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Energy, Water and Environment



# MIURA STEAM BOILER OPERATION MANUAL



LX-50	LXL-50
LX-100	LXL-100
LX-150	LXL-150
LX-200	LXL-200
LXH-200	LX-300
LXH-300	



INFORMATION IN THIS MANUAL MAY BE CHANGED  
WITHOUT ANY NOTICE.

Please ensure that operation manual is read and observed in  
full by all persons working with the steam boiler.

Please also ensure that it is stored in a location where it may  
be easily accessed by said persons.

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# 1 INTRODUCTION

## **Safety Indicators**

- The following headings are used within this manual in order to ensure safe and efficient operation of your steam boiler.  
Please ensure that you fully understand the meaning of each and use the boiler accordingly.



# WARNING

Failure to use the steam boiler correctly could possibly lead to serious injury or death of the user.



# CAUTION

Failure to use the steam boiler correctly could possibly lead to injury of the user or to property damage.

# NOTE

Important information from the point-of-view of preventing boiler malfunction and ensuring efficient operation, or information that will prove useful during operation of the steam boiler.

Meaning of safety indicators



The number contained within this symbol indicates a relevant page.



This symbol is used to indicate forbidden actions. Specific details of these actions will be presented together with the symbol.

## **Glossary**

■ Please use the following table to confirm the meanings of special terms used within the operation manual.

Term	Meaning
Low water level interlock	The action of preventing ignition when the normal water level has not been achieved.
Pre-purge	Purging with air from the boiler's combustion chamber before the start of combustion.
Post-purge	Purging with air from the boiler's combustion chamber after the end of combustion.
Pilot ignition	Ignition of the pilot burner.
Pilot only	A condition wherein only the pilot burner is lit.
Main ignition	Ignition of the main burner.
Low fire	A condition wherein combustion takes place at between 33 to 65% of maximum combustion performance. (firing rate depends on models)
High fire	A condition wherein the boiler is operating at maximum combustion performance.
Scale	The buildup of water impurities such as calcium and magnesium on water tubes.
Sludge	Impurities that precipitate inside the boiler.
Untreated water	Water that has not yet been treated.
Soft water	Water which has had calcium and magnesium removed.
Boiler makeup (water)	Treated water that is supplied to the boiler, or the act of sending this water.
Equivalent evaporation	The mass of steam generated in one hour when water at 212°F is changed into steam at 212°F.
Carry over	The unwanted discharge of moisture or impurities in the steam.
Blowdown	The discharge of water contained within the boiler.
Water tube	A tube making contact with combustion gas on the outside, and through which boiler water flows.
Deaerator	A device used to heat the boiler makeup water in order to reduce the level of oxygen dissolved in it.
Cavitation	A situation where air enters a pump and prevents normal operation.

## **Warranty**

Please review the twelve month boiler warranty carefully so (you) the end user is aware of your responsibilities and what is covered under this warranty. Below are a few points to ensure the warranty is fully understood.

1. The warranty covers defective workmanship and materials NOT mis-use of the boiler.
2. Miura must approve the start-up and have a signed start-up report on file.
3. End User Responsibility: Water hardness must be tested EVERY day.
4. End User Responsibility: In addition to a daily hardness check, water quality must be tested every four months because the quality of water sources changes from season to season. This is to include a full water test (not just hardness). Test result should be compared to STANDARD BOILER WATER SPECIFICATIONS FOR MIURA BOILERS shown in this manual.
5. End User Responsibility: Keep a log of the hardness tests and full water quality tests.

Note: One of the most common causes of boiler damage is due to the build up of scale. This is why the water hardness should be tested daily. The conventional test method for hardness is a manual test. Results can vary due to sample and reagent amounts, personal interpretation, and lack of continuity in monitoring hardness. An optional MIURA Colormetry solves all these problems by offering an automatic monitoring system for sample water collection, chemical reagent injection, mixing and evaluation. With this option, the MIURA boiler will also display the message "CAUTION – CHECK SOFTENER" whenever the MIURA Colormetry detects hardness leakage through the water softening system.

## **Introduction**

MIURA Boiler Co., Ltd. began North American activities in 1988, when the manufacturing plant in Brantford, Ontario, was established. Subsequently, our engineering department developed procedures to meet ASME codes and to gain listing approval from UL, CSA. The United States corporate sales office, MIURA Boiler, Inc., was then established and has since developed relationships with national, state and city inspectors and agencies.

Our North American network consists of branches in Atlanta, Chicago, Los Angeles, New York, Texas, and Ontario. The parent company, MIURA Boiler Ltd. of Japan, is the leading manufacturer of boilers and other thermal equipment in the Pacific Rim region with market share in excess of 55%. Operating factories in five countries, our production volume now exceeds 14,000 units per year.

As a result of design necessities in Japan — such as limited space and a total dependence on foreign energy — the MIURA Steam Boiler has been engineered with a highly efficient, vertical water tube, once-through, forced-flow design. Featuring a compact unit with low water content, the MIURA Boiler is designed to be run with simple push-button controls and a minimum amount of maintenance. Operation is quiet, radiant heat losses are minimal, and steam quality is second to none. Furthermore, MIURA Boilers are often installed in a multiple boiler network.

MIURA Boilers, in combination with the patented MIURA Multiple Installation panel, allow the required horsepower to be brought on and off line quickly in order to meet sophisticated production needs with maximum fuel economy. The *MIURA Advantage* — proven in the field over fifty years of excellent service — is the ability of our boilers to reach full output steam from a cold start in less than five minutes using the least



amount of energy and having the lowest environmental impact. In recognition of its compact, safe, and cost-effective design, the high-efficiency MIURA Boiler has won numerous awards from engineering societies and gas associations.

## **Features**

The MIURA Steam Boiler features a once-through, forced flow, low water content, water-tube design, which can achieve full output within five minutes. What's more, this boiler is designed to be run with simple push-button controls and a minimum amount of maintenance. Using the patented MIURA BL11 computer controller, we can monitor precise characteristics of boiler operation from our offices and provide fast, accurate feedback data. Radiant heat losses are minimal and steam quality is second to none. In addition, MIURA Boilers are often installed in a multiple boiler network.

MIURA Boilers, in combination with the patented MIURA Multiple Installation panel, allow the required horsepower to be brought on and off line quickly in order to meet sophisticated production needs with maximum fuel economy. The high-efficiency MIURA Boiler has received numerous accolades in Japan, including awards from the Japanese Society of Mechanical Engineers and the Japanese Gas Association. This boiler is characterized by compact, safe, cost-saving performance — an advantage that is underscored by our greater than 55% market share in the Pacific Rim region.

MIURA Boiler Co., Ltd. has developed the Low NOx Boiler using state-of-the-art technologies, and both the flat burner and rectangular boiler vessel have been uniquely designed for the LX.

It is generally explained that the temperature of a combustion flame should be less than 3,272°F (1,800°C) in order to prevent NOx generation. Nevertheless, combustion flames will generally have some high temperature areas generating this harmful pollutant. Miura engineers determined the temperature distribution in the combustion and heat exchanging areas of our boilers, and through exhaustive theoretical analysis and rigorous testing, optimized the boiler design so as to have a uniform temperature distribution at less than 3,272°F (1,800°C). Specifically, an ideal combustion process was achieved by making the burner surface as large as possible, and the furnace volume as small as possible. As a result, the LX and LXL boast NOx emission levels of less than 20 PPM at 3% converted O<sub>2</sub> (based on natural gas combustion). Miura LX models can also meet more stringent emission requirements (eg. NOx lower than 20ppm) upon request.

Thanks to its highly compact design, the LX fits through a standard door opening, thereby eliminating the need to demolish doorways or knock down walls during installation.

The completely packaged LX features the following as standard:

- UL, c-UL approved and labeled boiler design (FM available)
- HIGH GAS and LOW GAS pressure switches
- LOW AIR pressure switch
- Control Steam Pressure transducer with a backup control pressure switch
- High steam limit pressure switch featuring a manual reset
- ASME steam safety relief valves for the boiler and an optional economizer
- Main gas line and pilot line regulators
- Dual pilot-gas solenoid valves
- Dual main-gas fluid actuator valves and plugged leak-test port (vent valve also available)
- Forced-draft blower and motor
- Completely enclosed, heavy gauge casing
- ASME stamped pressure vessel with internal inspection ports
- Two independent low-water fuel cutoffs, one featuring a manual reset
- Digital steam-pressure display with a backup pressure gauge
- Thermocouples on water tubing in order to prevent overheating due to low water or scale buildup
- Water volume control
- Intermittent Automatic Blowdown system with a strainer and manual shutoff valve
- External separator
- Blower-cover dust warning
- MIURA BL Microprocessor Boiler Control featuring a user-friendly digital display
- Communication interface functionality
- Display of hours of operation and logging of the seven most recent faults
- Support for remote modem-based monitoring of boiler performance and troubleshooting from a MIURA technical center

## **Description**

The following answers frequently asked questions by providing a general overview of the design and operational characteristics of MIURA Boilers.

The MIURA boiler design comprises straight water tubes between upper and lower headers. Both headers are encased in a castable refractory leaving only the tubes exposed to combustion gases. There is very little water and consequently very little energy stored within the steam boiler. Water remains exclusively inside the tubes, with only incidental bubbling in the upper header. Therefore, the design features no natural circulation such as the riser or downcomer effect common to natural circulation boilers.

Water is forced into the bottom header and tubes by means of a feed water pump. The water is flashed into steam in the tubes, realizing a dynamic bubbling system that also cools the tubes. This bubbling action may be best described as a “steam gradient,” with more steam at the top of the tubes than at the bottom. Steam is accumulated in the upper header with a final separation in the external separator. Condensate separated in the external separator is fed back into the lower header.

As a result of this steam gradient characteristic, there are no strictly defined steam and water levels, and thus, the boiler requires no sight glass. Furthermore, special modifications are incorporated into the boiler construction and safety system in order to accommodate this.

First of all, the water control system relies on an electrical conductance system — specifically, when water makes contact with a probe, a circuit is formed. Three such probes control the boiler feed, with a short probe for low-fire, a medium length probe for high-fire, and a long probe for low water cutout. This safety configuration may seem confusing to the inspector who encounters the MIURA Steam Boiler in the field for the first time, particularly because a water column typically suggests a fixed water level. This is not true for our steam boilers, however, because of the low water content and the fierce boiling action of the steam gradient. Control of this dynamic system has been made possible by adding a special modification in the form of the water column in order to create an artificial level. The flanged pipe leading from the boiler body runs through the column, with three holes drilled in the pipe to realize an orifice effect. Nevertheless, even with this orifice effect, the artificial level oscillates — especially with swings in system load. This oscillation is desired and is directly proportional to the volume of water in the boiler tubes.

Secondly, the water volume control relies on electrical resistance, and the bubbling action is what cools the tubes. As the volume of water in the steam boiler is consumed, there is less bubbling at the top of the tubes, increasing the amount of electrical resistance. Should the water volume ever become so low as to lose effective contact with the low-water cutout probe, the boiler will shut down. In certain models, an extra probe will activate the feed water pump until the bubbles re-establish effective contact with the probe.

Third in the list of safety modifications are thermocouples, attached directly to the tubes. These thermocouples measure the temperature of the tubes and will shut down the boiler if a low water volume condition is detected due to insufficient bubbling, if dry fire occurs, or if scale buildup is detected. Scale formation reduces heat transfer rates and is therefore monitored directly based on any increase in tube surface temperature. The early detection of scale formation is an important factor in maintaining a high efficiency boiler. According to the US National Bureau of Standards, 1/4” of scale buildup on heating units requires up to 55% more energy to attain the same temperature.

The boiler will not operate should any of these low-water safeties fail. Only through tampering could the boiler operate without these safeties and give rise to a dry fire condition. Even in the unlikely event that such a situation should occur, by the time the tubes superheat to the level required to overcome the steel's tensile strength, the amount of energy contained in the remaining water would be so small that the possibility of a pressure explosion is negligible. The MIURA Steam Boiler design has been used for more than 50 years, and over 200,000 units are presently in operation worldwide. There is no record of ANY pressure vessel explosion.

Steam is produced within five minutes from cold start-up and selected tubes can be visually inspected through two-inch openings located in the top and bottom headers. A full inspection is typically completed within 30 minutes.

All MIURA steam boilers are annotated as a forced flow steam generator (with no fixed steam or water level) on the pressure vessel's P-3 form and registered with the National Board. The complete packaged steam boiler is listed as a standard with UL and c-UL, and it can be tuned to meet FM and/or ASME-CSD1 requirements at the customer's request.

Please note that all flanges used on our boilers are class 150 (class 300 for the LXH) and comply with ASME/ANSI standard B16.5. The "class 150" stamping refers to a standard classification, and not the Maximum Allowable Working Pressure (MAWP). This specification matches the 170 PSI MAWP rating of the LX boiler.

## CAUTION

All steam systems require continuous, appropriate water treatment. This treatment is mandatory from the time of installation of your MIURA Steam Boiler. Failure to follow the recommended water treatment and maintenance procedures could shorten the service life (and efficiency) of your boiler and could also affect the warranty. The scale and overheat thermocouples may, in some cases, not be able to shut down the boiler before troubles occur.

## **Acts & Regulations**

There are a number of codes, standards, laws and regulations for boilers and related equipment that should be considered. Regulatory requirements are dictated by a variety of sources and are focused primarily on safety. This equipment shall be installed in accordance with the current regulations, codes, and specifications of the applicable municipal, national, provincial, state, and/or federal agencies. Authorities having jurisdiction should be consulted before the commencement of installation work. For more information on how the various rules affect boiler selection and operation, you may want to contact your local MIURA authorized representative or the engineering firm designing your boiler installation. Here are some essential rules to take into consideration:

- a. The boiler industry is tightly regulated by the American Society of Mechanical Engineers (ASME) and ASME codes, which control boiler design, inspection, and quality assurance. All boiler pressure vessels including economizers, should have an ASME stamp.
- b. All pressure vessels should be inspected and registered with the National Board.
- c. In Canada, the design of all boilers, pressure vessels, fittings, and piping must be registered with your local province as required in CSA B51.
- d. The insurance company insuring your facility or boiler may dictate additional requirements. Boiler manufacturers can provide special boiler trim according to the requirements of major insurance companies such as FM. Special boiler trim items usually take the form of added safety controls. Some industries — such as food processing, brewing, or pharmaceuticals — may also have additional regulations that have an impact on the boiler and boiler room.
- e. UL or c-UL approval may be required in order to verify safe boiler performance.
- f. A full-time boiler operator may be required. Operator requirements depend on the boiler's size, pressure, heating surface area and volume of water. Boilers can be selected to minimize the boiler operator requirements, either by choosing a boiler that is exempt from certain rules, or by installing special equipment that gives the operator more freedom within the facility. Contact your local boiler inspector for more details.
- g. Most state, provincial, and local authorities have a permit that must be acquired in order to install and operate a boiler. Additional restrictions may apply in non-attainment areas where air quality does not meet the national ambient air quality standards and where emission regulations are more stringent. Be sure to investigate these requirements before purchasing a boiler.
- h. Most states or provinces require an annual boiler inspection, and additional requirements may also apply to piping.
- i. Most regional authorities have established a maximum temperature at which water can be discharged to the sewer system. In such a case, a blowdown separator or blowdown tank will be required.
- j. U.S. Federal emission standards — including permit and report-related procedures — apply to all new boilers with inputs over 10 million BTU/Hr.
- k. Boiler ratings are based on operation at sea level. For operation at elevations above 2,000 feet (600 m), ratings must be reduced at a rate of 4% per 1,000 feet (300 m) above sea level.

## **National Regulatory Organizations**

In order to obtain assistance in the identification of, and compliance with, codes and regulations, we recommend contacting your actual insurance provider as well as the utility companies. A partial list of agencies having jurisdiction over boiler installation and operation is given below.

This list is comprehensive, but by no means all-inclusive.

### **UNDERWRITERS LABORATORIES**

333 Pfingsten Rd.  
Northbrook, IL  
60062  
(847) 272-8800

### **NATIONAL BOARD**

1055 Crupper Ave.  
Columbus, OH  
43229  
(614) 888-8320

### **A.S.M.E.**

345 East 47th St.  
New York, NY  
10017  
(212) 705-7800

### **AMERICAN GAS ASSOCIATION**

1515 Wilson Boulevard  
Arlington, VA 22209

### **OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION**

### **LOCAL FIRE MARSHAL**

### **LOCAL BOILER INSPECTORS**

### **T.S.S.A.**

3300 Bloor St., West  
16th Floor, Centre Tower  
Toronto, Ontario M8X 2X4  
(877) 682-8772

### **N.F.P.A.**

1 Batterymarch Park  
P.O. Box 9101  
Quincy, MA 02269-9101  
(800) 344-3555

### **FACTORY MUTUAL RESEARCH CORPORATION**

1151 Boston-Providence Turnpike,  
Norwood, MA 02062  
(617) 762-4300

### **AMERICAN NATIONAL STANDARD INSTITUTE**

11 West 42nd Street,  
New York, NY 10036

### **ENVIRONMENT PROTECTION AGENCY**

### **LOCAL BUILDING AND CONSTRUCTION INSPECTORS**

### **FOOD & DRUG ADMINISTRATION**

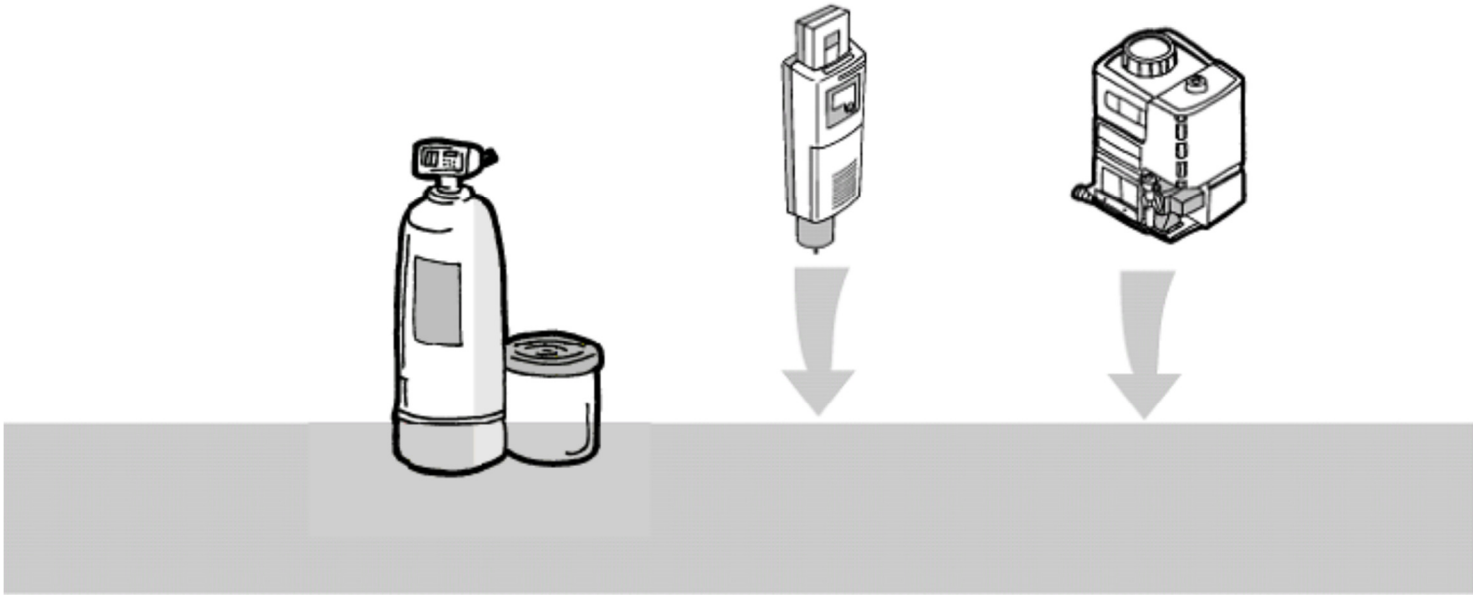
## 2 ESSENTIAL BOILER WATER TREATMENT

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## 2.1 Flow Chart

■ Hard-Leak Alarm (Colormetry)  
Monitors the treated soft water  
after the water softener.

