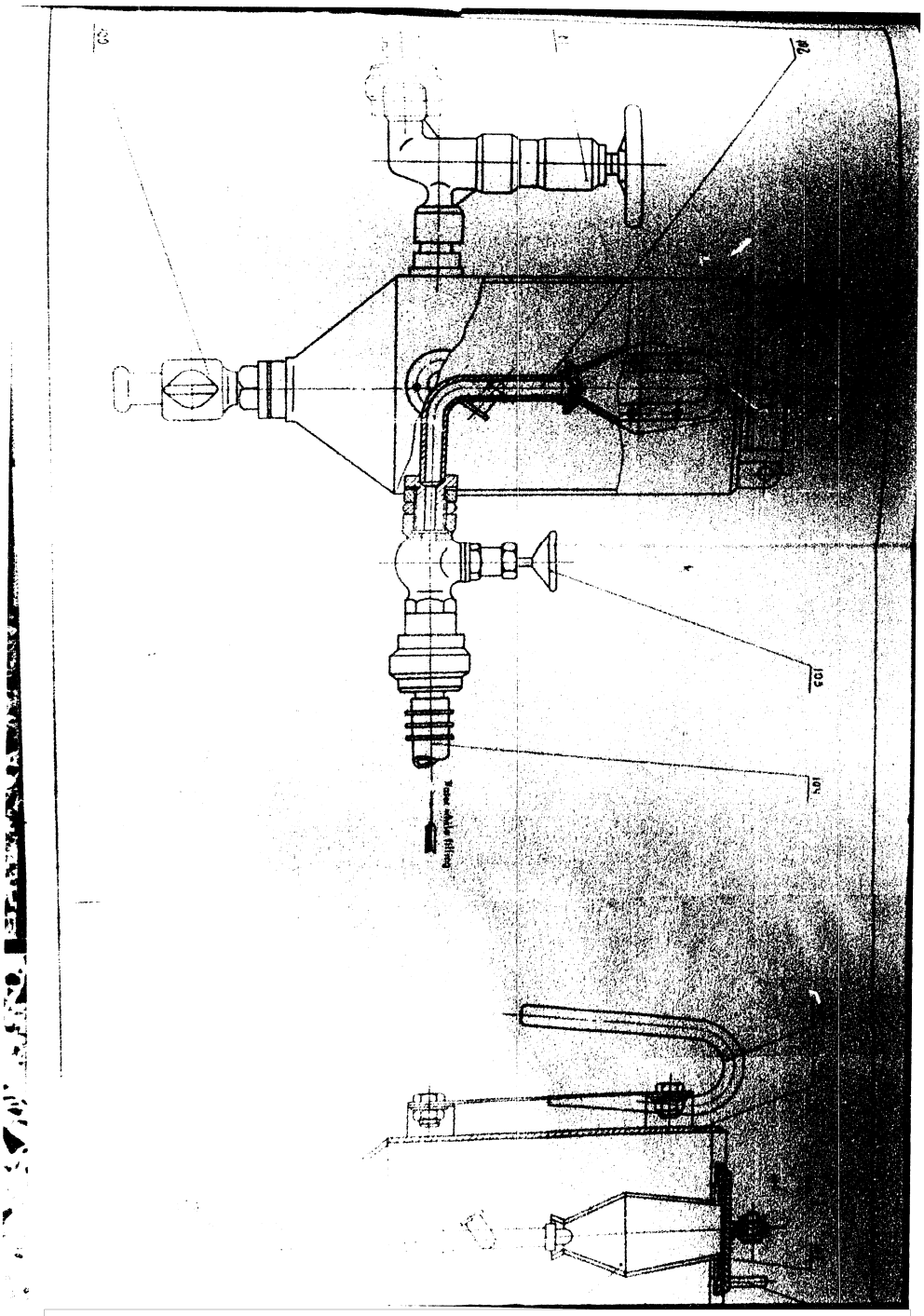
50X1-HUM

50X1-HUM



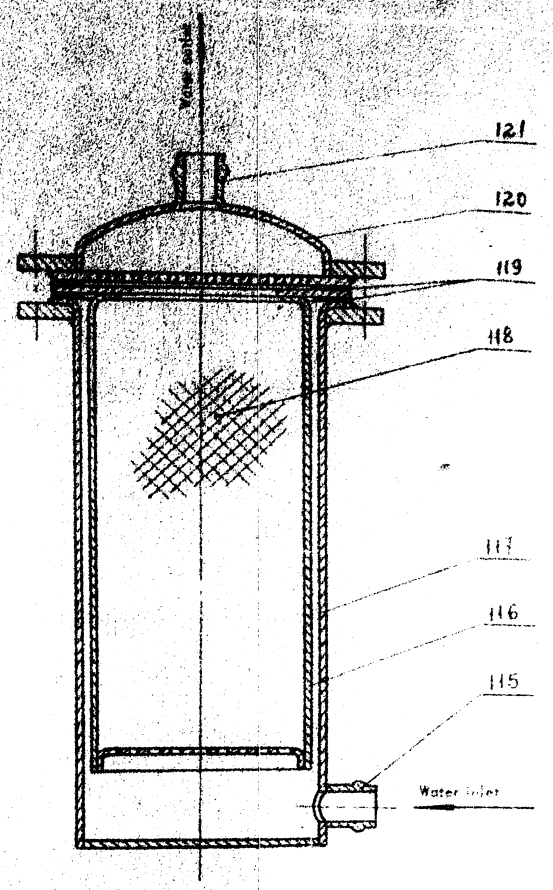
50X1-HUM

50X1-HUM



50X1-HUM

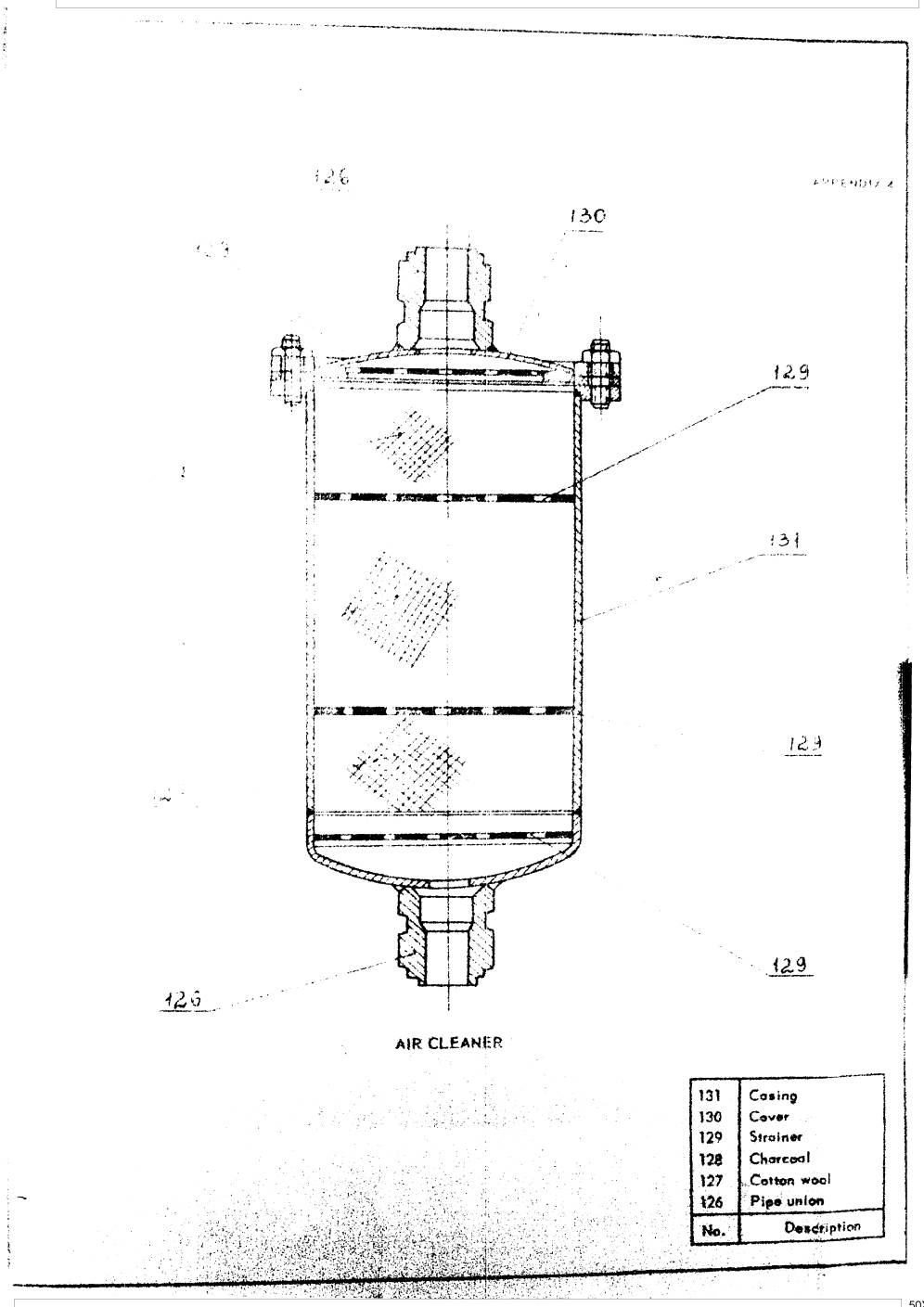
APPENDIX 3



DECHLORINATING FILTER

No.	Description
121	Pipe union
120	Cover with strainer
119	Gasket
118	Charcoal
117	Filter casing
116	Filter cell
115	Pipe union

50X1-HUM

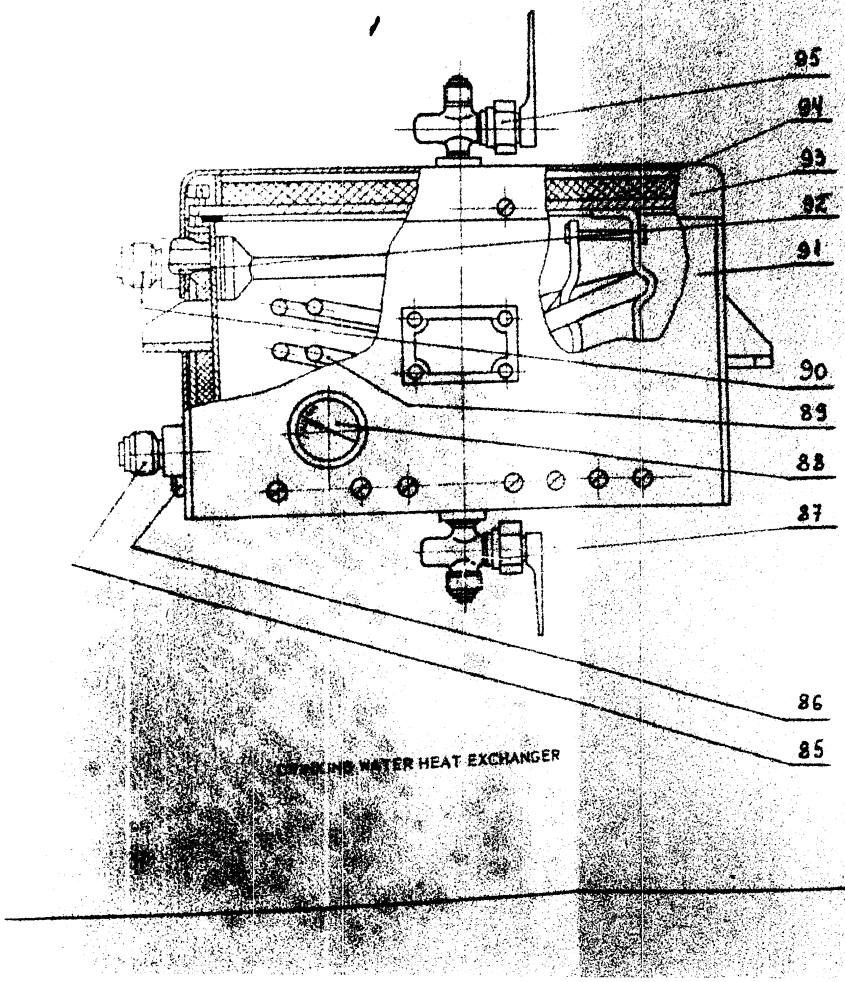


AIR CLEANER

No.	Description
131	Casing
130	Cover
129	Strainer
128	Charcoal
127	Cotton wool
126	Pipe union

50X1-HUM

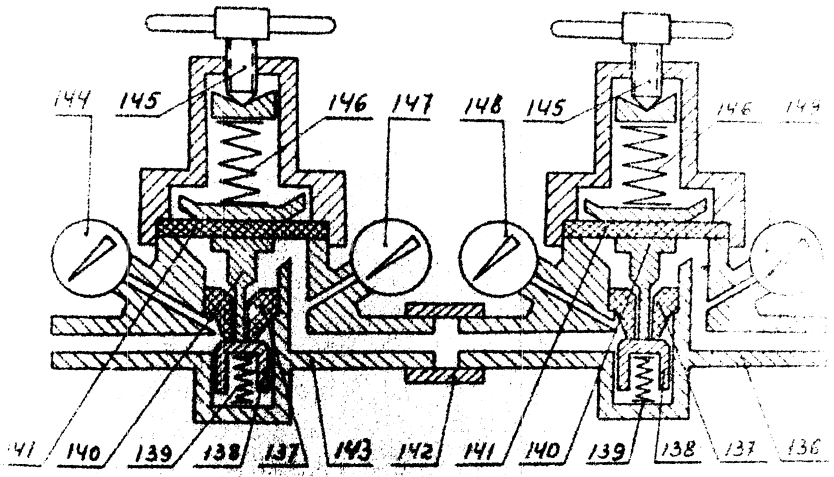
APPENDIX 5



COOLING WATER HEAT EXCHANGER

No.	Description
95	Vent cock
94	Insulation
93	Cover
92	Drinking water intake pipe union
91	Casing
90	Cooling water outlet pipe union
89	Coil pipe
88	Temperature gauge
87	Drain cock
86	Drinking water outlet pipe union
85	Cooling water intake pipe union

APPENDIX 6



ASSEMBLY OF AIR-PRESSURE REDUCING VALVES

No.	Description
149	Pressure gauge
148	Pressure gauge
147	Pressure gauge
146	Spring
145	Screw
144	Pressure gauge
143	Pressure-reducing valve
142	Connection pipe
141	Diaphragm
140	Tappet
139	Spring
138	Valve
137	Seat
136	Pressure-reducing valve

50X1-HUM

Описание и инструкция по обслуживанию
системы питьевой, мытьевой
и сточной воды
ИБ01-476-198
(на английском яз.)
3/32170

37

50X1-HUM

AIR-CONDITIONING COLD AND SEA WATER SYSTEM

Description and Maintenance Instructions

И641-А76-199

CONTENTS

The Book contains 24 pages and 1 inset between pages 22 and 23.

1
7

DESCRIPTION

A. PURPOSE AND BASIC SPECIFICATIONS

The air-conditioning cold and sea water system is designed:
To supply the water cooled in the refrigerating plant evaporator air coolers. In addition, the cold water is supplied to the heat ...ers for cooling the drinking water in compartments II and IV and ...oler of after gyrocompass ГК-1 in compartment VII.
To supply sea water to the air coolers.
To supply sea water to the refrigerating plant condenser.

...e: The terms used in the description and instructions for the pipe lines are:
cold water - the water cooled in the refrigerating plant evaporator and supplied to the air coolers;
warm water - the water supplied from the air coolers to the refrigerating plant evaporator;
sea water - the water supplied from the sea to the air coolers and the refrigerating plant condenser;
warm sea water - the water transferred from the air coolers and the refrigerating plant condenser.

...r-conditioning cold and sea water system includes:
...frigerating plant;
...d water pump;
...denser pump;
...and sea water pipe lines with fittings.
...frigerating plant installed in the air-conditioning room of com... is designed to cool the water supplied to the air coolers.
...frigerating plant consists of:
...mpressor-condenser unit.
...aporator-receiver unit.
...tomatic devices.

...e: For the description of the refrigerating plant units and automatic devices see Refrigerating Plant СПМХМ-ФУ-9С. Description and Maintenance Instructions.

...e cold water pump is designed to supply the cold water from the ...ting plant evaporator to the air coolers.
...e condenser pump is designed to deliver sea water to the refri... plant condenser.
...th the cold water pump and the condenser pump are installed in ...-conditioning room of compartment IV.

...te: For the description of the pumps see Pump НЦВ 40/15. Description and Maintenance Instructions.

The basic specifications of the pipe lines will be found in Table 1

Table 1

Description	Outer diameter by wall thickness of pipes	Material of pipes	Material of fittings	Remarks
2	3	4	5	6
Cold water pipe	90 x 5 55 x 3 45 x 2.5 38 x 3 32 x 3 24 x 3 22 x 3 14 x 2 9 x 1.5 6 x 1.5	Copper-nickel alloy	Bronze, brass	
Sea water pipe	90 x 5 55 x 3 45 x 2.5 38 x 3 32 x 3 14 x 2 6 x 1.5	Copper-nickel alloy	Bronze, brass	
3 Condensate drain pipe of air coolers	22 x 3 14 x 1.5	Steel	Steel	
4 Air pipe	14 x 2	Copper-nickel alloy	Bronze	
5 Pipes after drain valves, vent valves and safety valve 45	14 x 1.5	Steel	Steel	

The test data of the pipe lines are entered into Table 2 below.

Table 2

No.	Description	Testing pressure	Testing medium
1	2	3	4
1	Cold and warm water, sea water pipes		Water

2	3	4
Sea water pipes between valves 12, 45 and 47	3.0	Water
Sea water pipes in ballast tanks	0.5	Air
Air pipes from intermediate pressure air line up to valve 39	35.0	Air together with intermediate pressure air line
Drain pipes from air coolers, from funnel 25, from drain valves 4, from vent valves 5 and from safety valve 45	By flooding or in operation	

BASIC SPECIFICATIONS OF REFRIGERATING PLANT

1. Index CHMXM-4Y-90
2. Type . . . . . freon, single-stage compressor with condenser cooled by sea water
3. Refrigerating capacity . . . . . 62,000 Cal/hr provided cold water temperature at the evaporator inlet is + 11°C, cold water consumption is 30 cu.m/hr, the temperature of sea water supplied to the condenser is +28°C, sea water consumption for cooling the condenser is 30 cu.m/hr and compressor speed is 1450 r.p.m.

Operation of the refrigerating plant at sea water temperature above + 28°C guaranteed.

4. Refrigerant . . . . . Freon 12
5. Power consumption . . . . . 23 kW ± 5%
6. Weight of refrigerant (Freon 12) in the system . . . . 300 kg

BASIC SPECIFICATIONS OF COLD WATER PUMP AND CONDENSER PUMP

1. Index HHB-40/15
2. Type . . . . . vertical, centrifugal, single-stage, driven direct from electric motor
3. Output . . . . . 15 - 40 cu.m/hr
4. Pressure head . . . . . not less than 15 m of water
5. Suction pressure . . . . . 0 - 32 kgf/cm^2
6. Pump speed . . . . . 3000 r.p.m.
7. Pump shaft power . . . . . not more than 3.5 kW

B. DESCRIPTION OF INDIVIDUAL UNITS
(See Appendix No. 1)

The air-conditioning cold and sea water system consists of:

1. Cold water pipe line designed to supply the water cooled in the refrigerating plant evaporator to the air coolers.

2. Sea water pipe line designed to deliver water to the refrigerating plant condenser, air cooler BOГ-80 in compartment IV, air coolers 15 MBOO and BOГ-2C in compartment V and to air cooler BOГ-20 in compartment VII.

COLD WATER PIPE LINE

The cold water pipe line comprises a cold water mains and a wa... water mains. The mains run along the whole length of the submarine. C... nected in parallel to the mains are the air coolers and the heat exchange... designed for cooling the drinking water in compartments II and IV and t... cooler of after gyrocompass ГИ-1 in compartment VII.

The total number of the air coolers and their arrangement in com... partments are given in Table 3.

Table

Air coolers	Number of air coolers connected in compartments							
	I	II	III	IV	V	VI	VII	Total number
BOГ-30		1				1	1	3
BOГ-20			1					1
BOГ-12,5				2				2
BOГ-8		1		2				3
BOГ-3	1					1		2
15MBOO			1					1
10MBOO					1			1
Total	1	2	2	4	1	2	1	13

The cold water circulates in closed circuit. The circulation is effected by the cold water pump.

Used in the circuit as a cooling agent is sea water.

