TECHNICAL MANUAL

GB

BX

STEAM GENERATOR

INDEX

1 TECHNICAL CHARACTERISTICS

1.1 GENERAL

The semi-fix horizontal smoke tube steam generators complete with accessories included in the BX range work with gas, oil, heavy oil-fired pressurised burners.
Our generators are safe, reliable, provide high working efficiency and high steam titer. We recommend that you read carefully the instructions provided.

This FLAME INVERSION fired generator produces LOW PRESSURE (1 kgf/cm^2) steam

1.2 CHARACTERISTICS

- **Working pressure switches** (they control the 1st and 2nd burner flame)
- **Locking pressure switches** (they interrupt the fuel supply when steam max pressure is reached; a manual reset button is on the control panel)
- **Automatic level regulator** (2 gauges connected to an electronic conductivity relay maintain water level within set limits)
- **Water level limits** (2 gauges connected to an electronic conductivity relay block the burner when the level reaches the safety minimum level; a manual reset button is on the control panel)

1.3 TECHNICAL DATA

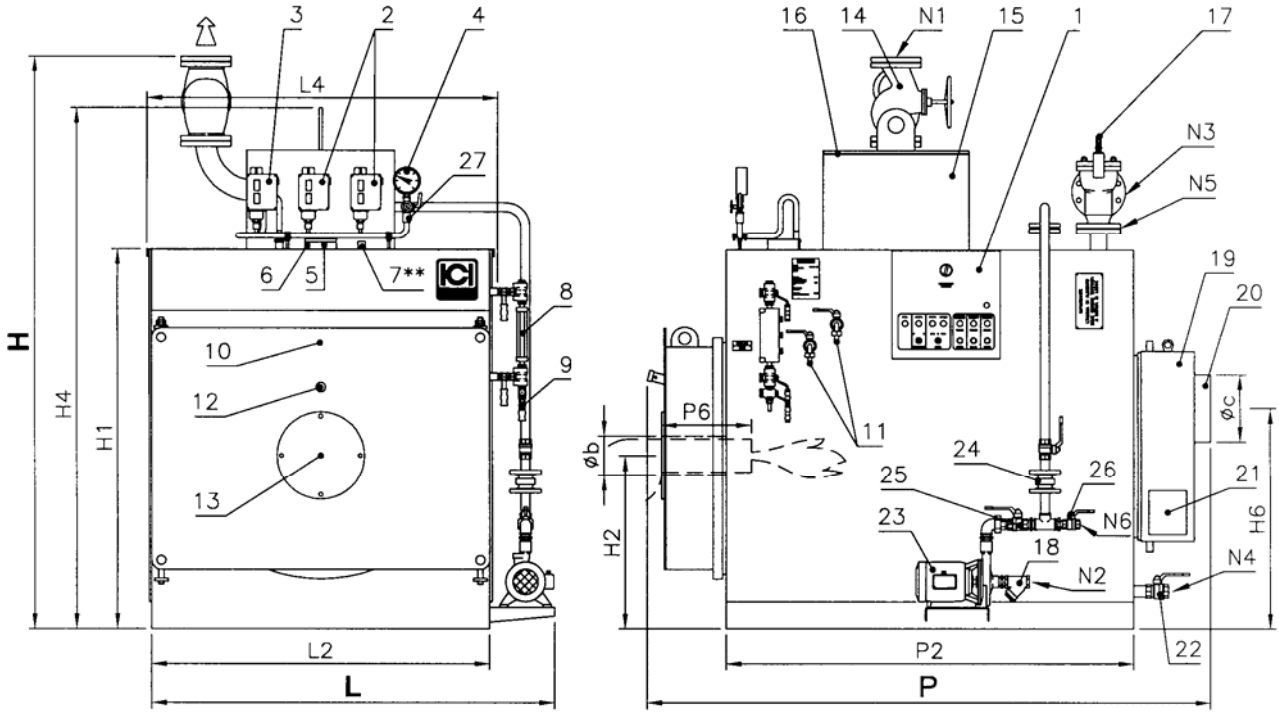


Fig. 1

KEY

1	Electrical panel	12	Flame control warning light	24	Non return valves
2	Regulation pressure switch/es	13	Burner mounting plate	25	Feed valve
3	Safety pressure switch	14	Steam intake fitting	26	Auxiliary feed valve
4	Manometer	15	Dry steam drum	27	Manometer holder tap
5	Safety level 1st probe	16	Inspection hatch	N1	Steam intake
6	Level regulation probe	17	Safety valve***	N2	Feed
7	Safety level 2nd probe**	18	Feed filter	N3	Safety valve exhaust***
8	Level indicator	19	Back smokebox	N4	Boiler exhaust
9	Level indicator discharge	20	Flue fitting	N5	Safety valve fitting
10	Rear manhole	21	Cleaning door	N6	Auxiliary feed
11	Level-control taps	22	Exhaust valve		
		23	Feed pump		

Characteristics	Heat output		Pressure losses flue gas side	Design Pressure	Total capacity	Steam capacity*	Total weight	Electric supply	Frequency	Insulation class	Electric power	Fuel			
	kW	kcal/h	mbar	bar	l	kg/h	kg	Volt ~	Hz	IP	W				
												Nat. gas	Lpg	Gasol	Heavy oil
BX 30	**32**	27.500	0,4	0,98	198	46	460	1/N 230	50,0	IP55	1500	X	X	X	X
BX 60	**69,8**	60.000	0,7	0,98	198	100	470	1/N 230	50,0	IP55	1500	X	X	X	X
BX 90	**105**	90.000	1,5	0,98	410	159	660	1/N 230	50,0	IP55	1500	X	X	X	X
BX 200	**233**	200.000	3,5	0,98	805	354	1080	1/N 230	50,0	IP55	1500	X	X	X	X
BX 300	**349**	300.000	3,5	0,98	1050	530	1400	3/N 400	50,0	IP55	6000	X	X	X	X
BX 400	**465**	400.000	5,0	0,98	1210	708	1520	3/N 400	50,0	IP55	6000	X	X	X	X
BX 500	**581**	500.000	4,5	0,98	1540	883	1960	3/N 400	50,0	IP55	6000	X	X	X	X
BX 600	**698**	600.000	6,0	0,98	1740	1060	2200	3/N 400	50,0	IP55	6000	X	X	X	X
BX 800	**930**	800.000	5,5	0,98	2225	1415	2600	3/N 400	50,0	IP55	6000	X	X	X	X
BX 1000	**1163**	1.000.000	7,0	0,98	2530	1770	3200	3/N 400	50,0	IP55	9500	X	X	X	X
BX 1200	**1395**	1.200.000	7,5	0,98	3020	2000	3600	3/N 400	50,0	IP55	9500	X	X	X	X
BX 1500	**1744**	1.500.000	6,5	0,98	3840	2650	4400	3/N 400	50,0	IP55	12500	X	X	X	X
BX 1750	**2035**	1.750.000	7,5	0,98	4240	3000	4900	3/N 400	50,0	IP55	12500	X	X	X	X

Dimensions	H	H1	H2	H4	H6	L	L2	L4	P	P2	P6	Øb	Øc	N1	N2	N3	N4	N5	N6
	mm	mm	mm	mm	mm	mm	mm	mm	**mm**	mm	mm	mm	mm	DN/in	DN/in	DN/in	DN/in	DN/in	in
BX 30	**1500**	900	385	1280	520	**1200**	750	800	**1215**	818	240-290	130	180	1"1/4	1"	1"	1"	1/2"	3/4"
BX 60	**1500**	900	385	1280	520	**1200**	750	800	**1215**	818	240-290	130	180	1"1/4	1"	1"	1"	1/2"	3/4"
BX 90	**1680**	990	420	1460	560	**1220**	900	950	**1720**	1168	280-330	160	200	40	1"	40	1"	25	3/4"
BX 200	**2010**	1240	575	1760	720	**1400**	1080	1130	**2060**	1508	280-330	180	250	50	1"	65	1"1/4	40	3/4"
BX 300	**2260**	1400	640	1920	815	**1590**	1240	1290	**2092**	1510	310-360	225	250	65	1"	80	1"1/4	50	3/4"
BX 400	**2260**	1400	640	1923	815	**1590**	1240	1290	**2342**	1760	310-360	225	250	65	1"	100	1"1/4	65	3/4"
BX 500	**2280**	1560	700	1970	900	**1750**	1400	1450	**2384**	1761	350-400	280	300	80	1"	100	1"1/4	65	3/4"
BX 600	**2280**	1560	700	1970	900	**1750**	1400	1450	**2633**	2011	350-400	280	300	80	1"	100	1"1/4	65	3/4"
BX 800	**2570**	1710	735	2225	950	**1900**	1550	1600	**2633**	2012	370-420	280	350	100	1"	125	1"1/4	80	3/4"
BX 1000	**2570**	1710	735	2225	950	**1900**	1550	1600	**2963**	2312	370-420	280	350	100	1"	125	1"1/4	100	3/4"
BX 1200	**2720**	1850	785	2354	1000	**2000**	1680	1730	**3160**	2512	370-420	320	400	125	1"	150	1"1/4	100	3/4"
BX 1500	**3000**	1990	850	2450	1080	**2200**	1840	1890	**3419**	2714	420-470	360	450	150	1"	125	1"1/4	80	1"
BX 1750	**3000**	1990	850	2450	1080	**2200**	1840	1890	**3719**	3014	420-470	360	450	150	1"	125	1"1/4	80	1"1/4

