Ref: WI/MAINT/08

**Confined Space Activity Inside boiler**

# Work instruction of Boiler coil repair work confined space

Objective Boiler coil repair work

Responsibility Engineer in charge and workmen at job

PPEs to be used Helmet, Safety shoes, safety hand gloves, ear plugs and nose mask

Aspect-Impact

Fumes, CO gas leakage air pollution

Noise generation noise pollution

Steel Scrap Resource Depletion

Water Spillage Land contamination

Hazards Identified

Mechanical Hazard Slip, fall and trap

Physical hazard Temperature

Health hazard CO/Oxygen gas

Human behavior Poor housekeeping, Non use of PPEs, Alcoholism, Height phobia

SAFETY PRECAUTION

24 volt DC supply should be used for providing illumination

Cotton/Leather hand gloves, nose mask, white/black goggles should be used

Proper checking of Welding machine, gas cutting set, grinding, cut off, flexible grinding machine, etc.,

While one person is working inside, one person should always be there outside continuously to communicate and monitor to inside person.

The person working inside should wear Full Body harness (FBH) and one rope should be tied to FBH and the other end of rope should be tied outside of boiler.

Breathing apparatus should be kept with the person outside.

Special care should be taken care regarding CO poisoning. CO gas should be pre checked using Multigas detector before the person entering and starting his work and check the oxygen level at working zone excess or deficient to be checked.

Also presence of any flammable gases to be checked.

Proper illumination to be ensured.

Before starting of gas cutting or welding work bottom areas must be free from fire catching media or covered or clean area.

Fumes rising from confined space where there was no manholes, keep or arrange the opening from availed spaces or else provide exhaust fan for removal of fumes.

**Physical isolation/blanking to be provided to carry any activity inside the boiler or BFG gas line system by isolating complete BF gas sources from Pig iron Plant.**

**LTI - On 06/02/2022 at 12:00 PM 3 Anish Scaffolding workmen Mr. Manu Nag, Mr. Kunjay Naik, Mr. Lambodhar Naik, Mr. Sri ram (supervisor) who were engaged in scaffold erection as a part of boiler 1 tube replacement job became victim of gas leak. While, Mr. Manu Nag and Mr. Kunjay Naik resumed duty post observation at dispensary. Mr. Lambodhar Naik was referred to GMC Bambolim for further medical care where he was kept under observation for 24 Hrs and he joined duties next day**

PRECHECKS

* Before Entering in Boiler ensure –
* Main ID fan must be in operation shutdown with LOTO.
* MSSV valve, GD Valve, U-seal must be filled overflow and control valve shutdown with LOTO. Double isolation to be ensured in system
* Boiler inside temperature should be 25 to 45 degree Celsius.
* CO Level should be 0 ppm
* Attendant must ensure proper illumination, if illumination not found ok, he must inform concern electrical person to provide additional hand lamp for inside.
* Take the work permit from HOD, Safety for entering inside the Boiler as it is confined space.
* The workmen (Entrant) who is trained and certified by SUB head and having valid confined space gate pass should perform the activity and he can be replaced(in emergency) only by certified entrant .
* A standby (attendant) who is trained and certified by SUB head and having valid confined space gate pass should perform the activity and he can be replaced(in emergency) only by certified attendant .
* Standby person who shall be positioned outside the confined space , must have no other duties other than monitoring people and conditions inside the confined space and coordinating with rescue personnel (he must have contact number of rescue team members) if required.
* Standby (Attendant) person has to log down the In/Out entry of all entrants and ensure that entrant should be come out within 30 minutes from confined space for normal jobs.
* In some cases In/Out time may be relaxed /extended based on the risk involved in the particular confined space.
* Check Internal atmosphere of the space for sufficient oxygen content (19.5% to 23.5 %) flammable gases and vapours, and the potential for toxic air contaminants by the use of multi gas detector, if required use pump with extension before entering into Boiler. If there is any deviation, do not enter into Boiler.
* Check for the presence of Chemical asphyxiates such as Carbon monoxide (CO gas detector).It should be 0 PPM
* Check inside temperature and it should be is in the tolerable range (25 deg C to 45 Deg C). If the temperature is not within limits then appropriate ventilation to be used to normalize the temp.
* Check for suitability of equipment that is used at the confined space.
* Check any dust due to which visibility is reduced or respiratory tract is irritated.
* The sign-in and sign-out of all persons entering into Boiler should be recorded.
* Use 24V DC supply illumination to avoid electrocution/electric shock.
* Ensure that main fan damper is in open condition for natural draft during inspection and maintenance job in Boiler.
* Body Stretcher to be in place outside the confined space where work is carried out.

