

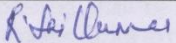
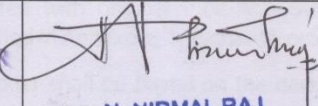
Annexure-III



TECHNICAL SPECIFICATION FOR IN-SITU ID SHOT PEENING OF FINISH SH REAR COILS

Specification no. PP-SP-02 Rev.00

Dated: 20.09.2022

Prepared By	Checked by	Approved by
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Objective:

To perform In-situ (As erected condition) shot peening of Finish Superheater Rear coils in 800MW boilers erected by BHEL. There are 107 coil assemblies in each unit. Each assembly has 9 tube circuits.

Site location:

NTPC Gadarwara STPP Stage-1 (2 x 800MW), Madhya Pradesh

Coils Material of Construction:

The coils are fabricated using tubes of the following OD, thickness and material:

- D44.45 mm x 7.11 mm – SA213TP347H
- D44.45 mm x 8.13 mm – SA213TP347H

Coil dimension:

- The individual fabricated coil assemblies will be of length 21118 mm, width 1513mm.
- The developed length of the individual elements of coil will be between 43.1 meters to 40.5 meters.
- The total length of shot peening for all the 107 assemblies with 9 elements will be approximately 40,193 meters.

Coil configuration:

The coils to be shot peened are already erected in vertical orientation. The entry and outlet of the coils shall be accessed through the openings in pent house. Refer Fig-01 for configuration of coils. The coil details with cutting locations for shot peening access is provided in Fig-02.

Qualification requirements:

The bidder should have successfully completed shot peening of coils in any of the thermal power projects within or outside India. The bidder shall share PO copy and/or evidence document in proof of having executed such job for reference.

Alternatively, bidder shall perform trails and demonstrate capability to perform shot peening in coils with U shaped bends. The material of the bend should either be SA213TP347H or SA213UNSS30432. The tube OD shall not be less than 44.45mm. The U bends should have sufficient straight length and two 90 Deg bends to resemble the actual coil configuration at site. The tube samples shall be subjected to lab testing before & after shot peening. The results after shot peening shall be compared with original tube analysis result to meet all the technical requirements (3.1 a to d) specified in Annexure-1. Bidder to produce relevant test results to BHEL.

The final acceptance of the bidder shall be based on the documents furnished and approval by BHEL / End customer.

Scope:

The vendor shall establish the facility for shot peening at suitable location. After installation of the facility at site, vendor shall initially perform trials and prove the effectiveness of shot peening by lab testing of samples as indicated in technical requirements. Once the process is established, the vendor shall perform shot peening of all the 107 assemblies meeting all the technical conditions. Refer annexure-01 for technical requirements of shot peening. The detailed scope of work is provided in Annexure-2.