* 80°C feeding water
** BX 60: probe on the inspection hatch
*** Nr. 2 for BX 1500 and BX 1750

2 ACCESSORIES

BX Steam generators are equipped with the following range of accessories:

- Safety devices (safety valve, water level limits)
- Observation devices (level gauges, pressure gauges, fire observation glass)
- Regulation systems (level switches, pressure switches)
- Water feeding systems (motor-driven pump)
- Operating pressure systems (cut-out valves, discharge valve, steam valve, feeding valve).

In the following description, accessories are classified according to the physical quantity they control (pressure and level).

2.1 PRESSURE

2.1.1 Pressure gauge (Fig. 2)

Bourdon type, with a metal pipe having a tight, elliptical cross-section bent into an arc. One end is open and is connected to the inside of the generator or the device for which pressure has to be measured; the other end is free to move and is connected by means of a system of levers and toothed sector.
The red dot on the pressure gauge indicates the rated pressure.

The manometer is mounted on a 3-way tap which is necessary for:

- Generator/manometer communication (normal working position)
- Manometer/external communication (position requested to drain the trap)
- Generator/manometer/manometer specimen communication (position requested for comparing the manometer)

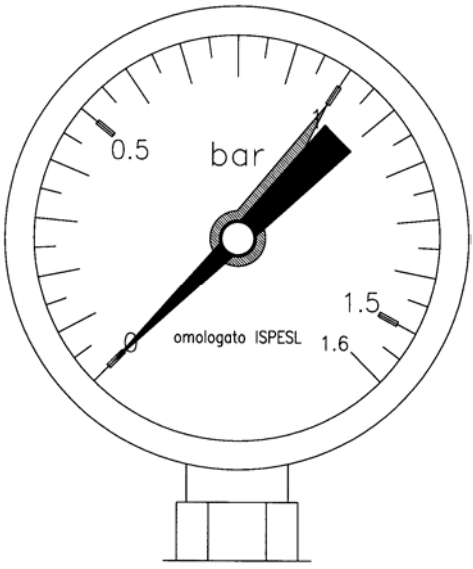


Fig. 2

2.1.2 Operating pressure switch

This device controls the pressure in the generator and keeps it within the preset maximum and minimum values.
Calibration instructions.
The electrical switch has 3 screws (2-1-3 from the right to the left side). When the pre-set pressure is obtained, contact 2-1 is commuted into a 2-3 contact.

Pressure switch calibration (Fig. 3):
a) Rotate the knob (1) until the scale pointer (2) is set on the pressure value that restarts the burner.
b) Remove the pressure switch cover and set the drum (3) on the desired differential value (burner stop) according the Fig. 4 chart.

Example:
* Pressure switch type: RT 110
* Scale pointer: 0.7 bar
* Drum pointer: 7 corresponding to 0.2 bar
* Burner start: 0.7 bar
* Burner stop: 0.9 bar

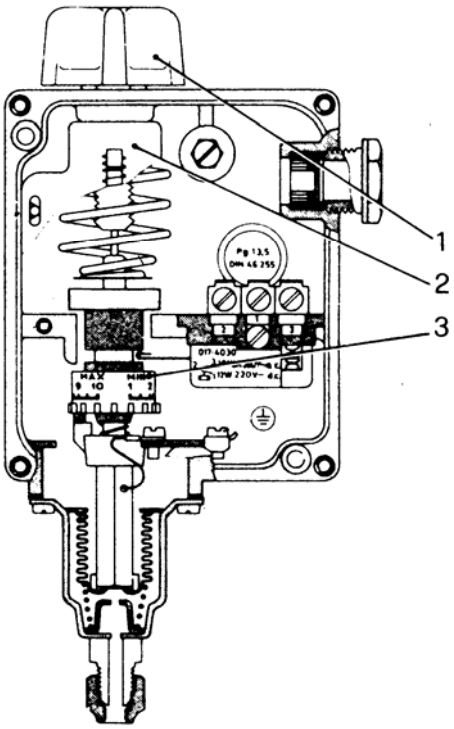


Fig. 3

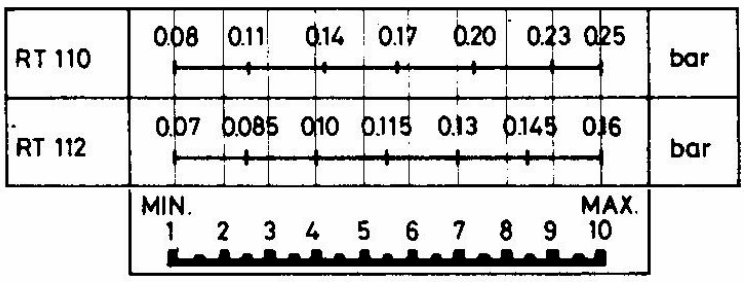


Fig. 4

2.1.3 Safety pressure switch

This unit is calibrated at a higher pressure than the maximum working pressure but at a lower pressure than safety valves setting.

The safety pressure switch operates in the event of a fault in the regulation pressure switch: the burner is thereby brought to a halt and cut-out. Burner restart only takes place once the cause of the cut-out has been eliminated, together with manual resetting of the electrical control panel.
To regulate this pressure switch follow the instructions for the regulation pressure switch but make sure that the drum pointer is on 1, i.e. the differential is almost inactive.

2.1.4 Spring loaded safety valve

This valve discharge the steam when the preset maximum pressure value is reached.

The boiler valves can be of the **weight/lever** (Fig. 5) or **spring** type (Fig. 6).
This valve discharge the steam when the preset maximum pressure value is reached. Safety valve is the most important and most delicate component of the generator and is the best assurance that pressure inside the generator itself does not exceed rated pressure.
As the safety valves are really tripped during normal generator operation, it is **good practice to regularly check that they are not obstructed:** operate the lifting lever until the valve begins to discharge steam.

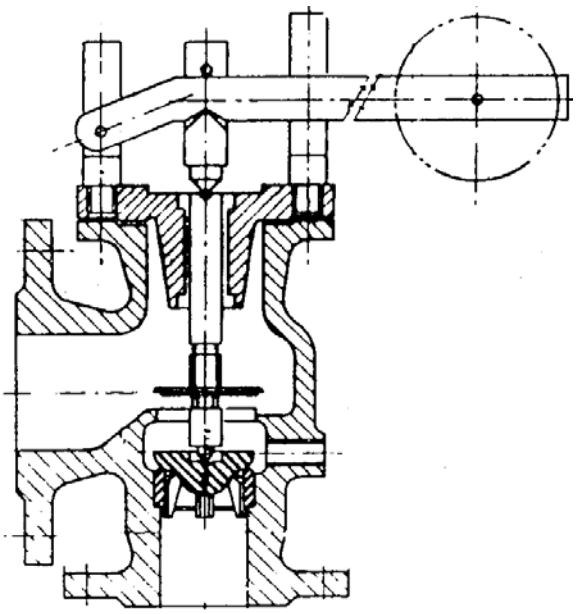


Fig. 5

WARNING
At the first start up ensure that the safety valve is calibrated at the standard generator pressure. In general, the spring safety valve is already calibrated while for the weight/lever valve the weight must slide along the bar until the opening value is attained which corresponds to the appliance standard pressure.
The safety valve installed on the steam generators must discharge outside the boiler room. Special attention should also be given to the installation of the discharge pipes; there follow some examples.

