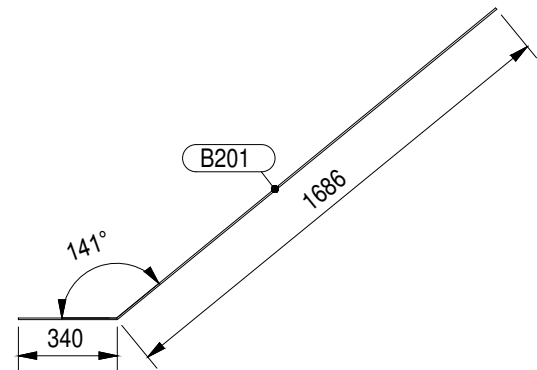
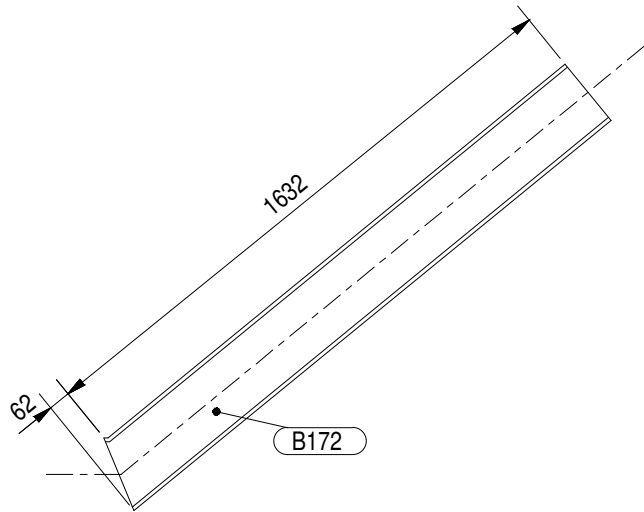
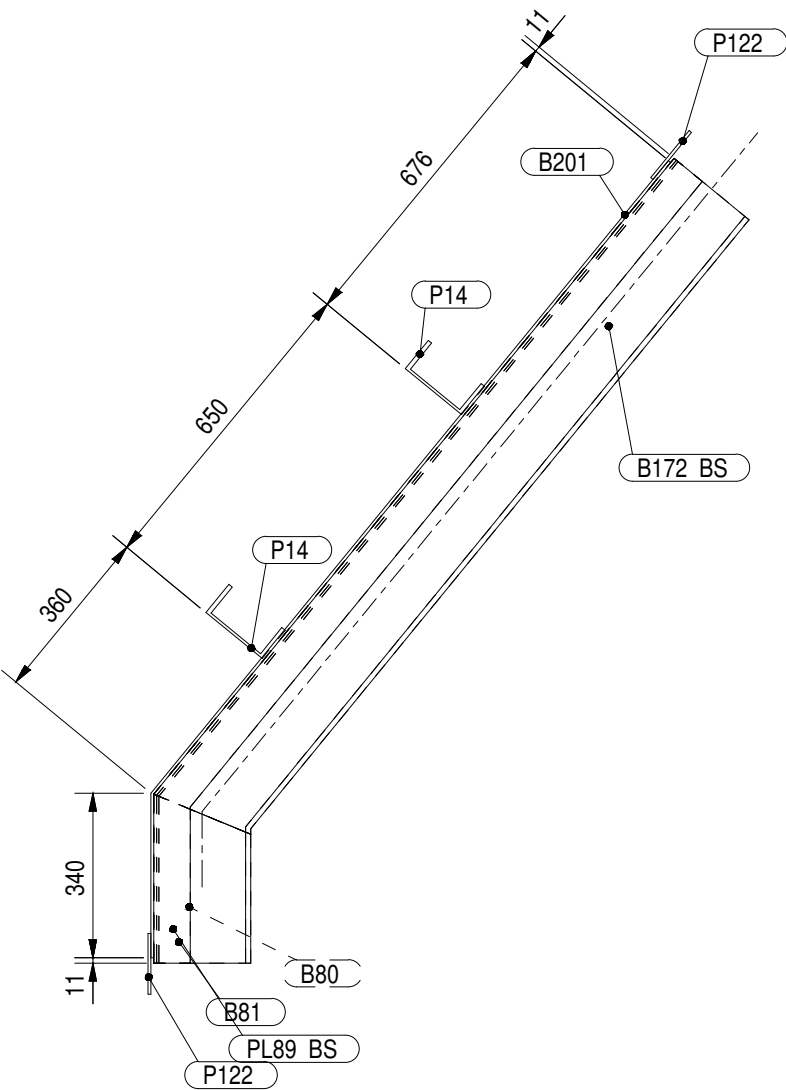
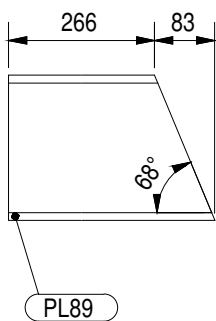
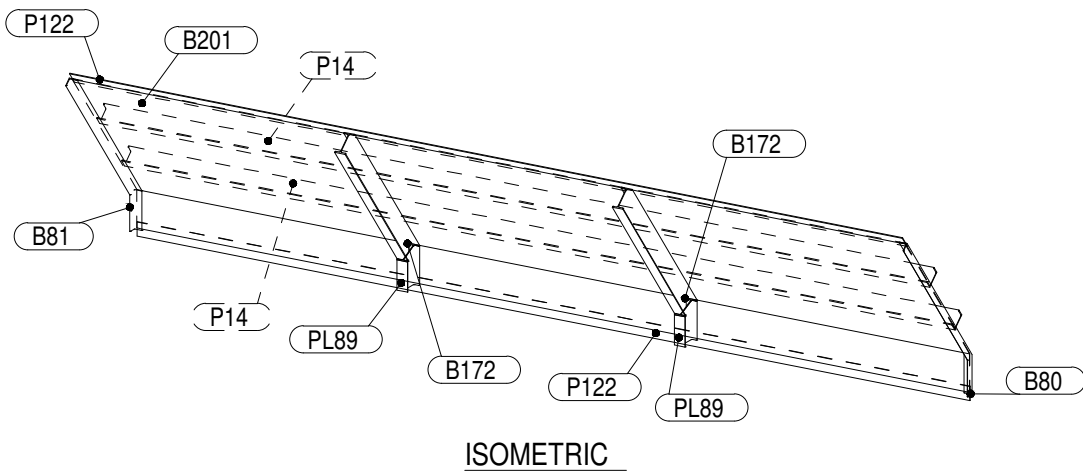
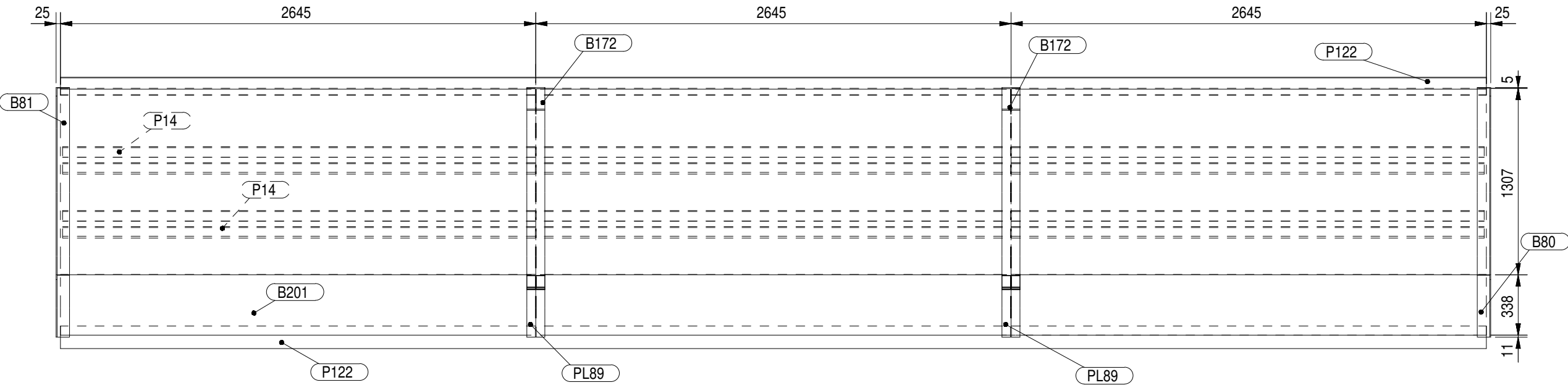
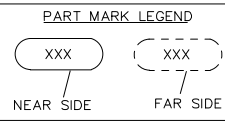


DRAWING NO:
2-48-208-62358

FOR TOLERANCES OF UNTOLERANCED
DIMENSIONS DURING MANUFACTURE
REFER PLANT STD. NO TP 023 0299

- NOTES:**
01. FOR GENERAL NOTES REFER PAGE NO.41 (REF.41) OF DUCT CONSTRUCTION MANUAL
REF. 121 FOR CONSTRUCTION DETAIL
02. THIS DRAWING TO BE READ ALONG WITH ASSEMBLY DRAWING 1-48-208-44748