■ Chemical Feeder  
Feeds chemicals into the boiler in  
order to prevent it from corroding.

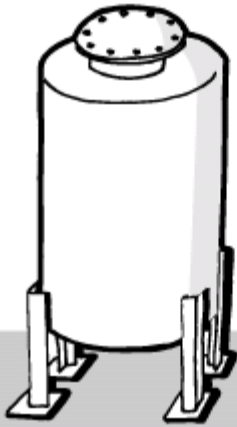


■ Water Softener  
The water supply is usually hard water.  
The water softer converts this to soft water.

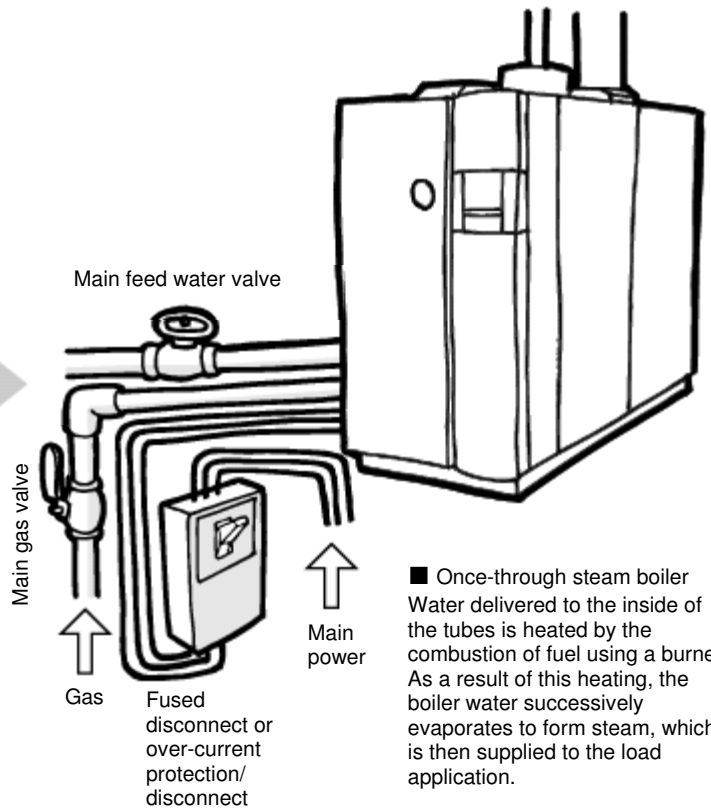
### NOTE

Tap water and well water contain a wide range of dissolved impurities in varying amounts. If this water is used without removing the impurities in advance, buildup of scale, carry-over, corrosion, and other similar factors would have a detrimental effect on the boiler's efficiency and service life. For this reason, the installation of water treatment equipment and thorough control of water quality are critical. The above flowchart sets forth a standard for water treatment system.





■ Boiler Makeup Tank  
 Two different varieties of boiler makeup tank are available – namely, the water tank and the deaerator tank.



■ Once-through steam boiler  
 Water delivered to the inside of the tubes is heated by the combustion of fuel using a burner. As a result of this heating, the boiler water successively evaporates to form steam, which is then supplied to the load application.

## **2.2 Water Treatment Guidelines**

### **Basic**

Proper water management/treatment is essential for steam boiler operations. Any one or the combination of the following three major issues can potentially halt your daily activities; corrosion (including condensate return corrosion), scaling, and carryover. The objective of boiler water treatment is to support your uninterrupted daily steam boiler operation and to allow our valued customers to obtain good quality steam economically.

### **MIURA water treatment proposal**

MIURA recommends that customers utilize the available genuine water treatment equipment and chemical, "BOILERMATE®," for MIURA boilers. MIURA boilers are designed with a unique pressure vessel which allow for once-through water flow, high-heat transfer, and small package system. This makes the water content of MIURA boilers much smaller than that of conventional boilers, leading to a difference in boiler water behavior compared to conventional design. Focusing on our steam system needs, MIURA water treatment products are continuously researched, developed, and optimized to work best with our equipment.

### **System integrated water softeners**

One of the most common causes of boiler damage is scale. MIURA offers a solution through our System Integrated Water Softener - MW series; featuring split flow regeneration and MIURA Online Maintenance. Due to advanced integral sensors, the whole regeneration process is monitored so that the softener will reliably supply softened water. In the case that a non-MIURA softener is used, we strongly recommend installing a polisher (an additional softener after the main softener) to maintain production of highly softened water (<1ppm).

### **Colormetry**

The conventional method of testing water hardness is through manual testing. MIURA's hardness detecting equipment, "Colormetry", functions as an automatic monitoring system for make-up water. This device automatically handles the test reagent injection, mixing, and evaluation. It also functions as an optional upgrade component for MW series softeners and can integrate with the MIURA Online Maintenance System. When the Colormetry detects a hardness leak in the make-up water, the MW softener can switch the service resin tank automatically in order to continue supplying softened water.

### **BOILERMATE®**

BOILERMATE® chemicals are designed to help provide customers with seamless operation of MIURA boilers and save cost on steam when utilized as recommended. Conventional boiler water treatment may not satisfy MIURA's boiler water guidelines. We recommend customers to utilize our BOILERMATE® silica program for corrosion inhibition and chelant/polymer type dispersant; to ensure your MIURA boiler's optimum condition over its entire life.

CAUTION: Proper water treatment MUST be used from the time the boiler is first operated.

NOTE: MIURA cannot be responsible for any problems encountered with the boiler due to unsuitable water treatment. Sulfite type oxygen scavenger programs may not be effective for the MIURA steam boiler if the feed water temperature is too low.

Phosphate type treatments create excess solids that are not water-soluble. As such, this type of treatment may result in scaling.

## **Daily operation**

MIURA has no warranties to cover damage due to improper water treatment and failure to maintain the guidelines listed.

## **MIURA MAKE-UP WATER MAINTENANCE CHECK**

To keep your MIURA boilers running in optimum condition, be sure to check the following daily:

### **a) CHEMICAL FEED PUMP**

- i. Proper chemical feed.
- ii. No air in the chemical feed pump or lines.

### **b) WATER SOFTENER**

- i. Boiler Make-up water is completely soft (use a test kit sensitive to less than 1.0 PPM).
- ii. Make sure the water softener timer or softener flow meter is working every day.
- iii. Make sure the by-pass valve is closed and inlet and outlet valves are open.
- iv. Make sure there is no hardening (caking) of the salt in the brine tank. In case of salt hardening or "bridging", break the salt into small pieces to allow for proper brine concentration.
- v. If applicable, make sure the polishing water softener is working properly.

## WATER TREATMENT GUIDELINES FOR MIURA STEAM BOILERS

The chemistry values given in the table below have been specially designed for Miura steam boilers. These guidelines help to attain the longest possible life for boilers operating under standard conditions. Continuous maintenance and monitoring is key to preventing water related issues.

Parameter	Units	Make-up Water	Feed Water			Boiler Water					Condensate Water
			Pure Water <sup>3</sup>	Soft Water		Pure Water <sup>3</sup>	Soft Water				
				Silica Program	Sulfite Program		Silica Program		Sulfite Program		
pH	-	7.0-9.0	7.0-9.0 <sup>2</sup>	7.0-9.0 <sup>2</sup>	7.0-9.0 <sup>2</sup>	11.0-11.8	11.5-12.4		11.5-12.4		7.0-9.0 <sup>10</sup>
EC	µS/cm	<1500 <sup>1</sup>	≤20 <sup>3</sup>	<600	<500	<2500	<4000 <sup>5</sup>	<3000 <sup>6,8</sup>	<4000 <sup>5</sup>	<3000 <sup>6,8</sup>	-
Hardness	ppm	0	0	0	0	<3.0	<3.0	<3.0	<3.0	<3.0	<1.0
Chloride	ppm		-	-	-	<150	<400 <sup>5</sup>	<300 <sup>6</sup>	<400 <sup>5</sup>	<300 <sup>6</sup>	-
Chloride + Sulfate	ppm	-	-	-	-	<500	<1000 <sup>5</sup>	<750 <sup>6</sup>	<1000 <sup>5,9</sup>	<750 <sup>6,9</sup>	-
Silica	ppm	-	-	-	-	150-500 <sup>4</sup>	150-500 <sup>4,5</sup>	110-500 <sup>4,6</sup>	150-500 <sup>4,5</sup>	110-500 <sup>4,6</sup>	-
Sulfite	ppm	-	-	-	-	(20-50 <sup>5</sup> / 10-20 <sup>6</sup> ) <sup>7</sup>	-	-	20-50 <sup>5</sup>	10-20 <sup>6</sup>	-
Iron	ppm	<0.3	<0.3	<0.3	<0.3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

**Note 1.** The limitation of make-up water conductivity 1500 µS/cm is related to the limitation of water softener make-up water.

**Note 2.** Feed water pH with condensate return 7.0-9.0. Feed water pH may vary from 5.8-9.0 with no water treatment chemicals. For carbon steel feed water tanks, the recommended range is 8.0-9.0.

**Note 3.** Pure water is less than 20µS/cm (without chemical). When feed water EC>20µS/cm, refer to soft water treatment program. If pure water is a mix of RO water and soft water, refer to soft water treatment program.

**Note 4.** Silica concentration is dependent on feed water quality, please contact your Miura representative for changes in dosage.

**Note 5.** Value is based on the Boiler Operation Pressure below 150Psi.

**Note 6.** Value is based on the Boiler Operation Pressure when 150Psi<P<300psi.

**Note 7.** Silica program is recommended when pure water is used for boiler feed.

**Note 8.** Site specific circumstances may influence recommended values, contact your Miura representative.

**Note 9.** Sulfate values from non-silica type chemical programs are not included in totals.

**Note 10.** pH 8.0-9.0 is strongly recommended.

### ADDITIONAL NOTES:

1. Sulfite oxygen scavenger programs may not be effective for Miura steam boilers if the feed water temperature is too low.
2. Phosphorus containing water treatments creates excess solids that are not water-soluble. This type of treatment may result in scaling.

### END USER RESPONSABILITIES:

1. Water test must be performed every day. Miura recommends to record the results from the daily test. Refer to your contract terms and conditions or contact your Miura representative for guidelines about daily water test and log.
2. A full water test (not just hardness) for all water types should be done every month. Refer to your contract terms and conditions or Miura representative for the frequency for a full water test. Test results should be compared to the above WATER TREATMENT GUIDELINES FOR MIURA STEAM BOILERS.
3. Consult or retain a qualified water treatment professional to follow these guidelines.

### **3 COMPONENT NAMES & FUNCTIONS**

## LX-300SG-07

### Safety valve

Allows pressure to escape from the pressure vessel when it reaches an abnormal level (i.e., exceeding the maximum pressure).



Pressure gauge

### Control panel

Provides switches and display devices required for operating the boiler.

### Emergency stop button

In an emergency, push this button to stop combustion



Main steam outlet  
Used to provide steam to the  
load application.  
(Control/connection of steam to  
the load application)

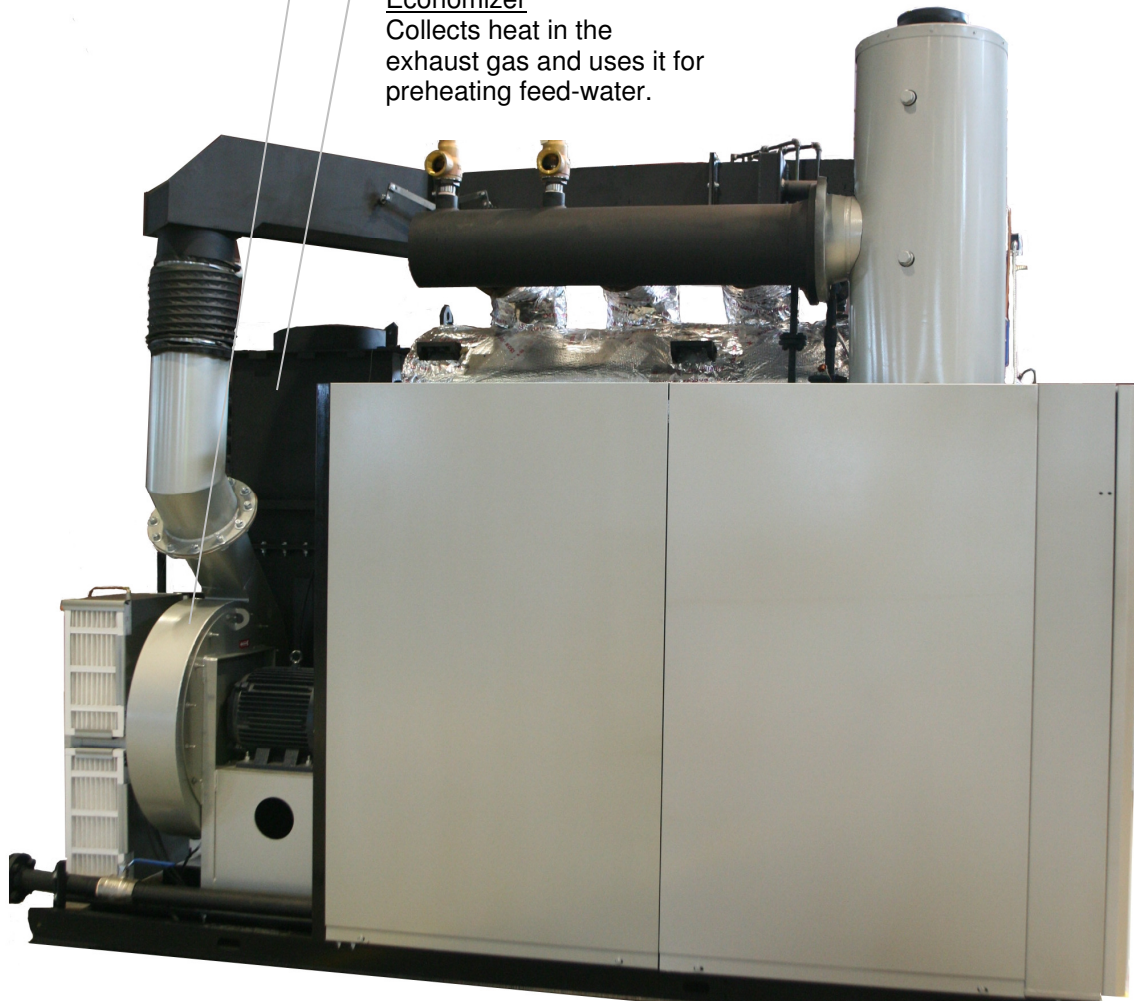
Control box  
Contains electrical parts  
used to control the boiler.

Blower

Delivers the air required for combustion into the combustion chamber.

Economizer

Collects heat in the exhaust gas and uses it for preheating feed-water.

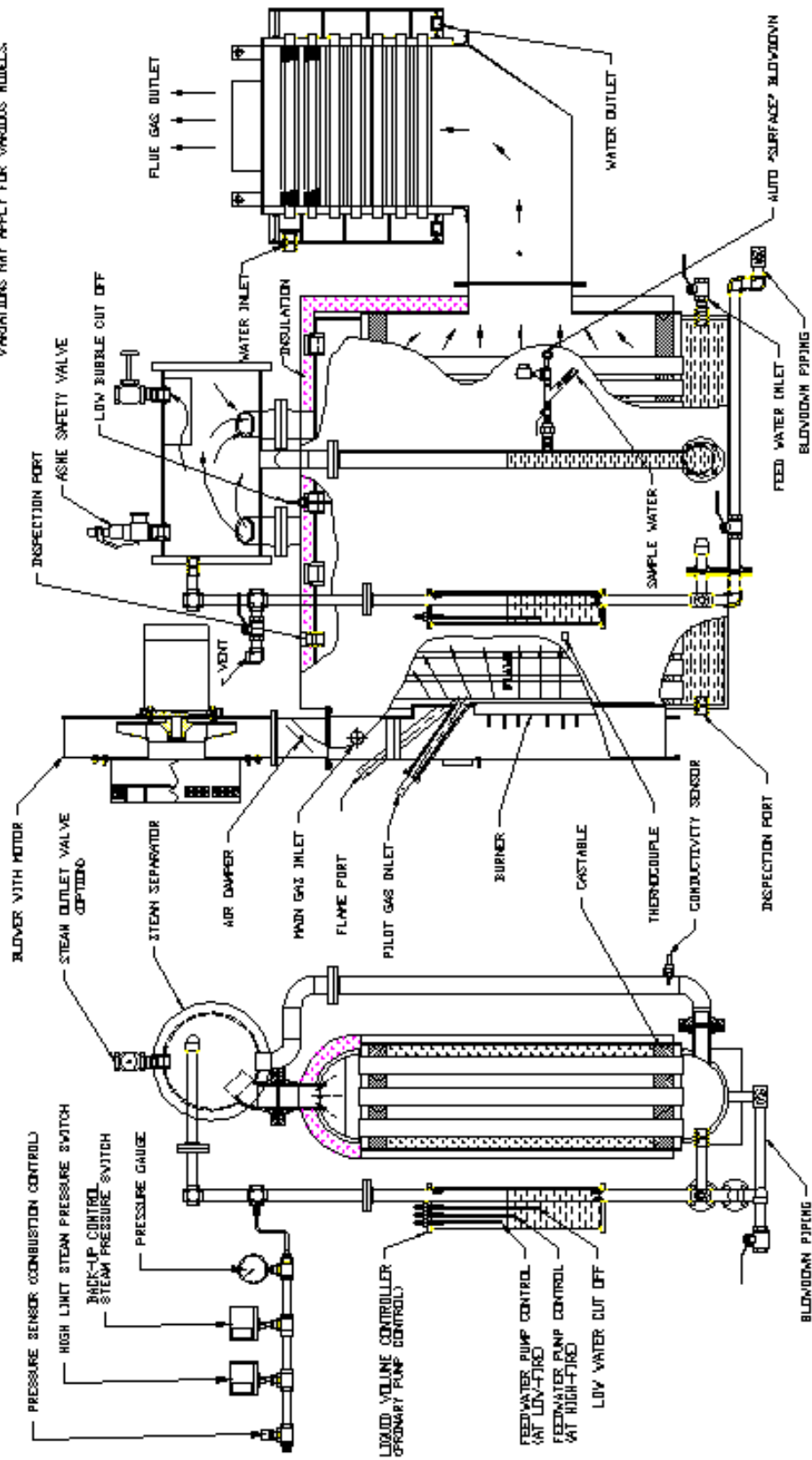


Warning label

Presents cautions and warnings that must always be read before using the boiler. For more details, please refer to *SECTION 4. BASIC PRECAUTIONS.*



\* THIS DRAWING IS FOR ILLUSTRATION PURPOSES ONLY.  
 VARIATIONS MAY APPLY FOR VARIOUS MODELS.