- It is advisable to install discharge pipes using a pipe diameter at least equal to the diameter of the output flange of the safety valve.
- Any curves/bends in the discharge pipe must have a large radius.
- All discharge pipes must be installed in such a manner as to avoid the formation of condensate. Pipes should therefore be installed at a sufficient angle to ensure complete drainage of condensate.

Special attention must also be given to the sanding of the seat shutter, should this operation be necessary to correct leak or blow-by; use silicon carbide-based abrasives of carborundum and oil. It is recommended to perform a first sanding operation with a fine-grain abrasive and a second pass with a very fine-grain abrasive.

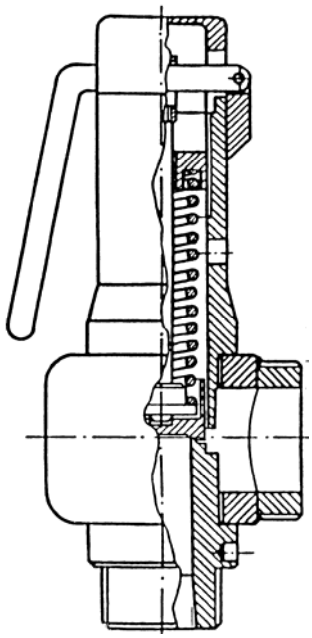


Fig. 6

2.2 LEVEL

2.2.1 Level indicators

The level indicator is equipped with a couple of taps connected to a reflection box with a prism glass. This device is connected to the generator over and under the normal water level; at the lower end it has a drain tap for mud discharging and keeping glass clean. These taps are required to check the efficiency of the level indicators at intervals, as follows:

- Open the bleed tap for a few seconds and then close it again. If the water disappears and then returns quickly to the previous level with large oscillations, the gauge can be considered to be in good working order. If, on the other hand, the water returns slowly or stops at a different level, this means communication with the boiler is obstructed.; in order to detect which of the two routes is obstructed and to bleed it, close the steam tap, leaving the water tap open, and then open the bleed cock: water should emerge carrying with it any sludge deposits formed in the ducts. Close the water tap and open the steam tap: steam should emerge from the bleed tap. Closing the bleed cock and leaving the water and steam taps open, the water should return to its previous level. If this does not take place, the connecting ducts linking the level indicator to the generator need cleaning.

2.2.2 Automatic level regulator and water level limits (Fig. 7)

The level detection and control principle is based on water electrical conductivity. This is an electrical conduction type with electronic relays and probes of different lengths submerged in the boiler body.
Working conditions:

- **Pump automatic start and stop**: the boiler contains 2 probes: the longer probe starts the pump while the shorter stops it. They are both connected to one regulation relay on the control panel
- **Burner stops when the level is low**: the boiler contains 2 probes of the same length and connected to two different regulation relays on the electrical panel. They both stops permanently the boiler when the level lowers to the minimum admitted limit.

Boiler probes:

6. Pump stop
7. Pump starting
8. 1st burner cut-out safety device and alarm ON
9. 2nd burner cut-out safety device and alarm ON

NOTE: it is recommended that an alarm bell is installed in the boiler room as well as a sound or visual alarm in highly visited rooms.

** BX 60: probe on the inspection hatch

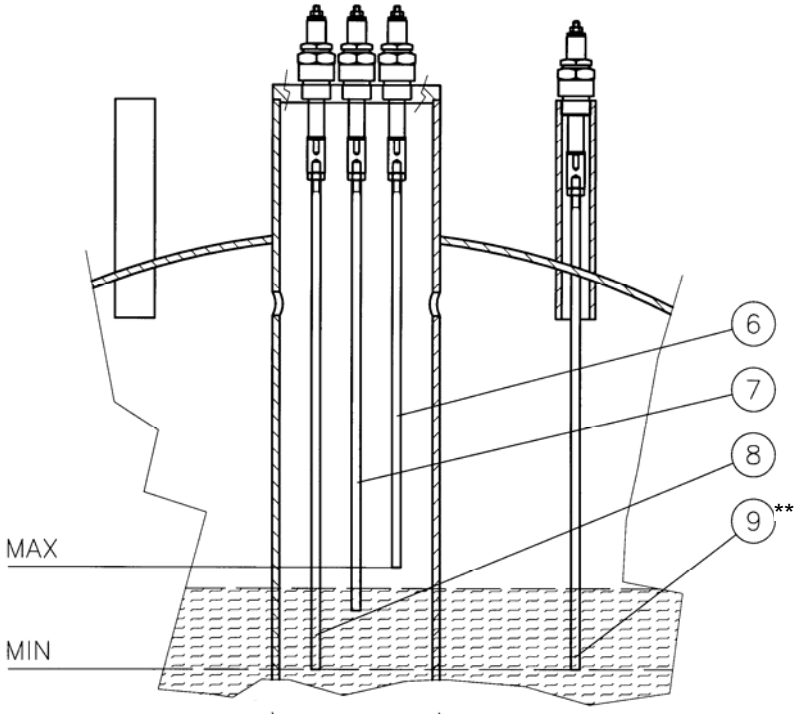


Fig. 7

2.3 FEEDING

Water is fed by a centrifugal motor-driven pump. Steam generators are equipped with 1 stage pump and steam generators with great capacity. The pump must not exert any intake action but should rather be "under head", that is under the pressure of a column of water resulting from the difference in height between the water in the collection tank and the axis of the pump itself. Whereas a pump may intake cold water from a tank (5-6 mt), when the water is heated, the pump is not only unable to intake the water but it has to flow to the pump under a certain pressure. The height of the tank varies with temperature variations, as shown in the table:

Feed water temperature (°C)	**Head on intake** (metres)
60	1
70	2
80	3
90	4,5

WARNING

- **Avoid water at a temperature lower than 60°C, because it has a very high oxygen concentration and that may produce corrosion.**
- **To avoid the pump cavitation problems, water temperature in the condensate collecting basin must never exceed 90°C.**

3 INSTALLATION

3.1 POSITIONING

Steam generators are constructed in an en-bloc which does not require foundation building work; a smooth uniform support base, possibly raised by 5-10 cm, is sufficient.

3.2 HYDRAULIC CONNECTIONS

After their installation, steam generators must be connected to the plant as follows (Fig. 9):

Water

From the condensate collection tank (10) (if fitted, otherwise from the depurated water collection tank) to feed intake pump; from depurated water collection tank or directly from mains water supply to injector intake (9) to the intake pump (9).

Steam:

From main steam fitting valve (3) to services (distribution manifold or other services); from the safety valve (6) outlet to the outside of the installation site in a safety position;

Discharge

From the level indicator discharge (16) and boiler discharge (17) to the discharge system.

Fuels

Burner connections for gas- or methane-fired versions.

