एन टी पी सी लिमिटेड
(भारत सरकार का उद्यम)
NTPC Limited
(A Govt. of India Enterprise)
(Formerly National Thermal Power Corporation Ltd.)
(केंद्रीय कार्यालय नोएडा)
Corporate Center NOIDA

Reference : CC-ENGG-9585-001-110-QVM-G-614 **Date :** 28/03/2024

From : Ranjeet Kumar Jha ADDL. GENERAL MANAGER	**To :** BHEL DELHI SIRIFORT, BHEL HOUSE,P.S.PROJECT MANAGEMENT GRP BHEL NEW DELHI 110049 **Cc :** NKALITA@BHEL.IN

Subject : QUALITY PLANS FOR TOTAL EPC

Please find enclosed following drawings/ documents for necessary action at your end.

Vendor Drg. No. :		PSWR
Orgn. Drg. No.	:	9585-001-110-QVM-G-614
Revision No.	:	02
Drg. Title	:	FIELD QUALITY PLAN FOR ERECTION of ACC
App. Category	:	CAT-I
Release Date	:	28/03/2024

Scan to verfiy

Comments : Approved in Cat-I with minor comments in line with discussions with BHEL.

FIELD QUALITY PLAN

FOR

AIR COOLED CONDENSER
PVUNL PATRATU STPP (3X800 MW) Ph-I

Contract No-01/PVUNL-CS-9585-001-2/NOA-TC

DOC / FQP No.	9585-001-110-QVM-G-614	
REVISION	02	
DATE	20.03.2024	

Issued To:	Issued By
	Shri J M Ganvir AGM(Quality)

इक़बाल अहमद/EQUBAL AHMAD
प्रबंधक (गुणवत्ता & बी.ई.)
Manager (Quality & B.E.)
बी.एच.ई.एल., पा.से.प.क्षे., नागपुर.
BHEL, PS-WR, NAGPUR

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR - WESTERN REGION
NAGPUR - 440001

PSWR-QUALITY

AUTHORISATION FOR DIFFERENT CATEGORY OF CONSTRUCTION / ERECTION CHECKS & NONCONFORMITY

Category ofCheck	Agency	Inspection Authority	Accepting Authority	Nonconformity Disposition Authority
'A' Customer Hold Point	**BHEL**	Erection Engineer & QAE	Head of Erection	ENGG Center/ Head (Quality): PS-Region
'B' Customer Hold Point	**BHEL**	Erection Engineer	Head of Erection	ENGG Center/ Head (Quality): PS-Region
'C'	**BHEL**	Erection Engineer	Head of Erection	ENGG Center/ Head (Quality): PS-Region

Category of Check	Agency	Witness & Accepting Authority	Surveillance By NTPC
'A'	**NTPC**	FQA in association with Executing Engineer.	**Head (FQA)**
'B'	**NTPC**	Executing Engineer	FQA Engineer
'C'	**NTPC**	Executing Engineer	Another Engineer authorized by Head (executing Department)

LEGEND for TYPE OF CHECK:
R – Record Verification, V – Visual Check, P – Physical Check, M – Measurement, T – Test.

Note:

1. Disposition authority for all categories of checks shall be as under: Product nonconformities: BHEL Engineering Center. Process/System nonconformities: BHEL, Head (Quality): PS Region.
2. Wherever log sheet is not called for, suitable record shall be maintained in logbook/protocol.
3. In case of nonconformity, accepting authority shall ensure the disposition of the nonconformity before acceptance, and disposition shall be reflected in the log sheets/protocols.
4. QAE shall witness 'A' category checks. He is also authorized to carry out surveillance in any of B & C category of checks at his discretion.
5. Concerned agencies shall ensure that instruments having valid calibration are only used for measurements.
6. Quantum of check shall be 100% for all characteristics unless otherwise mentioned specifically in Field Quality Plan/ reference documents.

BHEL	**STATEMENT OF CHECKS**	FQP No: 9585-001-110-QVM-G-614 REV. No.: 02 DATE-20.03.2024 PAGE 1 OF 18

CAPACITY/TYPE	:	800MW
SYSTEM	:	CONDENSER
Sub System	:	AIR COOLED CONDENSER
Area	:	ERECTION

- For checks where log sheets are not called for, suitable records should be maintained in the form of log book / protocols.
- As an evidence of having carried out the work satisfactorily, a general purpose log sheet L-00 shall be maintained for all the checks.
- Abbreviations used in the column "Type of check" are :

  R : Record Verification

  M : Measurement

  V : Visual

  T : Test

  P : Physical

- The task performer at site should refer the latest drawings and fill up nominal values and drawing numbers in the respective log sheets.

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Manager (Quality & B.E.)
बी.एच.ई.एल., पा.से.प.क्षे., नागपुर.
BHEL, PS-WR, NAGPUR

SUPPLIERS NAME AND ADDRESS	FIELD QUALITY PLAN					PROJECT:	3X800MW PVUNL Patratu Project		
BHEL PSWR,NAGPUR	ITEM : CONDENSER			QP NO. : 9585-001-110-QVM-G-614		PACKAGE:	EPC PACKAGE		
	SUB-SYSTEM : AIR COOLED CONDENSER			REV. NO .: 02 DATE : 20/03/2024 PAGE : 02 OF 18		CONTRACT NO:	01/PVUNL-CS-9585-001-2/NOA-TC		
						MAIN CONTRACTOR	BHEL , PSWR Nagpur		

SL. NO	ACTIVITY	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	D*	REMARKS
1	2	3	4	5	6	7	8	9		10
A	**STORAGE INSTRUCTIONS & FACILITIES**									
A.01	Availability of Storage/ Preservation Instructions/ Procedure for Material at site.	-	B	R	100%	Storage & Preservation Instruction / Recommendation of Manufacturer		SR	√	Storage & Handling procedure manual by SPG is attached(Ref No-PTT-PRO7500)
B	**MATERIAL RECEIPT**									
B.01	Check availability of Bill of materials (BOM), packing slip, dispatch documents.		C	R	100%	-	Availability of documents	SR		
B.02	Check materials for completeness, correctness, and shortages / excesses as per Bill of Materials / Dispatch documents / Packing slip.		C	V	100%	BOM, Dispatch documents & Packing slip	Completeness of material	SR	√	Non-conformity noticed on receipt to be reported and dipositioned as per agreed procedure.
C	**STORAGE**									
C.01	Material storage & preservation : Check for proper storage, shelf life, preservation etc. after receipt at site		B	V	100%	As per storage instructions Point no 1 above		SR		

EQUBAL AHMAD
BHEL PSWR

SIGNATURE (MAIN CONTRACTOR)

LEGENDS :
* Records identified with tick (√) shall be essentially included by supplier in QA documentation
# Class A : Critical, Class B : Major, Class C : Minor
Class A checks shall be witnessed by NTPC FQA, Class B checks shall be witnessed by NTPC Execution Engineer, Class C checks shall be witnessed by BHEL Site engineer
SR - Site Register, TR- Test Report, IR - Inspection Report,

एनटीपीसी NTPC
A Maharatna Company

FOR NTPC USE

DOC. NO. 9585 - 001- 110- QVM-G-614

REVIEWED BY	APPROVED BY	APPROVAL SEAL

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				PAGE : 03 OF 18		MAIN CONTRACTOR	BHEL , PSWR Nagpur		

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1	2	3	4	5	6	7	8	9		10
D	**ERECTION**									
D.1	**STRUCTURAL STEEL**									
D.1.1	Understructure									
D.1.1.0	Foundations	-	B	V	100%	Visual check of foundation	BHEL drawing	Site protocol		
D.1.1.1	Preassembly / installation fixation	-	B	V	100%	Check visual preass. / installation	BHEL Drawing	Site protocol		
D.1.1.2	Alignment / elevation	As required	B	M	100%	Check visual alignment / elevation (Review alignment report)	BHEL Drawing/Tolerances	Site protocol	√	
D.1.1.3	Final bolting-up / torqueing	torque wrench	B	P	100%	Random check with standard wrench	As per torque table in erection manual	Site protocol	√	
D.1.2	Fan deck plates									
D.1.2.1	Installation / location cutouts fixation	-	B	V	100%	Check cable / pipe / columnprotrusion Check fixation type / length	Conform DWG :	Site protocol		
D.1.3	Motor support structure									
D.1.3.0	Top understructure	-	B	V	100%	Visual check top understructure Review alignment report	Conform DWG :	Site protocol		
D.1.3.1	Preassembly / installation fixation	-	B	V	100%	Check visual preass. / installation	Conform DWG :	Site protocol		

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				PAGE : 04 OF 18		MAIN CONTRACTOR	BHEL, PSWR Nagpur		

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1	2	3	4	5	6	7	8	9		10
D.1.3.2	Alignment / elevation	As required	B	M	100%	Check visual alignment /elevation Review alignment report	BHEL Drawing/Tolerances	Site protocol		
D.1.3.3	Final bolting-up / torqueing	torque wrench	B	P	100%	Random check with standard wrench	As per torque table in erection manual	Site protocol	√	
D.1.3.4	Grating & clips /toe plate handrailings	-	B	V	100%	Check fixation (type) and cutouts	Conform to Drawing	Site protocol		
D.1.4	**" A " - frames / C-channels & temporay bundle supports / sliding & fixed supports (for steam distribution manifolds) / partition windwall sheeting**									
D.1.4.0	Top understructure	-	B	V	100%	Visual check top understructure Review alignment report	Conform DWG :	Site protocol		
D.1.4.1	Preassembly / installation fixation	-	B	V	100%	Check visual preass. / installation Check bolt type/protrution length	Conform DWG :	Site protocol		
D.1.4.2	Alignment / elevation A- frames, C-channels & temporay tube bundle supports and sliding & fixed supports)	As required	B	M	100%	Check visual alignment / elevation Review alignment report	Conform DWG : Conform tolerances :	Site protocol		
D.1.4.3	Final bolting-up / torqueing	torque wrench	B	P	100%	Random check with standard wrench	As per torque table in erection manual	Site protocol	√	
D.1.4.4	Doors Removable parts for hoist device	-	C	V	100%	Check correct opening (direction) Check removal of parts possible	Conform DWG :	Site protocol		

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	SUB-SYSTEM : AIR COOLED CONDENSER			REV. NO .: 02		CONTRACT NO:	01/PVUNL-CS-9585-001-2/NOA-TC		
				DATE : 20/03/2024		MAIN CONTRACTOR	BHEL, PSWR Nagpur		
				PAGE : 05 OF 18					

SL. NO	ACTIVITY	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	D*	REMARKS
1	2	3	4	5	6	7	8	9		10
D.1.4.5	Sheeting install. / location fixation	-	B	V	100%	Check cable / pipe protrution Check fixation type / length	Conform DWG :	Site protocol		
D.1.5	Windwall structure & sheeting									
D.1.5.0	Top understructure	-	B	V	100%	Visual check foundation Review alignment report	Conform DWG :	Site protocol		
D.1.5.1	Preassembly / installation fixation	-	B	V	100%	Check visual preass. / installation Check bolt type/protrution length	Conform DWG :	Site protocol		
D.1.5.2	Alignment / elevation	As required	B	M	100%	Check visual alignment / elevation Review alignment report	Conform DWG : Conform tolerances :	Site protocol		
D.1.5.3	Final bolting-up / torqueing	torque wrench	B	P	100%	Random check with standard wrench	Bolt torque conform " torque table for bolts "	Site protocol	√	
D.1.5.4	Doors	-	B	V	100%	Check correct opening (direction)	Conform DWG :	Site protocol		
D.1.5.5	Sheeting install. / location fixation	-	B	V	100%	Check cable / pipe protrution. Check fixation type/ length	Conform DWG :	Site protocol		
D.1.6	Air seal plates									
D.1.6.1	Installation / location cutouts fixation	-	B	V	100%	Check visual installation	Conform DWG :	Site protocol		
D.1.7	Hoisting beam									
D.1.7.1	Installation fixation	-	B	V	100%	Check visual installation	Conform DWG :	Site protocol		
D.1.7.2	Final bolting-up / torqueing	torque wrench	B	P	100%	Check with standard wrench	Bolt torque conform " torque table for bolts "	Site protocol		

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SUPPLIERS NAME AND ADDRESS	FIELD QUALITY PLAN	PROJECT:	3X800MW PVUNL Patratu Project
BHEL PSWR,NAGPUR	ITEM : CONDENSER QP NO. : 9585-001-110-QVM-G-614 REV. NO .: 02 SUB-SYSTEM : AIR COOLED CONDENSER DATE : 20/03/2024 PAGE : 06 OF 18	PACKAGE: CONTRACT NO: MAIN CONTRACTOR	EPC PACKAGE 01/PVUNL-CS-9585-001-2/NOA-TC BHEL, PSWR Nagpur

SL. NO	ACTIVITY	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	D*	REMARKS
1	2	3	4	5	6	7	8	9		10
D.1.7.3	Load test	-	A	V	100%	Load test acc. procedure :	Conform procedure :	Site protocol	√	As per IS code:o IS 3177 : 1999
D.1.8	Air inlet bells + rings									
D.1.8.1	Preassembly segments fixation	-	B	V	100%	Check visual roundness / dia. Check bolt type /protrution length	Conform DWG :	Site protocol		
D.1.8.2	Installation air inlet bells fixation	-	B	V	100%	Check visual installation	Conform DWG :	Site protocol		
D.1.8.3	Alignment	As required	B	M	100%	Check visual alignment / diameter Review VENDOR alignment report	Conform DWG : Conform tolerances : Fan supplier instation manual	Site protocol		
D.1.8.4	Final bolting-up / torqueing	torque wrench	B	P	100%	Random check with standard wrench	As per torque table in erection manual	Site protocol	√	
D.2	**STAIRS & LADDERS / WALKWAYS AND PLATFORMS / HANDRAILS**									
D.2.1	Stairs & ladders									
D.2.1.0	Foundations	-	B	V	100%	Visual check foundation Review client foundation protocol	Conform DWG :	Site protocol		
D.2.1.1	Installation / elevation /Alignment fixation	As required	B	M	100%	Check visual installation / elevation Verticality of the columns is checked with the instrument Check bolt type/protrution length	Conform DWG :	Site protocol		

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	SUB-SYSTEM : AIR COOLED CONDENSER			REV. NO .: 02		CONTRACT NO:	01/PVUNL-CS-9585-001-2/NOA-TC		
				DATE : 20/03/2024					
				PAGE : 07 OF 18		MAIN CONTRACTOR	BHEL, PSWR Nagpur		

SL. NO	ACTIVITY	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS		REMARKS
1	2	3	4	5	6	7	8	9	D*	10
D.2.1.2	Final bolting-up / torqueing	torque wrench	B	P	100%	Random check with standard wrench	As per torque table in erection manual	Site protocol	√	
D.2.1.3	Grating & clips toeplate handrailings	-	B	V	100%	Check fixation (type) and cutouts Check fixation / check for sharp edges	Conform DWG : No openings between toe plate / grating	Site protocol		
D.2.2	Walkways & platforms									
D.2.2.0	Respective supporting structure	-	B	V		Visual check supporting structure	Conform DWG :			
D.2.2.1	Installation / elevation fixation	-	B	V	100%	Check visual installation / elevation Check bolt type/protrution length	Conform DWG :	Site protocol		
D.2.2.2	Final bolting-up / torqueing	torque wrench	B	P	100%	Random check with standard wrench	Bolt torque conform " torque table for bolts "	Site protocol		
D.2.2.3	Grating & clips toeplate handrailings	-	B	V	100%	Check fixation (type) and cutouts Check fixation / check for sharp edges	Conform DWG : No openings between toe plate / grating	Site protocol		
D.3	**AIRCOOLED CONDENSER EQUIPMENT**									
D.3.1	Bundles									
D.3.1.0	Foundations	-	B	V	100%	Visual check foundation Check alignment report	Conform DWG :	Site protocol		
D.3.1.1	Installation	-	B	V	100%	Check visual installation	Conform DWG :	Site protocol		

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	SUB-SYSTEM : AIR COOLED CONDENSER			REV. NO .: 02 DATE : 20/03/2024		CONTRACT NO:	01/PVUNL-CS-9585-001-2/NOA-TC		
				PAGE : 08 OF 18		MAIN CONTRACTOR	BHEL, PSWR Nagpur		

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1	2	3	4	5	6	7	8	9		10
D.3.1.2	Alignment / elevation	water level/ plumb bob	B	M	100%	Check visual alignment / elevation Check alignment report	Conform DWG : Conform tolerances :	Site protocol		
D.3.1.3	Welder qualification	-	A	V	100%	ASME IX / AWS D1.1	ASME IX / AWS D1.1	WPQ		BHEL-HWR approved WPS shall be used.
D.3.1.4	Welding	-	B	V	100%	According to WPS, applicable codes	Conform to WPS, applicable codes	Site protocol		
D.3.1.5	NDE procedures / NDE PERSONNEL	-	A	T	100%	according to ASME section V	Conform to code(s): ASME section VIII WPS	Site protocol		
D.3.1.6	Visual inspection welding	-	B	V	100%	100% inspection of weldings according to ASME V, equivalent BS / EN	ASME VIII, equivalent BS / EN	Site protocol		
D.3.1.7	Dye penetrant test	-	B	T	100%	100% on weldings according to ASME V, equivalent BS / ENBS / EN	ASME VIII, Div. 1 , app. 8, equivalent BS / EN	Site protocol		
D.3.1.8	RT for Longitudinal, circumferential of pressure parts	-	A	T	10% on weldings	according to ASME V	ASME VIII, Div. 1 , app. 8	RT Report	√	
D.3.1.9	Jacking screws	-	B	V	100%	Check jacking screws are removed after all welding	Conform DWG :	Site protocol		

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				PAGE : 09 OF 18					

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1	2	3	4	5	6	7	8	9		10
D.3.2	Gearboxes / motors / fans									
D.3.2.1	Preassembly motor - gearbox coupling motor - gearbox	-	B	V	100%	Check visual preassembly Check correct installation coupling	Conform DWG : Conform gearbox supplier installation manual	Site protocol		
D.3.2.2	Installation motor, gearbox & Alignment of motor to Gear box	slip gauge/ feeler gauge, spirit level	B	V & M	100%	Check visual installation Check bolt type/protrution length	As per BHEL drawing/ gearbox supplier installation manual	Site protocol	√	Please refer the page no.45 to 48 in erection manual of ACC
D.3.2.3	First oil fill gearbox	-	B	V	100%	Check oil type / level	Conform gearbox supplier installation manual tagplate data	Site protocol		
D.3.2.4	Installation hub plate / retaining plate fixation	-	B	V	100%	Check horizontality Check presence Check bolt type/protrution length	Conform DWG : Conform fan supplier installation manual	Site protocol		
D.3.2.5	Installation fan blades fixation Blade angle	-	B	V	100%	Check visual installation Check blade angle setting / review VENDOR measuring report Check bolt type/protrution length	Conform DWG : Conform fan supplier installation manual / DSH 3210	Site protocol		
D.3.2.6	clearance	silp gauge/ feeler gauge	B	M	100%	Check tip clearance	Conform fan supplier installation manual	Site protocol	√	Blade Track Variation & Tip Clearance shall be checked in assembled condition

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FOR NTPC USE

DOC. NO. 9585 - 001- 110- QVM-G-614

REVIEWED BY	APPROVED BY	APPROVAL SEAL

SUPPLIERS NAME AND ADDRESS	FIELD QUALITY PLAN		PROJECT:	3X800MW PVUNL Patratu Project
BHEL PSWR,NAGPUR	ITEM : CONDENSER	QP NO. : 9585-001-110-QVM-G-614	PACKAGE:	EPC PACKAGE
	SUB-SYSTEM : AIR COOLED CONDENSER	REV. NO .: 02 DATE : 20/03/2024	CONTRACT :	9585
		PAGE : 10 OF 18	MAIN CONTRACTOR	BHEL, PSWR Nagpur

SL. NO	ACTIVITY	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	D*	REMARKS
1	2	3	4	5	6	7	8	9		10
D.3.2.7	Final bolting-up / torqueing gearbox	torque wrench	B	P	100%	Random check with standard wrench	As per torque table in erection manual	Site protocol	√	
D.3.2.8	Final bolting-up / torqueing retaining plate fixation hub plate fixation fan blade fixation	torque wrench	B	P	100%	Random check with standard wrench	Bolt torque conform fan supplier installation manual	Site protocol	√	
D.3.3	Vacuum equipments(holding vacuum pump skid and Hogging vacuum pump skid)									
D.3.3.0	Foundations	-	B	V	100%	Visual check foundation Review client foundation protocol	Conform DWG :			
D.3.3.1	Installation fixation	-	B	V	100%	Check visual installation Check bolt type/protrution length	Conform DWG :	Site protocol		
D.3.3.2	Alignment / elevation	feeler gauge, dial gauge	B	M	100%	Check visual installation / elevation Review VENDOR alignment report	Conform DWG : Conform pump supplier installation manual	Site protocol	√	Refer page 102-103 of erection manual.
D.3.3.3	Final bolting-up / torqueing	torque wrench	B	P	100%	Random check with standard wrench	As per torque table in erection manual	Site protocol	√	
D.4	**Air cooled condenser ducting**									
D.4.1	Turbine exhaust steam duct / Risers & expansion bellows									

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	SUB-SYSTEM : AIR COOLED CONDENSER			REV. NO .: 02		CONTRACT NO:	01/PVUNL-CS-9585-001-2/NOA-TC		
				DATE : 20/03/2024		MAIN CONTRACTOR	BHEL, PSWR Nagpur		
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1	2	3	4	5	6	7	8	9		10
D.4.1.1	Foundations (turbine exhaust steam duct)	-	B	V	100%	foundation drawing	As per BHEL drawing/Erection manual	Site protocol		
D.4.1.2	Installation / positioning (exhaust duct pieces)	-	B	V	100%	Check visual installation / positioning	Conform DWG :	Site protocol		As per SPG , There is no requirement of slope checking. However site to maintain the elevations marked in the ACC GA drawing
D.4.1.3	Installation / positioning(elbow pieces)	-	B	V	100%	Check visual installation / positioning	Conform DWG :	Site protocol		
D.4.1.4	Alignment / elevation (steam exhaust duct connection for vertical duct part)	water level/ plumb bob	B	M	100%	Check visual alignment / elevation Check alignment report	Conform DWG : Conform tolerances :	Site protocol		
D.4.1.5	Alignment / elevation (steam exhaust duct connection for risers)	plumb bob	B	M	100%	Check visual installation / elevation Check alignment report	Conform DWG : Conform tolerances :	Site protocol		
D.4.1.6	Final bolting-up / torqueing (fixed / sliding supports)	torque wrench	B	P	100%	Random check with standard wrench	Bolt torque conform " torque table for .. bolts "	Site protocol		
D.4.1.7	Qualified WPS for duct welding	-	A	V	100%	ASME IX	ASME IX	Site protocol		BHEL-HWR approved WPS shall be used.
D.4.1.8	Welding (exhaust duct pieces)	-	A	V	100%	According to WPS, applicable codes	Confirm to WPS, applicable codes	Site protocol		Welder Qualification by FQA

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	SUB-SYSTEM : AIR COOLED CONDENSER			REV. NO .: 02 DATE : 20/03/2024		CONTRACT NO:	01/PVUNL-CS-9585-001-2/NOA-TC		
				PAGE : 12 OF 18		MAIN CONTRACTOR	BHEL, PSWR Nagpur		

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1	2	3	4	5	6	7	8	9		10
D.4.1.9	Welding (elbow pieces)	-	B	V	100%	According to WPS, applicable codes	Conform to WPS, applicable codes	Site protocol		Welding shall be done by suppliers with qualified welders.
D.4.1.10	Preassembly (vertical part exhaust duct-expansion bellow)	-	B	V	100%	Check visual preassembly Check orientation / flow direction	Conform DWG : Conform expansion bellows vendor installation manual	Site protocol		
D.4.1.10A	Fit-up check between exhaust duct - expansion bellow	-	B	V	100%	Check visual preassembly	As per BHEL drawing	Site protocol		Bellow supplier's WPS to be use Refer CRS for large bellow welding
D.4.1.11	Alignment to turbine / elevation	-	B	V	100%	Check visual installation / elevation Check VENDOR alignment report turbine supplier spec.	Conform DWG : Conform tolerance : /turbine vendor spec.	Site protocol		
D.4.1.12	Welding (vertical part - expansion bellows)	-	B	V	100%	According to WPS, applicable codes	Confirm to WPS, applicable codes	Site protocol		
D.4.1.13	Final bolting-up / torqueing (turbine exhaust flange)	torque wrench	B	P	100%	Random check with standard wrench	Conform turbine vendor requirements	Site protocol	✓	
D.4.1.14	Preassembly (risers - expansion bellows)	-	B	V	100%	Check visual preassembly Check orientation / flow direction	Conform DWG : Conform expansion bellows vendor installation manual	Site protocol		
D.4.1.15	Welding (risers -expansion bellows)	-	B	V	100%	According to WPS, applicable codes	Confirm to WPS, applicable codes	Site protocol		

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				PAGE : 13 OF 18		MAIN CONTRACTOR	BHEL, PSWR Nagpur		

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1	2	3	4	5	6	7	8	9		10
D.4.1.16	Preassembly (elbows - expansion bellows)	-	B	V	100%	Check visual preassembly Check orientation / flow direction	Conform DWG : Conform expansion bellows vendor installation manual	Site protocol		
D.4.1.17	Welding (elbows - expansion bellows)	-	B	V	100%	According to WPS, applicable codes	Confirm to WPS, applicable codes	Site protocol		
D.4.1.18	Installation (risers)	-	B	V	100%	Check visual preass. / installation Check alignment report	Conform DWG : Conform tolerances :	Site protocol		
D.4.1.19	Welding (risers - steam exhaust duct)	-	B	V	100%	According to WPS, applicable codes	Confirm to WPS, applicable codes	Site protocol		
D.4.1.20	Welding (risers - steam dist.manifold)	-	B	V	100%	According to WPS, applicable codes	Confirm to WPS, applicable codes	Site protocol		
D.4.1.21	Shipment bracing of bellows	-	B	V	100%	Check shipment bracings removed	Conform expansion bellows vendor installation manual	Site protocol		
D.4.1.22	NDE procedures / NDE PERSONNEL	-	A	T	100%	according to ASME section V	Conform to code(s): ASME section VIII WPS	Site protocol		
D.4.1.23	Visual inspection welding	-	B	V	100%	100% inspection of weldings according to ASME V	ASME VIII,	Site protocol		

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				PAGE : 14 OF 18		MAIN CONTRACTOR	BHEL, PSWR Nagpur		

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1	2	3	4	5	6	7	8	9		10
D.4.1.24	Dye penetrant test of bellow welds as-well-as ducting	-	B	T	10%	100% on weldings according to ASME V, equivalent BS / ENBS / EN	ASME VIII, Div. 1 , app. 8, equivalent BS / EN	Site protocol	√	100% DPT for bellows
D.4.1.25	RT for Longitudinal, circumferential of pressure parts	-	A	T	10%	10% on weldings according to ASME V	ASME VIII, Div. 1 , app. 8		√	
D.4.1.26	UT for high stressed welds (Nozzle connections)	-	A	T	100%	100% on weldings according to ASME V	ASME VIII, Div. 1 , app. 8,	Site protocol	√	
D.4.1.27	Cleanliness, Closure of manholes	-	B	V	100%	Check inside cleanliness, Random check with standard wrench	Bolt torque conform " torque table for .. bolts "	Site protocol		
D.4.2	Steam distribution manifold / expansion bellows									
D.4.2.1	Top " A frames / supports	-	B	V	100%	Visual check foundation Check fixed / sliding supports Review VENDOR alignment report	Conform DWG : Conform tolerances :	Site protocol		

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D.4.2.2	Rupture discs	-	B	V	100%	Check rupture disc installation	Conform vendor installation manual and DWG :	Site protocol		
D.4.2.5	Rupture disc access platform	-	B	V	100%	Check installation see also 2.2	Conform DWG :	Site protocol		
D.4.2.6	Installation manifold	-	B	V	100%	Check visual installation	Conform DWG :	Site protocol		
D.4.2.7	Alignment / elevation (manifolds - connection risers) + Tackwelding	water level, plumb bob	B	M	100%	Check visual installation / elevation Review vendor alignment report	Conform DWG : Conform tolerances :	Site protocol		
D.4.2.8	Fixed / sliding saddle	-	B	V	100%	Check position / assembly	Conform DWG :	Site protocol		
D.4.2.9	Final bolting-up / torqueing (fixed / sliding support)	torque wrench	B	P	100%	Random check with standard wrench	Bolt torque conform " torque table for .. Bolts "	Site protocol		
D.4.2.10	Qualified WPS	-	A	V	100%	ASME IX	ASME IX	Site protocol		BHEL-HWR approved WPS shall be used.
D.4.2.11	Welding (manifold pieces)	-	B	V	100%	According WPS :	Conform WPS :	Site protocol		
D.4.2.12	Welding (manifold - bundles)	-	B	V	100%	Drwg	Conform DWG :	Site protocol		
D.4.2.13	Visual inspection welding	-	B	V	100%	100% inspection of weldings ASME V	ASME VIII	Site protocol		

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				PAGE : 16 OF 18		MAIN CONTRACTOR	BHEL, PSWR Nagpur		

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D.4.2.14	Dye penetrant test	-	B	T	10%	ASME V, equivalent BS / EN	ASME VIII, Div. 1 , app. 8, equivalent BS / EN	Site protocol	√	
D.4.2.15	Cleanliness /Closure of manholes	-	B	V	100%	Check inside cleanliness Random check with standard wrench	As per torque table in erection manual	Site protocol		
D.5	**INTERCONNECTING PIPING / VALVES & APPENDAGES / INSTRUMENTATION (Installation and checks ss per Hangers drawings. Suppliers installation procedure shall be provided at the time of installation for hangers)**									
D.5.1	Interconnecting piping									
D.5.1.1	Installation pipe supports /fixation	-	B	V	100%	Check visual installation Check bolt type/ protrution length	Conform DWG :	Site protocol		
D.5.1.2	Final bolting-up / torqueing	torque wrench	B	P	100%	Random check with standard wrench	As per torque table in erection manual	Site protocol		
D.5.1.3	WPQR / WQ	-	A	V	100%	ASME SEC IX	As per ASME SEC IX	Site protocol		Wleder test by FQA
D.5.1.4	WPS	-	A	V	100%	According vendor standard / ~~CNO 435~~	WPS certified by WPQR	Site protocol		BHEL-HWR approved WPS shall be used.
D.5.1.5	Alignment / elevation (interconnecting piping) + Tackwelding.	-	B	V	100%	Check visual alignment / elevation	Conform ISOMETRICS :	Site protocol		
D.5.1.6	Welding (interconnecting piping)	-	B	V	100%	MWPS According WPS :	Conform WPS :	Site protocol		
D.5.1.7	Visual inspection welding	-	B	V	100%	ASME V/ASME VIII	Acceptance criteria of the appropriate standard ASME V/ASME VIII	Site protocol		

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D.5.1.8	Dye penetrant test	-	B	T	10%	ASME V, equivalent BS / EN	ASME VIII, Div. 1 , app. 8, equivalent BS / EN	Site protocol	√	Surveillance by FQA
D.5.1.9	Hydrostatic pressure test of pipework	-	B	T	100%	Drwg/ datasheet. (Ref doc.PTT-PRO7704)	No leakage	Site protocol	√	Test pressure is 0.3bar
D.5.2	Valves									
D.5.2.1	Installation valves steam duct syst. Installation valves vacuum syst. Installation valves condensate syst. Installation valves cleaning syst.fixation	-	B	V	100%	Check visual installation Check flow direction / tagnr. Check bolt type/ protrution length	Conform P&ID: and DWG : Conform installation manual (if appl.) / valve list	Site protocol		
D.5.3	Instrumentation									
D.5.3.1	Installation instr. steam duct syst. Installation instr. vacuum syst. Installation instr. condensate syst. Installation instr. cleaning syst. Installation instr. condensate tank	-	B	V	100%	Check visual installation Check flow direction / tagnr.	Conform P&ID: and instrument list : Conform P&ID: and instrument list : Conform vendor installation manual (if appl.)			
D.5.3.2	Span / range	-	B	V	100%	Check span / range	As per instrument DSH	Site protocol		

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D.6	**AIR COOLED CONDENSER TESTING**									
D.6.1	Pressure test									
D.6.1.1	Preparation	-	B	V	100%	Check installation of blank plate(s) Check valves position	Mfg standard			Ref doc.PTT-PRO7704
D.6.1.2	Pressure test	-	B	T	100%	Drwg/ datasheet	Drwg/datasheet. Pneumatic test pressure 0.3bar.Ref doc.PTT-PRO7704	Site protocol	√	Surveillance by FQA
D.6.1.3	Preparation (removal of temprary arrangements)	-	B	V	100%	Check removal blank plate(s)	Mfg standard	Site protocol		
D.7	**GENERAL**									
D.7.1	Check identification									
D.7.1.1	All systems in ACC scope	-	C	V	100%	Check visual tagplate data	Conform P&ID :	Site protocol		
D.7.2	Check cleanliness									
D.7.2.1	All systems / structures ACC ACC scope	-	C	V	100%	Check cleanliness	Appearance and good workmanship	Site protocol		
D.8	**VERIFICATION OF FAN BALANCING QUALITY REQUIREMENT**									
D.8.1	Measurement of vibration	Online Vibration Transmiter with fan	A	M	100%	Drwg/ datasheet	Drwg/ datasheet	Site protocol	√	In case of deviation, corrective actions including balancing of machine shall be done at site by OEM
D9	**DRAIN TANK,CONDENSATE TANK DEAERATOR**									
D9.1	Fitup of Joint	-	C	V	100%	Approved drg	Approved drg	Site protocol		
D9.2	Dye penetration test	-	B	T	100%	ASME V/Equivalent BS / EN	ASME V/Equivalent BS / EN	Site protocol		
D9.3	UT/RT for butt weld	-	A	T	10%	ASME V	ASME V	Report	√	
D9.4	Hydrostatic pressure test	-	A	T	0.65bar(g) for 30 min	As per drg / Data sheet	As per drg / Data sheet	Site protocol	√	Deaerators shall be installed on condenstat tank. And complete assembly of CST and deaerators shall be hydrotested ay gorund only
D10	**DRAIN PUMP**									
D10.1	Check foundation dimensions including floor elevation,position of foundation bolt pocket,pit depth,vortex breaker locationetc as applicable	Tape	B	M	100%	As per drg / Data sheet	As per drg / Data sheet	Site Protocol		Also refer erection manual guide
D10.2	Assembly of pump on floor,record clearance between sleev and shaft,sleev & cut -less rubber bearing and between wearing rings of casing and impeller.	-	B	V/M	-	As per drg / Data sheet	As per drg / Data sheet	Site Protocol	√	
D10.3	Check float of Pump shaft and fix Rotor position.	-	B	M	-	As per drg / Data sheet	As per drg / Data sheet	Site Protocol		
D10.4	Check distance between coupling halves of Pump & Motor	-	B	M	-	As per drg / Data sheet	As per drg / Data sheet	Site Protocol		
D10.5	Alignment between Pump & Motor shafts and their coupling.	-	B	M	-	As per drg / Data sheet	As per drg / Data sheet	Site Protocol		
D11	**FIN CLEANING SYSTEM**	**For fin cleanng system refer general installation instruction.**								

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* Records identified with tick (√) shall be essentially included by supplier in QA documentation
# Class A : Critical, Class B : Major, Class C : Minor
Class A checks shall be witnessed by NTPC FQA, Class B checks shall be witnessed by NTPC Execution Engineer, Class C checks shall be witnessed by BHEL Site engineer
SR - Site Register, TR- Test Report, IR - Inspection Report,

एनटीपीसी NTPC A Maharatna Company
FOR NTPC USE

DOC. NO. 9585 - 001- 110- QVM-G-614

REVIEWED BY	APPROVED BY	APPROVAL SEAL

ERECTION OF ACC(3X800MW PATRATU VIDYUT UTPADAN NIGAM LTD,PATRATU STPP)			
Comments on Document/Drawing.- FQP for Air Cooled Condenser Document no: 9585-001-110-QVM-G-614		Date-20.03.2024	
SL. No.	**NTPC comments**	**BHEL reply in Rev-02**	**Remarks**
1	Write FQA in place of FQE	Incorporated .	
2	Presence /supervision of M/s SPG Dry Cooling -Belgium representative during installation and commissioning	Supervision of M/s SPG dry cooling Belgium for Erection and commissioning is applicable for Unit-1 only. ~~For Unit 2 and 3 there is no supervision of SPG.~~ Refer remarks fir Unit 2 & 3	M/s SPG representative shall be deployed in Unit# 2 & 3 whenever requirement is raised jointly by BHEL erection & PVUN Erection
3	At numerous places in this FQP "Conform DWG: " is mentioned, should it be read as BHEL approved drawings?	Yes	
4	As per S.N. D.1.1.0-Who is Client? BHEL itself is making foundation.	Incorporated	
5	D1.4.3-Final bolting-up / torqueing	As per torque table in erection manual.	
6	S.N. D.1.7.3-Load test procedure.	As per IS code:o IS 3177 : 1999	
7	D.1.8.4-Final bolting-up / torqueing	As per torque table in erection manual.	
8	D.2.1.2-Final bolting-up / torqueing	As per torque table in erection manual.	
9	As per S.N. D.3.2.2.There is no installation instruction in Revision-00 of referred document.	For installation instructions of Fan, Gearbox and Motor please refer page no 45 to 48 of Erection manual	
10	D.3.3.2-Alignment / elevation	Refer page 102-103 of erection manual.	
11	D.3.3.3-Final bolting-up / torqueing	As per torque table in erection manual.	
12	As per S.N. D.4.1.1-Who is Client? BHEL itself is making foundation.	Incorporated.	
13	D.4.1.8.Welding (exhaust duct pieces)	A class check	
14	D.4.1.10A-Welding of large size Bellows supplied in split parts shall be done by supplier's shop welder	Confirmed. welding of large size bellow (assembly of bellow pieces) shall be welded by bellow supplier shop welder. However welding of bellow with steam duct shall be done by BHEL site.	
15	D.4.1.24 & D.4.1.25	Incorporated .	
16	D.4.2.13	Incorporated.	
17	D.4.2.14,D.4.2.15,D.5.1.2,D.5.1.3,D.5.1.4,D.5.1.7,D.5.1.8,D.5.3.2	Incorporated.	
18	BHEL to incorporate checks for fit-up, welding, NDT and hydro test of tanks and Deaerator.(In the CRS rev-01)	Incorporated	

इक़बाल अहमद/EQUBAL AHMAD
प्रबंधक (गुणवत्ता & बी.ई.)
Manager (Quality & B.E.)
बी.एच.ई.एल., पा.से.प.क्षे.,नागपुर.
BHEL, PS-WR, NAGPUR

PSWR-QUALITY

RECORD OF QUALITY CHECKS

SHEET NO. OF FQP	CHECK NO.	RESULTS ACHIEVED OK / NOT OK	DRAWING / DOCUMENT REFERENCE	FORMAT OF RECORD	INSPECTED BY SIGN. & DATE	CLEARED BY SIGN. & DATE	REMARKS

Note: Any protocol made is to be numbered & mentioned in “Format of Record” column.

