



Surface Auto Blowdown Control System

User Manual



1 Important Safety Instructions to the Users

- This manual presents information that will help to install, operate and maintain the equipment properly. It is expected that the contents be carefully read before handling the equipment.
- All safety instructions and warnings given in these mounting and operating instructions, particularly those concerning installation, start-up and maintenance, must be strictly observed.
- To ensure appropriate use, only use the SABCO in applications where the operating pressure and temperatures do not exceed the specifications used for sizing at the ordering stage.
- The manufacturer does not assume any responsibility for damage caused by external forces or any other external factors.
- Any hazards that could be caused in the SABCO by the process medium, operating pressure or by moving parts are to be prevented by taking appropriate precautions.
- A good installation is a permanent asset while a bad one can be a constant source of trouble. It can cost much more to correct a bad installation than to put a new one.
- SABCO is a product of many years of knowledge, field experience & engineering effort, to provide long life & excellent service to the users. This unit will provide continued trouble-free service, if instructions on installation, operation and maintenance are properly followed.
- It is expected that the person involved in Installation, Operation & Maintenance possessing necessary qualification, competence, license & authority (if applicable) only, should handle the product. It is solely the responsibility of the equipment owner & user to ensure that all applicable statutory (if applicable) norms are adhered to during Installation, Operation & Maintenance of this equipment.
- The mechanical devices supplied as a part of the unit are chosen because of their known ability to perform, with proper operating techniques and maintenance procedures. Tampering with the safeties & controls or bypassing any of these is not permissible at any time.
- Any "Automatic" features included in the design do not relieve the attendant of any responsibility. Such features may free him of certain

- repetitive chores and give him more time to devote to the proper upkeep of the equipment.
- No amount of written communication can replace intelligent thinking & reasoning.

The following symbols/terms have been used in this manual at the end of some chapters for the attention of the users:



This is a symbol of "warning" to the equipment user & provides information about practices or circumstances that should never be allowed as can lead to personal injury or death, property damage, or economic loss.



This symbol is for hot surface areas where there is chance of temperatures above ambient temperatures which causes injuries.



This symbol is to avoid hand/fingers getting crushed with the flange joints/pipes.



Avoid injuries while working in steam leaking areas.



This is a symbol of "Caution" to the equipment user & provides information about the care to be taken on the actions or procedures, which if not performed correctly, may lead to personal injury or incorrect function of the instrument or connected equipment.



Recommended Action

2 Abstract

Thank you for choosing sustainable solutions in energy and environment which helps in conserving resources and preserving the future. This manual describes the principle of operation, instructions for installation, operation & maintenance of SABCO supplied by Thermax Ltd. The General Instructions which are not detailed out in this document, need to be

performed in accordance with standard and safe acceptable practices as may be required by local codes, specifications and or regulations. The instruction contained within this manual must be read before undertaking any work on the equipment supplied. For any queries, please contact Thermax Limited.

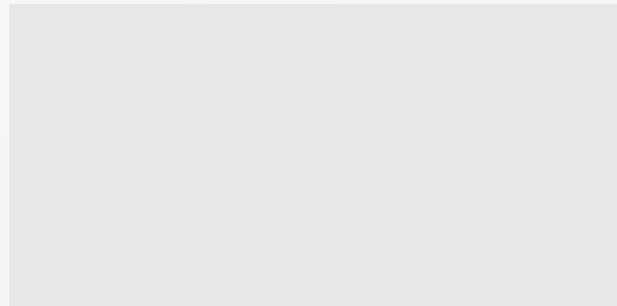
3 Product Identification

The product specifications and details are mentioned in the name plate details, please refer the figure 3.1A for template.



For all maintenance, service & spares requests, it is important to mention the serial identification number as mentioned in the name plate details of your product to Thermax Ltd.

figure 3.1A



4 Concept of SABCO

Steam is generated in boiler by boiling water under pressure. Then the steam is transported to user equipment, where latent heat of steam is transferred to the process fluid for heating.

The steam after delivering its latent heat, is converted to liquid water, which is termed as Steam Condensate or simply condensate. In an efficient system the condensate formed in indirect heating (like in heat exchangers, jacketed kettles, reboilers, PHES, etc.), which is distilled water, is returned to the boiler feed water tank and reused. Any loss of condensate and Steam used in direct injection, are made up by cold treated water termed as make up water.

If condensate is not recovered due to fear of contamination or other considerations, the feed water used is 100% treated make up water. The water used in boiler for steam generation is known as boiler feed water and has to conform to minimum specifications, as laid down by quality standards for efficient boiler operation.