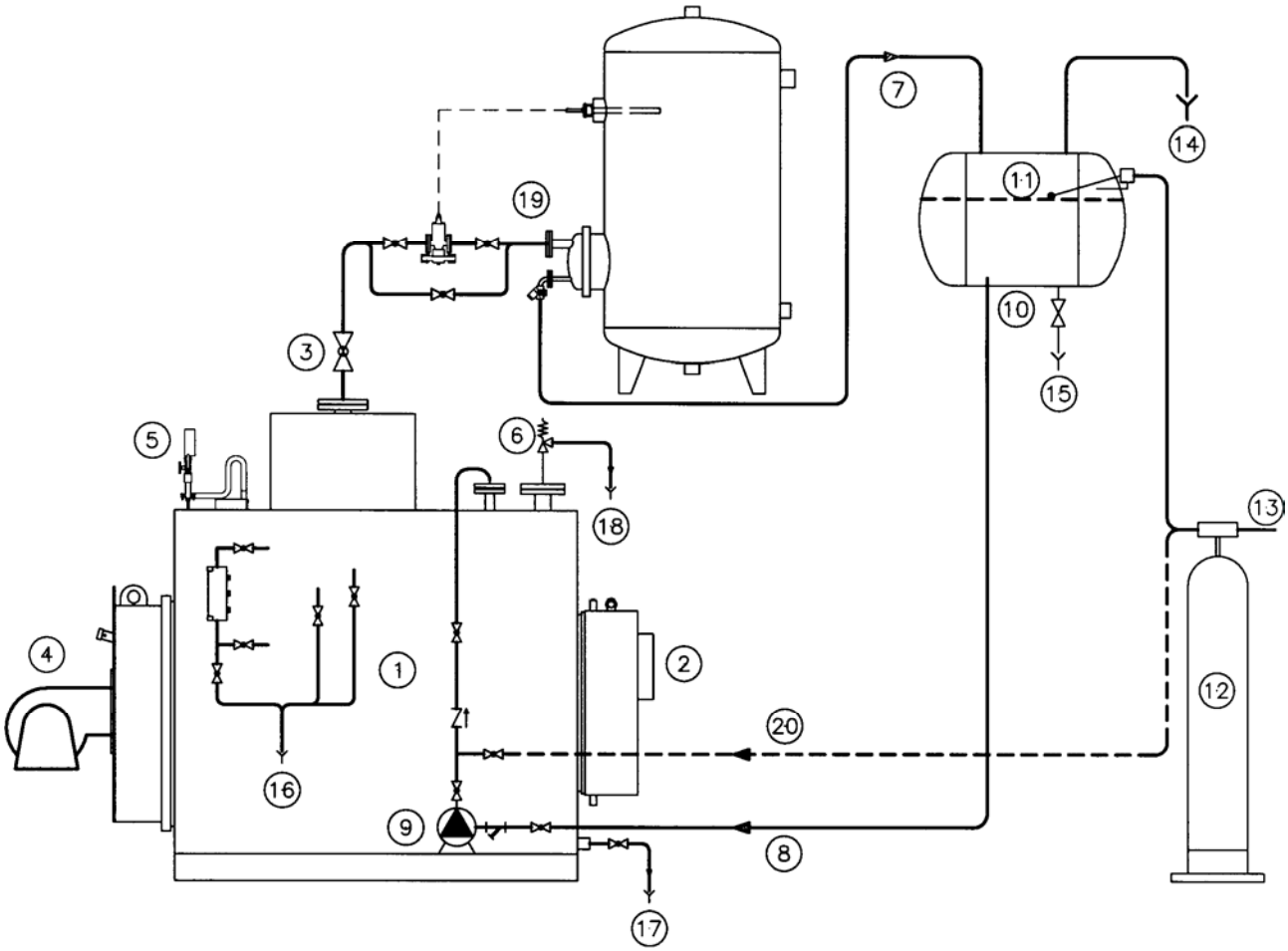


Fig. 9 – Plant diagram

1 Generator
2 Flue
3 Steam intake
4 Burner
5 Pressure switch
6 Safety valve
7 Condensate return
8 Motor pump feeding
9 Feed pump
10 Condensate collecting basin
11 Water level
12 Water conditioner
13 Water supply
14 Ventilation opening
15 Condensation tank discharge
16 Level indicator discharge
17 Boiler discharge
18 Safety valve discharge
19 Examples of use
20 Water supply emergency feeding

3.3 ELECTRICAL CONNECTIONS

Generators are supplied with the electrical panel (IP 55 protection degree) fully assembled to the boiler accessories. Before connecting the electrical panel, the efficiency and above all the earthing system should be inspected.

Electrical diagram
Refer to the diagram supplied with the specific switchboard.

3.4 FLUE

The connection pipe from the boiler to the base of the flue must slope upwards in the direction of the flue gas flow with recommended gradient of no less than 10%. Its path must be as short and straight as possible with the bends and fittings rationally designed in accordance with air duct criteria.
For lengths of up to 2 metres, the flue connection diameters (see technical data table) can be used. For more winding paths, the diameter must be suitably enlarged.
For flue size regulations in force should be always observed. Special attention should be drawn on internal diameter, insulation, anti-smoke, access for cleaning and hole for smoke sample collection for the combustion analysis

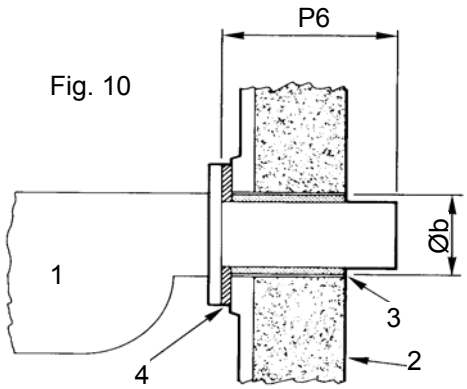
3.5 BURNER

We suggest that you install a **2-flame** or **modulating** burner to better meet users' requirements; any level overload can be avoided and the generator can work evenly.
Furthermore, in light oil-fired burners, at each burner re-start, air is "pre-washed" inside the combustion chamber and cools the low water mass inside the boiler with a consequent rapid pressure drop. Furthermore, with methane-fired systems, each time the burner restarts, the combustion chamber is long pre-ventilated which causes a significant heat loss at the flue.

3.5.1 Boiler-burner coupling

Ensure that the inner space between the draught tube and the door are filled with ceramic- flame-resistant insulating material (Fig. 10).

Fig. 10



KEY:
1. Burner
2. Manhole
3. Thermoinsulating material
4. Flange

All details on the draught tube lenght (**P6**), the diameter of the burner hole (**Øb**) and the pressurization are included in the par. Technical Specifications.

4 OPERATION

4.1 FIRST START-UP

WARNING: Before start up insert all the turbolators into the smoke tubes ensuring that there is a space of at least 100 mm at the front after they have been pushed fully inside.

- First and foremost, make sure that all fittings are well-tightened.
- Make sure that the feed water pipe is clean, flushing repeatedly with discharge to the sewers before final filling.
- Close the following valves: discharge, steam connection level discharge and tank
- Open the following valves: level cut-out and feed (up-line and down-line of water pump)
- Make sure that upper hatch is properly closed
- Start the boiler, as follows:

1 Power up the boiler control panel
2 Make sure that the motor-driven pump drive shaft is free to rotate and that rotation direction is correct.
3 Set the pump selector switch on AUT and verify that burner cannot start before the attainment of the minimum level;
4 Make sure that the pump stops when the maximum level is reached, observing level indicators and checking the position of their cocks;
5 Maintain safety level reset pressed for 10 sec because it is employed an electronic delayed relay
6 Open the boiler discharge and check on the level indicator the intervention point of probe pump start
7 Set the pump selector switch on "0", leaving the discharge open, and check the intervention level of safety probes, referring to the minimum level information plate;
8 Close the discharge, place pump selector switch to AUT;
9 Power up the burner and bring boiler pressure up; calibrate the work pressure.

WARNING: With generators fitted with a manhole, at the first start up, it is fundamental that the 2 manhole bolts are progressively tightened when the pressure increases.
Should this not be the case, a dangerous situation may be created from the steam leakage that deteriorate rapidly the seal creating a dangerous situation for the professionals working in the thermal plant.

4.2 NORMAL WORKING CONDITIONS

Cold start – ensure that:
- The boiler is filled to the minimum level;
- The heating-caused volume increase does not increase too much and needs to be discharged at regular intervals to bring the level on the glass indicator centre;
- Once the set pressure has been reached, the steam intake valve must be opened gradually to heat the flow tubes and eliminate any condensation in the tubes;
- The manhole seal is working efficiently.

5 MAINTENANCE

5.1 ORDINARY

- Bleed periodically (level indicators, probe-holder barrel if any, boiler) to avoid mud deposits.
- Check the efficiency of the regulation and control instruments by inspecting carefully the electrical (also connections) and the mechanical parts (pressure switches); it is also recommended that the probe-holder ceramic plugs are replaced every year
- Perform burner maintenance (see appropriate instructions);
- Check the tightening of bolts on the flanges and the condition of the gaskets.
- Check the inside coating of the doors;
- Clean the tube bundles and the turbolators;
- Service correctly the pump (bearings, mechanical seal)
- Inspect the discharge valve that are submitted to a faster wear due to muds abrasive action;