LX BOILER SECTION VIEW

## 4 BASIC PRECAUTIONS

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# WARNING

The following precautions must all be observed before operating the boiler.  
Failure to do so may result in injury.

## **Items to Check before Use**

Check the boiler's installation condition.

Check the boiler's installation condition.  
Confirm that it has been installed correctly as set forth in *SECTION 5. PRE-OPERATION INSPECTION*.



Trial operation must always be performed before actual use.

When you have confirmed that the boiler is correctly installed, please arrange for trial operation to be conducted by MIURA maintenance personnel or distributor.



Ensure that you use the boiler correctly.

Do not attempt to operate or service the steam boiler until you have read and fully understood this operation manual.



## **Clothing Requirements for Safe Operation**

Be sure to wear suitable clothes for working on the boiler.

To operate or service this steam boiler, avoid wearing loose clothes or accessories that could become caught on valves or other mechanical components.

In addition, clothing stained with oil or grease poses a fire risk and it should not be worn.



Always wear protective clothing.

Helmet, safety glasses, safety footwear, and leather gloves must always be worn.

Handling of hazardous chemicals may cause injury when contact with eyes or skin. Therefore, it is crucial that safety glasses and rubber gloves should be worn during this dangerous operation.



## **Warning Labels**

Location of warning labels

Warning labels have been applied to indicate locations where hazards exist.



Maintenance of warning labels

Any peeling or torn warning labels must be replaced.

Please contact a MIURA sales office or your local dealer regarding this and other warning-label inquiries.

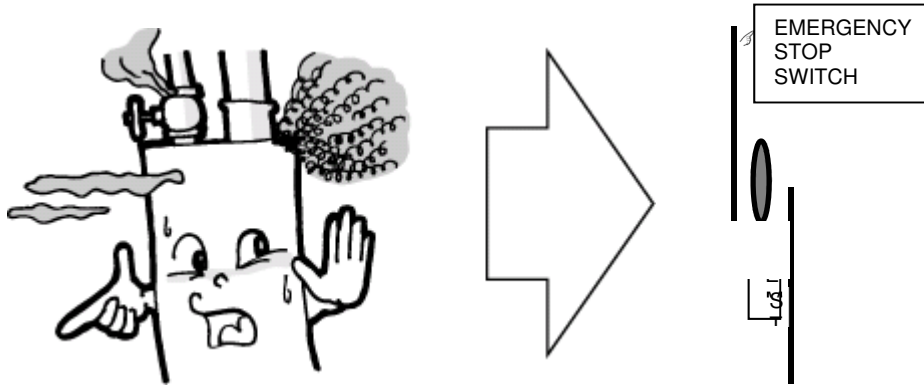


# WARNING

The following precautions must all be observed before operating the boiler.  
Failure to do so may result in injury.

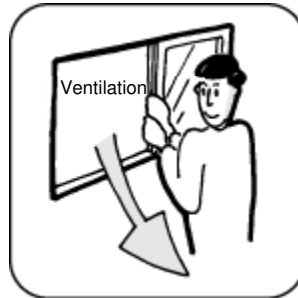
## **Dealing with Abnormal Conditions**

Immediately push the "EMERGENCY STOP" button to stop combustion and close the main gas valve first, then cut out the main power supply to the boiler whenever you notice abnormal noise, strange smells, black smoke, gas leaks, or any other unusual conditions. Failure to react to this precaution may result in fire or gas explosion.



### No ignition source near gas leaks

When a gas leak is suspected, open windows and doors to ventilate the area. You must not turn fans or other electrical devices on or off without good reason in such situation. Failure to observe this precaution may result in explosion.



### Responding to abnormal conditions

Always follow the instructions given by MIURA sales offices or local dealers when abnormal conditions arise. In addition, discontinue to use the boiler until the abnormality has been removed. Failure to observe this precaution can result in fire, explosion, and other dangerous situations.



## **Precautions for Boiler Usage**

Always use the recommended fuel.

Usage of any fuels other than those recommended could result in the boiler explosion.



No ignition source near boiler fuel or combustible materials.

Boiler fuel and highly flammable material can easily be ignited in the presence of a ignition source. No combustible materials should be present within the minimum distance of the boiler required by the local code.



Failure to observe this precaution may result in fire. Do not place combustible materials inside the control box. Failure to this precaution may result in fire.

Use ventilation equipment (or air vents) during operation.

Fans should be running during operation of the boiler, and ensure ventilation ports are not blocked. Failure to observe this precaution could result in incomplete combustion, which in turn could lead to carbon monoxide gas poisoning or boiler explosion.



Always store flammable materials in a safe location, away from ignition source. Failure to observe this precaution may result in fire.

**MIURA recommends CO detectors to be Installed.**

Do not touch the boiler during operation.

With the exception of the control panel, avoid contact with any part of the boiler while it is operating. Failure to follow the precaution can result in electric shock, burns, and other injury.

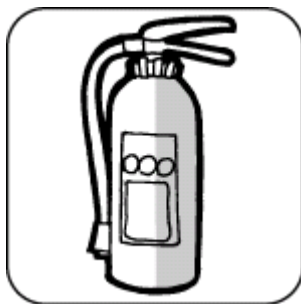


**NEVER BURN GARBAGE OR PAPER IN THE UNIT**

## **Fire Extinguishers & First Aid Boxes**

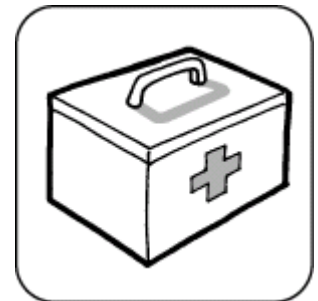
Provide fire extinguishers.

In order to be prepared for the outbreak of fire, ensure that fire extinguishing equipment is provided near the boiler, and that its operation is fully understood.



Provide a first aid box.

Select suitable locations for the first aid boxes, and ensure that they are always there.



# WARNING

All the following precautions must be observed before operating the boiler.  
Failure to do so may result in injury.

## **Prohibition of Unapproved Modification**

No customizing or modification

Any customizing or modification of the boiler other than that recommended by MIURA (for example, connection to additional equipment and piping work) can have serious consequences in terms of safety.

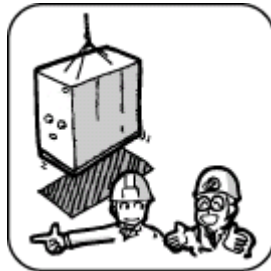
Always confer with MIURA maintenance personnel before carrying out any such modification work. Note that MIURA will not be responsible for the consequences of unapproved modification.



## **When Reselling or Relocating**

Contact us when intending to move or sell your boiler

Whenever the boiler is to be relocated, it is important that the installation work be carried out correctly and the required equipment for moving is available. Always contact a MIURA sales office or your local dealer before moving or reselling the steam boiler. Inappropriate installation work or the connection of unsuitable ancillary equipment can result in injury and must be avoided.



Include the operation manual if reselling

This operation manual must be read by all who intend to use the boiler. This manual must be given to the new user.



## **Combustion Check**

Combustion data at the shop test can be located inside each boiler. Please refer to the shop test data for proper combustion when adjustments are needed.

## 5 PRE-OPERATION INSPECTION

Refer to the “INSTALLATION MANUAL” for more details.



# WARNING

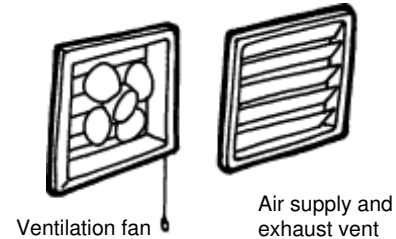
Before operating the boiler, please check each of the installation points below. Do not use the boiler if it has not been correctly installed.

Failure to follow this precaution may have serious consequences.

## ■ Boiler Room

### **Installation of ventilation equipment (or air vents)**

Confirm the boiler room is installed with ventilation fan or air supply and exhaust vents. Insufficient ventilation can result in incomplete combustion, which in turn can lead to carbon monoxide gas poisoning or boiler explosion.



## ■ Boiler Installation

### **Installation on a non-flammable floor**

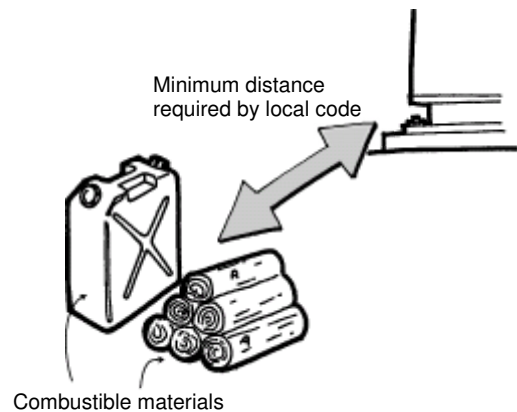
Confirm that the boiler is installed on a floor that is not made of wood or another flammable material.

Installation on a flammable surface can lead to the outbreak of fire and have other undesirable consequences.



### **Combustible materials should be distant from the boiler**

Hazardous materials with flammable nature should not be handled near the boiler, and combustible materials should be located at no closer than the minimum distance required by local code.

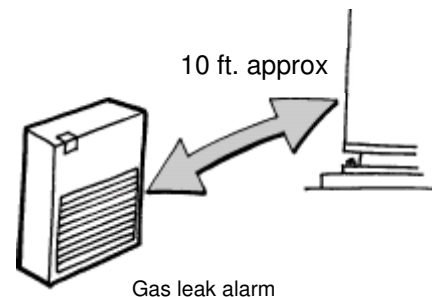


## ■ Fuel Piping

### **No fuel leaking from piping**

Installation of gas leak alarm LPG-fired boilers must be provided with gas-leak alarm equipment.

This fuel is heavier than air and builds up close to the ground, where it is not easily noticed. It is crucial that you provide a gas leak alarm in order to prevent explosion.



■ Electrical Work

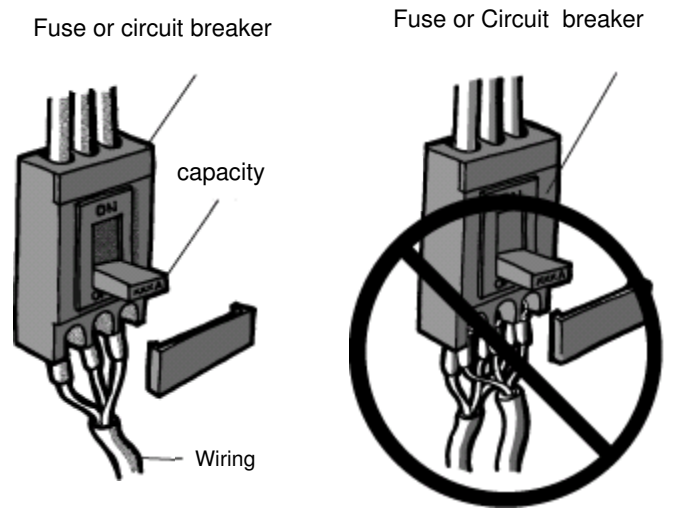
Failure to observe warnings relating to electrical work can lead to electric shock.

**Dedicated power supply for the boiler**

Confirm that the boiler has a dedicated supply of main power and a dedicated breaker installed on the power-supply line.

**Installation of a fuse (or a time-limit type circuit breaker)**

Confirm a fuse (or a time-limit type circuit breaker) is installed on the main power supply line. The rating of the fuse is on the boiler name plate. Please refer to *SECTION 11: SPECIFICATIONS*.

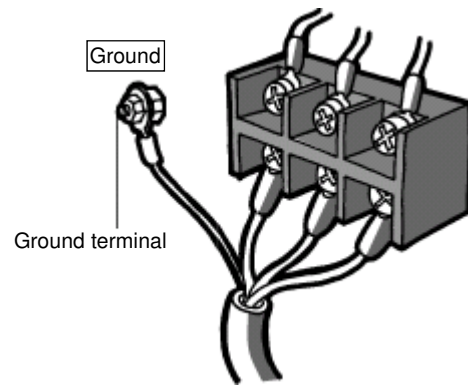


**Power supply lines with the required wire gauge**

Confirm the wire gauge of the power supply lines is as required. For more details regarding power-supply line gauges, please refer to *SECTION 11: SPECIFICATIONS*.

**Ground terminal connected to a grounding wire**

Confirm that a grounding wire is connected to the ground terminal located inside the boiler's control box.



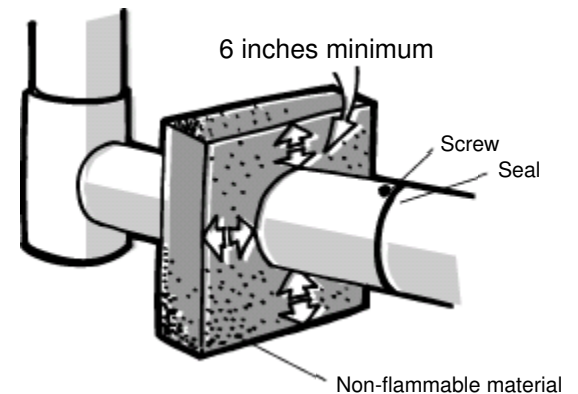
■ Chimney Installation

**Non-flammable parts in contact with chimney path**

Confirm that any section of roof or wall which the chimney passes through is made of a non-flammable material. Flammable material in the vicinity of the chimney poses the threat of fire hazard.

**Area around chimney outlet should be free of combustible material**

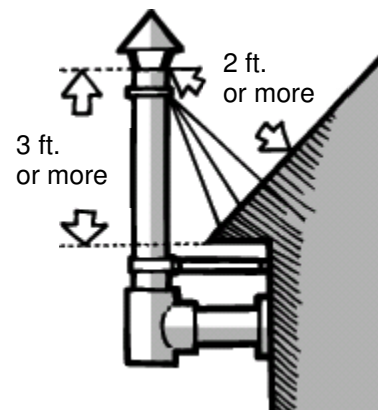
Confirm that no flammable materials are present near the chimney outlet. Any flammable material in that area poses fire hazard.



**Properly sealed and secured joints**

Confirm that there are no joints on the pipe or elbow where it is inside the wall.

Confirm that joints have been properly sealed and secured in place and inside the pipe must be free from any debris. If this is not the case, exhaust gas may leak and rise the risk of carbon monoxide poisoning.



# WARNING

Before operating the boiler, please check each of the installation points. Do not use the boiler if it has not been correctly installed.

Failure to follow this precaution may have serious consequences.

## ■ Safety-Valve Discharge Piping

### **End of discharge piping to be pointing in a safe direction**

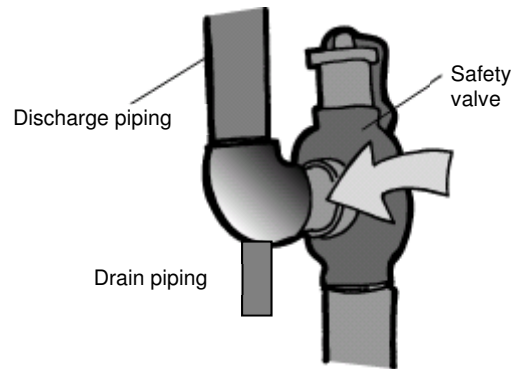
Confirm the end of the safety valve's discharge piping is pointed in a direction that would not endanger anyone when steam is discharged.

If this is not the case, discharged steam could cause burns and other injuries.

### **No movement of discharge piping during discharge**

Confirm by hand that the discharge piping is secured in place.

If this is not the case, the piping could move in reaction to the discharge of steam, which could then cause burns and other injuries.

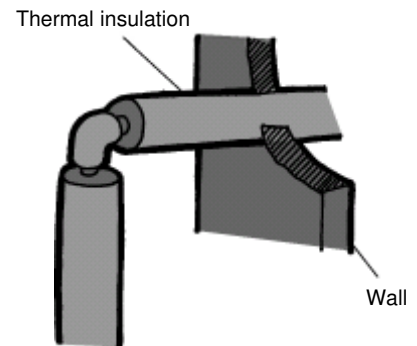


## ■ Steam Piping

### **Fully insulated steam piping**

Confirm that any sections of steam piping passing through inflammable walls are fully insulated.

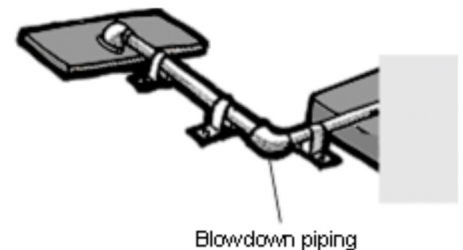
Insufficient insulation can result in the outbreak of fire.



