

Boiler Manufacturing Scenario in Bangladesh

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Abstract

A boiler or steam generator is a closed vessel used to generate steam by transferring heat energy to water. According to Bangladesh Boiler act 1923 boiler means any closed vessel exceeding 22.76 liters in capacity which is used expressly or generating steam under pressure and includes any mounting or other fitting attached to such vessel, which is wholly or partly under pressure when steam is shut off. Prior to 2007 there were no boiler manufacturing companies in Bangladesh. At that time Bangladesh export boiler from china, UK, India, Germany, USA, Taiwan, etc, as a result Bangladesh lost huge amount of foreign currency. According to Bangladesh Boiler Regulation (BBR) 1951 to manufacture a boiler heat treatment was mandatory. After amendment of BBR at 2007 heat treatment waived for small industrial boiler and private sector started to manufacture boiler. Now many company managed heat treatment arrangement and produce large boiler of up to 10 ton/hr besides of small industrial boiler. But they cannot produce boiler according local demand. Boiler uses most of the industries for their process work or electricity generation purpose. Bangladesh is growing up industrially day by day as a result development of boiler manufacturing sector is mandatory.

Keywords

Boiler, Boiler Manufacturing, Inspection authority, Manufacturing statistics in Bangladesh, Manufacturing company

1. Introduction

Boiler is only device that can convert most of the fuel energy by combustion and transferring heat to water into steam and then steam energy can easily convert to required form. Boiler play vital role in most of the industries, previously boiler used for generation of power, run steam engine. Now a day boiler use for process work, ironing of cloth and even rice boiling. From liberation to till now registered boiler in Bangladesh approximately 11,000. Bangladesh boiler regulation has been established in 1951 but boiler manufacturing industries have been started after 2007. Before starting the local boiler manufacturing, boilers demands were met by importing from different countries. Till now around 1800 boilers manufactured in Bangladesh. Most of these manufactured boilers are small industrial boiler of capacity 50kg/hours to 500kh/hours. All large boilers imported from different country. Importing a boiler from foreign country not only losses huge money but also valuable time. If boiler buy from locally then from purchase to run 30 days is enough. But in case of export sometimes it requires 4 -12 month or more as a result run of plant at due time delay. Now it is time to manufacture large boiler for smooth industrialization. During manufacturing process Office of the Chief Inspector of Boilers plays important roles to ensure quality. Office of the Chief Inspector of Boilers is the Regulating and Inspecting Authority in Bangladesh for the safe operation of boiler and to ensure the safety of public life & property also ensure quality of boiler during manufacture.

2. Boiler Manufacturing Standards/Code

George Babcock and Steven Wilcox invented boiler, in 1867. Stirling Boiler Company manufactured boiler in 1981 [1]. At initial there were no codes for manufacturing of boilers. After several serious explosions in the state of Massachusetts. A fire-tube boiler exploded at the Grover Shoe Factory in Brockton, Massachusetts, on March 20, 1905, which resulted in the deaths of 58 people and injured 150. Then on December 6, 1906, a boiler in the factory of the P.J. Harney Shoe Company exploded in Lynn, Massachusetts. As a result, the state of Massachusetts enacted the first legal code based on ASME's rules for the construction of steam boilers in 1907. Finally, in 1914, ASME issues the first Boiler Code [2]. Different countries apply different code to the construction and certification of boilers. In Europe: The Pressure Equipment Directive (PED) prevails. It imposes the use of a harmonised of local calculation code for the pressure containing parts such as:CODETI, COVAP,RCC-M for nuclear ESPs. In North America: the ASME code prevails. In Bangladesh: Bangladesh Boiler Regulation (BBR) prevails. In India: Indian Boiler Regulation (IBR) prevails. Other standards exist in other parts of the world: for example, the GOST and Rostechnadzor certification system for Russia [3].