Typical feed water specifications for a shell type boiler are as given per below table 1:

Hardness	ppm	0
Dissolved O ₂	ppm Max	0.1
pH Value		8.5 to 9.5
Bound CO ₂	ppm	5
TDS	ppm	200



The table 1 represents general water quality parameters required for shell type Boilers. Hence actual water quality parameter to be referred from the concerned Boiler O&M manuals or Boiler manufacturer recommendations.

Cold make up water used for steam generation contains dissolved solids known as Total Dissolved Solids (TDS). Also, treatment of water increases dissolved solid level in the water due to addition of chemicals like Sodium Sulphite, Hydrazine, etc.

As steam generated is removed from the boiler, the concentration of solids in boiler water in the boiler drum keeps on increasing. If this concentration is permitted to increase, the water within the boiler drum cannot hold the dissolved solids in the dissolved condition and will start depositing on the heat transfer surfaces of boiler tubes or furnace. These deposits are bad conductors of heat and will not permit the efficient heat transfer to boiler water. This will reduce the capacity of actual steam generation within the boiler and will lead to failure of boiler tubes or furnace, due to overheating of these metal surfaces. To avoid such failures, boiler manufacturers specify maximum permissible TDS in the boiler water. As per IS-10392 the maximum permissible TDS in the boiler water is 3,500 ppm for packaged boilers operating up to 21 kg/cm² pressure.

The TDS in the boiler water can be reduced by draining some amount of high concentration water, which will get replaced by fresh feed water having low TDS. The draining of high TDS water from the boiler is known as blow down. In addition to the TDS control, sludge and other undesirable particles heavier than water, also settle down at the bottom of the boiler and are removed periodically by opening the bottom blow down valve.

4.1 Surface Blow Down Vs Bottom Blow Down - An Overview

The concentration of Total Dissolved Solids increases at the location where steam is formed. This is at the steam - water interface or just below the Normal Water Level (NWL). TDS control is most effective, if steam is drained from, near the steam water interface. A separate piped connection on the boiler shell is provided for this purpose, along with the sensor, controller and automated valve.

Bottom Blow Down is not effective in controlling TDS as the concentration of TDS is highest at steam - water interface within the boiler. At the bottom of the boiler, only sludge and other heavy undissolved particles settle down. The bottom blowdown is recommended to be used only for sludge removal and not for TDS control. The limitations of using bottom blow down for TDS control are as below:

- Improper TDS control
- Coating of sensor due to presence of sludge
- Choking of sensor chamber
- Failure of blow down valve internal trim parts

4.2 Why Surface Automatic Blow Down Control (SABCO)

When boiler is given blow down to reduce the boiler water TDS, is it only water that is being lost? NO. The water is at saturated steam temperature corresponding to operating pressure of boiler, say 10.5 Kg/cm². The temperature at 10.5 Kg/cm² is 185 degree C. This water has a heat content of approximately 185 kcal for every Kg of water and increases with boiler water pressure / temperature. This heat is generated by burning fuel. If we consider Furnace oil, it's calorific value is 9650 Kcal/Kg and about 88% of this is useful in an industrial boiler. Thus, by burning 1 Kg of Furnace Oil, the useful heat obtained is 9650 x 0.88 = 8492 Kcal. For every Kg of hot water lost in blow down, the equivalent weight of furnace oil lost is 18 grams. Considering cost of Furnace Oil as Rs. 15 / Kg, you lose money equal to Rs.0.27.

4.3 Why Surface Automatic Blow Down Control (SABCO)

A 50 mm NB manual blow down valve will discharge 12 Kg/sec of boiler water operating at 10.5 Kg/cm². The valve is generally kept open for 2 minute per shift (6 minutes per day). This will discharge boiler water 12 x 6 x 60 = 7,560 Kg/day. Fuel Loss of Rs. 0.27 x 7560 = Rs. 2041 per day.

Considering 300 days operation per year, the total loss of Rs.6,12,300. A very heavy loss!

4.4 Is This loss avoidable?

Manual blow down given is always in excess of required quantity due to the following reasons:

- Manual blow down is based on human judgment.
- The blow down connection provided is of large size for removal of sludge, deposits and other heavy suspended particles due to their large size. This is not suitable for TDS control.

er water. As per IS-10392 the maximum permissible TDS in the TDS control needs smaller size nozzles (To be sized based on blow down quantity which in turn depends upon the feed water TDS). But if smaller sized nozzle is provided at the bottom of the boiler, it will choke due to sludge and other particles and the sensor will get coated due to suspended impurities present at the bottom of the boiler. So, the smaller nozzle has to be located elsewhere where the solids are in the dissolved state and not in suspended condition.