	1	B80	ISA75X75X6 2043			ITEM NO	150130050000	A/C/P	UNIT	13.892	GS	ZONE
						VAR NO	IS2062E250A			QUANTITY		
	2	B81	ISA75X75X6 2043			ITEM NO	150130050000	A/C/P	UNIT	13.892	GS	ZONE
						VAR NO	IS2062E250A			QUANTITY		
	3	B172	ISMB200 1395			ITEM NO	150090120000	A/C/P	UNIT	35.425	GS	ZONE
						VAR NO	IS2062E250A			QUANTITY		
	4	B201	PLATE 6 7935.0x2021.0			ITEM NO	152110920000	A/C/P	UNIT	756.307	GS	ZONE
						VAR NO	IS2062E250A			QUANTITY		
	5	P14	ISMC150 7911			ITEM NO	150100350000	A/C/P	UNIT	132.905	GS	ZONE
						VAR NO	IS2062E250A			QUANTITY		
	6	P122	PLATE 6 7935.0x125.0			ITEM NO	152110920000	A/C/P	UNIT	46.718	GS	ZONE
						VAR NO	IS2062E250A			QUANTITY		
	7	PL89	ISMB200 349			ITEM NO	150090120000	A/C/P	UNIT	8.852	GS	ZONE
						VAR NO	IS2062E250A			QUANTITY		
VARIANT NUMBER	S.NO	ITEM NUMBER	DESCRIPTION	STD	DRAWING NUMBER	ITEM NO	MATERIAL CODE	A/C/P	UNIT	UNIT WEIGHT	GS	ZONE
						VAR NO	MATERIAL SPECN			DI		

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

TYPE OF PRODUCT
OR NAME OF
CUSTOMER/PROJECT



Bharat Heavy Electricals Ltd.
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI - 620014

DEPT DUCT
CODE 124

ALL DIMENSIONS
ARE IN MM

PROJECTION
SCALE
NTS

WEIGHT (Kg)
1231.889

REF TO ASSY / OLD DWG

TITLE
ELBOW DUCT WALL

DRAWING NO :
2-48-208-62358

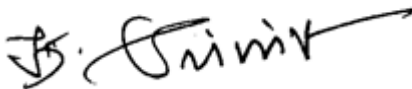
REV

DU NO: 14 DU QTY: 2

BHARAT HEAVY ELECTRICALS LIMITED
Tiruchirappalli - 620 014



BHUSAVAL THERMAL POWER PLANT, 1 X 660 MW
M/s. MAHAGENCO, JALGOAN DIST., MAHARASHTRA
CUSTOMER NO. U6/1727, UNIT-6
PAINTING SCHEDULE

Prepared by	K. Srinivasan Senior Engineer/ Plant Lab		Document No: PL: C3 - PS / 1727
Reviewed by	D. Vijayakumar SM /PE/FB		Revision No: 00 Dated: 11-06-2018
Approved by	A. Santha kumari AGM / Plant Lab		Sheet No. 01 of 11

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RECORD OF REVISIONS

Rev. No	Date	Details of revision	Remarks
00	11-06-2018	New	Prepared in line with MAHAGENCO Bid Specification. No. DG/BSL U-6/2011/ T-1 & clarifications to Bidding Documents.

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
1 PS1AC	Collector & Separator Vessels (Except Internals), Supports 04-147,321,547;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	1	--	--	Synthetic enamel paint (Long Oil Alkyd) to IS2932 (DFT = 20 μm /coat)	2	International orange Shade No: 592 of IS 5	70
2 PSSB	Collector & Separator Vessels Internals & foundation materials 04-347; Machined components and threaded surfaces (Dd items): 07-302,303,309,331,360,361,362,393;09-303,304; 12-306,314,317,324,327,328,344,348,354,393; 17-304,306,319;19-304,306,307;21-602,605; 24-352,803,818,823,827,842;28-700; 32-700; 35-010,190,700; 39-012,700; 41-710;42-700,710; 43-710;45-710;47-710;48-019;65-710;67-710;	SSPC-SP1/ or SSPC – SP3 Solvent / Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=20 μm per coat	2	--	--	--	--	--	40
3 PS 1JT	<u>Buck stays</u> 08-001,003,006,007,111,501,503,901, 08-910;34-100,200,300; <u>Boiler supporting structures,</u> <u>Columns, Girders, Bracings</u> 35-211,212,213,214,221,222,231,232; 35-311,312,321,322,331,332,341,342,351; 35-352,361,362, 381,382; 35-383, 390,441,442; 35-443, 451,452,453; 35-511,512,513;35-521,522,523; 35-531,532,533,993,995;	Blast cleaning to SA2 ½ or SSPC-SP10 (Near white metal) with surface profile 35 μ	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 35 μm per coat	2	--	--	#Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 25 μm per coat # Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μm per coat	2* 1	Light Grey Shade No: 631 of IS5	140

Out of 3 coats of finish paint, *first coat of synthetic enamel finish paint to 25 microns shall be given at shop / subcontracting works. Second coat of synthetic enamel finish to 25 microns and third coat of synthetic enamel paint to 20 microns shall be applied at site.

S. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
3 PS 1JT (continuation)	36-110,150,311,312,313,314; 36-315,316,321,322,323,324,325, 36-326,331,613,993; <u>Galleries, Stair-ways & inter connecting Walkways</u> 36-332,333,334,335, 341,342; 36-343,344,345,351,352,353,354,355; 36-361,362,363; 36-391,392,393,394; 36-395,610,620,740; 38-210,299,310; 38-381,410,510,610,710,993; 39-101,102, 39-141,142,150, 300,301,304,305,306,993; 48-015,115,225,265,385,435,465,485,495; 48-665,911,912;	Blast cleaning to SA2 ½ or SSPC-SP10 (Near white metal) with surface profile 35 μ	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 35 μm per coat	2	--	--	#Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 25 μm per coat # Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μm per coat	2* 1	Light Grey Shade No: 631 of IS5	140
4 PS3	Components >95° C Insulated other than components in Sl.No.6 &8 Ring Headers, Down Comers, Hot air Headers outside the gas path etc. 05-155,227,231,251,327,330,350; 07-110,125,223,231,232; 10-174,178,191,274,278,283,284, 10-285,291;12-178,900; 15-136,178;15-236,278;17-504,807,900; 18-001,010;19-701,702,753,903;21-600; 24-800,805,806,807,808,809,811,815; 32-010,210,810; 33-970; 37-010; 42-020,030,128,150,158; <u>Hot Air:</u> 48-202, 207,208,212,214, 48-222,224,232,234,262,264,267,662,664,667. <u>Flue Gas:</u> 48-372,382,384,386,432,434 48-462,464,482, 484,492,494;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	2	--	--	No paint	No paint	Red oxide	60

Out of 3 coats of finish paint, *first coat of synthetic enamel finish paint to 25 microns shall be given at shop / subcontracting works. Second coat of synthetic enamel finish to 25 microns and third coat of synthetic enamel paint to 20 microns shall be applied at site.

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate Coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
5 PS9	Components >95° C and <400°C uninsulated other than components coming in gas path. 20-511; 24-820,824,835,860,865,867; 42-200,300,358;48-200,915;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr. II DFT 20 μm per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr. II DFT 20 μm per coat	1	Aluminum	40
6 PS10	<u>Components uninsulated other than components coming in gas path.</u> Temp: >400°C & <600°C 09-003,004,005,503; 28-220;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr. I DFT 20 μm per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr. I DFT 20 μm per coat	1	Aluminum	40
7 PS2	Loose tubes, SH, RH & Eco. coils, 11-074,078,374,378,406,416,467, 11-487,606,608,684,694,716,718, 11-767; 11-769,787,791,916,918,967,969,987,991; 12-184,187,368,405,514,515; 12-524,544,554,803,805;12-852,903,914,917; 12-924,927,928,944,948,954,968; 16-079,201,202,203,270,379; 19-402,802,814,824,884; 19-914,924,984;	SSPC – SP2 or SSPC – SP3 Hand tool / Power tool cleaning	Red Oxide Zinc Phosphate Dip coat primer to PR: CHEM: 09 – 03 DFT=35 μm per coat	1*	--	--	No paint	No paint	Red Oxide	35

*-In lieu of dip painting, 2 coats of brush painting of Red oxide Zinc Phosphate primer to a coating thickness of 60 μ is also permitted in line with Sr.No.9.

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate Coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
8 PS1A	Miscellaneous casing sheets, fuel piping, duct plates, expansion joints and coal handling items 07-409,431,460,461,462,502,503,531,560; 12-906,907;21-601,604,700; 24-350,700,804; 24-817,822,825,826,836,837,840; 24-841,855,950,955,960; 30-219,233,234,235; 36-611, 621; 38-611; 39-302; 41-350,390,500; 42-001,002,005,010,046,065,070; 42-120,152,154; 42-157;43-004,005,104,105,200;45-200,801; 45-802,804,805,858;47-261,263,858; <u>Cold Air</u> 48-012,014,018,112,114,141; <u>Tempering Air:</u> 48-142,144,145,204,205; 65-736;67-204,272,276,283,801,802,803; 95-088,089,091,485;96-186;97-585,591,592; Handling equipments: 99-099,100,300,400,600;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μm per coat	2	Smoke Grey Shade No: 692 of IS5	70

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
9 PS3	Components >95° C coming in the gas path, Headers, Commissioning Spares & erection Materials, Miscellaneous materials etc., 05-137,147;06-400,401, 434,437; 06-451,453,455,500,501,731,732; 06-734, 737,741,744, 747,751,752; 06-753,755;07-315,316,318,423,993; 10-182,183,184,185;11-408,491; 12-850,993; 17-506;19-763,783,793,850,851,852,853; 20-998;24-993; 30-215; 30-103,223,224; 31-010,104; 34-390,400,500; 35-111,112,121,122,130,140,150; 36-130,327;42-858; 48-993;65-200;67-200;97-282,590; 20-988;21-987,988;24-987,988; 24-989;41-988;42-988;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	2	--	--	No paint	No paint	Red oxide	60
10 PS6	Hand rails and posts, ladders / rungs 34 - 820,850; 35 - 821,822, 823,851; 36 -820,851,852,853; 38 - 820,850;39 - 820,850; Floor Grills, Guard plates 34-810;35 -811;36-811,812,813,814; 38 -810;39 – 810;	Acid pickling to SSPC-SP8	Hot dip Galvanizing to a coating weight of 610 g/m ² (minimum) Refer Notes given below **							