The cold water pump [illegible] water to the refrigerating plant evaporator where it is cooled down to 6-8°C and then through valve 52, throttle plate 51 of low [illegible] through 53 it is fed to the cold water mains.

From the mains the [illegible] along the branch pipes through valves 1 to the air [illegible]

...ter the air coolers the warm water flows through valves 3 to the ... water mains and through valves 11 and 13 returns to the cold water ...

...cold water pipe line is connected with the sea water pipe line ... compensating unit.

...compensating unit serves for replenishing the cold water pipe ... sea water through reducing valve 47 in case of leakage or when ... of water in the pipe line decreases due to temperature drop ... for bleeding water through safety valve 45 when the volume of ... in the pipe line increases due to temperature rise. Reducing ... adjusted for a pressure of 2 kgf/cm^2 while the safety valve is ... a pressure of 2.7 kgf/cm^2.

... WATER PIPE LINE

...sea water pipe line is installed in compartments IV, V and VII. ...pe line in compartment IV ensures supply of sea water to the ...g plant condenser and air cooler BOΓ-80.

...sea water is drawn through intake sea valve 41, filter 37 and ... the condenser pump and through valve 40 is delivered to the ... After the condenser the water is discharged through valve 14 ... sea valve 15 overboard.

...nected in parallel to the condenser is air cooler BOΓ-80 to which ... water is supplied through valves 33 and 34 and drawn off through ... The air cooler is switched on only when the submarine is ...d to the atmosphere.

...he discharge end of the condenser pump pipe line has a connection ... 18 through which the water from the pump may be supplied to ... line cooling pipe and to the air coolers in compartment V when ...marine runs submerged at an endurance speed.

...pipe line in compartment V is designed to supply sea water to ...-20 and two air coolers with axial flow blowers ... water through valves 21 and 29 enters the air coolers and ... valves 24, 28, valve 23 and drain sea valve 19 it is ... board.

The pipe line in compartment VII ensures supply of sea water to ...cooler BOΓ-20.

The sea water from the cooling pipe of the oil cooler of the ...ydraulic system is passed through valve 27 to air cooler BOΓ-20 and ...hen through valve 26 it is drawn to the drain cooling pipe of the oil ...cooler.

The air-conditioning cold and sea water system is employed under two operating conditions:

(a) During Submerged Run of Submarine

The cold water is supplied from the refrigerating plant evaporator by the cold water pump to the air coolers in compartments I - VII.

7
7 7

[redacted] water through the refrigerating [redacted]
[redacted] supplying water to the cooler [redacted]
[redacted] circulating pump is inoperative, the sea [redacted]
[redacted] in compartment V as well as [redacted]
[redacted] is delivered from the condenser pump
[redacted] the sea water is supplied to two air coolers [redacted]
[redacted] from the shaft line cooling pipe.
[redacted] air cooler 30T-20 is inoperative and [redacted]

[redacted] Run of Submarine and in Snorkeling

[redacted] on the refrigerating plant evaporator is [redacted]
[redacted] pump to the air coolers in compartments I [redacted]
[redacted] in the recess of compartment V.
[redacted] pump forces the sea water through the condens[redacted]
[redacted] the submarine to the atmosphere also through [redacted]

[redacted] water is supplied.
[redacted] coolers 30T-30, 30T-5 in compartment VI a[redacted]
[redacted] VII from the shaft line cooling pipe through the [redacted]
[redacted] with valve 31, with shut-off valve 30 being closed;
[redacted] air coolers 15MB00 in compartment V;
[redacted] air cooler 30T-20 in compartment VII.

When the refrigerating plant is inoperative, the water to the air [redacted] connected to the cold water pipe line is delivered by the cold w[redacted] from the sea.

In this case the compensation unit is disconnected, i.e. valves [redacted] are closed.

To adjust the water supply to the air coolers or to completely [redacted] the air coolers from the system, provision is made for valve[redacted] 24, 26 - 29, 32 and 33, installed on the inlet and outlet pipes of [redacted]

The required refrigerating capacity of the air coolers is obt[redacted] maintaining the temperature difference of the cold and sea water at the [redacted] inlet and outlet equal to 2 - 3°C.

To check the operation of the air coolers thermometers [redacted] are [redacted] the warm water pipes after the air coolers. The operation [redacted] refrigerating plant evaporator is checked by means of thermometers [redacted] and the functioning of the refrigerating plant condenser is [redacted] by means of thermometers 17 and 43.

To protect the evaporator from freezing, installed on the [redacted] pipe line are

(1) low water cut-out switch PPK-80MII that regulates the air [redacted] water flowing through the evaporator, stops the refrigerating plant [redacted] compressor as soon as the water supply is reduced (less than 15 cu.m/[redacted] discontinued at all and switches on the alarm system. The low wat[redacted] cut-out switch makes it possible to start the compressor only when [redacted]

8

50X1-HUM

... through the evaporator ... for the switch ... ential safety thermostatic ... with a thermal bulb in ... pipe between the evaporator ... valve 52 which stops the ... as the water temperature ... 2°C and at the same ... on the alarm signal.

... the temperature of the ... within the rated limits ... made for the operating thermostatic switch with a thermal ... in the pipe between the refrigerating plant evaporator and ...

... operating thermostatic switch starts the refrigerating plant com... temperature of the water leaving the evaporator equal to ... stops the compressor at a temperature of $6^{\circ}\pm0.5^{\circ}C$.

... water and sea water pipe lines of the air-conditioning ... filled from sea by means of the condenser pump. The air from ... is released through vent valves 6.

... draining the pipe lines the water is drained into portable ves... compartments II and IV, and in the other compartments, into the ... through valves 4 with vent valves 5 kept open.

... draining the condensate condensed from the air provision is ... drain pipes connected to the condensate receiving tray of the air ...

... compartments IV and VI the condensate is drained from the air ... to the sanitary pipe line of the drinking, washing and contaminated ... and further to the sanitary tanks, and in other compartments, direct... the bilge.

To prevent odours from infiltrating into the compartments from the ... tanks, the drain pipes running from funnel 25 and from the con... receiving trays in compartment IV are provided with hydraulic ...

To ensure the removal of the condensate from the air coolers instal... on the exhaust pipes of the compartment ventilation system, the drain ... of the air coolers are also provided with hydraulic seals. The hydraulic seal does not permit the air to be sucked in and thus ensures ... drainage of the condensate.

The cold and sea water pipes are coated with heat-insulating material ФС-72 which protects the pipes from sweating.

The refrigerating plant and the pumps are installed on shock absorbers damping the vibrations and absorbing the noise produced during their operation. With the same aim in view the pipes running to the refrigerating plant condenser, the suction and discharge branch pipes of the pumps are connected through shock absorbing branch pipes 10.

The discharge pressure of the cold water pump and condenser pump is measured by means of [illegible] gauges 8 and 35 provided with a red mark at the level of 30 [illegible].

To make it possible [illegible] the pressure gauges from the pumps under repair or [illegible] near pressure gauge 8 is provided with valve 9 and [illegible] gauge 35, with valve 38.

50X1-HUM

To guard hull intake sea valve 41 against corrosion provision is made for a protector installed on the pipe between sea valve 41 and strainer 37.

C. CONTROL INSTRUMENTS

Table 4

	Purpose, name and type of instrument	Type of indicating instrument and scale	Rated value	Installed
		4	5	6
	Toluene thermometer TC-4 for measuring the temperature of cold water flowing from evaporator	Toluene thermometer TC-4 with scale 0 -100°C and scale division value equal to 1°C	Cold water 9 - 12°C	On water pipes of air cooler
	Toluene thermometer TC-4 for measuring the temperature of cold water flowing from evaporator	Same	6 - 9°C	On pipe of cold water outlet from evaporator
	Toluene thermometer TC-4 for measuring the temperature of warm water flowing to evaporator	Same	9 - 12°C	On pipe of warm water inlet to evaporator
	Toluene thermometer TC-4 for measuring the temperature of warm sea water flowing from condenser	Same	<33°C	On pipe of warm sea water outlet from condenser

1	2	3	4	5	6
5	43	Toluene thermometer TC-4 for measuring the temperature of sea water entering condenser	Toluene thermometer TC-4 with scale of 0 - 100°C, and division value equal to 1°C	<30°C	On pipe of sea water inlet to condenser
6	8	Pressure gauge for measuring the pressure of warm water supplied to evaporator	[illegible] - 100S 0 - 40 kgf/cm², division value equal to 1 kgf/cm²	<30 kgf/cm²	On discharge branch pipe of cold water pump
	35	Pressure gauge for measuring the pressure of sea water supplied to condenser	Same	<30 kgf/cm²	On discharge branch pipe of condenser pump

II. MAINTENANCE INSTRUCTIONS

A. GENERAL SUPERVISION AND UP-KEEP

1. During service of the air-conditioning cold and sea water system keep the fittings and pipe lines in good repair, see to it that they are reliably attached to the hull structural members.

2. When the system is in service:

(a) keep the pipe lines and fittings in the condition of constant readiness for use;

(b) take care to keep the pipe lines and fittings watertight giving special attention to the outboard fittings, flange and pipe union connections, shock absorbing branch pipes; if leakage is detected in the pipe union and flange connections and gland seals, eliminate it;

(c) exercise care that the valves and sluices are easily accessible never obstruct the passage to the fittings;

(d) open the valves of the pipe lines under pressure smoothly;

(e) periodically lubricate the friction parts of the fittings;

(f) tighten up and repack the glands of the fittings as required.

3. The pressure gauges and safety valve should be in good repair and sealed; once a year and in case of false readings or damaged seal the pressure gauges should be removed for checking or replaced by new ones.

4. During service of the air-conditioning cold and sea water system give special attention to the condition of the pipe lines, line protector fittings, to the tightness of the pipe joints and the serviceability of the pressure gauges.

5. During disassembly and reassembly of the pipe lines care should be observed that no foreign matter is allowed to get into them. For this purpose the ends of the disconnected pipes should be plugged. NEVER close the pipe ends with waste cloth or tow since it can get inside the pipe.

6. To avoid damage to the parts during disassembly and reassembly never attempt to use unspecified tools.

7. The separate sections of the pipe line subjected to disassembly should be pressure tested according to Table 2.

B. PREPARATION FOR USE

FILLING THE SYSTEM WITH WATER

8. Check valves 1, 3, 28 and 29 of the air coolers for opening.

[redacted]

...pen the valves on the pipes running to additional consumers
...ective instructions.
...pen intake sea valve 41.
...pen valves 9, 11 - 14, 16, 20 - 24, 26, 27, 30, 32, 33, 34, 36,
...44, 46, 48 - 50 and 52.
...rt the condenser pump.
...ning successively vent valves 5 beginning with the end com-
... the system with water.
... soon as the water shows from the pipes of the vent valves,
...lves 5.
...n drain sea valves 15 and 19.
... the condenser pump operate for 10 - 15 min and release the
...g vent valves 5.
... the system in the initial position.

...AL POSITION

...e water pipe line is filled with water.
...e cold water pump and the condenser pump are stopped.
...ves 1 and 3 are open.
... the other valves are closed.
...ter pipe line is filled with sea water.
...alves 28 and 29 are open.
... the other valves are closed.

...ARATION FOR USE

...pen intake sea valve 41.
...n valve 39 and blow sea valve 41. Close valve 39.
...n drain sea valve 15.
...pen drain sea valve 19.

...STARTING, SERVICING DURING OPERATION AND STOPPING

...ior to starting the air-conditioning system be sure that all the ...ations listed in the above section are performed.

The valves that are to be opened or closed during operation of the ...conditioning system should be set into the initial position after switch... off the system.

[redacted]

17

DURING OPERATION OF THE REFRIGERATING PLANT

When the submarine runs submerged, do the following:

27. Open shut-off valves 22 and 30.
28. Open valves 9, 11 - 14, 23, 36, 38, 40, 46, 48, 50 and 52.
29. Start the condenser pump.
30. Start the cold water pump.
31. Start the refrigerating plant.

Notes: 1. If strainer ФМТ-200Г is to be used, open valves 21 and 24 (see "Ventilation and Air-Conditioning System. Description and Maintenance Instructions".)

2. If the shaft line cooling pump is not used, open valves 18 and 34.

When the submarine runs on the surface and when snorkeling, do the following.

32. Open valves 9, 11 - 14, 20, 23, 26, 27, 31, 36, 38, 40, 46, 48, 50 and 52.
33. Start the condenser pump.
34. Start the cold water pump.
35. Start the refrigerating plant.

Notes: 1. When the ship's ventilation system employs air cooler ВОГ-60 installed in compartment IV, open valves 32, 33 and 34.

2. When the sea water temperature is below +15°C, it is necessary to give correct water supply to the condenser by adjusting valve 40 so as to make the refrigerating plant operate within the preset range of the condensation pressure (see the maintenance instructions for the refrigerating plant).

WHEN THE REFRIGERATING PLANT IS INOPERATIVE

When the submarine runs submerged, do the following:

36. Open shut-off valves 22 and 30.
37. Open valves 9, 11, 16, 23, 44, 48 and 49.
38. Start the cold water pump.

Notes: 1. When strainer ФМТ-200Г is be used, open valves 21 and 24 (see "Ventilation and Air Conditioning System. Description and Maintenance Instructions").

2. If the shaft line cooling pump is not used, open valves 18, 34, 36, 38 and start the condenser pump.

When the submarine runs on the surface and when snorkeling, do the following:

39. Open shut-off valves 22 and 30.

40. Open valves 9, 11, 16, 23, 44, 48 and 49.
41. Start the cold water pump.

Note: When the ship's ventilation system employs air cooler BOP-80 installed in compartment IV, open valves 32, 33 and 18.

SERVICING DURING OPERATION

42. Observe the readings of thermometers 2 on the drain pipes of the coolers and if necessary adjust the temperature difference by means of valves 1, 3, 21, 24, 28, 29, 32 and 33.
43. Watch pressure gauge 35 and pressure gauge 8 to check the pressure of the condenser pump and of the cold-water pump, respectively.
44. Check the opening of the valves in accordance with the operating instructions of the system.
45. Check the indications of low water cut-out switch 53 which should be within the limits of 30 - 34 cu.m/hr. Otherwise adjust valve 52 or 49.
46. Carry out the maintenance of the refrigerating plant, pumps and coolers according to the instructions supplied together with these

AIR-CONDITIONING DAMAGE CONTROL MEASURES

47. In case of failure of the condenser pump the sea water can be supplied to the refrigerating plant condenser from the discharge pipe of the shaft line cooling system.

In this case drain sea valve 15 and valves 14, 18, 34 and 40 should be open.

48. Should the cold water pump be defective, the sea water can be transferred to the air coolers by the condenser pump from the sea. In this case it is necessary to open intake sea valve 41 and drain sea valve 15, to open valves 16, 22, 30, 36, 38, 42, 49 and to start the condenser pump.

SWITCHING OFF THE AIR CONDITIONING

49. Stop the refrigerating plant.
50. Stop the condenser pump.
51. Stop the cold water pump.
52. Shut off hull intake sea valve 41.
53. Shut off hull drain sea valves 15 and 19.
54. Bring the system in the initial position.

DRAINING THE SYSTEM

55. Open all the valves except intake and drain sea valves 41, 15, 19 and valve 39 and bleed the water from the system through drain valves 4.

Note: Prior to draining the system make sure that the shaft line cooling pumps are stopped and the shaft line cooling pipe is drained.

D. MAINTENANCE DURING PROLONGED SHUT-DOWN

56. When the air-conditioning cold and sea water system is not used for a long period of time it is necessary to perform the following operations

(a) drain the water from the pipe lines through the drain valves and open connections located in the lower parts;

(b) blow the pipe lines with compressed air, check the amount of water remaining in the pipe lines and then tighten the connections;

(c) disassemble the sea water strainer, clean it and if necessary replace the straining medium, reassemble and return it into place;

(d) for final drainage of the pipe lines, open the vent and drain valves for 5 days and then shut them off;

(e) coat all the other parts with a film of gun grease.

57. Prior to switching on the air-conditioning cold and sea water system after a long period of idleness, do not fail to do the following:

(a) remove the grease gun with waste cloth wetted in diesel fuel;

(b) work out the valves; disassemble, check, reassemble, adjust and seal the safety valve;

(c) fill and pump the pipe line with water;

(d) check the condition of the glands and if necessary tighten the glands or replace the packing;

(e) check the functioning of the system.

N o t e: The servicing of the refrigerating plant, pumps and air coolers during long period of idleness is carried out according to the instructions supplied together with them.

E. TROUBLES AND REMEDIES

Prior to eliminating the troubles and damage requiring the disassembly of the pipe lines first it is necessary to make sure that they are not under the pressure otherwise it is necessary to shut off the valves, release the pressure and drain the water from the corresponding sections of the pipe line.

7 7

...bable troubles and remedies are listed in Table 5 below.

Table 5

	Trouble	Cause	Remedy
	...kage of gland ...ckings of sea ...lves and valves ...es are not ...ght	Loose nuts tightening gland nuts, wear of gland packing Nonuniform wear or damaged seating of valve disks or saddles	Tighten the gland nuts, replace the gland packing Lap the valve disks
	...sure drop in ...mp suction ...e	1. Clogged hull sea valve 41	1. Shut off valve 36, open valve 39 and blow intake sea valve 41 with intermediate pressure air
		2. Dirty sea water strainer 37	2. Clean straining medium of strainer 37
4	...ky safety ...valve 45	Faulty pressure-reducing valve 47: 1. Loose adjusting spring of pressure-reducing valve 47	Shut off valves 12 and 46, and: 1. Adjust spring and consequently pressure by means of adjusting bush of pressure-reducing valve 47
		2. Broken diaphragm	2. Disassemble pressure-reducing valve 47 and replace diaphragm
5	Leakage through: 1. Flange connections	Loose nuts; stripped thread of bolts, nuts or punctured gasket	Tighten nuts; replace bolts, nuts or pins, replace gasket
	2. Pipe connections	Punctured gasket or loose nut	Replace gasket or tighten nuts

In eliminating troubles and damage to the refrigerating plant, pum and air coolers guide by the maintenance instructions for these units.

N o t e: After correction of the troubles requiring the disassem of the pipe lines, test the pipes for tightness as directed in Table 2.

F. PREVENTIVE MAINTENANCE INSPECTIONS AND REPAIRS

Carry out the preventive maintenance inspections and repairs acco ing to the following directions:

DAILY INSPECTION

58. Make sure that the safety valve and pressure gauges are sea

WEEKLY INSPECTIONS

Perform all the operations of the daily inspection and in addition the following:

59. Inspect the pipe lines, valves and pressure gauges from outs and clean them.

60. Check and work out all the valves of the air-conditioning co and sea water system.

61. Clean and grease the thread of the sea valves and valves.

MONTHLY INSPECTION

Perform all the operations of the weekly inspection and besides t the following:

62. Check the condition of the gland packings of the sea valves an valves and if necessary tighten or repack the glands.

63. Check the functioning of the safety valve by popping.

64. Check the condition and attachment of the rubber-metal welded hoses, flange and pipe connections and pipes. If any joint is loose, tighten it or replace the gaskets.

QUARTERLY INSPECTIONS

Perform all the operations of the monthly inspection and in addition do the following:

65. Every three months and each time before endurance cruise open,

50X1-HUM

... wash the straining medium of the sea water strainer.

... Subject the protector to external inspection, if necessary clean ... from dirt and corrosion products; replace the protector whose ... of wear exceeds 50%.

...ECTION DURING DOCKING

... Disassemble, check, repair and test all the hull sea valves for ... and tightness; replace the gaskets and protector.

...ECTION DURING MAINTENANCE

...form all the operations of the quarterly inspection and in addition ...owing:

Disassemble, check, adjust and seal the safety valve.

Disassemble, check and reassemble and test the hull sea valves. ...ary, disassemble and repair separate valves; replace worn-out ...nd gaskets.

Check the sea water strainer for condition and if necessary re... straining medium.

Test the reassembled cold and sea water pipe line for tightness ...rdance with Table 2.

... Replace the protector.

... Once a year deliver the pressure gauges for check test.

...4. Once a year and after the preventive maintenance repairs in-volving the disassembly of the pipe lines, test the pipe lines for tightness in accordance with Table 2.

N o t e: The preventive-maintenance inspections and repairs of the refrigerating plant, pumps and air coolers should be carried out in accordance with the instructions supplied together with these units.

HYDRAULIC TESTS FOR TIGHTNESS

The hydraulic tests of the pipe lines for tightness are preformed with a hand piston pump.