5.2 PERIODIC

5.2.1 Periodic control (every 6 hours of use)

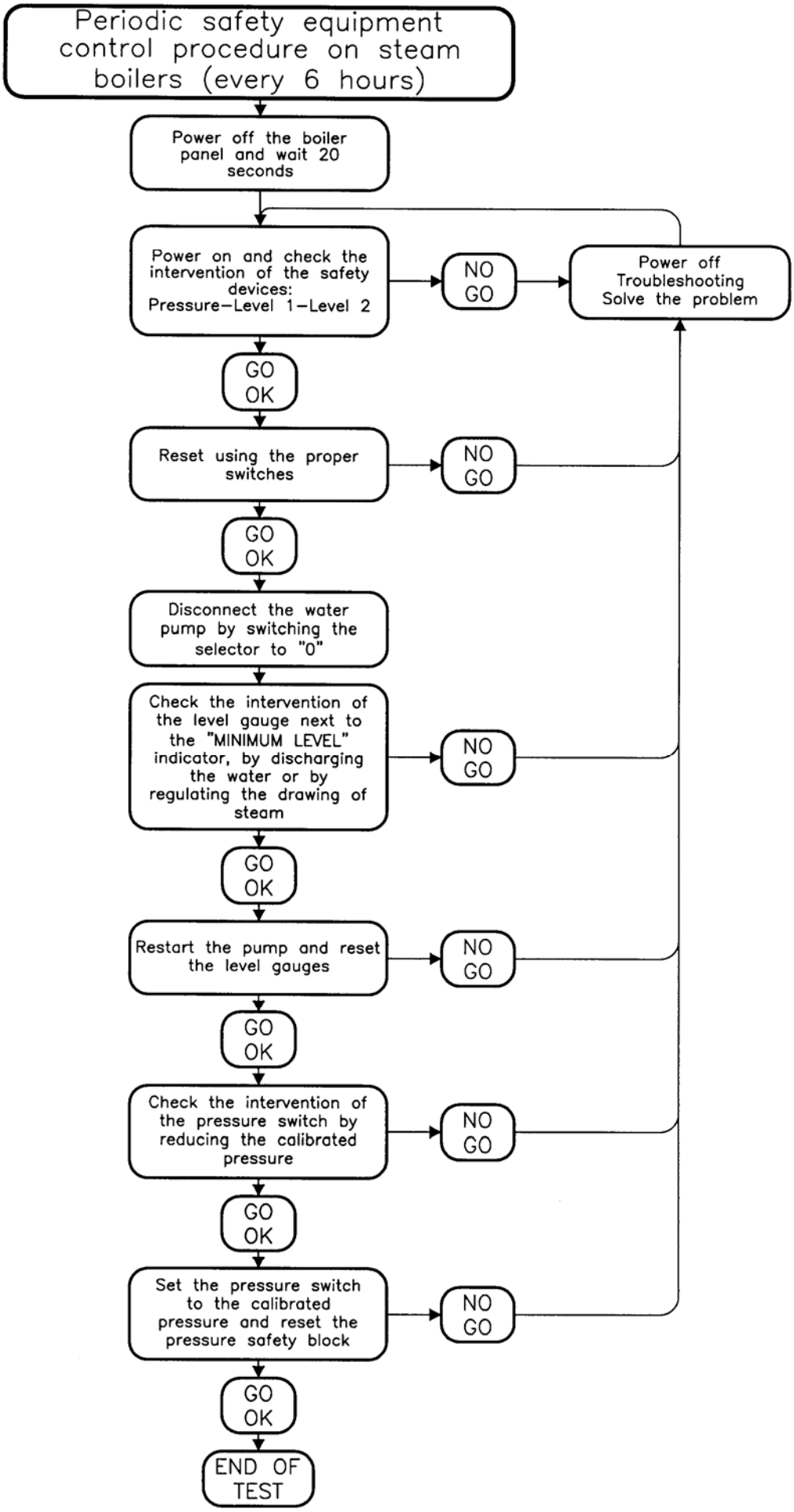
From time to time (every 6 hours of use) the thermal plant must be inspected by qualified personnel to check the efficiency of all safety accessories:

- Water level limits

- Safety valve

The system can be reset if no anomalies have been encountered: power off the panel for approx. 20 seconds, power on the main switch and press the reset buttons.

For further details follow the flow chart below:


Periodic safety equipment control procedure on steam boilers (every 6 hours)
Power off the boiler panel and wait 20 seconds
Power on and check the intervention of the safety devices: Pressure–Level 1–Level 2
NO GO
Power off Troubleshooting Solve the problem
GO OK
Reset using the proper switches
NO GO
GO OK
Disconnect the water pump by switching the selector to "0"
Check the intervention of the level gauge next to the "MINIMUM LEVEL" indicator, by discharging the water or by regulating the drawing of steam
NO GO
GO OK
Restart the pump and reset the level gauges
NO GO
GO OK
Check the intervention of the pressure switch by reducing the calibrated pressure
NO GO
GO OK
Set the pressure switch to the calibrated pressure and reset the pressure safety block
NO GO
GO OK
END OF TEST

5.3 EXTRAORDINARY

All generators must be stopped periodically to carry out a careful inspection and maintenance: the inactivity period must be decided upon the experience, working conditions, feed water quality and type of fuel used.
Before accessing the boiler body for inspection or cleaning purpose, ensure that no water or steam is allowed inside the generator through its connecting pipes. Each valve must be blocked and, if necessary, insulated by removing a pipe section of the connection or by inserting a blind flange.
The parts under pressure must be examined thoroughly inspected to detect any scaling, **corrosion** and other potential sources of danger that may be found in the **feed water**.
Scales must be removed mechanically or chemically. **With special instruments ensure that the real casing thickness is higher or equal to the one illustrated in the construction drawing**. Each blister or other type of corrosion must be scraped off and cleaned with an iron brush until the metal is raw again. Any leak in the smoke pipes and the tube plate must be carefully inspected; any welding must be carried out as provided for by the law keeping in mind that the steam generator is a pressure appliance with explosion danger.
During the inspection, check all accessories and above all the safety valve, level probes and pressure switches.

5.4 PRESERVATION DURING THE INCATIVITY PERIODS

The most serious corrosions start during the inactivity periods. Operations that must be carried out to preserve the generator depend mainly on the time of inactivity.
A dry preservation is recommended for longer periods of inactivity while a wet preservation is ideal for shorter stops or when the generator is used for backing up and must be ready for immediate start up. In both cases, the operations to be performed help eliminate all that causes corrosions.

5.4.1 Dry preservation

Empty and thoroughly dry the generator by inserting in the cylindrical body a hygroscope substance (quicklime, silica gel, etc.)

5.4.2 Wet preservation

The boiler must be filled to the top as corrosion is caused by the simultaneous presence of water and oxygen. Therefore, all oxygen must be eliminated from water trying to avoid any later air infiltration. Some substances, such as hydrazine or sodium sulphite, can absorb water. However, after they have been used, water basicity must be controlled.

6 WATER CHARACTERISTICS

For steam generators with heating surface over 15 sqm, **there are some regulations that require limit values for water characteristics.** These values are listed in the tables below.
However, limits should be adopted for all generators as stated by qualified companies that recommend the type of treatment to be carried out basing on careful analysis of the available water. **Many faults and sometimes serious accidents are caused by the use of water with non-conforming features.**

6.1 FEED WATER - LIMIT VALUES: (boiler feed inlet)

Table 1

Characteristics	**m.u**	**Pressure ≤ 15 bar**	**Pressure ≤ 25 bar**
pH		7 ÷ 9.5	7 ÷ 9.5
Hardness	mg/l $CaCo_3$	10	5
Oxygen (1)	mg/l O_2	0.1	0.05
Free carbon dioxide (1)	mg/l CO_2	0,2	0.2
Iron	mg/l Fe	0.1	0.1
Copper	mg/l Cu	0.1	0.1
Oily substances	mg/l	1	1
Appearances	Clear, transparent, no persisting foam		

(1) These values are valid to have a thermo degassing device. Without degassing device, the temperature of the tank water must be increased to at least 80°C (see chapter 2.3. - Feeding) to reduce the content of dissolved gasses (O_2 and CO_2). Chemical deoxygenators must be used to remove completely the oxygen from the feed water and reduce as much as possible CO_2 corrosive effects.

6.2 OPERATING WATER - LIMIT VALUES

Table 2

Characteristics	**m.u.**	**Pressure ≤ 15 bar**	**Pressure ≤ 25 bar**
pH		9 ÷ 11	9 ÷ 11
Total alkalinity	mg/l $CaCo_3$	1000	750
Hardness	mg/l $CaCo_3$	10	5
Max conductivity (4)	μS/cm	8000	7000
Silicon dioxide	mg/l SiO_2	150	100
STD (4)	mg/l	3500	3000
Water conditioner (2)			
Appearances	Clear, limpid, no persisting foam		

(1) In order to maintain the alkaline, silica parameters in the generator within the prescribed or recommended limits, it is necessary to bleed the generator continuously. The feed water and generator concentration values are connected to the continuous discharge based on the following relationship:

$$S\% = 100\frac{Ca}{Cc}$$

S% = Bleed percentage compared to water fed into the generator;
Ca = Actual concentration of a special salt or ion in feed water
Cc = Max concentration allowed for the same salt inside the generator

(2) For a correct management, conditioner/s dosages and limits refer to the nature and the features of the additives.
(3) Based on the filtered sample
(4) The 2 parameters have the same physical meaning but values can be correlated only if water chemical composition is known.