PROCEDURE

Ensuring above 1-15 points in prechecks, Confined space repair job in boiler can be started.

Shift the all required material like welding machine, gas cutter, grinding machine, all tools and inform to electrical department for required illuminating in particular Boiler.

Open all the manholes of economizer, evaporator & hopper after depressurizing boiler.

Start the leakage identification activity.

After identification give the clearance for draining.

Depending upon leakages if required then remove the insulating material, casing plate by cutting set.

Remove the damage coil with the help gas cutter, grinding the same as required.

Measure the damage length of coil and take the new coil for replacement.

Fit in to the required position and start the welding.

Fit the safety gag on safety valve and give the clearance for start the hydro test after half an hour of completion of welding.

Once the hydro find satisfied, start welding the casing plate, fix the insulation/cladding sheet and close all manholes for given clearance for boiler light up.

Remove the all machines/ tools / waste and shifted to proper designated areas.

# Work instruction of Boiler Steam Drum Maintenance work in confined space

Objective Boiler Steam Drum repair work

Responsibility Engineer in charge and workmen at job

PPEs to be used Helmet, Safety shoes, safety hand gloves, ear plugs and nose mask

Aspect-Impact

Fumes, CO gas leakage air pollution

Noise generation noise pollution

Steel Scrap Resource Depletion

Water Spillage Land contamination

Hazards Identified

Mechanical Hazard Slip, fall and trap

Physical hazard Temperature

Health hazard CO/Oxygen gas

Human behavior Poor housekeeping, Non use of PPEs, Alcoholism, Height phobia

SAFETY PRECAUTION

Ensure Sufficient Illumination. Please see for downcomers in boiler drum before walking inside the boiler drum.

24 volt DC supply should be used for providing illumination

Cotton/Leather hand gloves, nose mask, white/black goggles should be used

Proper checking of Welding machine, gas cutting set, grinding, cut off, flexible grinding machine, etc.,

While one person is working inside, one person should always be there outside continuously to communicate and monitor to inside person.

The person working inside should wear Full Body harness (FBH) and one rope should be tied to FBH and the other end of rope should be tied outside of boiler.

Breathing apparatus should be kept with the person outside.

Special care should be taken care regarding CO poisoning. CO gas should be pre checked using CO monitor before the person entering and starting his work and check the oxygen level at working zone excess or deficient to be checked.

Also presence of any flammable gases to be checked.

Proper illumination to be ensured.

Before starting of gas cutting or welding work bottom areas must be free from fire catching media or covered or clean area.

Fumes rising from confined space where there was no manholes, keep or arrange the opening from availed spaces or else provide exhaust fan for removal of fumes

**Physical isolation/blanking to be provided to carry any activity inside the boiler or BFG gas line system by isolating complete BF gas sources from Pig iron Plant.**