3. Classification of boilers

- 3.1. According to Tube content:
 - (i) Fire tube boiler and
 - (ii) Water tube boiler
- 3.2. According to Axis of shell:
 - (i) Horizontal,
 - (ii) Vertical,
 - (iii) Inclined
- 3.3. According to Location of furnace:
 - (i) Externally fired,
 - (ii) Internally fired
- 3.4. According to Method of circulation:
 - (i) Natural,
 - (ii) Forced
- 3.5. According to Mobility:
 - (i) Stationary,
 - (ii) Portable
- 3.6. According to Usage:
 - (i) Packaged,
 - (ii) Unpackaged
- 3.7. According to Pressure:
 - (i) High,
 - (ii) Low
- 3.8. According to Tubes:
 - (i) Single-tube
 - (ii) Multi-tube
 - (iii) Once through
 - (iv) Tubeless

4. Boiler Manufacturing Processes

Boiler basically categorized according to the nature of the fluid contained, The volume of fluid, The maximum permissible pressure. To make a boiler special type material required because of heat and pressure act at the same

time. In Bangladesh vertical and horizontal package type boiler manufacture. Below shown complete manufacturing procedure.

4.1. Drawing and design approval

Before manufacture a boiler manufacturer need to prepare drawing, heating surface calculation and pressure parts calculation to select material thickness and others. These drawing and design submitted to inspecting authority for approval. Inspecting authority checks drawing and design if all are correct then authority give permission to manufacture that boiler. All boilers during construction shall be under the supervision of inspection authority to ensure standard conditions in respect of material design and constructions.

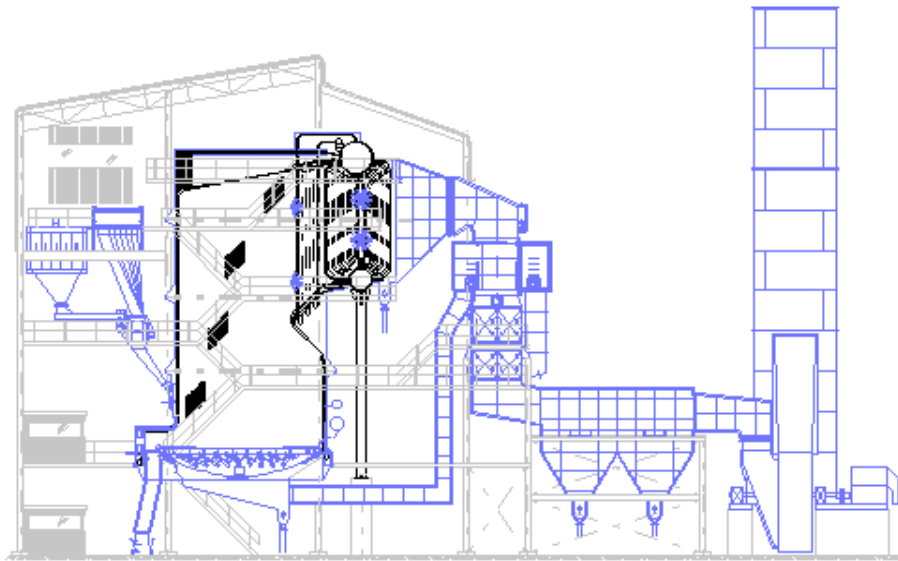


Figure 1: Drawing design approval by approving authority

4.2. Material marking

Metal sheet marking is first step to manufacture a boiler. According to drawing accurate dimension are marked in this step.



Figure 2: Marking metal sheet according to design

4.3. Cutting of metal sheet and bending of cutting plate

Second step in manufacturing boiler is cutting the metal sheet according to marking



Figure 3: Cutting of metal sheet

After cutting metal sheet, it bends into required size using bending machine.



Figure 4: Rolling/Bending

4.4. Test root gap for Welding of rolled plate and welding

Bent plate edge shape required format then check root gap before welding. The inclined angel of the bevel shell not be less than 60. In order to obtain full penetration of the weld metal a gap shall be maintained between the plates when they are being welded. Joints shall be welded from both sides and the slag shall be removed after making each run. Before second side of the joint welded any slag or defect at the bottom of the first run shall be removed by grinding, chipping or machining.



Figure 5: Root gap checking

Then weld the joint properly



Figure 6: Welding

4.5. Non Destructive tests

Every portion of the longitudinal and circumferential welded joints of the drum shell be subjected to non destructive test. To ensure welding done properly two types of non destructive test usually uses (a) ultrasonic test, it is done by ultrasonic flaw detector machine. In this test any crack or blow hole identified. (b) Radio graphical test, this test done by using radiographic instruments [4].