## ■ Blowdown Piping

### **No movement of the piping during blowdown**

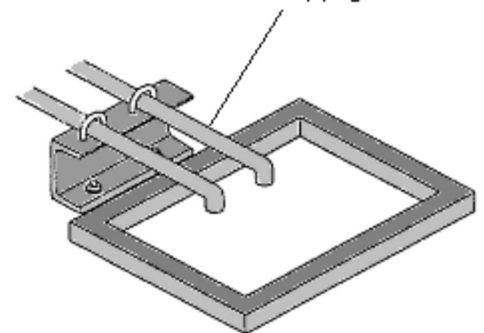
Confirm by hand that the blowdown piping is secured in place. If this is not the case, the piping could move in the reaction of steam discharge, which could then cause burns and other injuries.



## ■ Economizer drain fitting

An economizer drain fitting (2" npt) is included on every unit. This connection should be piped to a source which can accept strongly acidic (pH 3 or 4) water. It is required to install a water trap of 4" or more, which will prevent the flue gases from filling the economizer drain line. Stainless steel pipe materials should be used for this purpose because of the strong acidity.

**When it is open, exhaust gas may leak and may create the risk of carbon monoxide poisoning.**

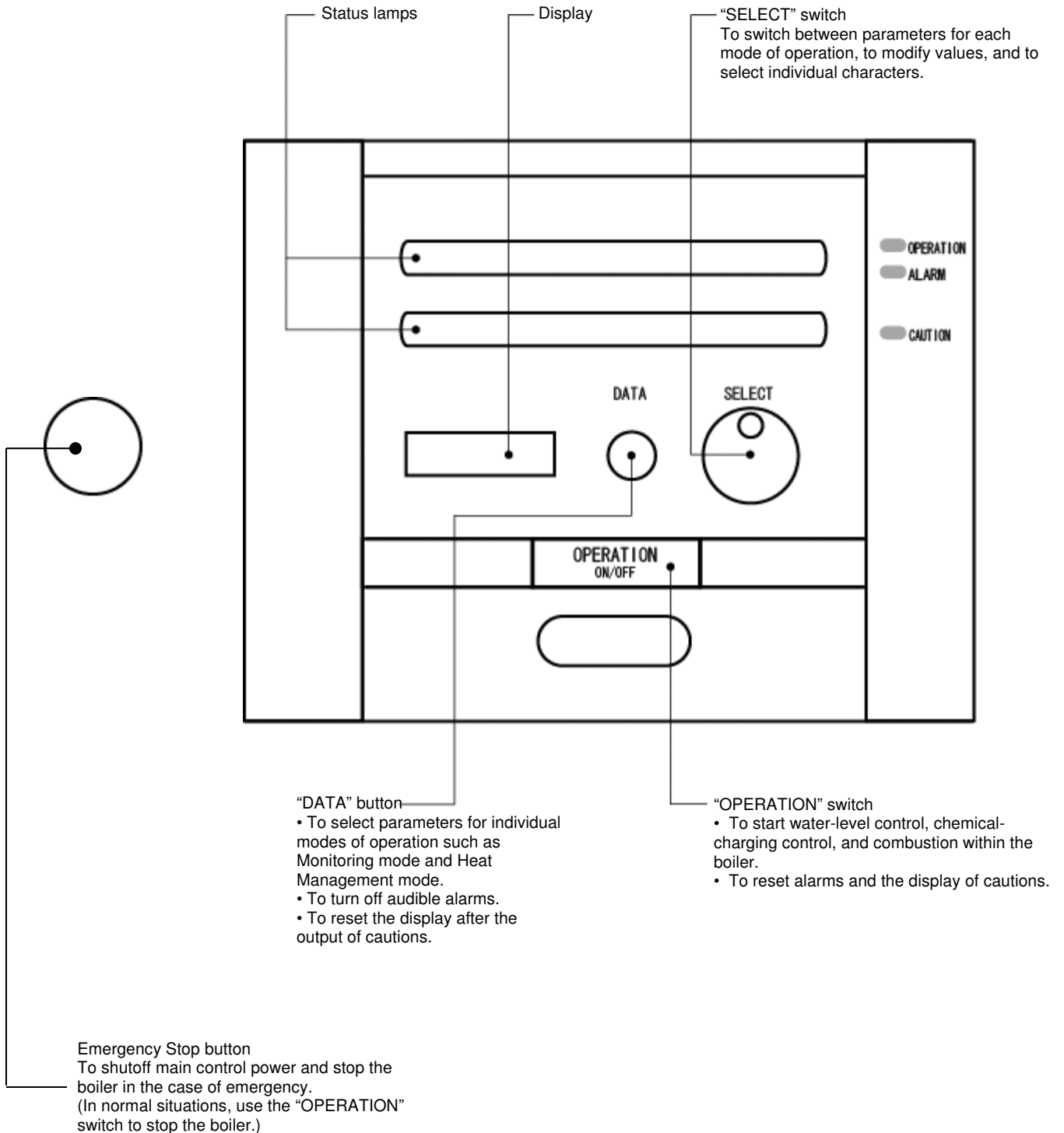


## 6 USING BOILER CONTROLS

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## Names & Functions of Control Panel Items

### ■ Names & Functions of Switches



## Working with the Display

### 6.2.1 Display Content

- Operation Status & Parameters (Monitoring mode)

Typical display: Upper row of display:  
Boiler operation mode

HIGH FIRE	
STEAM	100 PSI

Lower row of display:  
Monitoring data for  
selected parameter

#### NOTE

If switches are not operated for a period of time, the system will automatically switch over to Monitoring mode and the display will show steam-pressure data.

Status presented in upper row of display

DISPLAY CONTENT	BOILER OPERATION MODE
DISABLE	Operation stopped
STAND-BY	Standby
FEED WATER	Low water level interlock
PREPURGE	Pre-purge
IGNITION	Pilot ignition
PILOT	Pilot only
MAIN IGNITION	Main ignition
LOW FIRE	Low fire
HIGH FIRE	High fire
POSTPURGE	Post-purge
PILOT HOLD	Pilot fire hold
LOW FIRE HOLD	Low fire hold
PREPURGE HOLD	Pre-purge hold

Parameters presented in lower row of display

MONITORED PARAMETER	TYPICAL OUTPUT
Steam Pressure	STEAM 999PSI
Exhaust Gas Temperature	FLUE GAS 999F
Feed Water Temperature	FEED WATER 999F
Scale Monitor Temperature	SCALE MNTOR 999F
Overheat Thermostat Temperature	HIGH LIMIT 999F
Flame Current	FLAME 99.9µA
Remaining Blowdown Time	NEXT B/DOWN 999Hr
Condensate Blowdown Valve On / Off	SFCE B/DOWN ON/OFF
Water Conductivity	CONDUCT 9990µS
Water Level Condition	W/LEV L2 LMSD SS
Date & Time	MM/DD/YY HH:MM

■ Purpose of Each Mode

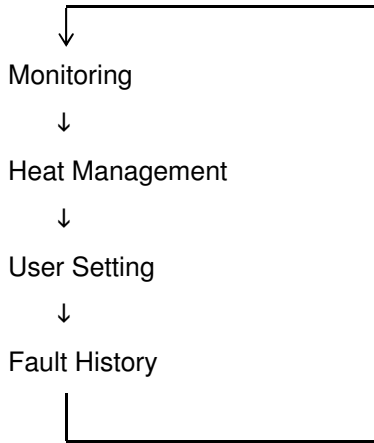
Monitoring Mode	In this mode, data required for boiler control such as the steam pressure and exhaust gas temperature is presented. Refer to page 36 for more details regarding the actual display content.
Heat Management Mode	In this mode, data required for heat management such as the boiler efficiency and fuel consumption is presented. Refer to page 39 for more details regarding the actual display content.
User Setting Mode	This mode is used to make steam pressure and time settings. Refer to page 40 for a description of how to set the system time (i.e., program-time setting).
Fault History Mode	Use this mode to view the content of the seven most recent alarms and cautions, together with the corresponding times of occurrence. Refer to page 43 for more details on how to view this content.

The four operation modes – Monitoring, Heat Management, User Setting, and Fault History – can be displayed using the “DATA” button.

6.2.2 Using the Display (“DATA” & “SELECT”)

■ Using the “DATA” Button

Press the “DATA” button to scroll through the four operation modes – Monitoring, Heat Management, User Setting, and Fault History.



■ Using the “SELECT” Switch

Turn the “SELECT” switch to change the displayed parameter or the corresponding value.



### 6.2.3 Display Content for Heat Management Mode

You can display a total of 11 heat-management parameters in Heat Management mode, with the corresponding values being presented in the lower row.

Typical display:

Boiler's current mode of operation

HIGH FIRE

IGN CYCLE            9999

#### Heat Management Parameters

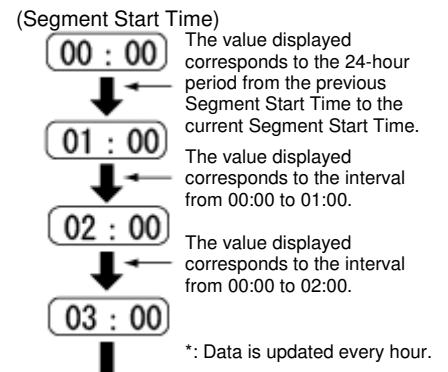
Parameters displayed for Heat Management mode

№	HEAT MANAGEMENT PARAMETER	DISPLAY OUTPUT	RESOLUTION
1	Ignition Cycles	IGN CYCLE 9999	1
2	Gas-fired Low Fire Duration	GAS L HRS 99:99	Hours: Minutes
3	Gas-fired High Fire Duration	GAS H HRS 99:99	Hours: Minutes
4	Gas-fired Average Exhaust-Gas Temperature (low fire)	GAS L TEMP 999F	1°F
5	Gas-fired Average Exhaust-Gas Temperature (high fire)	GAS H TEMP 999F	1°F
6	Average Feed Water Temperature	FW AVG TEMP 999F	1°F
7	Gas-fired Boiler Efficiency	GAS EFFIC 99.9%	0.1%
8	Gas Consumption	GAS U 999999SCF	1 SCF
9	Boiler Makeup Water	F WATER 99999GAL	1 Gal
10	Steam Generated	STEAM 999999LB	1 Lb.
11	Surface Blowdown Volume	B/DOWN 99999GAL	1 Gal

For these parameters, the display shows cumulative value from the Segment Start Time of the current day to the current time (or for the Segment Interval).

For these parameters, the display shows cumulative value from the Segment Start Time of the current day to the current time (or for the Segment Interval).

For these parameters, the display shows cumulative value from the Segment Start Time of the current day to the current time (or for the Segment Interval).



**NOTE**

The Segment Start Time can be set in intervals of one hour. (The default setting is 00:00.) If you need to change this setting, please arrange for MIURA maintenance personnel to do so.



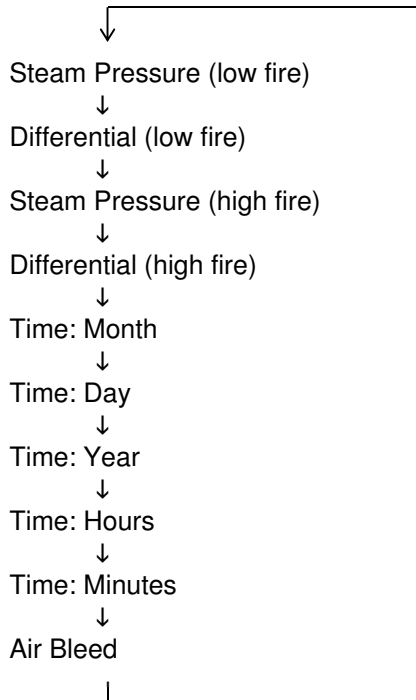
### 6.2.4 Display Content for User Setting Mode

In User Setting mode, you can set steam pressure levels and the current time (YY/MM/DD HH:MM).

#### NOTE

The current time is used by a range of different processes working with control data, and for this reason, you must set it correctly. Although the time is set before the boiler is shipped from the manufacturing plant, you should check to confirm that it is correct.

- 1) Press the “DATA” button to select User Setting mode.
- 2) Press and hold the “DATA” button for two seconds to switch to User Setting mode. Parameters for this mode change as follows in response to pressing of the “DATA” button.



INI SET MODE  
PRESS&HOLD“DATA”

DATA



STEAM SET(L) 100PSI

DATA



- 3) To exit User Setting mode, again press and hold the “DATA” button for two seconds.

DATA



■ Setting Steam Pressures

NOTE

If no switches are operated for a certain period of time, the system will automatically switch over to Monitoring mode and the display will show steam-pressure data. (This action does not cause any settings to change.)

- 1) Press the “DATA” button to select User Setting mode.
- 2) Press the “DATA” button to select the steam pressure setting to be changed.

INI SET MODE  
PRESS&HOLD “DATA”

DATA



DATA



PARAMETERS	DETAILS
Steam Pressure (low fire)	If the pressure of steam inside the pressure vessel reaches or exceeds this setting, the boiler will switch to low-fire operation. Furthermore, the boiler will return to high-fire operation if the pressure of steam inside the pressure vessel drops to (Steam Pressure (low fire) – Differential (low fire)).
Differential (low fire)	
Steam Pressure (high fire)	If the pressure of steam inside the pressure vessel reaches or exceeds this setting, the boiler will switch to stand-by. Furthermore, the boiler will restart combustion if the pressure of steam inside the pressure vessel drops to (Steam Pressure (high fire) – Differential (high fire)).
Differential (high fire)	

- 3) Use the “SELECT” switch to change a pressure setting.

NOTE

Do not change either Steam Pressure value (i.e., for high or low fire) to 20psi (2psi for LXL) below the safety valve setting or higher.  
If you wish to operate the boiler in this elevated range, please consult with a

STEAM SET(L) 100PSI

SELECT



- 4) When you have finished changing settings, press and hold the “DATA” button for two seconds to leave User Setting mode. Settings are updated as you leave this mode. Failure to carry out this action will result in the original settings remaining unchanged.
- 5) Confirm that the pressure settings have been changed as intended.

DATA



■ Setting the System Date & Time

**NOTE**  
 If no switches are operated for a certain period of time, the system will automatically switch over to Monitoring mode and the display will show steam-pressure data. (This action does not cause any settings to change.)

- 1) Press the “DATA” button to select User Setting mode.
- 2) Press the “DATA” button to select the Time Setting screen.  
 The current month will start to flash.  
 When a setting flashes in this way, its value can be changed.
- 3) Using the “DATA” button, move to the setting that you want to change.
- 4) Use the “SELECT” switch to change the setting as required.
- 5) When you have finished changing the settings, press and hold the “DATA” button for two seconds to leave User Setting mode.  
 Settings are updated as you leave this mode.  
 Failure to carry out this action will result in the original settings remaining unchanged.
- 6) Confirm that the date and time have been changed as required.

INI SET MODE  
 PRESS&HOLD“DATA”

DATA



TIME SET  
 07/01/06 08:00

DATA



TIME SET  
 07/01/06 08:00

DATA



TIME SET  
 07/01/06 13:00

SELECT



DATA



### 6.2.5 Display Content for Fault History Mode

Using Fault History mode, you can review the content of recent alarms and cautions, together with the corresponding times of occurrence.

Specifically, you can use the “DATA” button to display the seven most recent alarms and cautions. For more details regarding this mode’s display items, refer to *Section 10.3: Action to be Taken before Ordering Repairs*.

- 1) Select Fault History mode using the “DATA” button.



DATA

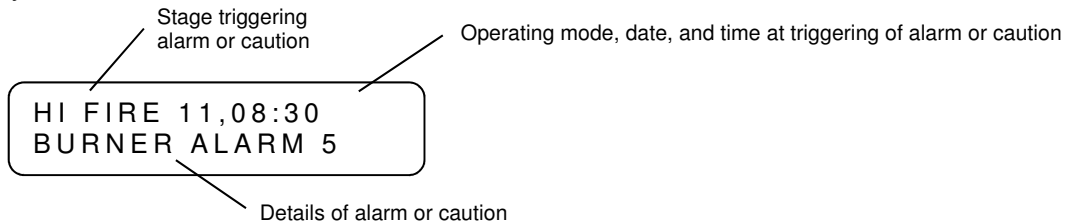


- 2) Press and hold the “DATA” button for two seconds to switch to Fault History mode. In addition, you can use the “SETTING” switch to display the possible causes of alarms and cautions.

DATA



Typical display:



Typical display of possible causes:



- 3) To exit Fault History mode, press and hold the “DATA” button for two seconds.

## Confirming Gauge Readings

### ■ Steam Pressure Display

The steam pressure gauge measures the pressure of steam inside the boiler. The measured value is presented in both digital and analog format.

The analog display is in units of \*\* PSI.

The digital display has a resolution of 1 PSI.



<Analog display>

#### NOTE

As a result of the different measurement-error characteristics of the analog and digital displays, there may be a slight difference in the pressures indicated by each.

HIGH FIRE  
STEAM 100 PSI

### ■ Water Level Display

The control system provides information regarding the amount of water in the boiler in terms of electrode conditions.

The display presents the status of the electrode on which water is detected.

HIGH FIRE  
W/LEV L2 LMSS SS

Water level: Low ←————→ High  
Displayed by default during combustion.

SS : High water alarm option

## Operating the Main Steam Valve

### **WARNING**

The main steam valve is located high on the boiler with limited space available for footing. It is important to wear suitable protective clothing (i.e., long sleeves and trousers, safety footwear, a helmet, gloves) whenever opening or closing this valve.

As the entire boiler will remain at a high temperature for some time after shutdown, avoid to touch any boiler part other than the handle of the main steam valve. Failure to follow this precaution can result in burns and other injuries.

#### NOTE

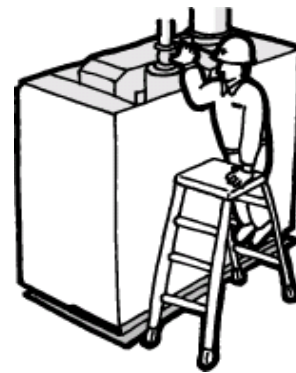
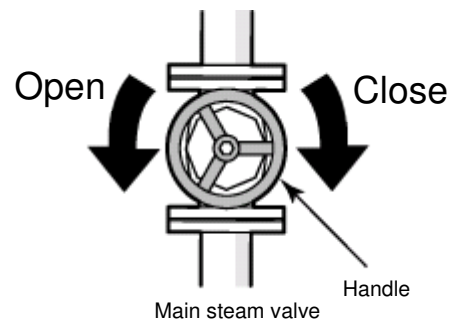
If a steam header has been installed on the piping, ensure that the main steam valve is left open.

