

CASE STUDY 1 –COMMISSIONING A GAS FIRED STEAM BOILER

A steam boiler has been built and installed at a factory for the provision of process steam. The following lists the requirements used in the commissioning of the boiler and associated plant.

When a new plant such as a steam boiler is installed, the commissioning must be conducted by suitably qualified people. Usually these will be provided by the company manufacturing the boiler but often the company that is purchasing the boiler will employ consultants to produce a planned start up schedule and train company employees to undertake future start up and shut down procedures as well as emergency procedures.

In addition to the people doing the commissioning and receiving training, other people present during the process might include representatives from the construction company who built the installation, the gas supply company, and from interested insurance companies who will conduct future boiler inspections. Instructions regarding the proper care and maintenance of the unit should be outlined with these people present.

Before beginning start-up, the start-up technician should thoroughly study installation instructions and become completely familiar with the exact sequence of operation and boiler controls. This should include review of wiring schematic, and the fuel burner control systems and manufacturers recommended operating variables (for example temperatures, pressures, drafts, relief valve settings and flue gas content).

TYPICAL INSTALLATION COURTESY OF



<http://www.parkerboiler.com/>



BOILER COMMISSIONING START-UP CHECKLIST

Date _____

SITE DETAILS

Company _____ Facility _____

BOILER IDENTIFICATION

Manufacturer _____ Boiler Model _____

Identification number _____ Fuel type _____

INSTALLERS DETAILS

The installers should be suitable qualified and experienced to carry out the work in accordance with regulations and legal requirements.

INSTALLER 1 Name _____

Certification Details _____

INSTALLER 2 Name _____

Certification Details _____

OWNERS DETAILS

Details are required of the persons representing the owners who will be responsible for operating and maintaining the unit. (These should be present during the initial start-up to assume responsibility for gas, water, electrical and vent systems.)

PERSON 1

Name _____ JOB TITLE _____

PERSON 2

Name _____ JOB TITLE _____

UTILITY REPRESENTATIVE

For gas fired boilers a representative of the utility company is required to be present.

Name _____ COMPANY _____

EQUIPMENT REQUIRED

Monitoring equipment should be part of the plant with displays at the operator position but typically those doing the commissioning should have:

- ❖ Hand tools
- ❖ Electric Multimeter
- ❖ Gas pressure gauges
- ❖ Draft gauge (to measure the draft in the flue)
- ❖ Damper weights (to adjust draft in flue)
- ❖ Combustion Analyzer (For monitoring flue gas composition)

CHECK LIST

CHECK ITEMS - BOILER		YES	NO	REMARKS
1	Required Installation Permits obtained on boiler, electrical, vent, gas and plumbing.			
2	Boiler installed on a concrete floor or non-combustible base.			
3	Boiler installed in approved room and properly protected from weather and drafts. Insure no flammable materials or fumes are in room or can enter room.			
4	Boiler installed in accordance with manufacture's instructions and code, adequate space for accessibility to inspect and service. Proper control panel access and clearance.			
5	Proper air openings provided conforming to Code and Manufacturer's instructions.			
6	Insure no negative pressure in room. If any sort of exhaust fans are present in boiler room, insure that boiler draft is not affected. Draft inducer and engineered flue system may be required.			
7	Provisions for proper boiler Water Treatment and water softening.			
8	Proper electrical service to boiler with disconnect per Code and proper feed pump wiring per diagram.			
9	Proper earth ground connected to green ground screw in panel by Electrician.			
10	Chemical feed pump wired properly.			
11	Safety valve type, setting and capacity, is appropriate and correct for boiler.			
12	Safety valve discharge independently piped full size with Sch. 40 pipe, discharging to safe location. Pipe properly supported and union provided.			
13	Safety valve body drain piped to safe location.			
14	Draft hood or barometric damper installed on boiler.			
15	Flue gas spillage switch mounted and wired if (provided).			
16	Vent stack full size with proper height and termination point.			
17	Unrestricted vent cap on top to protect from weather and down drafts. Stack Termination meets code.			
18	Vent stack weight properly supported (not on boiler).			
19	Vent stack is installed in accordance with Local Code Regulations for proper fire protection.			
20	Check gas devices for proper venting, provide goosenecks.			