(1) <u>Cold Water Pipe Line</u>

75. Disconnect the drain pipe from one of drain valves 4 and connect the pump to it.

76. Open valves 1, 3, 9, 11, 13, 22, 30, 48, 49, 50, 52 and check valves 4, 5, 12, 16, 20, 31, 42 and 44 for closing.

77. Open valve 4 to which the pump is connected and fill the pipe with water. Vent the pipe while it is being filled with water by opening vent valves 5 in turn beginning with the end compartments.

78. Use the pump to build up a pressure of 38 kgf/cm^2 in the pipe line and check the pipe joints and fittings for tightness.

79. After the tests release the pressure in the pipe line, shut off valve 4 to which the pump is connected, disconnect the pump from valve 4.

50X1-HUM

Connect the drain pipe to it and drain the water from the pipe line through drain valves 4.

Note: When testing the cold water pipe line for tightness simultaneously test up to the first seals the cooling pipe line of the drinking water heat exchangers in compartments II and IV and the cooling pipe of after gyrocompass ГК-1 in compartment VII for which purpose check the first seals for closing.

(2) Sea Water Pipe Line

Perform the hydraulic tests of the following sections of the sea water pipe line:

(a) sea water pipe line in compartment IV;
(b) sea water pipe line in compartment V;
(c) sea water pipe line in compartment VII.

(a) Sea Water Pipe Line in Compartment IV

80. Disconnect the drain pipe from drain valve 4 and connect the testing pump to it.

81. Open valves 14, 32, 33, 34, 36, 38, 40, 46 and check sea valves 1 and 3 and valves 5, 16, 18, 39, 42 and 44 for closing.

82. Open valve 4 and use the pump to fill the pipe line with water. When the pipe line is being filled with water it is vented through vent valve 5 and valves 42 and 44.

83. Operate the pump to create a pressure of 38.0 kgf/cm^2 in the pipe line and test the pipe joints and fittings for tightness.

84. After the tests are over release the pressure in the line, shut off valve 4, disconnect the pump from the valve, connect the drain pipe to it and drain the water from the pipe line.

(b) Sea Water Pipe Line in Compartment V

85. Release the pressure in the shaft line cooling pipe, disconnect the cooling pipe from valve 21 and connect the pump to valve 21.

86. Open valves 23, 24, 28 and check sea valve 19 and valves 20 and 29 for closing.

87. Open valve 21 and fill the pipe line with water with the help of the pump. When the pipe is being filled with water, vent it by opening valves 20 and 29 in turn.

88. By using the pump build up a pressure of 38 kgf/cm^2 in the pipe line and check the pipe joints and fittings for tightness.

89. After the tests are over release the pressure in the pipe line, shut off valve 21, disconnect the pump from the valve, drain the water from the pipe line and connect the disconnected pipe to valve 21.

(c) Sea Water Pipe Line in Compartment VII

90. Remove the pressure in the oil cooler cooling pipe line of the hydraulic system, disconnect the oil cooler cooling pipe line from valve 27 and connect the pump to valve 27.

91. Check valve 26 for closing.

92. Open valve 27 and fill the pipe line with water with the help of the pump. When filling the pipe line, vent it by opening valve 26.

93. With the help of the pump create a pressure of 38 kgf/cm^2 in the pipe line and check the pipe joints and fittings for tightness.

94. The tests being over, release the pressure in the pipe line, shut off valve 27, disconnect the pump from the valve, drain the water from the pipe line and reconnect the disconnected pipe to valve 27.

Notes: 1. Perform the hydraulic tests of sea water pipe lines in compartments V and VII before starting the hydraulic tests of shaft line cooling pipe and the oil cooler cooling pipe line of the hydraulic system.

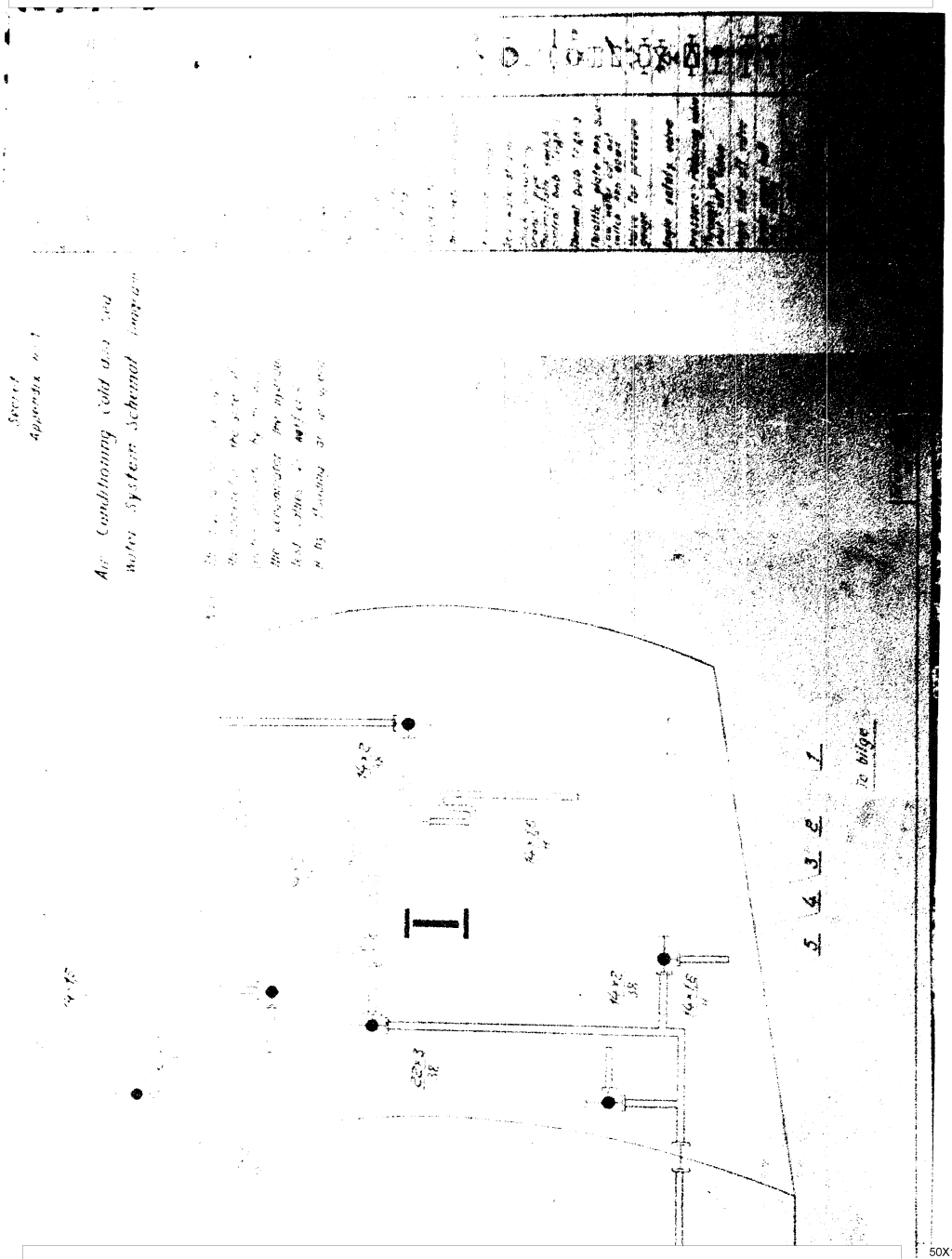
2. The pipe sections from the shaft line cooling pipe [illegible] to valves 18, 21, 29, 31 and from the oil cooler [illegible] line of the hydraulic system up to valves 26 and [illegible] [illegible] with a hydraulic pressure of [illegible] kgf/cm^2 [illegible] the shaft line cooling pipe line and the [illegible] pipe line of the hydraulic system.

G. REFERENCE DATA

95. The cold and sea water pipes are heat insulated [illegible] of heat-insulating material mark ФС-[illegible] and then [illegible] canvas.

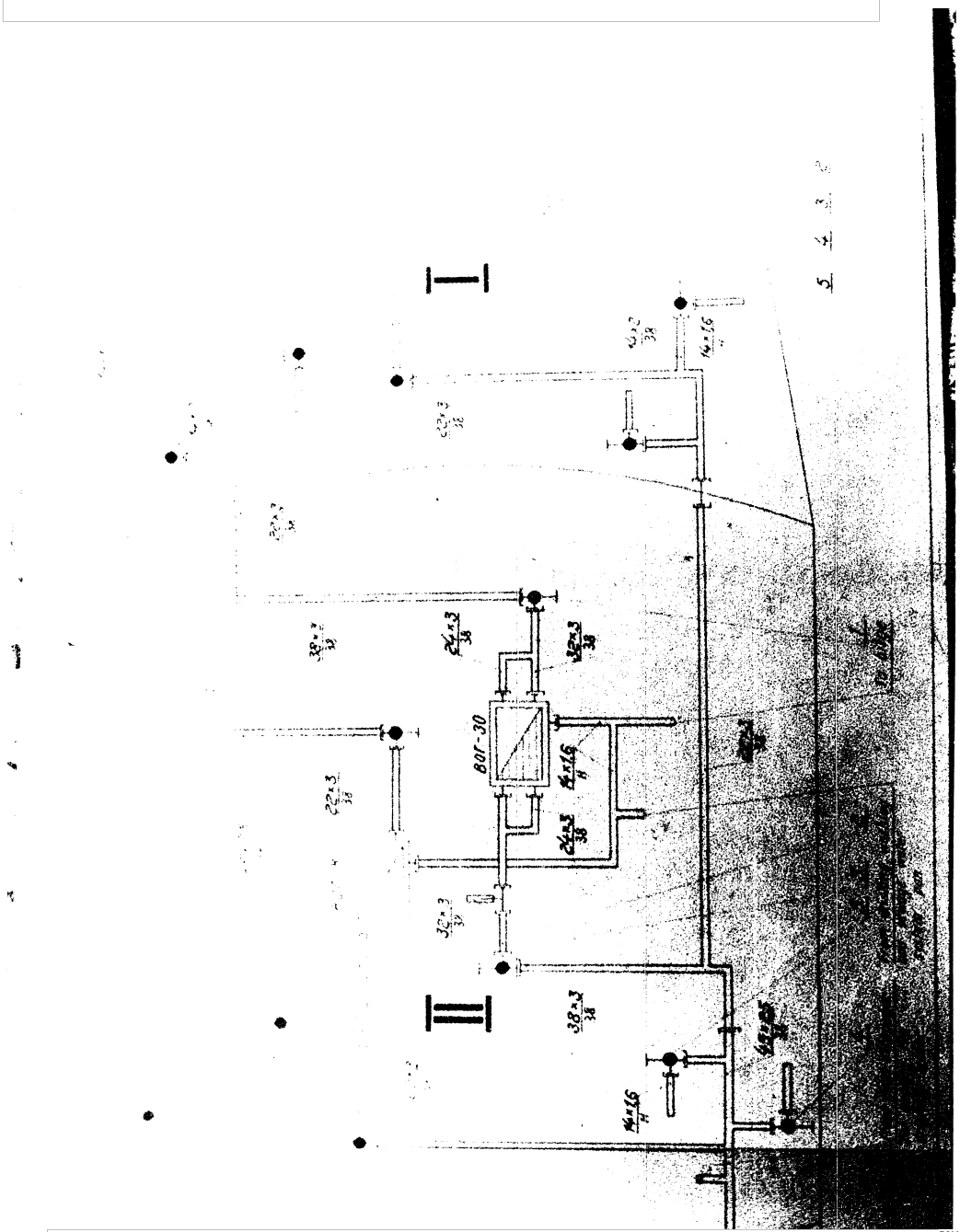
96. The gaskets for joints are made of paronite.