Notes **: Guard plates, Hood Ladders, Stringer channels, angles and plates shall be painted as per painting scheme prescribed in Sl. No: 03

PAINTING SCHEME FOR VALVES

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μ m (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
11	Cast carbon steel valves (Conventional) Cast alloy steel valves (Conventional) All API valves, QCNRV, SV & SRV Silencers, 24-885; 21-800,825; Safety valves & ERV 21-850; 24-880,881;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr. I/DFT 20 μ m per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr. I/DFT 20 μ m per coat	1	Aluminium	40
-	Forged valves	Chemical cleaning	Phosphating to a coating weight of 1500 mg per sq.ft.	--	--	--	--	--	--	--
12	Soot Blower components (Outside surface – shell) 20-051,054,201,204,794,962;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μ m per coat	2	--	--	Syn. Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μ m per coat	2	Verdigris Green Shade No. 280 of IS5	100
PS 1AS	HP / LP system	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr.I 20 μ m per coat	2	--	--	--	--	--	40

Sl.No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
13 PS15	For CLH & VLH* PGs 07,08,12,17,19,21,24,47,48 &80 07-402,403,405,505;12-506; 17-904,906,919; 19-506,507,904,905,906,907; 24-351,353,810; 48-206,395;	Abrasive blast cleaning to Sa2½ 35- 50 μm	Epoxy zinc rich Primer to IS 14589 Gr II % VS = 35(min)	1 DFT =40 μm Per coat	--	--	Aliphatic acrylic poly-urethane paint % VS = 35(min)	1 DFT= 30 μm Per coat	Phirozi blue Shade No. 176 of IS 5	70
14 PS8A	Components >95 C & < 150 C, un-insulated Fuel pipes 47-269;	SSPC-SP3/ Power Tool Cleaning	General purpose Aluminium paint to IS 2339 DFT= 20 μm per coat	1	--	--	General purpose Aluminium paint to IS 2339 DFT= 20 μm per coat	1	Aluminum	40
15 PS 5B	All Columns below '0' level (embedded in concrete) PGs 34, 35,36,38 39	SSPC-SPI/ or SSPC – SP3 Solvent / Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=20 μm per coat	2	--	--	--	--	--	40

*- For components other than CLH & VLH, Painting scheme shall be as given in Sl. No. 8.

NOTES:

1. Rust Preventive Coating should be given on HSFG Bolt and nut threads.
2. All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, Sleeves, machined surfaces and retainers shall be coated with Temporary Rust Preventive Fluid and during execution of civil works; the dried film of coating shall be removed using organic solvents.
3. Ground shade/ colour of Finish paints & identification tag/Band for equipments, pipings pipe service, boiler supporting structures and other boiler components shall be followed.
4. Refer respective engineering document for all sub-vendor items not covered under this document.
5. No painting is required for Stainless Steel, non-ferrous & galvanized components. Abrasive blast cleaning to SSPC-SP6 (Sa2) shall be done to prepare the surfaces of hot worked pipes prior to application of primer.
6. Wherever inside surfaces of components under PGMA 48 – XXX & others, need protection till erection, two coats of Red-oxide zinc phosphate primer paint to IS12744 to a DFT of 60 microns followed by 1 coat of synthetic enamel paint to IS 2932 – shade smoke grey shall be applied, after blast cleaning. For items meant for spares and subcontracting where no further processing is involved, the painting scheme selected shall be the same as that of similar product configuration/ description.
07. The Temporary Rust Preventive coating that already been applied on any components, tubes, pipes etc., shall be visually inspected for good adherence. If the coating is intact, direct coating of alkyd based red oxide paints over the coating is permitted. In case the coating has peeled off over a large area, the coating is to be removed by suitable solvents / heating to 350 –400 °C for an hour before primer paint application –but, in this case, it should be ensured that the minimum surface cleanliness required for primer paint application shall be SSPC – SP2 (equivalent – Hand Tool cleaning).
08. In components, wherever plates / sheets of thickness less than or equal to 5 mm and rods of <25mm/tubes/drain pipes are used, power tool / hand tool cleaning to SSPC – SP3 shall be followed and the painting shall be done as described in Sl.No.8.
09. For all commissioning components-erection materials (xx-993) two coats of Redoxide Zinc Phosphate Primer shall be applied to meet the temporary protection till erection, after power tool cleaning. This painting Schedule is valid for only Customer No: U6/1727- 1X660 MW BOILER for MAHAGENCO BHUSAWAL TPP.
10. Touch-up painting of damaged areas shall be carried out as per clause no. 15.1 of Page. No. 80 of 555 of Section – 4, Volume – II, master specifications of bid specification no. DG/BSL U-6/2011/ T-1.
11. All components covered under different PGMA's are to be painted in case any component is left out, the same shall be deemed to be included under the relevant section based on paint logic approved.
12. For very small components like clamps etc. Sl.no.8 shall be followed with power tool cleaning.
13. Only weldable primer 2 coats to a DFT of 50 μ (2x25 μ) shall be applied on both external and internal surfaces within 50mm from the end of the component to be welded subsequently at site. At those locations no other paint shall be applied. All small components (less than 300x300 mm in dimension) shall be given only weldable primer.
14. DUs coming under Constant Load Hangers (CLH)/ Variable Load Hangers (VLH) shall be painted as per the system - PS 15 indicated in Sl. No. 13 of the table. However, for DUs other than CLH/VLH, the painting shall be as per Painting Scheme PS 1A indicated in Sl. No. 8 of the table.
15. For internal protection of Pipes, tubes, headers and other pressure parts, Volatile Corrosion Inhibitor (VCI) pellets shall be put (after sponge testing/ draining/ or drying) and subsequently end capped. The dosage of VCI pellets shall be approximately 100 g/ Cu.m. For tubes typically 4 – 5 tablets per end are to be put. For C & I items the dosage of self-indicating Silica Gel (colourless) shall be 250 g/ cu.m. (About 2 to 3 bags weighing approximately 100 grams each). VCI pellets shall not be used for stainless steel components and its composite associates.
16. All threaded components of spring assemblies and turnbuckles shall be galvanized and achromatized to 15 microns minimum thickness.
17. Soot blower components i.e Valve head assembly having high surface temperature (> 200 and <600 deg. C) shall be applied with HR aluminium IS13183 Gr.II paint (up to 400 deg.C) and Gr.I paint (up to 600 deg.C)
18. Handrails of PGMA under Sl. No. 3 need to be galvanized in line with scheme for handrails (i.e. Sl .No. 10). For chequered plates having thickness <=5mm, surface preparation can be power tool cleaning to St3 and painting shall be in line with Sl. No. 8.
19. It is mandatory that for finish coat each layer shall have a permanent DFT and free from any paint defects like sags, wrinkles etc. Total DFT of a component correspond to respective painting scheme has to be ensured.
20. Inside surfaces of fabricated structure (e.g. Box type column) shall be painted with two coats of red oxide primer paint during fit up stage.
21. Painting of bunker structures to be in line with painting scheme of supporting structures (Sl. No. 3).

Details for paint procurement & application purposes

Sl.No.	Generic nature of paint	Theoretical Covering Capacity Sq.m per Litre.	No. of pack	Volume solids, % (min)**	DFT in microns per coat (approx.)	Shade	Shade No. to IS5	Mode of appln.	Over coating interval, Hrs.
1	Epoxy Zinc rich primer to IS14589 Gr.II	8	2	35	40	Grey	--	Spray	24
2	Aliphatic acrylic polyurethane paint to IS 13213	12	2	40	30	Phirozi – Blue.	176	Spray	24
3	Heat resistant Aluminium paint to IS 13183 Grade I/II	10	1	-	20	--	--	Brush / Spray	24
4	Red oxide zinc phosphate primer paint to IS 12744	10	1	--	30	-	--	Brush / Spray	12
5	Red oxide Zinc Phosphate Dip coat primer paint to PR: CHEM: 09-03	10	1	--	35	--	---	Dip	12
6	Long oil alkyd synthetic enamel finish paint to IS2932	10	1	--	20	Reqd. shade	Corrpdg. Shade no.	Brush / Spray	12
7	Temporary Rust preventive fluid to PR: CHE: 09 – 04	10	1	--	20	--	--	--	12
8	General purpose Aluminium paint to IS 2339	10	2	--	20	Aluminum	--	Brush	12

Brush painting is accepted, if recommended by the Paint suppliers. The covering capacity of paints specified is only approximate. The paints and Rust Preventive fluid shall be procured from BHEL's approved suppliers. ** Values are indicative.