In this type of setup, the steam header's valve will act as the main steam valve for the boiler.

1) Setup a ladder.

2) Confirm that the position of the valve and the required direction of turning in advance.

3) Climb the ladder and open or close the main steam valve as required.



### **WARNING**

Do not jump on or jump off the ladder.

You must keep both hands and one foot, or both feet and one hand in contact with the ladder at all times when ascending or descending. Failure to observe this precaution may result in a fall and the associated injury.

## **7 PREPARING FOR STARTUP**

■ The following checks must be carried out before starting the boiler.

- 1) Turn on the breaker for the boiler's main power.

## WARNING

Do not carry out this procedure with wet hands. Failure to observe this precaution may lead to electric shock and have other undesirable consequences.

## WARNING

All cover plates, enclosures and guards must be in place at all times, except during maintenance and servicing.

### NOTE

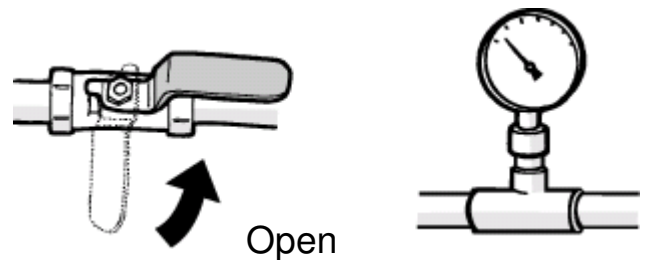
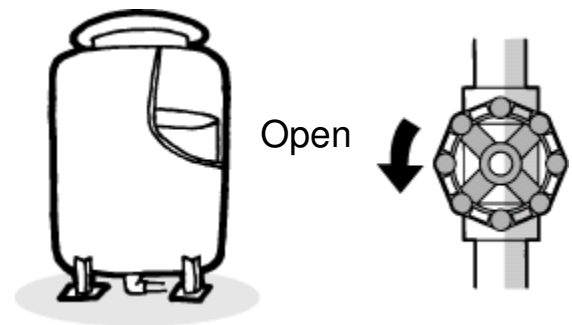
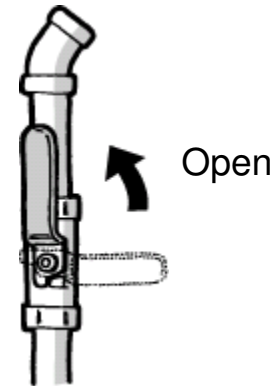
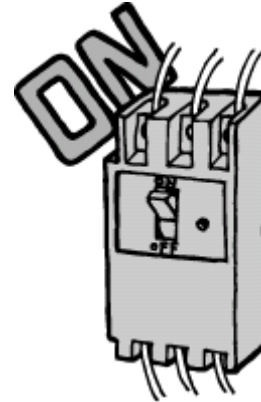
Even when the boiler is not in use, the main-power breaker should not be turned off. If the boiler receives no power for an extended period of time, the data stored in its memory will be lost. In addition, communication will not be possible if no power is being supplied.

- 2) Open the pressure vessel's air bleed valve for approximately five seconds, and then fully close the valve.

## WARNING

Never open the pressure vessel's air bleed valve when the boiler is pressurized, no matter how small the pressure level. You must always confirm that the steam pressure gauge reads 0 PSI at this time. Opening the valve at any pressure above 0 PSI will result in the discharge of steam, which could cause burns and other injuries.

- 3) After confirming that the feed water tank is at least two-thirds full of water, open the main feed-water valve.
- 4) Open the main gas valve.  
As described in *Section 9.5.3: Checking the Gas Pressure*, confirm that the value indicated by the gas pressure gauge is within the rated range.

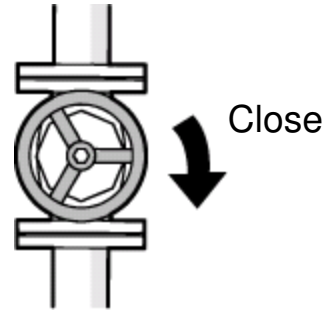




- 5) As described in *Section 9.5.2: Checking the Water Softness*, confirm that the feed water has been correctly softened.



- 6) Confirm that the main steam valve is closed.  
If this is not the case, apply the method described in *Section 6.4: Operating the Main Steam Valve* and close the valve.



## 8 OPERATING THE STEAM BOILER

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## 8.1 Boiler Startup

- 1) Perform the checks described in *SECTION 7: PREPARING FOR STARTUP*.

### **WARNING**

This is a shop-tested, assembled, and fully-packaged boiler. Each unit and assembly has been carefully adjusted at the factory. It is very important not to make any adjustments without first consulting a MIURA sales office or the local dealer.

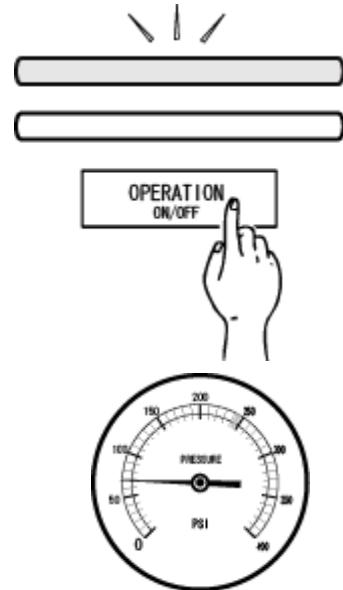
- 2) Turn on the "OPERATION" switch.

The Status lamp will light in green, and the system will begin water level control. The Status lamp will light in red at this time if the water level is too low.

- 3) When the normal water level has been reached, the Status lamp will turn green and pre-purging will begin. Combustion will follow pre-purging.

When the pre-purge has been completed, the control system will perform ignition on pilot burner.

Following main ignition, the system will perform low fire combustion for approximately 10 seconds, before switching to high fire.



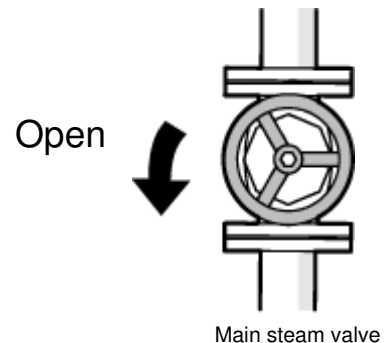
Steam pressure gauge

### **WARNING**

Fans and other ventilation equipment must be turned on at this time. Insufficient ventilation can result in incomplete combustion, which in turn can lead to carbon monoxide gas poisoning or boiler explosion.

- 4) Stand by until the pressure level indicated by the steam pressure gauge reaches the rated level (i.e., at least 70 PSI).
- 5) Applying the method described in *Section 6.4: Operating the Main Steam Valve*, slowly open the main steam valve.

The boiler will alternate high-fire combustion and low-fire combustion in order to deliver steam at the rated pressure level.



Main steam valve

## 8.2 Inspection during Operation

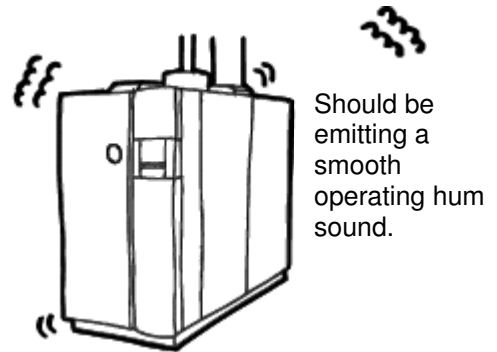
### **WARNING**

At any time, when a gas leak is suspected, immediately turn off the “OPERATION” switch, close the main gas valve and open windows and doors in order to fully ventilate the area around the boiler. You must never turn fans or other electrical device on or off without good reason in such a situation. Failure to observe this precaution may result in explosion.

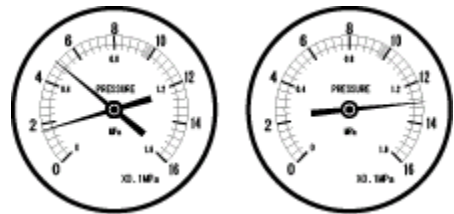
Immediately turn off the “OPERATION” switch and close the main gas valve whenever you notice abnormal noise, strange smells, black smoke, or any other unusual conditions. Failure to observe this precaution may result in fire, gas explosion, and other dangerous situations.

Always follow the instructions given by MIURA sales offices or local dealers whenever strange or abnormal conditions arise. In addition, discontinue use of the boiler until the abnormality has been removed. Failure to observe this precaution can result in fire, explosion, and other dangerous situations.

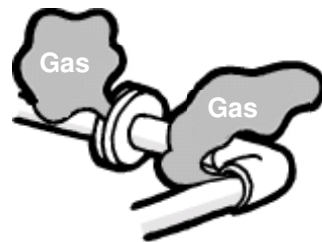
Listen to the blower, feed water pump, and other devices and confirm that no abnormal operating noise is being generated.



Confirm that the readings on the steam pressure gauge and the gas pressure gauge are within the normal ranges, and the gauge pointers are not swinging wildly.

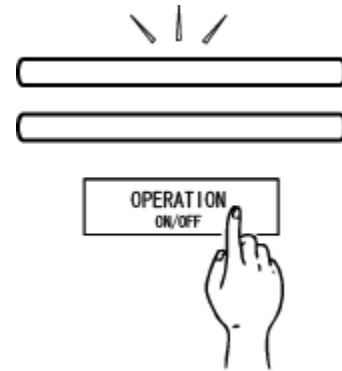


Confirm that there is no gas leaking from the piping.

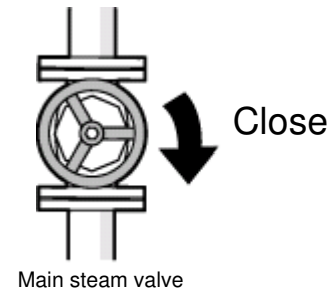


## 8.3 Boiler Shutdown

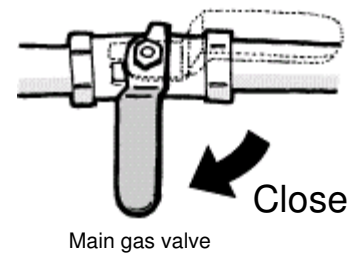
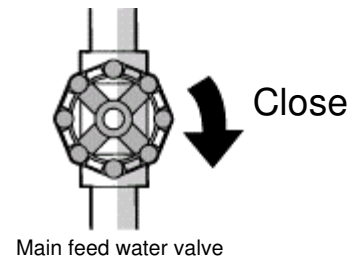
- 1) Turn off the "OPERATION" switch.  
Confirm that the Status lamp turns off.



- 2) Apply the method described in *Section 6.4: Operating the Main Steam Valve* and close the valve.



- 3) Close the main feed water valve and the main gas valve.



### NOTE

If there is any concern regarding freezing of the boiler, implement the protective measures described in *Section 9.1: Preparing for Possible Freezing*.

Refer to *Section 9.2: Maintenance during Extended Inactivity* if the boiler will not be used for an extended period of time.

## 9 INSPECTION & MAINTENANCE

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## Preparing for Possible Freezing

### NOTE

The following describes one specific set of measures to protect against freezing. Ensure that the measures implement for both boiler and ancillary equipment are suitable for the local region and boiler installation.

If you require more information regarding such countermeasures, please do not hesitate to contact MIURA sales office.

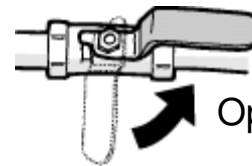
### 9.1.1 Bleeding Water to Protect against Freezing

#### ■ Bleeding Water from the Pressure Vessel

- 1) Shut down the boiler as described in *Section 8.3: Boiler Shutdown*.
- 2) Stand by until the pressure reading on the steam pressure gauge reaches 30 PSI.
- 3) Slowly open the boiler blowdown valve and carry out boiler-water blowdown.



Steam pressure gauge



Open slowly

Boiler blowdown valve

### WARNING

All parts of the boiler will be extremely hot at this time. Touch only those parts clearly identified in the instructions. Failure to observe this precaution can result in burns and other injuries. Do not open the boiler blowdown valve rapidly. Anything other than slow opening of this valve will result in the violent discharge of steam, which could cause burns and other injuries.

- 4) Stand by until the pressure reading on the steam pressure gauge reaches 0 PSI.
- 5) Slowly open the boiler's air bleed valve.



Steam pressure gauge



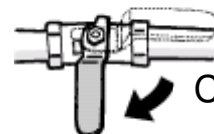
Open slowly

Boiler air-bleed valve

### WARNING

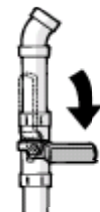
Steam may be discharged from the boiler's air bleed valve. For reasons of safety, therefore, ensure that no work is being done in the direction of discharge. Failure to follow this precaution can result in burns and other injuries.

- 6) Open the water sampling valve and confirm no water is discharged.
- 7) Close the boiler blowdown valve, the boiler air-bleed valve, and the water sampling valve.



Close

Boiler blowdown valve



Close

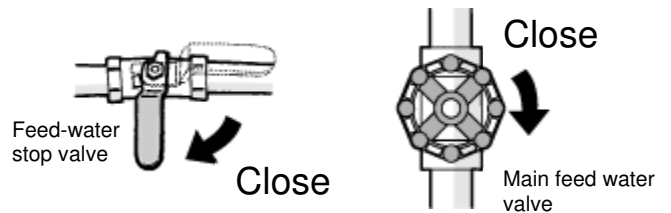
Boiler air-bleed valve

■ Bleeding Water from the Feed-Water Pump

 **WARNING**

Piping near the feed water pump is extremely hot. For this reason, you should wait until it has sufficiently cooled down (at least two hours after boiler shutdown) before performing this work. Failure to observe this precaution can result in burns and other injuries.

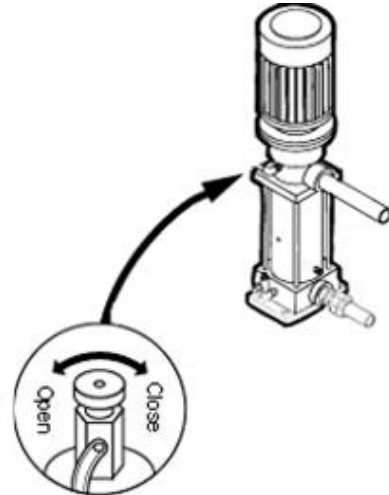
- 1) Close the feed-water stop valve and the main feed-water valve.
- 2) Open the feed water pump's water bleed valve and air bleed valve. Discharge water contained in the feed water pump via the water bleed valve.



NOTE

Do not rotate the handle for both the water bleed valve and the air bleed valve for more than one complete turn. Failure to observe this precaution may result in the gushing out of water.

- 3) Stand by until water is no longer discharged from the water bleed valve.
- 4) Close the feed water pump's water bleed valve and air bleed valve.



**Maintenance during Extended Inactivity**

NOTE

A boiler that is inactive for an extended period of time must be properly maintained. It is often the case that boiler maintenance is neglected once it has become inactive. Failure to maintain suitable storage conditions for the pressure vessel during extended periods of inactivity can result in the start and acceleration of corrosion. In order to avoid this outcome, one of two maintenance methods may be used – namely, wet lay-up (the application of volatile corrosive inhibitors) or dry lay-up.

To prevent internal corrosion during periods of extended shutdown (5 to 9 days), deoxidizing agent should be maintained at 150-200 mg/L in the boiler water and the boiler water pH level must be kept between 11-12 to reduce corrosion

For shutdown longer than 10 days, the boiler must be filled up with water with higher deoxidizing, to maintain a chemical residual of 200-400 mg/L in the boiler water or drained and treated with inert gas or deoxidizing agent. Please contact Miura service office for further details.



Since the LX is a small water content boiler, in places where freezing is a problem, caution should be taken when storing with water inside the pressure vessel.

Finally, check to make sure all manual valves (water inlet, steam outlet, main & pilot gas,...) are closed tightly and turn off the main power supply to boiler during shutdown.

Starting the boiler after a long period of shutdown

Drain the water and chemicals in the boiler.

Fill up the boiler with feed water, run the boiler until the boiler pressure reaches 30PSIG, and blow off the water too remove chemicals in the boiler. Repeat this process once again.

Conduct an internal inspection of the pressure vessel, and clean the water level probes.

Install the inspection port plugs and probes and operate the boiler normally.

If the boiler is to be inactive for a protracted period of time, please contact a MIURA sales office or your local dealer.

### **Regular Maintenance Tasks and Timing**



## **WARNING**

No work other than that clearly indicated below is to be carried out on the boiler. Failure to observe this precaution may result in injury.

The inspection and cleaning tasks listed below must be carried out on a regular basis in order to prevent breakdown and to maintain the high levels of cost effectiveness and safety delivered by your LX steam boiler over a long service life. (Some of the listed items may not apply to your system. If in doubt, please contact MIURA maintenance personnel.)

This table presents the standard timing for each inspection and cleaning task. However, the best replacement timing differs depending on the operating condition. It is important to follow the priority given to instructions by MIURA maintenance personnel regarding the required frequency of maintenance work.

INSPECTION OR CLEANING TASK		TIMING			
		Daily	As shown on display	Once every four months	Yearly
Chemical Feed Check	Page 59	✓			
Water Softness Check	Page 60	✓			
Gas Pressure Check	Page 61	✓			
Steam Pressure Check	Page 61	✓			
Low Water Level Interlock Test	Page 63	✓			
Blowdown	Page 62		✓		
Air Filter Cleaning	Page 64		✓	✓	
Feed-water Strainer Cleaning	Page 66			✓	
Feed-water Tank Interior Cleaning	Page 68			✓	

Water Quality Check	Page 19			✓	
Safety Sensors Check	Page 70			✓	
Safety Valve Inspection	Page 69				✓
Cleaning UV sensor Protective Glass	Page 70				✓

Electric motors are pre-lubricated at the factory and do not require additional lubrication at startup. Motors with grease fittings should be lubricated using lithium-base grease only and at the frequency given in the table below:

TYPE OF SERVICE	FREQUENCY OF GREASING
Seasonal (i.e., the motor or blower is idle for more than six months)	Annually
Intermittently (i.e., normal daily operation of the boiler)	Semi-annually
Continuous	Quarterly

Do not over-grease the bearings. Over-greasing will cause bearing heat to increase and can result in bearing and motor failure. Always follow the instructions given on the motor nameplate.

## **Spare Parts**

Please contact Miura service office in your area or your Miura representative for replacement parts, or the list of replacement parts.