50X1-HUM

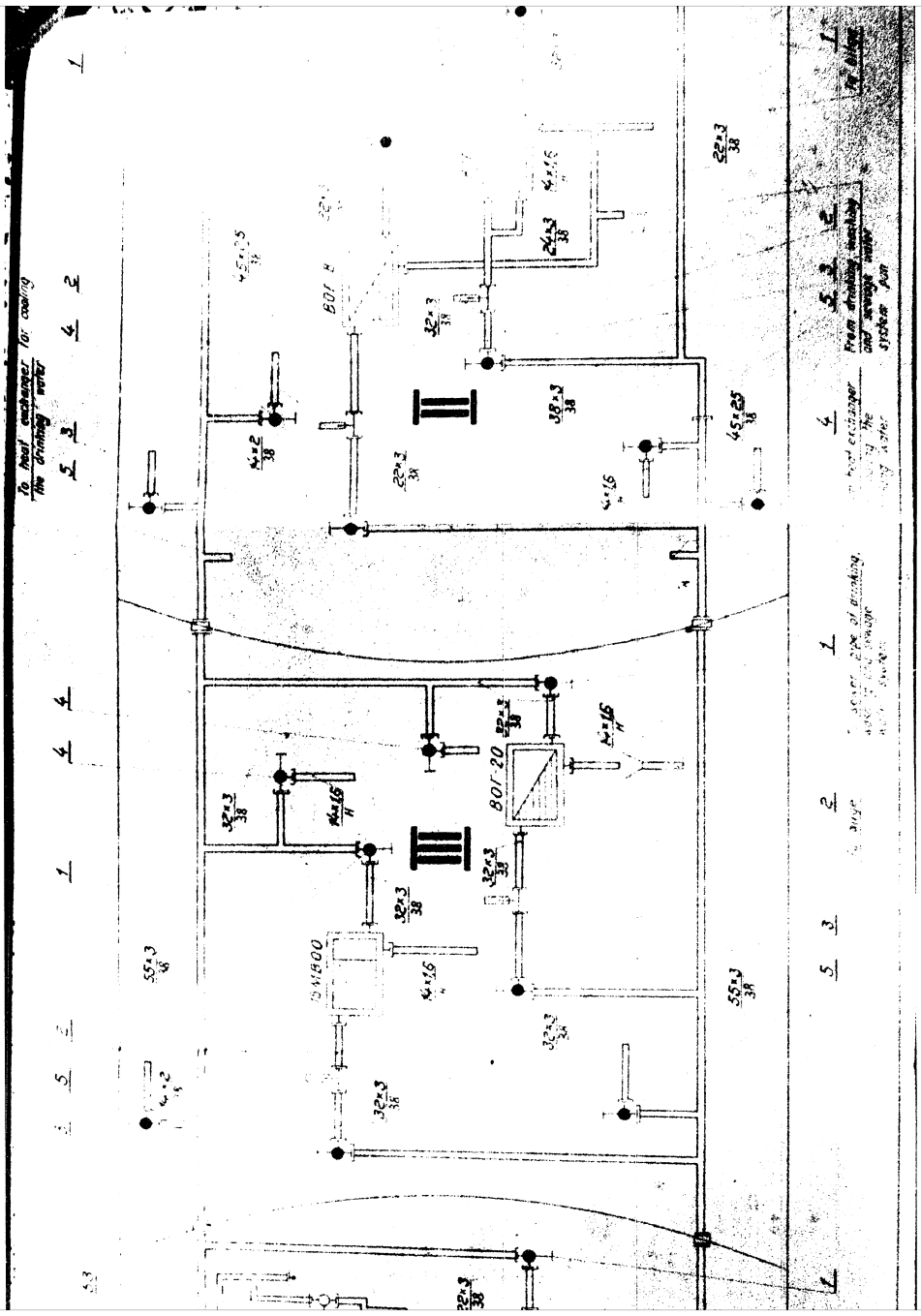


50X1-HUM

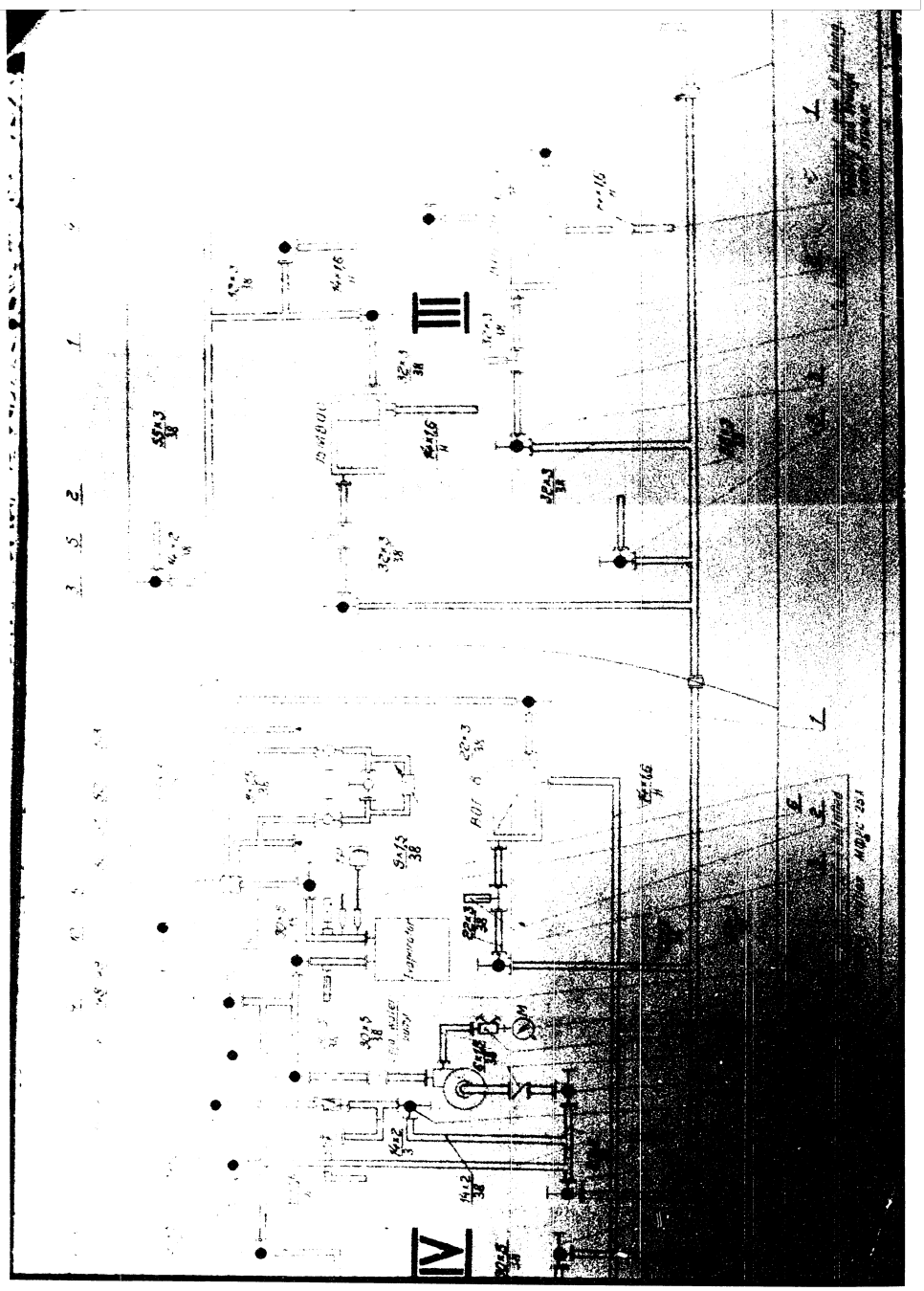
17



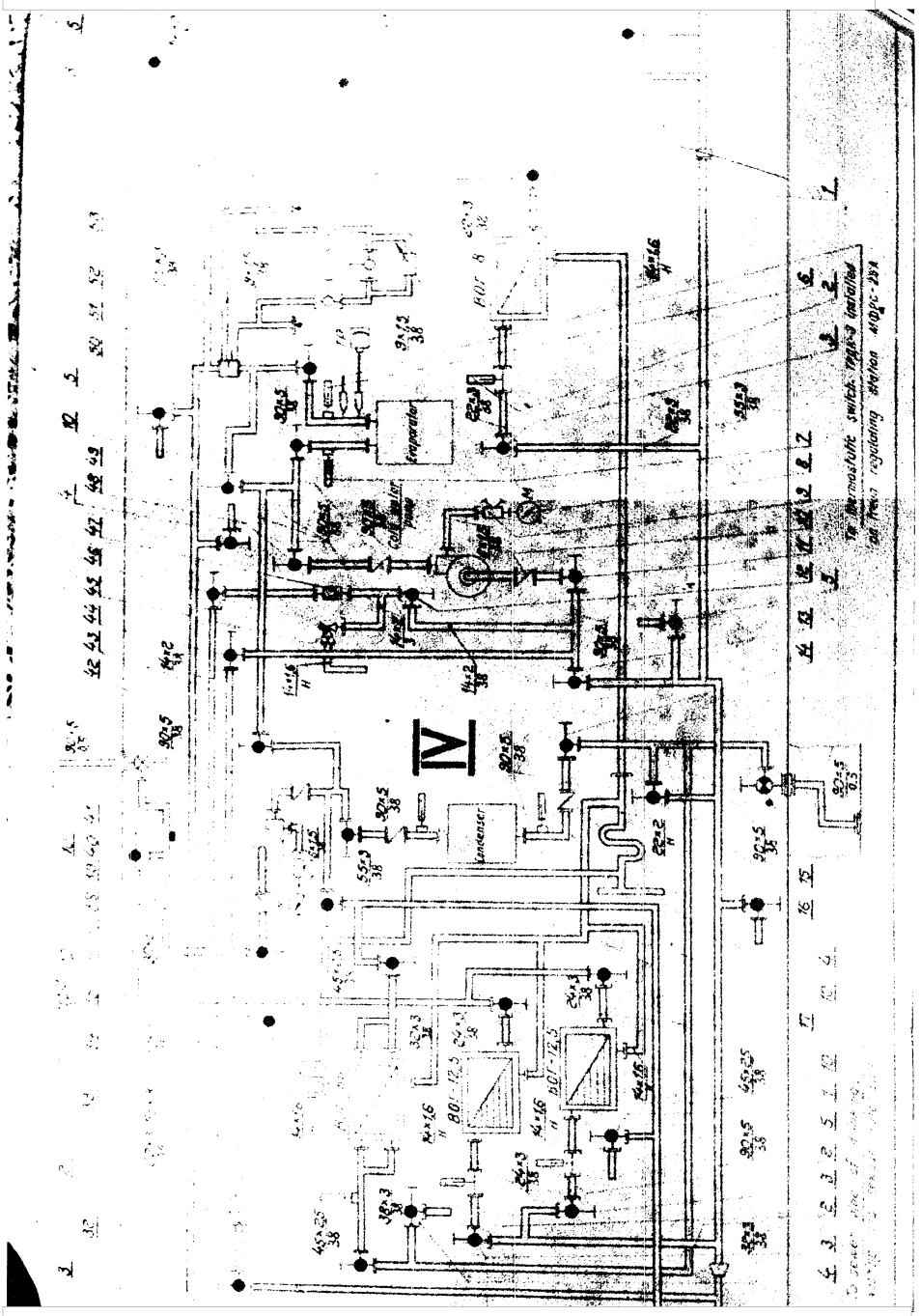
17



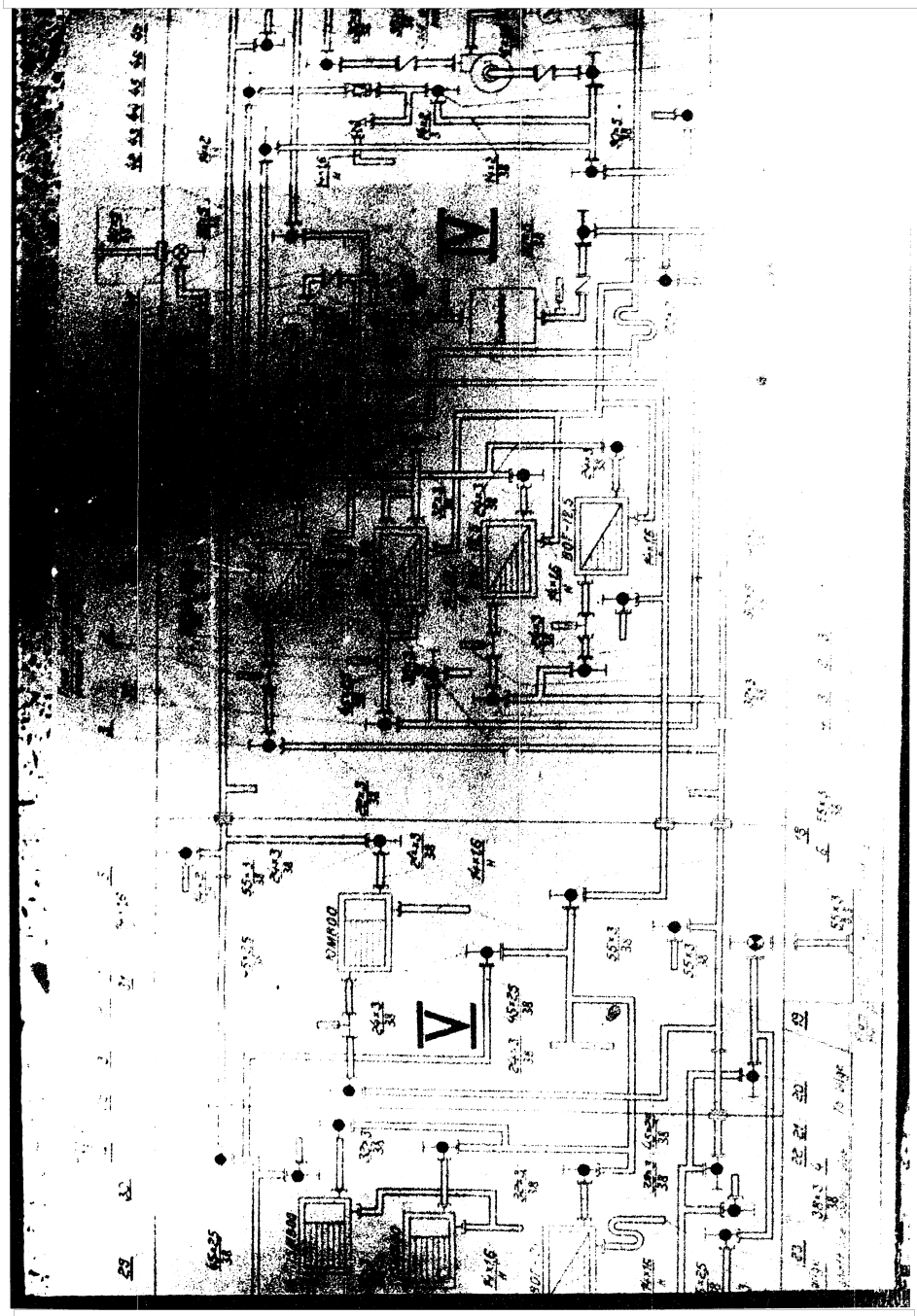
50X1-HUM



50X1-HUM

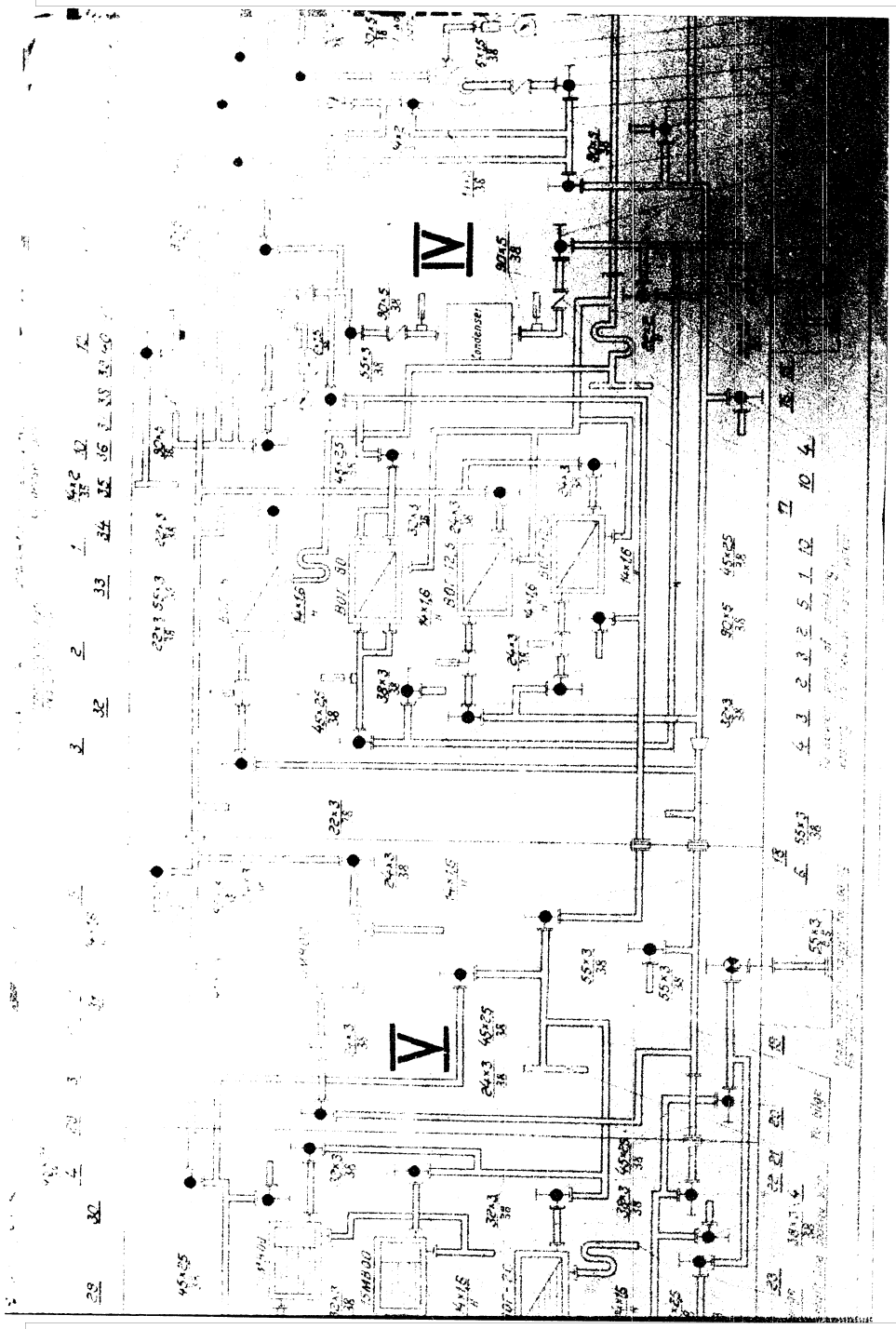


50X1-HUM

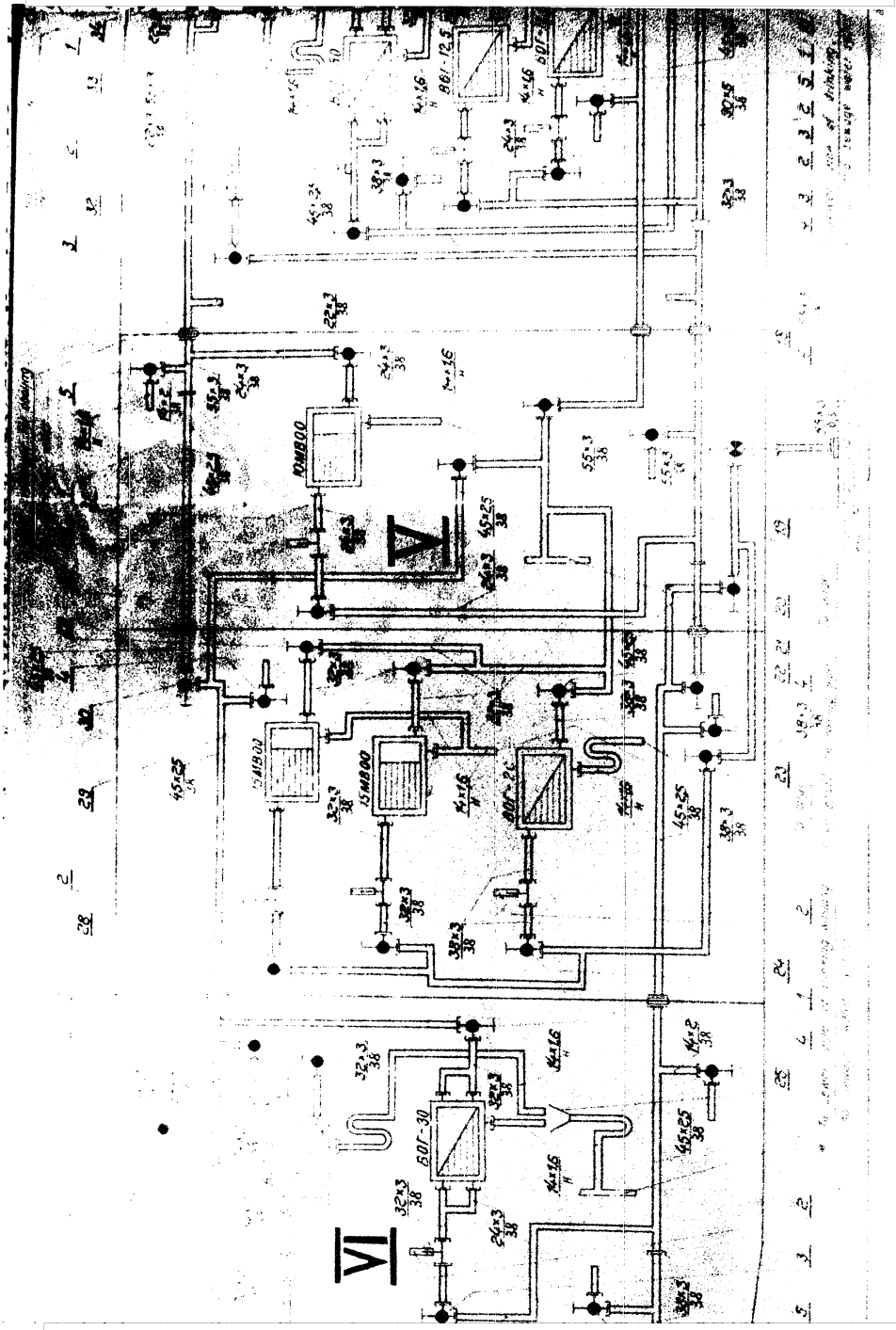


50X1-HUM

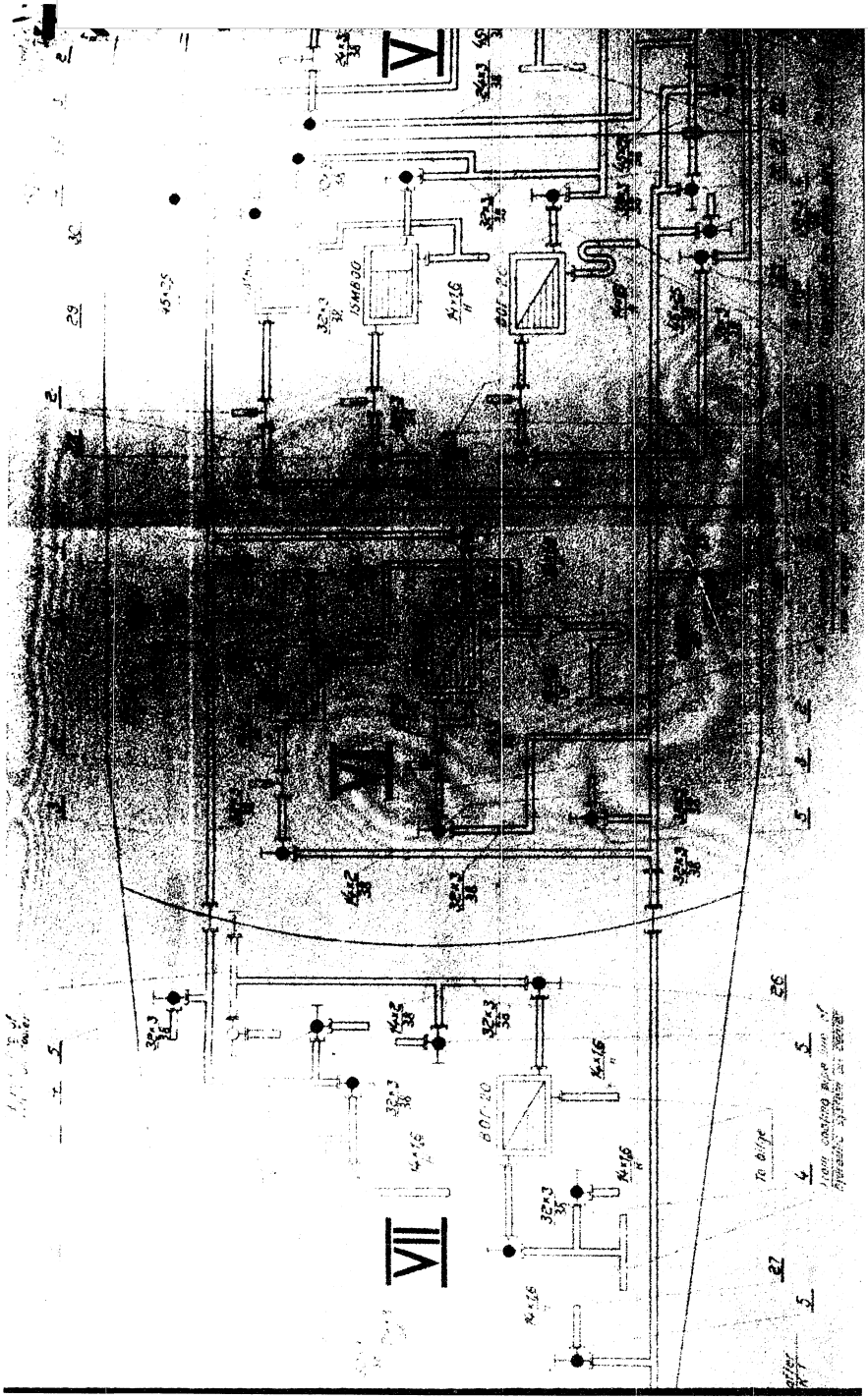
50X1-HUM



50X1-HUM

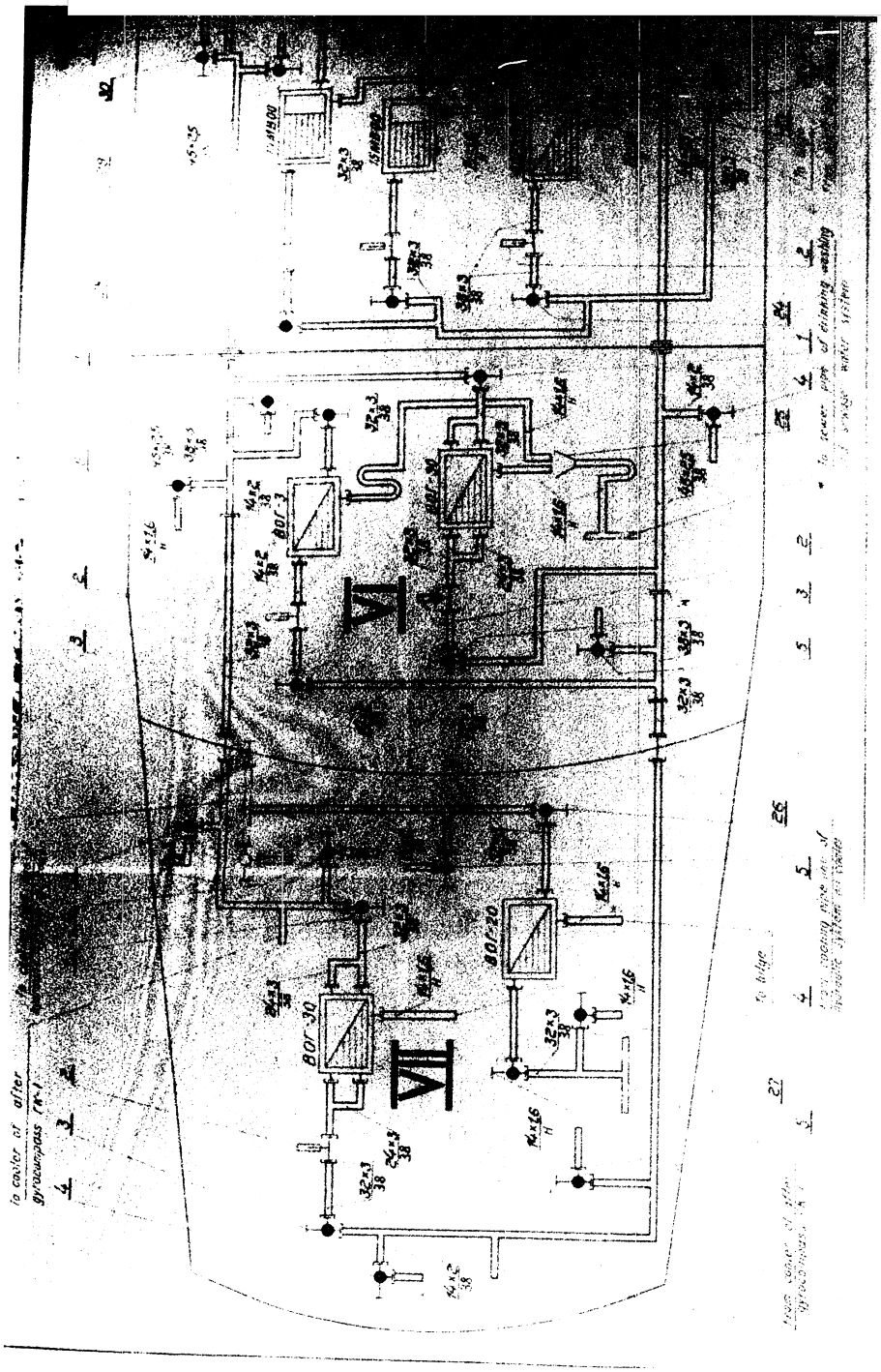


50X1-HUM



50X1-HUM

50X1-HUM



50X1-HUM

50X1-HUM

SHIPBOARD DRAIN SYSTEM

Description and Maintenance Instructions

H641-A76-278

50X1-HUM

50X1-HUM

C O N T E N T S

[redacted] 50X1-HUM

I. D E S C R I P T I O N

A. PURPOSE AND BASIC CHARACTERISTICS

The function of the main drain and bilge system is to [illegible]rm the following procedures:

1. Emergency dewatering of the compartments.
2. Discharging water from the bilge overboard.
3. Flooding and draining the regulating tanks.
4. Flooding and draining the trim tanks.
5. Flooding and draining the water-round-torpedo tanks [illegible] torpedo-compensating tanks.
6. Dewatering the battery wells.
7. Draining the sanitary tanks and fresh water tanks.
8. Draining the fuel tanks and fuel collecting tanks.
9. Feeding the fuel to another ship or to the tender.
10. Supplying the compensating water to the distilled [illegible]ter tanks and draining the latter.
11. Dewatering the [illegible] wells and the conning [illegible]wer.
12. Feeding water to the fire plugs.
13. Washing the deck and flushing the anchor chain.
14. Final dewatering of No.1 ballast tank.
15. Draining water from the sonar station recess.
16. Feeding the sea water to the distillate cooler of the storage battery cooling system.