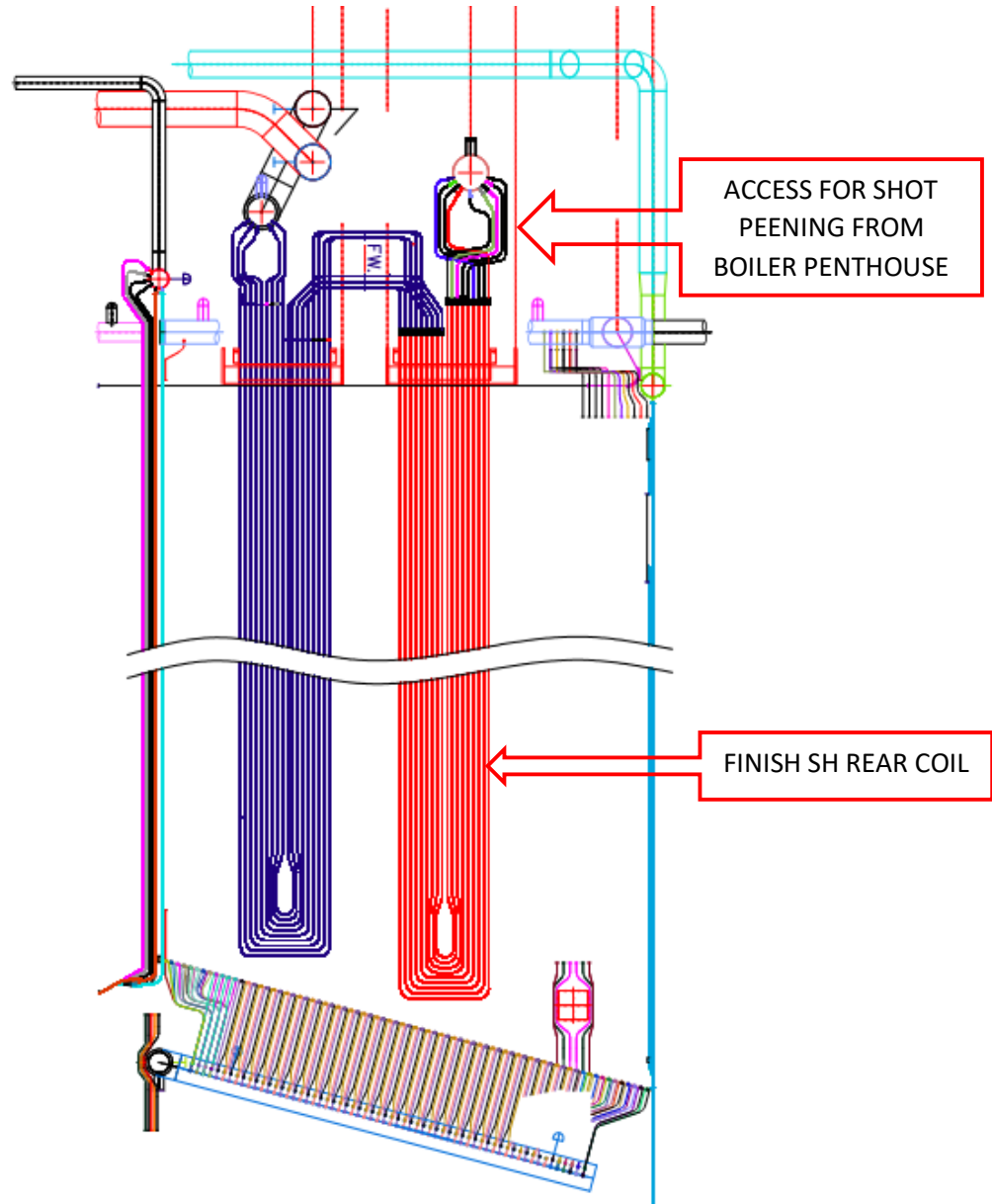


FIG-01: COIL CONFIGURATION



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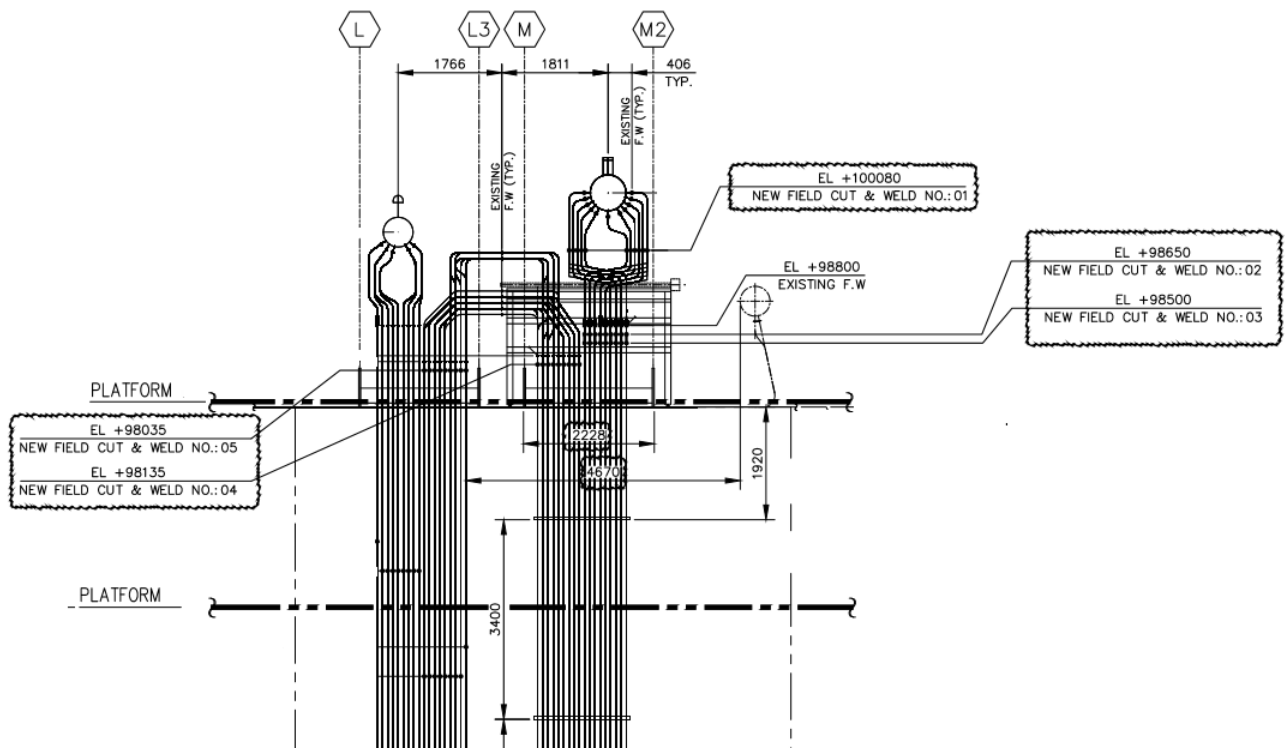