This has been done in SABCO by providing a correctly sized separate nozzle on the boiler just below the Normal Water Level (NWL) with a controller and automated valve.

Thus, the two operations of TDS control and removal of sludge / suspended particles have been separated leading to efficient and trouble-free operation of the boiler.

Due to smaller size of the nozzle and automated valve with Cv adjustment possible, only the required quantity of water is removed leading to good operations economy.

4.5 Typical boiler Blow Down Calculations

% Blow down required to be provided for a boiler is calculated as under:

$$\text{Blowdown\%} = (F / (B-F)) \times 100.$$

Where,
F = Feed water TDS, ppm (parts per million)
B= Recommended Boiler Water TDS, ppm

For example, if the Feed water TDS is 225 ppm, then the percentage Blow down calculated is,

$$(225/(3500-225)) \times 100 = 6.87 \text{ (Say 7\%)}$$

Now considering full load of 3000 kg/hr, then actual blow down shall be

$$3000 \times (7/100) = 210 \text{ Kg/Hr.}$$

Considering the condensate recovery of 80%, actual blow down will be,

$$\text{Quantity of condensate recovered} = 2400 \text{ kg/hr}$$

$$\text{TDS of the condensate} = 5 \text{ ppm.}$$

$$\text{The makeup water required} = 600 \text{ kg/hr.}$$

$$\text{TDS of makeup water} = 225 \text{ ppm.}$$

FW TDS or Resultant TDS is calculated as below

$$\text{TDS}_{\text{mixture}} = ((\text{TDS}_{\text{cond}} \times \text{Qty}_{\text{cond}}) + (\text{TDS}_{\text{makeup}} \times \text{Qty}_{\text{makeup}})) / (\text{Qty}_{\text{cond}} + \text{Qty}_{\text{makeup}})$$

In our case, the final TDS =

$$((5 \times 2400) + (225 \times 600)) / (2400 + 600) = 49 \text{ ppm}$$
$$\text{Blowdown \%} = (49 / (3500 - 49)) \times 100 = 1.41\%$$

Quantity of proposed blow down = 1.41 x 3000/100 = 42.3 Kg/Hr, Say 43 Kg/Hr.

Thus, with 80% condensate recovery, the blow down quantity reduces to the tune of 75%.



When the condensate recovery is more than 80%, Thermax High Pressure Condensate Recovery System (HPCRS) will help to pump back the condensate back directly to Boiler shell without any flash steam losses.

However, the muck, sludge and other suspended solids, which are settled at the bottom of the boiler, have to be removed by opening the bottom blow down valve at least once in a shift. The size of this blow down valve varies with capacity of the boiler.

5 Unloading receiving and inspection

The SABCO components are supplied in semi assembled condition, duly packed in polythene sheets & wooden cases/boxes for assembly & installation at site.



Ensure that the wooden cases should not be dropped or turned to any other position other than marked on the cases.

At the time of receipt at site, a thorough visual inspection of the product should be made for evidence of damage during shipment. Packaging slip should be referred for checking the items supplied for the system.

On receipt of the consignment at site, check that all the cases have been received per delivery documents & packing slip.

By careful inspection, determine whether any damage/loss has

occurred in transit, in spite of proper checking and loading of each component/equipment, at our factory before dispatch.

In the event of any damage being noted, the Company should be notified at once so they can start claims procedure for repairs or replacements, as per applicable clauses of contract.

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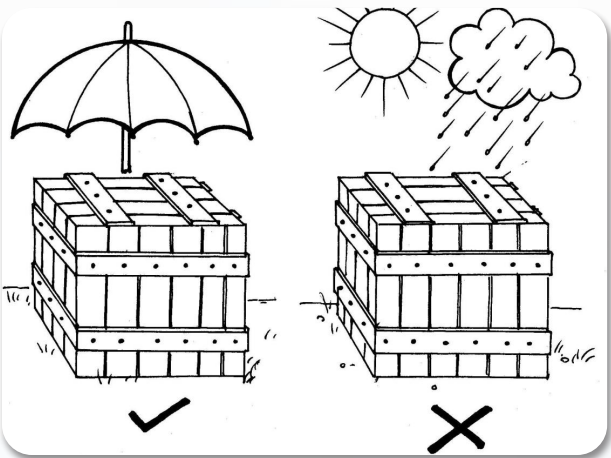
6 Storage

The place of storage of these equipment should be:

- Dust free, clean, dry and well ventilated
- Silica gel packed in cloth back shall be placed inside the electrical panels for absorbing moisture
- The silica gel shall be inspected periodically for colour change. Re-charging of silica gel shall be carried out as and when required.