1. PUMPS

(a) Main drain pump

Index - [illegible]

Type - vertical, double-impeller, [illegible], centri-fugal, permitting either [illegible] operation, driven from the [illegible] through a flexible coupling.

For characteristics of the pump under [illegible] conditions see the Table below.

[redacted] 50X1-HUM

Operating conditions	Total manometric pressure head, m	Output, m^3/hr	Speed, rpm	Shaft horsepower, kW
Series operation of impellers	70	75	2900	31.0
	110	45		25.5
	125	22		21.3
Parallel operation of impellers	20	180	2900	30.0
	30	150		29.0
	50	110		25.5

Vacuummetric suction lift is 5 m of water.

(b) Bilge pump

Index - 2П-1

Type - vertical, piston-type, two-cylinder, driven from the electric motor. Each cylinder is double-acting.

Output - 20 m^3/hr

Discharge pressure - 35 kgf/cm^2

Vacuummetric suction lift (at a temperature up to 30°C) - 6 m of water

Speed of the pump crankshaft - [illegible]

The pump operates reliably [illegible] angles of inclination up to 15°.

(c) Hand pump

Index - hand pump I

Type - piston, [illegible]

Output when discharging [illegible] minute - 20 lit/min

Manometric pressure [illegible]

Vacuummetric suction [illegible]

2. PIPE LINES AND FITTINGS

The system is worked in [illegible] pipes 170x10, 155x2.5, 110x5, [illegible]

5[illegible]x2, 45x2, 38x2.5, 32x2, 14x1.5, 9x1.5; copper nickel pipes 110x5; steel 108x4, 70x4, 57x2.5, 38x2.5, 32x2 and stainless steel pipes 25x1.5.

The pipes with an external diameter of 38 mm and less are connected through pipe unions, the pipes of larger diameter are connected through flanges.

The copper nickel pipes are employed in the system from the discharge branch pipe of the pump 6MBx2 as far as two-way cock manifold 21.

The joints of pipe lines under a pressure of up to 6 kg/cm^2 are packed with rubber gaskets, while those under a pressure exceeding 6 kg/cm^2 are packed with paronite gaskets.

The fittings are bronze, except the kingston valves made of brass.

The bodies of the strainers and the bilge meshes are made of steel.

The pipe line assembled with the fittings is tested for tightness under a hydraulic pressure (for particulars see Par.8).

B. GENERAL DESCRIPTION AND DESCRIPTION OF INDIVIDUAL UNITS

1. PUMPS

The shipboard drain system includes: one main drain pump 6MBx2 located in No.III compartment; three bilge pumps 2П-I located in compartments Nos I, III and VII and one hand pump located in No.IV compartment.

In an emergency the compartments are dewatered with the pump 6MBx2.

Besides, in an emergency the compartments may be dewatered with the bilge pumps 2П-1 and the shaft line cooling pumps BЦН-90A.

Water is discharged overboard with:

(a) pump 6MBx2 at a depth of submergence not greater than 120 m.

(b) pumps 2П-1 to the test depth;

(c) the shaft line cooling pumps at a depth of submergence not greater than 25 m.

The maximum bubble angles at which the compartments may be dewatered with the pumps are given in Table No.1.

The Table is drawn up for the following design data: suction lift of the pump 6МВх2 up to 5 m of water, and of pumps 2П-1 up to 6 m of water. The Table also gives the conditions of bubbles at which the pumps operate above the compartment flooded.

Table 1

Pumps	Compartments to be dewatered						
	I	II	III	IV	V	VI	VII
Pump 6МВх2	x)	-	x)	x)	14°	13°	10°
Pump 2П-1 of No.I compartment	x)	-	x)	14°	9°	9°	8°
Pump 2П-1 of No.III compartment	12°	-	x)	x)	10°	8°	8°
Pump 2П-1 of No.VII compartment	7°	-	11°	x)	x)	x)	x)

x) Dewatering may be effected at bubbles to 15°.

N o t e: 1. At [illegible] exceeding 15° protracted reliable [illegible] of the pumps 2П-1 is not guaran-

2. [illegible] of No.II compartment is done by [illegible] through valves 69 and 70 into [illegible] I and III.

In addition to [illegible] of the compartments, the pump 6МВх2 [illegible] ballasting tanks, flooding No.2 [illegible] to the battery [illegible].

The pumps 2П-1 [illegible] and battery wells.

The pump 2П-1 [illegible] dewatering the [illegible].

The pump 2П-1 [illegible]

(a) draining [illegible]

(b) draining the trim tanks;
(c) feeding fuel to another ship;
(d) dewatering the midship portion of the ship (compartments III and IV).

The pump 2П-1 of No.VII compartment is used for dewatering the after portion of the ship (compartments V-VII).

The bilge pumps are interchangeable and in case one of them gets defective, any of the bilge pumps may be used for dewatering the compartment through the main drain system.

The pumps 6МВх2 and 2П-1 are installed through the shock-absorbers and are connected with the pipe lines through the shock-absorbing branches.

To check operation of the pumps, they are equipped with vacuum gauges and compound pressure and vacuum gauges.

When the pumps operate with back pressure (pressure at the suction side), the compound gauge at the suction side and the pressure gauge at the discharge side are disconnected.

To protect the pumps from clogging, the strainers are provided.

The portable hand pump is used for stripping the bilges, cofferdams and battery wells.

2. PIPE LINES
(See Fig.8)

The shipboard drain system comprises the following lines:

(a) main drain line and the line of [illegible]
(b) flood, drain and vent pipe lines [illegible] tanks;
(c) deck flushing pipe line;
(d) pipe lines of the bilge pumps [illegible] compartments I, III and VII;
(e) pipe line of the water gauges [illegible] tank.

The pipe lines running outside the [illegible] disconnected with the aid of the [illegible]

The drain valves of the bilges [illegible] construction.

The intake strainers of the bilge and compartment drain piping are arranged directly on the hull in the low points.

The pipes running from the kingston valves mount protectors.

(a) Main drain line and pipe line of pump 6MBx2

The main drain line serves for dewatering all the compartments in an emergency. The line is run on the starboard side from valve 9 sited in No.1 compartment as far as valve sited in No.VII compartment. Valves 10 and 38 are used to disconnect the line from the pipe lines of the fore and aft bilge pumps.

Arranged on the line in No.III compartment are valves and 25 meant for disconnecting the fore and after portions case of damage.

Arranged in all the compartments (except No.II compartment) on the lines or on the branches are emergency drain valves 9, 15, 29, 33, 34 and 36 which are connected with the intake pipes equipped with strainers.

The emergency drain valves (except valve 15 sited in No.III compartment) are controlled from the compartments where they are arranged; control may be also effected from the adjacent compartment with the aid of the operating mechanism installed on the bulkhead. Valve 15 is operated from No.III compartment only.

Mounted on the bulkheads at frames 31 and 48 are drain valves 69 and 70 intended for emergency draining of No.II compartment which is effected by transferring water into compartments Nos I and III with simultaneously dewatering the latter through emergency drain valves 9 and 15.

The main drain pump 6MBx2 is connected to the main drain line in compartment No.III.

The pump has the intake and discharge pipes. In No.III compartment these pipes communicate with the sea through sea-and-drain kingston valve 20.

The line running in No.V compartment has branches led to the shaft line cooling system for dewatering the compartments in an emergency with the aid of the pumps BЦН-90A.

In No.IV compartment the line has a branch pipe running to bilge drain valve 30.

In compartments Nos I, III and VII the main drain line is connected with the pumps 2П-1.

Venting the drain line is effected through valves 74, and 37 arranged in compartments Nos I, V and VII.

(b) Main drain pump pipe line

The pipe line is laid in No.III compartment.

The intake pipe of the pump is connected to the main line through valve 22 and strainer 24.

The drain pipe of the pump is connected with the fill-drain kingston valve through non-return screw-down and two-valve manifold 21.

The drain pipe has branches running to four-valve manifold for draining and flooding the regulating tanks and branches running to the battery water cooling system.

(c) Nos 1 and 2 regulating tanks flood, vent and drain pipes

The line is laid in compartments Nos III and IV.

The regulating tanks are flooded and drained through the manifold 18, water flow meter 16 and valve 19.

The tanks are vented to the compartment: tank No.1 through valve 27 and tank No.2 through valves 27 and 57.

The pipes of the regulating tanks are connected to the high pressure air system to ensure blowing

Main pipe line

The line from No.III compartment enters the super-structure valve 62 from whence is brought out to the deck.

The line has three branches with hose couplings to connect hoses.

In addition, the pipe line has the branches running to valve 71 through which water is supplied for flushing the anchor chain and No.1 instrument of the sonar station and to valve 60 to drain water from the pipe line.

(e) Bilge pump pipe lines

The pipe line of the bilge pump seated in No.I compartment is run to the pump from intake kingston valve 80 meant for final dewatering of No.1 ballast tank through valve 76 and strainer 7.

The intake pipe line has branches running to: non-return shut-off valve 79 used for draining the fore portion of the bilge; to valve 75 used for flooding the ammunition tank; to valve 77 used for draining the fuel tanks as well as for flooding and draining the distilled water tanks; to non-return shut-off valve 8 used for draining the aft portion of the bilge; to valve 10 of the main drain line; to non-return shut-off valve 72 used for draining the sanitary tank; to valve 74 used for venting the main drain line.

The drain pipe line running from the pump through non-return shut-off valve 6 is brought to fill-and-drain kingston valve 5 used for pumping water to No.3 ballast tank and to drain kingston valve 3 used for pumping water outboard.

In addition, the drain pipe line through valve 4, water flow meter 2 is connected with manifold 78 and with the intake pipe line.

Four-valve manifold 78 is connected with the torpedo-compensating tanks and with the water-round-torpedo tanks.

Pipe line of the bilge pump arranged in No.III compartment is run to the pump through strainer 59 from non-return shut-off valve 66 used for draining the aft periscope mast well.

The intake pipe line has the following branches: to valve 11 on four-valve manifold 12 used for draining the battery wells of No.II compartment; to valve 14 used to connect the bilge pump pipe line with the main drain line; to valve 61 used for final dewatering of the bilge well with a [illegible] as well as for draining the fresh water tanks and the

tanks; to non-return shut-off valve 58 used for draining
e; to valve 55 on the four-valve manifold used for
the battery wells of No.IV compartment; to valve 64
draining the regulating and trim tanks with the
system is operation.

drain pipe line from the pump through non-return
valve 26 is brought to the drain pipe line of the
pump and has the following branches running: to
valve 62 of the deck flushing pipe line and to
connect to the fire hose.

1. The pipes with screwed-on nut-plugs are brought out to No.III compartment to effect final dewatering of the battery wells arranged in No.II and IV compartments. Dewatering is effected with the aid of the hand pump.
2. Lest water from the pipe lines should get into the battery wells, manifolds 12 and 56 mount try valves 11-A and 55-A to check valves 11 and 55 for tightness.

pipe line of the bilge pump arranged in No.VII com-
is run in compartments Nos V-VII.

intake pipe line is brought to the pump from non-
shut-off valve 54 used for dewatering the bilge of
partment through strainer 43. The pipe line has the
branches running:
in No.V compartment to non-return shut-off valve 52
draining the fuel collecting tank; to non-return
valve 53 used for draining the sanitary tank
compartment; to non-return shut-off valve 51 and 32
dewatering the bilge;
in No.VI compartment to non-return shut-off valves 48,
used for dewatering the bilge;
in No.VII compartment to non-return shut-off valve 47
dewatering the bilge; to valve 38 of the main drain
valve 42 used for draining the fuel tanks; to
used for disconnecting the suction and discharge
pump and furtheron to valves 44 and 39 used for
flooding the sanitary tank and the water-round-

The drain pipe line from the pump through non-return shut-off valve 41 is brought to fill-and-drain kingston valve 45 and has the branches running to valve 40 for dewatering the bilges to the sanitary tank and to the compartment flood valve.

The sanitary tank of No.VI compartment mounts safety valve 35 adjusted for popping at a pressure of 0.2 kgf/cm^2.

N o t e: The pipes with the nut-plugs are provided for final dewatering of the bilge of No.VI compartment with the aid of a hand pump.

(f) Pipe lines of water gauges of No.2 regulating tank (See Fig.1)

The water gauges of No.2 regulating tank (port and starboard) are mounted in No.III compartment.

The lower gauge is directly connected to the regulating tank through valves 92 and 93; the upper gauge through valves 90 and 91 is connected with the tank blow pipe line.

Valves 94 and 95 are used to drain water from the water gauges.

3. FITTINGS

All the fittings are simple in construction and no detailed description of them is given, except the kingston valve, non-return screw-down valve and its operating mechanism intended for emergency dewatering of the compartments, the strainer and the water gauge.

All the valves are provided with the name plates indicating their purpose.

(a) Kingston valve (See Fig.2)

This is used to disconnect the pipe line at points where it extends from the pressure hull.

Plate 2 of the kingston valve is housed in body 1 in such a way that the sea pressure makes it be tightly fitted to the saddle of the body, thus shutting the passage. The plate is displaced with the aid of spindle 3.

The open or shut position of the kingston valve will ... shown by the bead on the spindle made coincident with the ... ch O (OPEN) or 3 (SHUT).

(b) Non-return screw-down valve and its operating mechanism
(See Figs 3 and 4)

This is used for dewatering the compartments in an ...gency. The valve is operated through the operating ...anism with bevel gearing 5 and two handwheels 6 arranged ... adjacent compartments. Position of the plate is shown ...icators 7 available in the compartments from which the ...e is operated.

The indicator name plates have notches O (OPEN), ... (SHUT) and H (NO RETURN). Prior to setting the valve to ... NO RETURN position, set it to the OPEN position before-hand. This shall be done to release the plate of the valve in ...se of caking of the rubber packing ring to the body saddle.

To compensate for the length of the linkage, the travel coupling is provided.

(c) Strainer
(See Fig.5)

The strainer is used to clean the water from mechanical impurities which are likely to get into the pipe lines.

The straining sleeve is lined with brass mesh 4, clear size of openings 2x2.

Screwed into the cover and the bottom of the strainer are valve 5 and plug 7 used to bleed the air and drain water from the strainer.

Protector 6 is arranged on the strainer cover.

To clean the strainer, remove cover 2 with ... straining sleeve 3 with the sump from body 1.

(d) Water gauge
(See Fig.6)

Cut in body 1 are recesses for glasses 3 and the channels for the liquid. Each channel is limited with body 1 from one side and with the body partition from the other side, from the other two sides the channel is limited with glass 3.

From the top each glass is pressed with cover 2 and is packed with a paronite gasket.

Laid on the body is a brass plank - scale 4 graduated in litres in situ.

In the upper and lower portions of the water gauge there are sockets to receive the threaded pipe unions and eyes to secure the water gauges.

The sockets of the pipe unions communicate with the channels.

(e) Taper straining mesh
(See Fig.7)

The straining mesh is of a welded construction with drilled openings. The mesh is inserted into the pipes and is used to protect the water flow meter from clogging.

To clean the mesh, disassemble the flanged joint and remove the water flow meter.

The meshes are mounted from both sides of the water flow meter.

C. CONTROL INSTRUMENTS

The control instruments mounted on board the ship are water flow meters, employed in the drain system and used to measure the amount of water removed from or received to:

1. regulating and trim tanks;
2. torpedo-compensating tanks and water-round-torpedo tanks Nos 1 and 2.

WATER FLOW METERS

The water flow meter, dia.80 mm (Ref.16 Fig.8) is installed in No.III compartment on the flood and drain pipe line of the regulating tanks. The water flow meter, dia.50 mm (Ref.8) is mounted in No.I compartment of the flood and drain pipelines of the torpedo-compensating tanks and of water-filling torpedo tanks Nos 1 and 2.

The characteristics of the water flow meters are tabulated below.

Table 2

Index / Characteristics	BBO-80	BBO-50
Pipe diameter	80 mm	50 mm
Possible rates of flow:		
a) minimum	6 m^3/hr	3 m^3/hr
b) maximum during protracted operation	55 m^3/hr	16 m^3/hr
c) maximum during short period of operation	110 m^3/hr	35 m^3/hr

The maximum temperature of the water running through the water flow meters is 30°C.

To determine the level of water in No.2 regulating tank (No.III compartment) and of the torpedo-compensating tanks (No.I compartment), water gauges are installed.

II. M A I N T E N A N C E I N S T R U C T I O N S

A. GENERAL SUPERVISION AND UPKEEP

With the system in operation:

1. Keep the system in good order and in constant readiness for action.

2. See to it that the pipe lines and the fittings be perfectly tight, giving attention to the outboard fittings, flanged joints and shock absorbing branches.

3. Check to see that all the valves and their operating mechanisms are easy to get at.

4. The valves of the system which are under pressure shall be opened smoothly.

5. Regularly lubricate friction parts of the fittings and their operating mechanisms.

6. Tighten up and repair the glands as necessary.

7. Keep in good order the name plates of the system.

8. Restore painting and marking of the pipe lines in du time.

B. PREPARATORY STEPS

1. INITIAL POSITION

9. All the bilges and sanitary tanks are drained. The strainers are cleaned.

10. The main drain line and the pipe line of the 6MBx2 pump are filled with water.

11. All the valves and plugs are shut, except valves 13 and 25 on the main drain line, valve 60 on the deck flushing line; valves 11-A, 55-A on the battery well drain line; valves 90, 91, 92, 93 on the pipe line of No.2 regulating tank water gauges (see Fig.1). These valves are to be shut in an emergency only.

Cock 1 is open.

12. Some valves and plugs get opened and the pumps are started in case some procedures are to be performed, after which the valves shall be shut, the pumps shall be stopped and the system shall be brought to the initial position.

2. FLOODING THE MAIN DRAIN LINE AND THE PIPE LINE OF THE 6LBx2 PUMP

...ps are flooded with sea water by gravity through the ...tion valves.

...n flooding the main drain line:

.... Open vent valves 74, 31, 37 and the vent valve on ...er 24.

.... Open valve 10, valves A and B on manifold 21, non-... screw-down valve 23, valve 22.

.... Open kingston valve 20 and start flooding.

...When the open vent valves and the vent valve on the ...er show water, shut the valves.

...t es For filling the pump proceed in accordance with the Instructions for the pump.

. STARTING, DURING-OPERATION MAINTENANCE AND STOPPING

...For starting and stopping the pump proceed in accord-a... with the Instructions for the pump. If during operation ...p 2П-1 the compound and vacuum gauge reads a vacuum ... of 6 m of water (440 mm of mercury) in the suction ... transfer some water from the discharge to the suction:

- through valves 4 and 76 for the pump seated in No.I ...artment;
- through valve B of manifold 18 and valve 64 for the ... seated in No.III compartment;
- through valves 40 and 46 for the pump seated in ... compartment.