		SYSTEM	SUB-SYSTEM	AREA	QP NO: 9585-001-110-QVM-G-614
PROJECT					REV No.: 02
UNIT NO.					LOG SHEET No.: L- 00
RATING					PAGE 1 OF 1

PSWR	INSTRUMENT REG. NO./TAG		
	DATE OF INSPECTION		
	DRAWING / DOCUMENT REF.		

PROTOCOL

			NAME	SIGNATURE & DATE	FQP NO: 9585-001-110-QVM-G-614
PROJECT		INSPECTED BY			REV. NO.: 02
UNIT NO.		CLEARED BY			PROTOCOL NO.
RATING		CUSTOMER			PAGE:

Contract Name : **ACC for 3X800 MW Patratu Project, India**
Contract Number : **BHEL/HEEP/PPX-BOI/Patratu/ACC/20201744**
Document Title : **Storage and Handling Procedure for Air Cooled Condenser**

AIR COOLED CONDENSER

Storage and Handling Procedure for Air Cooled Condenser

SPG DC Ref. No: WB1-101-000568_PRO7500

Doc-No: PTT-PRO7500

-	14-Mar-23	VVS	GK	VVS	PRE	
Rev	**Date**	**Edited by**	**Approved by**	**Released by**	**Status**	**Remarks**

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PROJECT INFORMATION

1.	Project name:	ACC for 3X800 MW Patratu Project
2.	Project Location :	Patratu, India
3.	Scope:	Supply and
4.	Quantity:	3 Unit x 72 Fans
5.	Client:	BHEL

I. SCOPE OF THE CHAPTER

This storage & handling manual is only a general guide to the storage and handling practice. It is not a substitute for technical and professional engineering advice.

Additional and more precise information can be found in Supplier Specific Manual.

All storage & handling of the equipment should be performed by qualified personnel, trained in using industrial mechanical equipment.

II. GENERAL INSTRUCTIONS

Please carefully read this guideline before storage & handling. Compliance with the instructions will assure long and trouble-free operation of equipment.

III. DELIVERED CONDITIONS

Upon unloading of any equipment inspect it for damage.

The delivered goods should be checked upon arrival for full compliance with the order and/or the parts count and description on the packing list.

1. STEEL STRUCTURE

1.1 Storage

OUTDOOR STORAGE

To prevent the heavy packs or containers wagons from sinking into the ground choose a dry, smooth, well compacted, gravelled, asphalted or bricked storage location that is safe from flooding and free from vibration. Repair any damage on the packaging before putting the equipment into storage if this is necessary to ensure proper storage conditions.

If necessary, please cover the steel structure for protection against rain, snow and aggressive dust. Do not impede air circulation under the stored items. Covers or tarpaulins used to protect the equipment against the weather must not come into contact with the surfaces of stored good. Use wooden spacer elements to ensure that air can circulate freely around.

Figure 1

Figure 2

Container wagons should be left strapped in original manufacturer straps for storage.
Container Wagons must be placed on dunnage. Dunnage of hardwood or metal must be placed between frame and ground surface to facilitate lifting and to protect the frame and material against flood water. Dunnage should be symmetrical and of enough size to allow safe use of lifting/handling gear.
Dunnage can be placed in either a transverse or longitudinal direction, depending on the lifting gear being used. Generally, dunnage should not be smaller than 100mm x 100mm strong.

Unpacking of container wagons

Cut and remove the straps located in the middle of the load first and leave the straps that bind /attach the ends of the load. Special care to be taken when cutting tensioned strapping to avoid any injuries

Long materials

Long materials should be stored on horizontal and levelled ground so that unintended goods movement is avoided Long products should not be stored loose (un-bundled) on top of each other without restraints for the same reason.

Beams, Columns and Frames

- Material should be stored on hardwood spacers on a stable and horizontal ground
- If beams and columns are shipped with transport frames, these can be used for storage. Otherwise, they can be stored as free-standing stacks but putting the
- Widest/longest frames and beams at the bottom and the narrowest/shortest ones on top.
- Align stacks of beams centrally.

Maximum height for a free-standing stack should be defined by client or local standards if any.

Sample how to store the unpacked steel structure is shown in the figure below

Using of wooden spacers between frames and beams:

- Spacers should have a minimum section of 100mm x 100mm hardwood and should be long enough to go across the width of the stack. Small section timbers are likely to break due to point loading.
- Correct sizes of timber spacers and distances between each layer is left at the good appreciation of the client.
- To prevent the wooden spacers from splitting, the edge of the frame or beam should not be within 20mm of the end of the dunnage
- To prevent wood from breaking, no frame or beam should be supported on an overhanging piece of spacers
- Spacers should be vertically aligned within the stack.

1.2 Handling

For detailed information please read carefully the specific advices of supplier.
Handling good practices including the use of the proper lifting equipment will avoid damage on the corrosion protection layer of the beams and ensure a long-term problem-free storage.

When placing blocks under a raised load, the site workers should ensure that the load is not released before removing their hands from under the load. Blocking materials and timbers should be large and strong enough to support the load safely.

HANDLING GENERAL ADVICES

Ensure that the lifting machine has the required lifting capacity for the weight indicated.

Before transport and handling, make sure that material to lift is securely assembled.

- Only use suitable lifting belts, spreader bars, ropes, guide ropes and lifting equipment (e.g. forklift truck, low-lift platform truck, crane)
- The lifting belts must be protected against damage (e.g. by rubbing against sharp edges)

The lifting belts must be attached at suitable hitching place.

1.3 Packaging

In the bellow pictures you can see a general overview on how the big and small pieces should be packed but not limited to:

Big pieces

Small pieces

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Contract Number : **BHEL/HEEP/PPX-BOI/Patratu/ACC/20201744**
Document Title : **Storage and Handling Procedure for Air Cooled Condenser**

Contract Name : **ACC for 3X800 MW Patratu Project, India**
Contract Number : **BHEL/HEEP/PPX-BOI/Patratu/ACC/20201744**
Document Title : **Storage and Handling Procedure for Air Cooled Condenser**

2. BUNDLES

The bundles are delivered in containers. You can inspect the equipment for damages after unloading only. Before unloading please carefully check the right placement of elements in racks and the right racks geometry in container. There must be enough space between container walls and racks to allow smooth unloading. Please also check the condition of delivered containers for mechanical damages.

2.1 Storage

If the bundles cannot stay in containers, they must be stored in a clean area, protected from direct sun radiation, cement dust, vibrations, gases or corrosive agents. Do not open the packages for storage. Let the bundles unloaded from the container. NEVER PLACE BUNDLES DIRECTLY ON THE FLOOR: Use strong hard wooden dunnage.

- It is not allowed to store two transport packing frames with bundles on each other.
- The flat and proper supporting of packages should be checked frequently, mainly during rainy period. If supporting of the bundles is not flat, it should be corrected. No deformation of the packages or supporting frames during storage period is allowed.
- If estimated storage period is shorter than three months, it is not necessary to protect the bundles. If storage time is longer than three months, the bundles should be covered by plastic textile. This protection is necessary from the beginning, to protect the bundles from pollution, mainly from the dust.
- During long time storage the protection should be regularly checked and repaired if necessary.

Bundles should never be stored on unprepared area or on unlevelled ground.
The space for the storage of the bundles must be sufficiently resistant and perfectly flat. It must have a horizontal surface of adequate load-bearing capacity e.g. asphalted or bricked ground to withstand bundles weight. It must ensure effective protection against over flooding by rain.
For protection against rain, dust, aggressive and corrosive atmosphere or direct sun radiation please use covers or tarpaulins. The covering material must not come into contact with the surfaces of the equipment. Use wooden spacer elements to ensure free air circulation around the equipment.

2.2 Handling

Important remark: This guide includes only general information. For detailed information please carefully read and strictly follow the instructions of Specific Supplier Manual.

- Bundles should be transported from the storage area to the pre-assembling area in the pre-delivered packing frames. The bundles should be removed from frame structure one by one, according to pre-assembly steps.
- Before erection the bundles should be checked completely. Any damage should be reported for inspection by SPG DC and for further instructions on the repair. Heavy dust or sand etc. must be cleaned and removed from the bundle.
- Detailed Tube Bundles Erection Procedure can be prepared and agreed with SPG DC during site advising activities.
- A general construction procedure for bundle erection is available. Please refer to the “Construction Procedure for Condensate Manifold and Bundles”.

Attachment 1:

LOADING AND UNLOADING THE CONTAINER SPECIFICATION:

Used equipment and tools:

- one 10t forklift,
- two 50t cranes or container lifting machine,
- 1 outside track,
- 1 inside track,
- 1 inside fixed mount.

Equipment photo: container lifting machine

Equipment photo: 10t forklift

The preparatory work:

Fix the inside fixed mount and inside track, connect outside track, used bolt connect.

Inside Fixed:

Fix the inside fixed mount and inside track:

Inside track

screw fix inside track

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Connect outside track:

Loading container:

Lift bundles package frame put front wheels in outside track and support package frame with the forklift from behind, slowly push into the container.

Attention: the space between container wall and package frame must be equal on both sides.

Lifting bundles package to container gate:

Front wheel put in outside track:

forklift support behind

Into the container:

Binding, fixed and check

Fix package frame in container, must tighten reliably, top use M18 connector and wire rope φ9.3 and wire rope clip, below use located block fix wheel.

Top use wire rope fixed, below use located block fixed:

Check:

Seal the container

Record each corresponding **Container No; seal No.**

Unloading steps

1. Draw out the package from container as per opposite sequence above for loading container.

   In order to facilitate drawing out the package an outside track is provided.

2. The storage area should be flat and stable in order to give the bundle package good support. If necessary temporary additional support beams should be foreseen on site.
3. For lifting of the bundle package once it's been removed from the container there are three options (described below) available. Note that lifting tools are not provided.
4. Lift and place on the ground. Proper support of the packing frames should be verified. The floor/support must be flat: no curvature is allowed.

There are three options for lifting/unloading the bundles packing once they arrive at site. Each option is described in the drawings bellow (for information only).

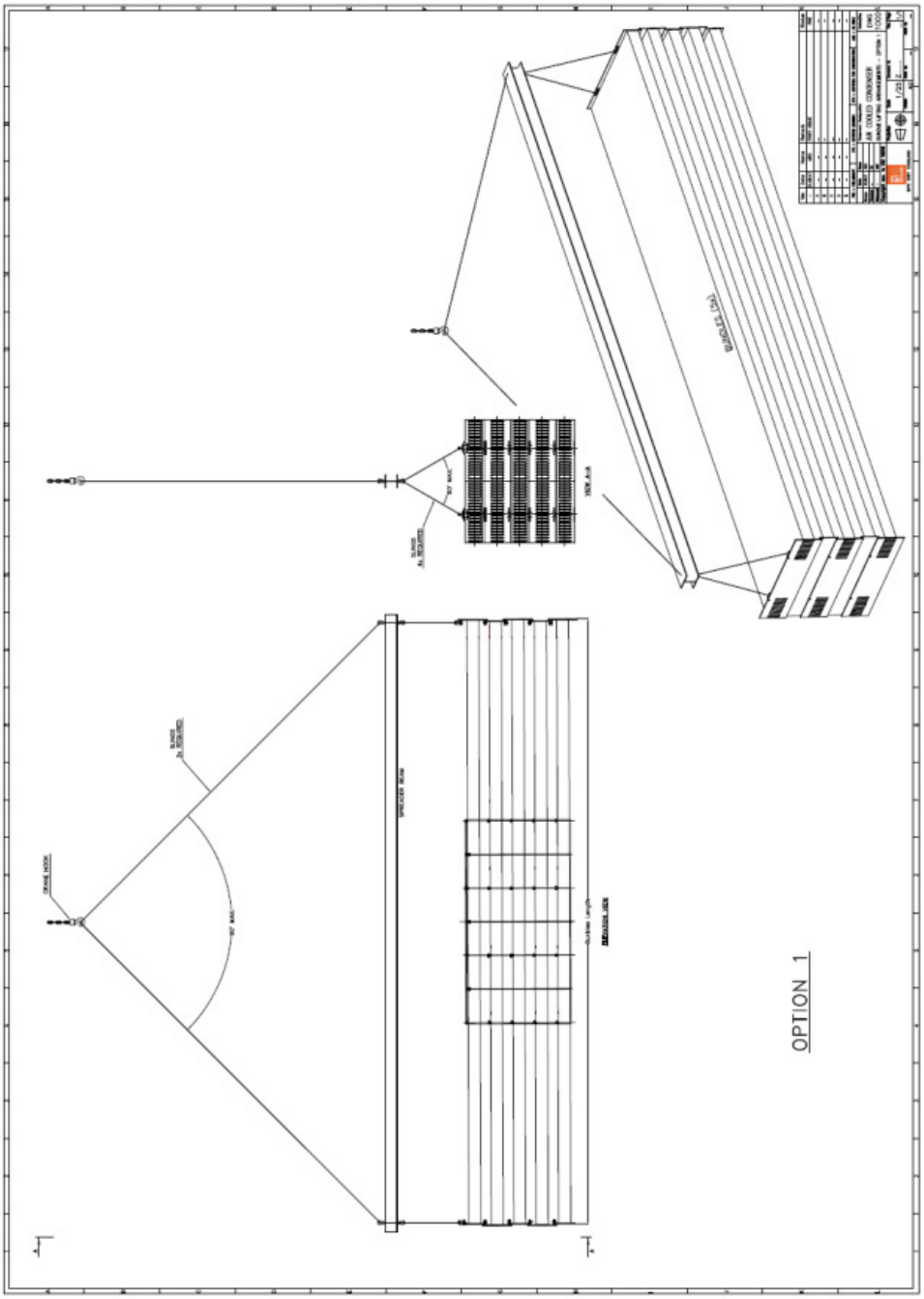
Lifting equipment's such as spreader beams, slings, shackles etc. are not part of SPG DC delivery.

Please ensure that the erector makes sure that the crane, spreader bar, slings and shackles, etc. all have enough lifting capacity, are in good condition and have up to date records / inspections according to the local requirements. The erector should also satisfy local lifting procedures & requirements in terms of lift plans. Please note that the options shown on the attached drawing are for information & are suggestions only. Please also allow adequate safety margins in the calculations you make when you plan the lift.

OPTION 1

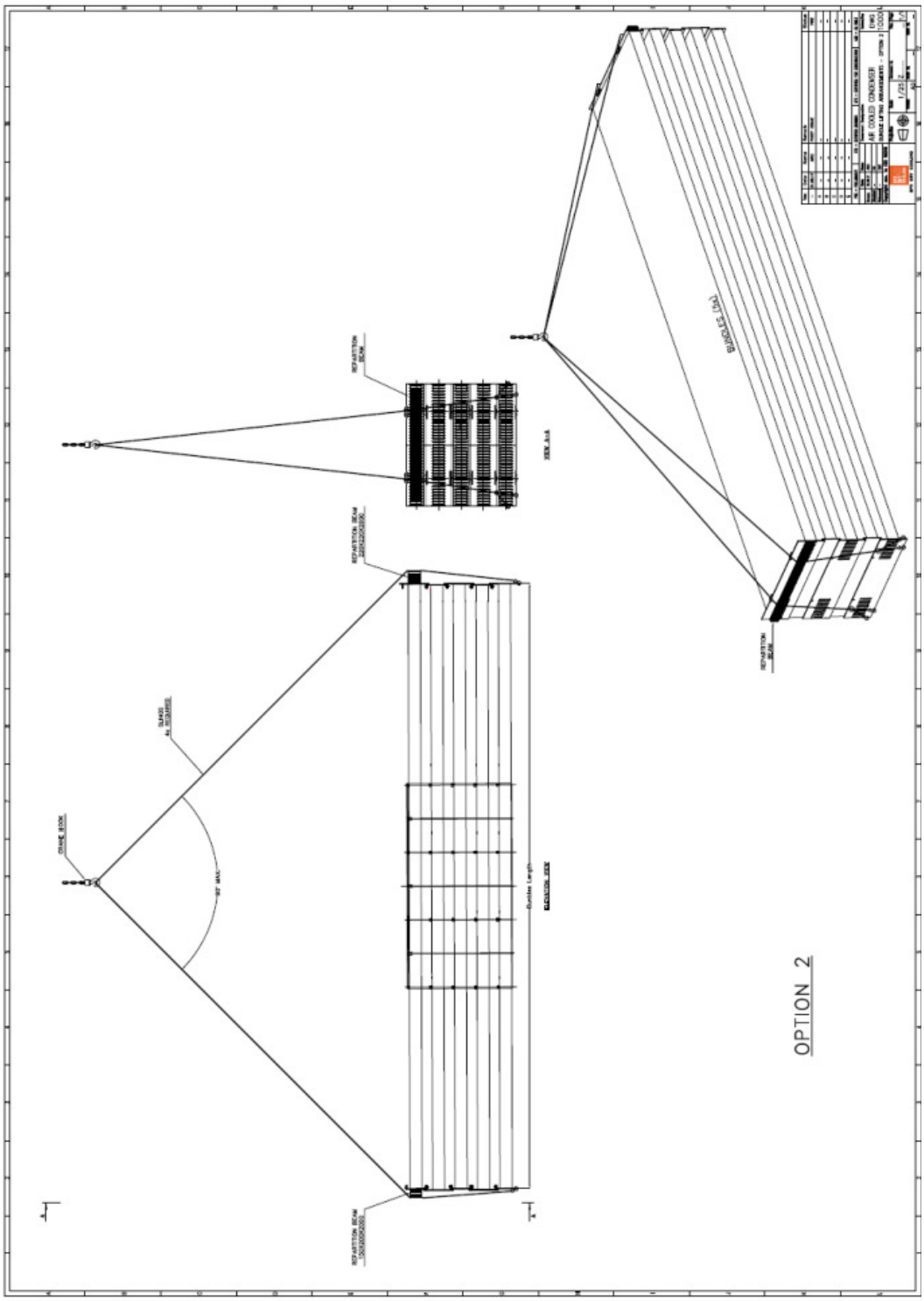
Most erection contractors prefer to lift the bundles by attaching the lifting equipment to the shipping frame with the use of a crane with a spreader bar. The crane and spreader bar should be calculated for this lift and be able to lift all the bundles packing. Verify the combined bundles weight prior to the lift. (Please remember to add on extra weight of the spreader bar & rigging when calculating the size of crane).

The spreader bar should be the same length as the bundles and have 2 cable slings at each end. It is very important to use long slings so as not to squeeze the frame causing damage & possible collapse. The slings should be attached to each packing corner lifting lugs of the shipping frame using shackles.



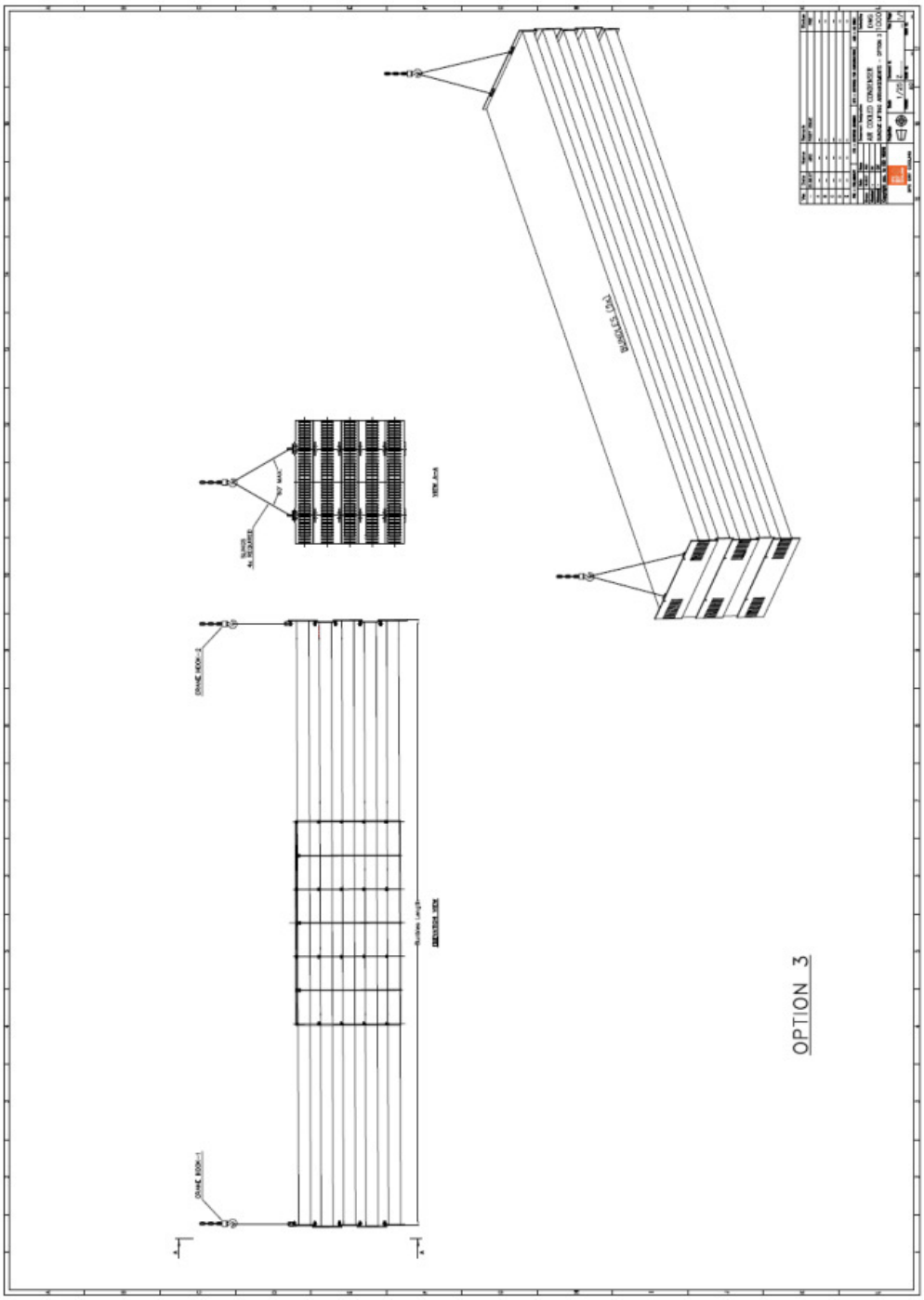
OPTION 2

If no spreader bar as described in option 1 can be made available, then it is permissible to use a crane with 4 very long slings. As in the method described in option one, it is very important to use long slings so as not to squeeze causing top bundles damage & possible collapse. It is important to use to repartition beams at the top of the tube sheet to avoid contact between the slings and the top of the tube sheet which can damage the bundles.



OPTION 3

A third option is to use 2 mobile cranes to off-load the trucks. The cranes are set up together side by side with the truck pulling up in front of them. Each crane has 2 long slings attached to the cranes hook and attaches to the lifting points at each end of the package. Each crane lifts an equal amount of the weight vertically, & when the load clears the trailer, the truck drives off. The cranes then lower the load to the ground. For this method the cranes have to be set up each time as they can't move the bundles far in this "tandem" method, but these smaller cranes can be set up & broken down quickly. The fact that there are 2 cranes, one lifting each end vertically, means that longitudinal crushing of the bundles is avoided.



Pictures below depict the fixing of the frame and track in container.

- Pictures below show frame and track fixing in the container - Connect Out Track system.

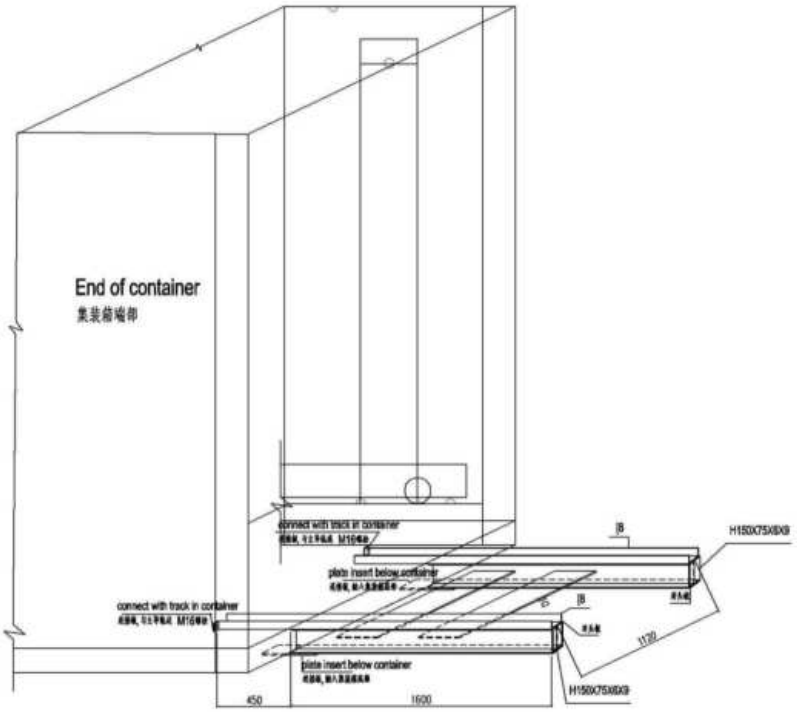
- LOADING: Lift the package frame together with wooden frame and airbags (non-inflated) with a crane; put on outside track and support the back of package frame with a forklift; slowly push into the container. NOTE: the space between container wall and package frame must be equal on both sides.

- Inflating the airbags fixes the bundles in the container:

- Fixing of the package frame in the container:

- UNLOADING: Pull out the package frame from the container using the procedure reverse to loading.
- ATTENTION: AIR BAGS MUST BE PUNCTURED BEFORE UNLOADING TO ENSURE SPACE FOR UNLOADING AND PREVENT DAMAGE TO BUNDLES
- In order to facilitate drawing out the packages, an outside track is provided together with all necessary additional parts. ATTENTION: WHILE PULLING OUT THE PACKAGE FRAMES THE OUTSIDE TRACK MUST BE USED. Put the outside track back into the container after having used it.

Attachment 3:



Outside track for loading/unloading container

All personnel involved must be fully qualified for operating and handling the specific devices involved.

2.3 Packaging

The pictures below show a general overview on how the pieces should be packed (but not limited to):

3. GEARBOXES

The gear unit is shipped without oil!
The inner parts of the gear units are sprayed with rust preventing mineral oil. The breather plug (standard, dust-proof, anti-humidity) is neither removed nor sealed.
The shaft extensions are protected with a rust preventing grease and waxed paraffin paper.
This standard system offers corrosion protection during transport and/or storage for up to one year indoors.

3.1 Storage

Always store gear units in their originally supplied shipping conditions. Gear units should not be stored near vibrating machines in order to avoid damage to bearings.
Always protect the complete drive against possible corrosion.

3.1.1 Short-term Storage

INDOORS
Up to two years, in a dry and well-ventilated area.

OUTDOORS
Up to nine months in originally supplied packing unit.
The gear unit must be filled with a small amount of mineral oil containing a volatile corrosion protective additive. All gear unit openings (dipstick, breather, and heater) are hermetically sealed and must remain sealed during handling and transport.

3.1.2 Long-term Storage

INDOORS
Up to five years, indoors, in a dry and ventilated area.
In case the units are stored for a period up to 5 years in a dry and ventilated area, the units must be re-filled with a small amount of mineral oil containing a volatile corrosion protective additive after the second and the fourth year.
The corrosion protection of the shaft extensions has to be checked - possibly corrected. At these occasions the high-speed shaft must be turned until the low speed shaft has made 2 complete revolutions. After that the unit must be

hermetically sealed again.

OUTDOORS

Up to 3 years outdoors, in a hermetically sealed envelope and enclosed in a packing case.

NOTE

All gear units treated and packed for long term storage should be marked with a specific sticker with caution and instructions on it.

It may in some cases be necessary to rinse the gear unit with the selected oil before starting up. Please check it with Specific Supplier Manual.

Handle any lubricant or oil with care and according to the handling and safety instructions supplied by the lubricant supplier or on customer request. These instructions must be handed over to any personnel performing installation, maintenance or repair of the gear unit.
Do not open the gear unit near flames, sparks or hot objects and take preventive measures to protect people against the volatile corrosion protective substance.

3.2 Handling

The gear units are easy to handle and to install. Make use of the integral oval lifting eyes.
For equal load sharing make use of all lifting eyes and use adequate tools.

Make use of attached lifting eye nuts or mount appropriate lifting eye nuts in housing feet. Attached lifting eye nuts must not be removed. Eye nuts must be fully engaged before lifting. Never lift units with slings wrapped around the shafts or motor lantern. Please check maximal forces on eye nuts attached to the gear unit with the Specific Supplier Manual.

Circumstances might dictate the temporary removal of thermostat(s), pressure gauge(s) and/or part of the oil feed piping. After removal of the latter elements, one should take special care to avoid ingress of moisture, etc... into the lubrication system of subject gear unit(s). For detailed information please carefully read the advices of Specific Supplier Manual.

3.3 Packaging

The bellow pictures show a general overview on how the goods will be packed but not limited to:

4. FAN MOTORS

4.1 Storage

Always store motors in their originally supplied shipping conditions and position.
If the motor is not installed immediately, it must be stored in a dry and clean environment, with relative humidity not exceeding 60%, with an ambient temperature between 5 °C and 40 °C, without sudden temperature changes, free of dust, vibrations, gases or corrosive agents. The motor must be stored in horizontal position, unless specifically designed for vertical operation, without placing objects on it. Do not remove the protection grease from shaft end to prevent rust.

OUTSIDE STORAGE

Choose a dry storage location which is safe from flooding and free from vibration. Repair any damage to the packaging before putting the equipment into storage if this is necessary to ensure proper storage conditions.
Do not impede air circulation under the stored items.
Covers or tarpaulins used to protect the equipment against the weather must not come into contact with the surfaces of the equipment. Use wooden spacer elements to ensure that air can freely circulate around the equipment.

If the motors are fitted with space heaters, they must always be turned on during the storage period or when the installed motor is out of operation. Space heaters will prevent water condensation inside the motor and keep the winding insulation resistance within acceptable levels. Store the motor in such position that the condensed water can be easily drained. If fitted, remove pulleys or couplings from the shaft end.

EXPOSED MACHINED SURFACES
All exposed machined surfaces (like shaft end and flange) are factory-protected with temporary rust inhibitor. A protective film must be reapplied periodically (at least every six months), or when it has been removed and/or damaged.

PACKAGING & STORAGE HEIGHT

The Motors are supplied in cardboard, plastic or wooden packaging. These materials can be recycled and must be disposed according to the applicable laws and regulations in each country.
The stacking height of the motor packaging during the storage period is defined in Specific Supplier Manual.
Please ensure that the crates are properly and stably stacked on each other. See picture below:

Grease lubricated bearings

We recommend rotating the motor shaft at least once a month (by hand, at least five revolutions, stopping the shaft at a different position from the original one). If the motor is fitted with shaft locking device, remove it before rotating the shaft and install it again before performing any handling procedure. Vertical motors may be stored in the vertical or in horizontal position. If motors with open bearings are stored longer than six months, the bearings must be re-lubricated before commissioning of the motor.
If the motor is stored for longer than 2 years, the bearings must be replaced or removed, washed, inspected and re-lubricated according to the Specific Supplier Manual.

The bellow pictures show a general overview on how the goods will be packed but not limited to:

Oil Lubricated bearings

The motor must be stored in its original operating position and with oil in the bearings. Correct oil level must be ensured. It should be in the centre of the sight glass.
During the storage period, remove the shaft locking device and rotate the shaft by hand every month, at least five revolutions, thus achieving an even oil distribution inside the bearing and maintaining the bearing in good operating conditions. Reinstall the shaft locking device every time the motor has to be moved.
If the motor is stored for a period of over six months, it must be checked by Supplier to see whether the bearings need to be re-lubricated before starting of the operation. If the motor is stored for a period of over two years, the bearings must be replaced or removed, washed according to manufacturer instructions, checked and re-lubricated. The oil of vertical mounted motors that are transported in horizontal position is removed to prevent oils leaks during the transport. These motors must be stored in vertical position after receiving and the bearing must be lubricated.

Oil Mist lubricated bearings

The motor must be stored in horizontal position. After filling with oil, rotate the shaft by hand, at least five revolutions)
During the storage period, remove the shaft locking device (if any) and rotate the shaft by hand every week, at least five revolutions, stopping it at a different position from the original one. Reinstall the shaft locking device every time the motor has to be moved. If the motor is stored for a period of over two years, please check whether the bearings need be replaced or removed according to Specific Supplier Spec.

The oil must always be removed when the motor must be handled. If the oil mist system is not operating after installation, fill the bearings with oil to prevent bearing rusting. During the storage period, rotate the shaft by hand, at least five revolutions, stopping it at a different position from the original one.

Sleeve Bearing

The motor must be stored in its original operating position and with oil in the bearings. Correct oil level must be ensured. It should be in the middle of the sight glass. During the storage period, remove the shaft locking device and rotate the shaft by hand every month, at least five revolutions, and at 30 rpm, thus achieving an even oil distribution inside the bearing and maintaining the bearing in good operating conditions. Reinstall the shaft locking device every time the motor has to be moved.
If the motor is stored for a period of over six months, the bearings may probably need to be re-lubricated according to the Specific Supplier Manual.

4.2 Handling

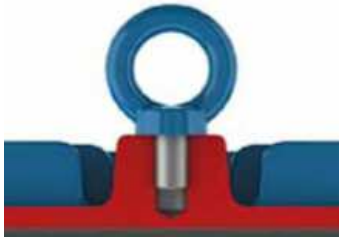
Individually packaged motors should never be lifted by the shaft or by the packaging. They must be lifted only by means of the eyebolts, when supplied. Use always suitable lifting devices to lift the motor. Eyebolts on the frame are designed for lifting the machine weight only as indicated on the motor nameplate. Motors supplied on pallets must be lifted by the pallet base with lifting devices fully supporting the motor weight.
The package should never be dropped. Handle it carefully to avoid bearing damage.

Eyebolts provided on the frame are designed for lifting the machine only. Do not use these eyebolts for lifting the motor with coupled equipment such as bases, pulleys, pumps, reducers, etc.
Never use damaged, bent or cracked eyebolts. Always check the eyebolt condition before lifting the motor.
Eyebolts mounted on components, such as end shields, forced ventilation kits, etc. must be used for lifting these components only. Do not use them for lifting the complete machine set.
Handle the motor carefully without sudden impacts to avoid bearing damage and prevent excessive mechanical stresses on the eyebolts resulting in its rupture.
To move or transport motors with cylindrical roller bearings or angular contact ball bearings, always use T the shaft locking device provided with the motor.

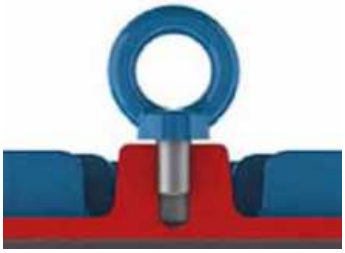
LIFTING

Before lifting the motor ensure that all eyebolts are tightened properly and the eyebolt shoulders are In T contact with the base to be lifted, as shown In Figures.

Ensure that lifting machine has the required lifting capacity for the weight indicated on the motor.



Correct tightening of the eyebolt



incorrect tightening of the eyebolt.

The centre of gravity may change depending on motor design and accessories. During the lifting the maximum allowed angle of Inclination should never be exceeded as specified below.

Examples for motor handling:

Horizontal motors with one eyebolt

For horizontal motors fitted with only one eyebolt, the maximum allowed angle-of-inclination during the lifting process should not exceed 30° in relation to the vertical axis, as shown below.

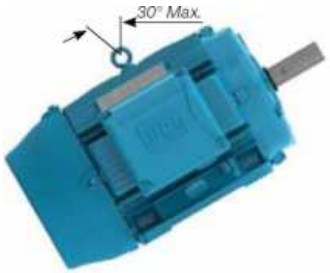
Horizontal motor with two eyebolts

When motors are fitted with two or more eyebolts, all supplied eyebolts must be used simultaneously for the lifting procedure.

There are two possible eyebolt arrangements (vertical and inclined), as shown below:

For motors with vertical lifting eyebolts the maximum allowed lifting angle should not exceed 45° from the vertical axis. We recommend using a spreader bar for maintaining the lifting elements (chain or rope) in a vertical position to prevent damage to the motor surface.

For HGF motors, as shown below, the maximum resulting angle should not exceed 30° from the vertical axis.



Important remark

This guide includes only general information. Some motors have more eyebolts as shown in samples, for every kind of motor is defined the right way to put the motor from horizontal into vertical positions. For detailed information please read carefully the advices of Specific Supplier Manual.

5. FANS

5.1 Storage

Always store the fans in their originally supplied shipping conditions.

If not installed immediately, it is recommended to store the impeller in a dry and shaded area.

OUTSIDE STORAGE

Choose a dry storage location which is safe from flooding and free from vibration. Repair any damage to the packaging before putting the equipment into storage if this is necessary to ensure proper storage conditions.

Do not impede air circulation under the stored items.
Covers or tarpaulins used to protect the equipment against the weather must not come into contact with the surfaces of the equipment. Use wooden spacer elements to ensure that air can circulate freely around the equipment.

Long-term storage

It is required an adequate and safe storage of the painted components in order to avoid any possible damage to the surface. Any defect on the painted surface is not admissible.

You may stack the “bunk beds” to a maximum of 3 high. Do not allow any heavy material of any kind to be stored on top of the blades.

5.2 Handling & Storage

Figure 1

Figure 2

The fan blades are usually packed in so-called “bunk beds” (see Figure 1).
The width of the crates suits standard container dimensions. Fan blades that will be transported by container sea-freight, are equipped with skids and hoist eyes (see figure 2), to allow easy container loading / unloading. Through these hoist eyes, one can pull the bunk beds from the container without damaging the fan blades or the crates.

The fan blades can be lifted from the packing by placing a single sling around the blade. Position the sling in such a manner that the blade tip is somewhat hanging down, which makes it easier to move the blades around. Handle the blades with care to avoid scratches of the surface and any damages. For all detailed information see Specific Supplier Manual.

6. FAN BELLS

The fan bells will deliver usually in containers. You can inspect the equipment for damages in fact after unloading only. Before unloading please see carefully for the right placement of elements in racks and the right racks geometry in container. It must be enough space between containers wall and racks to allow a smooth unloading. For that case please check also the condition of delivered containers for mechanical damages.

6.1 Storage

Always store the cleaning water pump in their originally supplied shipping conditions and position.

If the fan bells are not installed immediately, there must be stored in a clean environment, protected against direct sun radiation and cement dust, vibrations, gases or corrosive agents. The racks must be stored in horizontal position without placing objects on it.