Figure 5: Ultrasonic test of welded joint

4.6. Heat treatment

After the completion of the welding of the seams before the hydraulic test, each drum shell be heat treated for stress relieving. For this heat treatment drum shell be placed in a furnace sufficiently large to accommodate whole drum. The furnace shell be slowly raised to a temperature between 600°C to 650°C and the drum shell remain until it has uniformly reached this temperature [4].



Figure 6: Heat Treatment Chamber



Figure 7: Heat treatment of pressure parts

4.7. Hydraulic test

Each drum on completion of all welding and after heat treatment shall be subjected to a hydraulic test pressure of one and a half times the boiler drum maximum permissible working pressure and while the pressure is applied the weld shall be given a through hammer test throughout their length [4].



Figure 8: Hydraulic test

4.8. Mountings and accessories

Every new boiler shall be fitted with the followings

- | | |
|--|---|
| a) Two safety valve | f) A blow down valve |
| b) Two independent means of indicating the water level | g) A fusible plug when boiler have internal furnace |
| c) A steam pressure gauge | h) An attachment for inspector test gauge |
| d) A steam stop valve | i) Automatic water level control |
| e) A feed check valve (two when heating surface exceed 150 sqf.) | j) Automatic firing level control |

Other mountings and accessories to run boiler efficiently.



Figure 9: Finish Vertical Boiler

5. Manufacturing statistics in Bangladesh:

From 2007-208 fiscal year to 2018-2019 fiscal year total 1869 boiler manufactured in Bangladesh in supervision with office of the chief inspector of boilers [5] [6]. Comparison of yearly registered and locally manufactured boiler in last five year in Figure 10.

Table 1. Manufacturing Statistics

Sl. No.	Fiscal Year	Manufactured Boiler	Registered
1.	2018-2019	251	869
2.	2017-2018	312	762
3.	2016-2017	323	697
4.	2015-2016	263	578
5.	2014-2015	181	415
6.	2013-2014	116	337
7.	2012-2013	124	328
8.	2011-2012	111	343
9.	2010-2011	103	309
10.	2009-2010	85	303

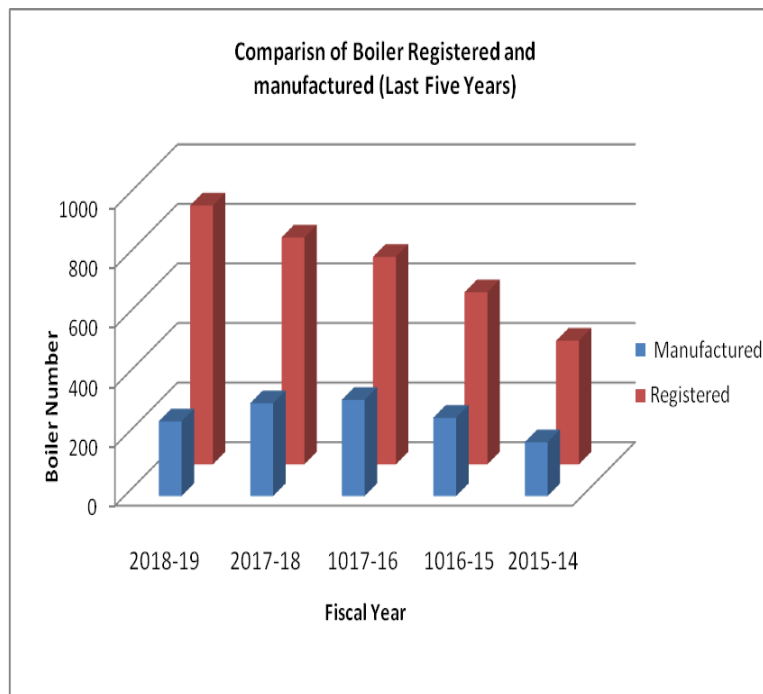


Figure 10: Registered Vs locally manufactured boilers

6. Manufacturing company

Presently, more than twenty local boiler manufacturing companies are manufacturing almost 80% of small industrial boiler and 5% of medium capacity horizontal fire tube boiler. These companies are in Tavble 2.