If the pointer of the pressure gauge starts vibrating, ... the valve at the pressure gauge a slight amount.

CAUTION! To protect the pipe lines from breaking which may occur due to excessive loads, do not start the pump 2П-1 until the stop-cock valves in the suction and discharge have been opened.

Stop the pump by switching off the electric ... shut the valves in the suction and discharge ...

1. DEWATERING THE COMPARTMENTS IN AN EMERGENCY

For emergency dewatering of any of the compartment open the valves and start the pumps in accordance with the Table below depending on condition of the system and on the depth of submergence.

Table 3

Depth of submergence, m	Pumps are started and valves are opened			Remarks
	6MBx2	2П-1, all	BШН-90А	
0-20 and deeper	Acc.to Item 18	Acc.to Item 21	-	
	-		-	
	When emergency drain valves cannot be opened			
0-20 and deeper	Acc.to Item 19	-	-	
	-	Acc.to Item 21	-	
	When the bilge drain valves cannot be opened			
0-20 and deeper	Acc.to Item 18	-	-	
	-	Acc.to Item 20	-	
	When pump 6MBx2 cannot be started			
0-20	-	Acc.to Item 20	Acc.to Item18	
20-120	-			
120 and deeper	-			

16. For emergency draining of the compartments with the aid of the 6MBx2 and BШН-90А pumps, open the valves and the kingston valves in accordance with Table 4 depending on the compartment to be dewatered and start the pump.

Table 4

to ...ed ...ning	Compartment No.	Refs of valves to be opened: emergency drain valves	pump and line valves	kingston valves	Remarks
	I	9	22,23 and	20	Non-return screw-down valves 9, 15, 29, 33, 34, 36 and 23 to be set to the NO RETURN position
	III	15	valve "A"		
	IV	29	on mani-		
	V	33	fold 21		
	VI	34			
	VII	36			
BHH-90-A	I	9			Non-return screw-down valves 9, 15, 29, 33, 36, 34 to be set to the NO RETURN position
	III	15			
	IV	29			
	V	33			
	VI	34			
	VII	36			

Note: 1. When dewatering No.II compartment, drain water to compartments Nos I and III through valves 69 and 70.

2. For connecting the pumps BHH-90-a, proceed in strict adherence to the Operating Instructions for the shaft line cooling system.

19. In case the emergency drain valves get defective, the pump 6MBx2 may be connected for draining through the bilge valves, for which purpose open the valves and the kingston valve in accordance with Table 5 depending on the compartment to be dewatered and start the pump.

Table 5

Pump to be used for flooding	Compartment No.	Refs of valves to be opened: drain valves	Refs of valves to be opened: pump and line valves	Refs of valves to be opened: kingston valves	Remarks
[illegible]x2	I	8, 79	Valve A on manifold 21, 76, 10, 22, 23		Non-return screw-down valve 23 shall be set to the no return position
	III	58	14, 22, 23, and valve A on manifold 21		
	IV	30	22, 23 and valve A on manifold 21	20	
	V VI VII	51,54,32 48,49,50 47	38,22,23 and valve A on manifold 21		

20. In an emergency the compartments are dewatered with the aid of 2M-1 pump through emergency drain valves, for which purpose open the valves and the kingston valves in accordance with Table 6 and start the pump.

Table 6

	Compartment No.	Valves to be opened			Remarks
		emergency drain valves	pump and line valves	kingston valves	
	I	9			Emergency drain valves 9, 15, 29, 33, 34, 36 to be set to the NO RISING position
	III	15			
	IV	29			
	V	33	6 and 10	3	
	VI	34			
	VII	36			
	I	9			
	III	15			
	IV	29	14, 26 and valve A on manifold 21	20	
	V	33			
	VI	34			
	VII	36			
	I	9			
	III	15			
	IV	29	38, 41	45	
	V	33			
	VI	34			
	VII	36			

2. DRAINING THE BILGES AND THE SANITARY TANKS

21. When dewatering is effected with the help of the bilge pumps, open the valves and the kingston valves in accordance with Table 7 depending on the bilge or the tank to be drained and start the pump.

Table 7

Pump to be used for draining	Tank or bilge to be drained	Refs of valves to be opened				Remarks
		drain valves	pump valves	line valves	kingston valves	
1	2	3	4	5	6	7
Pump 2П-1 of No.I compartment	Bilge of No.I compartment	8.79	6	76	3	
	Sanitary tank of No.II compartment	72		-		
Pump 2П-1 of No.III compartment	Bilge of No.III compartment	58	26 and valve A on manifold 21	-	20	
	Bilge of No.IV compartment	30		14		
[illegible]	2	3	4	5	6	7
[illegible] of No.VII com-	Bilge of No.V compartment	51, 54, 32		-		

1	2	3	4	5	6
[illegible] of No.VII compartment	[illegible] compartment	[illegible]			
	Bilge of No.VI compartment	48, 49, [illegible]		-	
	Bilge of No.VII compartment	47	41	-	45
	Sanitary tank of No.V compartment	53		-	
	Sanitary tank of No.VI compartment	44		46	Valve 44 to be set to the NO RETURN position

N o t e: If there is danger of detection, to avoid a tell-tale oil slick, the bilges of compartments V - VII shall be dewatered into the sanitary tank of No.VI compartment. For this purpose set the valves to the positions indicated in columns 3, 4, 5 of Table 7 and open valves 40 and 44 as well.

CAUTION! Never allow the sanitary tank of No.VI compartment to be overflowed when filling it with the bilge pump.

3. DEWATERING THE BATTERY WELLS

The battery wells of Nos II and IV compartments are dewatered with the aid of the 2П-1 pump of No.III compartment.

To dewater the battery wells of No.II compartment, proceed as follows:

22. Shut valve 11-a.

23. Open valves A, Б, B or Г on manifold 12 depending on the well to be drained.

24. Open valves 11, 26 and valve A on manifold 21.

25. Open kingston valve 20 and start the pump.

To dewater the battery wells of No.IV compartment, proceed as follows:

26. Open valve 55-a.

27. Open valves A, Б, B or Г on manifold 56 depending on the well to be drained.

28. Open valves 55, 26 and valve A on manifold 21.

29. Open kingston valve 20 and start the pump.

4. STRIPPING THE BILGES, MC BOWL RECESS AND BATTERY WELLS

The bilges, recess of the MC bowl and the battery wells are stripped with the aid of the portable hand-operated pump by using a hose discharging water to a bucket or to the bilge where the strum boxes are arranged.

For stripping proceed as follows:

30. Remove the nut-plug from the pipe brought out of the vicinity where stripping is to be done, connect the intake hose of the hand pump and discharge water into the bucket.

31. Stripping over, remove the hose and screw on the nut-plug in its place.

5. FLOODING AND DRAINING THE EQUALIZING TANKS

For flooding and draining the equalizing tanks proceed in accordance with the variable weights compensation instructions.

No.1 regulating tank may be flooded either when running on the surface or when the sub is submerged to a depth to [illegible] the tank is flooded either by gravity or with the aid of the 2N-1 pump seated in No.III compartment.

CAUTION! When the submarine is running at a depth below 30 m do not flood the tank by gravity since it may cause damage to it.

Note: Should the need arise to take water into No.1 tank when the submarine is running at a depth greater than 30 m, flood the tank by gravity from No.2 regulating tank through four-valve manifold 18.

[illegible] running on the surface, No.2 regulating tank may be flooded by gravity or with the aid of the pumps 6MBx2 and 2N-1 seated in No.III compartment.

[illegible] running submerged at a depth to 150 m, flooding is effected either by gravity or with the aid of the pump 6MBx2, at a depth greater than 150 m by gravity only, since the sum of sea pressure created by the pump and the sea pressure may exceed the design pressure for strength.

(a) For flooding the regulating tanks by gravity, proceed as follows:

32. Open the valves and the kingston valve according to Table 8.

Table 8

Tank to be flooded	Refs of valves to be opened			
	valves on manifold 21	valves on manifold 18	line valves	kingston valve
Regulating tank No.1	Б	Г	67 and 19	20
Regulating tank No.2	Б	А or Б	27 or 57 and 19	20

For flooding No.1 regulating tank by gravity from No.2 regulating tank proceed as follows:

33. Open valves 67, 27 or 57.

34. Open valves A or Б and Г on manifold 18.

(b) When flooding with the help of pump 2П-1:

35. Open the valves and the kingston valves in accordance with Table 9 and start the pump.

Table 9

Tank to be flooded	Refs of valves to be opened			
	valves on manifold 18	valves on manifold 21	line valves at pump	kingston valve
Regulating tank No.1	В and Г	Б	14, 26, 67	20
Regulating tank No.2	А or Б and В	Б	14, 26, 27 or 57	20

N o t e: When flooding the regulating tanks by gravity watch water flow meter 16 to check the amount of water taken.

(c) When flooding with the aid of the pump 6МВх2:

36. Open the valves and the kingston valves according to Table 10 and start the pump.

Table 10

Tanks to be flooded	Refs of valves to be opened			
	on manifold 18	on manifold 21	line valves at pump	kingston valves
Regulating tank No.1	-	-	-	-
Regulating tank No.2	А or Б and В	Б	22 and 23 27 or 57	20

N o t e: Set non-return screw-down valve 23 into NO RETURN position.

The regulating tanks are drained with the aid of the 6MBx2 and 2П-1 of No.III compartment. They may be also drained with intermediate pressure air.

(d) When draining the tanks with the aid of the 6MBx2 and 2П-1 pump, proceed as follows:

1. Open the valves and the kingston valve in accordance with Table 11 and start the pump.

Table 11

Tanks to be drained	Refs of valves and kingston valves to be opened when draining tanks with pump	
	6MBx2	2П-1
Regulating tank No.1	Valve Г on manifold 18; valves 19,22,25,67; valve A on manifold 21; kingston valve 26	Valve Г on manifold 18; valves 19,14,26,67; valve A on manifold 21; kingston valve 26
Regulating tank No.2	Valve A or B on manifold 18; valves 19, 22, 25, 27 or 50; valve A on manifold 21; kingston valve 26	Valve A or B on manifold 18; valves 19, 14, 26, [illegible] on manifold [illegible] kingston

N o t e: Set non-return [illegible] NO RETURN position.

CAUTION! 1. In case the [illegible] system is in use, drain [illegible] the aid of the 2П-1 [illegible] valve 64.

2. When the tanks [illegible] sub running at a [illegible] flow meter to check [illegible] allow the rate of [illegible] This purpose is achieved [illegible] aid of valves A, B or [illegible]

(e) When draining the tanks with air:

28. Open the valves and the kingston valve in accordance with Table 12.

Table 12

Tank to be drained	Refs of valves to be opened
Regulating tank No.1	Valve Г and Б on manifold 18 Valve A on manifold 21 Kingston valve 20
Regulating tank No.2	Valve A or Б and В on manifold Valve A on manifold 21 Kingston valve 20

After the above-mentioned valves have been opened, start blowing the tanks with intermediate pressure air by opening the respective valves on the pipe line in accordance with the Operating Instructions for the shipboard intermediate pressure air system.

CAUTION! 1. Keep an eye on the pressure gauge to check the pressure of the air supplied.
The pressure of air fed to No.1 tank shall not exceed 3 kgf/cm^2; the pressure of air fed to No.2 tank shall not exceed 27 kgf/cm^2.
2. Do not drain the regulating tanks with compressed air through the water flow meter in order not to damage the latter.

6. MEASUREMENT OF LEVEL IN REGULATING TANKS

The water level in No.1 regulating tank is determined by a sounding rod.

Water level in No.2 regulating tank is shown by the gauges.

For better visibility of the water level in the gauge, drain contaminated water into the bilge. For this purpose do the following:

39. Close valves 92 and 93 (see Fig.1).

40. Open valves 94 and 95.

After water has been drained bring the valves to the initial position and read off the scale of the water gauges.

7. FLOODING AND DRAINING THE TRIM TANKS

Prior to flooding or draining the trim tanks, prepare the trim system for operation proceeding in accordance with the Operating Instructions for the trim system.

The trim tanks should be flooded by gravity, for which purpose do the following:

41. Open valve A on manifold 21, valve B on manifold 18 and Kingston valve 20.

In case of necessity the tanks may be flooded with the help of the pump 2П-1 seated in No.III compartment and in an emergency with the help of the pump 6МВх2. In such a case proceed as follows:

42. Open the valves as indicated in Table 13.

Table 13

Tank to be drained	Refs of valves to be opened when flooding tanks with pump	
	2П-1	6МВх2
Trim tanks	Б on manifold 18 B on manifold 21, 14 and 26	Б on manifold 18 B on manifold 21, 22 and 23

Valve 23 shall be set to the 40 tonne position.

Kingston valve 20 and start the pump.

tanks are drained with the aid of the 2П-1 No.III compartment. In this case proceed

valves 14, 19, 26, A on manifold 21, B the pump.

In case of necessity, the trim tanks may be drained with intermediate pressure air. In this case proceed as follows:

45. Open valve B on manifold 18; valve A on manifold [illegible] and kingston valve 20, as well as all the valves stipulated by the Operating Instructions for the intermediate pressure air system.

N o t e: When the storage battery water collector is on service, drain the trim tanks through valve 64.

8. FLOODING AND DRAINING THE TORPEDO-COMPENSATING TANKS AND WATER-ROUND-TORPEDO TANKS

These tanks are flooded by gravity.

For flooding the torpedo-compensating tanks and water-round-torpedo tanks Nos 1 and 2, do the following:

46. Open valve 4 and the valve on manifold 18 depending on the tank to be flooded.

47. Open kingston valve 3 and check the amount of water taken by the water flow meter or by the water gauges when taking water into the torpedo-compensating tanks and by the sounding rods when taking water into water-round-torpedo tanks Nos 1 and 2.

When flooding No.3 water-round-torpedo tank, do the following:

48. Open valves 39 and 40.

49. Open kingston valve 45 and watch the sounding rod to check the amount of water taken.

N o t e: When flooding water-round-torpedo tanks Nos 1, 2, 3 open the respective vent valves of the tanks.

In case of necessity the torpedo-compensating tanks may be flooded with the aid of the pump 2П-1 seated in No.1 compartment

In this case proceed as follows:

[illegible] Open valve B on manifold 21 and kingston valve 20.

[illegible] Open valves 10, 6 and 4.

52. Open valve A or Г on manifold 78 depending on the tank to be flooded.

53. Start the pump and watch the water flow meter to check the amount of water taken.

The starboard and port torpedo-compensating tanks and water-round-torpedo tanks Nos 1 and 2 are drained with the aid of the pump 2П-1 located in No.1 compartment.

When draining the torpedo-compensating tanks:

54. Open valve A or Г on manifold 78.

55. Open valves 76, 6 and kingston valve 3 and start the pump.

When draining water-round-torpedo tanks Nos 1 and 2:

56. Open valve Б or В on manifold 78.

57. Open valves 76 and 6.

58. Open the vent valves of the tanks.

59. Open kingston valve 3 and start the pump.

Water-round-torpedo tank No.3 is drained with the aid of the 2П-1 pump located in No.VII compartment. For draining this tank, proceed as follows:

60. Open valves 39 and 46.

61. Set non-return screw-down valve 41 to the NO RETURN position.

62. Open kingston valve 45 and start the pump.

N o t e: When draining water-round-torpedo tanks Nos 1, 2, 3 open the respective vent valve of the tanks.

9. FLOODING AND DRAINING THE DISTILLED WATER TANKS

After the distilled water has been consumed, the tanks may be flooded by gravity in case of necessity. In this case proceed as follows:

63. Remove the plugs from valve 77 and from the vent pipe of the tank.

64. Use a hose to connect valve 77 with the vent pipe on the distilled water tank.

65. Open valves 4, 76, 77.

66. Open kingston valve 3.

CAUTION! Prior to flooding the distilled water tanks, open their vent valves, otherwise the tanks are liable to be burst.

The distilled water tanks are drained with the aid of the pump 2П-1 seated in No.I compartment. In this case proceed as follows:

67. Remove the plug from valve 77 and use a short hose to connect valve 77 with the fill-and-drain pipe.

68. Open the vent valve of the tank, open valves 76 and 77, kingston valve 3 and start the pump.

10. FEEDING THE SEA WATER TO BATTERY COOLING SYSTEM

Sea water is fed by the pump 6МВх2 with its two units operating in series.

When feeding the sea water, prepare the storage battery water cooling system proceeding in strict adherence with the Operating Instructions for the storage battery water cooling system.

69. Open valve 22 and valve A on manifold 21.

70. Open kingston valve 20 and start the pump.

N o t e: 1. To control the amount of water flowing through the cooler, let some water flow past the cooler through valve 23 and shut valve A on manifold 21 a slight amount.

2. In case the storage battery water ccoling system is on service, drainage through the main drain line should be performed after disconnecting the storage battery cooling system only.

11. FEEDING FUEL TO ANOTHER SHIP OR TO TENDER

To feed fuel, use pump 2П-1 of No.III compartment and proceed as follows:

71. Remove the nut-plug from the deck flushing pipe, connect the hose and shut valve 60.

72. Remove the nut-plug from valve 61 and connect the other end of the hose shall be connected to the valve in the fuel pipe line.

[redacted]

[redacted] valve 20, Kingston valve 62 and start the [redacted].

[redacted]

[redacted]. [redacted] WATER TO DECK FLUSHING LINE, ANCHOR CHAIN AND No.1 DEVICE FLUSHING LINE AND TO FIRE PLUG

After to the deck flushing line is supplied by the [redacted] located in No.III compartment. In this case proceed as follows:

[redacted]. Open valves 14, 26 and valve B on manifold 21, Kingston valve 62 and shut valve 60.

[redacted]. To flush the deck remove the plug from the deck flushing line and connect the hose.

[redacted]. To flush the anchor chain, open valve 71.

[redacted]. To flush No.1 device of the sonar station, connect the hoses, remove the plug from the deck flushing line and connect the hoses.

[redacted]. To feed water to the fire plug in No.III compartment, remove the plug from valve 63, connect the hose and open valve 63.

[redacted]. After the procedures outlined under Items 74 - 78 have been performed, open kingston valve 20 and start the pump.

[redacted] valve A on manifold 21 to control the pressure head in the pipe line lest the pressure should exceed 6 - 8 kgf/cm^2.

Note: For flushing No.1 device of the sonar station, do not connect the nozzle to the hoses.

The water to the deck flushing pipe line is delivered with the valves A and B seated on manifold 21 with the aid of the shaft line cooling pumps BiH-90A.

[redacted]. DEWATERING THE CONNING TOWER AND THE PERISCOPE MAST WELL

Water from the conning tower and from the periscope well is discharged to the bilge of No.III compartment. To drain water from the conning tower, open valve 65.

[redacted]

81. To drain water from the periscope mast well, open valve 68.

14. DEWATERING THE RECESS OF THE SONAR STATION

Water from the recess of the sonar station is discharged to drained No.1 ballast tank. To accomplish this proceed as follows:

82. Shut cock 1 communicating the recess of the sonar station with the sea and remove plugs 81 and 82.

Use the bilge pump 2П-1 of No.I compartment (See Para.16 to remove water from No.1 ballast tank.

15. FLOODING AND DRAINING THE AMMUNITION TANK

The ammunition tank is flooded with sea water by gravity. To flood the tank, do the following:

83. Open valves 4, 75 and 73.

84. Open kingston valve 3.

The ammunition tank is drained with the aid of the pump 2П-1 seated in No.I compartment. To drain the tank, proceed as follows:

85. Open valves 73, 75, 76.

86. Open valve 6, kingston valve 3 and start the pump.

16. FINAL DEWATERING OF No.1 BALLAST TANK

No.1 ballast tank is drained finally with the pump 2П-1 located in No.I compartment. For final dewatering of the tank, do the following:

87. Open kingston valve 80 and valve 76.

88. Open valve 6, kingston valve 3 and start the pump.

17. DRAINING THE FUEL TANKS AND FUEL COLLECTING TANKS

The fuel tanks are drained with pumps 2П-1 located in compartments Nos I, III and VII. To drain the tanks, do the following:

89. Remove the plug from valves 77, 61 or 42 [illegible] pump to be used for drainage and connect the [illegible]

[redacted]

[redacted]. Connect the hose running from valves 77, 61 or 42 [redacted] valve provided in the fuel compensating line.

[redacted]. Open valves 77, 61 or 42 and the vent valves of the [redacted] tanks.

[redacted]. Open the valves and the kingston valves in accordance with Table 14 and start the pump.