FIG-02: COIL DETAILS



ANNEXURE-1 : TECHNICAL REQUIREMENTS FOR IN-SITU ID SHOT PEENING

Sl. no	Scope	Operation Description	Reference Standard	Acceptance Criteria	Format of Record
1	100% tubes	i) Visual Inspection ii) ID cleaning of tubes by sponge pass #	i) As per ASME SA 213/ SA 1016 ii) Sponge pass by dry compressed air with 6 Bar pressure	i) No visual damage on surface ii) ID shall be free from foreign particles, dirt & water	IR
2	Stainless steel shots	Test Certificate Verification	AMS 2431-4	AMS 2431-4 , table -1	MTC
3	SHOT PEENING (STAINLESS STEEL SHOTS SHALL BE USED)				
3.1	QUALIFICATION TEST OF SHOT PEENING (DESTRUCTIVE TEST- MICRO HARDNESS & METALLOGRAPHY SHALL BE PERFORMED ONCE PER UNIT)				
a)	Selected Tube of coil assembly & any other (samples from front, middle & Rear end) for each shot peening machine	Micro-hardness	ASTM E 384	The hardness values of the shot-peened zone shall be a minimum of 100 HV 0.1 above the average hardness of the unaffected base material.	Lab Test Report
b)	Selected Tube of coil assembly & any other (samples from front, middle & Rear end)	Sample preparation, Microstructure	ASTM E 3	Micro-section for proof of cold worked inner surface/ deformed microstructure (deformed grains/slip lines) across the tube	Lab Test Report



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	for each shot peening machine	Presence of residual Oxide at inner surface		circumference at a minimum depth of 70 µm. No continuous layer of residual oxide scale after shot peening	
c)	Selected Tube of coil assembly (samples from front & Rear end) for each shot peening machine	Almen strip test (at front & rear end of tube)	SAE J442 SAE AMS 2430	As Almen testing is to be used for in-process tests, Almen strips representing acceptable shot-peening conditions shall be produced during the qualification #	Log / Test Report
d)	One more Sample to be cut from the location of the selected coil where highest oxide scale thickness is observed to establish that the shot peening process is suitable for different thicknesses of oxide scales.	Micro-hardness Microstructure Presence of residual Oxide at inner surface	ASTM E 384 ASTM E3	The hardness values of the shot-peened zone shall be a minimum of 100 HV0.1 above the average hardness of the unaffected base material. Deformed microstructure (deformed grain / slip lines) across tube circumference at a minimum depth of 70 µm acceptable shot-peening conditions shall be produced during the qualification No continuous layer of residual oxide scale after shot peening	Lab Test Report