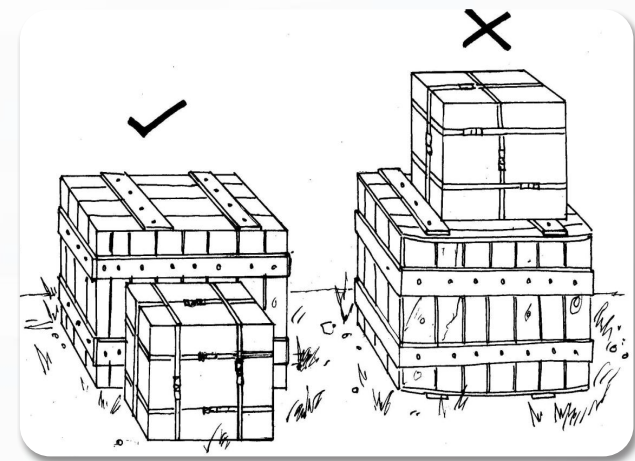
A) All the material should be stored under roof and should be protected from rain, water or direct sunlight.

Figure No 6.1A: Material should be stored under roof.



B) Do not pile up cases

Figure No 6.1B: Do not pile up cases.



C) Do not store heavy material on soft soil.

E) Parts should not be stored under corrosive atmosphere.

F) Periodically, the unit should be inspected to make sure no damage, such as corrosion, is taking place.

7 Installation Guidelines

- Sensor should be installed vertically against the blow down water flow direction.
- Distance should be maintained between sensor and controller, not more than 20 meters.
- Ensure that separate line should be provided for SABCO discharge till blowdown pit.
- Provide 230V AC, single phase UPS power supply for controller.
- Necessary IBR approvals to be obtained from local authorities.
- Kindly refer the figure 7.1 for installation.

Thermax will supply only the spool piece(s) in which the sensor can be mounted, rest all necessary piping will be in customer scope at site and necessary IBR clearance will be in customer scope.

Figure: 7.1

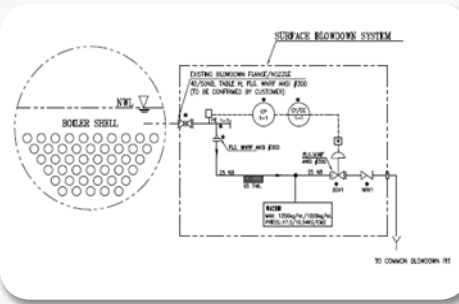
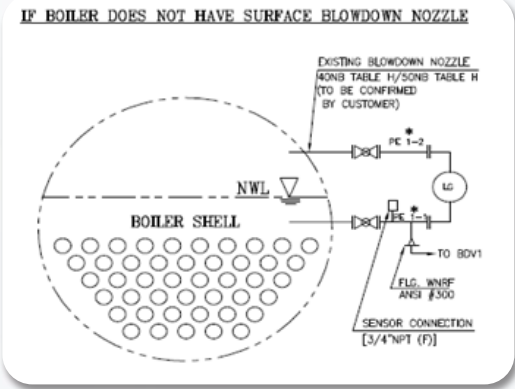


Figure: 7.2

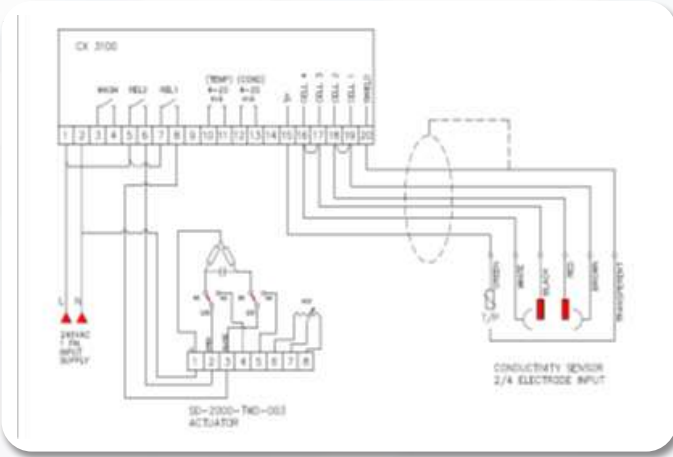


8 Control Panel & Instruments:

SABCO smart control panel is pre-programmed at factory, it has fixed parameters. During pre-commissioning, parameters to be entered as per figure 8.1.2. These settings are normally sufficient for general usage of SABCO

230V, 1 Phase, with proper earthing (voltage to neutral & earth to be less than 3V) UPS power supply to be provided by customer at site.