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PRECHECKS

1. Before Entering in Boiler Steam Drum ensure –
2. Main ID fan must be in operation shutdown with LOTO.
3. MSSV valve, GD Valve, U-seal must be filled overflow and control valve shutdown with LOTO. Double isolation to be ensured in system
4. Steam Drum inside temperature should be between 25 to 45 degree Celsius.
5. CO Level should be 0 ppm
6. Attendant must ensure proper illumination, if illumination not found ok, he must inform concern electrical person to provide additional hand lamp for inside.
7. Take the work permit from HOD, Safety for entering inside the Boiler as it is confined space.
8. The workmen (Entrant) who is trained and certified by SUB head and having valid confined space gate pass should perform the activity and he can be replaced(in emergency) only by certified entrant .
9. A standby (attendant) who is trained and certified by SUB head and having valid confined space gate pass should perform the activity and he can be replaced(in emergency) only by certified attendant .
10. Standby person who shall be positioned outside the confined space , must have no other duties other than monitoring people and conditions inside the confined space and coordinating with rescue personnel (he must have contact number of rescue team members) if required.
11. Standby (Attendant) person has to log down the In/Out entry of all entrants and ensure that entrant should be come out after 30 minutes from confined space for normal jobs.
12. In some cases In/Out time may be relaxed /extended based on the risk involved in the particular confined space.
13. Check Internal atmosphere of the space for sufficient oxygen content (19.5% to 23.5 %) flammable gases and vapours, and the potential for toxic air contaminants by the use of multi gas detector, if required use pump with extension before entering into Boiler. If there is any deviation, do not enter into Boiler.
14. Check for the presence of Chemical asphyxiates such as Carbon monoxide (CO gas detector).It should be 0 PPM
15. Check inside temperature and it should be is in the tolerable range (25 deg C to 45 Deg C). If the temperature is not within limits then appropriate ventilation to be used to normalize the temp.
16. Check for suitability of equipment that is used at the confined space.
17. Check any dust due to which visibility is reduced or respiratory tract is irritated.
18. The sign-in and sign-out of all persons entering into Boiler should be recorded.
19. Use 24V DC supply illumination to avoid electrocution/electric shock.

Ensure that main fan damper is in open condition for natural draft during inspection and maintenance job in Boiler.

PROCEDURE

Before start of Work, Ensure 1-13 Pre-checks and Work Permit.

Open all the manholes of economizer, evaporator, hopper, steam drum after depressurizing boiler for cooling the space.

Check for any abnormalities like broken, cut inside, any supports. Check for choking of HP Dosing lines.

Clean the HP dosing line.

If any portion of pipe inside steam drum is damaged. Remove the same by cutting with cutting machine or gas cutting.

Measure the dimension of removed piece. Make the pipe ready by gas cutting and edge preparation outside the confined space. Also do the edge preparation of pipe inside the drum.

Weld the pipe at removed portion.

If any abnormality found rectify the same.

Remove the all machines/ tools / waste and shifted to proper designated areas.

Close the manhole of steam drum, after all the entrant are outside of it.

Normalise all the isolation, cancel the work permit.

# Work instruction for Boiler pressure part tube replacement.

Objective Boiler pressure parts replacement work

Responsibility Engineer in charge and workmen at job

PPEs to be used Helmet, Safety shoes, safety hand gloves, ear plugs and nose mask

Aspect-Impact

Fumes, CO gas leakage air pollution

Noise generation noise pollution

Steel Scrap Resource Depletion

Water Spillage Land contamination

Hazards Identified

Mechanical Hazard Slip, fall and trap

Physical hazard Temperature

Health hazard CO/Oxygen gas

Human behavior Poor housekeeping, Non use of PPEs, Alcoholism, Height phobia

SAFETY PRECAUTION

1. 24-volt DC supply should be used for providing illumination
2. Cotton/Leather hand gloves, nose mask, white/black goggles should be used

Proper checking of Welding machine, gas cutting set, grinding, cut off, flexible grinding machine, etc.,

1. While one person is working inside, one person should always be there outside continuously to communicate and monitor to inside person.
2. The person working inside should wear Full Body harness (FBH) and one rope should be tied to FBH and the other end of rope should be tied outside of boiler.
3. Breathing apparatus should be kept with the person outside.
4. Special care should be taken care regarding CO poisoning. CO gas should be pre checked using Multigas detector before the person entering and starting his work and check the oxygen level at working zone excess or deficient to be checked.
5. Also presence of any flammable gases to be checked.
6. Proper illumination to be ensured.
7. Before starting of gas cutting or welding work bottom areas must be free from fire catching media or covered or clean area.
8. Fumes rising from confined space where there was no manholes, keep or arrange the opening from availed spaces or else provide exhaust fan for removal of fumes