Prevent equipment from sinking into the ground. Do not impede air circulation under the stored items.
Use wooden spacer elements to ensure that air can circulate.

6.2 Handling

Important remark - This guide includes only general information. For detailed information please read carefully and strictly follows the advices of Specific Supplier Manual.

Remove pallet out from the container.

To pull the pallet out from the container, a forklift or any other machine that is able to pull the pallet on the floor of the container can be used. The forklift or a machine used should be appropriate

During the movement, the pallet should be monitored to avoid wedging the pallet with container wall.
Belts should be set up at a distance of no more than ~20 cm from the edge of the pallet.
When the pallet approaches the edge of the container floor, a second forklift lifts the package at the other edge.

Attention: It should be noted that both Forks of forklift covers crossbar of the pallet.
The pallet should be attached to the forklift in such way, that the forklift is able to take the pallet out from the

container.

Please pay attention that part of the pallet nearer the forklift is slightly raised above the floor of the container. The pallet should be pulled out using the forklift until the pallet approaches the edge of the container.

From this moment the second forklift is needed (Forklift No 2) and the pallet is lifted by forklift no 2. The forklift no 1 should be released and drove away.

Attention: It is very important that the forklift no 2 is set to the appropriate side of the pallet.
Please pay special attention to the fact that the forklift should be set symmetrically to the pallet, and the forks should cover both crossbars of the pallet. Spacing cross is 140 cm.
Place the rack carefully on the prepared, horizontal surface.

6.3 Packing

The bellow pictures show a general overview on how the goods will be packed but not limited to:

Contract Name : **ACC for 3X800 MW Patratu Project, India**
Contract Number : **BHEL/HEEP/PPX-BOI/Patratu/ACC/20201744**
Document Title : **Storage and Handling Procedure for Air Cooled Condenser**

7. EXPANSION BELLOWS

Inspect the packing first for damage. If packing is damaged and the Specific Supplier Manual does not define other way, carefully unpack and check the bellows for damages.

7.1 Storage

Always store expansion bellows in their originally supplied shipping conditions and position.

INDOOR STORAGE

For expansion bellows indoor storage is preferable.
If expansion bellows are not installed immediately, they must be stored in a dry and clean environment, free of dust, vibrations, gases or corrosive agents, in horizontal position without placing objects on it. Do not store expansion bellows direct on the floor, use wooden dunnage elements. To avoid the condensation of water do not cover expansion bellows.

Do not remove the expansion bellow from its original packaging until you are ready to install.
In case of aggressive atmospheres or long terms storage requirements contact Contract Engineer for specific packing procedures.

7.2 Handling

Individually packaged joints should never be lifted by the shaft or by the packaging. They must be lifted only by means of the eyebolts, when supplied.
The package should never be dropped.

HANDLING GENERAL ADVICES

Handle it carefully and consider all data of the operating instructions included in Specific Supplier Manual.
Ensure that lifting machine has the required lifting capacity for the gross weight indicated on the packing unit.

Unpack the expansion joints carefully.
Use only designated lifting lugs to lift the expansion joints. For expansion joints not provided with lifting lugs, the best

lifting method should be evaluated at the time of installation.

Do not lift the expansion joint by the shipping bars. Shipping bars (painted yellow) are not designed to be lifting devices.

Do not lift the expansion joint by the hinges, gimbals, tie rods or any other operative device.

Do not fix any chains or ropes to the bellows section. The bellows portion of the expansion joint may be easily damaged and cannot usually be repaired.

Inspect the units directly after unpacking has been completed. Report any damage immediately to your Engineering/Inspection Department for correct disposition.

DO NOT REMOVE ANY BLOCKING/TRANSPORT DEVICE (MOSTLY YELLOW MARKED AND CLEARLY IDENTIFIED) IF AVAILABLE UNTIL THE EXPANSION JOINT HAS BEEN INSTALLED.

Please note the following:

Lifting operations must always be carried out by experienced staff; using appropriate lifting equipment (forklifts, cranes, etc.).

Use only designated lifting lugs when available. These are properly identified.

When using cranes to lift the cases, make sure that the ropes shall not constrict the wooden cases when lifting. Do not use metal chains to lift the cases.

The lifting belts must be sufficiently long (spread angle smaller than 90°)

The lifting belts must be protected against damage (see above). Therefore, use lifting belt with a rugged edge protection

The lifting belts must be attached at suitable hitching points

The lifting belts must be routed so that the bellow cannot slip out or tip.

7.3 Packing

The bellow pictures show a general overview on how the goods will be packed but not limited to:

8. DUCTING

8.1 Storage

Always store all ducting elements in his originally supplied shipping conditions and position.

OUTDOOR STORAGE

Ducting elements are to be stored on previously prepared area. The storage area should be big enough for all received pipes and have enough space for handling equipment such as cranes, heavy forklifts and transportation.
It must have a smooth, horizontal surface of adequate load-bearing capacity e.g. asphalted or bricked to ensure effective protection against over flooding by rain and against sinking in the ground.

Never store pipes on unlevelled ground. For storage of single elements, use wooden dunnage in right thickness.
When ducts with different sizes and diameters are shipped on the site, it is recommended to put the heaviest and largest parts near to the entrance of storage area to facilitate later handling of the oversized parts.
If possible, we recommend storing ducting under roof or indoor.

8.2 Handling

HANDLING GENERAL ADVICES

ALWAYS MOVE EQUIPMENT WITH CAUTION. FAILURE TO FOLLOW PROPER HANDLING PROCEDURES MAY CAUSE EQUIPMENT TO TIP AND LEAD TO SEVERE PERSONAL INJURY OR DAMAGE TO EQUIPMENT.

All personnel involved must be fully qualified for the handling of such specific devices.

Please consider all detailed operating instructions included in Specific Supplier Manual.

When transporting with lifting equipment take the following basic rules into consideration:

- Only use suitable lifting gear (e.g. traverses, belts, ropes/cables and guide ropes) and transport equipment (e.g. forklift truck, low-lift platform truck, crane).
- Units supplied on pallets such as fittings must be lifted by the pallet base with lifting devices fully supporting the gross weight
- The capacity of lifting equipment and lifting gear must be at least equal to the duct weight
- The lifted elements must be secured so that they cannot tip or fall
- During transport, especially by wind of for temperatures below 0°C (32 °F), the duct should not undergo any significant agitation.
- The crane must never lift, nor ducts be stored on uneven, weak and unprepared ground
- The lifting belts must be sufficiently long (spread angle smaller than 90°)
- Always use enough long guide ropes
- The lifting belts must be protected against damage (e.g. by rubbing edges)
- The lifting belts must be attached at suitable hitching place, defined individually in Specific Supplier Manual
- The lifting belts must be routed so that the duct cannot slip out or tip.
- Never secure the lifting belt to points not defined in the rules, e.g. to ducts edges.

8.3 Packing Procedure for Ducting in Bulk

Use cradles for difficult to handle parts of the ducting sent in bulk.

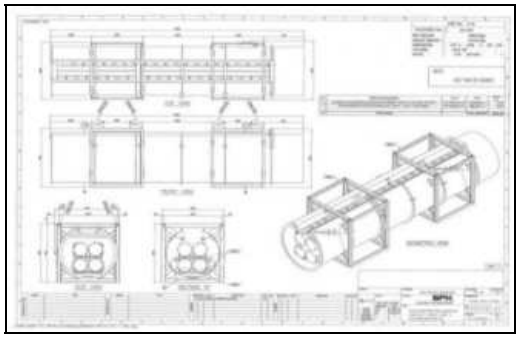
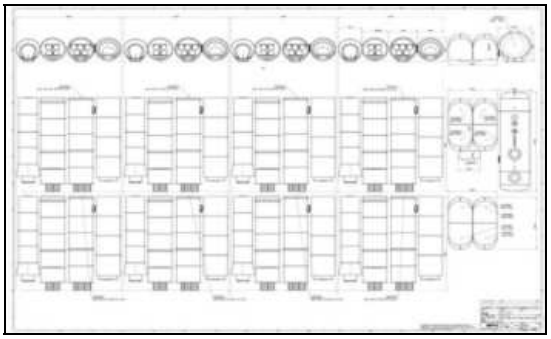
Prepare and paint the cradles, put the material easily and fast into the cradles. Fix the material to the cradle for transport.

The upper traverses can be welded afterwards to ensure frame rigidity.

Oversized duct pieces should be fitted with lashing and lifting lugs.


The inside of the main duct can be used to store smaller parts in order to reduce volume of shipment. Transport optimization is a must, for each package truckload must be at least 12 tons.


Already during fabrication, it is necessary to prepare the packing plans in order to optimize the placement of pieces and preparation of carrying frames (see examples below).

1. Inside the 1st duct the brackets are welded temporarily to fix on them NPU profiles (to be used as rails). As a

reinforcement extra H or NPU beams are welded to the 1st duct wall to support the 2nd duct.

2. The 2nd duct must be put on two temporary saddles, one of them wheeled.
   The wheels are then placed on the rail and the 2nd duct can be easily pushed inside the 1st duct.

3. Both saddles have to be fixed to the rail and reinforcement profile for transport.
   Open ends of ducts are covered with tarpaulin to protect from sun and rain.
   The ducts are then put onto temporary saddles and fixed by safety ropes.

4. Pieces are loaded onto trucks using steel ropes lifting equally both sides of ducts.

5. Then pieces are fixed to the trucks using load safety ropes.

Material must be covered with plastic sheeting and/or tarpaulin, in order to protect from the sun and rain.

Sea transport under deck.

Each element should be clearly identified with appropriate markings.

8.4 Packaging

The pictures bellow shows a general overview on how the goods will be packed and marked:

9. CONDENSATE STORAGE TANK

9.1 Storage

Always store the condensate tank in its originally supplied shipping conditions and position.

OUTDOOR STORAGE

If the tank is not installed immediately, it has to be stored in a clean environment, protected from rain, snow, direct sun radiation, cement dust, vibrations, gases or corrosive agents. It should remain in delivered position and packaging without placing objects on it.

Prevent the condensate tank from sinking into the ground. The tank rack must never be set down or stored on uneven ground. The storage area must have a smooth, horizontal surface of adequate load-bearing capacity e.g. asphalted or bricked surface to ensure effective protection against over flooding by rain.
Do not impede air circulation under the stored items. Cover the items using wooden spacer elements to ensure the air circulation.

Make sure that closures are mounted on all openings (e.g. blind flanges on connections, plugs on threaded connections)
Make sure that the tank is dry inside and outside.

9.2 Handling

Please do not lift the condensate tank by gripping to its packaging. It must be lifted only by hitching points, defined in Specific Supplier Manual. Always use suitable lifting devices to lift the condensate tank.
The package or tank should never be dropped.

HANDLING GENERAL ADVICES

Handle the condensate tank carefully and consider all data of the operating instructions included in Specific Supplier Manual.
Ensure that lifting machine has the required lifting capacity for the weight indicated.
For the machine weight see Specific Supplier Manual.

When transporting with lifting equipment, observe the following basic rules:

Only use suitable lifting gear (e.g. belts or ropes/cables) and transport equipment (e.g. forklift truck, low-lift platform truck, crane)

The lifting capacity of lifting equipment and lifting gear must be at least equal to the machine's weight

The machine must be secured so that it cannot tip or fall

During transport, especially for temperatures below 0°C (32 °F), the machine cannot undergo significant agitation.

The machine must never be set down or stored on uneven floors or surfaces!

LIFTING

We recommend transport with a crane and lifting belts.

Please note the following:

The lifting belts must be sufficiently long (spread angle smaller than 90°)

The lifting belts must be protected against damage (e.g. by rubbing edges). Therefore, use lifting belt with a rugged edge protection

The lifting belts must be attached at suitable hitching points

Suitable attachment points include: the bearing housing, the lower inlet/discharge connections, openings and lifting pins on base plates

The lifting belts must be routed (eg. in undercuts) so that the machine cannot slip out or tip.

Make sure that no damage is caused to any attached fittings

Never secure the lifting belt to points not defined, like flanges.

9.3 Packing

The bellow pictures show a general overview on how the goods will be packed but not limited to:

Contract Name : **ACC for 3X800 MW Patratu Project, India**
Contract Number : **BHEL/HEEP/PPX-BOI/Patratu/ACC/20201744**
Document Title : **Storage and Handling Procedure for Air Cooled Condenser**

10. PIPING

10.1 Storage

Always store the pipes in his originally supplied shipping conditions and position.

OUTDOOR STORAGE

Pipes are to store on a pre-prepared area. The storage space should be big enough for all received pipes in best possible way. The storage area must have a smooth, horizontal surface of adequate load-bearing capacity eg. gravelled, asphalted or bricked surface to ensure effective protection against over flooding by rain and against sinking in the ground.
Where the storage area with such surface conditions is not available or when a surface cannot be well prepared, the pipe may be placed on solid planking. The planking should be evenly spaced along all the pipes length.
Never store pipe units or single pipes on unlevelled ground.

The pipes will be delivered arranged in sets as shown in the picture below

When unpacked, the pipes should temporary be stored on shelves or on hard wooden or stable sandbags at two supporting points usually located at ¼ and ¾ of the pipe length. Make sure the shelves or the dunnage can support

the gross weight of the materials and will withstand weather conditions.

If possible, we recommend storing the pipes and fittings under roof or indoor.

10.2 Handling

HANDLING GENERAL ADVICES

Handle the pipes units and fittings carefully and consider all data of the operating instructions included in Specific Supplier Manual.
Ensure that lifting equipment has the required lifting capacity for the weight indicated.
For the gross weight of pipes of strapped pipe bundles see the technical documentation.

When transporting with lifting equipment, observe the following basic rules:

- Only use suitable lifting gear (e.g. traverses, belts, ropes/cables and guide ropes) and transport equipment (e.g. forklift truck, low-lift platform truck, crane)
- Units supplied on pallets such as fittings must be lifted by the pallet base with lifting devices fully supporting the gross weight
- The lifting capacity of lifting equipment and lifting gear must be at least equal to the packages weight
- During transport, especially for temperatures below 0°C (32 °F), the package cannot undergo any significant agitation.
- The crane must never lift, nor pipes be stored on uneven ground
- The lifting belts must be sufficiently long (spread angle smaller than 90°)
- The lifting belts must be protected against damage (e.g. by rubbing edges)
- The lifting belts must be attached at suitable hitching place, by lifting of single pipes usually it is ¼ of the pipe length from each pipe end, by lifting of packages as described in Specific Supplier Manual
- The lifting belts must be routed (e.g. in undercuts) so that the pipe of strapped pipe bundle cannot slip out or tip.
- Never secure the lifting belt to points not defined in the rules, such as pipe edges.

11. VALVES

Upon receipt, the valves should be inspected for shipping damage. If the end protectors are removed for inspection purpose, be sure to re-install them to maintain internal cleanliness.
If caps are missing, an inspection of the valve cavity is required.

11.1 Storage

Always store the valves in a clean environment and if possible, in their originally supplied shipping conditions. Valves should be kept in the fully open or closed position. They are usually shipped in the closed position to protect the seat surfaces during transportation.

Valves are normally shipped with adequate protection for indoor storage for up three months. This protection consists of a rust preventative and plastic valve end protectors.

To avoid damage due to humidity, valves should be stored in a humidity-controlled storage area and the end caps should not be removed prior to valve installation.

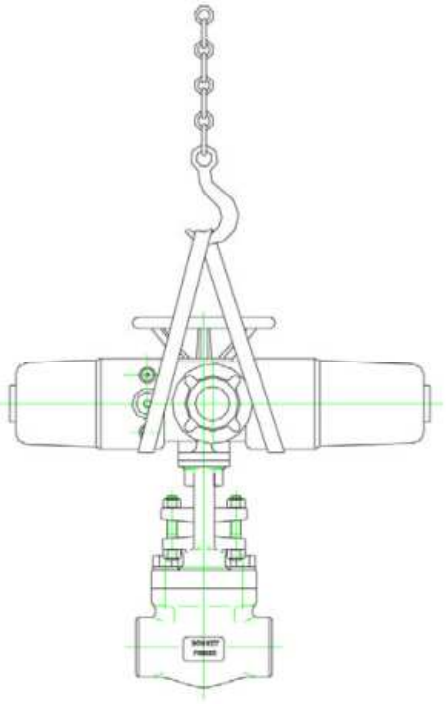
Be careful not to damage the valve stems during handling. In case the valves are rack mounted for storage, their packing chambers should not come directly in contact with the racks. It is not recommended to place valves directly on the ground or on a concrete floor.

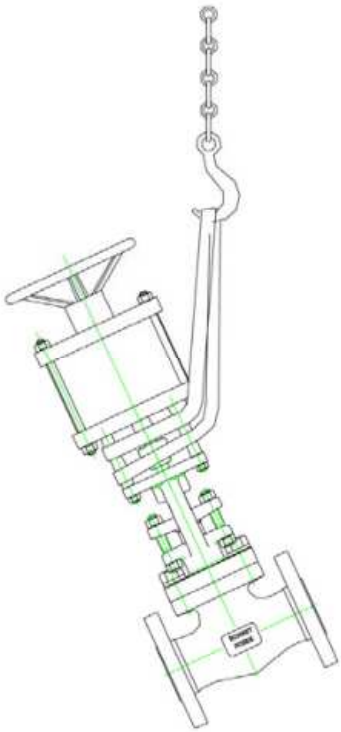
Depending upon the valve type, materials, parameters and storage duration, there are different, special requirements described in Special Supplier Manual.

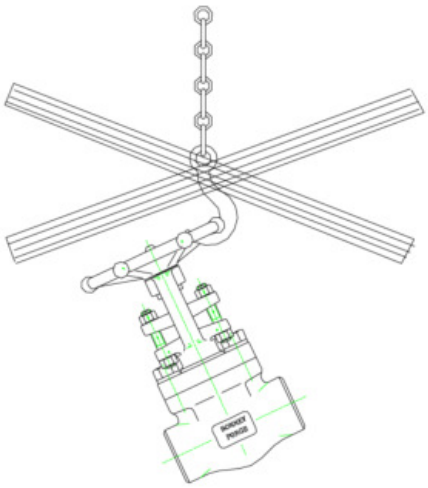
11.2 Handling

Please do not lift the individually packaged, heavy valves or strainer by gripping to their packaging They must be lifted only by means of the eyebolts, when supplied. Always use suitable lifting devices to lift, specified in Special Supplier Manual. Goods supplied on pallets should be lifted by the pallet base with lifting devices fully supporting the goods weight.

For motor operated valves, we suggest protecting the actuator as shown below.







11.3 Packing

The bellow pictures show a general overview on how the goods will be packed but not limited to:

12. RUPTURE DISCS

12.1 Storage

INDOOR STORAGE

For rupture discs, indoor storage is required.
They must be stored as supplied in a dry and clean environment, free of dust, vibrations, gases or corrosive agents and in horizontal position without placing objects on it. Do not store the wooden boxes directly on the floor. Instead use wooden dunnage elements. To avoid the condensation of water do not cover the rupture discs.
Do not remove the discs from its original packaging until you are ready to install. Unpack the discs only on the installation place.

12.2 Handling

The boxes are to be handled manually. The package should never be dropped. Handle it carefully and consider all data of the operating instructions included in Specific Supplier Manual.

12.3 Packaging

The bellow pictures show a general overview on how the goods will be packed but not limited to:


01/02/2012


Fike
Fike
Fike
01/02/2012

13. VACUUM PUMP SYSTEM

13.1 Storage

Always store vacuum pumps in their originally supplied shipping conditions and position.

INDOOR STORAGE

If the vacuum pump or vacuum unit is not installed immediately, it must be stored in a dry and clean environment, free of dust, vibrations, gases or corrosive agents and in horizontal position without placing objects on it.

The machine must never be set down or stored on uneven ground.

Do not remove the protection grease from shaft end to prevent rust.

STORAGE GENERAL ADVICES

Check machine and components for completeness and damages

Make sure that all pipes and hoses are connected

Make sure that closures are mounted on all openings that are not required (e.g. blind flanges on connections, plugs on threaded connections)

Make sure that the machine is dry

Check the coating of unpainted parts (bright parts and internals), re-coat if necessary, with a rust preventive fluid

Store the goods together (per package) to avoid misplacement or loss of parts consignment

Special care should be taken for delicate components, like separately packed mechanical seals, instruments etc., if applicable

13.2 Handling

Individually packaged units or pumps should never be lifted by the shaft or by the packaging. They must be lifted only by means of the eyebolts, when supplied.

Always use suitable lifting devices to lift the motor.

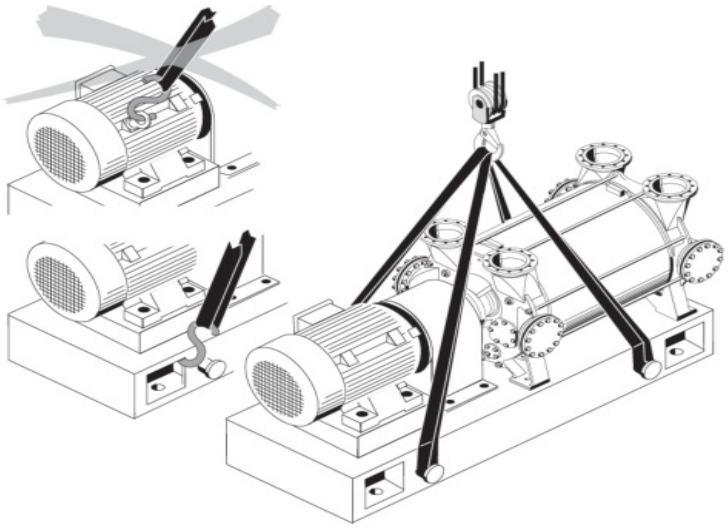
Eyebolts on the frame are designed for lifting the machine weight only as indicated on the motor nameplate. Motors supplied on pallets must be lifted by the pallet base with lifting devices fully supporting the motor weight.

The package should never be dropped.

HANDLING GENERAL ADVICES

Handle it carefully and consider all data of the operating instructions included in Specific Supplier Manual.
Ensure that lifting machine has the required lifting capacity for the weight indicated on the vacuum pump or unit.
For the machine weight and centre of gravity, see general arrangement drawing.

Before transport and handling, make sure that all components are securely assembled and secure or remove all components which have had their fasteners loosened.
When transporting with lifting equipment please observe the following basic rules:
Only use suitable lifting gear (e.g. belts or ropes/cables) and transport equipment (e.g. forklift truck, low-lift platform truck, crane)
The lifting capacity of lifting equipment and lifting gear must be at least equal to the machine's weight
The machine must be secured so that it cannot tip or fall
During transport, especially for temperatures below 0°C (32 °F), the machine cannot undergo significant agitation.
The machine must never be set down or stored on uneven ground!
Eyebolts mounted on components, such as on end shields, forced ventilation kits, etc. must be used for lifting these components only. Do not use them for lifting the complete machine set.

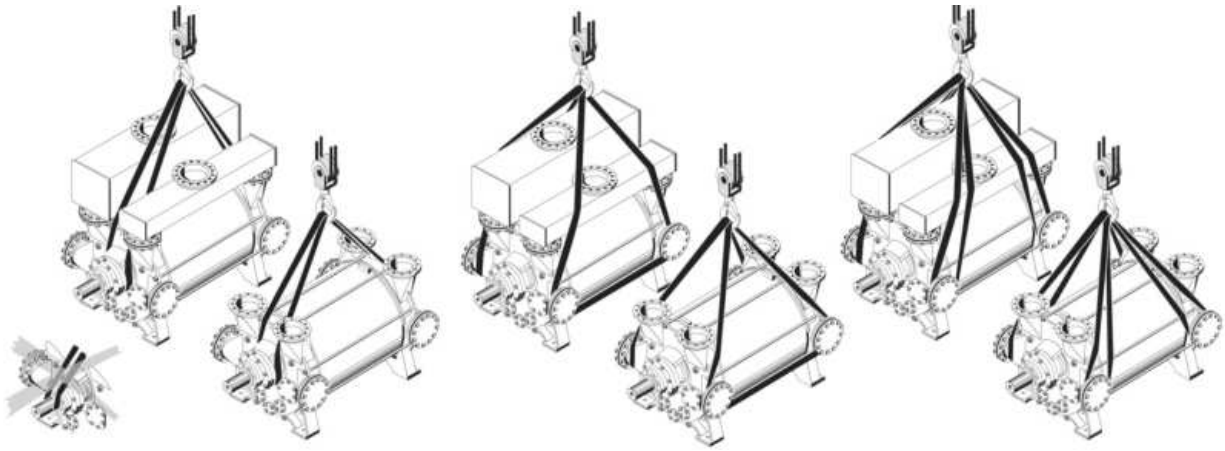


LIFTING

We recommend transport with a crane and lifting belts.
Secure the lifting belts as shown in figures below.

Please note the following:

- The lifting belts must be sufficiently long (spread angle smaller than 90°)
- The lifting belts must be protected against damage (e.g. by rubbing through on edges). Therefore, use lifting belt with a rugged edge protection
- The lifting belts must be attached at suitable hitching points
- Suitable attachment points include: the bearing housing, the lower inlet/discharge connections, openings and lifting pins on base plates
- The lifting belts must be routed (e.g. in undercuts) so that the machine cannot slip out or tip. However, the lifting belts may be routed over attached Y-pipes or separators. Spreading devices are usually not required here
- Make sure that no damage is caused to any attached fittings
- Never secure the lifting belt to the following points:
  - Shaft ends
  - Attached individual components or fittings
  - Hitching points of individual components, as these are only designed for the separate transport of each component.



13.3 Packaging

The bellow picture shows a general overview on how the goods will be packed but not limited to:

Contract Name : **ACC for 3X800 MW Patratu Project, India**
Contract Number : **BHEL/HEEP/PPX-BOI/Patratu/ACC/20201744**
Document Title : **Storage and Handling Procedure for Air Cooled Condenser**

14. CONDENSATE EXTRACTION PUMPS

14.1 Storage

Always store the pumps in their originally supplied shipping conditions and position.

STORAGE GENERAL ADVICES

Check machine and components for completeness and damages.
Make sure that all pipes and hoses are connected.
Make sure that closures are mounted on all openings that are not required (e.g. blind flanges on connections, plugs on threaded connections).
Make sure that the machine is dry.
Check the coating of unpainted parts (bright parts and internals). Re-coat if necessary, with a rust preventive fluid
Store the goods together (per package) to avoid misplacement or loss of parts consignment.
Special care should be taken for delicate components, like separately packed mechanical seals, instruments etc., if applicable.
Rotate the shaft by hand once a month, e.g. via the motor fan.

INDOOR STORAGE – recommended

If the pump or pump unit is not installed immediately, it must be stored in a dry and clean environment, free of dust, vibrations, gases or corrosive agents and in horizontal position (like delivered) without placing objects on it.
The machine must never be set down or stored on uneven grounds. Never place the units directly on the floor. Use wooden dunnage for base.

OUTDOOR STORAGE

Outdoor storage is not recommended. Only if it is necessary choose a location which is safe from flooding and free from vibration. Repair any damage to the packaging before putting the equipment into storage.
Prevent equipment from sinking into the ground. Cover the packed pump (set) and accessories with waterproof material. Do not impede air circulation under the stored items. Covers or tarpaulins used to protect the equipment

against the weather must not come into contact with the surfaces of the equipment. Use wooden spacer elements to ensure that air can circulate freely around the equipment.
By temperatures below 5°C the outside storage is not recommended. Please check this possibility with Specific Supplier Manual.

14.2 Handling

Individually packaged units or pumps should never be lifted by the shaft or by the packaging. They must be lifted only by means of the eyebolts, when supplied. Always use suitable lifting devices to lift the motor. Eyebolts on the frame are designed for lifting the machine weight only as indicated on the motor nameplate. Motors supplied on pallets must be lifted by the pallet base with lifting devices fully supporting the motor weight.
The package should never be dropped.

HANDLING GENERAL ADVICES

Handle it carefully and consider all data of the operating instructions included in Specific Supplier Manual.
Ensure that lifting machine has the required lifting capacity for the weight indicated on the pump or pump unit.

Before transport and handling, make sure that all components are securely assembled and secure or remove all components which have had their fasteners loosened.
When transporting with lifting equipment, observe the following basic rules:
Only use suitable lifting gear (e.g. belts or ropes/cables) and transport equipment (e.g. forklift truck, low-lift platform truck, and crane)
The lifting capacity of lifting equipment and lifting gear must be at least equal to the machine's weight
The machine must be secured so that it cannot tip or fall.
During transport, especially for temperatures below 0°C (32 °F), the machine cannot undergo significant agitation.
The machine must never be set down or stored on uneven grounds!
Eyebolts mounted on components, such as on end shields, forced ventilation kits, etc. must be used for lifting these components only. Do not use them for lifting the complete machine set.

LIFTING

We recommend transport with a crane and lifting belts.

Secure the lifting belts as shown in figures below.

Please note the following:

The lifting belts must be sufficiently long (spread angle smaller than 90°)

The lifting belts must be protected against damage (e.g. by rubbing through on edges). Therefore, use lifting belt with a rugged edge protection

The lifting belts must be attached at suitable hitching points

Suitable attachment points include: the bearing housing, the lower inlet/discharge connections, openings and lifting pins on base plates

The lifting belts must be routed (e.g. in undercuts) so that the machine cannot slip out or tip.

Make sure that no damage is caused to any attached fittings

Never secure the lifting belt to the following points:

- Shaft ends
- Attached individual components or fittings
- Hitching points of individual components, as these are only designed for the separate transport of each component.

15. CLEANING PUMP SYSTEM

15.1 Storage

Always store the cleaning pump system in its originally supplied shipping conditions and position.

If the pump is not installed immediately, it must be stored in a dry and clean environment, with an ambient temperature above 5 °C, without sudden temperature changes, free of dust, vibrations, gases or corrosive agents. The pump has to be stored in horizontal position without placing objects on it.
Do not remove the protection grease from shaft end to prevent rust and other protection elements before installation.
The machine must never be set down or stored on uneven floors or surfaces.

OUTSIDE STORAGE

Pumps should not be stored in excessively hot, humid, dirty or dusty environments. Protect the pump and against direct sun radiation.
In potentially cold climates, pumps must be protected from frost as freezing will cause serious irreparable damage!

Choose a dry storage location which is safe from flooding and free from vibration. Repair any damage to the packaging and covering before putting the equipment into storage.
Prevent equipment from sinking into the ground. Do not impede air circulation under the stored items.
Covers or tarpaulins used to protect the equipment against the weather must not come into contact with the surfaces of the equipment. Use wooden spacer elements to ensure that air can circulate freely around the equipment.

EXPOSED MACHINED SURFACES

All exposed machined surfaces (like shaft end and flange) are factory-protected with temporary rust inhibitor. A protective film must be reapplied periodically (at least every six months), or when it has been removed and/or damaged.

15.2 Handling

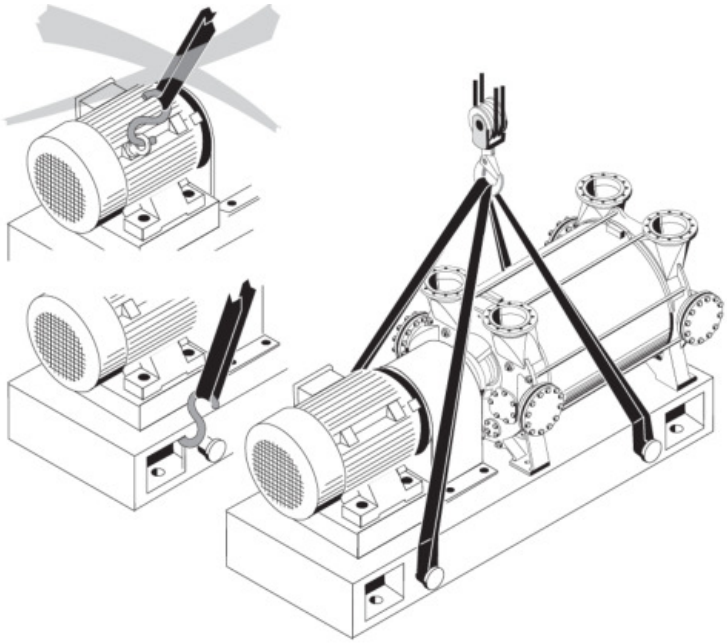
HANDLING AND TRANSPORT

Always use suitable lifting devices to lift the pump. Eyebolts on the frame are designed for lifting the machine weight only as indicated on the unit nameplate. Units supplied on pallets must be lifted by the pallet base with lifting devices fully supporting the pump weight. Eyebolts mounted on components, such as end shields, forced ventilation kits, etc. must be used for lifting these components only. Do not use them for lifting the complete machine set.

The package should never be dropped. Handle the pump carefully without sudden impacts to avoid damage and prevent excessive mechanical stresses on the eyebolts resulting in its rupture.

We recommend transport with a crane and lifting belts.
Secure the lifting belts as shown in figures below.
Please note the following:

- The lifting belts must be sufficiently long (spread angle smaller than 90°)
- The lifting belts must be protected against damage (e.g. by rubbing through on edges). Therefore, use lifting belt with a rugged edge protection
- The lifting belts must be attached at suitable hitching points
- The lifting belts must be routed (e.g. in undercuts) so that the machine cannot slip out or tip. However, the lifting belts may be routed over attached Y-pipes or separators. Spreading devices are most not required here
- Make sure that no damage is caused to any attached fittings
- Never secure the lifting belt to the following points:
    - Shaft ends
    - Attached individual components or fittings
    - Hitching points of individual components, as these are only designed for the separate transport of each component.



15.3 Packaging

The picture bellow illustrates how the goods will be packed (but not limited to):

16. INSTRUMENTATION

16.1 Storage

INDOOR STORAGE

Instrumentation equipment has very specific conditions for storage. They contain very sensitive electrical, electronic and mechanical components to perform steering, control, monitoring and safety functions of the ACC. Therefore, most of these components are of high quality and need be handled with special care.

Due to a big range of Instruments, it is not possible to specify the storage requirement in detail for all of them.

For detailed information please carefully read the advices of Specific Supplier Manual.

General rules for storage:

- Store the instruments original packed like shipped, if possible.
- Always store the instruments indoors in a heated building that is clean and dry and furniture with racks or cabinets. Never put the instruments directly on the floor
- The floor should be smooth and easy to be kept clean.
- Take all measures to prevent the instruments against dampness, dust, aggressive and corrosive atmosphere, direct sun radiation (through the window) and extreme temperature changes.
- To control water condensation, make sure the storage is well ventilated. Install temporary space heaters or air dryer if necessary.
- The relative humidity should not exceed 50%, with an ambient temperature between 15 °C and 30 °C. The temperature and air humidity should be controlled and registered.
- Goods in storage should be checked periodically for any signs of deterioration.

16.2 Handling

For detailed information please carefully read the advices of Specific Supplier Manual.

The handling and lifting of most of the instruments is manual. Therefore, the qualification of working staff is very important to avoid damages.

- All personnel involved must be fully qualified to transport, install and inspect the type of instrument involved
- The responsibilities, competence and supervision of all personnel involved in transport, installation and inspection must be clearly defined by the responsible project engineers.
- The participation in such training has to be confirmed in written.
- Handle the instruments with special care!

16.3 Packaging

The picture bellow depicts a general overview on how the goods will be packed (but not limited to):

17. SHEETING

POLMET YAPI

A) PACKING

Trapezium sheets are fixed with plastic tapes and covered with moisture barrier. Wooden carriers are placed under every package. (in addition, dehumidifier bags are available in each loading container)

B) LOADING

Packed trapezium sheets are must be loaded to Open Top Containers /vehicles with cranes. Packing weights must be under 3 tones.

POLMET YAPI İNŞAAT METAL SAN. VE TİC. LTD. ŞTİ.
Yenişehir Mah. Cumhuriyet Bulvarı Dumankaya Cadde Sitesi A Blok / 12-1/51 Pendik / İstanbul
e-mail : info@polmetyapi.com
Tel: 02165040675 Faks: 02165040678

POLMET YAPI

C) UNLOADING

Trapezium packages are unloaded from top of containers with cranes . meantime, the rope using for unloading process , must cover two sides of the package . Wood carriers placing under the packages, must be used in the same way again.

D) STORAGE

The goods are must be stocked indoor without any damage to the packing. They must be kept away from water, moisture and exposuring with the ground directly. Other factor is condensation due to tempreture differences between night and day, shortens shelf life of the goods. Therefore, at storage process relative humidity must be under 70 % with ventilation.

POLMET YAPI İNŞAAT METAL SAN. VE TİC. LTD. ŞTİ.
Yenişehir Mah. Cumhuriyet Bulvarı Dumankaya Cadde Sitesi A Blok / 12-1/51 Pendik / İstanbul
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AIR COOLED CONDENSER

PTT PATRATU PROJECT

ERECTION MANUAL GUIDE
Technical Advisory Contracts

ACC A Frame - SRC

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-	22/07/2022		BMA		PREL	First Issue
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PROJECT INFORMATIONS

Project name:	**PATRATU POWER PLANT PROJECT**
Project location:	**INDIA**
Task:	**Erection of ACC Air Cooled Condensers**
Quantity:	**The quantities listed in this document are for three (3) Units with eight 8 streets of nine (9) modules-Cell per street.**
Language:	**Correspondence and minutes of meeting: English all other documents: English**

Definitions:

Owner:	**NTPC**
Owner's Engineer:	**TBC**
EPC Contractor:	**BHEL**

1. INTRODUCTION

Abbreviation

ACC: Air Cooled Condenser
CCM: Condensate Collecting Manifold
SDM: Steam Distribution Manifold
MED: Main Exhaust Duct
HDT: Hotwell Drain Tank
ACC CT: ACC Condensate Tank
TOS: Top of Steel
TOC: Top of Concrete Columns
CL: Centre Lines
PCT: Power Consumption Test
ALT: Air Leak Test
CCL: Cold Commissioning List
MAG: Steam System
MAJ: Air Take Off System
LCM: Drain Pump System
LCA: ACC Condensate Drain System
SDA: Cleaning System
EC: Erection Company
EPC: Engineering Procurement and Construction
SPGDC: SPG Dry Cooling

Generalities

This erection manual guide is issued to cover the erection of the materials and equipment for the ACC Air-Cooled Condenser UNIT 1-2-3

The purpose of this manual is to detail, both in principle and specifically, the methodology for erection of the Air-Cooled Condenser and associated equipment. The contents of this manual could be subject to amendment at the discretion of SPGDC according to site circumstances.

Adherence to this erection manual guide shall not be considered mandatory. It is issued to the EC for guidance purposes only and does not constitute an instruction to work in any particular way or sequence that will give rise to future claims for additional costs from EC. Variation from the detail of this erection manual guide is solely at the discretion and risk of the EC. Should unforeseen circumstances result in out of sequence deliveries the EC shall use their best endeavours to use available material to fully utilize the labour resources on site and mitigate delay and cost.