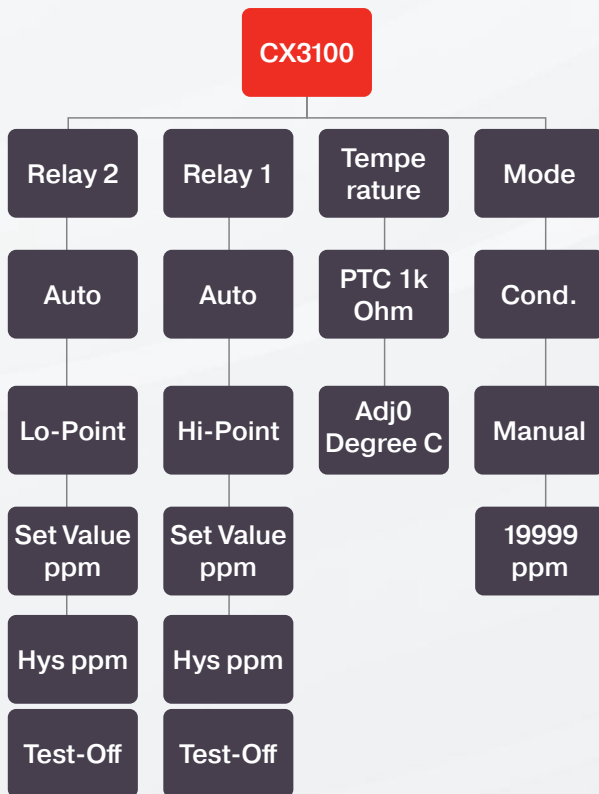
For the SABCO smart panel, customer to provide 4 core 1.0 sq mm copper cable for TDS sensor. 3 core 1.5 sq mm from control panel to blow down valve. These cables need to be laid with proper gland packing and cable tray. Refer the figure 8.1.1 for terminal connections



Refer the figure 8.1.1 for doing the termination in automated valve.

It is always recommended to check the continuity of the cables before termination.

Figure: 8.1.2



8.1 Index of Keypad: Figure number: 8.1A

Figure 8.1A

Keypad	Index Bar	Description
[Back]	[Back]	Return to previous level or action
[Left]	[Left]	Left or left page
[Right]	[Right]	Right or right page
[Up]	[Up]	Increase digit
[Down]	[Down]	Decrease digit
[Enter]	[Enter]	Confirm and proceed to next step

8.2 The TDS value displayed on the meter can be re transmitted as 4-20 mA through the terminal 10 & 11.

8.3 In setup menu, select "Frequency" and press "Enter" to adjust power frequency. You may select 50Hz or 60Hz according to local power frequency. This setting will affect transmitter performance and measurement. Please adjust with caution and absolute certainty.

9 System operation

System needs to be flushed thoroughly before starting of the unit.

Open isolation valves of sensor and motorised valve

Set conductivity value on controller

Valve opens when relay- 1 set point is reached

Valve closed when relay- 2 set point is reached

It is highly recommended to ensure Boiler water low level safety is always in place. Bypassing or malfunctioning of Boiler low level safety will lead to major accident and explosion.

It is also recommended to cross check the Boiler water parameters periodically in a proper laboratory, as recommended by Boiler manufacturers.

9.1 For setting the required ppm in smart controller, figure 8.1.2 to be referred.

9.2 Set point entered in the relay 1 will be for automated valve opening and set point entered for Relay 2 will be for automated valve closing.

9.3 For testing the automated valves opening, refer figure number 8.1.2 and enable the Test option to "ON" in Relay 1 to check the valve opening in manual mode. Similarly, for closing, refer the figure number 8.1.2 to enable the Test option to "ON" in Relay 2 to check the valve closing.

9.4 Check the resistance between body to centre of pin, it should be less than 1 ohm. If it is higher than 1 ohm, the sensor is faulty.

9.5 Calibration Procedure:

Known standard solution calibration is only applicable to conductivity measurement mode.

Toggle to select closest pre-set standard solution value: 84.0µS/cm, 1413µS/cm or 12.88mS/cm.