6.3 ANALYSIS FREQUENCY

The interval at which analysis should be carried out depends on how the generator is used and the quality of feed water; however, it is recommended that the value of pH, total hardness and feed/working water alkalinity is checked every two days
In changing working conditions, it is good practice that every month a significant feed/working water sample undergoes a complete analysis.
Furthermore, condensation returns should be checked visually to detect oily and highly polluting substances (lower boiler water evaporation due to a coat of oil).

7 TROUBLESHOOTING

FAULT	POSSIBLE CAUSE	RECOMMENDED REMEDY
Opening of safety valve/s	Max pressure set on the valve which must be equal to the planned pressure for the appliance, has been exceeded	Adjust the safety pressure switches and/or any limit too high
	The safety valve is not correctly adjusted	Check and re-adjust the safety valve with a reference manometer
Safety valve/s slightly leaking	Dirt all around the valve housing	Clean the housing using at times the lever for manual opening
	Valve housing scratched	Dismantle the valve and polish inside with extra fine abrasive paste
Blocked pump	Pump thermal relay OFF	Check motor absorption
		Check thermal relay adjustment
	Blocked pump shaft	Service the motor pump
Safety pressure switch intervention	Limit pressure switch adjustment too high	Adjust the limit pressure switch
	Faulty limit pressure switch	Replace the limit pressure switch
	Clogged pressure switch holder serpentine	Clean or replace the serpentine
Safety intervention level 1 or 2	Interrupted water level monitoring	Scaled stainless steel bar Broken connection cable
	Faulty safety level relay	Temporary replace the safety electronic relay with one of the two relays in the panel. If this is the problem, replace definitively the faulty relay.
	Water does not load	See "Loading" inconv.
Insufficient water load	Blocked pump	See. "Blocked pump" inconv.
	Dirty pump sucking filter	Clean the filter
	Level regulation anomaly	Temporary replace the safety electronic relay with one of the two relays in the panel. If this is the problem, replace definitively the faulty relay.
	Level regulation probes short circuit	Dismantle the adjustment probes to inspect visually the ceramic insulation
	Pump cavitatation	Insufficient head (=different height between the collecting vessel and the pump levels) in comparison with water temperature
		Clean the pump sucking filter
		Decrease the pipe resistance between the collecting vessel and the pump by increasing the passage section
	Pump sense of rotation	Invert one of the two phases (three-phase pump)
Burner always on	Incorrect electrical panel connection	Consult the electric diagram
	Faulty level safety relays	See "Safety intervention level 1 or 2"
	Regulation pressure and/or safety switches OFF	Check the pressure switches regulation
		Check the pressure switches connection to the electrical panel
Burner always off	Burner problems	See burner manual
	Interrupted burner fuses	Replace fuses
	Lack of burner consent from the regulation pressure switch	Replace regulation pressure switch
	Lack of burner consent from the level safety relays	See "Safety intervention level 1 or 2"
	Incorrect electrical panel connection	Consult the electric diagram

8 WATER LEVEL LIMITS

8.1 GENERAL

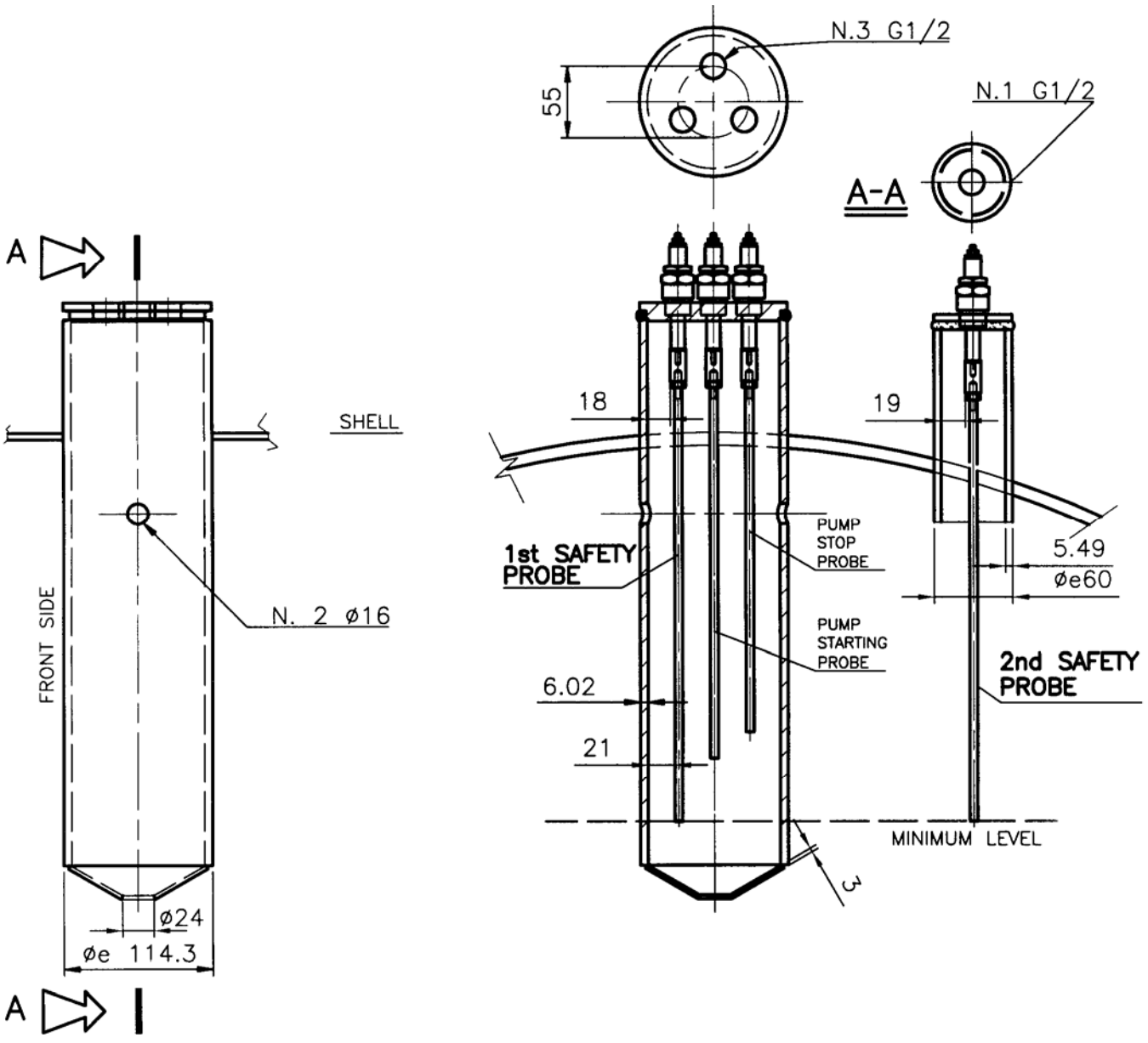
The water level limits consists in: n. 2 level rods, n. 2 probes, electrical cables, n. 2 electronic relays. The device prevents the lowering of the level of water in the steam generators and the consequent overheating of the membrature.

The principle of survey and control of the level is based on water conductivity. In order to guarantee the correct operation of the device, following conditions must be fulfilled:

- **Water conductivity > 250 μS/cm**
- **Water temperature < 210°C**
- **Pressure < 20 bar**

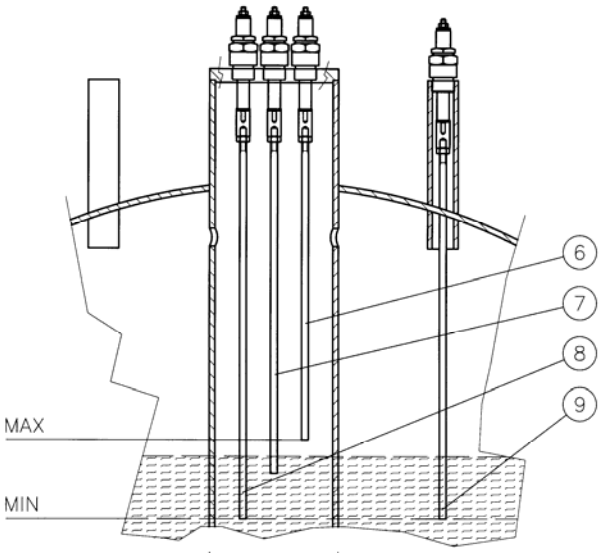
(See. " Operating water " - Tab. 2).