## **Overview of Inspection**

### 9.5.1 Checking the Chemical Feeder

#### NOTE

A chemical feeder (not included) is a critical component of the overall water management system for a boiler. Be sure to read and understand your chemical feeder's operation manual thoroughly, and to operate the feeder in a strict accordance with the instructions given. You should also ensure the chemical feeder's operation manual is stored together with this operation manual in a location that can be readily accessed by persons working on the boiler system.

- 1) Confirm that the chemical feed is as required.
- 2) Confirm that sufficient liquid is present to properly dissolve chemicals.
- 3) Confirm that there is no air in the chemical feed pump or feed line.



## **WARNING**

Protective glasses and rubber gloves must be worn when adding chemical compounds. These compounds may cause sight loss, burns, and other injuries when they contact with skin or eyes.  
If boiler chemical comes into direct contact with skin, immediately wash away using cold water.  
If this chemical enters an eye, immediately wash away with cold water and seek medical attention.

#### NOTE

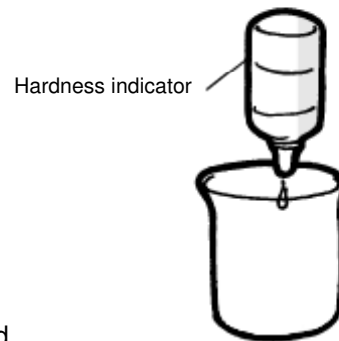
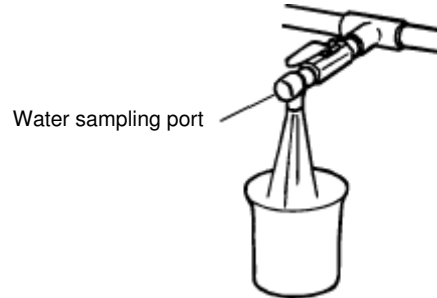
Always follow the instructions of your water treatment personnel in terms of chemical dosage. Insufficient replenishment of chemical compounds can lead to air entering the chemical feed pump and the interruption of supply to the boiler. Accordingly, chemical level checks must be carried out in a proper manner.  
If the level of chemical in the chemical tank does not reduce at the expected rate, it could indicate that air has become trapped in the pump. In such a case, bleed air from the chemical feed pump.

### 9.5.2 Checking the Water Softness

#### NOTE

A water softener (not included) is a critical component of overall water management for a boiler. Be sure to read and understand your water softener's operation manual thoroughly, and to operate the softener in strict accordance with the instructions given. You should also ensure that the water softener's operation manual is stored together with this operation manual in a location that can be readily accessed by persons working on the boiler system.

- 1) To prepare for sampling, rapidly discharge approximately two liters of water from the water sampling port.
- 2) Thoroughly wash the sampling beaker with the sample water.
- 3) Add four drops of hardness indicator to the sampling beaker.
- 4) Add approximately 20 mL of sample water and agitate well to mix.
- 5) After agitating, fill the sampling beaker up to the 50-mL level by collecting more sample water.
- 6) Determine the water hardness based on the color of the solution in the sampling beaker.  
Light or dark blue : Water is sufficiently soft  
Purple or red : Water has not been sufficiently softened.



## CAUTION

Do not use a finger to mix the water in the sampling beaker. This type of mixing is not sufficient for hardness measurement.

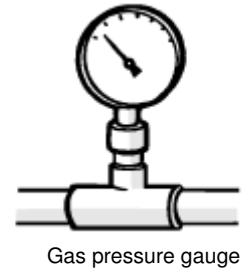
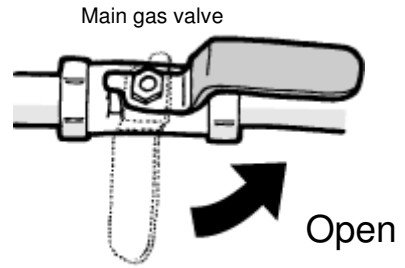
In order to reliably determine the water hardness, it is crucial that only four drops of hardness indicator be added, and 50 mL of sample water.

When adding drops of hardness indicator, do it slowly with the bottle held vertically.

After agitating well, add more sampled water to increase the overall volume in the sampling beaker to 50 mL, and then immediately check the color of the solution. The color will change after approximately 10 minutes, so any judgment after 10 minutes will be unreliable.

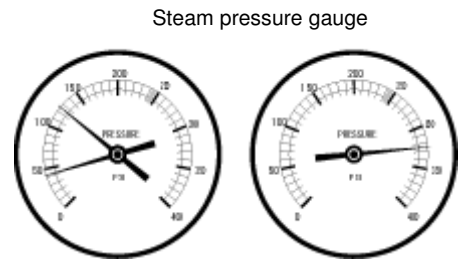
### 9.5.3 Checking the Gas Pressure

- 1) Open the main gas valve.
- 2) Using the boiler's gas pressure gauge, confirm whether the gas is pressurized to the required range (i.e., 3 to 5 PSI).
- 3) If the reading on the gas pressure gauge is not within the required range, immediately shutdown the boiler as described in *Section 8.3: Boiler Shutdown* and contact a MIURA sales office or your local dealer for further instruction.



### 9.5.4 Checking the Steam Pressure

- 1) Startup the boiler as described in *Section 8.1: Boiler Startup*.
- 2) Confirm that the reading on the steam pressure gauge is in the normal range, and that the gauge pointer is not swinging wildly.



## WARNING

If the steam pressure is not within the normal range, immediately shutdown the boiler and contact a MIURA sales office or your local dealer for further instruction. Continued use of the boiler with abnormal steam pressure levels may result in boiler damage, which in turn could lead to injury.

### 9.5.5 Blowdown & Testing of the Low Water Level Interlock

## WARNING

Do not start blowdown until you have first confirmed that the boiler has been shutdown. Failure to observe this precaution can result in burns and other injuries.  
(There is no need to carry out blowdown immediately after the display presents a blowdown request during normal boiler operation. It is recommended to wait until the next startup on the following operating day.)

### NOTE

The system will inform you that regular blowdown is required by lighting the Status lamp in yellow and outputting the message “BOILER CHECK1” on the display. (The display’s “B” indicator will also flash at this time.)

Although the Status lamp will turn off and the display’s blowdown request will be cleared when the “DATA” button is pressed, the “B” indicator will not.

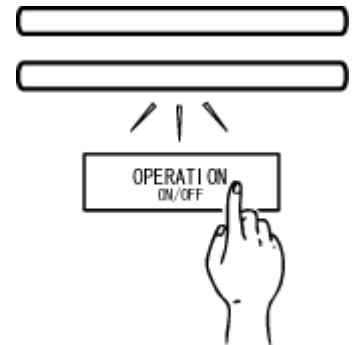
Blowdown must always be carried out in strict accordance with instructions given by MIURA maintenance personnel.

### ■ Blowdown Procedure

- 1) Carry out steps 1 to 3 of the boiler startup procedure described in *Section 8.1: Boiler Startup*.
- 2) Confirm that the steam pressure gauge is reading 30 PSI.
- 3) Turn off the “OPERATION” switch.  
Confirm that the Status lamp turns off.  
(The main steam valve should also be closed at this time.)



Steam pressure gauge



## WARNING

Blowdown must not be carried out if the pressure reading on the steam pressure gauge is above 30 PSI. If this precaution were to be ignored, steam and hot water could be violently discharged from the boiler, which in turn could cause burns and other injuries.

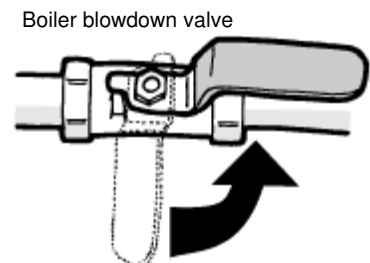
(The steam pressure can be lowered by temporarily opening the main steam valve.)

- 4) Slowly open the boiler’s blowdown valve and carry out boiler-water blowdown.

## WARNING

All parts of the boiler will be extremely hot at this time. In order to avoid burns and other injuries, avoid touching any part of the boiler other than the blowdown valve.

Do not open the boiler blowdown valve rapidly. If the valve is not opened slowly, violent discharge of steam, will cause burns and other injuries.



Boiler blowdown valve

Open slowly

## WARNING

Confirm that the blowdown piping has been firmly secured in place in order to prevent it moving in reaction to the blowdown discharge.  
Confirm that the outlet of the blowdown piping is fully open and in a safe location, such as inside a pit.

- 5) Confirm that the display's "B" indicator turns off.
- 6) Close the boiler blowdown valve.
- 7) Turn on the "OPERATION" switch.
- 8) Confirm that the Status lamp lights in red.  
If the Status lamp lights in green at this time, it will indicate that a water level probe error has occurred.  
In such a case, refer to *Section 10.3.2: Inspecting Water Level Probes*.

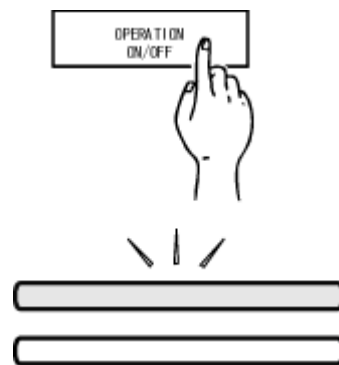
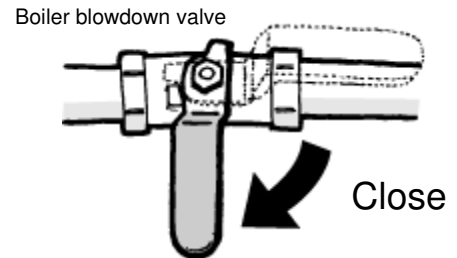
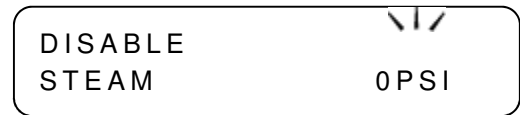
Once the normal water level has been reached, the Status lamp will switch from red to green, and after a short while, combustion will begin.

- 9) Normal operation procedures (i.e., from step 3 of the startup sequence detailed in *Section 8.1: Boiler Startup*) apply from this point onward.

### ■ Low Water Level Interlock Test

If the water volume, for any reason, falls below the pre-determined water volume, combustion will immediately be stopped and if it is not recovered after 15 sec after combustion shutoff, a warning alarm will be activated. The display will read, "WATER ALARM 1".

For testing the Low Water Volume Cut-off, open the ball valve at the bottom of the LVC and allow time for the steam pressure to force the water out of the LVC. When the low water cut-off probe loses contact with the water for more than 15 seconds, the boiler will shift to stand-by mode first and shut down 15 seconds, the alarm will sound and the BL11 Microcomputer will display "WATER ALARM 1".





### 9.5.6 Cleaning the Air Filter

#### NOTE

If dust or other foreign matter has caused the air filter to become clogged, the control system will inform you by lighting the Status lamp in yellow and presenting the message “CLEAN & INSPECT AIR FILTER” on the display.

Incomplete combustion could occur if this situation is not addressed, therefore, it is important that the air filter is cleaned whenever blockage has occurred.

We recommend that the filter also be cleaned on a regular basis in order to ensure clean, safe operation of this steam boiler.

Extra care must be taken regarding to the cleaning of filters in cement factories, textile plants, and other locations where a large amount of airborne material is present inside the boiler room.

■ LX-50/100/150/200, LXH-200 and LXL-50/100/150/200

## WARNING

Before attempting to clean the air filter, be sure to always receive instruction from MIURA maintenance personnel and to fully familiarize yourself with the process involved.

- 1) Turn off the breaker for the boiler's main power.

## WARNING

Allow sufficient time for the boiler to cool down before performing this task.

As all parts of the boiler remain at a high temperature for some time after shutdown, failure to observe this precaution can result in burns and other injuries.

The main-power breaker must be turned off in advance of this procedure.

If the blower were to operate, injury such as the loss of fingers could easily occur.

Never operate the breaker for the boiler's main power supply with wet hands. Failure to observe this precaution may lead to electric shock and have other undesirable consequences.

- 2) Setup a ladder and ensure safe foothold.

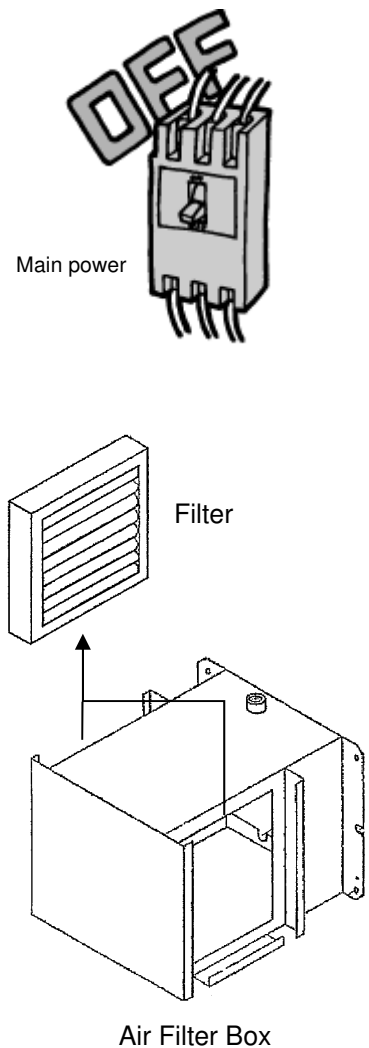
## WARNING

Do not jump onto or jump off the ladder. You must keep both hands and one foot, or both feet and one hand in contact with the ladder at all times when ascending or descending. Failure to observe this precaution may result in a fall and the associated injury.

Use only the indicated footing.

Failure to observe this precaution may result in a fall from the boiler or damage to the boiler itself.

- 3) If the filter is damaged or extremely dirty, it must be replaced. In such a case, please contact MIURA maintenance personnel.



 **WARNING**

Before attempting to clean the air filter, be sure to always receive instruction from MIURA maintenance personnel and to fully familiarize yourself with the process involved.

- 1) Turn off the breaker for the boiler's main power.

 **WARNING**

Allow sufficient time for the boiler to cool down before performing this task.  
As all parts of the boiler remain at a high temperature for some time after shutdown, failure to observe this precaution can result in burns and other injuries.  
The main-power breaker must be turned off in advance of this procedure.  
If the blower were to operate, injury such as the loss of fingers could easily occur.  
Never operate the breaker for the boiler's main power supply with wet hands. Failure to observe this precaution may lead to electric shock and have other undesirable consequences.

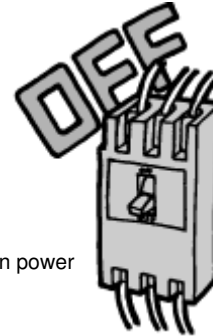
- 2) Pull the filter forward together with the filter retainer.

- 3) If the filter is damaged or extremely dirty, it must be replaced. In such a case, please contact MIURA maintenance personnel.

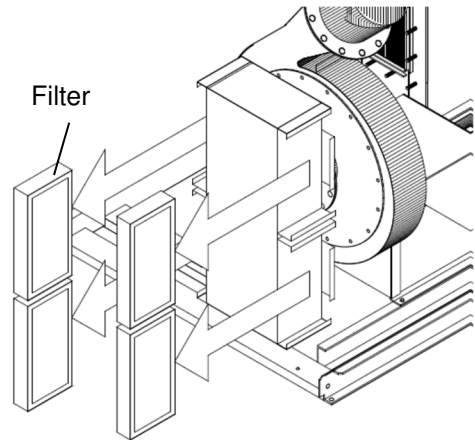
- 4) Return the filter to its original position.

 **WARNING**

Do not operate the boiler without the air filter installed. Failure to observe this precaution may cause blockage with airborne dust and dirt and lead to carbon monoxide poisoning or explosion caused by incomplete combustion.



Main power



9.5.7 Cleaning the Feed-water Strainer

# ⚠ WARNING

Water in the feed-water tank for the boiler connecting to a deaerator or hot water tank is extremely hot. For this reason, you should wait until the boiler's water supply lines have sufficiently cooled down (at least two hours after boiler shutdown) before performing this work. Failure to observe this precaution can result in burns and other injuries.

- 1) Turn off the breaker for the boiler's main power. Confirm that the steam pressure gauge is reading 0 PSI. If this is not the case, stand by until the pressure reading drops to zero.

# ⚠ WARNING

Never operate the breaker for the boiler's main power supply with wet hands. Failure to observe this precaution may lead to electric shock and have other undesirable consequences.

- 2) Confirm that the main feed water valve is closed.
- 3) Open the boiler blowdown valve and carry out boiler-water blowdown.

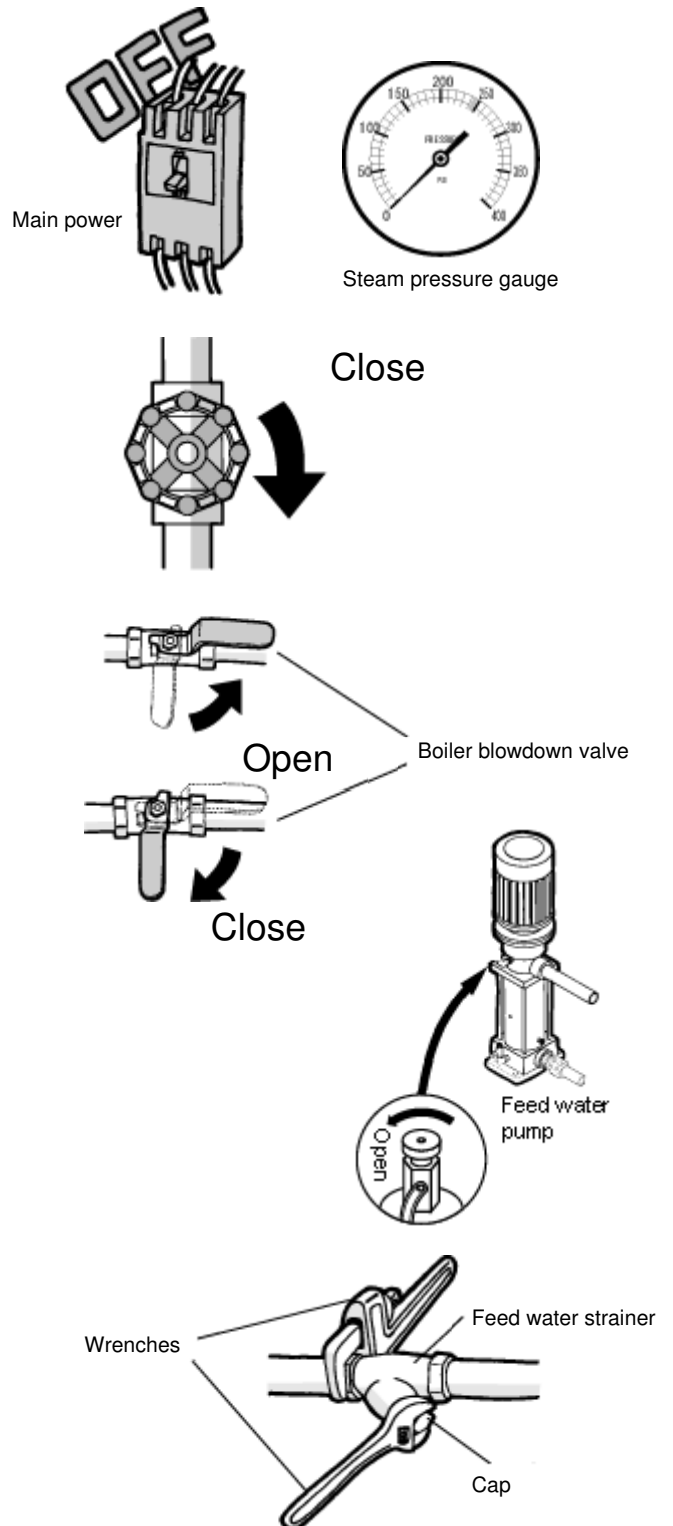
# ⚠ WARNING

Be sure to always carry out boiler-water blowdown before cleaning the feed water strainer. If reverse flow of boiler water were to occur during this procedure, it could result in burns or other injury.