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PRECHECKS

Before Entering in Boiler ensure –

* Main ID fan must be in operation shutdown with LOTO.
* MSSV valve, GD Valve, U-seal must be filled overflow and control valve shutdown with LOTO. Double isolation to be ensured in system.
* Boiler inside temperature should be 25 to 45 degree Celsius.
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# Safety precaution for crane positioning at site.

* Crane selection must be within range of critical lift.
* Crane to be placed minimum 2-meter distance away from MCD – bus bar conductor.
* For Boiler 1 any critical lift, crane must be positioned towards roadside.
* For Boiler 2 excluding economizer bank1 bottom segment coil replacement crane must be parked towards MCD oven end keeping 2-meters distance from bus conductor. Rest all are pressure part removal crane must be parked on roadside.
* Special care is to be taken whenever any lift object in boiler 2 where crane parked near conductor area if it is very closure i.e. less than 2 meters that case proper shutdown to be taken for each lift by co ordinating with MCD operation and electrical team.

PROCEDURE

Ensuring above 1-15 points in prechecks,

Shift the all required material like welding machine, gas cutter, grinding machine, all tools and inform to electrical department for required illuminating in particular Boiler.

Remove the casing plate which pressure part replacement location and placed at designated place.

Inspection of entire coil, check CO level, Oxygen level, skin temperature of zone prior to any activity.

Dismantling of eco coils one by one by using crane and shift designated place.

If any lift which is closure up to less than 2 meter from MCD bus bar conductor that case isolation/LOTO to be in place.

Surface preparation of all coils and erection of each one coil one by one by using crane.

After completion of erection hydro test to be carried out. After completion of hydro casing plate welding and shifting all generated scrap in to designated place.

Clear the work permit. an.

the manholes of economizer, evaporator & hopper after depressurizing boiler.

Start the leakage identification activity.

After identification give the clearance for draining.

Depending upon leakages if required then remove the insulating material, casing plate by cutting set.

Remove the damage coil with the help gas cutter, grinding the same as required.

Measure the damage length of coil and take the new coil for replacement.

Fit in to the required position and start the welding.

Fit the safety gag on safety valve and give the clearance for start the hydro test after half an hour of completion of welding.

Once the hydro find satisfied, start welding the casing plate, fix the insulation/cladding sheet and close all manholes for given clearance for boiler light up.

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**Corrective action and preventive action on above LTI**

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| Sl no. | Recommendations | Responsibility |
| 1 | SOP to be revised stating that whenever jobs in pressure parts (BFG line, steam line, water line, etc) are taken up positive isolation such as blanking/ provision of Goggle valve should be done | Nitin Gaikwad, Deepak Kudalkar  & Anand Ghadigaonkar |
| 2 | Steam purging system should be installed at PP | Deepak Kudalkar |
| 3 | Pressure transmitter should be installed at strategic location so as to determine the line pressure of BFG entering PP | Vengatesan |
| 4 | Explore the possibility of providing Purging vent valve provision should be provided | Deepak Kudalkar |
| 5 | U seal and drip pots inner parts may be checked at desired intervals by dismantling by preparing schedule | Nitin Gaikwad & Deepak Kudalkar |
| 6 | In gas prone areas whenever job is carried out at multiple levels at least one portable CO monitor should be present with people working on each level | Nitin Gaikwad & Deepak Kudalkar |
| 7 | Explore the possibility of changing the Boiler U seal design at PP if required | Deepak Kudalkar & Nitin Gaikwad |
| 8 | More online CO sensors should be fitted at strategic locations | Vengatesan |
| 9 | Portable self powered CO monitors to be procured that has audio/visual alarm with a wireless communication to control room, | Vengatesan |