This erection manual guide is issued to the EC with the assumption that all erection activities will be executed in accordance with good working practice. Furthermore, it is assumed that the EC is imbued with sufficient experience and knowledge to erect the plant described and will deploy personnel resources at site and project level accordingly.

The EC should refer to the erection schedule issued by EPC staff and for overlapping and interfacing in the erection activities.

EC shall erect in accordance with the drawings, documents and specifications mentioned in this erection manual guide.

It is EC's responsibility to verify the good receipt and understanding of drawings, design data and specifications of SPGDC and transmitted by EPC.

Incorrect or incomplete documents will not be accepted as a reason for not fulfilling the erection. During construction period, site supervisor instruction or new document revision should be considered as applicable.

It is EC's duty to check, the correctness, and completeness of its erection activities.

With approval of EPC, EC shall visit the site prior to starting erection in order to be fully informed about local erection conditions, accessibility and all site regulations.

All materials covered by this erection manual guide are to be erected in full, and complete, ready for industrial operation and to the full satisfaction of SPGDC and the EPC

EC shall execute the erection in conformity with the applicable requirements of governing codes agreed with EPC. EC is considered to have found no discrepancy between the present erection manual guide and the regulations and codes mentioned above.

With agreement of EPC, EC shall perform sufficient inspection to ensure continuous quality of erected materials.

EC accepts to work in a site managed as per the rules defined by EPC and SPGDC advisory. The required services and documentation needed by this organisation will be provided.

EC is aware that in the same work area other contractors are simultaneously performing work. Consequently, EC shall co-ordinate with others to avoid unwanted work force concentrations, allowing all parties to perform their duties satisfactorily. The working conditions resulting from such coordination are mean to be normal for the contract works execution. Coordination activities will be organised as per EPC/CLIENT regulation to be issued.

EC shall participate if requested to all co-ordination meeting held on site and managed by EPC/CLIENT.

Particular note:

EPC/client and EC will agree on available storage and pre-fabrication area and evaluate commonly the erection sequence of the 3 units, knowing that during erection of the 3 ACC units, some of part of the roads around ACC can be blocked due to pre-fabrication works and/or access roads for mobile or other cranes.

2. DOCUMENTS

SPGDC main documents useful for erection purpose.

	DOCUMENT CONTROL LIST			
	AIR COOLED CONDENSER - PATRATU			
Doc. Nr.	REF.NR Key	Content	TITLE	Client Due Date
			BILL OF MATERIAL	
PTT-BOM4010	BOM	4010	Bill of Material for Ducting	02/06/2022
PTT-BOM4020	BOM	4020	Bill of Material for interconnecting piping	14/07/2022
PTT-BOM4024	BOM	4024	Bill of Material Piping Support	14/07/2022
PTT-BOM6104	BOM	6104	Bill of Material for Electrical Items	09/08/2022
			DESCRIPTIONS	
PTT-DES5700	DES	5700	Cleaning System Procedure	08/09/2022
PTT-DES6401	DES	6401	Functional Description For Air Cooled Condenser	
			DESIGN NOTES	
PTT-DNO2000	DNO	2000	Steel Structure Design Note	21/04/2022
PTT-DNO2010	DNO	2011	Design Note Civil (RCC) design	
PTT-DNO2011	DNO	2011	ACC Concrete Support Pillars Design Note	21/04/2022
PTT-DNO4730	DNO	4730	Rupture Disc Design Note	24/03/2022
PTT-DNO5210	DNO	5210	Design Note for Condensate Tank	05/05/2022
PTT-DNO5220	DNO	5220	Design Note For Drain Tank	05/05/2022
PTT-DNO5230	DNO	5230	Design Note For Deaerator	05/05/2022
PTT-DNO5360	DNO	5360	Design Note for Vacuum Pump	19/05/2022
PTT-SNO0002	SNO	0002	Heat Load and Surface Computation Details	17/02/2022
			DATASHEETS	
PTT-DSH0002	DSH	0002	Thermal Datasheet	17/02/2022
PTT-DSH3210	DSH	3210	Fan Datasheet	07/04/2022
PTT-DSH3310	DSH	3310	Gearbox Datasheet	07/04/2022
PTT-DSH4610	DSH	4610	Expansion Bellow Datasheet	21/04/2022
PTT-DSH4732	DSH	4732	Rupture Disc Datasheet (30 inch)	05/05/2022
PTT-DSH4810	DSH	4810	Control Valves Datasheet	16/06/2022
PTT-DSH4811	DSH	4811	Control Valves Actuator Datasheet	16/06/2022
PTT-DSH5360	DSH	5360	Vacuum pump Datasheet	19/05/2022
PTT-DSH5520	DSH	5520	Duct Drain Pump Datasheet	
PTT-DSH5810	DSH	5810	Industrial Lift Datasheet	02/06/2022
PTT-DSH6311	DSH	6311	Temperature Gauge Datasheet	18/08/2022

PTT-DSH6312	DSH	6312	Temperature Switches Datasheet	18/08/2022
PTT-DSH6313	DSH	6313	Temperature Assemblies Datasheet	18/08/2022
PTT-DSH6317	DSH	6317	Temperature Points Datasheet	18/08/2022
PTT-DSH6321	DSH	6321	Manometer Datasheet	18/08/2022
PTT-DSH6382	DSH	6382	Junction Box Datasheet	16/06/2022
			DRAWINGS	
PTT-DWG0001	DWG	0001	General Arrangement	
PTT-DWG0010	DWG	0010	Foundation Loading - ACC	15/04/2022
PTT-DWG0011	DWG	0011	ACC - GA & RC Details of Steam Duct Foundations	
PTT-DWG0012	DWG	0012	ACC - GA & RC Details of Vacuum Pump Foundations	
PTT-DWG0013	DWG	0013	ACC - GA & RC Details of Drain Pot Foundations	
PTT-DWG0014	DWG	0014	ACC - GA & RC Details of Drain Pump Foundations	
PTT-DWG0015	DWG	0015	ACC - GA & RC Details of Condensate Tank Foundations	
PTT-DWG0030	DWG	0030	P& ID Steam System	10/03/2022
PTT-DWG0032	DWG	0032	P& ID Air take-off System	10/03/2022
PTT-DWG2340	DWG	2340	Anchorage ACC	
PTT-DWG4010	DWG	4010	Shop Drawings	
PTT-DWG4020	DWG	4020	Piping Layout Condensate Lines	14/07/2022
PTT-DWG4021	DWG	4021	Piping Shop Drawings	
PTT-DWG4211	DWG	4211	Isometric main condensate lines	25/08/2022
PTT-DWG4221	DWG	4221	Isometric condensate pump lines	25/08/2022
PTT-DWG4231	DWG	4221	Isometric drain pump lines	25/08/2022
PTT-DWG4311	DWG	4311	Isometric air take off holding lines	25/08/2022
PTT-DWG4321	DWG	4321	Isometric air take off hogging lines	25/08/2022
PTT-DWG4331	DWG	4221	Isometric balancing line	25/08/2022
PTT-DWG5210	DWG	5210	Condensate Tank	16/06/2022
PTT-DWG5211	DWG	5211	Shop Drawings for Condensate and Drain Tank	
PTT-DWG5220	DWG	5220	Hotwell Tank Drawing	16/06/2022
PTT-DWG5520	DWG	5520	Drain Pump Drawing Supplier	16/06/2022
PTT-DWG5700	DWG	5700	Cleaning System Drawing	
PTT-DWG6102	DWG	6102	Electrical and Instrumentation Equipment Location	
PTT-DWG6104	DWG	6104	Typical Wiring Diagram for Electrical Actuator	
PTT-DWG6382	DWG	6382	Junction Box Layout	
PTT-DWG6421	DWG	6421	DCS Logic Diagram	19/05/2022
			HOOK-UP DRAWINGS	
PTT-IHK6301	IHK	6301	Instrumentation Hook-up Drawings	14/07/2022
			LISTS	
PTT-LIS0002	LIS	0002	Document Control List	03/02/2022
PTT-LIS0004	LIS	0004	Piping and Insulation List	14/04/2022
PTT-LIS0005	LIS	0005	Valve List	
PTT-LIS0007	LIS	0007	Terminal Point List	
PTT-LIS0024	LIS	0024	Painting List	05/05/2022
PTT-LIS6201	LIS	6201	Electrical Consumers List	07/03/2022
PTT-LIS6301	LIS	6301	Instrument List	19/05/2022

PTT-LIS6401	LIS	6401	Control Input Output List	19/05/2022
			MANUALS	
PTT-MAN5360	MAN	5360	Operating And Maintenance Manual of Vacuum Pump	
PTT-MAN5520	MAN	5520	Operating And Maintenance Manual of Drain Pump	
PTT-MAN6300	MAN	6300	Operating And Maintenance Manual for Instruments & Accesso	
PTT-MAN7901	MAN	7901	Operating And Maintenance Manual	
			ORGANISATION DOCUMENTS	
PTT-ORG0002	ORG	0002	Contract Organisation Chart	
			PERFORMANCE CURVES	
PTT-PCU0001	PCU	0001	Performance Curves	24/08/2022
PTT-PCU3211	PCU	3211	Fan Characteristic Curve	
PTT-PCU5360	PCU	5360	Performance Curves for Vacuum Pumps	
			PROCEDURES	
PTT-PRO7704	PRO	7704	Standard Procedure for the Pneumatic Leak Test (Advisory Proc	
			QUALITY CONTROL PLANS	
PTT-QCP0002	QCP	0001	B.O Items Quality Control Plan & Quality Documents Submission	24/03/2022
PTT-QCP1240	QCP	1240	Fin Tube Bundles Quality Control Plan	24/03/2022
PTT-QCP2000	QCP	2000	Steel Structure Quality Control Plan	24/03/2022
PTT-QCP3100	QCP	3100	Fan Stack Quality Control Plan	
PTT-QCP3310	QCP	3310	Gearbox Quality Control Plan	24/03/2022
PTT-QCP4010	QCP	4010	Ducting Quality Control Plan	24/03/2022
PTT-QCP5210	QCP	5210	Condensate Collecting Tank Quality Control Plan	24/03/2022
			SCHEDULES	
PTT-SCH0002	SCH	0002	Schedule for Contract Execution	24/03/2022
PTT-SCH7801	SCH	0003	General Maintenance Schedule - STANDARD	24/03/2022
			TECHNICAL PURCHASING SPECIFICATIONS	
PTT-TPS4010	TPS	4010	Technical Purchase Specification for Ducting/Manifolds Parts	14/07/2022
PTT-TPS4020	TPS	4020	Technical Purchase Specification for Interconnecting Piping	14/07/2022

3. SUPERVISOR SCOPE OF WORKS

The flowing tasks and responsibility are part of SUPERVISOR'S scope of works:

- To provide supervision, advisory assistance, guidance, and counsel to the EPC.
- To provide advisory reports on EPC's demand. This report shall be related to technical issues.
- To provide advisory for correction, modification and deviations actions. Such piece of advice shall not engage the responsibility of the SUPERVISOR regarding the effective action taken by the EPC or the EC.
- To provide advisory of compliance to the Erection Quality Control Plan.

Number?

- Supervision as per contract conditions: Construction Advisor – seventy (70) months and xx (xx) round trips. (total amount for 3 units)

  Start-up/Commissioning Advisor – Nine(9) months and two (18) round trips. (Total amount for 3 units)

  Particular advisory note: SPG DC and Client will decide together on the best timeline for execution of the above supervisory scope.

The following tasks and responsibility are NOT in SUPERVISOR'S scope of works.

- To receive on site and make final check of materials supplied by SPGDC. This responsibility belongs to the EPC and EC.
- To approve and sign the Erection Quality Control Plan. This responsibility belongs to the EPC and EC.
- To issue any regular progress reports, schedules, recovering planning to the EPC and/or EC;
- The SUPERVISOR is not entitled to approve and give direct instructions to the site teams regarding the execution, nor scheduling, nor the handling of material, nor the Quality Control, nor the Health and Safety, nor storage, nor preservation of goods, and concerning any activities on construction site. Instructions given by the SUPERVISOR will be issued in direct line from the EPC to the EC.
- The SUPERVISOR bears no responsibility with respect to the execution, quality and scheduling of its advices.
- Advises, guidance or counsels issued by the SUPERVISOR and approved for execution by the EPC shall not be considered as a cause of extra costs or schedule delays attributable to the SUPERVISOR or SPGDC.

4. EC - ERECTION COMPANY SCOPE OF WORKS

The scope of works is globally defined as the site erection of all materials and equipment's, in full compliance with EPC specification and all SPG drawings and documents.

Battery limits of foundations, interconnection piping, instrumentation, power/instrumentation cable, cable tray and ducting are clearly defined in following drawings:

- General arrangement	DWG 0001
- Foundation Loading ACC	DWG 0010
- P&ID: Steam & Condensate system	DWG 0030
- Electrical and instrumentation interfaces	DWG 6101 TBC
- Main Cabling Ladder Arrangement	DWG 6103 TBC

All under-described new material and goods except grouting, consumable and welding metal will be of SPGDC supply.

All lifting devices, cranes, tools, scaffolding, safety devices required to erect under-described materials are EC's scope of supply.

EC shall be responsible for erection of 3 ACC's comprising each 8 streets of 9 modules per street. More specifically:

- Survey and acceptance of foundations.
- Acceptance of erection, offices, and storage areas.

Steel structure, mechanical, sheeting, air seals and flashings

- Elements are delivered in containers & bundles. Site work can generally be split into different phases:
  - Pre-assembly: put together on the ground several steel structures pieces or components in order to make an assembly. This phase includes Main Structure panels or modules, Upper Structure – A Frames modules, MED Main Exhaust Ducting preassembled onto large erection spools /Horizontal Duct, Main Risers, MED Manifolds, STREET Risers, SDM Steam Distribution Manifolds, Wind wall structure with Sheeting, Fan Motor Bridges and Fan Drive, Fan Stack and secondary elements like grating, plates, sheeting, airs seals, footsteps, handrails, fixation etc.
  - Erection: lifting and positioning of pre-assembled piece-spools or modules from ground into final position. Temporary supports may be requested.
  - Alignment: best fitting of all pieces together, tightening of bolts, adding of shims. Alignment report could be requested during erection at main steps of erection.

- Pre-assembling, erection and alignment of under-structure frames, octagonal structure and fan deck plates.
- Pre-assembling, erection and alignment of under-structure frames-panels or modules. Modules will be assembled with four and two Fan Stack /Cantilevers sections.
- Pre-assembling, erection and alignment supporting cantilever structure for MED Manifolds DN8000-DN2800

Installation and Grouting of column bases on the top of concrete columns TOC. EL. 43.950 after alignment and before loading with under - upper structure and other equipment. Grouting arrangement is depended of EC and EPC

- Pre-assembly, alignment and erection of Fan Stack / fan bells and fan screens.
- Pre-assembly of motor bridges including grating, handrails, kick plates, Fan motor and gearbox support.
- Pre-assembly, alignment and installation Complete Fan Units assembled from: FMB Fan Motor Bridge, Fan Drive & Axial Fan / Fan motor, gearbox and Fan Impeller with couplings and hubs attached to gearbox outlet shaft and Fan Blades bolted to Fan Hub
  Fan blades will be installed onto temporary up-right position and fixation bolts torqued maximum 60% of nominal torque value.

- Pre-tuning (pitching) and final tuning of the fan blade pitch angle / position after PCT power consumption test. Above mention Fan Blade fixation bolts will be torqued 100 % in cross sequences follow the EM and Bolts Torque values
- Erection and alignment of complete fan drive.
- Pre-assembly of Upper Structure /A-frame. A Frames can be assembled on ground zero to cover one or two Fan modules with all related Items as: A Frames, Top Girders, Cross Beams, Longitudinal monorails, Bracings, Partition wall & Door structure, Air seals structure Internal -Partition wall sheeting could be already cut to size and installed to A-frame
- Erection and alignment of A-frames modules with all above mentioned – related items.
- Pre-assembly, erection and alignments of staircase and ladders.
- Pre-assembly, erection and alignment Elevator structure & Elevator installation
- Pre-assembly, erection and alignments of walkways and access platforms.
- Pre-assembly, erection and alignments of maintenance platform and ladders around rupture disc
- Pre-assembly and erection of peripheral wind wall with installation of sheeting, doors and flashings -air seals.
- Installation of central bundle access platforms within the valleys of the streets – Movable cleaning ladders walk ways, including ladders to access platform parts in front of access doors.
- Cutting to size and installation of all other air seals.
- Pre-assembly and erection of ACC CT condensate tank platform including grating, handrails, ladder, kick-plate, ladder, stairs, and anchors.
- Installation Hotwell Drain tank with related Items and Equipment
- Pre-assembly and erection of top maintenance platforms on SDM including grating, handrails, ladder, kick-plate, access ladders.
- Gunning tools and cartridges for erection of sheeting and air seals are at EC's charge.
- Any loss of necessary bolts, washers, nuts and shim-plates on site will be covered by EC.
- Drilling of structure /concrete walls, etc, for pipe supports installation as required.

Main Steam Exhaust duct and risers

- Elements of duct are delivered in bended plates or spools for its transportation. Site duct work can be split in different phases:
  - Pre-assembly: put together, tag-weld and weld several bended plates and stiffeners in order to make a spool and assemble complete spools to make a larger spool. This activity is typically done in proper condition at ground level in order to ease access and liftings. Therefore, this task includes as much as possible mounting of singularities like saddle, nozzle, pads, holes, etc.

- Erection: lifting and positioning of pre-assembled spools into final position. Temporary support may be requested.
- Alignment: best fitting of all spools together, cutting of over-length, tag-welding.
- Welding: last bevel grinding, welding following WPS, visual inspection and NDT.
- Minor modifications during final fit-up may be required and are to be considered as part of the scope

- Pre-assembly, erection, final alignment and welding of all MSED main steam exhaust duct pieces from turbine Hot Box to SDM Steam Distribution Manifolds, more specifically:
  - MSED Main – Ground /Horizontal Duct with Bottom Elbow TEE DN8000 from Turbine Hot Box Flange including S1-S2-S3 supports ,14 Rupture Disc Exhaust Pipes, Blank plate for ALT Air Leak Test. Cutting and Removal main blank plate after ALT .
  - Installation and alignment MSED Supports S1-S2-S3 Base Plates. Base plates will be installed, aligned and properly shimmed. Base plates will be grouted before or after MED Horizontal -Ground part Installation and alignment. Grouting arrangement is depended of EC and EPC
  - Main Risers DN8000 with top Elbows DN8000 UNIT 1 & 3 as Y Piece Unit 2
  - MSED Manifolds DN8000-DN2800 from Main Risers Top Elbows and Y piece with related equipment – items /ie. Lisega Hangers and Rigid Struts
  - Manholes DN600 with access platform
  - Rupture disk with exhaust pipes
  - Equalizing line connection (pad and nozzle)
  - Drain box
  - STREET Risers DN2800 with lateral expansion joints and Top Elbows DN2800

- Pre-assembly, erection, final alignment and welding of rupture disk exhaust pipes including installation of rupture disk itself, gasket and bolts.

- Pre-assembly, erection, alignment and welding of duct supports S1 S2, S3 (sliding & fixed supports)

- Removal of all temporary internal bracings or spiders and shipping steel. Removal all temporary transportation and installation bolts and devices from Expansion joints, Spring Supports etc. after installation, alignment and welding completion. These temporary devices removal will be subject of SPGDC and EPC approval

- Welded joint between MSED Main Steam Exhaust Ducting and Turbine Hot Box Flange will be execution will be subject of SPGDC and EPC approval

- If required, supply, assembling and installation of temporary support for safe erection of duct – preassembled large spools. Design, calculation note, quantity and location is at EC discretion but shall be prior subject to SPGDC and EPC approval.

CCM, TB Tube Bundles and SDM Steam Distribution Manifold

- Elements of CCM and SDM are delivered in prefabricated spools. Site CCM and SDM work can be split in different phases:
  - Pre-assembly: assemble complete spools to make a larger and complete spool. This activity is typically done in proper condition at ground level in order to ease access and lifting's. Therefore, this task includes as much as possible mounting of singularities like saddle, nozzle, pads, holes, etc.
  - Erection: lifting and positioning of pre-assembled spools into final position. Temporary support may be requested.
  - Alignment: best fitting of all spools together, cutting of over-length, tag-welding.
  - Welding: last bevel grinding, welding following WPS, visual inspection and NDT
- Pre-assembly, erection and alignments of the CCM, one on each side of A-frames to support the fin tube bundles.
- Erection and alignments of the secondary and then primary fin tube bundles.
- Pre-assembly, erection and alignments SDM complete with hinged expansion joints, stem isolating BFLY Valve ,sliding supports (with pads if any), movable ladder rail and the removal of all temporary internal bracings or spiders and shipping steel.
- Welding of the CCM to the bundle outlet tube sheets.
- Welding of the SDM to the bundle inlet tube sheets.
- Cutting to size and installation and welding of closure plates SDM and CCM after removal of tube sheet adjustment screws.
- Minor modifications during final fit-up may be required and are to be considered as part of the scope

Interconnecting Piping MAG-MAJ-LCM-LCA-SDA

- Piping above 2" (called main piping) is delivered in pieces or pre-assembled spools depending of container or bulk size. Site piping task can be split in different phases:
  - Pre-assembly: put together, on the ground, several pipe pieces or spools in order to make a bigger spool with over-length.
  - Erection: lifting and positioning of pre-assembly spools into final position. Installation of piping supports. Temporary support may be requested before welding
  - Final alignment: best fitting of all spools together, cutting of over-length.
  - Welding: last bevel grinding, welding following WPS, visual inspection and NDT (see QCP 7600).

- Piping 2" and below (called small bore piping) is delivered in container or bulk of non-prefabricated length with fittings and raw material for support. Small bore piping work can be split in different phases:
  - Pre-assembly: Final routing and length measurements are directly taken on site. Put together, on the ground, several pipe pieces and fitting in order to make a spool.
  - Erection: lifting and positioning of fabricated spools into final position. Piping support is fabricated on site, as per piping routing, with delivered raw material.
  - Final alignment: best fitting of all spools together.
  - Welding: last bevel grinding, welding following WPS, visual inspection and NDT.

- For erection of small-bore piping (2" and below), care must be taken for the execution of the supports to avoid fixed point near the line where they are connected. Taking the temperature of the lines in consideration, expansion loops must be provided to absorb the thermal movement during plant normal operation.

- Pre-assembly, erection (including supports), final alignments and welding of piping lines as shown in P&ID: Steam, Condensate, Vacuum /Air Take Off System and cleaning system DWG 0030 & DWG 032

- Minor modifications during final fit-up may be required and are to be considered as part of the scope

- Prefab Spools: cutting and bevelling for site adjustment (normally spools are coming with extra length to allow final adjustment on site). Included in the scope of works

- Drilling of structure /concrete walls, etc, for pipe supports installation as required.

More specifically but not limited to:

MAJ -MAG Air/Steam Lines:

- Piping lines from secondary fin tube bundle nozzles to vacuum pumps /skids – Air Take-Off lines
- Piping lines from vacuum pumps /skids lines to make-up domes
- Piping from steam duct to condensate tank (Equalizing line)

LCA-LCM Condensate Lines:

- Piping line system from Hotwell drain tank to Condensate drain recovery pumps inlet / 3 x 100%
- Piping line system from drain recovery pumps outlet to ACCCT /condensate tank.
- Piping lines from CCM to ACC CT / condensate tank (main condensate line)
- Vent line from drain pumps strainer to Hotwell Drain Tank
- Interconnecting line between drain pumps outlet
- Filling line at drain pump outlet
- Gland seal water line
- Various vent and drain nozzle/lines from equipment

Various Lines

- MAG Piping of stand pipes on ACC CT /condensate tank and Hotwell Drain Tank
- SDA Cleaning system Piping from EPC/OWNER's service water supply to cleaning HP pumps

- SDA Cleaning system Piping from HP cleaning pumps to quick coupling connections on longitudinal and central walkways (cleaning lines).
- Flexible hose from quick coupling to cleaning ladder.
- CEP TP on ACCCT

- During erection phase, it's EC responsibility to determine location and dimensioning of temporary support.
- Installation of the valves as per P&ID and LIS 0005, air extraction, vents, drains to the sump, etc. included in piping lines.

Instrumentation and electrical equipment

- Installation of all instruments as per LIS 6301 and IHK 6301 including valve, tubing (where required) and interconnecting piping between the equipment and the instrument itself.
- Installation of instrument tags and identification plates where required.
- Installation of junction boxes and instrument cables from instruments to junction boxes in accordance with DWG6382
- Installation of instrumentation cable trays and power cable ladders, instrument cable conduits from instruments to junction boxes in accordance with DWG6102.
- Installation of earthing cables up to feet of columns
- Input/loop test from instrumentation and equipment to DCS or other control system.
- Installation of electrical container /MCC Motor Control Centre / per ACC unit for LV switchgears and VFD, control panels for fan motors under the ACC. Scope of EC TBC
- Drilling of structure /concrete walls, etc, for cable tray supports installation as required.

Equipment

- Installation of the vacuum hogging and holding pumps / skids including the required supports and fixation and such to the steel structure, insulation, outlet piping, including assembly of loose accessories and instrumentation on the skids.
- Erection and alignment of the electric motors with coupling shaft between motor and gearbox.
- Erection and alignment of ACC & HOTWELL Condensate tank including welding in position of make-up dome access platforms, handrails and ladders.
- Erection of the gearboxes with all accessories including brake (If applicable), breather, first oil filling of the gearboxes for first running period (see gearbox manual). EC shall execute first draining of preservation oil, and then a second filling with new oil or filtering. (If applicable)
- Installation and mechanical alignment of HP cleaning pump, and condensate drain recovery pumps WKTA 3 x 100 %

- Erection and careful alignment of upper and lower guiding rails to ensure full movement along the ACC of moveable cleaning ladders as well as installation of spraying manifolds spray nozzles and interconnecting cleaning system pipe work and hoses. In general: erection of all cleaning system

- For Information: Two Cleaning pump trolleys are supplied for the 3 ACC units and should be stored in a warehouse until necessary use on one of the units. Details to be confirmed. HP Pumps installed on ground zero or Movable HP Pumps on the top of ACC /Transversal walk ways TBC

- Erection, installation and testing of manual and electric hoists for motor and gearbox (including load test)

Attention that perforated part of dump tubes (spargers) inside the duct is oriented to ACC (not to the turbine direction)

Various

- All inspection and testing including NDT and pneumatic Air Leak test as per SPGDC advisory Erection Inspection Plan.
- Including:
  - Inspection with the SPGDC supervisor of complete ACC system before and after the pneumatic air leak test to ensure complete compliance with SPGDC recommendations.
  - The inspection and necessary adjustments of piping to comply with the design requirements, before they have been insulated and brought up to the operating conditions.
  - EC must issue the complete quality manual, with detailed weld maps.
  - The weld quality control measures should be conducted on duct, manifolds and piping following advisory QCP of SPGDC.
  - Alignment reports, inspections report as per SPGDC recommendations.
- For Air leak test and rest of site tests (where needed) Mechanical Contractor must include all necessary blind flanges, provisional gaskets and bolts, hoses, compressor or compressed air from the central compressor station, pressure pumps, etc. In summary, all necessary means to perform the requested tests.
- Mechanical Contractor must include all necessary shim plates for alignment purposes (steel structure, structural supports, pumps, vessels, skids, etc)
- Completion of erection and commissioning punch lists. Completion of punch lists from SPGDC, EPC and OWNER shall meet with erection schedule and milestone completion dates.
- Dry cleaning of all accessible internal parts of duct, manifolds, tanks and piping, in particular for sand, welding slag and others.
- Touch-up of damaged or welded areas during erection (steam duct, steel work, fan deck, equipment's, piping, supports etc.). Including:
  - Local shot blasting (or meticulous mechanical brushing) to SA 2½ of all injured or paint less areas.
  - Painting in accordance with Contract specifications.
  - Repair of the painted (or if any galvanized) structure as required.

- Submitting product technical data sheets as well as painting and galvanization repair procedures to SPGDC for prior approval.
- Immediate removal of any steel particles forthcoming from sheeting and deck plate erection.
- Protective measures avoiding grinding and welding activities to be implemented prior to start any welding activities. Any burning and/or rust formation on fan deck plates and to lower structural steel parts shall be removed immediately.
- Weekly / daily vacuum cleaning of the fan deck to avoid rust marks on painted and/or galvanized plates and maintenance of order on site for safety.

- Final painting of the duct, condensate tank and piping work within 4-6 months of delivery to accommodate the lifespan of the primer painted parts and avoid corrosion.
- Performance of all commissioning (cold and hot) activities in accordance with the SPG Dry Cooling Advisory Commissioning Manual. Including steam cleaning piping installation and removal and dirt water disposal.
- Production and submission of documentation (by EC). Including:
  - Filing of sketches with as built correction, if any, to allow the EPC to prepare corresponding final as built issue.
  - Filing of material receiving lists as well as material reports with indication of damages, if any, recorded at reception.
  - Filing of quality control reports as per EC QA/QC erection control plan.
- Insulation or personal protection of steam duct, piping or equipment where required.
- Any loss of necessary bolts, washers, nuts and shim-plates, gasket on site will be covered by EC.

5. Summary equipment / materials to be erected for one unit: (Weights indicative)

Main piece	Detailed document	Unity Weight (kg)	Quantity (#)	Total Weight (kg)
Steel structure -Under and Upper	DWG2600 - DWG2608	Pieces	Per unit	TBC
Main Duct, SDM, CCM, Risers	DWG 4110	Pieces	1/8/16/8	TBC
Steam Distribution Manifolds	DWG 4120	Pieces	8	TBC
MED Main expansion Bellow	DWG 4610-	xxx	1	TBC
MED Riser lateral Bellows	DWG 4610-	xxx	8	TBC
MED Elbow Hinged Bellows	DWG 4610-	xxx	8	TBC
Condensate Collecting Manifold	DWG 4130	xxx	16	TBC
Secondary Bundle	DWG 1243	3763	112	421 456
Primary Bundle	DWG 1242	3998	896	3 582 608
Hogging and holding vacuum skid	DWG 5350	Pieces	3	TBC
ACC Condensate tank with dome	DWG 5210	Pieces	1	TBC
Fan Impeller	DWG 3210	xxx	72	TBC
Fan Gearbox	DWG 3310	xxx	72	TBC
Fan Motor	DWG 3410	xxx	72	TBC
Fan Stack /Screen and FRP Bell	DWG 3100	xxx	72	TBC
Interconnecting Piping MAG-MAJ-LCM-SDA-LCA	DWG 4010	Pieces	xxx	TBC
Rupture disks	DWG 4731	Pieces	14	TBC
Cladding: Sheeting and air seals	DWG 2220	Pieces	xxx	TBC
Cleaning HPP pump	DWG 5721.	xxx	1	TBC
Movable Cleaning Ladders	DWG xxxx	Pieces	16	TBC
Piping & valves	LIS 00056.	Pieces	xxx	TBC
Drain recovery pumps	DWG 5520.	xxx	3	TBC
Power & Signal Cable Trays -Racks and Conduits between Instruments -Motors-Valves and JB-MCC				TBC
ACC Local instrumentation	DWG 6102	Pieces	xxx	TBC
Power and Signal cables between Instruments-Motor and JB -MCC				

Notes:

- (*) = included in Main Steam Exhaust Duct weight
- Weights to be confirmed TBC / weights are indicative
- Weights are preliminary and some of them may be subject to variation during detailed design and buying of goods.
- Ducting is split to optimise the transportation and preassembly on site.

6. SEQUENCE OF ERECTION

- It is advised that the EC executes the erection of the air-cooled condenser streets in the following main heading sequence. As stated in the introduction, the EC may vary from the recommended sequence at its

own discretion and risk. Such variation shall be submitted to SPG Dry Cooling for approval by way of an Erection Schedule prior to start the works.

- Recommended erection sequence of ACC itself (main tasks) is defined by the chronological presentation of the document:
"ACC erection sequences." This sequence is typical for all ACC and show the "vertical" erection process. It can be summarized as following steps:

Step	Task	Comment
1	Under-structure /Main Truss with Base Plates on the top of Concrete Columns	Base plates & Complete frames from base plate to fan deck beams. Including cantilever supports for MED - Manifolds DN8000-DN2800
2	Fan Deck Octagonal structure	Some fan deck plates can already be fixed on structure. Depended of Under Structure -Main Truss installation methodology – Modules or Single panels installation
3	Fan Stack / Fan screen and FRP bell	Both will be pre-assembled on the ground and installed one by one on Installed Under Structure or preassembled modules on Ground zero
4	Fan deck plates	Fan deck plates can be partially erected to fan deck structure if Under structure modules with Fan Deck beams will be pre-assembled on ground zero
5	Fan Motor bridge – Fan Drive -Fan Impeller	Including motor, gearbox, fan impeller, grating and handrails. Completely FMB with Fan Unit will be assembled on Ground zero -Temporary supports
6	A-Frames -Upper structure	Braced A-frames modules will be erected first
7	CCM Condensate Collecting Manifold	Different spools could be pre-assembled at ground level to large installation spools.
8	FTB Fine Tube Bundles	Welded street by street after alignment. Cross welds first and before SDM Installation.
9	SDM /TSH Steam Distribution Manifold -Top Steam Header	Different spools could be pre-assembled at ground level to large installation spool. Recommended Installation SDM Spool with fixed point first.
10	Wind wall structure, sheeting and Air Seals	After SDM Completion. Wind wall panels /Structure and sheeting can be pre-assembled at Ground zero
11	SDA Cleaning System	After SDM Completion. Top rails and brackets can be installed onto SDM during the SDM preassembly onto large installation spool on Ground zero.
12	MSED Main Steam Exhaust Duct:Ground Duct -Main Risers-Manifold & Street Risers	Installation of Horizontal Ducting can start in parallel with Under structure installation. Recommended sequences will be described below
13	HWT Hot well Tank installation	Placement – Installation before Ground /Horizontal MED Installation
14	ACC CT/ Condensate Tank with related Equipment Installation	ACCT Structure with stair case will be installed first. Grouted and ready for loading. Tank will be installed, aligned and fixed. Other Equipment will be installed later
15	Hogging and Holding Vacuum skids-Units Installation	Foundation should be ready. Steel structure & Related piping will be installed later.
16	SC Stair Case	Stair Case structure will be pre-assembled and installed in large spools
17	Permanent Elevator – Lift	Structure and Elevator Installation
18	ACC Instrumentation Installation & TP for Others	ACC Local Instrument and Transmitters will be installed according to Instrumentation List and P &ID
19	ACC Power and Signal	Power and Signal Cables – Trays -Conduits between

	Cables -Cable Trays -Racks and Conduits	Motors -Actuators – Instruments and JB/MCC . EC Scope TBC

- It is mandatory to Install all bracing of under-structure before continuing upper-structure.
- It is mandatory to start with erection of internal Under structure ie. Streets 2-7 and after that external – cantilever streets 1 & 8 as MED Cantilever Structure
- For Upper Structure / A-frame erection, it is mandatory to start erection with braced A-frame module and progressing adding left and right other A-frame structure.
- Erection sequence between entities ACC, platforms, MED main steam exhaust duct on support S1, S2, S3 to be discussed and coordinated on site with EPC, EC and SPGDC supervisor.
- All under-structure and A-frame of the concerned street should be finished, aligned, torqued up, grouting done, before loading / erection of CCM, Tube bundles ,MED Manifolds & SDM /TSH.
- Staircases, platform and gratings shall be erected as soon as secure walkability on fan-deck level is done.
- ACC Condensate tank V=261m3 with make-up dome and its structure shall be erected before ACC - CEP piping work will start.
- Condensate Drain - Hotwell Tank V=34m3 Installation and alignment. Sliding & Fixed Base plate installation. Tank should be aligned and fixed before related piping work will start LCM-MAG and Turbine Piping
- For all components to be erected inside the Turbine Building, EC shall schedule and coordinate works with EPC so as to avoid interference with other Teams working in the area.
- Main following entities could be pre-assembled, erected separately but interfaces to be verified during site meeting with SPGDC supervisor.