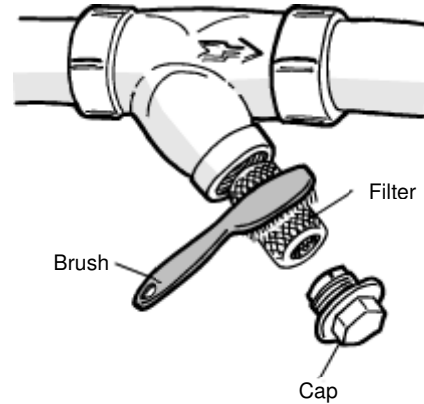
- 4) When the discharge of boiler water has stopped, close the boiler blowdown valve.
- 5) Open the feed water pump's air bleed valve. This action releases pressure from the feed water piping.
- 6) Using wrenches, open the feed water strainer's cap.

## NOTE

Water will discharge from the piping when you open the feed water strainer's cap. Particularly in cases where the piping is long, a relatively large amount of water may come out, and buckets or containers should be used to prevent spillage.



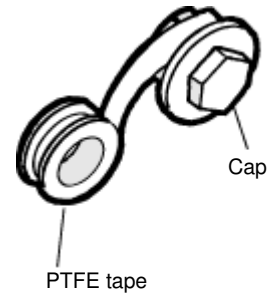
- 7) Remove the filter and clean it using a brush. If rust cannot easily be removed from gaps or significant deformation has occurred, the filter must be replaced. In such a case, please contact a MIURA sales office or your local dealer.



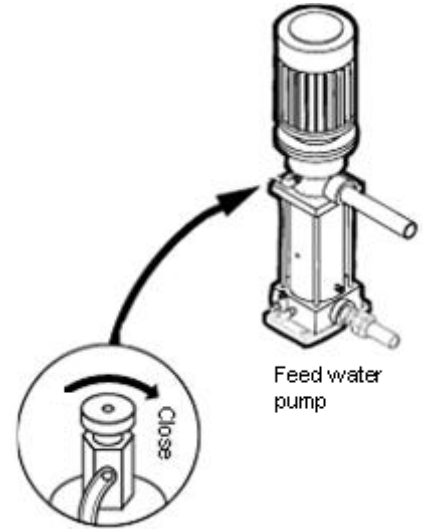
- 8) Return the filter to its original position inside the feed water strainer.
- 9) Wrap PTFE tape around the cap's contact surface, and then secure the cap tightly using wrenches.

NOTE

Be sure to wrap the PTFE tape neatly and in the opposite direction to that of cap tightening. Failure to observe this precaution can result in the leakage of water.



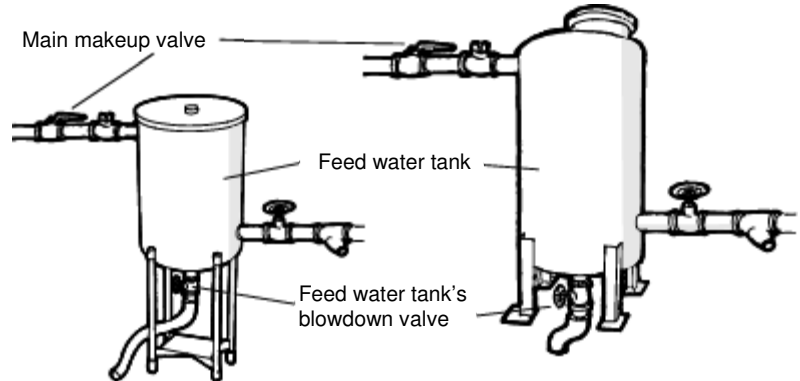
- 10) Close the feed water pump's air bleed valve. When the feed water strainer has been cleaned, it is important to bleed air from the feed water pump as described in *Section 10.3.1: Bleeding Air from the Feed Water Pump* before operating the boiler.



### 9.5.8 Cleaning the Feed-water Tank

## WARNING

Water in supply lines for boilers connecting to a deaerator or hot water tank is extremely hot. For this reason, you should wait until the tank water has sufficiently cooled down (at least two hours after boiler shutdown) before performing this work. Failure to observe this precaution can result in burns and other injuries.

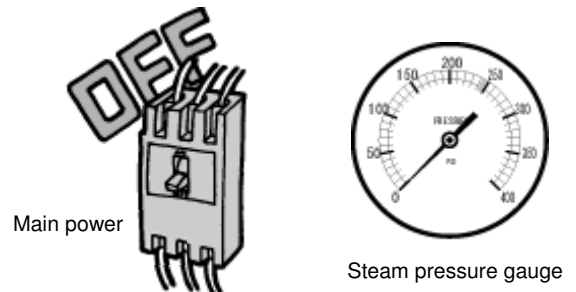


#### ■ Cleaning the Feed-water Tank

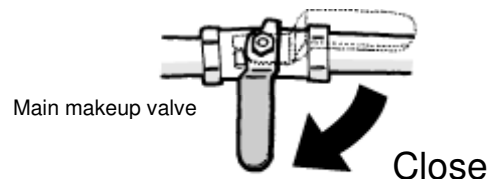
- 1) Turn off the breaker for the boiler's main power. Confirm that the steam pressure gauge is reading 0 PSI. If this is not the case, stand by until the pressure reading drops to zero.

## WARNING

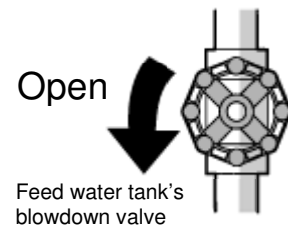
Never operate the breaker for the boiler's main power supply with wet hands. Failure to observe this precaution may lead to electric shock and have other undesirable consequences.



- 2) Close the main makeup valve.

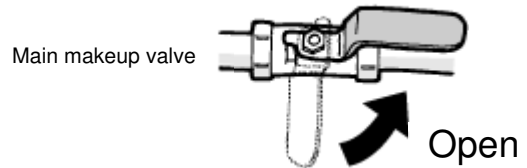
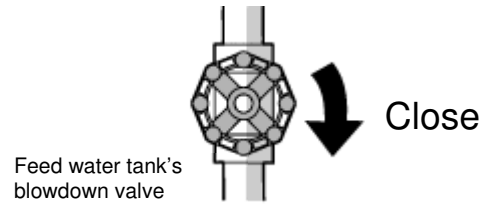


- 3) Open the blowdown valve for the feed water tank.



4) When the discharge of water ends, close the feed water tank's blowdown valve.

5) Open the main makeup valve.



#### 9.5.9 Inspecting the Safety Valve

### WARNING

The safety valve must be inspected on a regular basis. Failure to do so can result in valve damage, which in turn can lead to boiler explosion and have other undesirable consequences.

#### NOTE

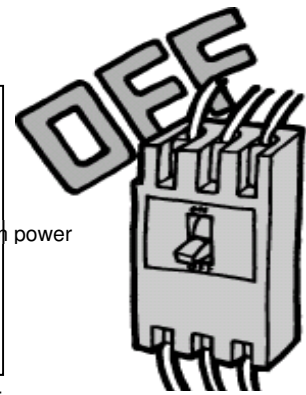
The safety valve's release pressure has been adjusted to match the indicated value. Despite the fact that a small amount of deviation may occur, you must not tamper with the pressure setting. If you suspect leakage or some other abnormality, please contact a MIURA sales office or your local dealer.

Please arrange for MIURA maintenance personnel to carry out safety-valve inspection.

### 9.5.10 Safety Sensors Check

## WARNING

As all parts of the boiler remain at a high temperature for some time after shutdown, you should allow sufficient time for cooling down before performing this work. Failure to observe this precaution can result in burns and other injury. Before attempting to clean the UV sensor's protective glass, be sure to always receive instruction from MIURA maintenance personnel and to fully familiarize yourself with the process involved.

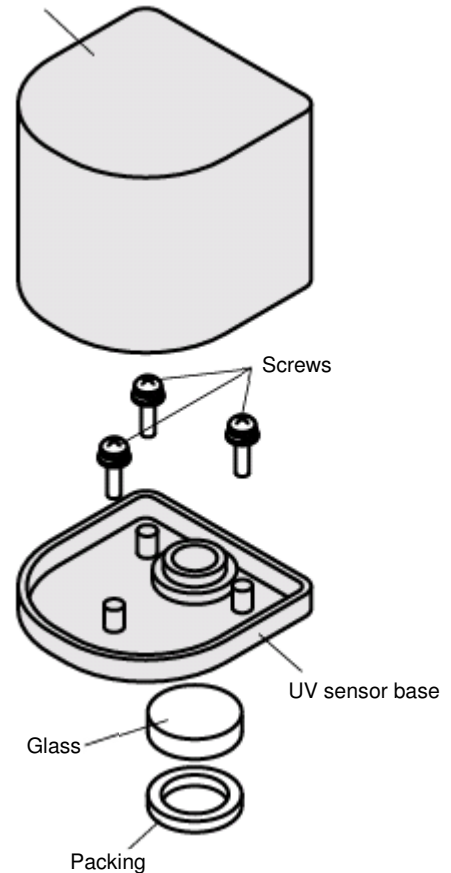


- 1) Turn off the breaker for the boiler's main power.

## WARNING

Never operate the breaker for the boiler's main power supply with wet hands. Failure to observe this precaution may lead to electric shock and have other undesirable consequences.

- 2) Extract the UV sensor.
- 3) Remove the mounting screws from the phototube base.
- 4) Using a soft cloth, wipe all soot from the glass at the bottom of the UV sensor's base.
- 5) Reassemble and replace the sensor in its original condition and position.



#### Note:

Safety sensors such as a scale monitor, overheat sensor, flue gas temperature sensor, gas pressure sensors/switches and steam pressure sensors/switches must be periodically inspected to make sure they are working properly. Checking the function of scale monitor sensor is quite important because it is supposed to detect scale built up for one of the boiler water tubes to protect the pressure vessel against scaling. Miura boilers have the function though, the hardness checking by Colormetry and manual water sampling still have to be done by all Miura customers. (Since there are several scaling patterns depending on the firing ratio, or water quality, scale monitor doesn't always detect the thickest scale. It doesn't guarantee the scale protection for all cases of scaling.)

Please contact a Miura maintenance office/representative to carry out the inspection.

# 10 BREAKDOWN & COUNTERMEASURES

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## 10.1 Alarm and Red Status Lamp – Alarm

### NOTE

A “alarm” is activated when the control system determines that extended operation of the boiler would constitute a safety hazard and potential boiler damage. In such a case, the system stops combustion and provides notification in the form of an audible alarm and display message.

Combustion is automatically stopped when an alarm is triggered. At this time, the control system sounds an alarm and lights the Status lamp in red. In addition, details of the alarm are shown on the display.

- 1) Press the “DATA” button to stop the alarm.

### NOTE

In the case of certain alarms, the display will request action that must be carried out by MIURA maintenance personnel. Refer to *Section 10.3: Action to be Taken before Ordering Repairs* for details regarding the correct action to be taken in response to an alarm.

- 2) Take note of the alarm details, and then turn off the “OPERATION” switch. This action will clear the alarm display.

### NOTE

In certain cases, the alarm will not stop in response to steps (1) and (2) above. In such a case, turn off the breaker for the boiler’s main power, and then contact a MIURA sales office for further instruction.

- 3) Eliminate the cause of the alarm as described in *Section 10.3: Action to be Taken before Ordering Repairs*.

## **WARNING**

Procedures aimed at removing the cause of an alarm must be carried out in strict accordance with the given instructions. Failure to do so may have serious consequences.

- 4) Startup the boiler as described in *Section 8.1: Boiler Startup*.  
If the same alarm reoccurs, it may be the result of additional factors. In such a case, contact a MIURA sales office or your local dealer for further instruction.

DATA



OPERATION  
ON/OFF



## 10.2 Yellow Status Lamp – Caution

NOTE

A “caution” is issued upon the occurrence of a situation that could result in the activation of an alarm if left unaddressed.

If the control system identifies a condition that could lead to the activation of an alarm during subsequent operation, combustion is allowed to continue as is, or the control method is changed automatically in order to facilitate ongoing operation.

At this time, the system lights the Status lamp in yellow.

No alarm is sounded upon the issuance of a caution.

Details pertaining to the caution are presented on the display.

NOTE

In the case of certain caution, the display will request action that must be carried out by MIURA maintenance personnel. Refer to *Section 10.3: Action to be Taken before Ordering Repairs* for details regarding the correct action to be taken in response to a caution.

The display of caution details can be reset by pressing the “DATA” button, even during operation of the boiler.

DATA



- 1) Carry out steps (1) and (2) from *Section 10.1: Alarm and Red Status Lamp – Alarm*.
- 2) Eliminate the cause of the alarm as described in *Section 10.3: Action to be Taken before Ordering Repairs*.



## WARNING

Procedures aimed at removing the cause of an alarm must be carried out in strict accordance with the given instructions. Failure to do so may have serious consequences.

### 10.3 Action to be Taken before Ordering Repairs

## WARNING

Whenever taking action in response to an alarm or a caution, be sure to always turn off the boiler's "OPERATION" switch, and follow the action in the table below, to carry out the required work in strict accordance with the corresponding instructions.

If the cause of the alarm or caution persists, despite repair work having been carried out as instructed, immediately shut down the boiler as described in *Section 8.3: Boiler Shutdown* and contact a MIURA sales office or your local dealer for further instruction.

No work other than that indicated below is to be carried out. Failure to observe this precaution may result in injury.

SYMPTOMS OR DISPLAY CONTENT		CAUSE	REQUIRED ACTION
Display does not turn on		No power is being supplied to the boiler.	Confirm whether a power failure has occurred.
		The breaker for the boiler's main power is turned off.	Turn on the breaker for the boiler's main power.
Red Status Lamp	BURNER ALARM 2	Problem with the volume of air required for combustion.	Inspect the air pressure switch.
	BURNER ALARM 4	Overcurrent has occurred in the blower.	Turn the "OPERATION" switch off and then back on. (This action will clear the alarm display.) If the same alarm occurs again, immediately shut down the boiler as described in <i>Section 8.3: Boiler Shutdown</i> and contact a MIURA sales office or your local dealer for further instruction.
	WATER ALARM 2	Overcurrent has occurred in the feed water pump.	
	BURNER ALARM 5	Either the main gas valve is closed or a problem has occurred in the UV sensor.	Open the main gas valve.
	BURNER ALARM 7	Either the main gas valve is closed or there is a problem with the volume of air required for combustion.	
	BURNER ALARM 13	A problem has occurred with the air damper.	Inspect the damper.
	BURNER ALARM 14		
	WATER ALARM 1	The main feed water valve is closed and no water is being delivered.	Open the main feed-water valve.
		The blowdown valve is open and water is being discharged from the boiler.	Close the blowdown valve.
		Air has become trapped in the feed water pump, preventing it from operating correctly.	Bleed air from the feed water pump.
		The feed water strainer is blocked and no water is being delivered.	Clean the feed water strainer.
		A problem may have occurred upstream of the feed water equipment.	Inspect the water system upstream of the feed water equipment.
	WATER ALARM 6	Poor electrical contact with the water level probe.	Inspect the probe.
	WATER ALARM 8		
	WATER ALARM 10		
WATER ALARM 11			
WATER ALARM 12			
WATER ALARM 13			
WATER ALARM 17			

SYMPTOMS OR DISPLAY CONTENT		CAUSE	REQUIRED ACTION
Red Status Lamp	WATER ALARM 3	There is poor continuity in the water level probe.	Inspect the probe.
	WATER ALARM 7		
	WATER ALARM 14		
	WATER ALARM 15		
	WATER ALARM 16		
	WATER ALARM 18		
	CONTROL ALARM 1	A problem has occurred with the control system.	Turn off the breaker for the boiler main power and then back on. (This action will clear the alarm display.) If the same alarm occurs again, immediately shut down the boiler as described in <i>Section 8.3: Boiler Shutdown</i> and contact a MIURA sales office or your local dealer for further instruction.
	CONTROL ALARM 2		
	CONTROL ALARM 3		
	SAFETY STOP 1	A problem has occurred with the combustion control system.	Turn the "OPERATION" switch off and then back on. (This action will clear the alarm display.) If the same alarm occurs again, immediately shut down the boiler as described in <i>Section 8.3: Boiler Shutdown</i> and contact a MIURA sales office or your local dealer for further instruction.
	SAFETY STOP 2	A problem has occurred with the fuel supply equipment.	
	SAFETY STOP 4	A problem has occurred with the UV sensor.	
	SAFETY STOP 5	The exhaust-gas temperature is not within the normal range.	
	SAFETY STOP 6	A safety device was activated.	
	SAFETY STOP 7	A high steam-pressure cutout was activated.	
	SAFETY STOP 8	A wire has broken for the overheat thermocouple.	
	SAFETY STOP 11	Abnormal combustion is occurring.	
SAFETY STOP 46	The regulator has malfunctioned or a wire has broken for the pressure switch.	Turn the "OPERATION" switch off and then back on. (This action will clear the alarm display.) If the same alarm occurs again, immediately shut down the boiler as described in <i>Section 8.3: Boiler Shutdown</i> and contact a MIURA sales office or your local dealer for further instruction.	
SAFETY STOP 47	The chimney damper has malfunctioned.		
SAFETY STOP 48	The gas valve has malfunctioned.		
SAFETY STOP 49	The chimney is blocked.		
SENSOR ALARM 1	A problem has occurred with the air pressure switch.		