BHEL		SQP:NP:01/04	Page 1 of 17
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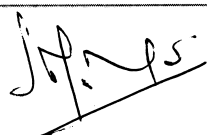
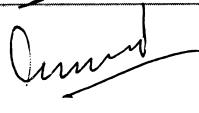
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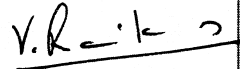
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STANDARD QUALITY PLAN FOR SQP:NP:01/04

DUCTS & HOPPERS

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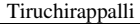
Prepared by	A.FRANCIS
Quality assurance	
REVIEWED BY	SIGNATURE
ENGINEERING (V.SRIDHARAN)	
OUT SOURCING (S.MOHANRAM)	
QUALITY CONTROL (AMITROY)	
QUALITY ASSURANCE (BIKRAMADITYA ROY)	

REV.NO.	DATE	APPROVED BY	SIGNATURE
01	15. 07.96	Sr.Manager/ Q A	V.Ragavendran
02		DGM/QA	C.R.RAJU
03	1.12.2005	DGM/QA	C.R.RAJU
04	18.07. 2011	AGM/QA	V.Ravikumar 

Proprietary Data – For Internal Use only

BHEL		SQP:NP:01/04	Page 2 of 17
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Rev. No.	Clause No.	Details of revision
00	--	This document consolidates all requirements of various previous SQPs.
01	--	Totally revised incorporating all amendments issued and latest TDC numbers.
02	--	SIP nos updated.
	3.2 in Note 3	Tolerances for depth of section revised in line with AWS D1.1 (2002 edition)
	4.1.3 & 4.1.4 in Note 4	Modified to incorporate Amendment A3 to rev.01
	4.2.4	deleted under Fillet welds and included under Butt welds as 4.1.7
	4.3.4 in Note 4	Added to incorporate Amendment A4 to rev.01
	5.1 (Vi) in Note 5	Added to incorporate Amendment A2 to rev.01
	5.2.3 in Note 5	Out of straightness revised in line with AWS D1.1 (2002 edition)
	5.2.5	Revised in line with AWS D1.1
	P5 in Note 6	Modified to incorporate Amendment A1 to Rev 01
03	2.2	Additional inputs added.
	3.1	Additional character added in trial assy.
	Note cl. No.1	New norms added for spliced joints with extra clarity.
	Note cl. No 2.5,3.1,	
	3.2, 3.3	Extra input added.
	Note cl. No.4.0,4.1.4	Inspection tolerance for
	4.1.7	Ducts/Hopper/Transition/Flanges added during trial assy.
	Note cl. No.5	Pre-qualification for welding.
04	1.0	S-TEN1 Material added.
	Note:3	Trial assy for duct assy classified based on the Note sheet approved by ED Applicable for OS, Non-NTPC). For ACF vendors, it will be reviewed and extended.



STANDARD QUALITY PLAN

BOILER DUCTS & HOPPERS

QP NO.: SQP:NP: 01 REV.: 04
DATE : 18/07/2011
PAGE : 3 of 17

SL. NO.	COMPONENT AND OPERATION	CHARECTERISTICS	CL.	TYPE OF CHECK	Quantum of Check	REF.DOCUMENT/ ACCEPTANCE STD.	TYPE OF RECORD		Agency **			REMARKS
								D	M	TPI	C	

[illegible]

 Tiruchirappalli		QUALITY ASSURANCE		STANDARD QUALITY PLAN				QP NO. : SQP:NP: 01 REV.: 04					
				BOILER DUCTS & HOPPERS				DATE : 18/07/2011 PAGE : 4 of 17					
SL. NO.	COMPONENT AND OPERATION		CHARECTERISTICS	CL	TYPE OF CHECK	Quantum of Check	REF.DOCUMENT/ ACCEPTANCE STD.		TYPE OF RECORD		Agency **		REMARKS
									D	M	TPI	C	

2.2	Welding qualifications	New qualification OR Pre qualification Procedure (as below)*	Review of Documents	100%	SIP:NP:07	R		QC	V		Before commencement of elding,
WPS document is to be prepared by contractor (on form E-1 (Front) as per Annexe E of AWS D1.1 M: 2004 Edition Page 334 as applicable for the welding process to be used) and submitted to A I A / QC (BHEL) for review & approval .. (See Notes - 5 for guidance on welding parameters)											
2.3	Weld Inspection	Personnel	Review of Documents	100%	SIP:NP:07	R		QC	V		
		Weld size & shape Weld quality	Visual LPI	100% 10% #	Drawing / SIP:NP:06 BHE:NDT:PB:PT1	- R		QC QC	V		# 100% for SS
3.0	FINAL INSPECTION	Leak test *	Kerosene leak test	100%	SIP:NP:05	R		QC			*For single side welds
3.1	Trial Assembly	Orientation , Dimensions Match marks	Measurement	100%	Drawings Note - 3	R		QC			
3.2	Painting and Preservation	Paint finish coat thickness	Visual Measurement	-- Random	SIP:PP:22	-		QC			
3.3	Identification	WO No., DU No. Match marks Flow direction for aerofoil	Visual		Drawings Fig: 1,2,3 (as applicable)	-		QC			

NOTES

- 1 The following are the norms applicable for splicing through additional joints:. Any deviation from the same shall have the approval of Engineering.

For **stiffeners** up to 4 Meter length : Not permitted.

For stiffeners above 4 Meter length, permitted within 1/5th and 1/3rd of length from ends.

Duct walls : As below

<u>Area in Square meters:</u>	<u>Maximum No of joints.</u>
Up to and including 2.....	NIL
Above 2 upto and including 5.....	2
Above 5 upto and including 10.....	4
Above 10 upto and including 15.....	6
Above 15 upto and including 20.....	8
Above 20 upto and including 25.....	10
Above 25.....	15

- Welds joints shall be back gouged and 100% LPI tested before welding from second side.
- Welds joint to stiffener distance shall be 50 mm and above .
- Weld joints shall be ground flush at stiffener seating locations.
- Joints parallel to the bend shall be at least 100 mm away from the bend.

- 2 For aerofoil of flow meter no vertical joints are permitted in the inlet region (leading edge of flow meter).Joint can be permitted beyond 250mm from tapping points on downstream side. Refer figure 1.

- 2.1 If required horizontal joints, shall be permitted beyond 250mm from the tapping points.

- 2.2 The weld reinforcement on outside surface of aerofoil shall be ground flush so as to avoid any resistance to flow.

- 2.3 For despatchable rectangular / square wall of size 2M x 2M or smaller, smallest dimension of any piece shall be 300mm. For despatchable rectangular /square wall of size greater than 2M x2M, the smallest dimension shall be 500 mm. However in case of transition, hopper and chimney walls, for triangular and trapezium shapes the smallest dimension can be Zero.

- 2.4 "T" joints can also be permitted in layout / cutting plan.

- 2.5 Butt welds on divider plate & guide vanes and aerofoil shall be free from abrupt projection.
Weld reinforcement upto 2 mm is permitted.

3.0 Trial Assembly

- 3.1 To ensure correct matching during site erection/assembly, Trial assembly will be carried out at vendor works as below

- 3.2** .Trial Assembly is waived off for the following duct shapes.

- a) Straight duct with out internal Truss
- b) Straight duct with internal Truss.

BHEL		SQP:NP:01/04	Page 6 of 17
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- c) Elbow duct with out guide vane.
- d) Elbow duct with out internal truss.
- e) T-Duct with equal opening
- f) T-Duct with unequal openings.
- g) Bend duct with out truss.
- h) Transition duct on one plane only.

Dimension check on layout can be ensured a close tolerance Of 2mm.

3.3; Trial assembly of Elbow duct, Tee bend & Y- ducts with Guide

Vanes ,Truss and partition plates are to be inspected/assembled as follows.

- a) The ducts with a height less than 6mtr shall be trial assembled completely .However the duct above 6 mtr can be assembled except the roof and the roof wall shall be trial assembled and checked on the ground.



- 3.4 Economiser out let ducts shall be trial assembled .A portion of the roof which may be difficult to assemble . A portion of roof height above 6 mtr , which is difficult to assemble can be checked on layout/ ground with prior written approval from BHEL/QC.
- 3.5 All other ducts such as T Duct,Hopper ,Transition non-symmetrical on axis or having bent plate corner arrangement and Aerofoil/Ventury ducts (flow meter duct) shall be fully trial assembled.
- 3.6 The schematic diagrams of the ducts of different configuration are enclosed for reference in the annexure –A.
- 3.7 Wherever trial assembly is waived off the tolerance as indicated in Note 4.1.8 of the this SQP (latest)shall be followed.
- 3.8 Chimney shells shall be trial assembled with suitable identification
- 3.9 Safety and stability is to be fully considered for trail assembly position and supporting during trial assembly.
- 3.10 During trial assembly, all segments shall be assembled together using temporary bolts, tack welds or other suitable means and held in position. For large and very odd shaped ducts, multiple stages of trial assembly is permitted after obtaining approval from Engineering and Quality.
- 3.11 All critical dimensions shall be checked and recorded during trial assembly. The tolerances given in the drawing shall be followed.
- 3.12 Before dismantling the assembly, the match marks shall be clearly punched, stenciled and bordered with white paint as shown in figure 2.
- 3.13 The manufacture and checking of duct walls shall be done on floor reasonably leveled and free from significant undulations.
- 3.14 All sides of ducts (top, bottom,& vertical sides) indivudally shall be assembled on level surface.
- 3.15 All profiled items (walls,shapes,angles&vanes) are to be checked by temp plate/layout. Other walls shall be checked by direct measurement.
- 3.16 After stiffener / flange welding the maximum gap between the temp plate and the bent wall profile (at the mid region) shall be 2mm.
- 3.17 All the profiled items are to be stiffened with stiffeners for retaining the profile

during transportation. Where profiling is shown in drawing such walls shall be checked on lay out.

- 3.18 The bent portion /corner angles to be welded to such walls shall be checked with templates/layout for profile prior to fit up on walls.
- 3.19 The vendors would also be informed that should there be any deviations noted during the site assembly , the vendors will be responsible for rectifying the same at site.