6.1. ERECTION PROCEDURE for MSED Main Steam Exhaust Duct

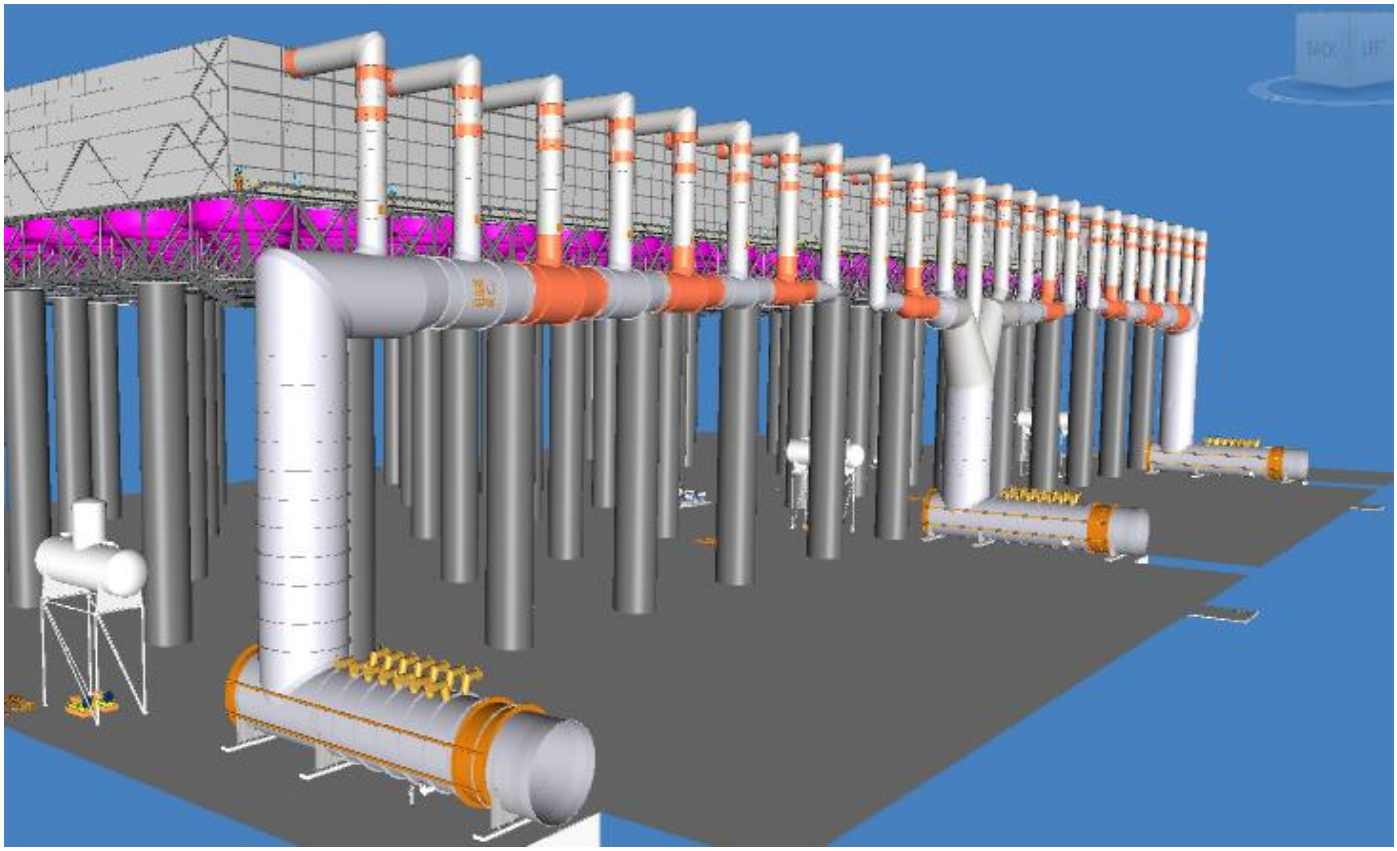
MSED - Ground -Horizontal section DN8000
MSED – Main Risers & Manifold DN8000-DN5600-DN2800
MSED – Street Risers DN2800
MSED – SDM Steam Distribution Manifolds DN2800-DN1200

- S1-S2-S3 Supports. Civil foundations survey X-Y-Z /Anchor bolts and shear key position. Base plates installation, alignment & grouting. Base plates should be shimmed with enough Shim plates because of levelling and to take load of MED during the Installation and alignment if base plates will be grouted after MED installation and alignment. Pay attention for PTFE on S1-S2 supports.
- MSED Spool with ALT Temporary Blank plate with or without Unrestrained axial expansion Bellow DN8000 pre-assembly and installation. From Turbine Hot Box to S1 Support
- MSED Bottom Elbow -Tee DN8000 Installation. Supported with S2-S3 Supports. Permanent Blank Plate Installation and welding is recommended as last step after Ground Duct Installation - Alignment and welding completion.
- MSED Ground-Horizontal DN8000 with 14 Rupture Disc Exhaust pipes installation. Maintenance platform and access ladder installation

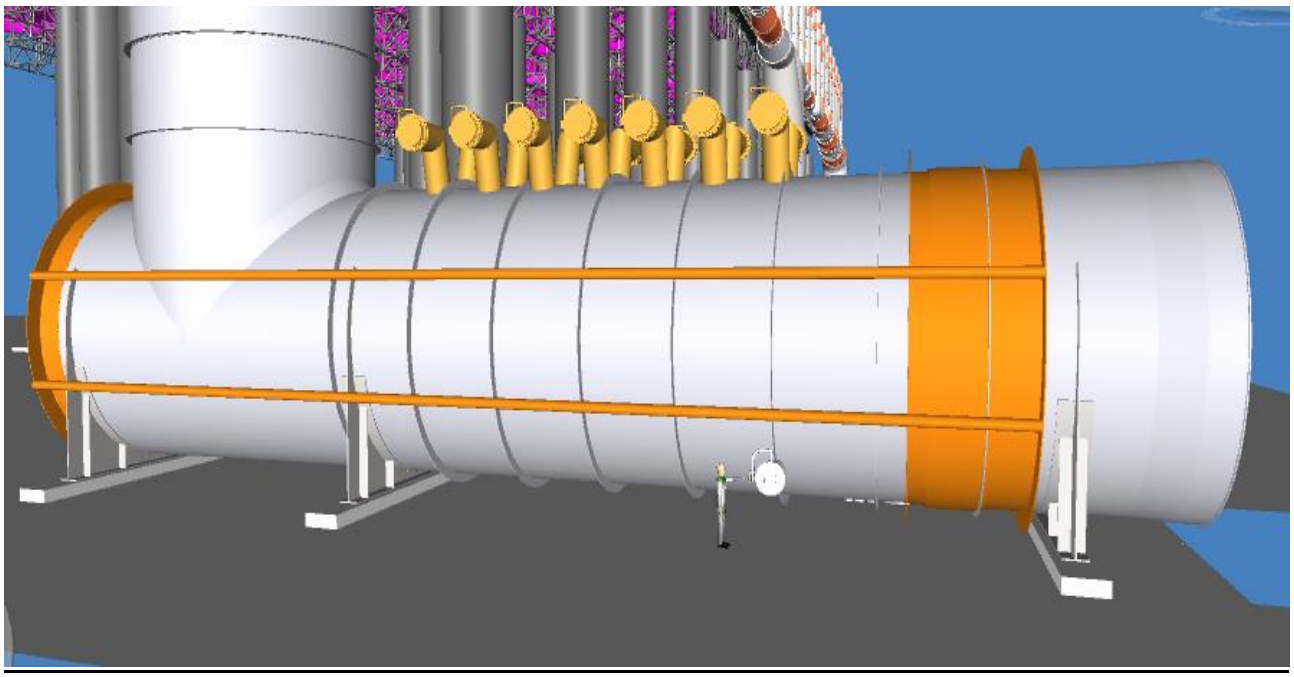
- Tie rods installation along MSED. Tie rods will be welded onto end permanent blank plate after MSED installation, alignment and welding completion
- MSED Main Risers DN8000 Installation and welding. Main Riser can be preassembled and welded onto one or two large installation spools for ACC UNIT 1&3
- MSED Main Risers -Top Elbows DN8000 and Y piece DN8000-DN5600 Installation and welding
- MSED Manifolds DN 8000 -DN2800 & DN5600-DN2800 pre-assembly to large spools and installation. Fixation to installed Cantilever structure. Rigid struts installation.
- MSED Street Risers DN2800 with Lateral Bellow & Top Elbows Installation
- MSED Street Risers DN2800 can be pre-assembled with or without Top Elbow and Hinged Bellow. Top Elbows with Hinged Bellow can be installed as one separate spool. Isolating BFLY valve pre-assembly and installation. These Item will be installed and welded onto SDM -TSH Steam Distribution manifold /Top Steam Header. As option is to pre-assembly Hinged Bellow and BFLY Valve in one spool and install it after SDM -TSH Installation and welding.
- MSED /SDM-TSH Steam Distribution Manifolds /Top Steam Headers Installation

PTT View of complete PTT MSED Main Steam Exhaust steam duct from steam turbine Hot Box TP01 to the SDM-TSH steam distribution manifolds /top steam headers with condensate manifolds

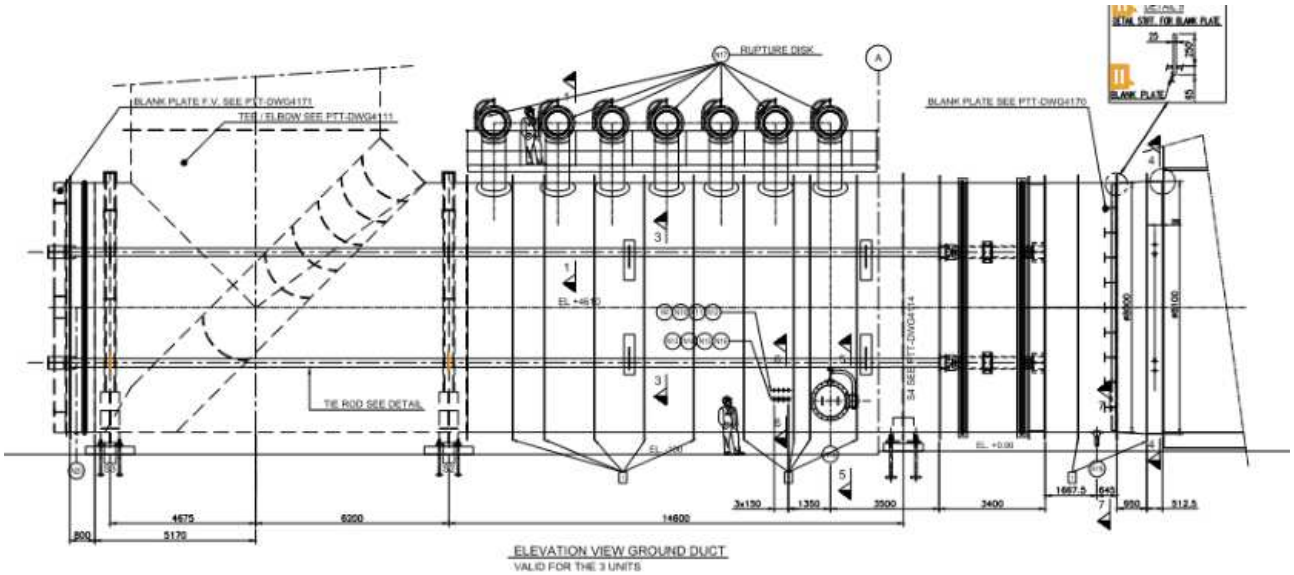
Note: All views herewith are only for information. The detailed documents and drawings, referenced here above, are applicable for the detailed construction works



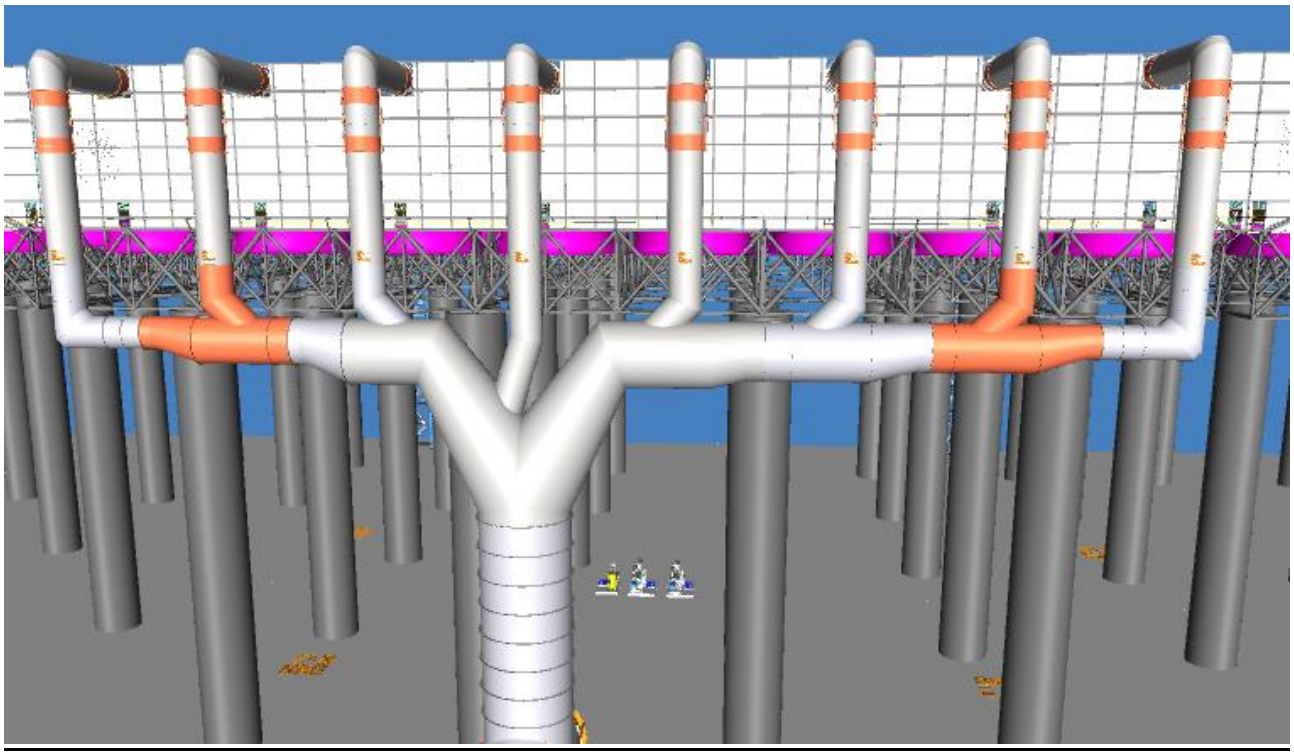
View of complete PTT MSED main steam exhaust duct -Ground from steam turbine Hot Box to Bottom Elbow TEE DN8000



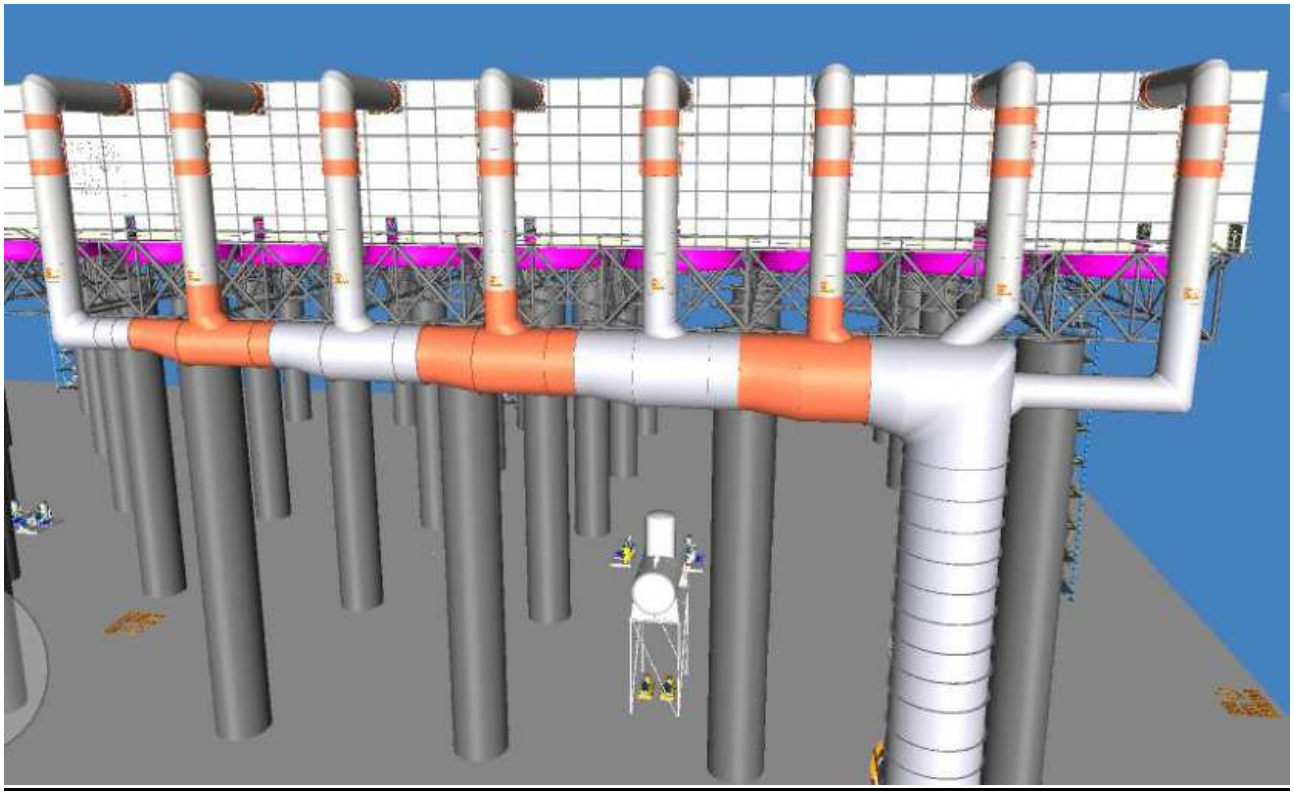
PTT Ground- Horizontal MSED Detail from MED GA Drawing



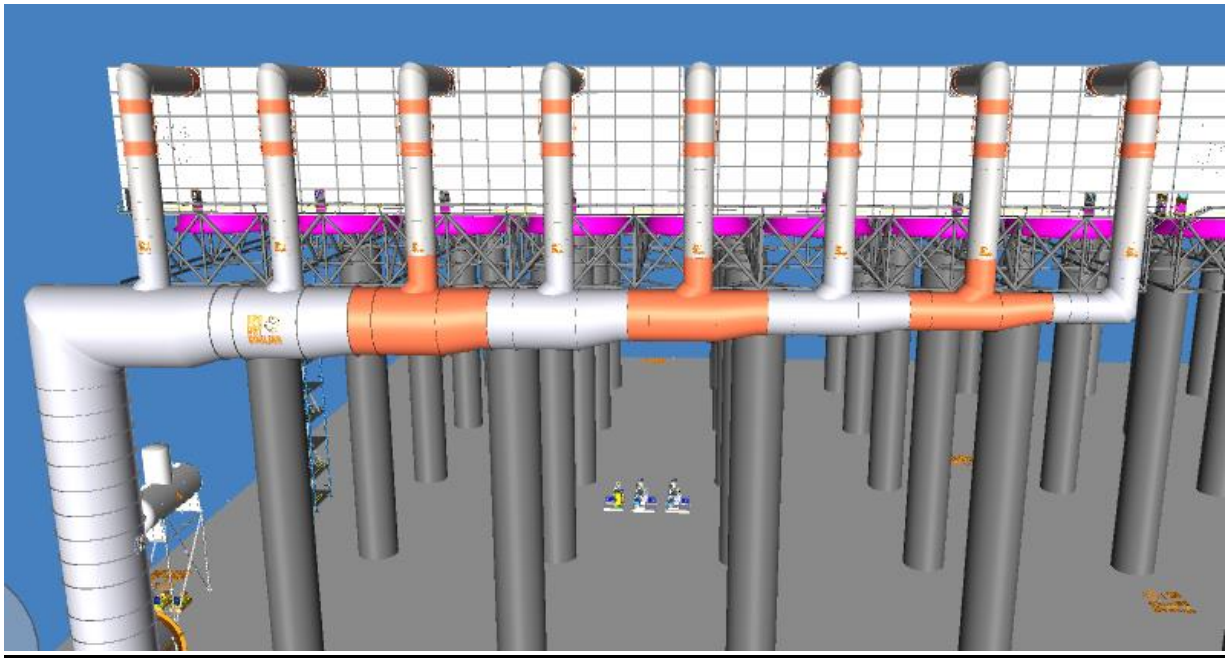
PTT ACC UNIT 2



PTT ACC UNIT 1



PTT ACC UNIT 3



Installed similar ACC – MSED Main Steam Exhaust Ducting for reference Only

MSED Pre-assembled large spool inside of TH

MSED large spool Installation inside of TH W=90 Ton

MSED Horizontal – Ground part with Elbow -Duct and Rupture Disc Exhaust Pipes Installation W=125 Ton

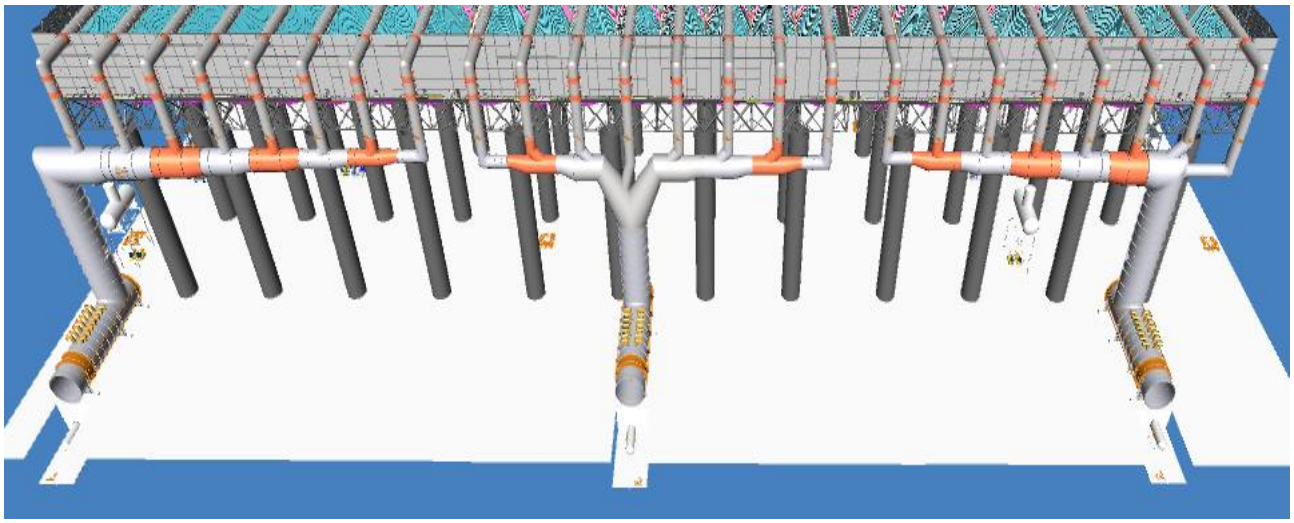
MSED Expansion Joint DN8000 Site Fabrication

MSED Bottom Elbows -Tee with permanent Blank Plates and Tie Rods

MSED Main Riser Installation W=82 Tons

Steam Distribution Manifold Installation W=79 Tons

View of Main steam exhaust duct outlet ACC UNIT 1-2-3 with risers to street 1-8



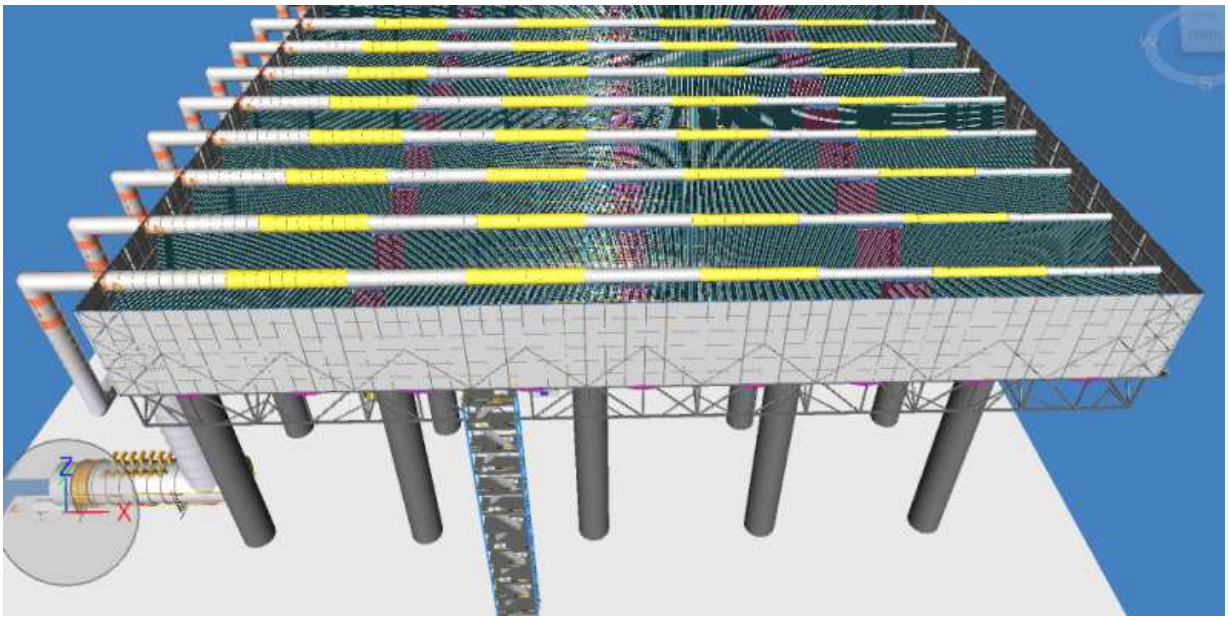
Example: Installed 6 Units - ACC 64 Cell -FDL +60 meters 6 x 790 MW

STREET RISERS - SDM-TSH Steam Distribution Manifolds /Top Steam Headers Installation

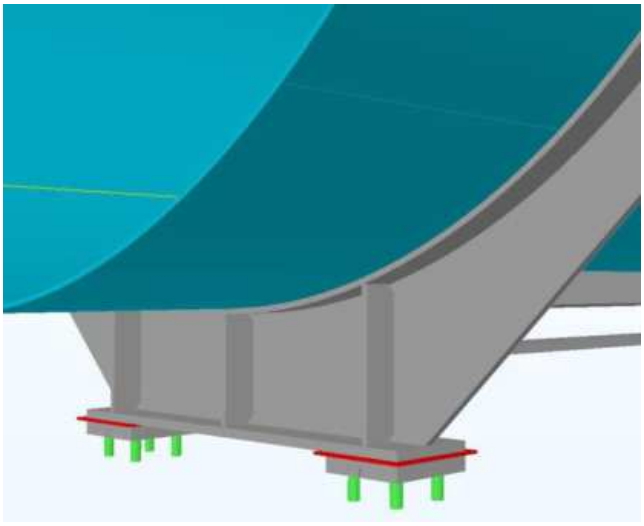
Top Elbow & Hinged Bellow **Pre-assembled Riser with Lateral Bellow & Top Elbow**

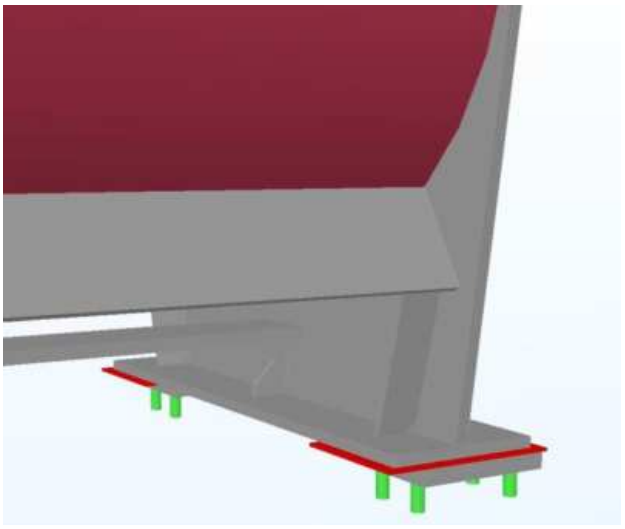
STREET Risers Installation example

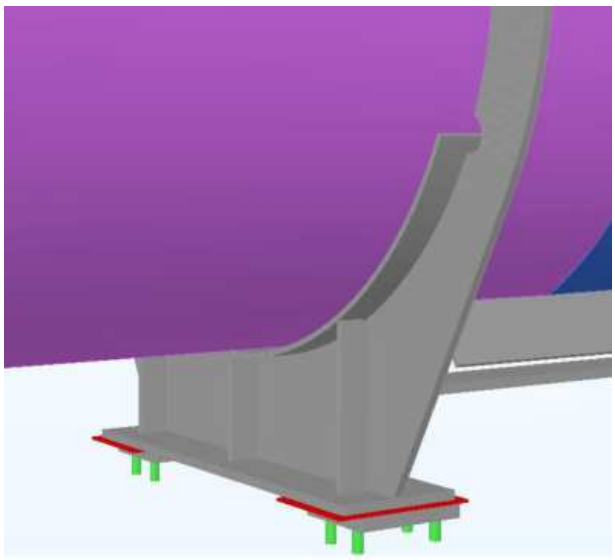
PTT ACC SDM-TSH Steam Distribution Manifolds -Top Steam Headers DB2600-DN1200 LAYOUT

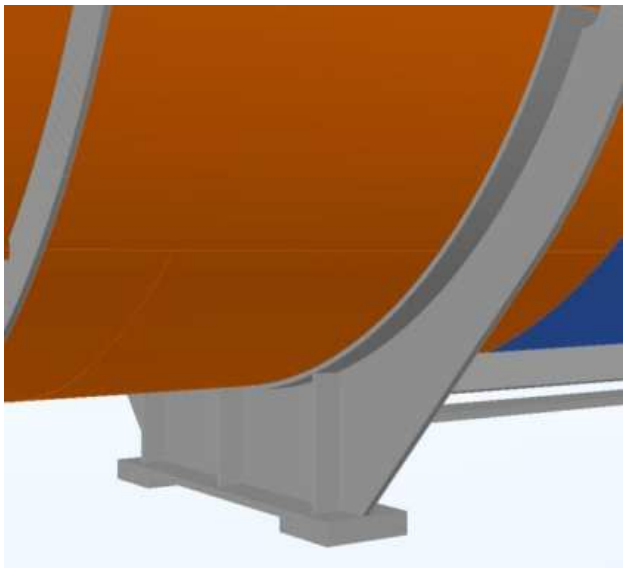


Typical: Steam Distribution Manifolds sliding and fixed supporting to A-frames

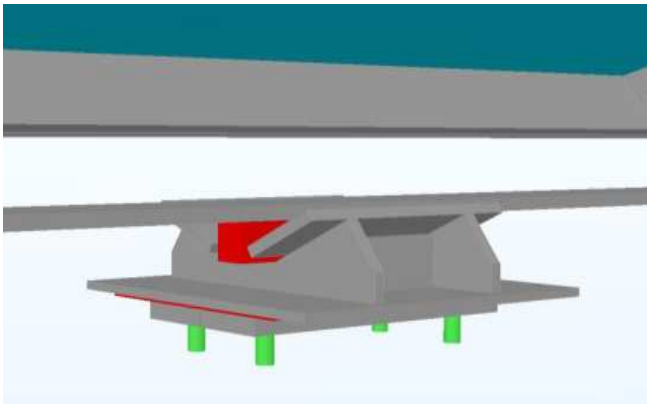


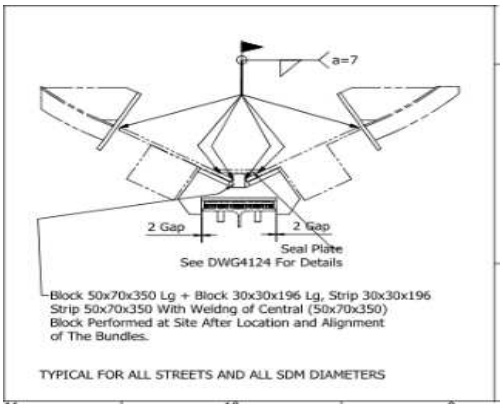






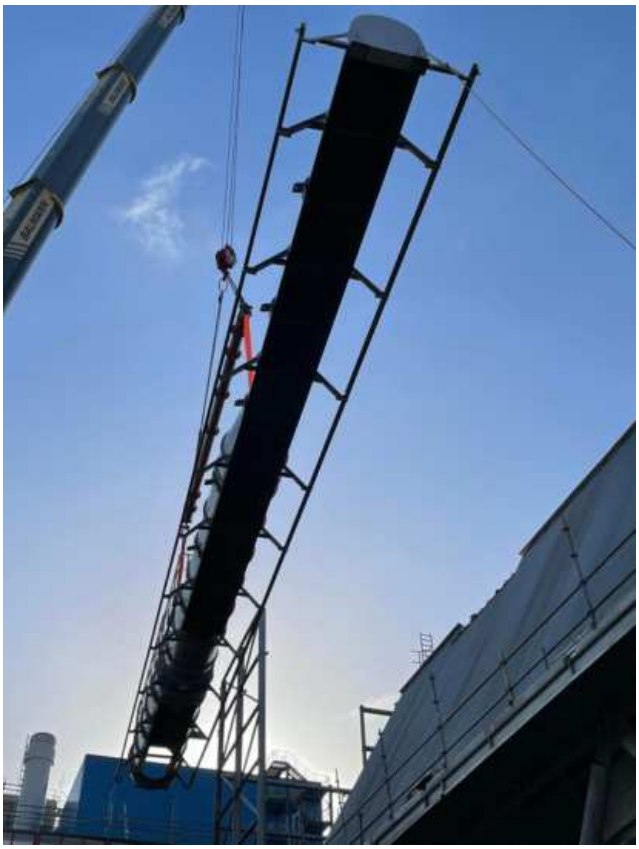
Typical: Special sliding point under bundles





- SDM-TSH DN2800-DN1200 can be pre-assembled and welded on the ground zero onto several large installation spools ie. Four large installation spools to cover CELL1-2 ,3-4 ,5-6,7-8-9
- Spool with fixed point will be installed and aligned first
- On First -front spool will be installed and welded steam isolating BFLY Valve DN2800
- Movable cleaning ladder Upper – Top rails will be installed and aligned onto SDM-TSH preassembled spools on ground zero prior lifting
- Manhole and Maintenance platform will be installed during the SDM-TSH pre-assembly

PRE-ASSEMBLED SDM-TSH Covering two Cell with installed BFLY Valve and Cleaning Ladder Top Rails



SDM short spools installation

SDM large spool installation

SDM Bellow & Valve assembly

Lifted – Installed Bellow and Valve as one Spool

SDM Site assembly to large spools & Installation

6.2. ERECTION PROCEDURE FOR UNDER STRUCTURE -FAN STACK-FAN MOTOR BRIDGE:

- **REFERENCE DRAWINGS**
- **PREPARATION**
- **UNDER-STRUCTURE**
- **FAN DECK & FAN STACK /SCREEN**
- **FAN MOTOR BRIDGE**
- **IMPORTANT NOTES**
- **ATTACHMENTS**

6.2.1 REFERENCE DRAWINGS:

1. Please refer to the erection drawings as well as detailed drawings

6.2.2 PREPARATION

1. Before any construction activity a Joint Survey of the ACC Foundations should be performed in order to establish any major discrepancy that could affect the correct placement and erection of the main components, and to confirm the official X,Y and Z. Coordinates / Datum points that are to be used during the erection of the ACC and the placement of the auxiliary equipment. Anchor bolts with shear key slots are installed on the top of concrete columns TOC EL. +43.950

2. Check for ground compactness and loadings as well as for any restrictions for movement of heavy Cranes or equipment in the vicinity of the ACC plot and the surrounding area thatcould restrict construction or assemble activities.

3. Identify and prepare the required structural steel parts street by street and transport these from laydown area to storage area nearby the assembly area.

4. The chosen pre-assembly area should be preferable located in close proximity to the ACC for each street to be erected. This would avoid double handling and reduce risk for possible damage and distortion.

5. A temporary supporting frame, sufficiently strong and large enough to support the parts to be assembled, should be erected and checked for being plumb & level. This frame must have a sufficient height (approximately 1 meter above the ground) to provide easy access to the bolted connections from underneath during pre-assembling activities.

6. Alternatively, if good compacted and level ground as well as sufficient space is available at the ACC plot or surrounding area, temporary support stands or railway sleepers could be positioned plus timber cribbage for additional levelling could be prepared and used for pre-assembling activities.

6.2.3 ERECTION OF THE UNDER-STRUCTURE

1. **SPG DC recommend erection sequence to be street by street starting with Internal streets 2-7. The method of erecting the main support steelwork can be performed in a different way and also depends on the number and capacity of cranes, machinery and scaffoldings. Available Site pre- assembly space and man power.**

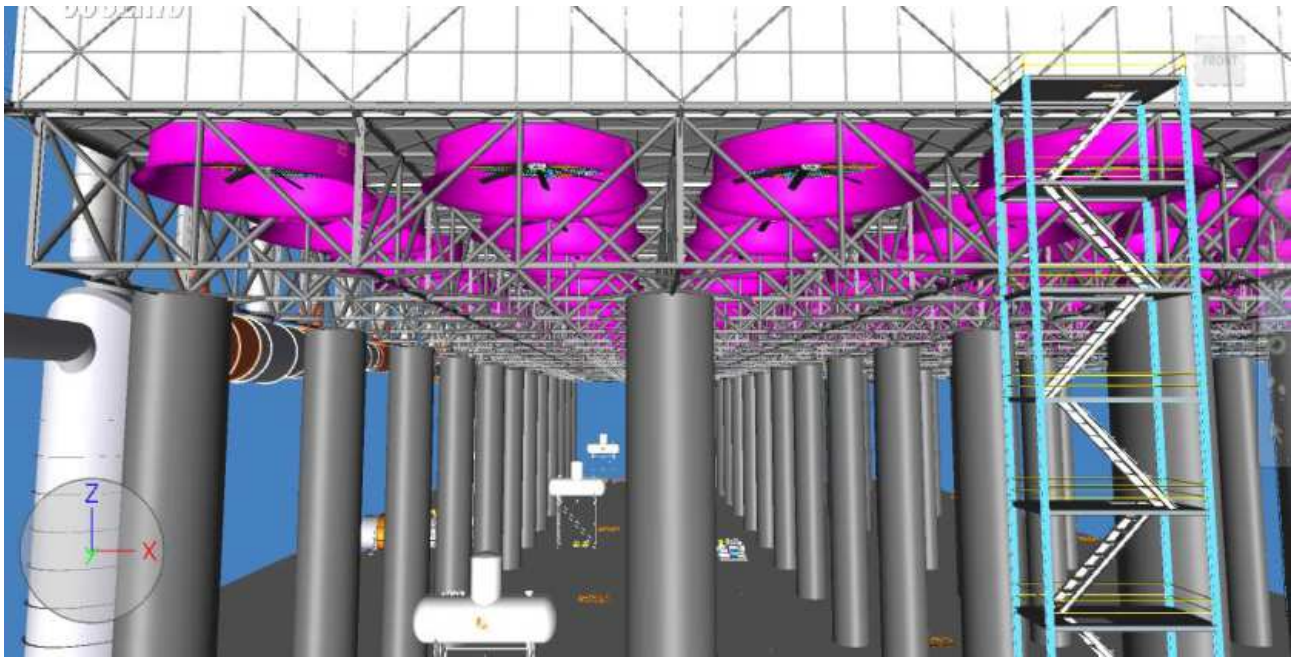
   The following building sequence describes the use different cranes and a mobile man-lift /cherry pickers / and the use of wire guide ropes tied to dead weights. However should additional cranes / equipment be available the following tasks are more simplified and the use of the wire guide ropes will not be necessary.