Table 14

[redacted] be connected drainage	Refs of valves to be opened		Remarks
	valves	kingston valves	
[redacted].I compartment	6	3	Non-return screw-down valve 41 should be set to the NO RETURN position
[redacted].III compartment	26, A on manifold 21	20	
[redacted].VII compartment	41	45	

Fuel collecting tank of No.V compartment is drained by the pump 2П-1 of No.VII compartment. To drain this tank, proceed as follows:

[redacted]. Open valve 52.

[redacted]. Set non-return screw-down valve 41 to the NO RETURN position.

[redacted]. Open kingston valve 45 and start the pump.

[redacted]. DEWATERING THE AFT PERISCOPE MAST [redacted] THE CONNING TOWER FOR CREATING AN AIR [redacted]

The aft periscope mast well and the [redacted] dewatered by the main drain pump 6МВт2 and [redacted] 2П-1 of No.III compartment.

[redacted] draining with the aid of the pump [redacted] follows:

[redacted]

96. Open valves 66, 14, 22 and 23.

97. Open valve A on manifold 21.

98. Start the pump and open kingston valve 20.

When draining by the pump 2П-1 of No.III compartment, proceed as follows:

99. Open valves 66, 26 and valve A on manifold 21.

100. Open kingston valve 20 and start the pump.

19. DRAINING THE FRESH WATER TANKS

The fresh water tanks are drained with the aid of the pump 2П-1 of No.III compartment. To drain the tanks, proceed as follows:

Prepare the fresh water pipe line for action proceeding in accordance with the fresh water system Operating Instructions.

101. Remove the plug from valve 61 and connect the hose.

102. Connect the hose running from valve 61 with the valve in fresh water line.

103. Open valve 26, 61, valve A on manifold 21, kingston valve 20 and start the pump.

20. DEWATERING THE MAIN DRAIN LINE

The main drain line is dewatered with the aid of the bilge pumps 2П-1 of Nos I, III and VII compartments. To dewater the line, open the valves and kingston valves as indicated in Table 15 and start the pumps.

Table 15

Pump to be used for drainage	Nos of valves to be opened: valves	kingston valves	Remarks
2П-1 of No.I compartment	6, 10, 37	3 or 5	
2П-1 of No.III compartment	10, 14, 26, 37, 74 and valve A on manifold 21	20	
2П-1 of No.VII compartment	10, 38, 41, 74	46	

D. TROUBLES AND REMEDIES

For possible troubles and corrective measures to be [illegible] see the Table below:

T a b l e 16

[illegible] or difficulty	Condition may be due to	Correction
[illegible] kingston valve [illegible] no water enters pipe line	Pipe line clogged	Pump pipe line with sea water
Gland packings of [illegible] and kingston valves leaky	Nuts tightening gland bushings loose. Gland packings worn	Tighten up nuts, replace gland packing
Valves untight	Uneven wear of or damage to fitting surface of discs or saddles. Rubber packing rings worn	Lap valve discs. Replace rubber packing rings
Strainer will not hold particles	Mesh defective	Replace mesh
Strainer will not pass water	Accumulation of impurities in strainer, mesh clogged	Clean strainer
Flanged joints untight	Nuts loose. Thread of bolts, nuts or studs stripped. Gasket punctured	Tighten up nuts, replace bolt, nut or stud. **Note:** Special nuts and studs securing the kingston valves shall be replaced with special nuts or studs only. Replace gasket

Problem or difficulty	Condition may be due to	Correction
Union connections untight	Nuts loose. Gasket punctured	Tighten up nuts, replace gasket
Valve operating mechanism linkage defective	Pins lost. Pins or cotter pins worn.	Drive pins. Replace pins or cotter pins

E. PREVENTIVE INSPECTIONS AND REPAIRS

DAILY INSPECTION

104. Perform an external inspection and clean the pipe lines, valves and control instruments. Make sure the safety valve and the pressure gauges are sealed.

Tighten up leaky flanged joints, if any.

105. Turn all the valves except emergency drain valves. Check the valves for proper position.

WEEKLY INSPECTION

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

106. Clean and lubricate the thread of the valves, work out the sticky valves.

107. Ensure that the strum boxes are perfectly clean. Clean and wash clogged strainers.

108. Turn the emergency drain valves.

MONTHLY INSPECTION

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

109. Check the gland packings of the valves for condition; tighten up or repack the glands if necessary.

110. Check the rubber-metal welded branches, flanged joints of the pipe lines and the drain plugs for condition and for proper attachment.

111. Clean the strainers and the meshes on the intake [illegible] of the compartment drain system. Blow the meshes of [illegible] intake outboard openings.

112. Check the water flow meter for correct readings.

INSPECTION EVERY THREE MONTHS

[illegible] perform the procedures of the monthly inspection and in addition do the following:

113. Make sure that all the water gauges and the sounding rods are clean and in good order.

[illegible] necessary, disassemble the water gauges, clean and [illegible] them.

114. Remove the safety valve on the sanitary tank and [illegible] it for popping.

115. Disassemble, clean and wash the taper meshes [illegible] wash the interior chambers of the water flow meters.

116. Inspect the pin-type protectors, and in case of [illegible] 50% wear replace them.

The pin-type protectors are arranged on the pipe at [illegible] kingston valves 80, 3, 5, 62, 45 and at manifold 21.

DURING-DOCKING INSPECTION

117. Disassemble, repair and test for tightness and for strength all the outboard valves and kingston valves, replace the rubber gaskets. Test the assembled system for working pressure.

118. Clean and paint all the tanks.

INSPECTION DURING RUNNING REPAIR

Perform the procedures of the inspection carried out every three months and in addition do the following:

119. Depending on the technical condition, disassemble, inspect and repair if necessary and lap some shut-off valves, the compartment emergency drain valves and the vent valves of the regulating tank.

120. Disassemble, inspect and repair if necessary the water gauges provided on the tanks.

121. Check the strainers and the meshes on the intake pipes of the compartments drain line; replace the meshes, if necessary.

122. Disassemble, inspect, repair if necessary and adjust the safety valve.

123. Test all the assembled pipe lines for tightness.

CHECKING THE PIPE LINES FOR TIGHTNESS

To check the main drain line and the pipe lines of the 2П-1 pumps for tightness, proceed as follows:

124. Bring the system to the initial position.

125. Prepare the pipe line in accordance with Table 17, connect the hydraulic ram and fill the pipe line with water.

126. In the section of the pipe line being checked create a pressure and watch the pressure gauge.

127. Check the fittings and the joints of the section being checked for tightness.

128. The anchor chain flushing pipe line and the intake pipes with open ends are to be tested in service for which they are intended.

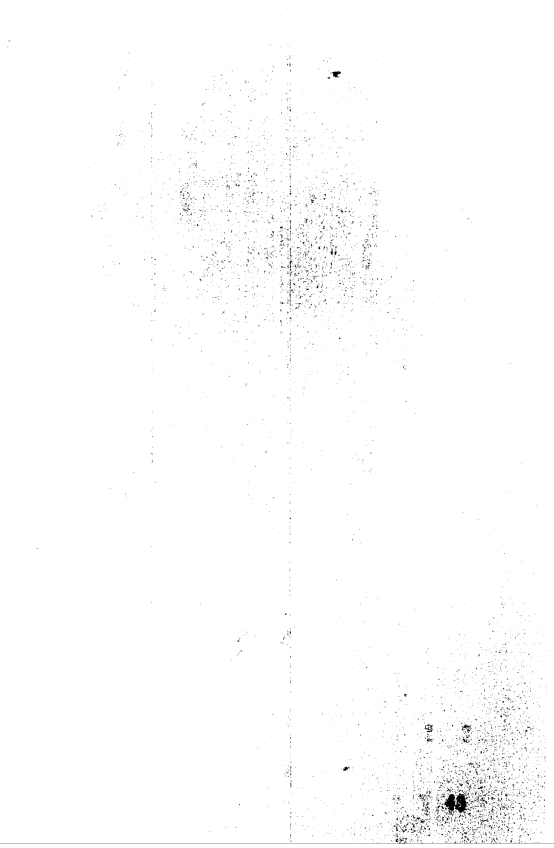
129. The air pipe line shall be tested for tightness with intermediate pressure air fed to the section to be checked from the intermediate pressure air system.

130. The pipes running from the weld-ons on the tanks as far as the nearest valves and manifolds shall be tested together with the tanks under pressures specified in the "Records and Instructions for Compartments, Tanks, Manholes and Hatches".

131. The pipes running from the water gauges on No.2 regulating tank as far as the nearest valves should be tested under a pressure of 30 kgf/cm^2 (when supplying pressure simultaneously to both the chambers of the gauges) and under a pressure of 5 kgf/cm^2 (when supplying pressure only to one of the chambers). Pressure is supplied through the drain pipe (from valves 94, 95).

[redacted] 50X1-HUM

Note: After the dismantled pipes and their fittings have been installed in their proper places, test the section of the pipe line subjected to dismantling for tightness proceeding in accordance with the directions outlined under Items 125-131 and Table 17.



[redacted] 50X1-HUM

Table 17

	...t to be checked	Test pressure for tightness, kgf/cm²	Refs of valves set to		Point to be connected to hydraulic ram
			SHUT	OPEN	
	2	3	4	5	6
	...in drain line, fore portion	38	25	Vent valve on strainer 24, valves 10, A and B on manifold 21	Strainer 7 of pump 2П-1 in No.I compartment x)
2	Main drain line, aft portion	38	13	Vent valve 38 on strainer 24	Strainer 43 of pump 2П-1 in No.VII compartment x)
3	Pipe line of pump 2П-1 of No.I compartment	38	-	6, 76, 4	Strainer 7 of 2П-1 pump, in No.I compartment x)
4	Pipe line of pump 2П-1 of No.III compartment	38	-	26, 64	Strainer 59 of pump 2П-1 in No.III compartment x)

1	2	3	4		
5	Pipe line of pump 2II-1 of No.VII compartment	38	-	37, 41, 46	Strainer of pump 2II-1 in No.VII compartment
6	Pipe line of pump 6MBx2	30	-	23	Strainer 24 of pump 6MBx2 x)
7	Deck flushing pipe line	12	60	62	Weld-on for protector at kingston valve 62

x) Into the plug of the air bleeding valve on the filter cover.

N o t e: 1. Additional supplying of pressure is permissible, since water is likely to leak from under the discs of the kingston valves.
2. The vent valve provided on strainer 24 is opened to protect the pump 6MBx2 from excess pressure.
3. The caps from the fire plugs are to be removed to avoid damage and when it is necessary to check the fire plugs for tightness.
4. Valves 11-a and 55-a are to be opened to check valves 11 and 55 for tightness.

50X1-HUM

APPENDICES

50X1-HUM

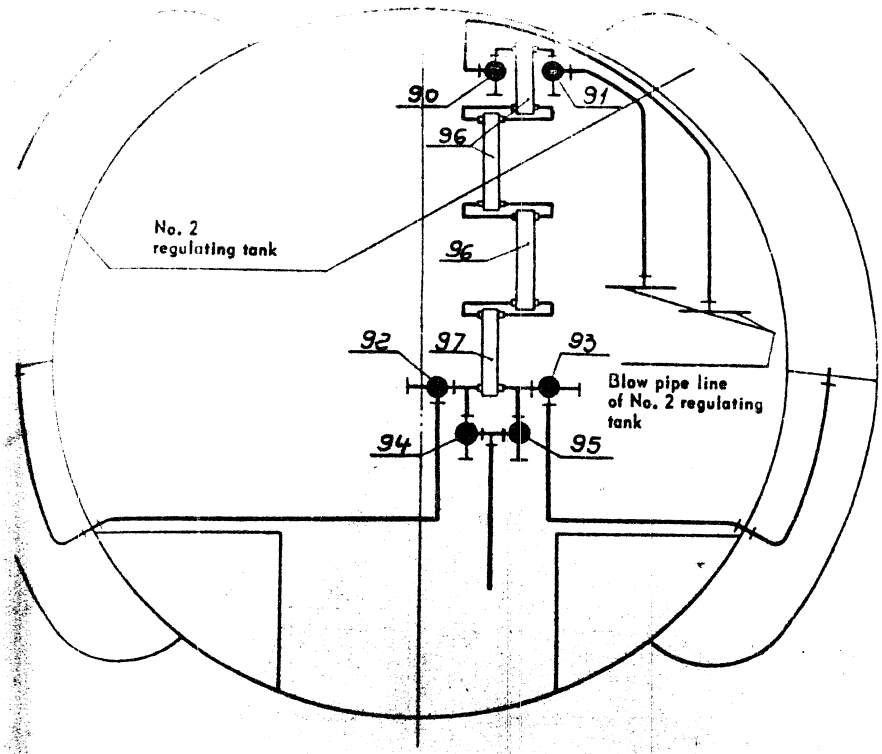
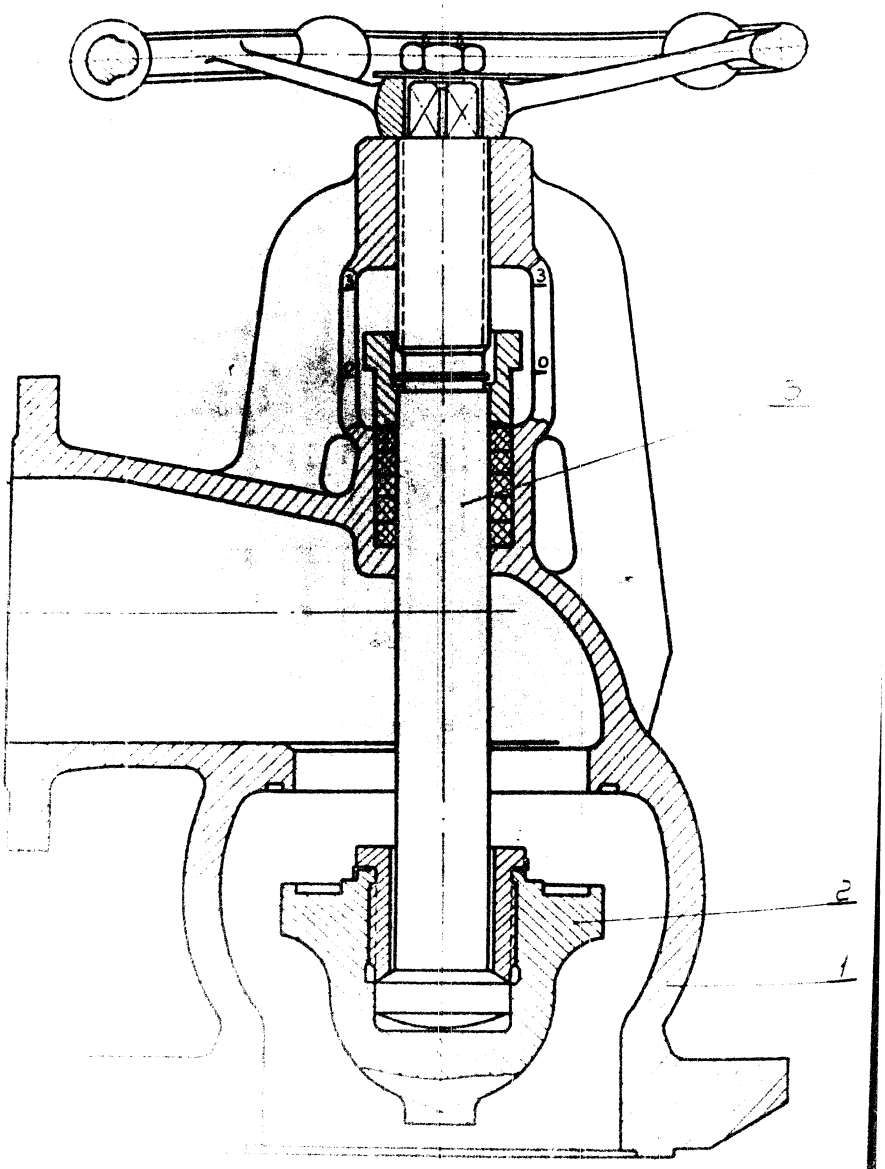