4.0 INSPECTION AND TOLERANCES (DUCTS / HOPPERS / TRANSITIONS) – when trial assembled as per Clause 3.0

- Length / width / diameter : ± 2 mm / meter (limited to 5 mm) of nominal dimensions
- Diagonals : @ of 1.5 mm / meter (limited to 5 mm) of nominal value.
- Circularity(at duct ends): @ of 2mm / meter (limited to 10 mm) of nominal diameter.
- Square ness (duct end) : @ 2mm/Mtr (limited to 10 mm) of nominal dimension –Fig 3
- Length : Limited to ± 5 mm variation (length up to 5 meters) and ± 10 mm for length above 5 meters.
- Flatness of flange face : Within 2 mm.
- Twist (in sections) : @ of 3 mm / meter (limited to 10 mm)
- Arm length of elbows : Within 2 mm. Refer figure 3.
- Center offset (figure 2.) : @ of 3 mm / meter (limited to 10 mm) between duct. openings
- Waviness (Duct walls) : @ of 6 mm / meter (limited to 10 mm).
- Height (Hopper/Chimney): ± 5 mm
- Stiffener shift on walls : ± 10 mm
- Guide vane shift : ± 5 mm
- Elbow arm length : ± 2 mm / meter (limited to 3 mm) - Fig: 3 b
- Center offset in transition : 3 mm / meter height (limited to 10 mm max) - Fig :3c (on top, bottom openings)
- Flow meters profile : 2 mm gap (maximum) with a template.(Fig:1)

4.1 Flow meters tolerances:(Unless otherwise specified in drg.)

- 4.1.1 Profile : 2 mm gap (maximum) with a template.(Fig:1)
- 4.1.2 Throat distance : within ± 2 mm.
- 4.1.3 The position of metering holes w.r.t. leading edges shall be within ± 2 mm.
- 4.1.4 Out of straightness of aerofoil(across the flow direction) shall be within 1mm/metre limited to 3mm max on the curvature side (flow entry)
- 4.1.5 Metering tubes shall be assembled separately outside maintaining the distance of tapping points and matched with tapping points on aerofoils.
- 4.1.6 Assembled tubes shall be kerosene leak tested for leak tightness and fitted with profile.

4.1.7 FLANGES Inside dimensions (rectangular / square / circular flanges) – when trial assembled

<u>Nominal dimension</u>	<u>1000 & less</u>	<u>above 1000 upto 3000</u>	<u>above >3000</u>
<u>Permissible deviation in mm</u>	- 0.0 to +1.0	- 0.0 to +2.0	- 0.0 to +4.0
Diagonals variation	: @ of 1.5 mm / meter (limited to 5 mm)		
Circularity in circular flange	: @ 2mm / meter (limited to 10 mm) of the nominal dimension..		
Center line of bolt holes	: Shall be parallel within ± 2 mm. (in opposite faces)		
Pitch of holes	: Individual - within ± 1 mm.		
	Cumulative (rectangular flanges) - with in ± 2 mm.		
Holes size	: With in ± 1 mm. (Only drilling permitted)		

4.1.8 INSPECTION AND TOLERANCES (DUCTS / HOPPERS / TRANSITIONS) – Loose walls
Wherever trial assembly **is not required** as per clause 3.0

- Length / width : ± 2 mm / meter (limited to 3 mm) of nominal dimensions
- Diagonals : @ of 1.5 mm / meter (limited to 5 mm) of nominal value.
- Flatness of flange face : Within 2 mm.
- Waviness (Duct walls) : @ of 6 mm / meter (limited to 10 mm).
- Stiffener shift on walls : ± 5 mm
- Center offset in transition: 3 mm / meter height (limited to 10 mm max) - Fig :3c
(on top, bottom openings)
- Corner angle tolerance : ± 2 mm from nominal value
- Flange face to face : ± 0 / -2 mm from nominal value.

4.1.9 FLANGES Inside dimensions (rectangular / square) – Loose walls

Wherever trial assembly **is not required** as per clause 3.0

<u>Nominal dimension</u>	<u>1000 & less</u>	<u>above 1000 upto 3000</u>	<u>above >3000</u>
Permissible deviation in mm	- 0.0 to +1.0	- 0.0 to +2.0	- 0.0 to +4.0
Diagonals variation	: @ of 1.5 mm / meter (limited to 4 mm)		
Pitch of holes	: Individual - within ± 1 mm. Cumulative - with in ± 2 mm.		
End holes	: To be slotted (2 x D)		
Holes size	: With in ± 1 mm. (Only drilling permitted)		

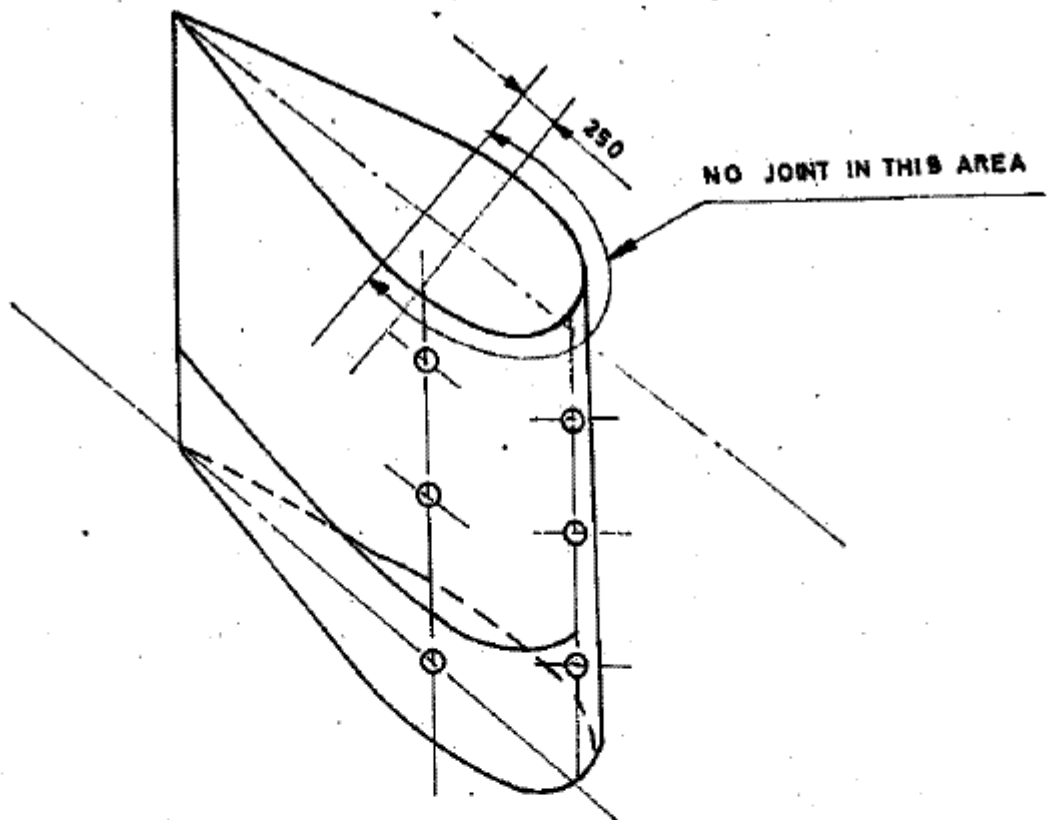
5.0 Guide lines for Pre qualification of WPS (Refer Clause 2.2). Refer to AWS D1.1 for further clarity.) as applicable for welds given in the drawing)

<u>WPS content</u>	<u>Requirements</u>
Electrode selection	E 60xx, or E 70xx for Plate T ≤ 20 mm E 70xx (with 10 deg C Pre heat for joints) for T > 20 mm
Weld groove/ fit up	As per Drawing
Weld width , depth	to be less than drawing weld face width, depth
Weld sizes (Groove , Fillet welds):	As per drawing but not less than the base metal thickness of thinner part T (T = thicker part if E 60xx is used)
Electrode dia (maximum) :	Dia 3.15mm (for Root pass), dia 4mm , (for balance passes)
Maximum current:	As per the recommendation of the electrode manufacturer
Maximum root pass thickness:	3 mm (for Horizontal welding), 4 mm (for Vertical welding and down hand welding)
Maximum filling pass thickness	4 mm .
Maximum fillet weld size when completed in single pass (for each welding position)	Within drawing weld size.

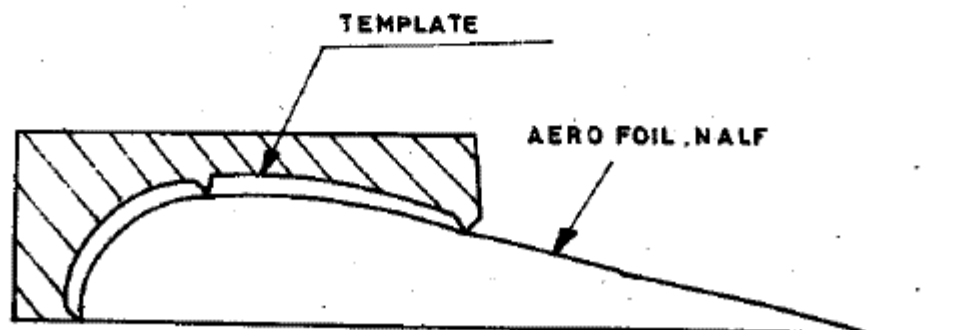
6.0 Surface preparation ,Painting and Identification

- 6.1.1 Temporary cleats, bridge-on pieces shall be removed carefully so as to avoid damage to parent material . Temporary tack welds shall be ground smooth. The completed assembly shall be thoroughly cleaned to remove spatter, slag, rust, oil or grease.