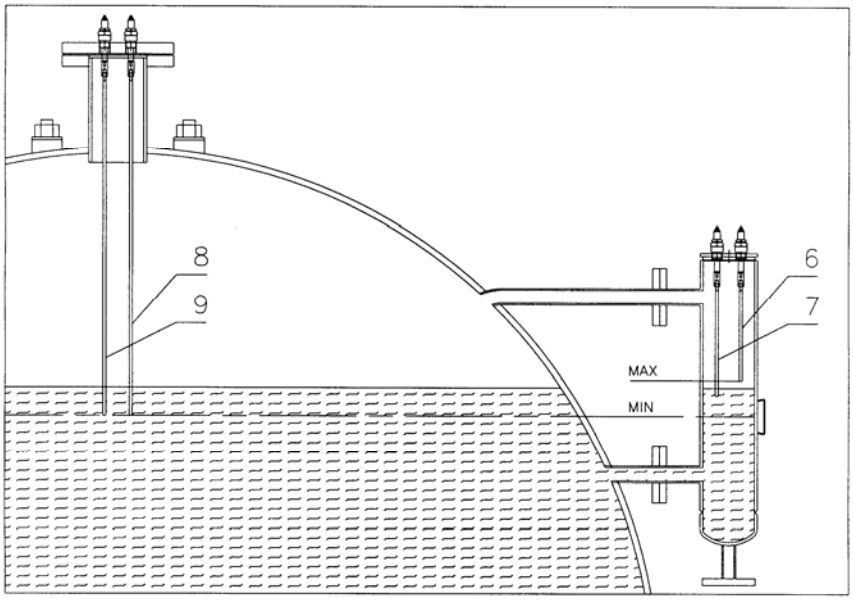
EXAMPLE: PROBES TANK FOR SAFETY AND REGULATION



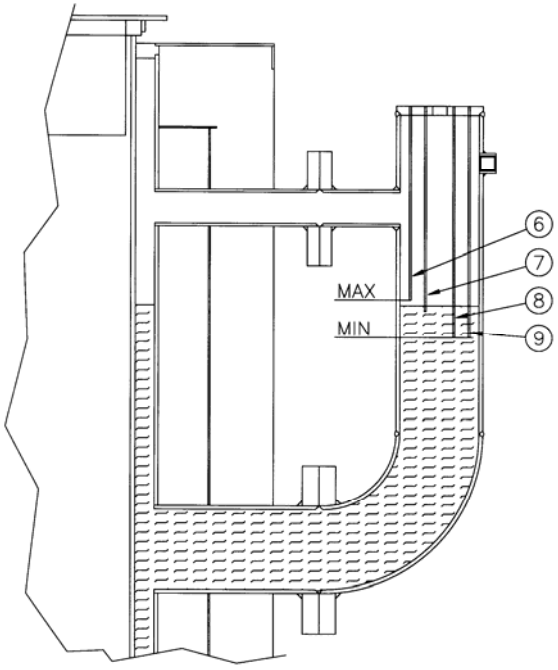
8.2 TYPICAL APPLICATIONS

Boiler probes:
6 Pump stop
7 Pump starting
8 1st burner cut-out safety device and alarm ON.
9 2nd burner cut-out safety device and alarm ON





NOTE: it is recommended that an alarm bell is installed in the boiler room as well as a sound or visual alarm in highly visited rooms.



8.3 ELECTRICAL CONNECTIONS

Refer to the diagram supplied with the specific switchboard.

8.4 STEAM GENERATOR OPERATION
(Water level limits)

8.5 FIRST START-UP

- Start the boiler, as follows:

1 Power up the boiler control panel
2 Make sure that the motor-driven pump drive shaft is free to rotate and that rotation direction is correct.
3 Set the pump selector switch on AUT and verify that burner cannot start before the attainment of the minimum level;
4 Make sure that the pump stops when the maximum level is reached, observing level indicators and checking the position of their cocks;
5 Maintain safety level reset pressed for 10 sec because it is employed an electronic delayed relay
6 Open the boiler discharge and check on the level indicator the intervention point of probe pump start
7 Set the pump selector switch on "0", leaving the discharge open, and check the intervention level of safety probes, referring to the minimum level information plate;
8 Close the discharge, place pump selector switch to AUT;

8.6 MAINTENANCE

8.6.1 Ordinary

- Bleed periodically (level indicators, probe-holder barrel if any, boiler) to avoid mud deposits.
- Check the efficiency of the regulation and control instruments by inspecting carefully the electrical (also connections); it is also recommended that the probe-holder ceramic plugs are replaced every year

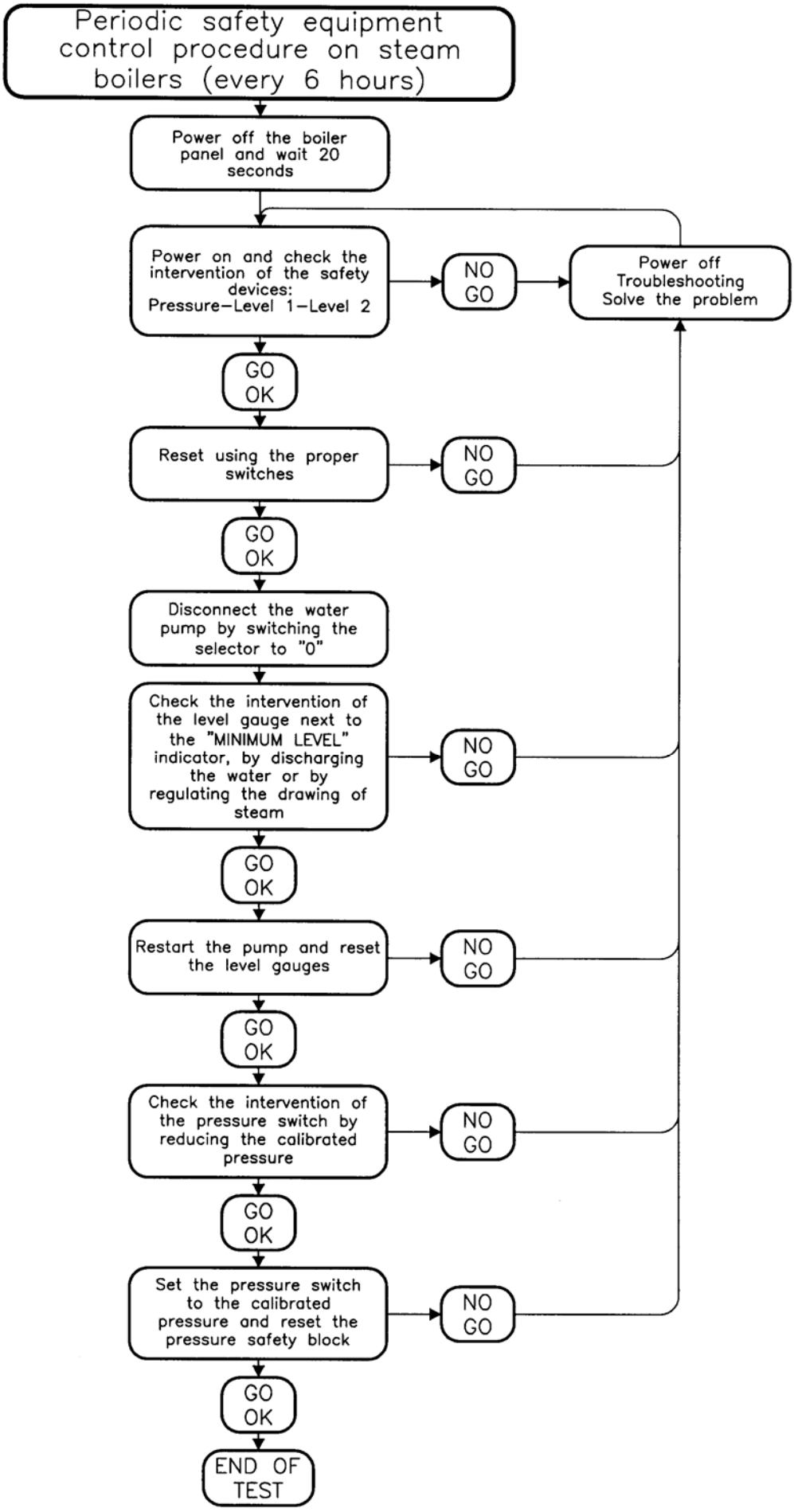
8.6.2 Periodic control (every 6 hours of use)

From time to time (every 6 hours of use) the thermal plant must be inspected by qualified personnel to check the efficiency of all safety accessories:

- Water level limits
- Safety valve

The system can be reset if no anomalies have been encountered: power off the panel for approx. 20 seconds, power on the main switch and press the reset buttons.