CHECK ITEMS – RETURN TANK		YES	NO	REMARKS
1	Return Tank vent connected to outside proper size.			
2	Tank overflow and drain opening connected to safe drain. Shut off valve on drain line.			
3	Soft water inlet to tank proper size with union, and line shut-off valve. Provision for filling chemical feed tank with soft water.			
4	Tank float valve adjusted for proper level and tested for correct shutoff.			
5	If water pressure exceeds 4.8 bar, pressure reducing valve installed.			
6	Water line to pump one pipe size larger than pump discharge with suction stop valve and strainer installed.			
7	Pump properly aligned. Confirm wiring to feed pump motor is correct per nameplate and wiring diagram.			
8	Check valves properly installed near pump discharge and boiler with proper pressure rating.			
9	Is recommended pump relief device installed and properly piped?			
10	Stop valve properly installed in water feed line near boiler with proper pressure rating.			

CHECK ITEMS – BLOW DOWN TANK		YES	NO	REMARKS
1	Blow down Tank proper size and to Manufacturer's recommendations and Local Code requirements.			
2	Proper size vent upward to safe point of discharge.			
3	Blow down line full size in accordance with Manufacturer's specification. Pipe to be Sch. 40, black steel with 8.6 bar minimum fittings for boilers up to 6.9 bar. For pressures over 0.69 bar Sch. 80 black steel pipe, forged steel fittings.			
4	Blow down Tank outlet proper size and piped to sump and safe point of discharge.			
5	Blow down Tank clean out (drain) proper size with valve and piped to sump and safe point of discharge.			
6	Blow-off valve properly installed on each blow down connection and near boiler.			
7	On pressure exceeding 0.69 bar, additional slow opening blow-off valve properly installed.			
8	Drain line from bottom of water column connected to Blow down Tank.			
9	All blow down and drain piping in accordance with Code and good safety practices.			
10	Gravity or cold boiler drain piped to floor sink.			

CHECK ITEMS – START UP		YES	NO	REMARKS
If boiler is a Low NOx system or Power Burner Model, refer to additional Supplemental Start Up Sheets in addition to this sheet.				
1	Notify Boiler Inspection Jurisdiction if required.			
2	Tighten all electrical terminals, conduit and linkages.			
3	All boiler gas valves turned off.			
4	System installer, plumber, owner and/or Gas Co. technician shall (if safe) turn on gas at meter and bleed air from gas line to proper safety standards if required to allow safe gas flow to boiler.			

CHECK ITEMS – START UP (Cont)		YES	NO	REMARKS
5	Gas pressure and service line proper size.			
6	Shut-off valve with handle and union ahead of boiler.			
7	Gas line blown out, thoroughly cleaned, tested for leaks. Install gas pressure gauges of proper ranges upstream and at burner manifold downstream test tap.			
8	Gas pressure at test opening on boiler inlet to Manufacturer's specifications, and Boiler Nameplate. LPG Models require 0.07- 0.35 bar.			
9	Insure boiler steam valve is closed.			
10	Remove cabinet door on pilot side.			
11	Check burners for proper position on orifices.			
12	Open water supply and boiler feed water valves. Never operate the boiler feed pump with any valve in the suction or discharge piping closed as this will damage the pump. Check for water and proper float valve level in return tank.			
13	Check electrical wiring per wiring diagram. With Boiler Control Switch off - turn on electricity to boiler if safe - hot switched black wire should read 115 VAC to ground, neutral white wire should read 0 VAC to ground. (Not applicable if 3 Phase power is provided.)			
14	With Main Burner Switch off, turn Boiler Controls Switch on. Pump will be energized. Check pump for proper start, stop and rotation.			
15	With blow-off valves and gravity drain valve open, let pump run 3-5 minutes or until water shows good volume and clean. When clean, shut blow down and drain valves, fill boiler.			
16	Check water level control for proper pump shut-off at slightly above centre of glass.			
17	Insure no personnel are near boiler door. Note: flame rollout could occur on cold boiler start up so insure safety of all present. Light pilot - see Lighting Instructions.			
18	With pilot safely "on", open main downstream gas cock at boiler. Check burners for smooth light.			
19	Check burners for bad burning or burning on orifice.			
20	Re-light boiler. Check igniters and flame light-off system for proper operation. Replace cabinet door.			
21	Close pilot valve and try and re-light boiler. Check for flame failure lockout.			
22	On flame safeguard controls where flame signal can be monitored, record : Pilot _____ Main flame signals. _____			
23	Soap test all gas lines and tubing with boiler firing. Repair leaks.			
24	Set high fire gas pressure. Record setting. See "Maximum Manifold Pressure" on heater label and tables. Confirm that Pressure holds with all appliances firing. Check gas inlet pressure also.			
25	Set operating control to desired steam pressure. Adjust differential to suit job conditions. Off point _____ bar Differential _____ bar			
26	Check operation of high limit control setting _____ bar			