Fig. 1 : Splicing detail of Aerofoil and Profile Template

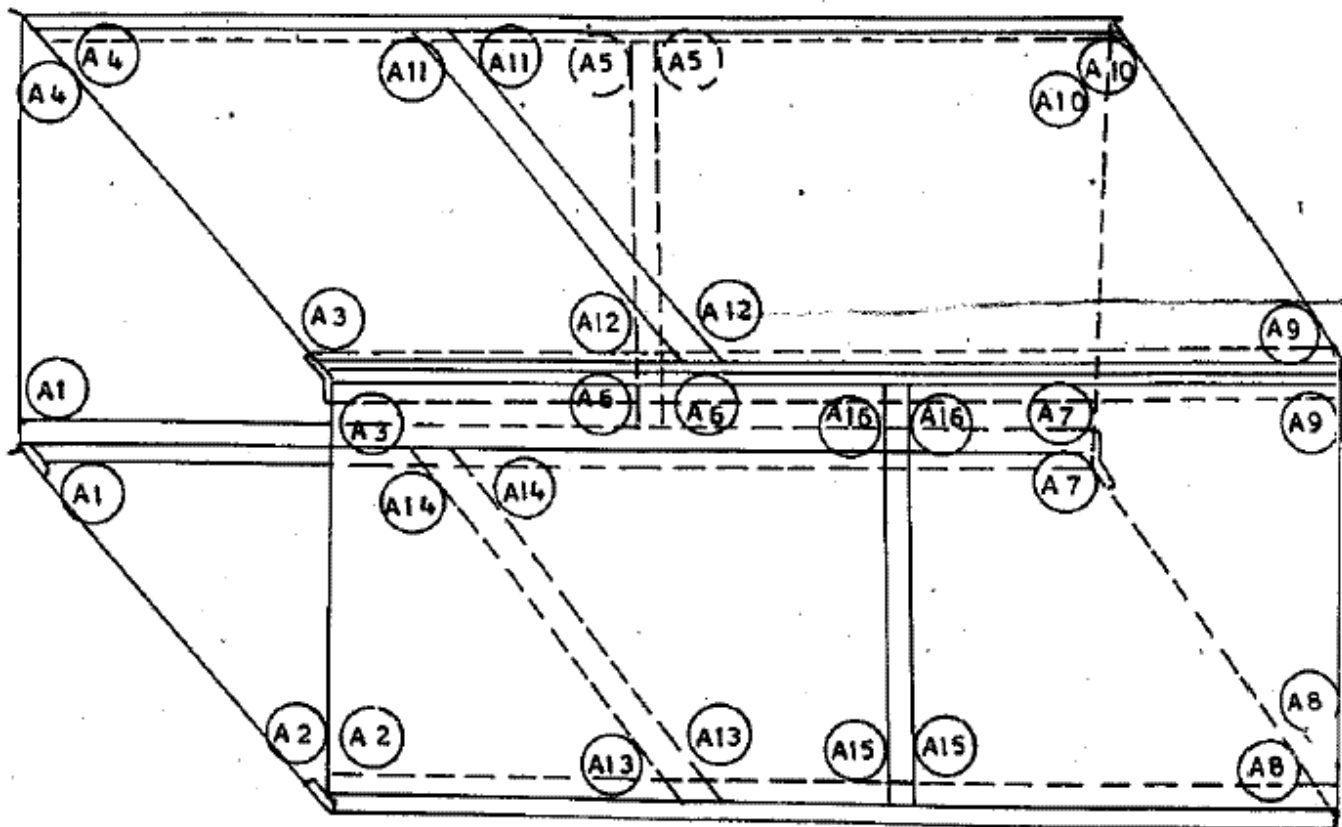


1. NO VERTICAL JOINT IS PERMITTED IN THE LEADING END MARK.
2. HORIZONTAL JOINT SHALL BE 250 MM AWAY FROM TAPPING POINTS.
3. FORMATION OF PLUS JOINTS SHALL BE AVOIDED



4. TEMPLATE SHALL BE MADE FROM 5MM. PLATE
5. VARIATION IN GAP BETWEEN TEMPLATE AND AERO FOIL SHALL BE LESS THAN ± 2.00 MM

Fig-2 : Match marking after trial assembly

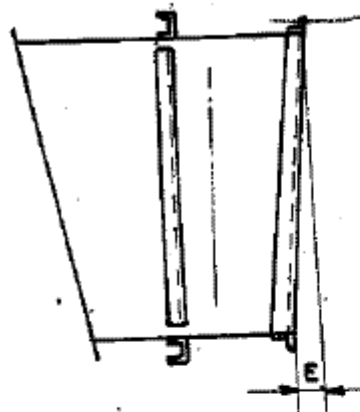


(X) FARSIDE

(X) NEAR SIDE

Fig. 3a, 3b and 3c : Tolerances

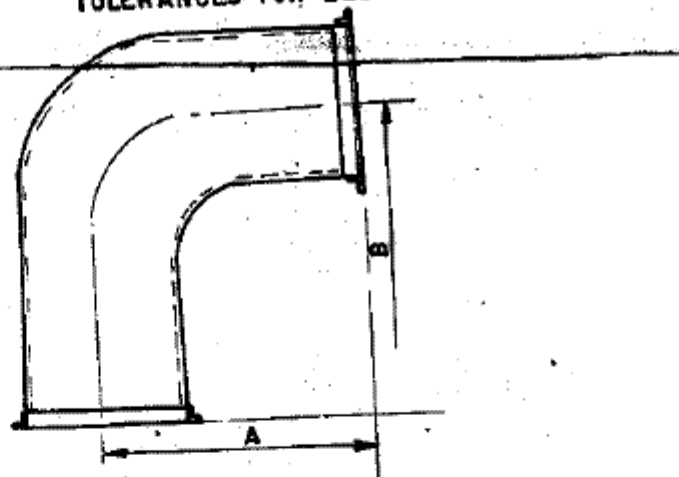
END OUT OF SQUARENESS



END OUT OF SQUARENESS
'E' SHALL NOT EXCEED 2MM
PER METRE OF DIAMETER OR
THE DEPTH OF THE SECTION

3a

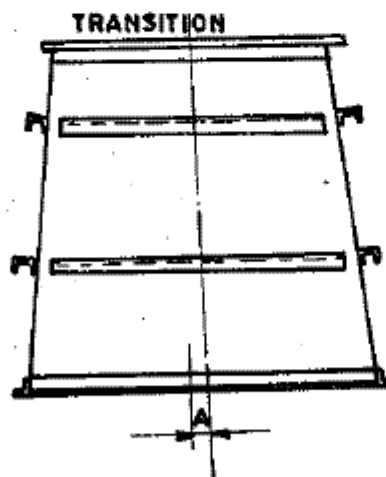
TOLERANCES FOR ELBOW



TOLERANCE ON A : $\pm 2 \text{ MM/M}$ NOT
EXCEEDING 3MM

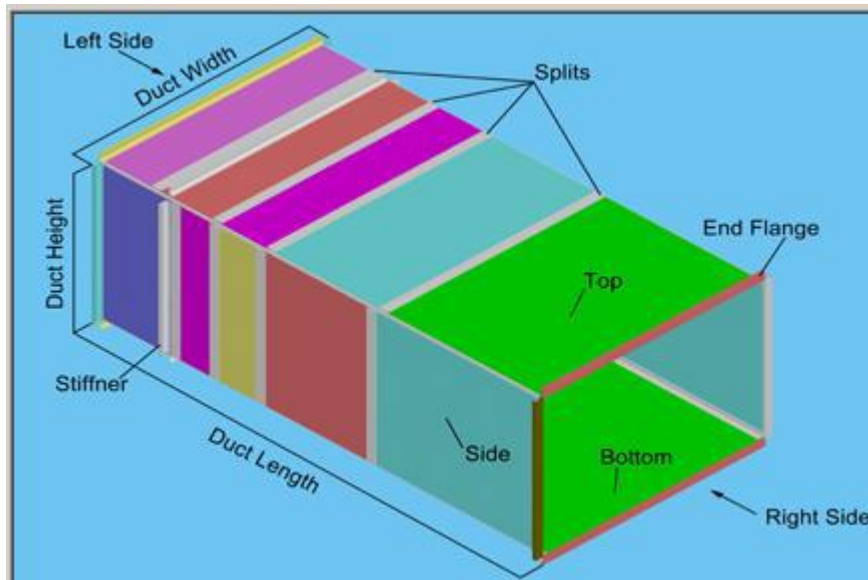
3b

TOLERANCE ON B : 2 MM/M NOT
EXCEEDING 5MM

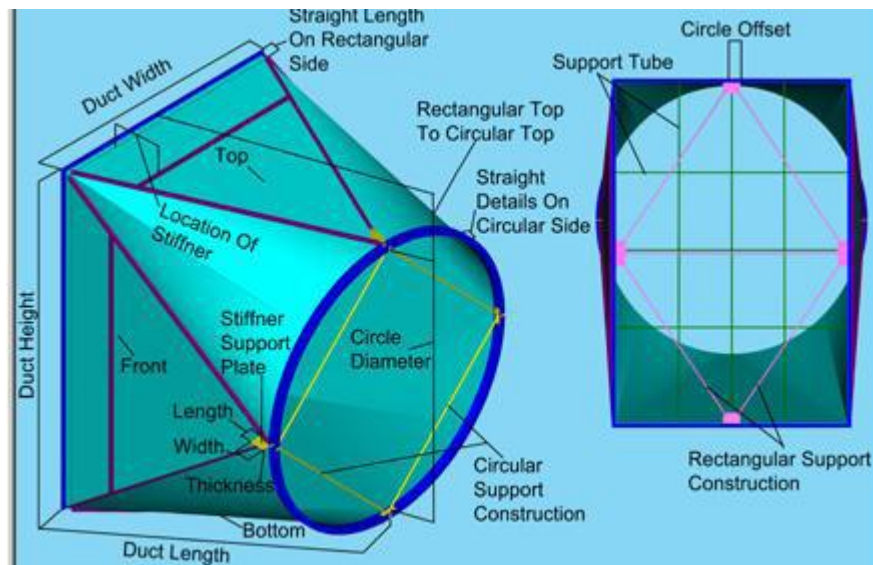


3c. AXES SHIFT 3MM M/OF NOMINAL HEIGHT
NOT EXCEEDING 5MM.