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e)	Visual inspection to be carried out while/after cutting sample from middle of the coil for ensuring SS shots are completely removed.	Visual Inspection	NA	No SS shots to be present in the tube	IR
3.2	IN-PROCESS TEST				
a)	Random sampling from any one tube (Max three places from the tube)	Micro hardness Microstructure Presence of residual Oxide at inner surface	ASTM E 384 ASTM E3	The hardness values of the shot-peened zone shall be a minimum of 100 HV0.1 above the average hardness of the unaffected base material Deformed microstructure (deformed grain / slip lines) across tube circumference at a minimum depth of 70 µm acceptable shot-peening conditions shall be produced during the qualification No continuous layer of residual oxide scale after shot peening	Lab Test Report
				"Minimum" shot-peening intensity for Almen strips needs to be	



b)	At the beginning of each shift for each machine or relevant change in shot peening machine	Almen strip test (at front & rear end of tube)	SAE J442 SAE AMS 2430	established during the qualification (to be confirmed by hardness test and metallographic examinations). For subsequent in-process tests, Almen test readings shall not be lower than the established, "Minimum" shot-peening intensity to ensure expected peening depth.	Log / Test Report
3.3	100% tubes	Visual Inspection (at rear end of tube)	Internal surface coverage verification	Comparison with a reference#	-
3.4	100% Coils	Compressed air & sponge pass	Cleaning of tube inside passage	No shots adhered to ID surface	IR



ANNEXURE-2 : DETAILED SCOPE & RESPONSIBILITY FOR IN-SITU SHOT PEENING		
Sl. no	Activity	Owner
Preparatory Work		
1	Power Arrangement at both ground level for compressor / other equipment's at pent house	BHEL
2	Arrangement for scaffolding & access	BHEL
3	Arrange line from compressor to pent house (size 1 1/2 inch , Length actual)	BHEL
4	Arrange spare tube for spool pieces for Finish SH outlet term tubes.	BHEL
5	Roof Area Cleaning	BHEL
6	Provision of adequate lighting and ventilation system	BHEL
7	Additional support for Placing vendor Equipment at penthouse	BHEL
8	Compressor Location to be cleaned and fenced at the ground level	BHEL
9	Lifting of Equipment from Ground level to the Penthouse (except Compressor)	BHEL
10	Install line from compressor to Pent house	BHEL
11	Cut two additional temporary openings in penthouse enclosure to allow easier access of shot peening equipment and personal access, improved ventilation.	BHEL
12	Finish SH rear coil tube inside gas path to be fully inspected for any damage/ operation impact and if required replaced with Spare tube.	BHEL/NTPC
13	Finish SH rear coil length reduction post shot peening operation to be covered with tarpaulin sheet and adequate protection to be provided	BHEL
14	Additional platform as mentioned in the sketch to be added for placement of Equipment. Sketch indicating location of platform to be provided by the vendor.	BHEL
15	Facility to provide at site for easy movement of Hose feeder equipment.	BHEL
Equipment at site and manpower mobilization		
16	All the equipment required for shot peening	VENDOR
17	Manpower mobilization	VENDOR
18	Induction Of EHS training to VENDOR	BHEL/NTPC



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Sl. no	Activity	Owner
Installation		
19	All the equipment required for shot peening	VENDOR
20	Compressor terminal connection	VENDOR
Coil Cutting		
21	Removal of Insulation at Finish SH rear outlet term Tubes	BHEL
22	Removal of Insulation in Cross over Tubes	BHEL
23	Removal of Insulation at Finish SH front outlet tubes above Roof.	BHEL
24	Based on the Quality of Insulation additional supply of Insulation to be planned	BHEL
25	Cutting of crossover and Term Tube as per the sketch.	BHEL
Process parameter Establishment-Test Sample		
26	Shot Peening of First Coil	VENDOR
27	Cut a sample and do the lab test for verification	VENDOR
28	Notification TO NTPC for Inspection/ Witness	BHEL/GE
29	Witness of test result	BHEL/GE/NTPC/VENDOR
30	Clearance for shot peening	BHEL/GE/NTPC
Shot Peening for all S40 coils		
43	Shot peening of coils inc. Almen strip verification using established process parameters	VENDOR
44	Cleaning of Coils after Shot peening and handover to BHEL	VENDOR
45	Fit up conn tubes and weld .(VT, RT, etc per agreed FQP)	BHEL
46	Check and Refix the thermocouple.	BHEL
47	Re-erecting the insulation at Cross over and Finish SH outlet Term Tubes	BHEL
48	Reinstall penthouse enclosure insulation and sheet metal at temporary openings	BHEL