2. The first under structure Large module with four CELL will be installed between four concrete columns dim X= 31.240mm Y=26.400mm . EC will decide Erection sequences and Under Structure pre-assembly and Installation methodology. Mandatory is to start on Internal Streets 2 to 7 . Second step will be External – Cantilever Streets 1 & 8

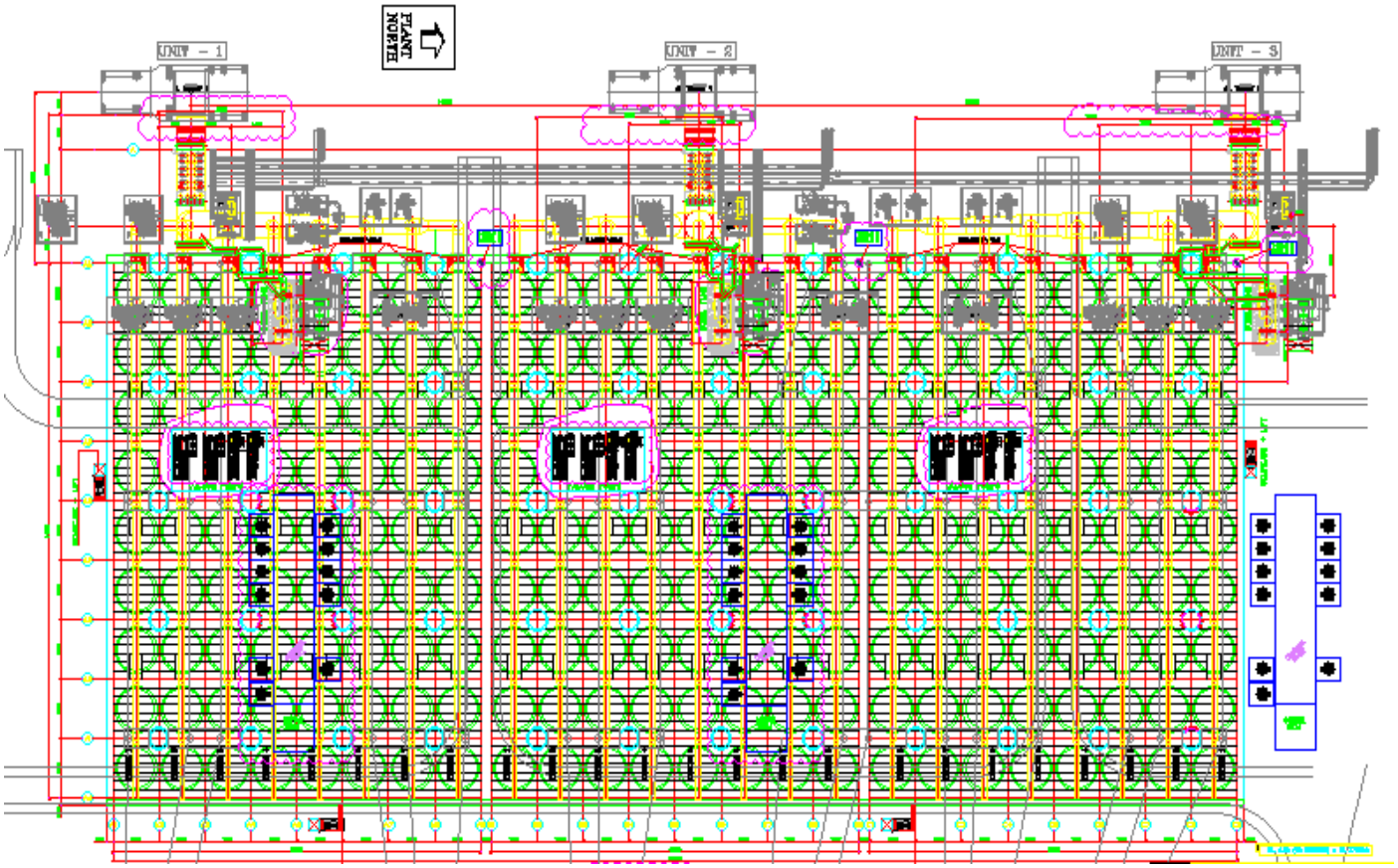
3. EC will prepare RAMS with clear under structure pre-assembly and installation sequences. In case of Heavy lifts CLP will be required. RAMS should be approved by EPC and SPGDC before work execution.

4. Below are described three basic steps for under structure pre-assembly and installation as recommended methodology and sequences:

PTT UNDER STRUCTURE TYPICAL SECTION



PTT ACC UNIT 1-2-3 LAYOUT



Recommended Under Structure Pre-assembly & Erection Sequences - Methodology:

- Under structure base plates installation, alignment and grouting on the top of Concrete Columns TOC
  ACC Foundations.
- Base plates will be located and lifted – installed onto top of concrete column TOC EL.+ 43.950
- Before Installation activities on the TOC, EC will install Safety Handrails and Safe access on the TOC
- Survey – position of Anchor Bolts as Shear Key /slots X-Y-Z will be done by all three parties. If results are acceptable and measured values according to tolerances, Base plates installation can start. EC will prepare proper shim plates different thicknesses for the alignment. Note: Base plate is heavy.
- We recommend to use special lifting device for Base plates lifting and installation. See details below FYI
- After installation and alignment survey will be done. Survey report will be attachment for Grouting Release request send to EPC. EPC and SPGDC will check & confirm Survey report prior base plates releasing for grouting

Base plate Lifting device

Base plate Installation TOC

Base plate Survey TOC

Installed-grouted and Loaded Base Plate

Under Structure Pre -Assembly and Installation Methodology. Below are recommended two options with enclosed photos for EC reference

A. Pre-Assembly and Installation Under Structure Panels along the Longitudinal Grids A1-A9 as Transversal Grids AA-AJ

- As mentioned above it is mandatory to start with under structure installation on internal STREETS 2-3 ,4-5,6-7 . Start with STREET 4-5 will allow you to move out with installation in parallel with STREET 2-3 and 6-7 after Modules completion on STREET 4-5
- It is recommended to start with Under structure panels with main columns pre-assembly on shorter Transversal Grids L=26.400mm and continues with Longitudinal Grids L=31.240mm.EC will decide the way of installation.
- Fix Installed under structure panels - Column base plates with anchor bolts -double nuts and square washers
- After Under Structure Main Panels Installation completion continues with Lower Horizontal Corner – Diagonal MAG bracings and Octagonal – Fan Deck structure

- After Under Structure - Module members installation completion all bolted joints must be torqued to required Torque values. Note : Main Structure Bolted -Flanged Joints must be torqued in Cross Sequences and marked with Cross sign on the Head of Bolt that is final torque completed. Bolts torque inspection sheet will be issued by QC and signed by all three parties
- Do not overstress and over-torque bolted joints and bolts
- ,,U Shape,, Under Structure Installation Methodology with CW Crane 400 Ton on the middle of ACC between CELL 2 & 4 STREET 1-2-3. On extension of ACC , Structure Panels pre-assembly area covered with Gantry Crane .Panels assembly on temporary supports-jigs.

ACC ,,U Shape ,, Under structure installation sequences

Single Under structure panels installation

CW Crane 400 ton and Installed Tower Crane 25 ton capacity for all light lifts. Tower crane is quick and very useful for light items installation.

Fan deck Octagonal Beams & Fan Deck Plates Installation

ACC UNIT 2 : EC started with STREET 2 & 3 ,continues with STREET 1 with CW Crane 400 Ton . After that EC Installed Tower Crane Capacity 25 Tons inside of ACC to cover all light lifts.

Under Structure panels -fan deck beams – FD plates- tube bundles -A Frames installation with Tower Crane

B. Under structure pre-assembly onto full modules on Ground zero with installed: Fan Deck Octagonal Beams ,Fan Deck Plates , Fan Stack and Introduced -installed LCA Piping /Drains from CCM

- For this installation methodology EC need strong cranes, special lifting devices for E & L Shape modules with cat ladders for access to TOC , strong slings and shackles etc.
- EC Benefits: Work reducing on height, scaffoldings, much quicker and safe installation on ground zero : Fan Deck Beams ,Fan Stack ,Fan Deck Plates ,Piping and supports installation onto modules etc.

Full module W=158 Ton Two CW Crane 450 Ton Full module L W-120 Tone Single Lift CW Crane 850 Ton

Cantilever module W=57Ton Single Lift CW 450 Tons

Module assembly on Ground zero


Condensate drain piping LCA-Fan Stack- Fan Deck Beams-Fan Deck Plates Installed onto modules

Modules Lifting devices-lugs SWL 50 Ton

MED Cantilever structure with LISEGA Spring hangers installed onto modules on the ground zero

Under Structure-Fan Deck Structure and Fan Deck plates Installation in progress. Because of work on height life lines are installed all along TOS Top of Steel.

6.2.4 ERECTION OF FAN DECK STRUCTURE

- Prepare the assembly area and transport the required structural steel from the storage / laydown area – using the pre-erected assembled or alternatively temporary support stands or railway sleepers/Timber Cribbage.

- Pre-assemble to the maximum extent octagonal fan deck support steelwork at ground level.
- Lift and Install the pre-assembled fan deck support steelwork and any additional members and secure into position.
- Continue the above process until the fan deck support structure for all modules for the street is complete.
- Survey and align the structure for the complete street, remove or install additional packing / shims plates as necessary to achieve prescribed line and level tolerances at the top of steel elevation.
- Tighten all Nut / Bolts to the required Bolt Torque Value.
- Following the Erection ITP make records of the final alignment and connection Bolt Torques and request if required for any third party inspection. If inspections are acceptable then request for foundation grouting should be submitted and performed

6.2.5 ERECTION OF FAN STACK / FAN BELLS & FAN SCREEN

1.1. The fan screens and fan bell segments are preassembled at ground level and subsequently lifted tothe fan deck level where they are fixed to the structure.

1.2. During assembly wooden planks or boards should also be used to spread the load and placed onto the top of the fan screen sections to allow stepping on and also to avoid damage to the wire mesh
– check and ensure that all the structural bolts have been tightened to the required bolt torque value after assemble.

1.3. Please note: The permissible loads on the fan screen using wooden planks are shown on **Attachment No1** at Section 8 of this document.

1.4. Assemble fan screen support framework and the fan screens panels on stands or Timber Cribbage, beneath each Fan Cell module along the street. The stands or Timber Cribbage should be high enough to allow access for installing the nut / bolts and for torque tightening and sturdy enough to support the weight of the complete fan screen & fan bell assembly.

1.5. After completing the Bolt Toque on the assembles Fan Screen, continue to mount / bolt the individual fan bell segment - 8No steel stiffening plates onto the fan screen

outer perimeter connection brackets.

1.6. Lift and install each 8 No FRP fan bell segments one at a time, between the steel stiffening plates and fit the Nut / bolts & Washers on each flange connection, the nuts / bolts should be left lose and not tightened until all FRP Segments are installed.

1.7. Commence & complete all the tightening of the nut / bolts on each flange connection also checking at the same time that the internal surface is flush and in alignment with each other between the steel stiffening plates FRP segments and also that there is no excessive gaps between the verticalflange sections.

1.8. Perform a dimensional check for roundness and that the internal diameter is within Drawingspecified tolerances for the inside internal diameter.

- Record this data / information on a recording sheet, file into quality records, this information will also be required during the commissioning activities. The roundness deviation must be within the recommended tolerances to achieve prescribed fan blade tip clearances to inner surface of the FRP fan bell ring.

1.9. After the dimensional records have been made and are found acceptable, commence preparation for lifting the completed fan bell & screen assembly to the fan deck by means of manual chain hoist or point lift with a crane, Please refer to **Attachment No2** Section 8 for recommended lifting points:.

1.10. Lift the assembled fan bell with fan screen up and guide it through and above the support structure, then turn / rotate to align the support brackets also checking that the correct orientation for the fan screen (Central grid section) has been achieved then lower and fix the support brackets to the 8No connections points.

1.11. Continue installing the fan deck plates to be fixed with fasteners (pre-drilling where required) or self-tapping screws to the fan deck support structure. The fixing to the fan bell steel ring should only be performed after all final adjustment has been completed of the Fan motor bridge + fan blades & all blade tip clearance criteria have been achieved.

1.12. Please note that special care should be taken in handling and storing the fan deck plates to avoid unacceptable corrosion & bowing or bending. SPG DC recommends shaking out the fan deck plates, putting adequate timber in between plates and having them slightly un-level during storage so that the rain water can run off.

6.2.6 FAN MOTOR BRIDGE-FAN DRIVE-FAN IMPELLER

1.13. To perform this task, Temporary support trestles (Three Pairs – enough for one street) should be fabricated a height suitable to give enough ground clearance and to allow the Hub plate & Fan blades to be installed and sufficiently stable & strong enough to support the total weight of the following components - Fan Bridge structure + Floor Gratings + Handrails + Motor & Gearbox + Fan Blades & Hub plate. (Please Note; that this is not an SPG DC supply, and the erector will have to fabricate this item)

1.14. The erector should also check during the following activities that the correct Labelled Motor / Gearbox are being assembled and installed at the correct location – Refer to P&ID and KKSNumbers

1.15. Pre-assemble – place two temporary support trestles on good solid and level ground, Lift and placethe Fan Bridge onto these two trestles and install any internal main bracings then adjust until the fan bridge is horizontally level. (This can be performed / checked by using a spirit bubble-level checking at both axis point for example Northerly & Easterly on the top of each main beam section)

1.16. Unpack and carefully lift the Gearbox check for being at correct orientation and

place it onto the Fan Bridge gearbox support frame, place stainless steel shim plates as required between the base of the gearbox and the support frame in order to set it plum and level and then install the holding down bolts, before tightening the holding down bolts to their specified Bolt Torque value, check that the gearbox is central to both axis points on the fan bridge, fine adjustment can be made using the jacking bolts mounted onto the support frame.

- **Please Note:** that any plastic plugs or caps installed by the Gearbox manufacture should not be removed, any instruments and Oil & Filters will be installed later and during pre-commissioning checks

1.17. Motor – Carefully unpack and before lifting into the vertical position the motor shaft coupling may have to be installed. (This section is for example only and dependent on Manufacture & scope of supply) First clean the protective coating of the shaft and the internal contact surface on the coupling, there are two options how to install the coupling – For example ROTEX 75 Coupling withaxial cooling fan.

- Option No1: Heat the coupling between 80° and 100° maximum and install onto the motor shaft. (Cooling fan has to be removed & placed onto the motor shaft before heating and refitted after the coupling has cooled down)
- Option No2: Apply grease onto the Motor shaft and push it on using the shaft M20 threaded centre bolt hole.

6.5.1 SPG DC advise that the Manufacturer's Installation & Maintenance Manual should always be referred to for the detailed instructions and that they are followed.

1.18. Using the two Motor lifting eye bolts (Before lifting check that they have been fully screwed – in, then released by un-screw one half turn 180° in order to reduce any additional and unnecessary strain to the casing during the turning process to the vertical position) attach the soft lifting slings to the two eyes, plus using an additional soft sling around the casing attached to a pull-lift to carefully support then lift turn / rotate the motor to the vertical upright position, check for the Terminal / Junction box being the correct orientation then carefully place onto the gearbox at the same time

also checking the alignment / clearance on the coupling connection on both the Motor & Gearbox, if this acceptable then install the flanged connection bolts and tighten to the recommended Bolt Torque values that should be indicated on the Drawing or the manufactures Installation manual.

1.19. Install the internal bracing local to the Gearbox then the handrails on both sides of motor-bridgeplus the floor gratings.

1.20. Fan Hub plate - un-pack and carefully turn to the correct up-right position if necessary and clean / remove any paint from the hub plate where the gearbox coupling will make contact, after cleaning this contact surface area apply a thin coating of oil or grease to help protect against corrosion. Special care should also be taken to prevent unnecessary damage the protective paint coating plus the Aluminium fan blade mounting blocks during these activities.

1.21. Please do not remove any bolts / plates that may have been installed on the Hub plate by the manufacturer, these items have been installed for balancing purposes and to reduce vibrations.

1.22. Carefully move and position the Hub plate under the Fan Bridge and locate to the gearbox shaft coupling. Also check and clean the contact surface of the gearbox coupling before fitting the hub plate. Place two pull-lifts using soft slings each side local to the main beams and attach two soft slings to the hub plate, carefully lift up, guide and align the hub plate to the coupling, then install the connection nut & bolts, tighten gradually by hand ensuring that the contact surface is together equally then perform the Bolt Torquing to the

specified value.

1.23. Fan Blades – **Please note:** the Fan Blades have been manufactured and supplied in balanced sets, therefore care should be taken to ensure that the Fan Blades are installed together in the correct set and also the correct location for the air flow and reverse numbering sequence. Please refer to the manufacturer's Installation and Maintenance Manual for more detailed information and follow the recommendations for the safe handling and how to install the fan blades and clamps ontothe hub plate.

1.24. The bolts for securing the fan blades onto the hub plate should not be fully tightened at this point of time; the tightening will be performed later during preliminary alignment and blade angle setting

1.25. Prior to lifting of the pre-assembled motor bridge, ensure that all the fan blades are pulled inwards as far as possible to achieve more clearance and to help and avoid damage to the blades whenlifting and placing / entering into the fan stack.

1.26. Soft rope (Not Wire sling or lashings) is also to used and tied to the fan blade shaft and between the motor bridge to stop the fan from rotating during lifting and placement activity and also to prevent wind milling until other final alignment activities have been completed. The installation of the Filters, Instruments and the Oil will be performed at a later stage when pre-commissioning activities commence.

1.27. Lift the assembled Fan Drive unit onto the fan deck structure by use of Four 8 meter (minimum length) soft sling and attach them equally spaced onto the Fan Bridge two main support beams. Floor grating local to these lifting positions will have to be released and temporary moved and tied / secured safely at another location along the fan bridge. Also place additional packing / protection at the lifting points on the main beams in order to avoid any damage that could occur to the kicker plate or sharp edges that could damage / cut through the soft lifting slings.

1.28. Before lifting the Fan Bridge assembly, attach rigging hand lines to help control and guide the fanbridge into position during the lifting and placement activities.

1.29. Lift the fan Bridge assembly and carefully lower and guide / check the clearance between the fan blade tip and the Fan Bell internal casing until the fan bridge is resting and making contact with the main supporting structure. Install the connection bolts to secure into position and then remove the lifting slings and immediately refit the loose floor grating to make the area safe.

1.30. After erection and alignment of the A-Frame structure has been completed, continue to check Fan Bridge level / alignment and adjust as necessary by installing packing plates between the fan bridge support legs and the main support structure. Complete the central bracing connection from the A-Frame. Check the gearbox for being level and central and adjust as necessary by installing or removing the shim plates between the gearbox/motor support frame, tighten the gearbox holding down bolts and re-check the bolt toque.

- Using a spirit bubble level, check for being correct on the Fan Bridge Structure the Gearbox output shaft and fan hub plate in both Northerly & Easterly directions and for Verticality.

1.31. Release / remove the soft rope that was tied to the fan blade to prevent it from rotating / wind milling. Pull out one fan blade until the shaft stop collar is making contact with the Aluminium mounting block. This blade will be used to rotate the fan blade assembly to check the clearance between the blade tip and the internal surface of the Fan Bell. Release the support bolts and adjust the Fan Bell as required to achieve the recommended Min 25mm / Max 55mm Gap.

1.32. Please Note: The difference between the Min /Max Gap should be gradually and not from one extreme Max gap down to the Min gap in a short distance of space, the fan bell should be adjusted to get the best possible and equal gap. It may also be

require that the fan deck plates are fixed to the top fan bell steel ring at the same time, in order to help achieve the required gap and hold the fan bell in position.

1.33. When the adjustment of the fan bell has been achieved, ensure that a record of the dimensions at a minimum of sixteen equal internal locations is made and entered into the site quality documentation. (This information will also be required and referred to during commissioning checks)

1.34. Blade Angle setting is to be performed on one fan first. This fan will be used to do a performance check so that the exact blade angle can be confirmed. Once this is done, the fan blades of the remaining fans must be adjusted as follows. Release the fan blade U-bolts just enough to allow the blade to be pulled out and also to be turned / rotated to the required - blade angle. A digital Inclinometer will be required and follow manufacturer's recommendations for location of the blade to be used for this task. Check and ensure that the shaft stop collar is making contact with the Aluminum mounting block. Tighten the U-bolts nuts gradually and check that the gap between the U-Bolt clamp on both sides is equal until the required Torque value is achieved. Recheck and ensure that the blade angle has not changed during the tightening process. Continue to perform the same activity on each blade until each fan set is completed.

Please Note:

- The fan blades assembly should be rotated to a particular location that is chosen to perform this activity, and the setting of each blade should be performed at the same location to help reduce anydifferences.
- Also ensure that the fan assembly is restricted from wind milling by use of a soft rope between one of the blade shafts and back to the Fan Bridge main support beam or motor frame after any work orinspections have been performed.
- Preliminary Blade Angle setting - the fan blades will provisionally be set to predetermined angle (SPG DC to advise / supply this information) in order to allow the fan unit to be operated during the commissioning activities and to record power consumption and vibration levels, based on these readings the blade angle will most likely be changed to improve the operation.

6.5.2 8) IMPORTANT NOTES:

- The fan blades assembly should be rotated and the setting of each blade angle should beperformed at the same location to reduce any differences.

- The fan blade assembly should be prevented from wind milling by using soft rope tied between one of the fan blade shafts and back to the fan bridge support structure or motor support frame.

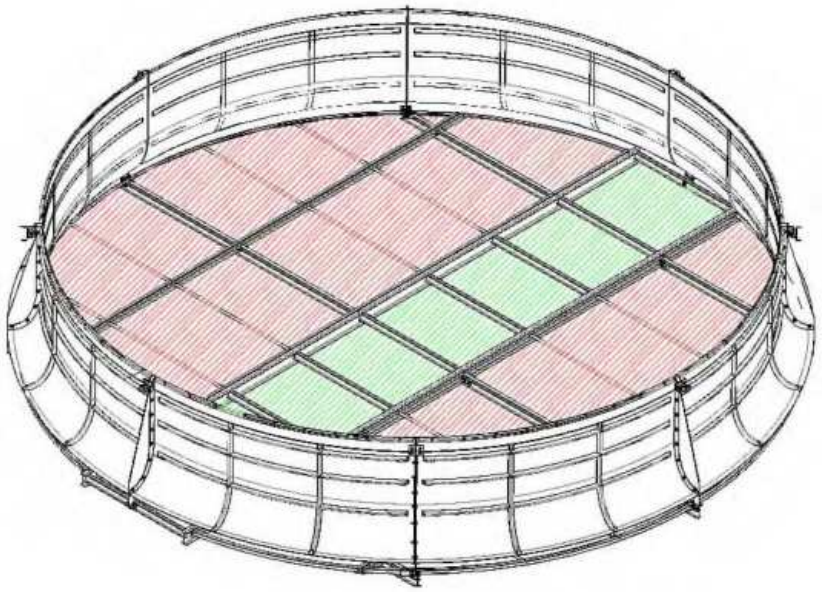
- The Fan Blade Installation should be strictly in accordance with Manufactures Installationprocedures recommendations.

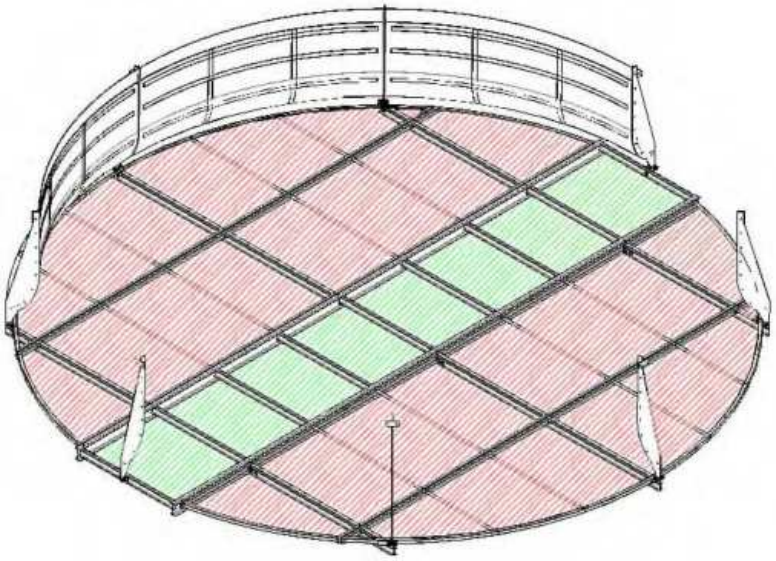
- The Gearbox should not be filled with oil during the construction phase. This should be performed shortly before the cold commissioning. Please observe special requirements in case prolonged storage is envisaged prior to commissioning.
- The pre-assembly and erection of adjacent streets can be performed using the same methodology as described in this procedure. For lifting and crane accessibility reasons it is recommended to complete a full street with A-frame, bundles and manifold (tack welded) before starting a new street.

- It is recommended that final alignment and bolt torque inspections are completed on the substructure for each street before installing or making the structural connections of the adjacentstreets.

Section 6 – 3 Attachment 1: Permissible Loads on Fan Screen

The herein after called maximum loads are only valid if the fan screen tobe laid out with wooden planks.



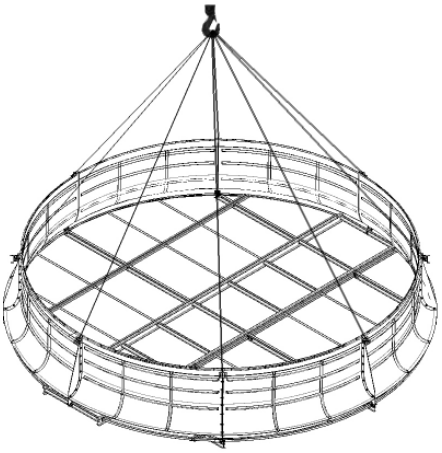


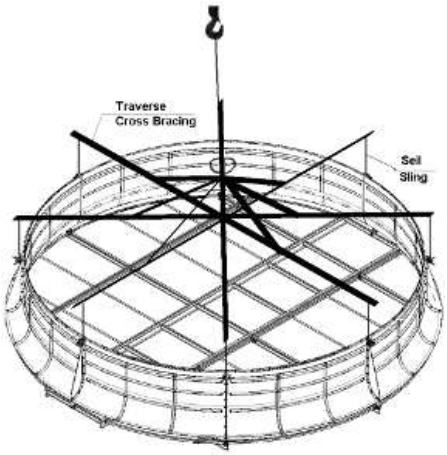
100 kg single load / 40 kg per square meter

100 kg per square meter / 150 kg single load

Section 6 – 9 Attachment 2: Lifting of Fan Stack with Fan Screen

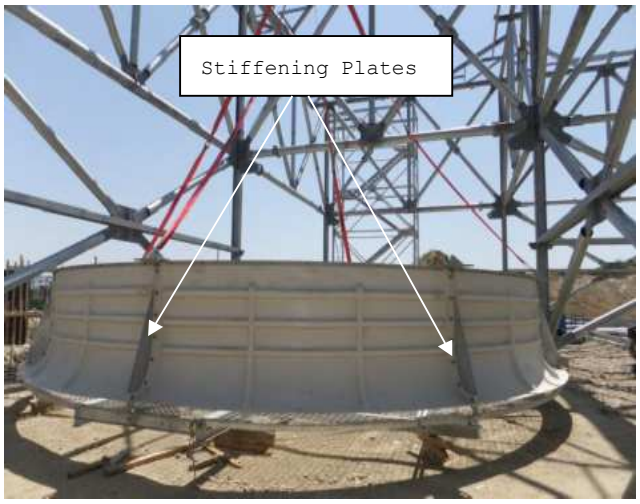
The below sketches are showing the different possibilities of lifting the fan bell with the fan screen



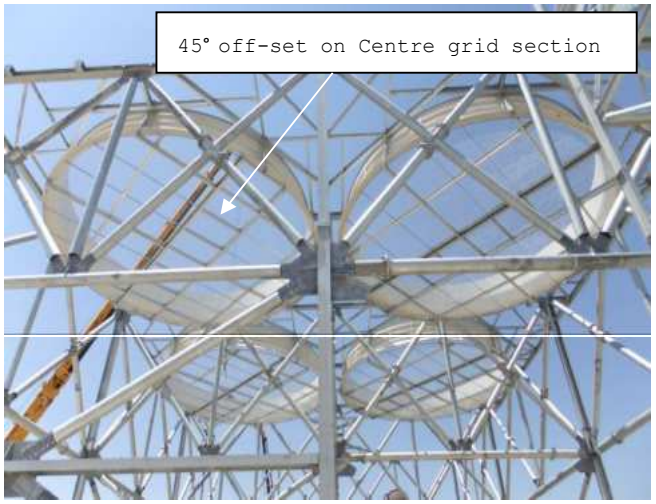


Section 6. Assemble of Fan Screen.

Section 6. Assemble of fan screen & FRP Fan bell



Section 6. Preparing for lifting.

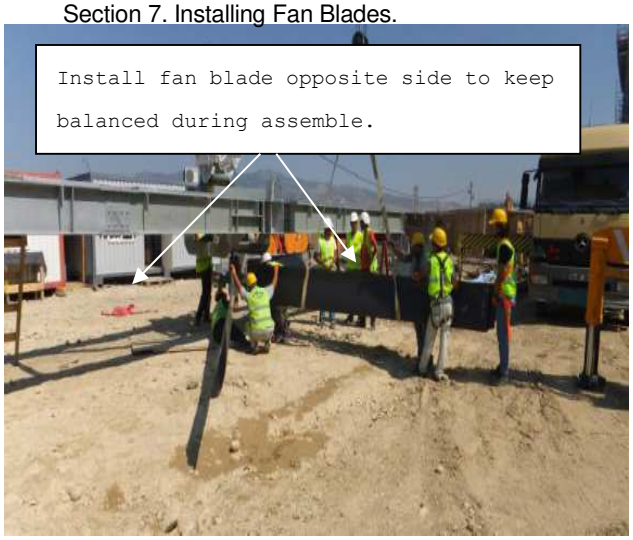


Section 6. Fan Bell's secured onto Fan deck structure.

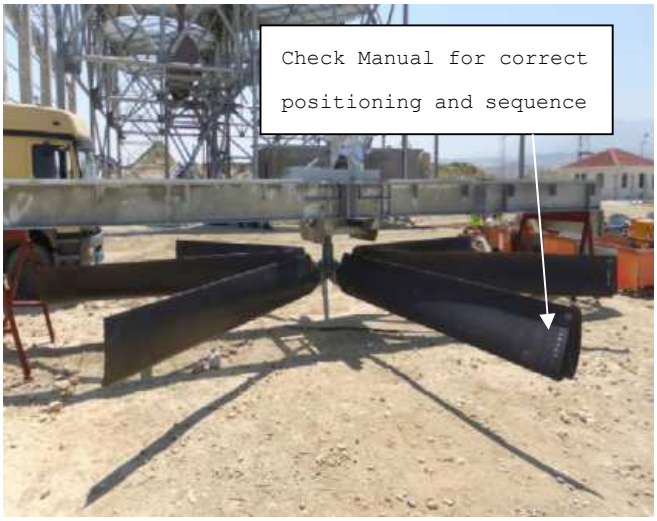
Section 6. Perimeter walk way & Fan Deck Plates. Section 7. Fan Bridge assemble on temporary trestles.

Section 7. Gearbox secured to support frame. Section 7. Fan Hub Plate with blade mounting blocks.

Section 7. Installing Fan Blades.



Section 7. Fan Blades assembled.



Section 7. Fan Bridge lifting points.

Section 7. Fan Bridge – Street 1 Cell 1

FAN UNIT Fan Stack – Fan Motor Bridge with Fan Drive & Fan Impeller ERECTION DETAILS

Fan Impeller assembly

Fan Motor Bridges with Fan Drive and Fan Impeller & Fan Stack Installation

Top view to ACC with Installed Fan Units

6.3. ERECTION PROCEDURE FOR A-FRAME & SHEETING

TABLE OF CONTENT

- REFERENCE DRAWINGS:
- PREPARATION & PRE-ASSEMBLY
- ASSEMBLY OF THE A-FRAMES INCLUDING PARTITION WALL SHEETING
- ERECTION AT HEIGHT

6.3.1 REFERENCE DRAWINGS:

Erection Drawings of group:
Structural steel:
DWG2800
Partition sheeting & profiles: DWG2220 and DWG2223 fixing profiles for sheeting: DWG2224

6.3.2 PREPARATION & PRE-ASSEMBLY

1. **The method of erecting the main support steelwork can be performed in a different way.The present procedure shows a typical sequence applied on several plants.**

   - Take the elevation measurements on the connection points for the A-frames & check if they are within the level tolerance. This can be easily done from the fandeck.
   - Check for ground compactness and loading bearing capacity as well as for any restrictions for movement of heavy Cranes or equipment in the vicinity of the ACCplot and the surrounding area that could restrict construction or assemble activities.
   - Identify and prepare the required structural steel parts street by street and transportthese from the laydown storage nearby the assembly area.
   - The chosen pre-assembly area should be preferable located near the ACC for each street to be erected. This would avoid double handling and reduce risk for possibledamage and distortion.
   - A temporary supporting frame, sufficiently strong and large enough to support theparts to be assembled, should be erected and checked for being plumb & level. Thisframe must be of sufficient strength.
   - Alternatively, if good compacted and level ground as well as sufficient space isavailable at the ACC plot or surrounding area, temporary supports or railwaysleepers could be positioned. Additional timber cribbage for levelling could beprepared and used for pre-assembling activities.

Steel structure racks used for erection bas plate to ensure stable building.

Fabricated Support sitting on the foundation of adjacent street to ensure stable building. Will require additional supporting under the middle cell A-frame

For large ACC's one can use the main fan deck beams of the last cells to be erected as a basis.

2. Assembly of the A-frames including partition wall sheeting

Define which sections will be ground assembled and which areas will be filled-out at height. Thebest way to start is to follow the splicing of the top girder beam.
From the Assembly part list and from the 3D model, one can define the required profiles should bebrought to the assembly area.

2.1. Assembly of the Single 'A' FRAME : (pics 1-6)

- Put A-frame beams flat on the ground. Check that the side on which the partition wallsheeting faces upwards. Connect the main 2 legs to the upper connection part.
- Introduce the main horizontal bracing & cross bracings connecting later-on to the motorbridge.
- Take the dimension between the 2 legs at the base and compare with the theoreticaldistance.
- Once the main dimensions are set, torque tighten the bolt connections.
- The intermediate A-frames will be assembled in the same way but here is obviously no partition wall to be erected. For space saving, this intermediate A-frames can be assembledon top of each other.
- Check following pictures illustrating above mentioned steps.

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2.2. Installation of the partition wall sheeting

Once the A- frame + the partition wall frame is assembled & torqued, one can proceed with theinstallation of the sheeting fixing L- profiles & cutting the sheeting panels.
Avoid the use of grinding disks as the grinding sparks will contaminate the sheeting.
A nibbler isless dangerous and will not cause sparking.
Avoid standing directly on the sheeting when fixing them. Use a plate to spread the load and toavoid direct contact and damage to the sheeting plates.

- Check the relevant drawing for length of L-profiles, fixing bolts and sheeting panels
- Install the L-profiles on the perimeter and on the intermediate profiles as indicated in thedrawing.
- The sheeting plates are split in an upper one and the lower one seen the length. It isadvisable to at least put the upper area in place as a minimum. This will reduce the scaffolding requirement later-on significantly. Ideally is to put all plates in place.
- The sheeting shall be cut to size in such a way that the outer edges stick over the A-frameno more then 180mm. This to avoid that later-on it will touch the bundle tubes and hinder bundle installation.
- It is advisable to make one set of sheeting plates that is used as a template. This allows toprepare & cut the plates prior to assembling.
- The cutting phase of the sheets must be touched-up with cold galvanization paint to avoidrusting of the edges when the assembly is still at grade. Refraining to do so will require to perform this work at height and with expensive scaffolding at the own cost of the EC.
- Don't waste the cut-off plates as these cut parts will have to be used elsewhere (check theconcerned drawing !). Refraining to do so may lead to a shortage of plates. EC shall re- supply in this case at his own cost.
- We will not put the 2 lower corners in place to facilitate the sheeting installation under theCCM's later-on. These corners will be installed afterwards.
- It is also advisable to leave off the 2 plates left and right of the lower door to avoid sheeting damage during lifting of the assembly. Since these sheets need to pass between the motor bridge handrails, they might get damaged during lifting. Install these later.
- Make sure the base line of the sheeting (facing towards the fan deck) will be within the A-frame perimeter (not too long!). This to avoid any damage to the sheeting when erecting the assembly on top of the fan deck.
- The sheeting fixation L-profile on the fan deck will be put in place once the assembly iserected.
- Foresee sufficient cut-out to allow bracing and bolting connection. Cut outs

are to be donein a professional, good-looking way and using a nibbler.

- Once the sheeting is installed and fixed, clean off the face of the it to remove any

2.3. Ground assembly of the Upper structure

- Once the A-frames are assembled with the partition wall sheeting, they are erected on the template and interconnected to each other with the monorail + vertical supports, horizontalbracings, cross bracings & top girder beam.
- Ensure that the right combination of A-frames and bracings is assembled in the correct sequence.
- Ensure the assembly area is properly barricaded off and closed for unauthorized passing orcrossing.
- When putting the first A-frame in upright position, keep it upright with steel cables. Tensionthe cables to avoid movement by wind. (pic 13)
- The second A-frame will be lifted in the same way and also kept upright with steel cables.
- Erect the monorail beam and connect to both A-frames.
- Continue to erect until all bracings are installed.
- Snug tight the bolts. Once this is done and the assembly is stable and cables can bereleased.
- Continue the ground assembly by adding frames and bracings.
- If possible, the CCM spools can be installed at grade as well. This will save some additionalseparate lifting.
- At the position of the Secondary bundles, also install the piping support and if possible andavailable the related piping spools.
- The ground assembly is only limited to the capacity of the crane and the height and weight that can be erected. EC should ensure to assemble according to these restrictions.
- If the partition wall sheeting is included in the assembly, the windspeed during lifting will bea limiting factor and to be taken into account.
- On the A-frame top girder also install the Teflon sliding plates + shim packs for the special sliding points and SDM sliding points. The upper part will be erected together with the bundle erection.

6.3.3 ERECTION AT HEIGHT

Once the assembly is completed at grade, it shall be lifted into its final position on the fan deck.

- Assess the weight of the assembly using the item list. Also take into account all additionalitems erected on the assembly at grade (sheeting, CCM spools, etc)
- Define the centre of gravity prior to lifting.
- For assemblies longer then 1 complete cell, it is advisable to use a spreader beam to avoidbending.
- Foresee minimum 2 draglines to guide the assembly once in the air.
- Take care not to damage the partition wall sheeting when bringing the assembly in place.
- Once the assembly is in final position, torque - tighten the connection bolts between A-framebase plate and column/fan deck.
- All bolts shall be installed and tightened to the required torque value.
- Connect the cross bracings to the motor bridge at the concerned locations
- Once all A-frame assemblies are installed on the fan deck, install the remaining bracings toconnect all together.
- The A-frame is ready to receive CCM spools.

Pre-assembled A Frame modules Erection

6.4. ERECTION PROCEDURE FOR CCM CONDENSATECOLLECTION MANIFOLD

TABLE OF CONTENT

INTRODUCTION

- BEFORE CCM INSTALLATION
- PRE-ASSEMBLING OFF CMM
- ERECTION OFF CMM
- MEASUREMENT PROTOCOL OF CCM
- INSTALLATION OF CCM END PLATES

Purpose

The purpose of this manual is to detail, both in principle and specifically, the methodology ***forerection of CCM***. The contents of this manual may be subject to amendment at the discretion ofSPG DC.

Adherence to this manual shall not be considered mandatory. It is issued to the EC for guidancepurposes only and does not constitute an instruction to work in any particular way or sequence that will give rise to future claims for additional costs from EC. Variation from the detail of this manual is solely at the discretion and risk of the EC. Should unforeseen circumstances result in out of sequence deliveries the EC shall use their best endeavours to use available material to fullyutilize the labour resources on site and mitigate delay and cost.

This manual is issued to the EC with the assumption that all erection activities will be executed inaccordance with good working practice. Furthermore, it is assumed that the EC is imbued with sufficient experience and knowledge to erect the plant described and will deploy personnel resources at site and project level accordingly.