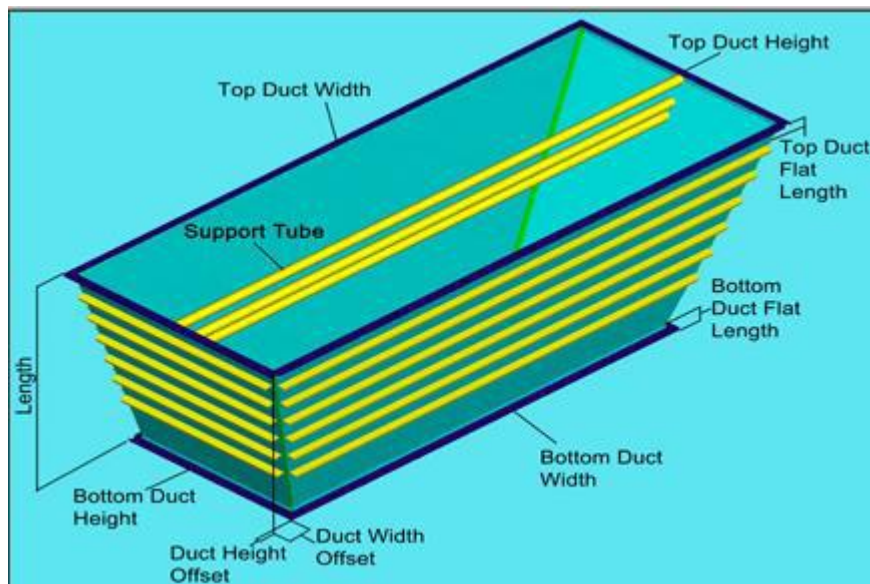
ANNEXURE-A



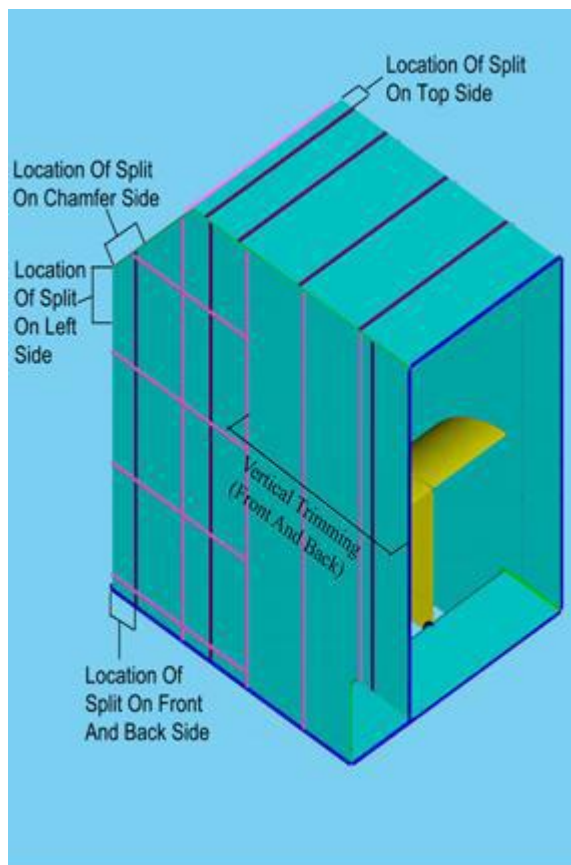
Straight Duct



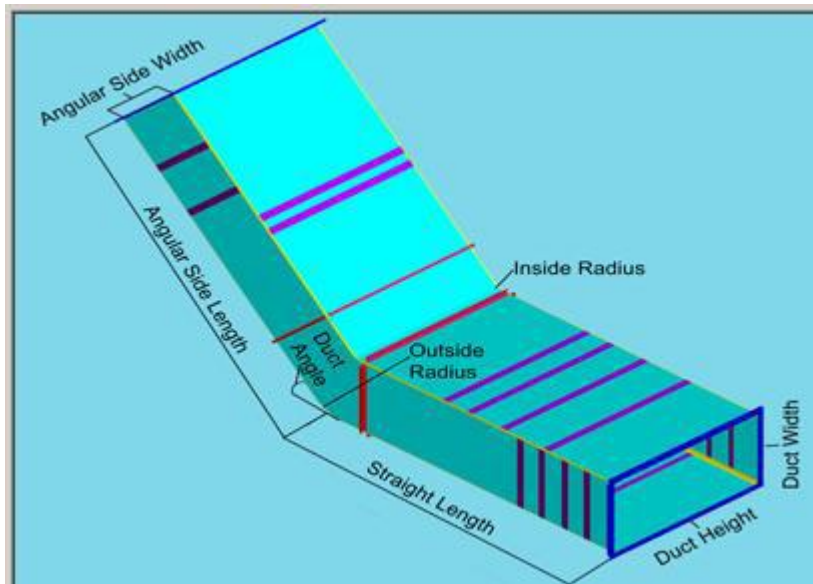
Transition from rectangular to Circular



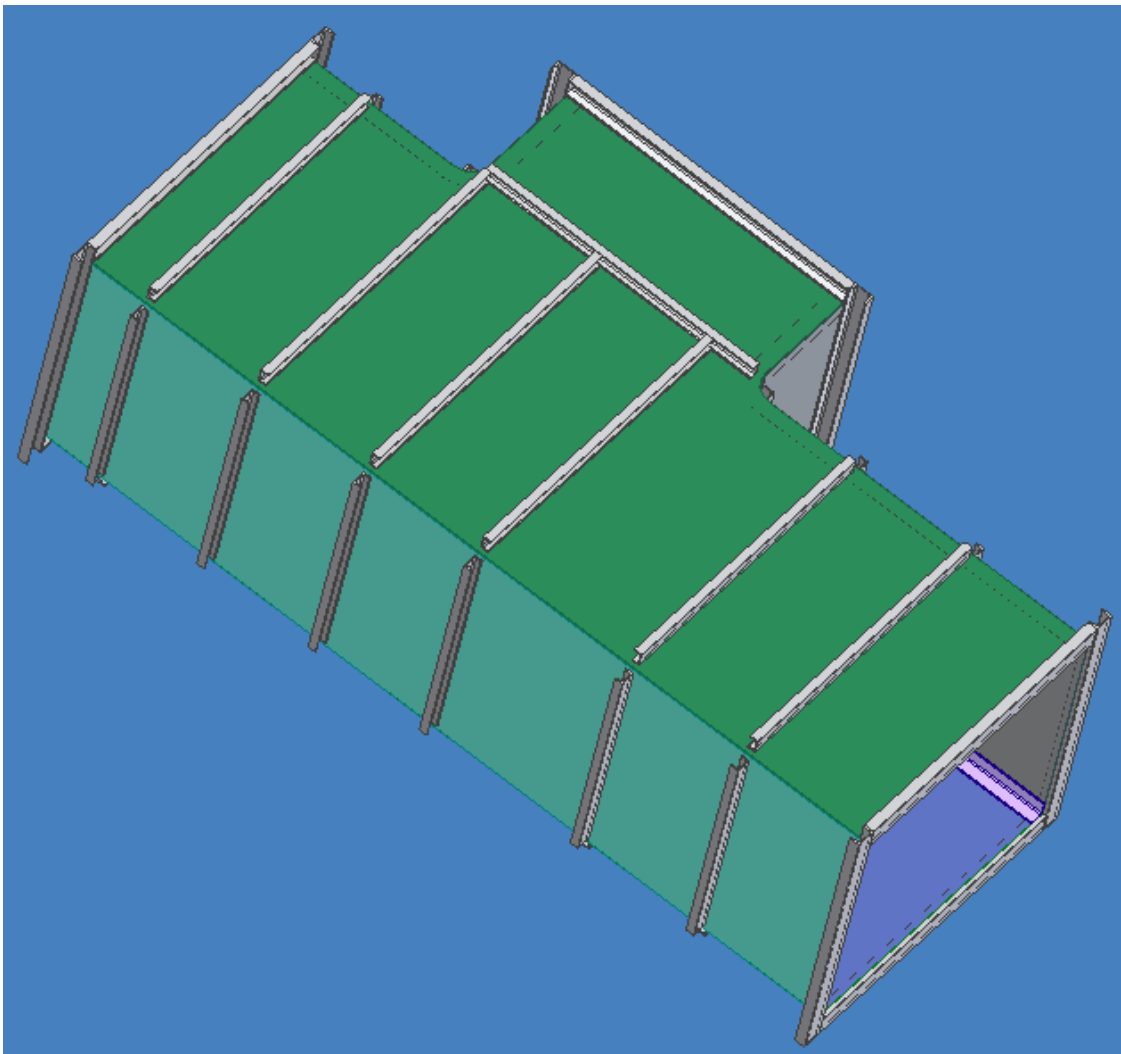
