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Commissioning of dedusting system for electric arc furnaces and utilisation of EAF dusts recovered from baghouse at SMS

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ABSTRACT

Substantial amount of fumes is emitted during electric arc furnace (EAF) operations at steel melting shop of ASP where three furnaces of 50 T capacity each are available. The EAF roof was provided with a fourth hole to extract fumes generated during operation and discharge through a chimney in the environment. To meet the stack emission norms and a better work-zone air quality, bag filter units have been commissioned for all the EAFs. While stack emissions are well within the statutory norms after successful commissioning of the dedusting systems, actions are on for recycling of dust recovered from baghouse to EAFs as briquettes.

INTRODUCTION

In electric arc furnace operation, scrap and reduced iron are charged from the top into a refractory and water panel lined chamber. Swing roof which is also lined with refractory and water cooled panel is placed over the chamber. Through the roof three graphite electrodes are placed and connected to a powerful A.C. transformer which supplies the power necessary to melt the scrap using high power arc discharges. The fume generated during operation is carried out through the fourth hole in the roof and then through a double walled water cooled elbow. Air is aspirated to combust CO. In the past, electric arc furnace emissions were controlled by systems which entailed only the collection of fumes sucked through the fourth hole and water cooled duct and ultimately exhausted into the environment through a chimney. The Air Act and the extended sensibility of communities no longer allow dust containing fumes generated during furnace operation to be exhausted without cleaning system. Dedusting system for each electric arc furnaces was considered to meet stack emission norms and for better work-zone air quality.

Dedusting System

The dedusting system consists of items like - Moving Sleeve, Water Cooled Duct, Plain Duct, Forced Draft Cooler, Bag House, Induced Draft Fan, and Stack.

Table-1 : Stack emission results

Sl. No.	Date of Sampling	Stack height	Stack Dia (m)	Gas Velocity Avg. (m/s)	Gas Temp. K	Flow Rate N Cu. M/HR	SPM Mg/N Cu.M
Electric arc Furnace # 2							
1.	02.12.95	43m	1.61 m	12.8	319	87888	92
2.	05.12.95	-do-	-do-	11.3	322	77589	122
3.	06.12.95	-do-	-do-	10.2	326	82988	77
4.	07.12.95	-do-	-do-	11.5	344	73223	94
Electric arc furnace # 3							
1.	20.05.95	30m	1.60 m	9.74	335	62048	33
2.	22.05.95	-do-	-do-	10.0	348	63878	134
3.	07.06.95	-do-	-do-	8.96	330	57348	66
4.	08.06.95	-do-	-do-	9.01	321	57453	39
5.	19.04.95	-do-	-do-	10.54	348	67160	3946 (Without Bagfilter)
Electric arc furnace # 8							
1.	25.05.95	43m	1.61 m	6.43	340	37000	47
2.	26.05.95	-do-	-do-	6.03	334	35310	40
3.	27.05.95	-do-	-do-	7.21	342	40806	51
4.	29.05.95	-do-	-do-	6.83	330	40503	129

Moving Sleeve

One water cooled type moving sleeve operated by electric motor supported on four wheels which moves as well as is guided by the fabricated MS Block. The motor is reversible type and provides forward or backward motion of the moving sleeve. The gap between the elbow and moving sleeve is maintained as per requirement during operation. Normally it is kept as 65mm during melting so that adequate air is passed through the duct for complete combustion of carbon-monoxide into carbon-dioxide as well as for effective suction by I.D fan.

Water Cooled Duct

After moving sleeve there is a water cooled duct to cool down the fume. This is particularly required when the choice of the cleaning system involves fabric filters. The duct is made of thick boiler quality M.S. plate provided with water jacket.

Plain Duct

Entire duct starting from water cooled duct to forced duct cooler is non-water cooled. Number of bends are kept as minimum as possible for easy flow of fumes and cleaning of particulate deposits.

Forced Draft Cooler

One forced draft cooler is provided for cooling the gas. It is designed such that the outlet temperature is below 130 °C. It is provided with 6 axial flow fans. One storage hopper of suitable capacity is attached below with FD cooler for storage of dust.

Bag House

The main component of dedusting unit is bag house. The pulse jet type of bag filter is provided along with filter bags made of polyester, casing with explosion vent, piping, valves etc. The bag filter unit is provided with cleaning mechanism with the help of compressed air. The construction of filter unit is such that re-entrainment of dust from one group of bags (under cleaning) on to the adjacent ones is completely prevented and the dislodged dust falls completely into the collecting hopper below.

Induced Draft Fan

After bag house, ID fan is there for suction of fume. The capacity of the fan is kept such that it can withstand the stresses which may be experienced during

normal operation and during speed testing. During operation, noise level of the I.D fan is less than 85 dB.

Stack

The cleaned gas before entering the centrifugal fan is controlled by damper which, depending upon generation by gas volume in the furnace, automatically adjusts the blade opening. The gas from the fan discharges through the stack of height 30m or more and released to the atmosphere. The stacks are provided with monitoring facilities as per statutory guidelines.

Performance of dedusting system

Good results have been obtained after successful installation of dedusting units at Steel Melting Shop. Particulate matter concentration from stacks are well below the statutory norms during both melting and lancing operation in each heat for all the furnaces. The total outflow of the fumes at the stacks, particulate matter and CO concentrations, temperature etc. at stack are presented in Table-1.

CONCLUSION

After commissioning of three dedusting systems, action for collection and disposal of dust from the hoppers has gained immediate importance and focus. Different types of solid wastes are produced during electric arc furnace operation e.g. slag from the melting and refining operation, waste refractories and dust collected from dedusting units.

Slags and used refractories are not considered to be potentially toxic. Dust, in particular coming out from arc furnaces producing Cr, Ni, Mo alloyed steels is considered as hazardous and hexavalent chromium must be carefully watched before dumping because chromates are readily soluble in water.

- Since the quantity of dust recovered from baghouses is quite substantial and at the same time dumping is not advisable as per Environment Act, a recycling attempt has been initiated to use this bag filter dust and making it to briquettes for reuse in the electric arc furnaces in place of scrap. Dust composition has been analysed and a series of trial run will be conducted for implementation of this recycling programme and making briquettes on regular basis.