6.4.1 BEFORE CCM INSTALLATION

As the EC will soon be starting to erect the upper structure and A-Frames, they should make surethey align the upper structure correctly and as per their Erection and Inspection Plan.

As part of this work, the EC should have a signed off inspection report ensuring that all of the upper-structure steel work including 'A' frame legs are square, plumb, true and is fully bolted. Allof the main components of the upper structure steel work (everything above fan deck level) should be installed and fully bolted at this stage.

It is EC duty to issue report measurement protocol of level and alignment of all sliding saddle and to organize with SPG DC and/or CLIENT an inspection protocol of tightening torque of bolts of erectedstructure.

Stainless steel plate needs to be located and bolted on "A" Frame (4 x M12 length 55 bolts & nuts).

Condensate manifold shall be inspected before lifting and placing into location. Making a verification oflength of each spool of condensate manifold is recommended.

Please note that any ancillary items such as access and maintenance doors, air seals, etc do nothave to be installed at this stage for CCM erection.

From SPG DC's experience, if the upper structure is not plumbed and pulled into line correctly, this will result and have an adverse effect on the CCM's to CCM circular weld gaps and the CCMsaddle bolt up to the A frames, as the CCM's bolt directly to the A-frame vertical columns.

The EC may then be faced with having to supply and install bands over any excessive gaps between CCM to CCM connections, or having to trim the ends of CCM's in the air to make fit ups,or even having to go back over some of his bolted connections to slacken off previously tightenedbolts so he can pull the structure into line.

6.4.2 CMM PRE-ASSEMBLING

As seen on the elevated and top views on the drawing, there are field welds shown at the ends ofthe CCM lengths. To lessen the amount of welds to be performed at height and in position, and also if the crane reach & lifting capacity limit allows, SPG DC recommend welding two CCM sections together at ground level, before lifting the sections of CCM to the structure. See photo below:

This helps to reduce the amount of circular welds performed in positional at height, and allowsfor easier inspection of the completed welding performed,

If the EC chose this option, they should make a simple survey of the mounting holes on the installed A-frames and then make sure this matches the holes in the saddle support brackets onthe CCM's as shown. This helps to ensure alignment and bolt up when the double-jointed CCM assembly is erected.

The field weld detail for CCM to CCM joint is shown on the drawing, and is full Penetration weld.

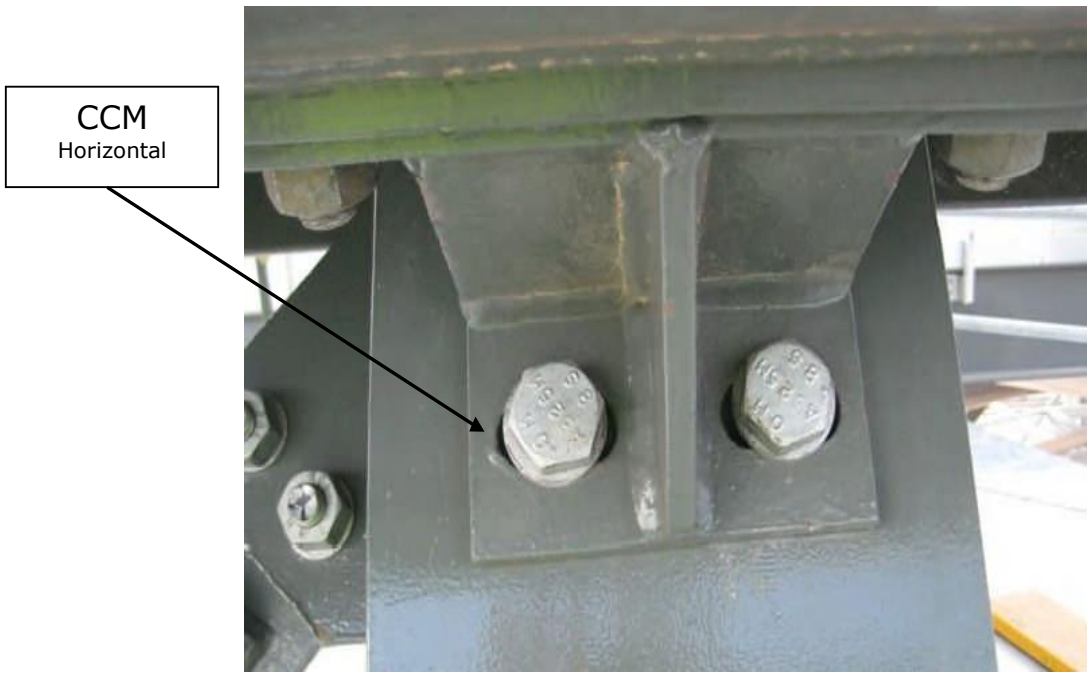
Please note that when making the circular field welds between CCM's, it is very important that theskirt plates of adjoining CCM's are aligned & not stepped. The tube bundles will ultimately sit onthese CCM skirts and if there are steps or misalignments between CCM lengths then much morefit up and weld out has to take place as gaps will exist between the tube sheet and CCM skirt. Any deviation (high / low) should be taken up in the circular part of the joint.

6.4.3 CCM ERECTION

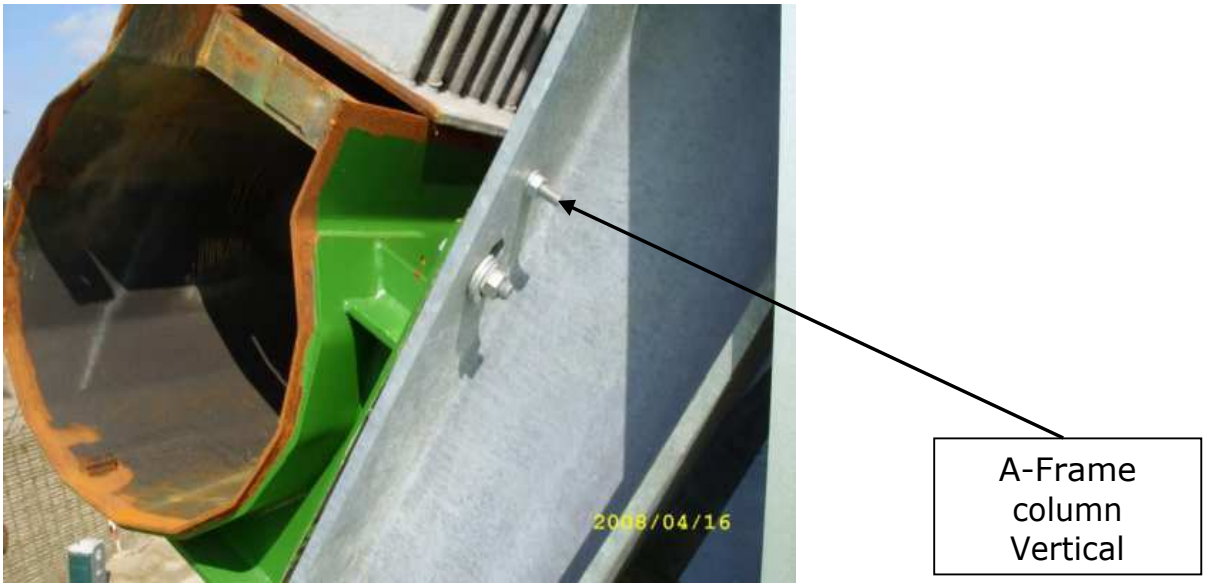
The first CCM to be erected should be the one located at the centre of the street, and the bolts installed in the centre of the slotted holes of the CCM saddle bracket & A-Frame column. See photo below:

The holes in the CCM saddle brackets that are used to connect to the A frame leg are horizontally slotted. Holes in A-frame column are vertically slotted. This will allow for any side to side and vertical adjustment that needs to be made in order to get correct alignment & fit ups between CCM lengths.

From SPG DC's experience, the connection bolts (4xM24 length 70 Bolts) between the A frame legs & the CCM's should all be installed but left loose (finger tight) so this adjustment can be made.



Once all the CCM's for a street have been loosely bolted in position, fit ups should be made alongthe whole length of the CCM for one side of the street. Once all fit ups have been made, these bolts



should then be fully tightened with a wrench and a snug fit to the stainless-steel plates.

Please note that the bolts used to connect the CCM's brackets to the A-Frame vertical columns should only be removed after all welding has been completed. This is not only the welding of the CCM's themselves, but the tube bundle sheet welds to CCM's, and all the welding of the top SDMand seal plates. SPG DC will advise later when these bolts can be removed.

Once the alignment work of the upper structure has been carried out as described above, pleasenote that SPG DC allows the EC the added possibility of extending the hole in the CCM foot by reaming to allow them to close any weld gaps between CCM sections and to help avoid the use ofbands. In SPG DC's experience, this option is much more preferable to the EC, rather than spendexcessive time in trying to pull the A frame legs and intermediate CCM supports into perfect alignment.

Before the EC decides that he needs to ream any holes, please inform SPG DC first, as eachsituation is assessed on a case-by-case basis.

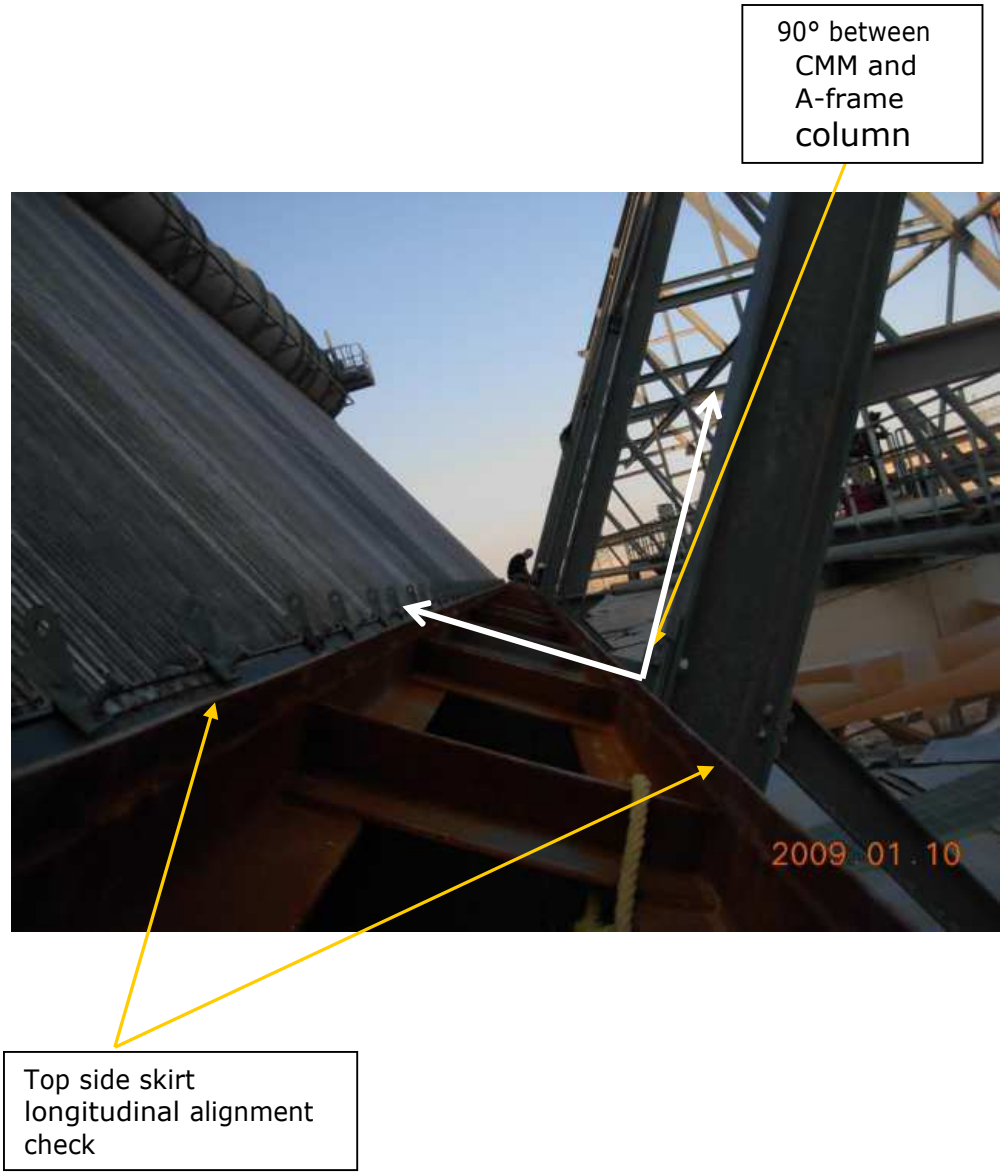
Once all fit ups have been made between CCM lengths, the field welds from fan deck should bemade

If necessary, EC can insert shims between the A frame saddle and the A frame leg to obtain fineangular adjustment of the CCM skirt plates. In theory, this angle should be 90 degrees to the A frame leg, but erection, civil and fabrication tolerances combined, will most probably dictate that some slight adjustment is often necessary. The skirt plates will ultimately weld to the tube bundleand the shims help maintain a correct weld gap.

6.4.4 CCM MEASUREMENT PROTOCOL

Once the EC consider that all fitting and adjustment are completed, they shall issue ameasurement report of levelling of CCM. This report must at least contain:
-Global level check and relative elevation of CCM & side skirt at each A-frame column position
-Correctness of perpendicular 90° position of top skirt of CMM and A-frame column support leg.
-Longitudinal alignment of CMM & side skirt

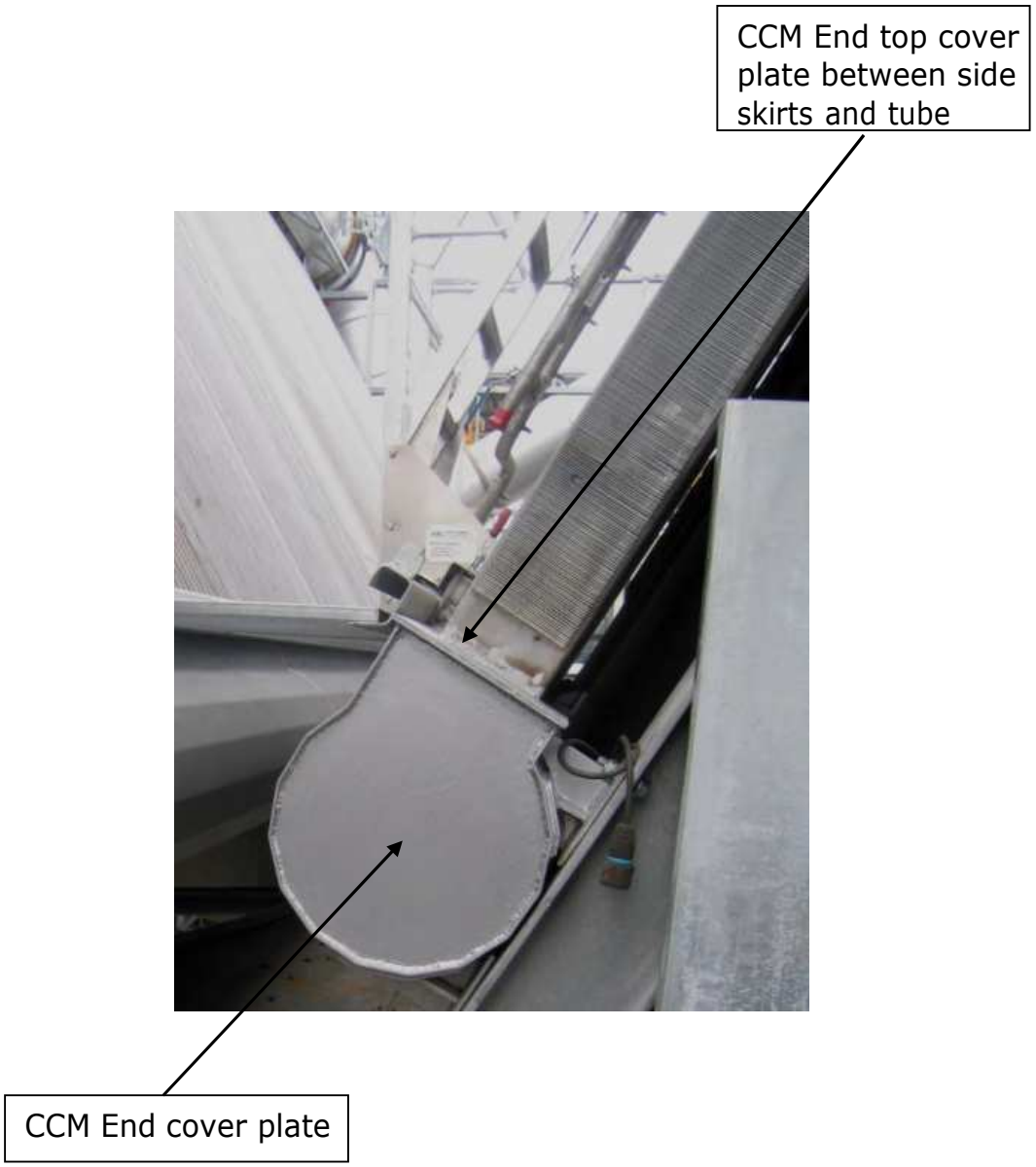
This report shall be officially transmitted to SPG DC for approval. EC may not continue with theerection of bundle without this approval.


90° between CMM and A-frame column
2009 01 10
Top side skirt longitudinal alignment check

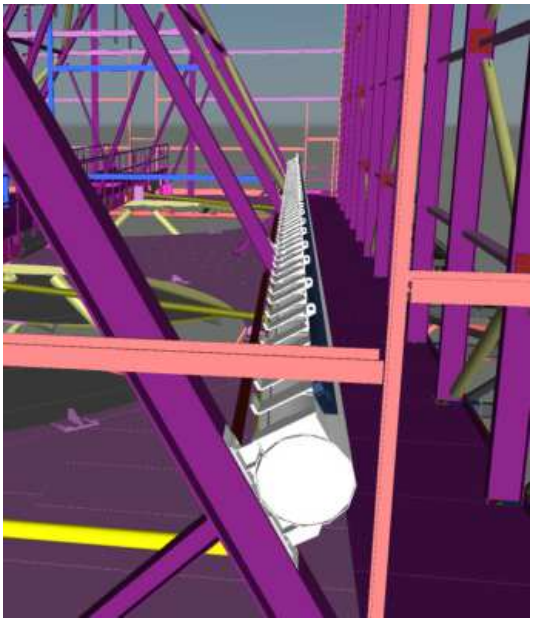
6.4.5 Installation of CCM End - Closing Plates

SPG DC recommends that both the filler and end plates should only be installed **after** erection and welding of the tube bundles and steam distribution manifolds. This is so the EC can clean theworst of the construction debris such as weld spatter, grinding duct and any mill scale out of the CCM's before they are finally closed.

After the tube bundles are erected, it is wise to temporarily cover these open CCM ends during construction to help avoid a build-up of construction debris and general site dirt and dust beingblown into them.

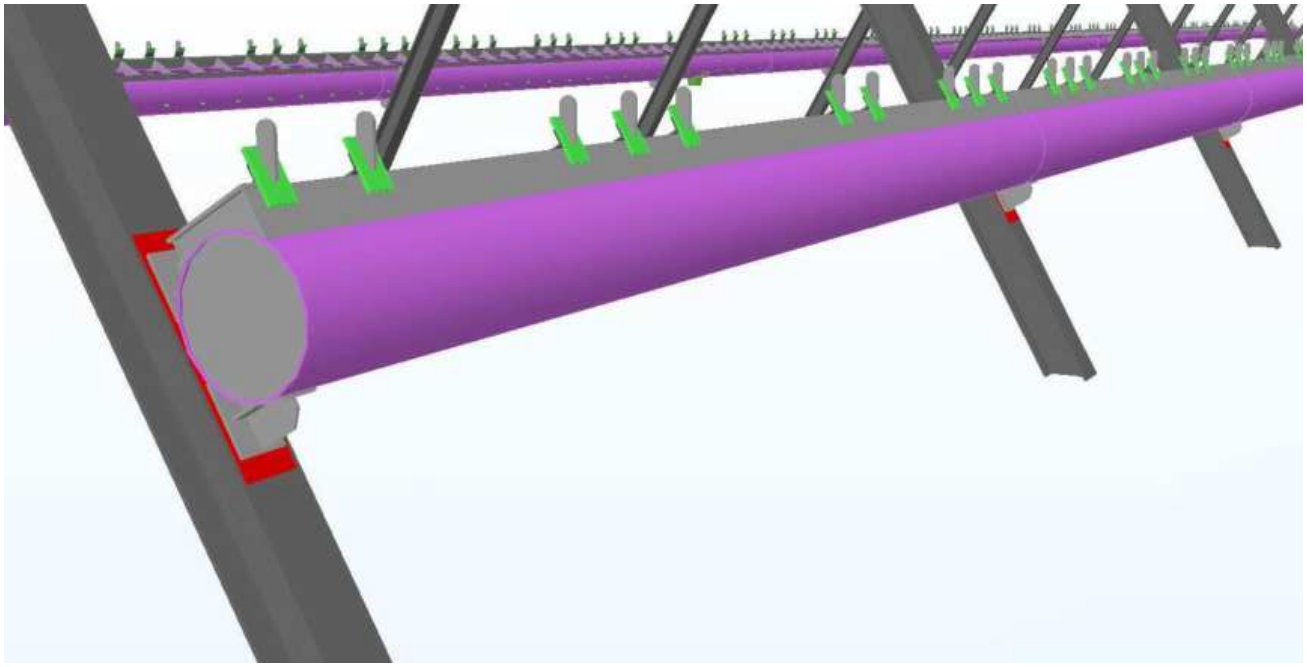


Streets with Condensate Collecting Manifolds (CCM)

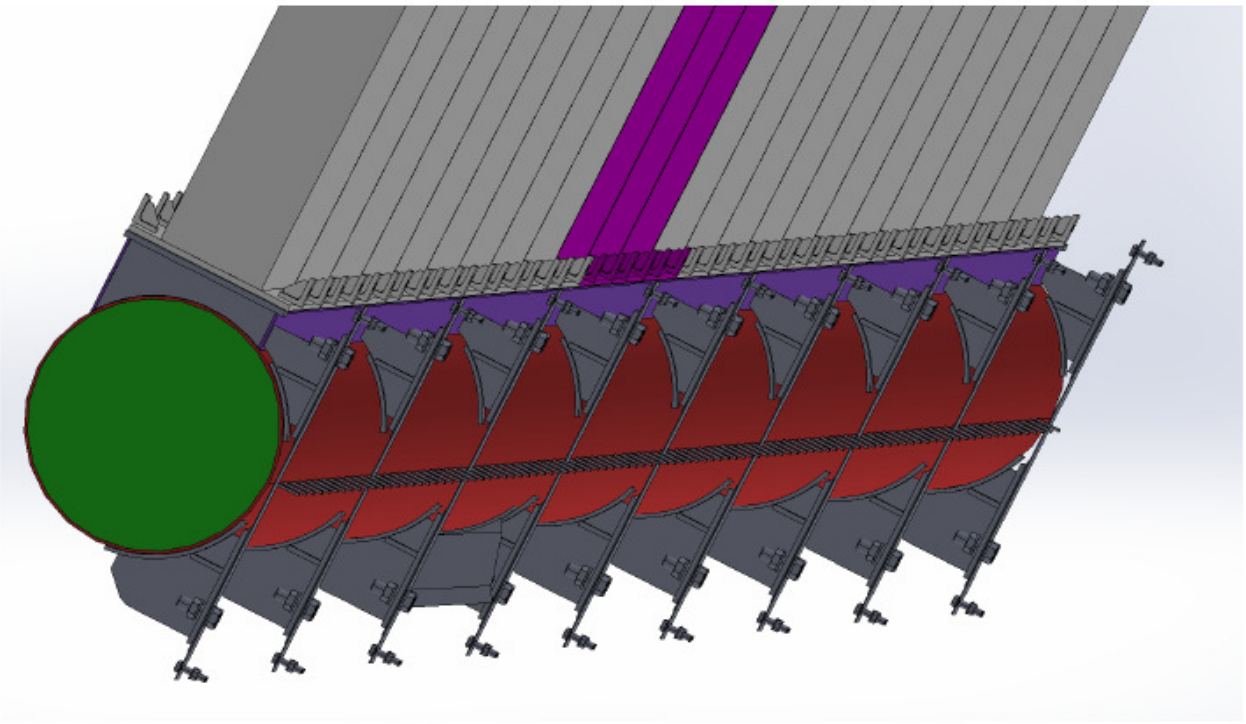


Typical: Condensate manifold (CCM) and adjusting clamps for bundles

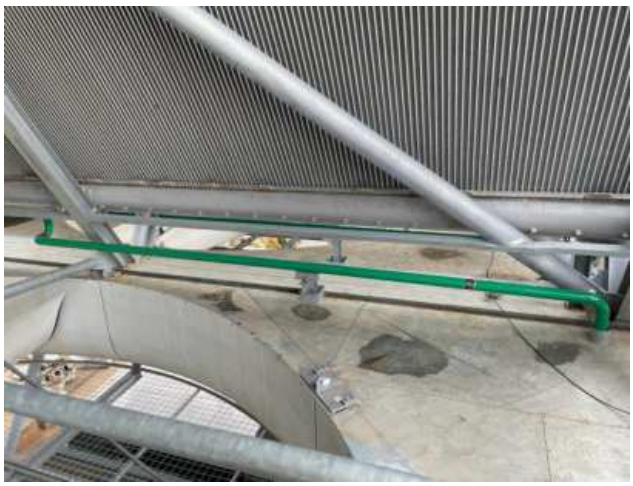
These clamps + Jacking bolts are installed on the bundles bottom side at grade before lifting. Two clamps are required per bundle



Typical: Condensate manifolds with sliding supports assembly and tube bundle adjusting screws



Installed CCM with LCA Drain pipe



6.5. ERECTION PROCEDURE FOR TUBE BUNDLES

TABLE OF CONTENT

- **BEFORE BUNDLES INSTALLATION**
- **REMOVING BUNDLES FROM PACK AND LIFTING ONTO STRUCTURE**
- **ERECTION AND SETTING OF SECONDARY TUBE BUNDLES**
- **ERECTION AND SETTING OF PRIMARY TUBE BUNDLES**

6.5.1 BEFORE BUNDLES INSTALLATION

As the EC will soon be starting to erect the upper structure and A-Frames, they should make sure they align the upper structure correctly and as per the Erection and Inspection Plan.

Before any bundles are erected, ALL of the under and upper structure must be completely installed and all bolts tight. All of the structural steel should also be in place, including all bracings, doorframes, door headers, sheeting channels between mini and main 'A' frames, fan deck plates, monorail beams, complete fan drive etc.

Once the above point has been completed, the EC with SPGDC, make an inspection of the streetbefore erection of the bundles can start. This is to ensure that all the necessary work is complete. Alignment and elevation checks must also be made by EC on the apexes of the main 'A' frames atevery grid line of the street, & a record made of these results should be added to the erection and inspection plan. Following these results, the EC can then determine the amount of shim packs that are required for each A-frame that will bring them all to the same height and the correct elevation before setting bundles.

All CCM shall be erected and aligned as instructed in "ERECTION PROCEDURE FORCONDENSATE COLLECTION MANIFOLD "
This includes the completion of the welded circular joints between the respective lengths.

For reminding: it is EC duty to issue report measurement protocol of level and alignment of all CCM.

The EC must take care and attention when moving, unpacking, erecting, positioning & welding of the tube bundles. The fins on the tube are quite fragile and can be easily damaged. The tubes are very expensive and damaged tubes are very time consuming to replace both in terms of man-hours and in delivery time.

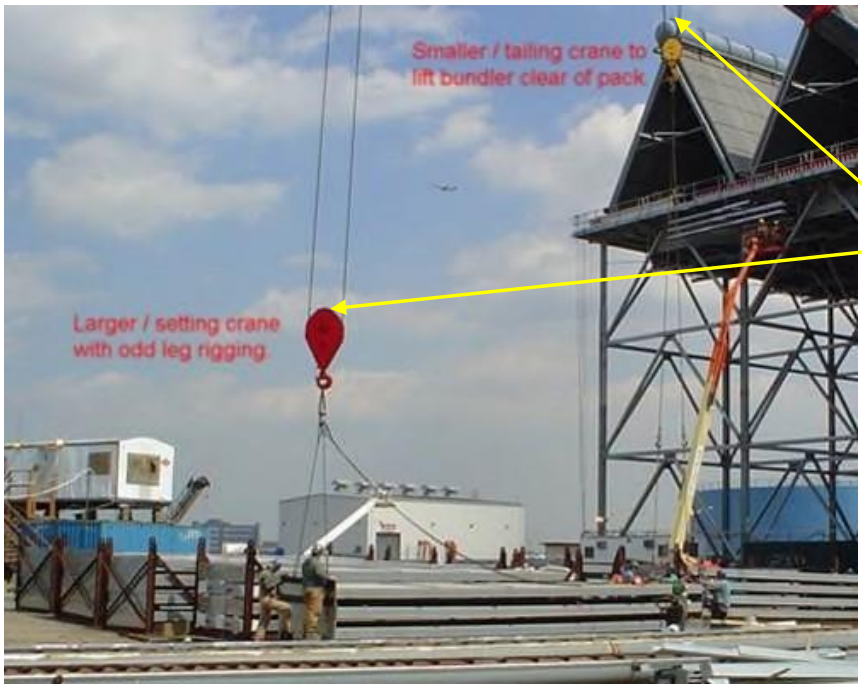
6.5.2 REMOVING BUNDLES FROM PACK AND LIFTING ONTO STRUCTURE

There are various methods of lifting the tube bundles from the packing frames and onto the structure. Twoof them are described in this procedure; site and carnages conditions can influence the choice.

ATTENTION : the bundles are bolted to each other in the rack for transportation. Hence it must be taken care off that the connection bolts between the upper bundle and the one below are removed prior to lifting.Otherwise, the tube sheet and/or tubes are damaged.

- *First recommendation*

Bundles are lifted straight from their shipping frames & be fitted in place. This manoeuvre will require two cranes in a tandem lift. Alternatively, there's the possibility to use a Telescopic forklift (Manitou) which will lift the lower part of the bundle when bringing it under an angle with the largercrane. The larger of the two cranes will have the odd leg slings attached to the hook. These slingswill be attached to the bundle. The smaller of the two cranes (approx. 50 ton capacity should suffice)will always be attached to the outlet tube end (bottom) of the bundle. The bundle will then be liftedout of the pack, keeping it horizontal with the two cranes. Once we are clear of the pack of bundles, the smaller crane will lower the outlet tube down until the larger crane has all of the weight. We then remove the smaller crane and the larger one is free to lift the bundle to its position on the structure.



Bundle horizontal lifting up while taking

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Bundle suspended in a clear area

Taking off progressively the weight of small crane's slings

Weight totally on slings of largest crane and removal

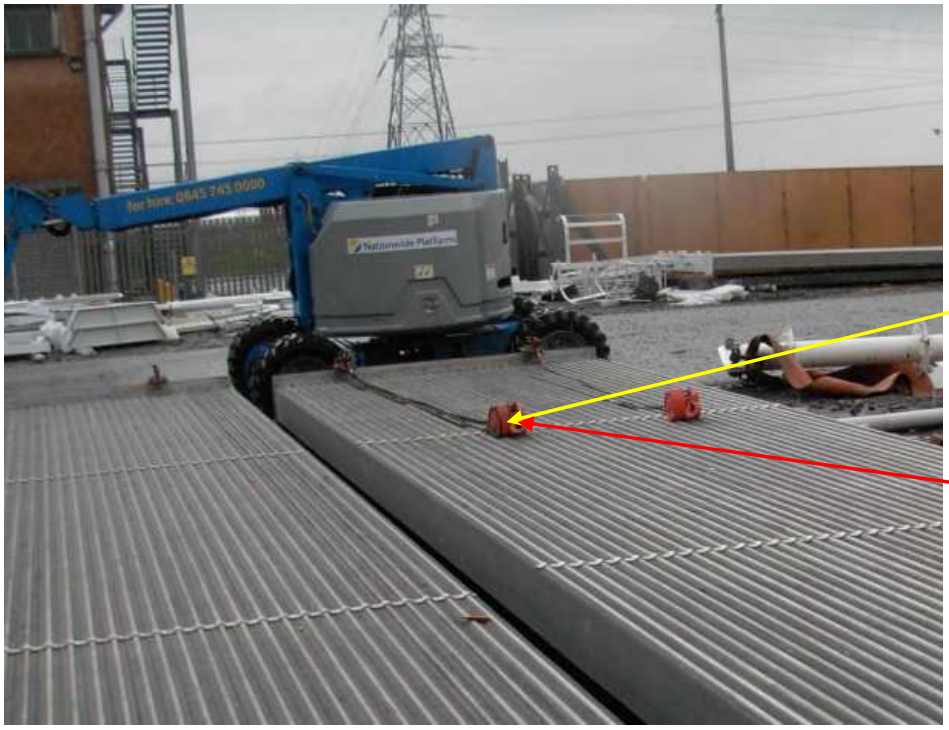
Lifting up bundle onto

Second recommendation

Each bundle can be unloaded horizontally from the shipping frame with a level four point pick andthen placed on wood at grade. The rigging can then be changed to the odd leg slings and the bundle can be lifted and set on the structure. In any case, SPGDC does not recommend that the

bundle be lifted straight from the shipping frame with the odd leg slings with the crane, as the angledload will have an offset centre of gravity and will have a tendency to slide before all of the weight is caught by the crane. This may result in damages to the tubes of to the bundle below it.

Whatever the method used by the EC, odd legged slings will lift the bundle directly in the right inclination asit should be in the final structure (60°). The two longer legs that attach to the lifting eyes nearer the outlettube end (bottom) of the bundle should each have three tons (3T) “chain fall / come-a-long”. This will allow you to make adjustments to the angle of the bundle. The two shorter legs attach directly to the lifting points nearer the inlet end (top) of the tube bundle. Judicious combinations of slings can also be a solution.

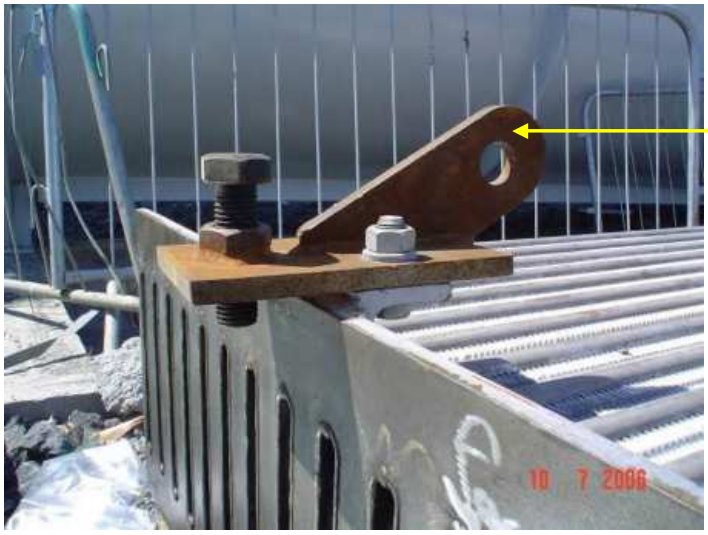


Chain-block for right lifting angle adjustment, what is to be 60°

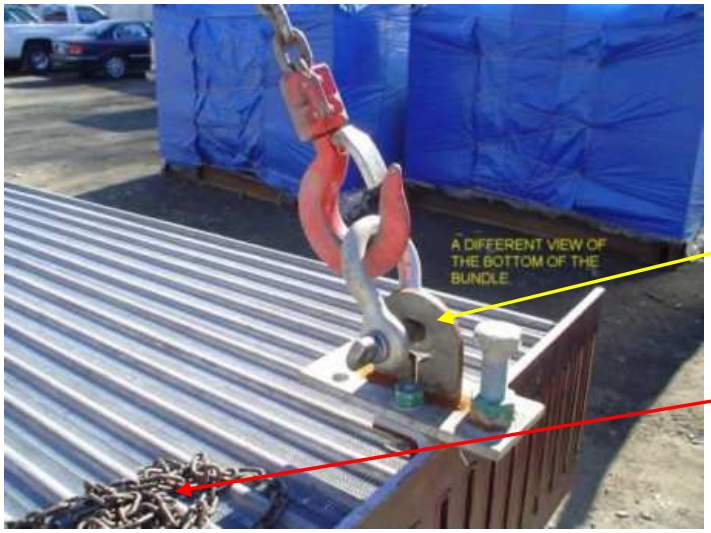
(As per precautionary method in this position a chain

Combination of slings for right angle adjustment.
Left side is a bad example as the upper slings are too short.
Ideally the crane hook shall be 3 – 4m above the bundle, as shown right.

Please see the attached photos for the type of arrangement of the lifting eyes and equipment at the outlet end (bottom) of the tube bundle. Note that the bottom lifting eye has an adjusting bolt that will rest on the side of the CCM. This should be set so that the outlet tube sheet sits squarely on the two plate sections ofthe CCM.



Typical lifting lugof bottom



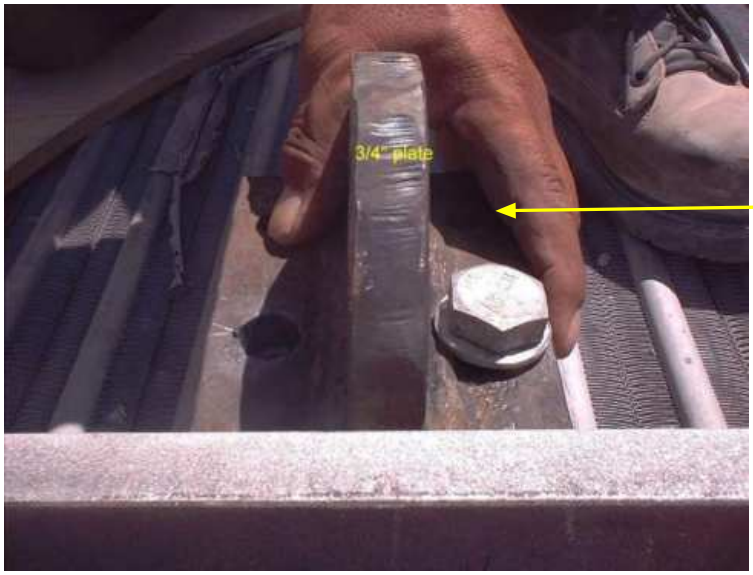
Another typical liftinglug of bottom tube sheet

(As per precautionary method no material will be in contact with the Fin Bundles in order to avoid any damages)

Lifting lug in position againstCCM

Please see the following photos for the type of the lifting lug at the inlet end (top) of the tubebundle (primary or secondary).