Transition in multiple planes



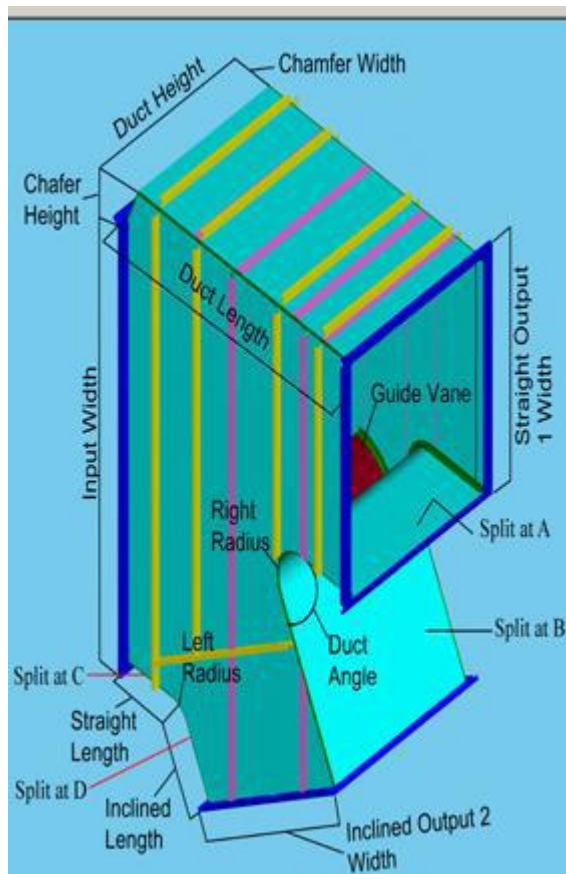
Elbow with guide vane



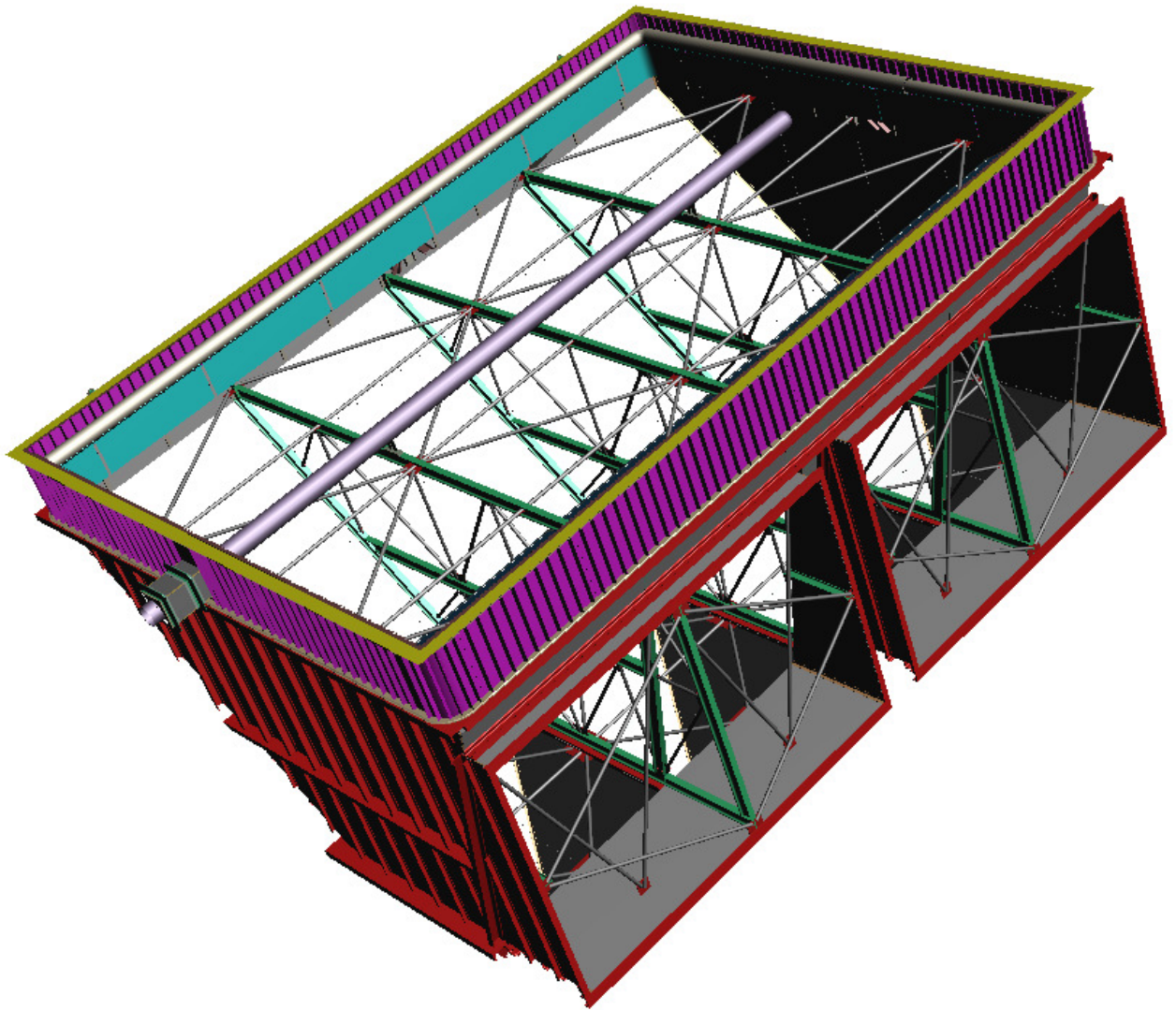
Bend Duct



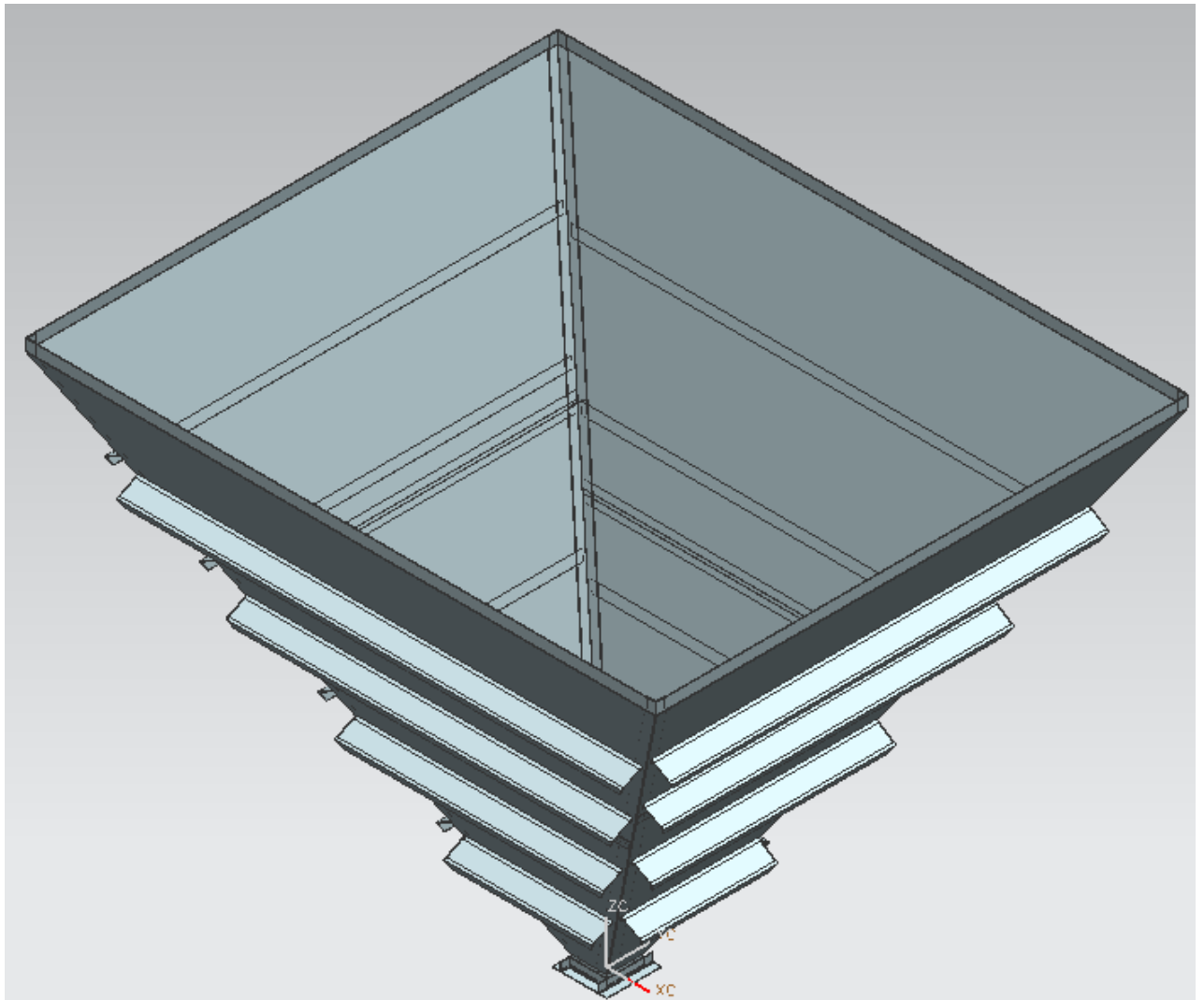
Tee Duct



Y duct



Eco Duct



Hopper Duct