For further details follow the flow chart below:


Periodic safety equipment control procedure on steam boilers (every 6 hours)
Power off the boiler panel and wait 20 seconds
Power on and check the intervention of the safety devices: Pressure–Level 1–Level 2
NO GO
Power off Troubleshooting Solve the problem
GO OK
Reset using the proper switches
NO GO
GO OK
Disconnect the water pump by switching the selector to "0"
Check the intervention of the level gauge next to the "MINIMUM LEVEL" indicator, by discharging the water or by regulating the drawing of steam
NO GO
GO OK
Restart the pump and reset the level gauges
NO GO
GO OK
Check the intervention of the pressure switch by reducing the calibrated pressure
NO GO
GO OK
Set the pressure switch to the calibrated pressure and reset the pressure safety block
NO GO
GO OK
END OF TEST

8.6.3 Extraordinary maintenance (water level limits substitution)

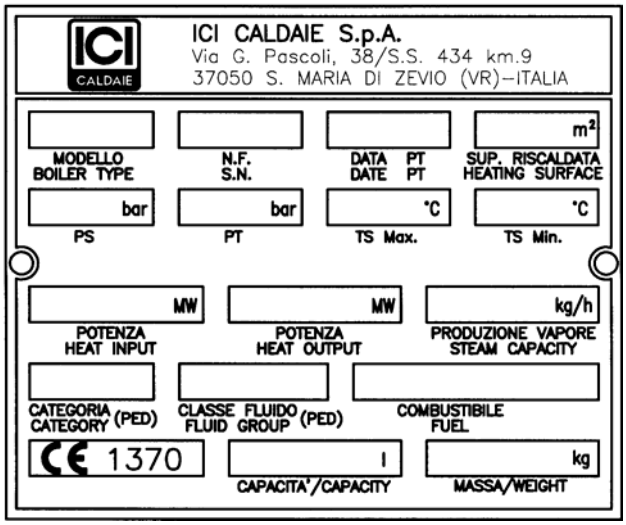
To replace the water level limits or parts of it, follow strictly the instructions below:
1. Ensure that the new ceramic plug is intact
2. Check the length of the rod
3. Ensure that the rod is coaxial to the plug axis
4. Inspect the electrical system and, in particular, ensure that the resistance of the electric circuit linking the ceramic plug to the electrical panel is intact (resistance must be over 10 MOhm)
5. Ensure that the automatic level control consisting of the two ceramic plugs and their conductivity-relays, work well

8.7 TROUBLESHOOTING

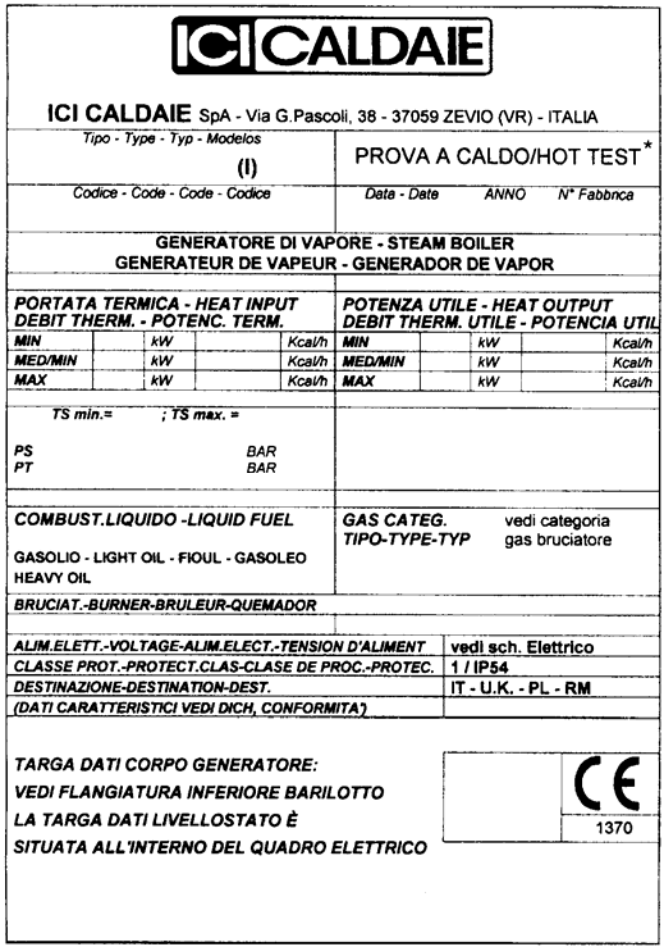
FAULT	POSSIBLE CAUSE	RECOMMENDED REMEDY
Safety intervention level 1 or 2	Interrupted water level monitoring	Scaled stainless steel bar Broken connection cable
	Faulty safety level relay	Temporary replace the safety electronic relay with one of the two relays in the panel. If this is the problem, replace definitively the faulty relay.
	Water does not load	See "Loading" inconv.
Insufficient water load	Blocked pump	See. "Blocked pump" inconv.
	Dirty pump sucking filter	Clean the filter
	Level regulation anomaly	Temporary replace the safety electronic relay with one of the two relays in the panel. If this is the problem, replace definitively the faulty relay.
	Level regulation probes short circuit	Dismantle the adjustment probes to inspect visually the ceramic insulation
	Pump cavitatation	Insufficient head (=different height between the collecting vessel and the pump levels) in comparison with water temperature
		Clean the pump sucking filter
		Decrease the pipe resistance between the collecting vessel and the pump by increasing the passage section
	Pump sense of rotation	Invert one of the two phases (three-phase pump)
Burner always on	Incorrect electrical panel connection	Consult the electric diagram
	Faulty level safety relays	See "Safety intervention level 1 or 2"
	Regulation pressure and/or safety switches OFF	Check the pressure switches regulation
		Check the pressure switches connection to the electrical panel
Burner always off	Burner problems	See burner manual
	Interrupted burner fuses	Replace fuses
	Lack of burner consent from the regulation pressure switch	Replace regulation pressure switch
	Lack of burner consent from the level safety relays	See "Safety intervention level 1 or 2"
	Incorrect electrical panel connection	Consult the electric diagram

8.8 DATA LABELS

BODY DATA LABELS



ASSEMBLY DATA LABEL



WATER LEVEL LIMITS LABEL

Boiler serial number

ICI CALDAIE S.p.A. Via G. Pascoli, 38 - S.S. 434 km 9 37059 ZEVIO/Fraz. Campagnola VERONA - ITALIA Tel. 045/8738511 -fax 045/8731148	
LIVELLOSTATO DI SICUREZZA *WATER LEVEL LIMITS*	
Modello / *Model*	**GP1**
N.fabb. / *Serial number*	
Conducibilità dell'acqua *Water conductivity*	> 250 μS/cm
PS max	20 bar
TS max	210°C
Fluido / *Fluid*	Acqua / Water
Data/*Date*	
Volt / Freq. / Pot. - *Power*	24 VAC / 50-60 Hz / 3 VA
Omologazione/*Approval*	CE **1370**
IL LIVELLOSTATO DI SICUREZZA DEVE ESSERE VERIFICATO OGNI **6 ORE DI FUNZIONAMENTO** ***WATER LEVEL LIMIT SHALL BE TESTED PERIODICALLY FOR A MAX OF 6 HOURS*** (ved. MANUALE TECNICO/*see TECHNICAL MANUAL*)	

Boiler final test date

* For mod. BX 60 only

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