CHECK ITEMS – START UP (Cont)		YES	NO	REMARKS
27	Adjust firing rate control i.e. modulating control or high low control to suite job conditions. Record low fire gas pressure _____ mm H ₂ O. Caution: Never set low fire gas pressure below recommended ranges.			
28	Check all electrical interface points i.e. remote start-stop, alarm dry contacts, alarm, run status if provided as shown on wiring diagram. Insure interface voltages are correct.			
29	Insure that no wires have been connected to panel which will by pass any safety controls or interfere with proper boiler operation. Any relays switching burner control circuit wiring must be electromechanical type, rated 115VAC, 8 AMP as a minimum.			
30	After insuring Blow down System is safe, open main blow-off valve and test to see if low water cut-off shuts off main burner when water reaches near bottom of glass. Blow boiler down to 0 pressure and refill. Insure secondary low water cut-off requires manual reset to fire boiler.			
31	Set and test low gas pressure switch (if present) Record setting _____ mm H ₂ O.			
32	Set and test high gas pressure switch (if present). Record setting _____ mm H ₂ O.			
33	Check operation of flue gas and heat spill switches (if present).			
34	Check operation of IRI vent valve (if present). Insure discharge is to safe location with rain and bug protection. Establish Program to continually monitor this valve.			
35	With boiler firing and boiler room doors closed, check vent for no flue leaks or spillage.			
36	If barometric damper is furnished, adjust draft per table with barometric damper weights. Insure free damper movement and double nut barometric damper weights. If draft hood, insure proper draft. Record setting _____ mm H ₂ O			
37	Blow down boiler and refill until blow down discharge water is clear.			
38	Check entire Steam and Condensate Return System for proper installation with proper piping, valves, traps, supports, insulation and provision for expansion.			
39	Check with Owner that steam system is complete, safe and ready for operation. If safe, open main steam valve slowly and check out entire system for leaks and proper operation.			
40	Check Return Tank. Clean and flush as required. Clean strainer.			
41	Carefully check entire boiler and approve for no leaks, damage or defective parts.			
42	Replace all gas test point plugs.			

FINAL INSTRUCTIONS & RECOMMENDATIONS TO OPERATOR				
1	Review Operating Instructions.			
2	Review steps in Starting Boiler.			
3	Review Shutdown Instructions.			
4	Review Blow down Instructions.			
5	Review Water Treatment Procedure. It is critical to assure proper boiler life to institute proper program.			
6	Review Water Sample Procedure.			
7	Review Weekly and Quarterly Maintenance and Inspection Reports.			

MANIFOLD GAS PRESSURE AND DRAFT REFERENCE TABLE				
MODEL	GAS PRESSURE mm H ₂ O		DRAFT mm H ₂ O	
	MAXIMUM	MINIMUM	DRAFT HOOD	BAROMETRIC
Atmospheric Natural Gas Boilers	100	25	0.25 – 0.5	1 – 1.5
LPG Atmospheric Boilers	460	280	0.25 – 0.5	1 – 1.5
9.5 LA	142-152	NA	0.25 – 0.5	1 – 1.5
30LA, 40LA, 50LA	142-152	100	0.5 – 1	1 – 1.5

LIST ANY ITEMS THAT ARE NOT APPROVED AS SATISFACTORY OR THAT MAY BE QUESTIONABLE:

1. _____
2. _____
3. _____

START-UP PERFORMED BY _____ **DATE** _____