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Confined Space Activity

1. 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

PRECHECKS

1) Before Entering in Boiler ensure –
   a) Main ID fan must be in operation shutdown with LOTO.
   b) MSSV valve, GD Valve, U-seal must be in operation shutdown with LOTO
   c) Boiler inside temperature should be 25 to 45 degree Celsius.
   d) CO Level should be 0 ppm
   e) Attendant must ensure proper illumination, if illumination not found ok, he must inform concern electrical person to provide additional hand lamp for inside.
   f) Take the work permit from HOD, Safety for entering inside the Boiler as it is confined space.
2) 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 .
3) 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 .
4) 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.
5) 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.
6) In some cases In/Out time may be relaxed /extended based on the risk involved in the particular confined space.
7) 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.
8) Check for the presence of Chemical asphyxiates such as Carbon monoxide (CO gas detector).It should be 0 PPM
9) 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.
10) Check for suitability of equipment that is used at the confined space.
11) Check any dust due to which visibility is reduced or respiratory tract is irritated.
12) The sign-in and sign-out of all persons entering into Boiler should be recorded.
13) Use 24V DC supply illumination to avoid electrocution/electric shock.

14) Ensure that main fan damper is in open condition for natural draft during inspection and maintenance job in Boiler.
15) 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.

2. Work instruction of ID Fan Cleaning and Balancing

Objective — Maintenance of ID Fan
Responsibility — Engineer in charge
PPEs to be used — Helmet, Safety shoes, safety hand gloves, ear plugs and nose mask

Aspect-Impact

Oil Spillage	Land contamination, RESOURCE DEPLETION
Oil traced waste generation	Land contamination & Resource Depletion
Generation of waste oil	Generation of hazardous waste, resource depletion
Dust generation	Air Pollution
Waste water	Resource Depletion

Hazards Identified

Mechanical Hazard	Slip, fall and trap
Physical hazard	Noise,
Human behavior	improper housekeeping, Non PPEs, Alcoholism, Violation system
Chemical hazards	CO gas poisoning in Area near Equipment

PRECHECKS

Take/ensure the work permit.
Ensure IGV, Gas Shutoff Valve are closed and isolated, LOTO is in place.
Ensure Boiler Suction U-seal from PIP and BF-3 is filled and isolated, LOTO is in place.
Ensure CO level in is zero.
Ensure O2 level is between 19.5 to 23.5
Take electrical Isolation of the Equipment and apply LOTO.

PROCEDURE

Balancing and cleaning activity of ID Fan impeller has to be in close co-ordination with Operation and Electrical Department.
User must be write note on electrical permit before the start of balancing and inform the operation department.
Permit requestor has to ensure in any work in ID Fan during balancing, LOTO with individual isolation (one man one lock) available at site only.
Balancing each trail will be carried out under close coordination of site supervisor, DCS engineer and electrician.

In this case either the shaft should have been isolated, secured and at zero energy or the machine guard should have been in place.
Permits should not be issued before the relevant authority has physically verified isolation and zero energy at the site.

After getting all clearance from operation department and ensuring LOTO, start to open inspection door.
Inspect Impeller for any damage or crack or dust deposition.
If deposition of dust is found on impeller, clean the impeller thoroughly.

Rotate the impeller to check the point of static unbalance and consequently identify the location for welding of trial mass. Trial mass is selected based on diameter and weight of impeller. Put reflecting sticker on impeller shaft for measuring the phase angle.

Balancing and similar activities to be done through non-driving end or by making arrangement of small opening/slot in the guard itself, such that guard cannot be removed.

Close the inspection door.
Clear the electrical isolation after removing all the locks on LOTO box and panel by visiting Panel room.

Co-ordinate with control room Engineer for starting ID fan. Control room Engineer should consequently take clearance from shift electrical person (Technician/Engineer). Before starting ID Fan, Maintenance Engineer should ensure no-man is in line of fire. No loose material should be near equipment.

Take first set of trial reading. Note down the vibration and phase reading.

Stop the ID fan and isolate the equipment. Bring LOTO Box back to site, ensure personal LOTO of each person working on balancing job.

Before opening Inspection door or carrying out any maintenance activity, ensure zero energy state of shaft rotation.

Open the inspection door, weld the suitable size trial mass on identified location as suggested by CBM/Balancing Expert.
Close the inspection door. Clear the electrical isolation after communication with control room Engineer. Start ID Fan along with co-ordination of both Desk Engineer and Shift electrical.
Take second set of reading which is based on trial weight.
Based on trial weight, vibration and phase reading is utilized for identification of correction weight.

Similarly repeat the process by welding correction weights at calculated phase angle recommended by balancing/CBM expert.
Process is repeated until the vibration reading is reduced below 3 mm/sec.
If Vibration is not reducing below 3 mm/sec, clean the impeller again, Attend any other recommendation suggested by CBM/Balancing expert.

After completion of ID fan balancing again electrically isolate the ID Fan and start the blower box up.