FIG. 1. WATER GAUGE PIPE LINE OF No. 2 REGULATING TANK

Refs	Description	Symbol
96-97	Water gauge	
90-95	Shut-off valve	

50X1-HUM



Refs	Description
1	Body
2	Disc
3	Spindle

50X1-HUM

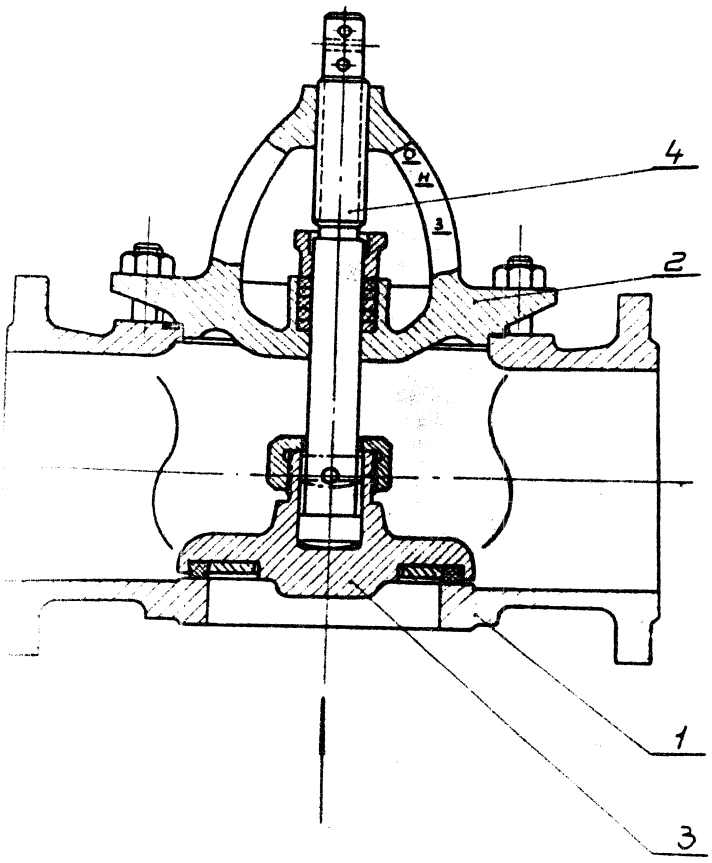


FIG. 3. NON-RETURN SCREW-DOWN VALVE, DIA. 200

Refs	Description
1	Valve body
2	Body
3	Disc
4	Spindle

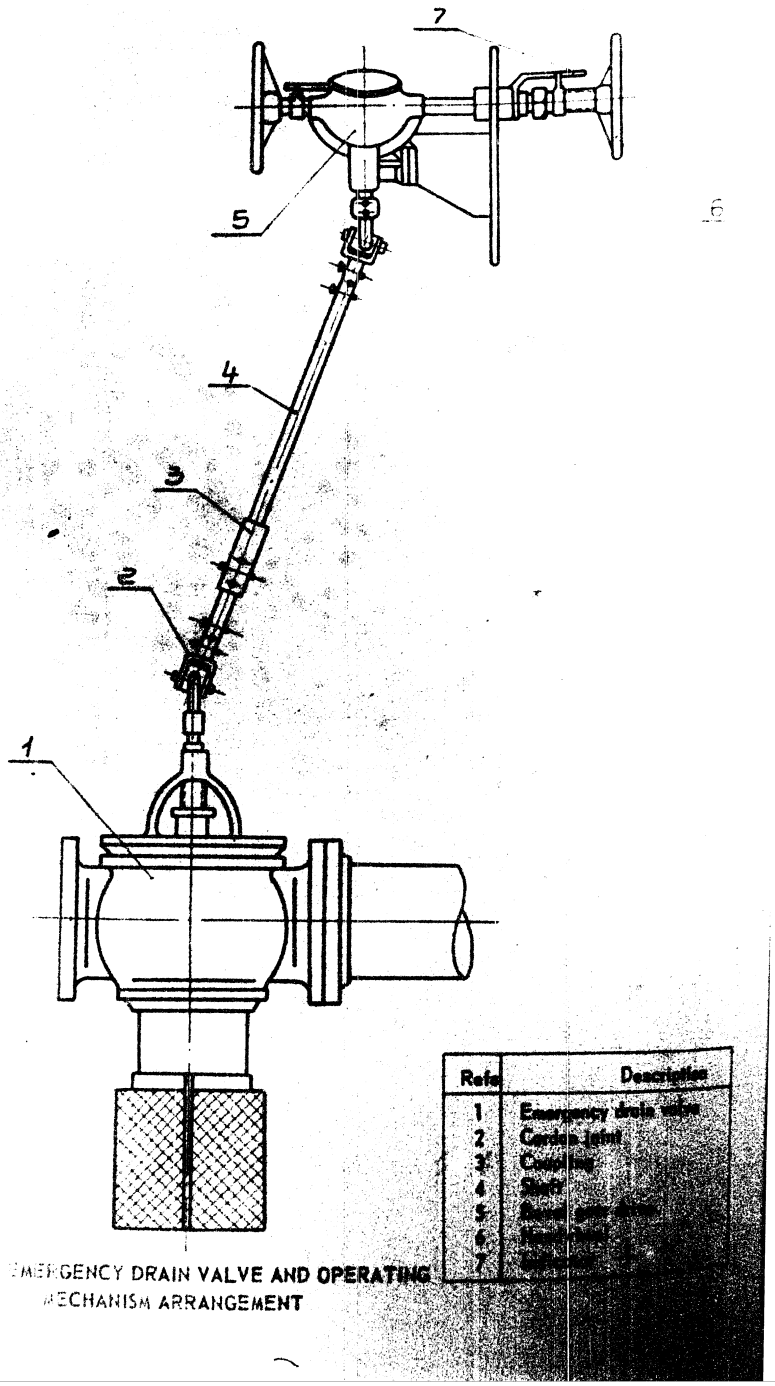


FIG. . EMERGENCY DRAIN VALVE AND OPERATING MECHANISM ARRANGEMENT

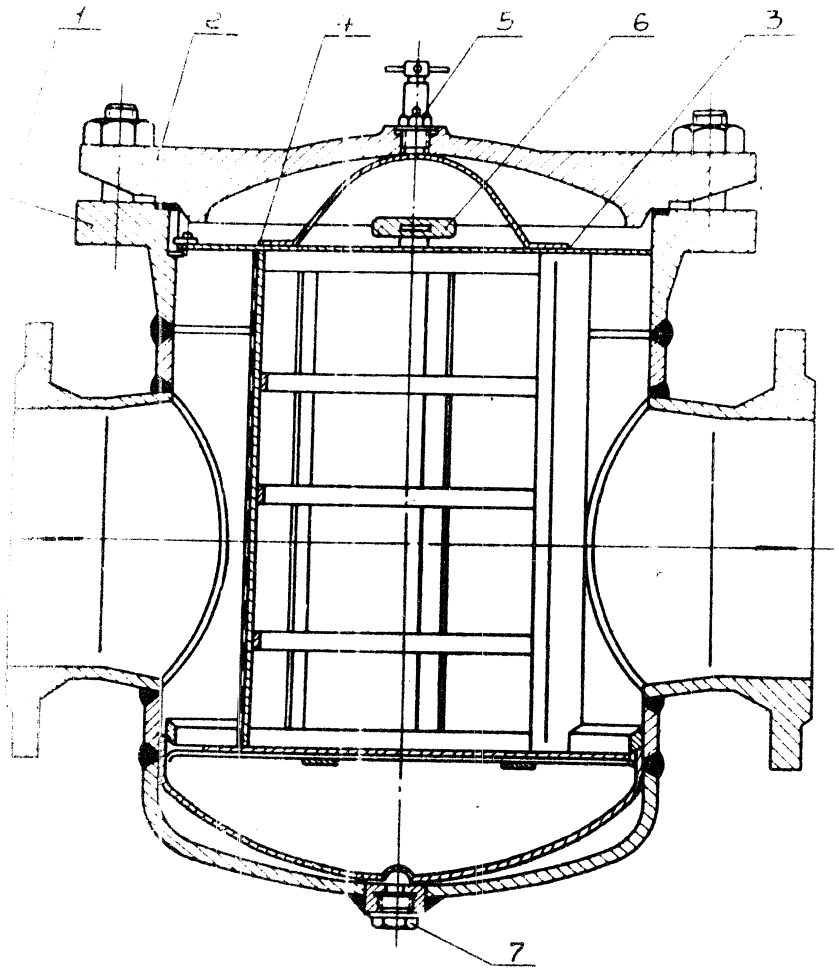
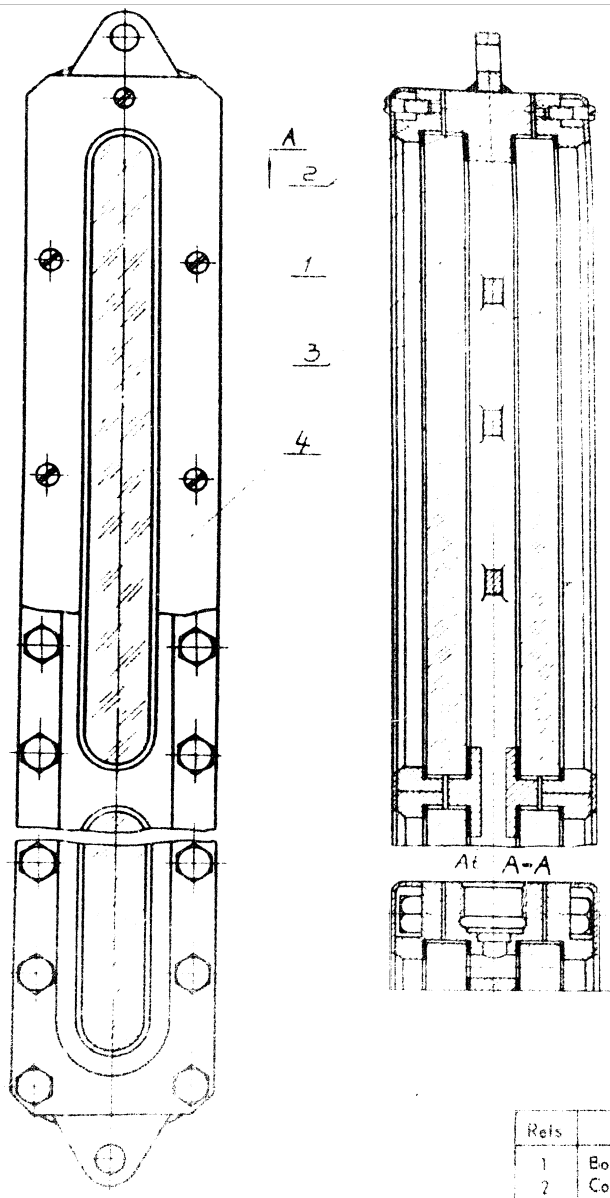


FIG. 5. STRAIGHT-WAY STRAINER

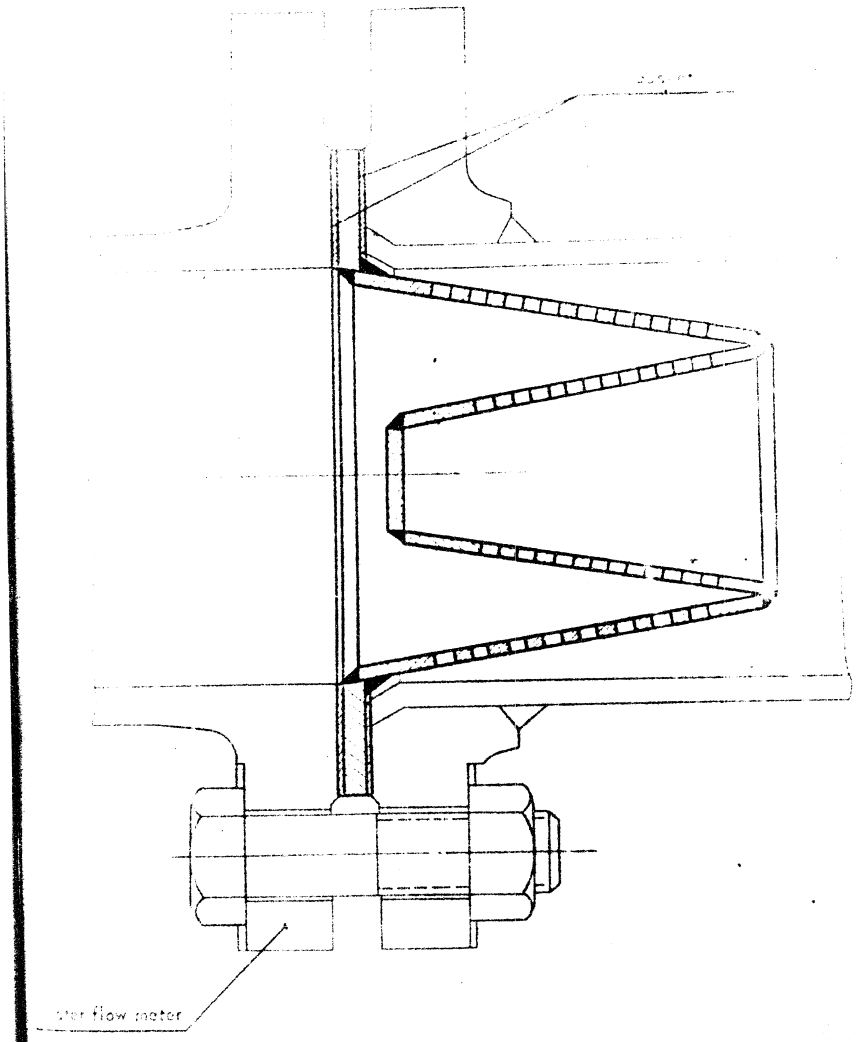
Refs	Description
1	Body
2	Cover
3	Straining sleeve
4	Mesh
5	Vent valve
6	Protector
7	Drain plug

50X1-HUM



Reis	Description
1	Body
2	Cover
3	Glass
4	Scale

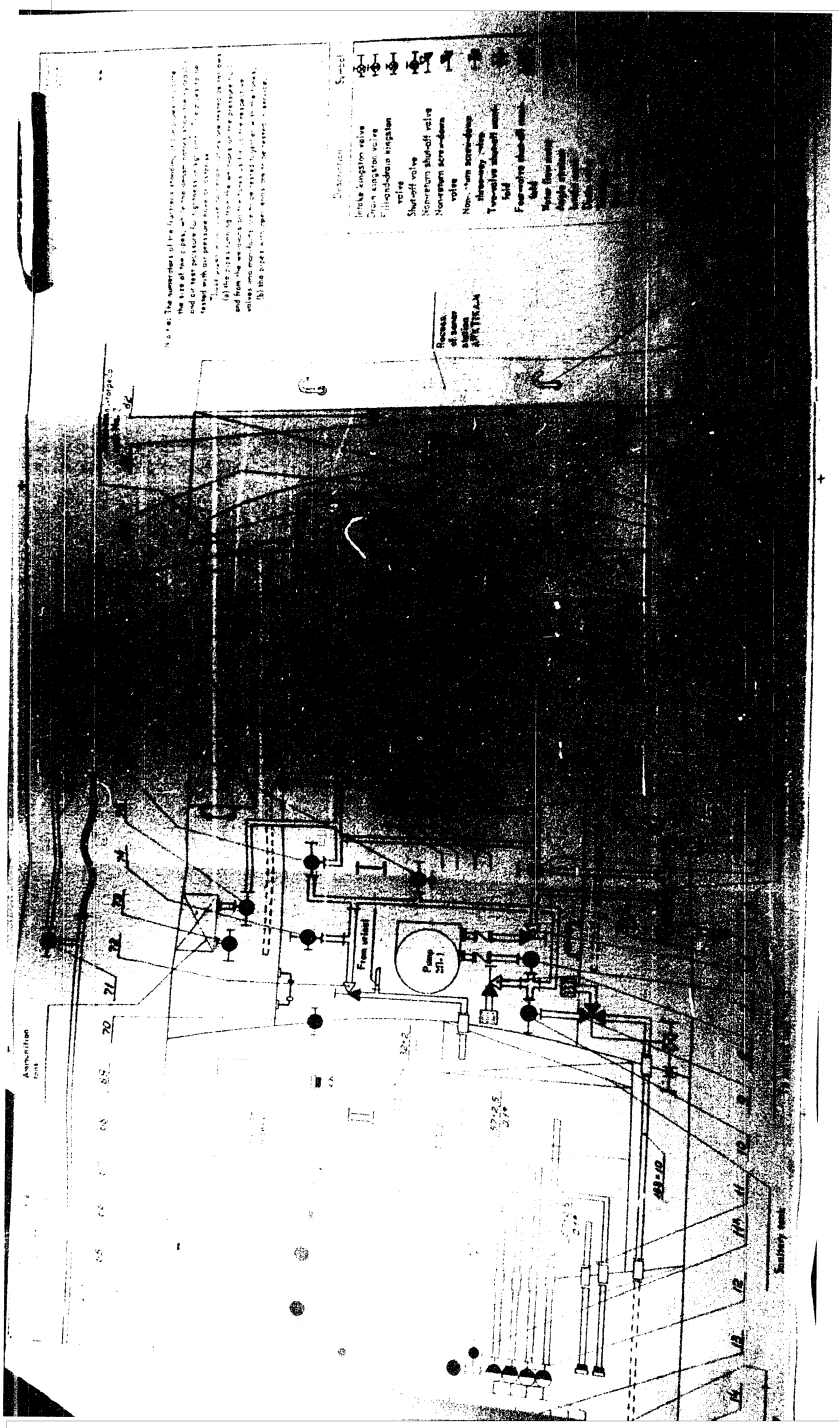
50X1-HUM



...ter flow meter

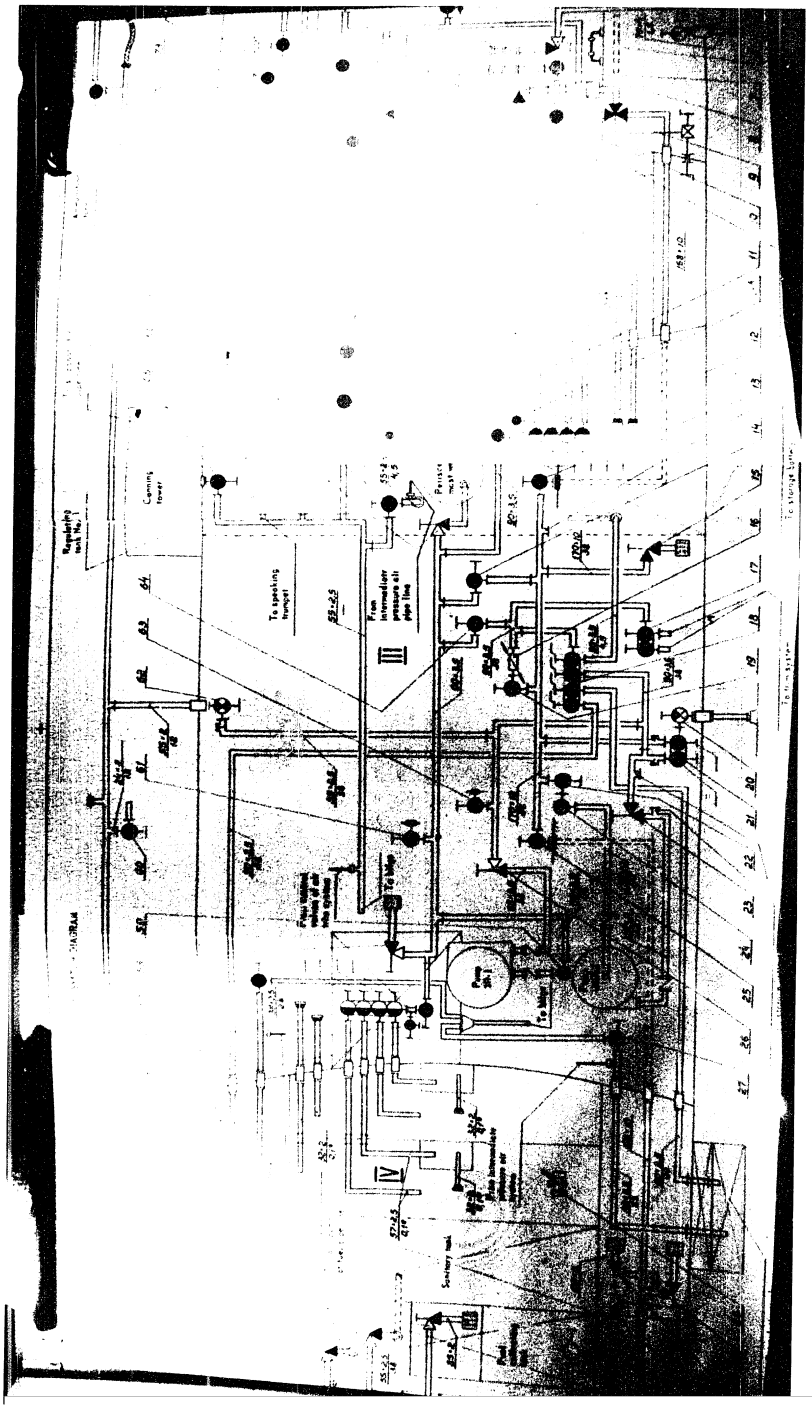
FIG. 1. PAPER SLEEVE FOR WATER FLOW METERS

50X1-HUM



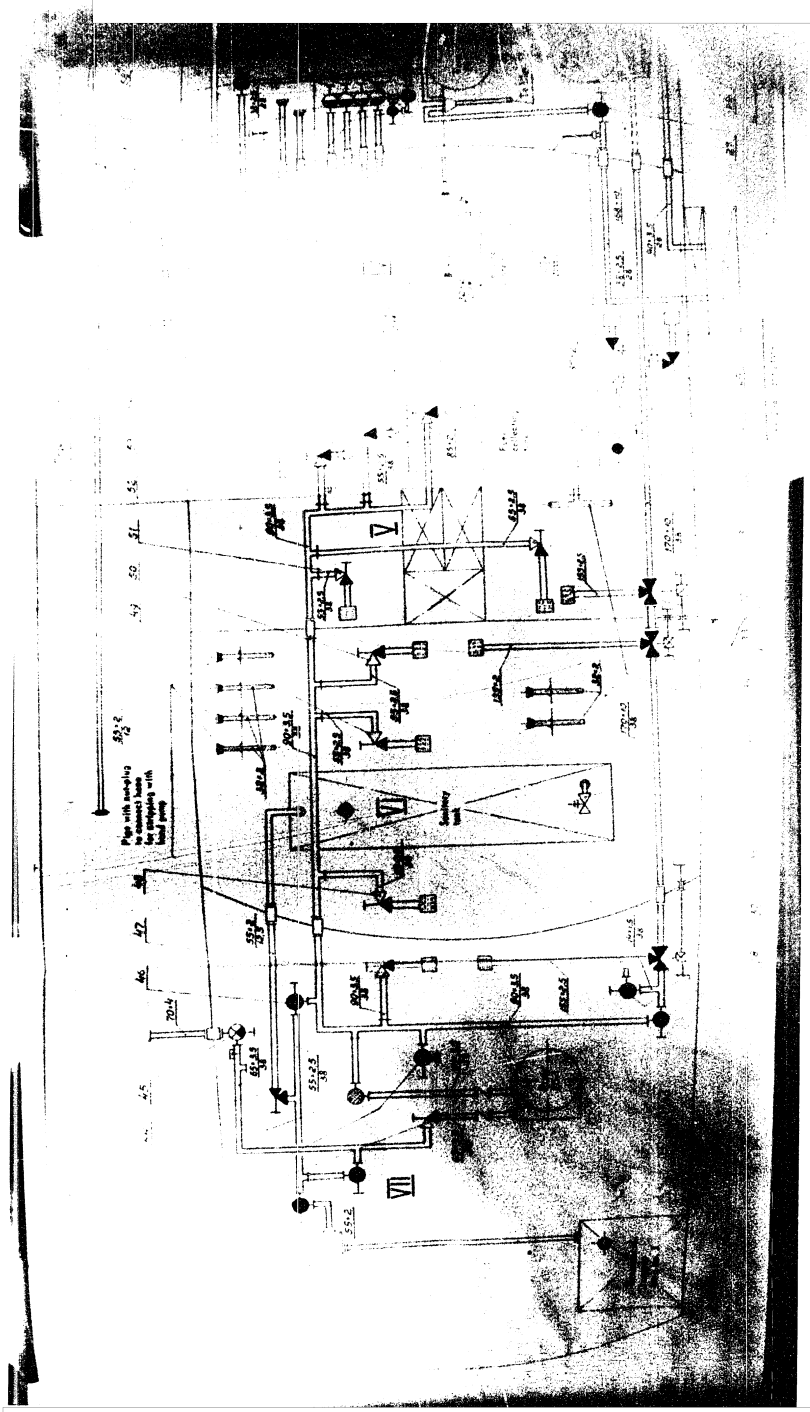
50X1-HUM

50X1-HUM



50X1-HUM

50X1-HUM



50X1-HUM

50X1-HUM