Place the conductivity sensor into the standard solution and press to enter calibration screen. Under ATC (Automatic Temperature Compensation) mode, the user may manually input conductivity value based on the measured temperature. Press "Enter" again to calibrate. The display will show indicating calibration is in progress. Once calibration is complete, the cell constant will show. Press "Enter" to exit.

1. The TDS value will vary with respect to the standard solution temperature, the same will be mentioned in the sample solution. Please refer the TDS value with respect to the temperature mentioned in the standard solution.

2. It is recommended to do the calibration before commissioning.

3. It is mandatory to do the re-calibration after 8000 hours of operation or even if sensor is stored/not used idle for the period of one year and above.

10 Troubleshooting

SYMPTOMS	POSSIBLE CAUSE
NO DISPLAY	Controller faulty Check voltage at power input terminal
Abnormal values	Clean the sensor Check parameter settings Change the cable Re-calibrate the sensor
Valve not opening / closing 100%	Adjust the limit switches
Manual handle not operating / getting slip	Check the latching of gear and do the greasing

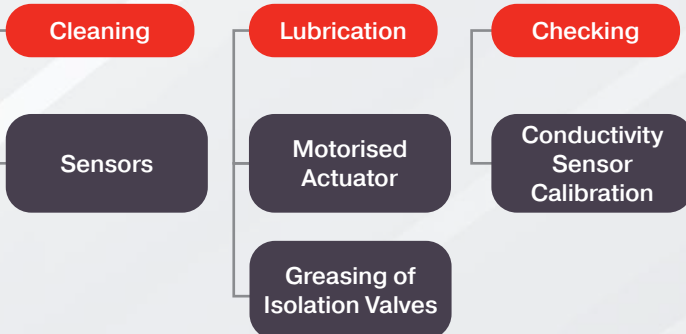
1. Physically ensure the limit switches adjustments are set for complete ON & OFF of automated valve to avoid any passing.

2. While checking the point 9.3, if the valve is not getting ON / OFF irrespective of all the set points and wiring being done as per recommendations, check if the automated valve ON & OFF limit switches are adjusted properly.

10.1 Error Message Table:

Message	Reason	Dispositions
Error1	The readout is unstable during calibration.	1. Replace the standard solution. 2. Calibrate the sensor after maintenance or replacement is complete.
Error2	1. The sensor cell constant exceeds upper or lower limit 2. The temperature is out of range.	1. Replace the standard solution. 2. Calibrate the sensor after maintenance or replacement is complete.
Error3	Incorrect passcode ERROR CODE	Re-enter passcode
Error5	Serious error that does not permit any further measurements	Please contact service engineer.

11 Maintenance



After 5000 hours of operation, the TDS sensor should be cleaned.

12 Warranty

Only trained or instructed person may be assigned to operation or servicing.

All our equipment is thoroughly inspected before dispatch and therefore can be depended upon for long and trouble-free services. We undertake to make goods by replacement or repair, defects arising out of faulty design, materials or workmanship within 12 (twelve) months of the date of commissioning or 18 (eighteen) months from the date of dispatch, whichever is earlier, subject to what is mentioned in your purchase order warranty terms. The parts, in respect of which a claim is made, must be sent to our works at buyer's expenses. If the claim is found to be legitimate, we shall refund such expenses.

Warranty Excludes

a) Normal Wear & Tear

b) Damages/defects due to wrong operation at the purchaser's end, and/or arising out of forced major.

c) Bought out components are guaranteed by us only to the extent of guarantees given to us by our suppliers.

d) Electrical components such as heaters, motors, contactors etc. Rubber components and instruments such as pressure gauges, thermometers, Controllers, etc. are however, not covered under this warranty.

This warranty is valid subject to the following conditions: -

• Installation completed within three months from the date of dispatch of the equipment and as per our installation instructions.

• The supply/ installation formally accepted as per the handing over clause.

• Use of specified utilities in technical quotation.

• The equipment being operated and maintained as per our Operation and Maintenance Manual.

• The equipment or part thereof not being subject to accident, alteration, abuse or misuse.

• Any replacements/repairs required under provisions of the above warranty will be carried out at either on site or at works. In the latter case, Buyer will send the defective parts to our works at Buyer's cost & liability.

13 Recommended Spares

TDS Sensor

Conductivity Controller



Registered Office:

Thermax Limited

D-13, MIDC industrial area, R D Aga Road, Chinchwad, Pune 411 019, India

enquiry@thermaxglobal.com, 1800-209-0115

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