3. ACTIVITY: REFRACTORY WORK IN BOILER

Scope: Refractory Repair Work in COFG Duct/Combustor/Boiler Evaporator-Economiser-Superheater.

Objective REFRACTORY WORK IN BOILER

Responsibility Engineer In charge

PPEs to be used Helmet, Safety shoes, safety hand gloves, cutting goggle, welding shields, safety belt and Dust mask

Aspect-Impact

Fumes	Health impact
Working inside hopper	Work Environment
Steel Scrap	Resource Depletion

Hazards Identified

Mechanical Hazard	Trapping Impact, Falling
Chemical hazard	Fumes
Human behavior	Improper 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 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.

PRECHECKS

1) Before Entering in Boiler/COFG Duct/Combustor ensure –
    a) Main ID fan must be in operation shutdown with LOTO.
    b) MSSV valve, GD Valve, U-seal must be in operation shutdown with LOTO
    c) Boiler/COFG Duct/Combustor inside temperature should be between 25 to 45 degree Celsius.
    d) CO Level should be 0 ppm
    e) Attendant must ensure proper illumination, if illumination not found ok, he must inform concern electrical person to provide additional hand lamp for inside.
    f) Take the work permit from HOD, Safety for entering inside the Boiler as it is confined space.
2) 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 .

3) 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 .
4) 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.
5) 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.
6) In some cases In/Out time may be relaxed /extended based on the risk involved in the particular confined space.
7) 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/COFG Duct/Combustor. If there is any deviation, do not enter into Boiler/COFG Duct/ Combustor.
8) Check for the presence of Chemical asphyxiates such as Carbon monoxide (CO gas detector).It should be 0 PPM
9) 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.
10) Check for suitability of equipment that is used at the confined space.
11) Check any dust due to which visibility is reduced or respiratory tract is irritated.
12) The sign-in and sign-out of all persons entering into Boiler should be recorded.
13) Use 24V DC supply illumination to avoid electrocution/electric shock.
14) Ensure that main fan damper is in open condition for natural draft during inspection and maintenance job in Boiler, COFG Duct and Combustor.

Take the work permit and check the co and oxygen level at work place.
Ensure that individual ‘U’ seal should be filled, check in every four hours by doing overflow, entire system should be in purge and CO monitors to be used.
Electrical Isolation of ID Fan, Mechanical Isolation BFG Line, Isolation of GD Valve, Isolation of MSSV valve.
Isolation of Diesel Pumps for repair work in Combustor.
Ensure temperature in boiler, Combustor, COFG Duct is between 25 to 45 degree Celcius wherever refractory repair is to be taken.
Check for certification of electrical equipment.
Body Stretcher to be in place outside the confined space where work is carried out.

Procedure

The Engineer in-charge shall ensure the following before commencement of work

Before start of work ensure the prechecks.

Use full body harness before entering confined space to have ease of rescue.

In case of height work, Scaffolding to be done by certified scaffolders and later to be certified by competent person. Before entry of scaffolder in confined space, ensure they are properly trained about confined space entry, associated hazards and control measures or they must have confined space pass.

Remove the debris of refractory fallen inside, so as to eliminate risk of trip and fall.

In case of damaged refractory wall portion of section, cut the same by gas cutting.

Remove the damaged the portion. Measure the size of damaged portion require repair.

Cut the plate outside the confined space to required size and grind the same.

Repair the damaged wall by welding new plate.

Remove the old damaged anchors from the walls by gas cutting and shift it outside the confined space.

Weld the new anchors on the walls from wherever removed.

Make the refractory material castable or equivalent ready outside the confined space.

Repair the damaged refractory on walls.

Do the housekeeping. After exit of all confined space entrant, close the manhole.

Normalise the isolations after completion of work. Clear the Work Permit and give the clearance to Operations for further actions.

4. 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

PRECHECKS

1) Before Entering in Boiler Steam Drum ensure –
    a) Main ID fan must be in operation shutdown with LOTO.
    b) MSSV valve, GD Valve, U-seal must be in operation shutdown with LOTO
    c) Steam Drum inside temperature should be between 25 to 45 degree Celsius.
    d) CO Level should be 0 ppm
    e) Attendant must ensure proper illumination, if illumination not found ok, he must inform concern electrical person to provide additional hand lamp for inside.
    f) Take the work permit from HOD, Safety for entering inside the Boiler as it is confined space.

2) 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 .
3) 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 .
4) 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.
5) 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.
6) In some cases In/Out time may be relaxed /extended based on the risk involved in the particular confined space.
7) 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.
8) Check for the presence of Chemical asphyxiates such as Carbon monoxide (CO gas detector).It should be 0 PPM
9) 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.
10) Check for suitability of equipment that is used at the confined space.
11) Check any dust due to which visibility is reduced or respiratory tract is irritated.
12) The sign-in and sign-out of all persons entering into Boiler should be recorded.
13) 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.