Table 2. Manufacturing company

Sl. No.	Company Name	Boiler manufacture type
1.	Modern Erection Ltd	Small Industrial Boiler
2.	Azad Boiler Ltd	Small Industrial Boiler
3.	New G Boiler Ltd	No boiler manufacture in last few years
4.	The Moon Engineering Ltd	Small Industrial Boiler
5.	Golden Boiler Company Ltd	Small & Medium
6.	Powertech Associates	Small Industrial Boiler
7.	Thermotech Engineers (pvt.)Ltd	Small Industrial Boiler
8.	S M Boiler Centre	Small & Medium
9.	R S Enterprise	Small Industrial Boiler
10.	Fulton Engineers and Traders	Small Industrial Boiler
11.	New Model Boilers	Small Industrial Boiler
12.	Techno Tower Company Ltd.	Small Industrial Boiler
13.	Turag Boiler Engineering	Small Industrial Boiler
14.	Ms Universal Technological services	No boiler manufacture in last few years
15.	Z N Boiler(BD) Ltd	Small Industrial Boiler
16.	Alif Boiler Company Ltd.	Small Industrial Boiler
17.	Ma Entarprise	Small Industrial Boiler
18.	Silver Boiler	Small Industrial Boiler
19.	Power Flame	Small Industrial Boiler
20.	Thermoflame	Small Industrial Boiler
21.	S P Green Engineers Ltd.	Small Industrial Boiler
22.	Macro Engineers Ltd.	Small Industrial Boiler
23.	Banglagreat Boilers Ltd	Small Industrial Boiler
24.	Bright Star engineers and trades	Small Industrial Boiler
25.	Maymensingh Boiler and engineering works	Small Industrial Boiler
26.	Al Madina Engineering and tread	Small Industrial Boiler
27.	Hurst Boiler Bd Ltd(Green Boiler)	Small Industrial Boiler
28.	The Bright Boiler Company	Small Industrial Boiler
29.	Shah Amanat Metal and Erection	Small Industrial Boiler
30.	Bangladesh Erection	Small Industrial Boiler
31.	Orient Boiler	Small Industrial Boiler

7. Conclusion

Since independence in 1971, Bangladesh has achieved a tremendous growth rate in its industries. Bangladesh Government prioritize the industrial sector and targeted to establish 100 economic zones and till now Bangladesh economic zone authority get approval to establish 88 economic zones countrywide. As a result boiler user industries will be increased. To fulfill the industries demand of boiler a great opportunity in boiler manufacturing sector. If the boiler manufacturing sector established strongly not only fulfill the country demand but also has opportunities to export in abroad. Till now several boiler manufacturing companies are exporting boilers to different countries including Australia. The local boilers are made by following boiler act, rules and regulations. The office of the chief inspector of boilers working as an inspecting and law enforcing authority.

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Biographies

Md Hanif Hossan is an Inspector of Boilers in Office of the Chief Inspector of Boilers in Bangladesh. He earned B.S. in Mechanical Engineering from Khulna University of Engineering and Technology (KUET), Bangladesh in 2011. Mr. Hanif served as Assistant Manager (Mechanical) in Carew and Company (Bangladesh) Ltd. an organization under Bangladesh Sugar and food industries Corporation (2012-2016), Assistant Engineer (Mechanical) in Eastern Cables Ltd. Under Bangladesh Steel and Engineering Corporation (BSEC), Assistant Engineer (Mechanical) in Shahajalal Fertilizer Company Ltd. an enterprise of Bangladesh Chemical Industrial Corporation (2016).

Mr. Pranab Kumar Sarker is an Inspector of Boiler working in Office Of the Chief Inspector of Boilers under Ministry of Industries, Bangladesh. He earned Bsc in Mechanical Engineering from Rajshahi University of Engineering & Technology (RUET) in 2009. He has 10 years experience about Boiler Operation, Maintenance, & Manufacturing in Government & Private organization. He served as a Assistant Engineer in a renowned Boiler Manufacturing Company Modern Erection ltd, Bangladesh (2009-2012), as an Assistant Manager (Mechanical) in Bangladesh Sugar & Food Industries Corporation (2012-2016), as an Assistant Engineer (Mechanical) Bangladesh Chemical Industries Corporation (2016). He is a Resources Person in Boiler operation, Maintenance & Safety training Program organized by Directorate of Continuing Education (DCE), BUET. Mr Pranab Kumar Sarker has attended many workshops, seminars, training programs about Boiler Operation, Maintenance & safety in Bangladesh & abroad.