SYMPTOMS OR DISPLAY CONTENT		CAUSE	REQUIRED ACTION
Red Status Lamp	POWER FAILURE CHECK POWER	A power failure has occurred.	Turn the "OPERATION" switch off and then back on. (This action will clear the alarm display.) If the same alarm occurs again, immediately shut down the boiler as described in <i>Section 8.3: Boiler Shutdown</i> and contact a MIURA sales office or your local dealer for further instruction.
	EMERGENCY STOP RESET	An emergency stop device was activated.	
	VIBRATION ALARM SW RESET	An earthquake detector was activated, causing the boiler to shutdown.(not supplied)	Reset the earthquake detector.
	NO FUEL or FUEL VALVE CLOSED	Either the main gas valve is closed or there is no gas left.	Confirm that sufficient gas remains and/or open the main gas valve.

SYMPTOMS OR DISPLAY CONTENT		CAUSE	REQUIRED ACTION
Yellow Status Lamp	WATER CHECK 1	The strainer is blocked or the blowdown valve is open.	Clean the strainer and/or close the blowdown valve.
	WATER CHECK 2	The check valve is damaged.	Contact a MIURA sales office or Miura representative for assistance.
	WATER CHECK 4	There is poor insulation in the water level probe.	Inspect the probe.
	WATER CHECK 5		
	WATER CHECK 7	There is poor continuity in the water level probe.	
	WATER CHECK 8		
	SECURITY CHECK 1	A problem has occurred with the water softener.	Inspect the water softener.
	SECURITY CHECK 2	Either the surface-blowdown strainer has become blocked or the solenoid valve has malfunctioned.	Clean the strainer.
	SECURITY CHECK 3	A wire has broken in the conductivity sensor.	Inspect the conductivity sensor.
	SECURITY CHECK 4	The level of voltage in the backup battery has dropped.	Replace the battery.
	SECURITY CHECK 12	A combustion adjustment error has occurred. The combustion-gas temperature is high due to reasons such as soot buildup.	Immediately contact a MIURA sales office or Miura representative for assistance.
	SENSOR CHECK 1	A problem has occurred with the feed-water temperature sensor.	The boiler's control system has identified a condition that could lead to the occurrence of an alarm during subsequent operation. Although operation of the boiler may be continued, you should contact a MIURA sales office or Miura representative for assistance.
	SENSOR CHECK 2	A wire has broken for the scale monitor.	
	SENSOR CHECK 3	A problem has occurred with the scale monitor.	
	SENSOR CHECK 4	A problem has occurred with the overheat thermocouple.	
	SENSOR CHECK 5	A problem has occurred with the exhaust-gas temperature sensor.	
	SENSOR CHECK 6	A problem has occurred with the exhaust-gas temperature sensor.	
	SENSOR CHECK 8	A problem has occurred with the steam pressure sensor.	
	SENSOR CHECK 11	A problem has occurred with the UV sensor.	
	DATA COM CHECK 1	A communication problem has occurred.	Immediately contact a MIURA sales office or Miura representative for assistance.
	DATA COM CHECK 2		
	UTILITY CHECK 1	There is a danger of freezing.	Carry out measures to protect against freezing.
	UTILITY CHECK 3	Ventilation is not sufficient.	Turn on fans and other ventilation equipment.
	BOILER CHECK 1	The scheduled time for blowdown has been reached.	Perform blowdown.
	BOILER CHECK 2		
	BOILER CHECK 3	The air filter is blocked.	Clean the air filter.
	MISC CHECK 1	A problem has occurred with the water softener.	Inspect the water softener.
	MISC CHECK 2	There is insufficient chemical in the system.	Add chemical.
	DATA COM ERROR1	A communication problem has occurred.	Immediately contact a MIURA sales office or Miura representative for assistance.
	DATA COM ERROR2		
	DATA COM ERROR3		
	DATA COM ERROR4		
	DATA COM ERROR6		
DATA COM ERROR7			
DATA COM ERROR8			
DATA COM ERROR10			
DATA COM ERROR11			

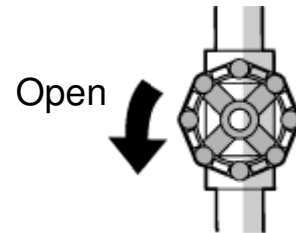
### 10.3.1 Bleeding Air from the Feed Water Pump

## WARNING

Water in supply lines for boilers connecting to a deaerator or hot water tank is extremely hot. For this reason, you should wait until the boiler's water supply lines have sufficiently cooled down (at least two hours after boiler shutdown) before performing this work. Failure to observe this precaution can result in burns and other injuries.

1) Carry out steps (1) to (3) from *Section 10.1: Alarm and Red Status Lamp – Alarm*.

2) Open the main feed-water valve.



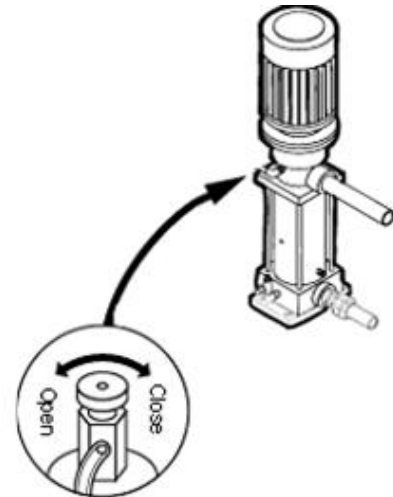
3) Open the feed water pump's air bleed valve. A mixture of air and water will be discharged from the air bleed valve. Air bleeding will be completed when air is no longer contained in the discharged water.

#### NOTE

Ensure that you rotate the handle for the air bleed valve by no more than one complete turn. Failure to observe this precaution may result in the rushing out of water.

4) Confirm that all air has been bled from the system and that only water is being discharged.

5) Close the feed water pump's air bleed valve.



### 10.3.2 Inspecting Water Level Probes

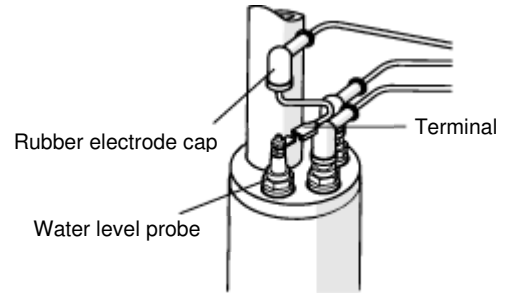
- 1) Carry out steps (1) and (2) from *Section 10.1: Alarm and Red Status Lamp – Alarm*.



## WARNING

Allow sufficient time for the boiler to cool down (at least two hours after boiler shutdown) before performing this task.

As all parts of the boiler remain at a high temperature for some time after shutdown, failure to observe this precaution can result in burns and other injuries.



- 2) Remove the rubber electrode cap from the top of the electrode, and reconnect the terminal. Following this, return the rubber electrode cap to its original position.
- 3) Startup the boiler in accordance with the prescribed manual procedure. If the same alarm reoccurs, immediately shutdown the boiler and contact a MIURA sales office or your local dealer for further instruction.

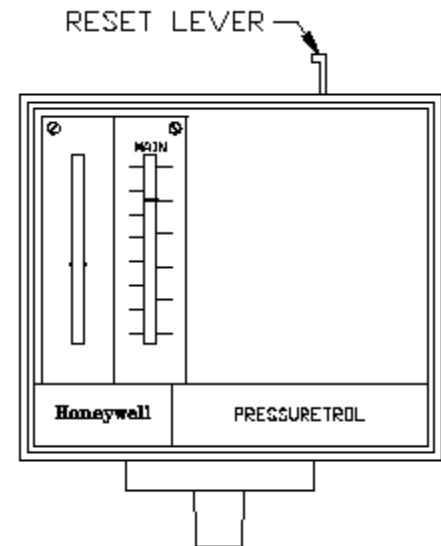
### 10.3.3 Resetting the High Pressure Limit Shutoff Switch

- 1) Carry out steps (1) and (2) from *Section 10.1: Alarm and Red Status Lamp – Alarm*.
- 2) If the boiler shuts down due to high pressure, you need to press the reset lever on the pressure switch to restart the boiler.
- 3) Startup the boiler in accordance with the prescribed manual procedure. If the same alarm reoccurs, immediately shutdown the boiler and contact a MIURA sales office or your local dealer for further instruction.

#### NOTE

Please check the pressure transducer and BL11 Microcomputer settings as well as the control pressure switch for any malfunction or incorrect setting. The control pressure switch should have a lower setting than the high pressure limit switch, and the microcomputer should have a lower setting than both steam pressure switches.

When testing the high pressure limit switch, set it lower than the BL11 Microcomputer setting so that it will shut down the boiler when the set pressure is reached. After testing, be sure to set it back to the original setting and to reset the high pressure limit switch.



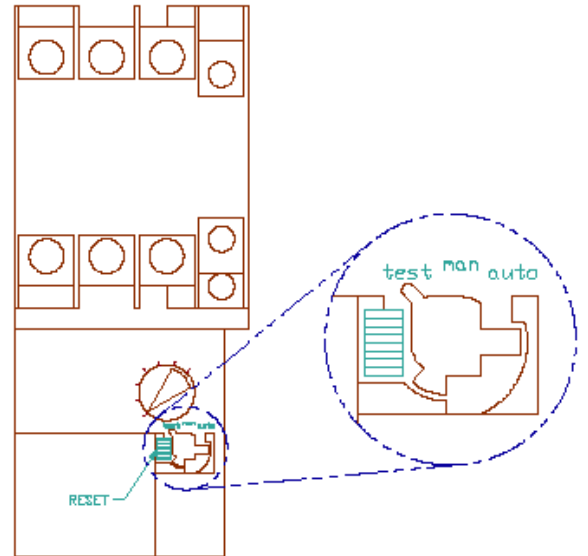


### 10.3.4 Resetting Blower Overcurrent

- 1) Carry out steps (1) and (2) from *Section 10.1: Alarm and Red Status Lamp – Alarm*.
- 2) Reset the tripped blower breaker or overload relay
- 3) Startup the boiler in accordance with the prescribed manual procedure.  
If the same alarm reoccurs, immediately shutdown the boiler and contact a MIURA sales office or your local dealer for further instruction.

**NOTE**

Short-circuiting or prolonged overloading of the blower motor will result in boiler shutdown. In addition, an alarm will be activated and the display will show “BURNER ALARM 4”. Some motors have an internal stator-winding thermal overload feature, in case of tripping because of these internal overload protection, operation will not resume until the blower motor has cooled down.



## 11 SPECIFICATIONS

# Specifications and Emissions

Please refer to separate boiler specification sheet for general specifications and emissions.

## **Required wire gauge for power supply**

Please refer to the installation manual.

## 12 APPENDIX

**MIURA BOILER OFFICES**  
**WWW.MIURABOILER.COM**

# 1 Description of Functionality

## 1) Combustion Control

### 1. Purging

Purging is the process whereby the blower operates for a certain period of time prior to ignition in order to discharge any residual gas from the combustion chamber. Specifically, this is referred to as a "pre-purge."

Meanwhile, the term "post-purge" is used to refer to a similar process carried out after boiler stops, with the blower again operating for a certain period of time to purge residual gas from the combustion chamber.

If a false flame is identified in the combustion chamber during purging, the purge is continued and will take place for a certain period of time after extinguishing this false flame. Furthermore, an alarm is activated if the false flame continues to burn for longer than a predefined time.

The set period for pre-purging is timed from the detection of air pressure following the start of operation of the blower.

### 2. Ignition and combustion

[Gas-fired]

Following pre-purge, ignition sparks are generated and the pilot burner is lit. After a specific period of pilot burn, the main burner is lit. After another predetermined period, the boiler transitions to high fire combustion.

If the "OPERATION" switch is turned off during high fire combustion, low fire burn is carried out for a specific period of time, and then the system performs a post-purge.

### 3. Pressure control

If the steam pressure rises over the low-pressure setting during high fire combustion, the system will switch to low fire combustion. If the pressure then rises over the high-pressure setting, combustion is ended and the system goes into standby mode.

It should be noted if steam pressure drops during low fire combustion to less than the low pressure setting's differential portion, high fire combustion will be restarted. Similarly, if the steam pressure drops during standby to less than the high pressure setting's differential portion, the control system will repeat pre-purging and will then perform ignition.

## 2) Feed Water Control

1. Feed water control is carried out using electrode-type water level detection rods.

## 3) Blowdown Control

1. Automatically modifying the equivalent blowdown time based on combustion conditions, the control system will perform surface blowdown control in order to maintain a high degree of steam quality.
2. The control system constantly monitors the pressure vessel's conductivity sensor and the surface blowdown rate in order to perform self-diagnosis.
3. Timing for blowdown is displayed in accordance with the level of concentration of the boiler water and the duration of combustion. The system automatically resets this value after blowdown has been completed.
4. If the system detects the maximum water level upon startup, it activates blowdown control in order to adjust to a suitable water level.

## 4) Optional Laborsaving Control

1. The fitting of an automatic bottom blowdown valve makes automatic bottom blowdown control possible, thus reducing the work required for blowdown-related activities.
2. Automatic control of the feed-water valve opening and closing is made possible by the fitting of an automatic feed-water shutoff valve.

## 5) Safety Devices

1. If any of the following abnormalities should occur, the system will lockout combustion and activate an alarm.
  - (1) Solenoid-valve leakage or false flame
    - If the flame sensor confirms the presence of a flame during purging
  - (2) Emergency stop
    - If the emergency stop button is pressed
  - (3) Misfire or flame failure
    - If the pilot burner does not light, or if the flame goes out after lighting of the pilot burner or main burner
  - (4) Air pressure problem
    - If the air pressure is continuous low during blower operation
  - (5) Gas pressure problem (gas-fired)
    - If gas pressure is not in the set level
  - (6) Low water level
    - If water remains below the normal level when firing is requested
  - (7) Water level probe problem
    - If a serious problem preventing ongoing control occurs, even if the water level control method has been changed
  - (8) Triggering of the overheat thermocouple
    - If the overheat thermocouple's temperature rises to a preset level or beyond
  - (9) Wire breakage in overheat thermocouple
    - If an open circuit is detected in the overheat thermostat
  - (10) Exhaust-gas temperature problem
    - If the temperature of the exhaust gas remains constantly above a preset level.
  - (11) Power failure
    - If the supply of power is interrupted while the "OPERATION" switch is on.
  - (12) Short circuit
    - If a ground fault is detected in the ignition transformer or the solenoid fuel valve while the "OPERATION" switch is turned on.
  - (13) Overcurrent
    - If the thermal relay in the electric motor's switching device has tripped while the "OPERATION" switch is turned on
2. A caution will be issued whenever any of the following situations arise. At this time, the boiler can continue to operate in the current mode of combustion, or if necessary, the control method can be changed to a new combustion mode.
  - (1) Insufficient air supply during low fire or high fire combustion
  - (2) Flame sensor degradation
  - (3) Degradation of feed-water pump capacity or water supply shortage
  - (4) Reverse flow
  - (5) Freeze alert
  - (6) Problem with water level probe
  - (7) Broken wire in thermocouple (with the exception of the overheat thermostat)
  - (8) High circuit-board temperature
  - (9) Problem with water softener  
(Optional specification)
  - (10) Problem with steam pressure sensor
  - (11) Air-pressure switch problem
  - (12) Blowdown timing reached or buildup of scale
  - (13) Battery replacement
  - (14) Inspection of surface blowdown required or problem with conductivity sensor
  - (15) Communication error



3. The display will show the following whenever an alarm is activated in response to an abnormality or whenever a caution is issued.
  - (1) Details of the abnormality
  - (2) Instructions for required action
  
4. Self-checking
 

The control system hardware constantly monitors its own operation, and it will immediately shutdown operation when an abnormality occurs.
  
- 6) Status Display
 

The display indicates the boiler's current operation status using the following text strings.

  - (1) DISABLE
  - (2) STAND-BY
  - (3) FEED WATER
  - (4) PREPURGE
  - (5) IGNITION
  - (6) PILOT
  - (7) MAIN IGNITION
  - (8) LOW FIRE
  - (9) HIGH FIRE
  - (10) POSTPURGE
  - (11) PILOT HOLD
  - (12) LOW FIRE HOLD
  - (13) PREPURGE HOLD
  
- 7) Monitoring
 

The following parameters can be output and monitored on the display.

  - (1) Steam Pressure
  - (2) Exhaust Gas Temperature
  - (3) Feed Water Temperature
  - (4) Scale Monitor Temperature
  - (5) Overheat Thermostat Temperature
  - (6) Flame Current
  - (7) Remaining Blowdown Time
  - (8) Surface Blowdown Valve On / Off
  - (9) Water Conductivity
  - (10) Water Level Condition
  - (11) Date & Time
  
- 8) Heat Management Data
 

The display can output the current day's boiler management data in terms of the following parameters.

  - (1) Ignition Cycles
  - (2) Gas-fired Low Fire Duration
  - (3) Gas-fired High Fire Duration
  - (4) Gas-fired Average Exhaust-Gas Temperature (low fire)
  - (5) Gas-fired Average Exhaust-Gas Temperature (high fire)
  - (6) Average Feed Water Temperature
  - (7) Gas-fired Boiler Efficiency
  - (8) Gas Consumption Level
  - (9) Boiler Makeup Water
  - (10) Steam Generated
  - (11) Surface Blowdown Volume

- 9) **Warning Logs**  
The following details on the seven most recent alarms and cautions can be called up and output on the display.
1. Details of the abnormality
  2. Date and time of occurrence
  3. Boiler operating status when abnormality occurred
- 10) **Communication Functionality**  
The boiler can be fitted with a communications port as an option, allowing remote communication with external devices.  
Using this functionality, online maintenance can be carried out from a MIURA technical center and the boiler can be remotely monitored.
1. **Communicated information**
    - (1) **Notification of abnormalities**  
Whenever an abnormality occurs, the control system will send notification containing a description of the abnormality and other associated information. Specifically, data transfer is achieved by automatic dialing on the connected telephone line.
    - (2) **Monitoring**  
The control system outputs data necessary for the regular monitoring of boiler conditions.
    - (3) **Control data**
      - Heat management data (for current and previous days)
      - Abnormality log (seven most recent items)
      - Operation log
    - (4) **Setting of control data**  
An external device can use the communication function to read and overwrite settings.