Typical lifting lugof top tube

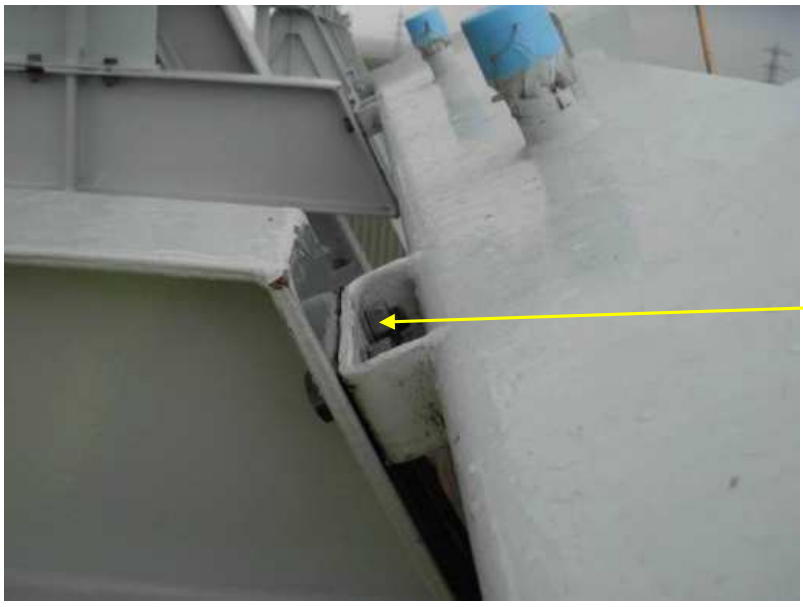


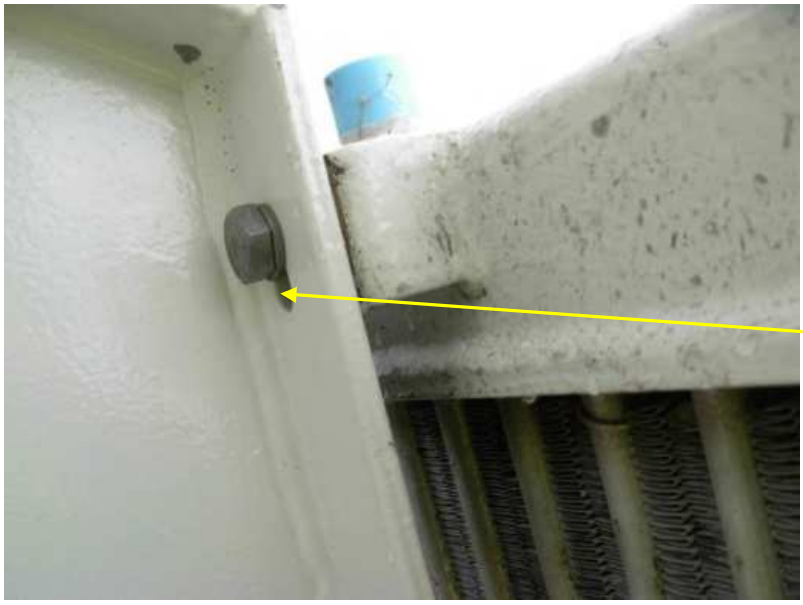
Typical lifting lug of top tube

Secondary Bundles lifting Lug

6.5.3 ERECTION AND SETTING OF SECONDARY TUBE BUNDLES

The erection will start with the secondary bundles next to SDM fixed point. The secondary bundles are fixed with temporary bolts that attach the bundle to the top girder and they also boltto each other. The angle of the bundle should be set so that the top of the bundle lands slightly before the bottom end.





Secondary bundles bolted to each other

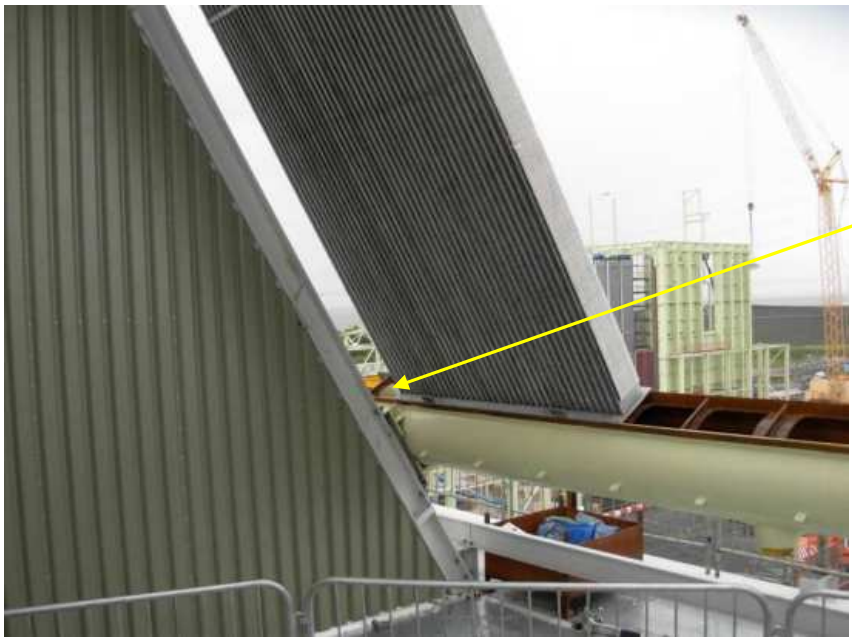
Secondary bundles area

Note that unless the primary bundles are also not installed all and the SDM is not fully installedand aligned on the top between its spools and against top tube sheets of all primary bundles, no tack welds can be done between the bottom tube sheets of secondary bundles and skirt plates ofCCMs.

Lateral jacking bolt

No tack welds to the CCM (not yet)

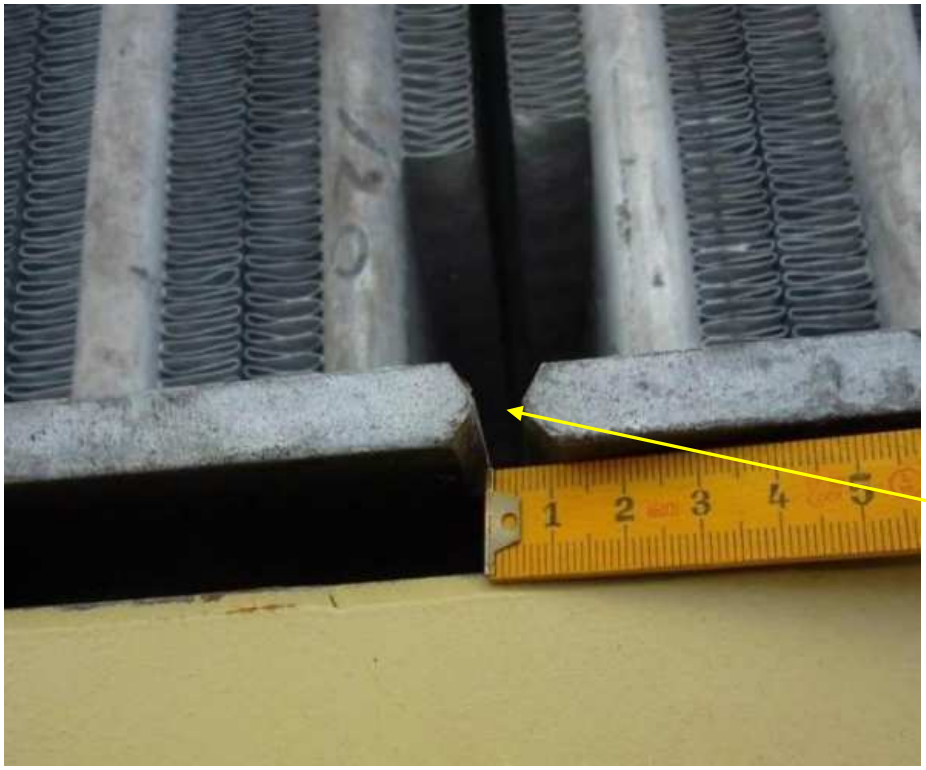
The edge of the first bundles erected must run along the centreline of the leg of the 'A' frame.



Alignment of bundle edge with A-frame's centreline

The tube sheet at the bottom of the bundle should also be set to the correct elevation on the CCM.Please note that a maximum gap of 2mm is permitted at the joint between the CCM and bottomtube sheet. An excessive gap will need too many weld passes to fill and too much heat generated in multiple welding passes will badly distort the tubes.

Unacceptable gap between bottom sheet and CCM's

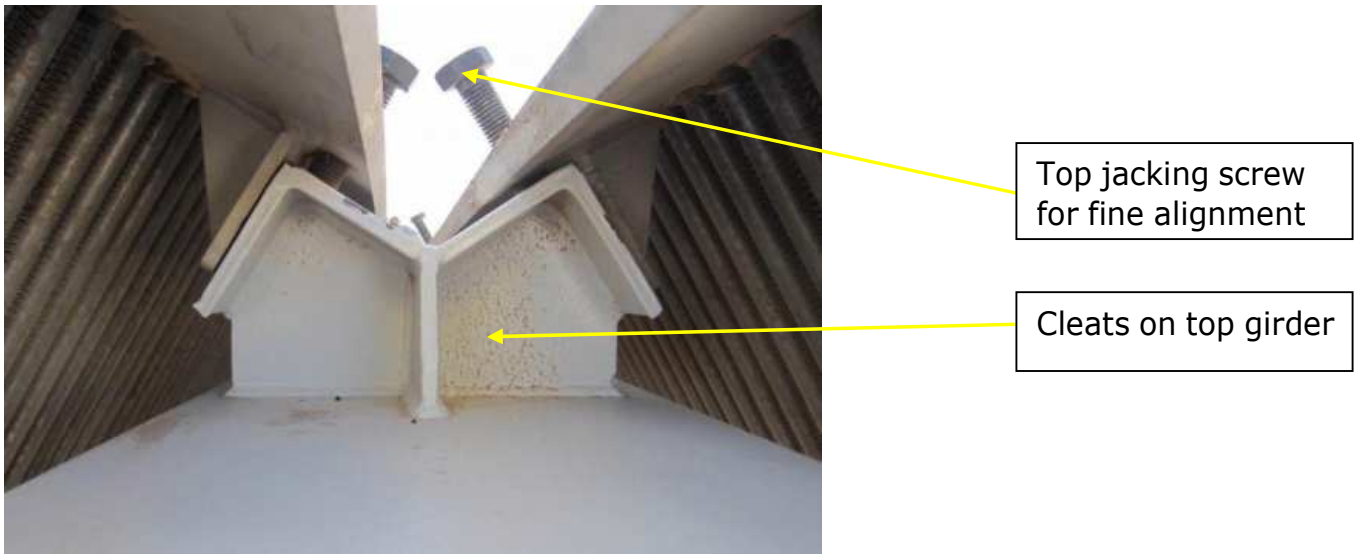


Unacceptablegap between bundles

After this has been achieved, erection can continue with the rest of secondary bundles toward end of a street alternating installation from one side to the other to ensure that the load is distributed evenly on the structure. Each bundle should be aligned and tack welded in position tothe CCM as they are.

6.5.4 ERECTION AND SETTING OF PRIMARY TUBE BUNDLES

Once all secondary bundles have been installed, the erection of the primary bundles can start in either direction. These are installed by "resting" the bundle on the CCM. Primary bundle should also be installed by alternating from one side to the other to ensure that the load is distributedevenly on the structure. The top tube sheet has a 24 mm hole for a jacking bolt that screws into the top tube sheet that can help correct minor misalignments, but theoretically all of the primaryand secondary tube bundle weight should be on the CCM.



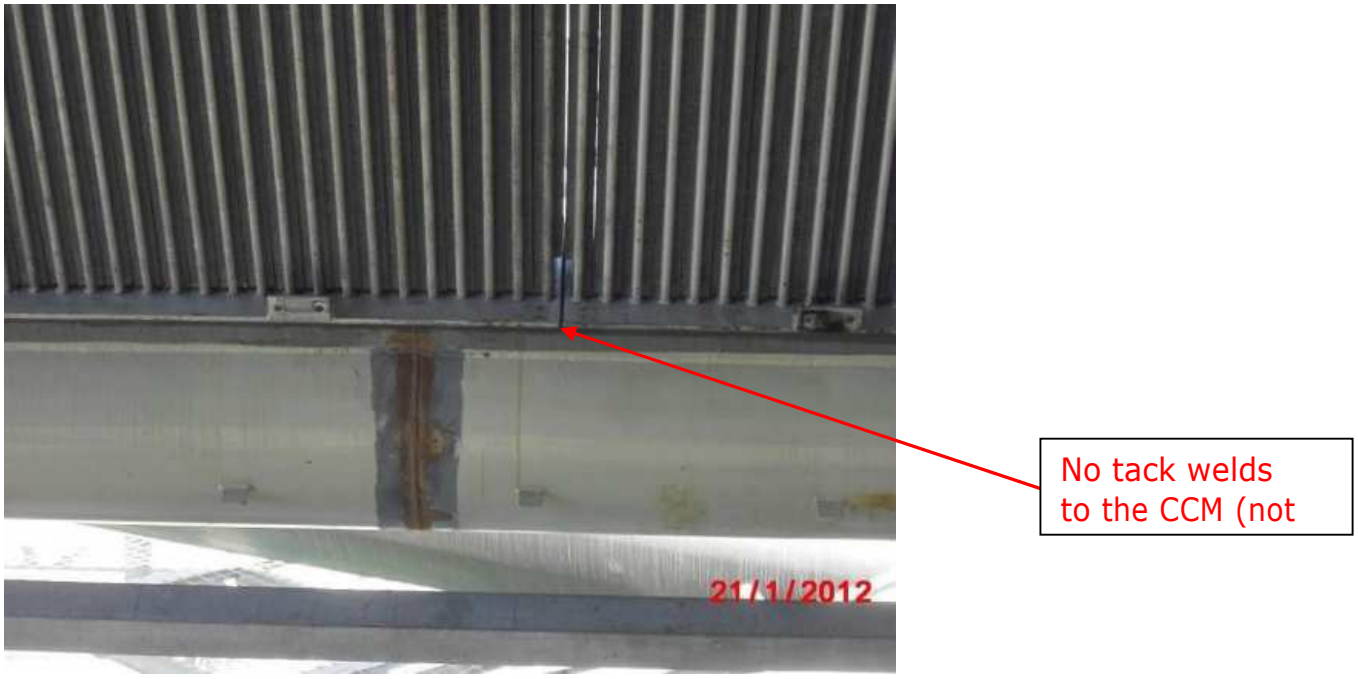
Please note that as the primary bundles are slightly longer than the secondary bundles, therigging will probably have to be changed slightly to obtain again the correct 60° lifting angle.

Care should be taken to align the bottom tube sheet of these bundles to the previously erectedsecondary bundles.

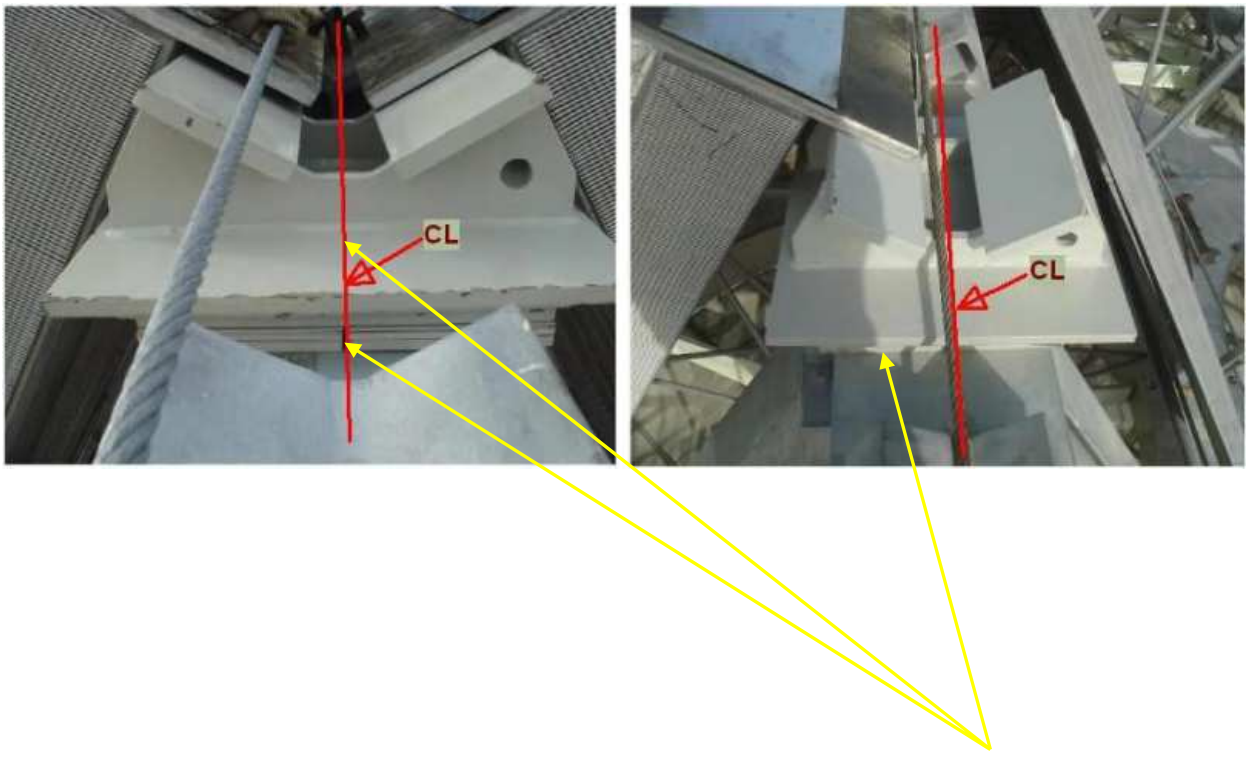
Note that unless the primary bundles are not installed all and the SDM is not fully installed andaligned on the top between its spools and against top tube sheets of all primary bundles, no tackwelds can be done between the top tube sheets of neighbouring primary bundles.

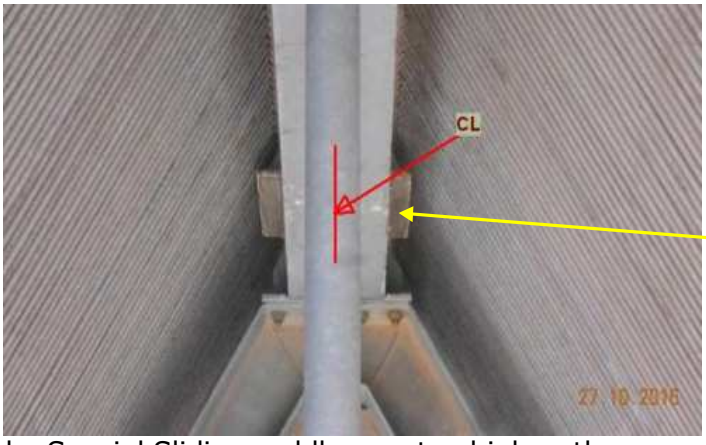
No tack welds at the top tube sheets (not yet)

Note that unless the primary bundles are also not installed all and the SDM is not fully installed and aligned on the top between its spools and against top tube sheets of all primary bundles, notack welds can be done between the bottom tube sheets of primary bundles and skirt plates of CCMs.



In order to keep at minimum the gap between the bottom tube sheets of primary bundles andskirt plates of CCMs utmost care to be taken when the primary bundles are placed over the Special Sliding saddles.





Set the height of allSpecial Sliding saddles correctly and keep them in the centerline of A-frame

If the Special Sliding saddles are too high or they are moved in unwanted offset position (out of
centreline of A-frame girder) when the primary bundles are placed over them, it will result an unwanted arc-formed bottom tube sheet of primary bundle at CCM zones just below the SpecialSliding saddles.

Unwanted arc-formed bottom tube sheet of primary bundle at CCM zones just below the Special Sliding

If gap between CCM and bottom tube sheet remains, SPGDC suggests to use cover strips of plateto close the large gaps by welding at these zones.

Cover strips of plate to close the large gaps by welding at these zones

SPGDC also suggests to use chain-blocks in the fit up of the CCM to the tube sheet. By wrapping achain-block around the CCM and putting the 'bite' in the correct place, the CCM skirts can be pulled against the tube sheet and the tack welds can be made easily. During this operation one horizontal range of bolts (2 bolts) of connection between CCM and A-frame can be slacked off toease slight deformation of CCM against tube sheet. "E" shape shims should be introduced between stainless steel plates to fill the created gap and then bolts can be re-torqued. These shims will be removed when complete welding of CCM and SDM is done.
With these chain-blocks is possible to distribute the force on the bottom tube sheet, when the CCM needs to be deformed to get a smaller welding gap. Do not use too much force, if the CCMdoes not go in the direction what is desirable. Check on the top, if the jacking bolts in the top tubesheet are not holding the bundle in a position, so it cannot move down. This will deform the toptube sheet, and this again creates issues when installing the SDM. Keep all as loose as possible that it have space to move.

Chain-blocks to push up CCM on bottom tube

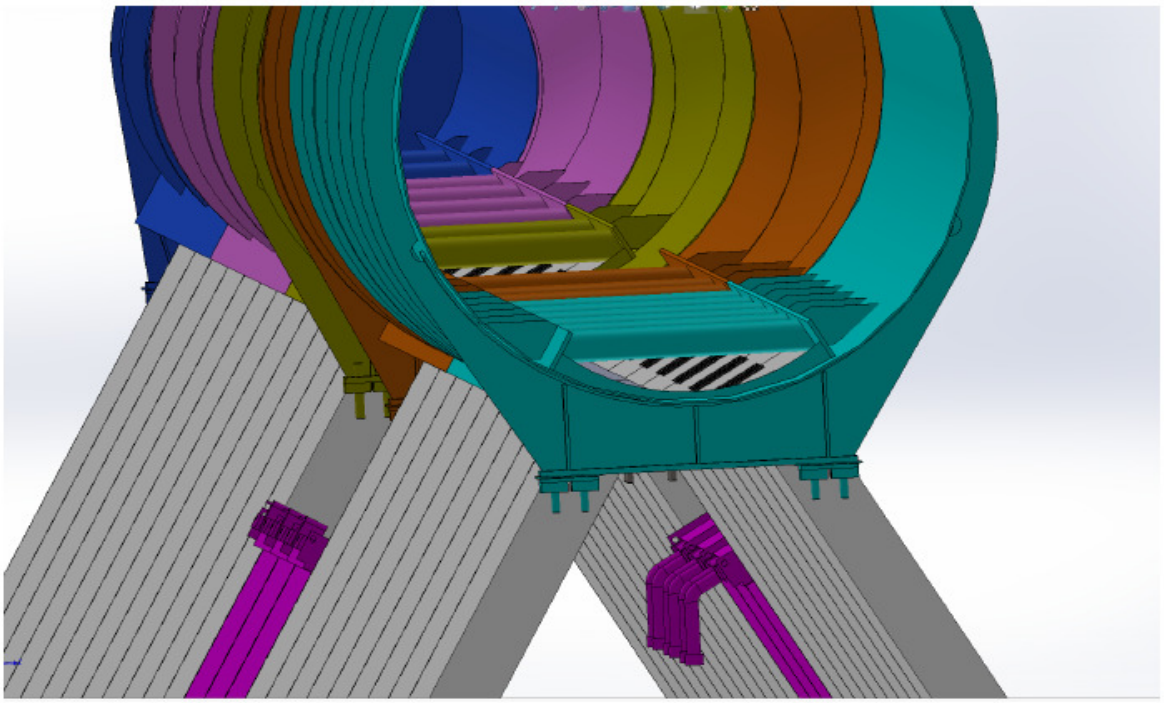
Please note that care should be taken to minimize tube sheet to tube sheet gap on the top and bottom of adjacent tube bundles (0 mm to max. 1.5 mm).

No gap between adjacent tubes

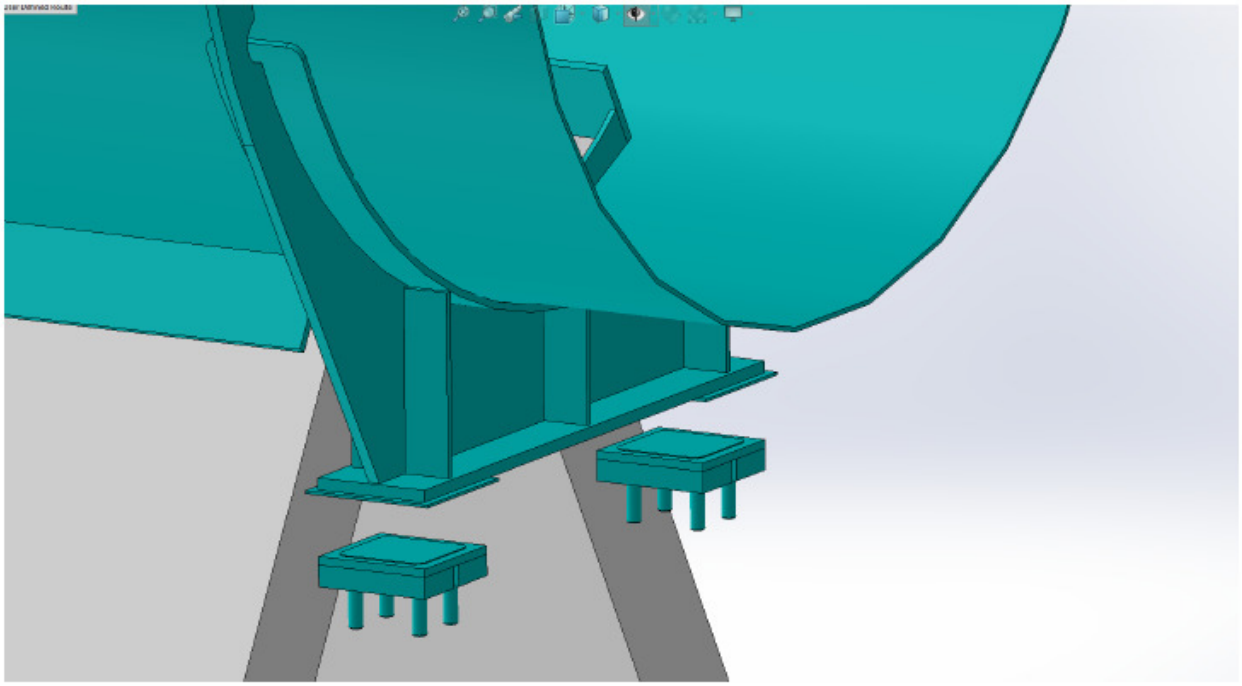
Once all bundles are erected in a street, final adjustments should be made to the bundles after the SDM is fully installed and aligned on the top between its spools and against top tube sheets of all primary bundles to ensure correct and level alignment. Please note that final adjustment of all bundles will take place after the erection of the SDM to help minimize any possible weld gaps. After that, all welding activities can be started at SDM and both SDMs in the same time.

Please make sure that the galv. protective sheet that is tack welded to the top of the primary bundles is left on. This helps prevent dust, debris, welding rod ends, etc from falling into the tubes. These are removed ONLY after the top SDM is completely erected and welded with seal plate and the final mechanical cleaning using broom and vacuum cleaner has been finished.

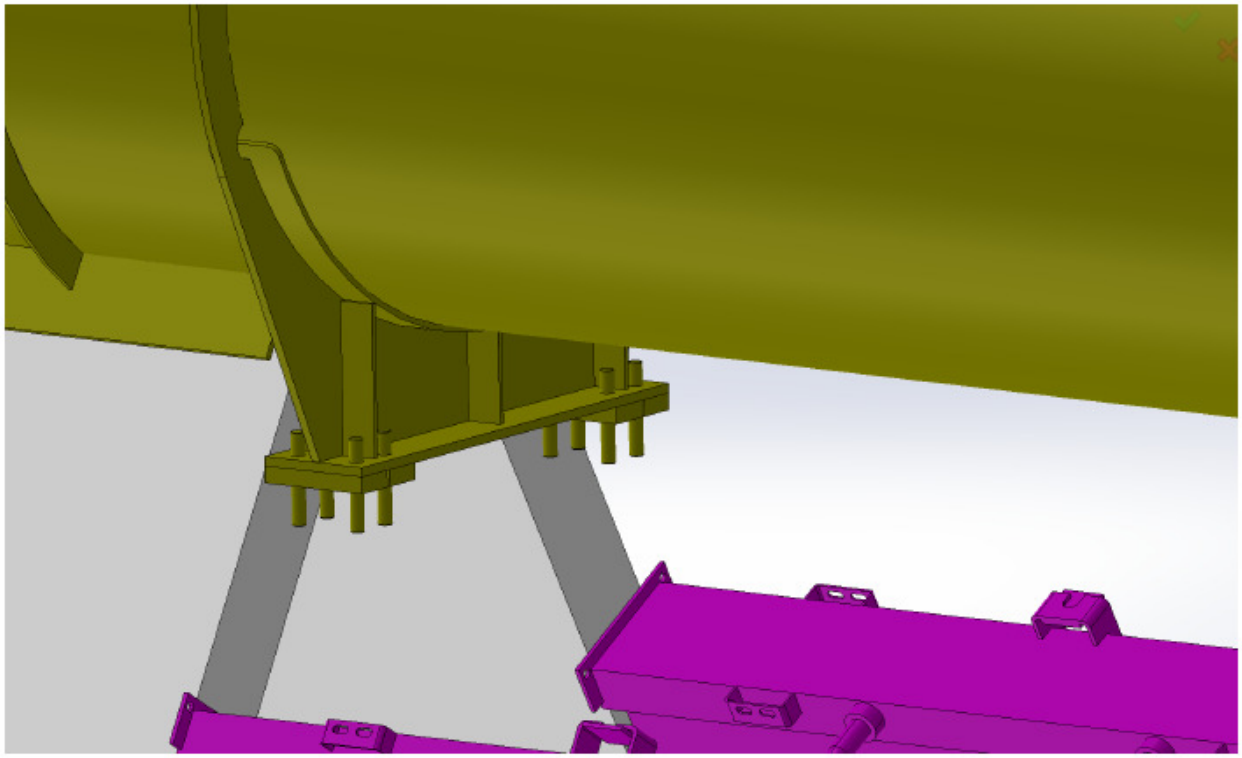
Typical: Steam distribution manifold with primary and secondary tube bundles



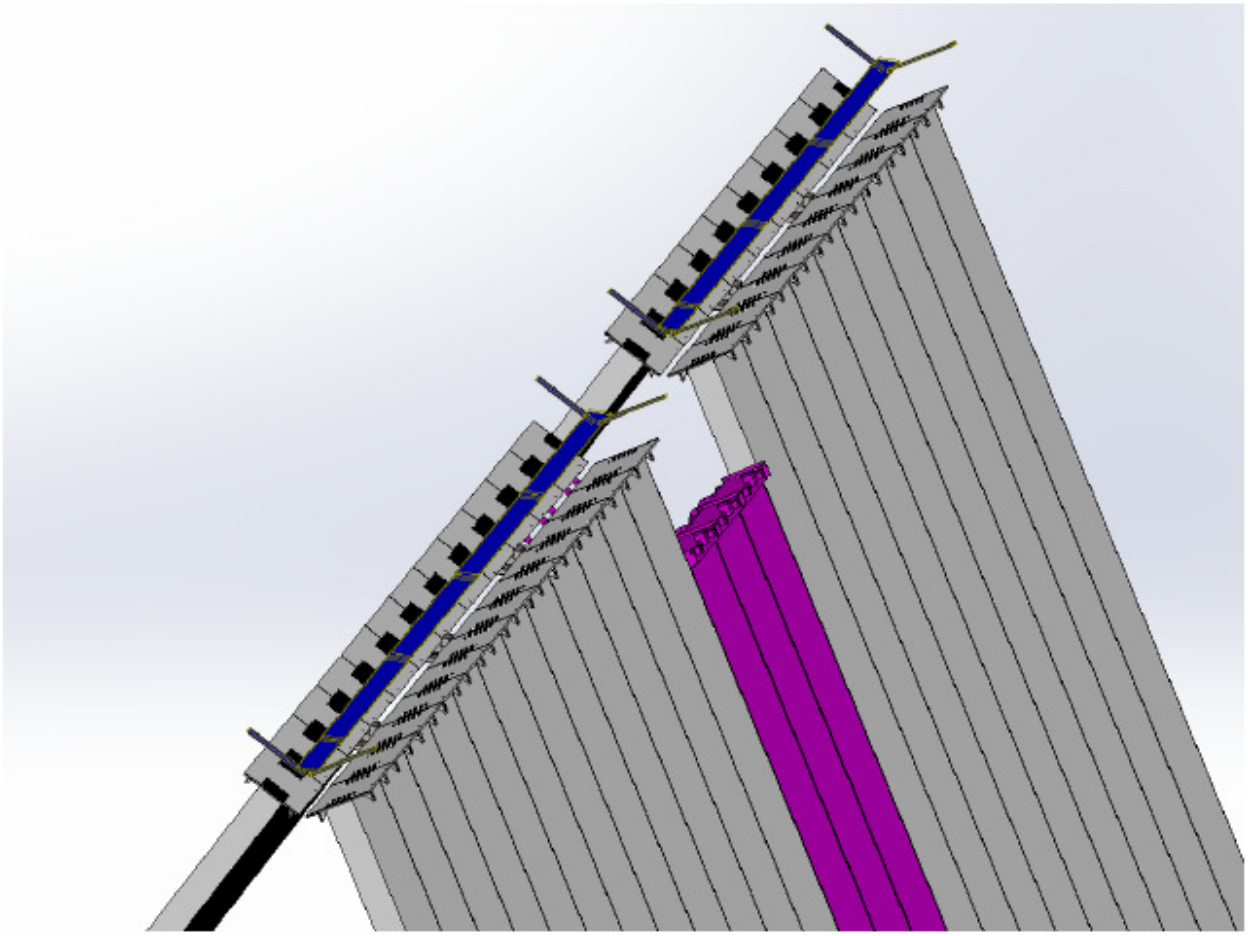
Typical: Steam Distribution Manifold with sliding supports pack at primary & secondary tube bundles



Typical: Steam Distribution Manifold with fixed supports



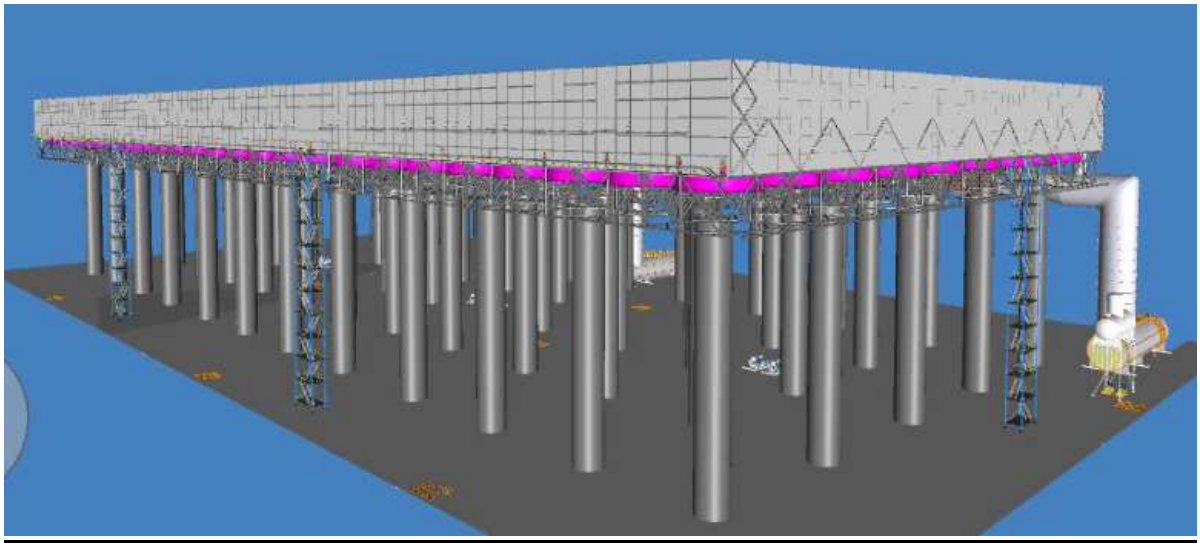
Typical: Primary and secondary tube bundles arrangement



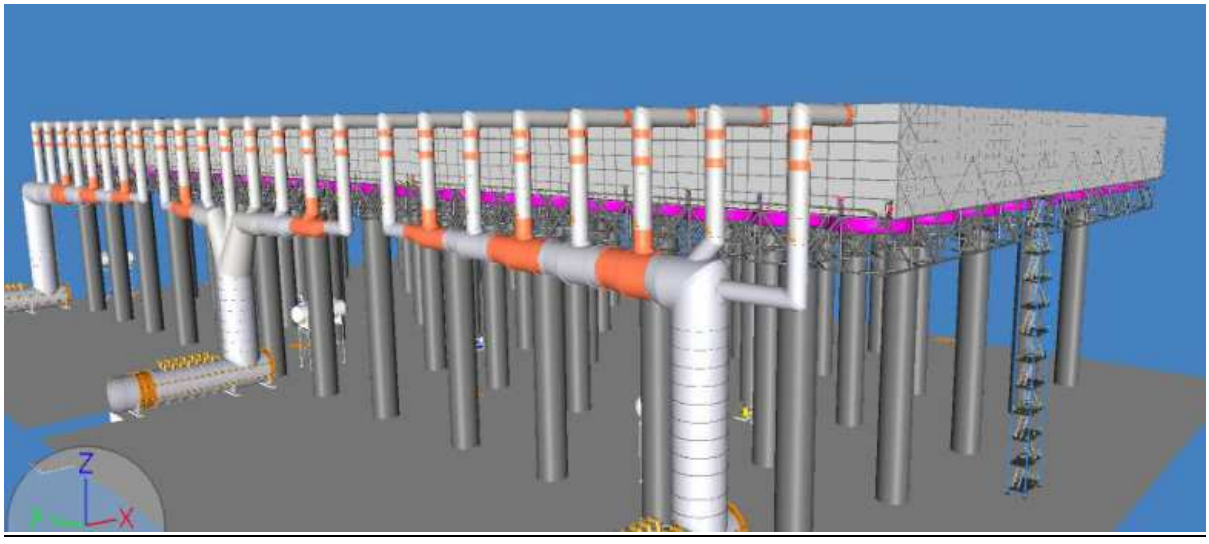
6.6. WIND WALL STRUCTURE and SHEETING ERECTION GRIDS AA-AJ and A1 -C9

- Transversal wind walls are instaelled along the Grids AA -AJ . Wind wall structure is fixed - bolted onto Under Structure -A Frames and SDM with re-inforcing bracing
- Longitudinal wind walls are Installed along the Grids A1-C9. Wind wall structure is fixed -bolted onto Longitudinal walk way supporting structure -under structure and on the top with re-inforcing bracings to SDM
- Between Units on Transversal direction will be structural gap covered with overlapped seal plates due to ACC independed movements -thermal expansions
- External wind wall height TOS is + 66.500

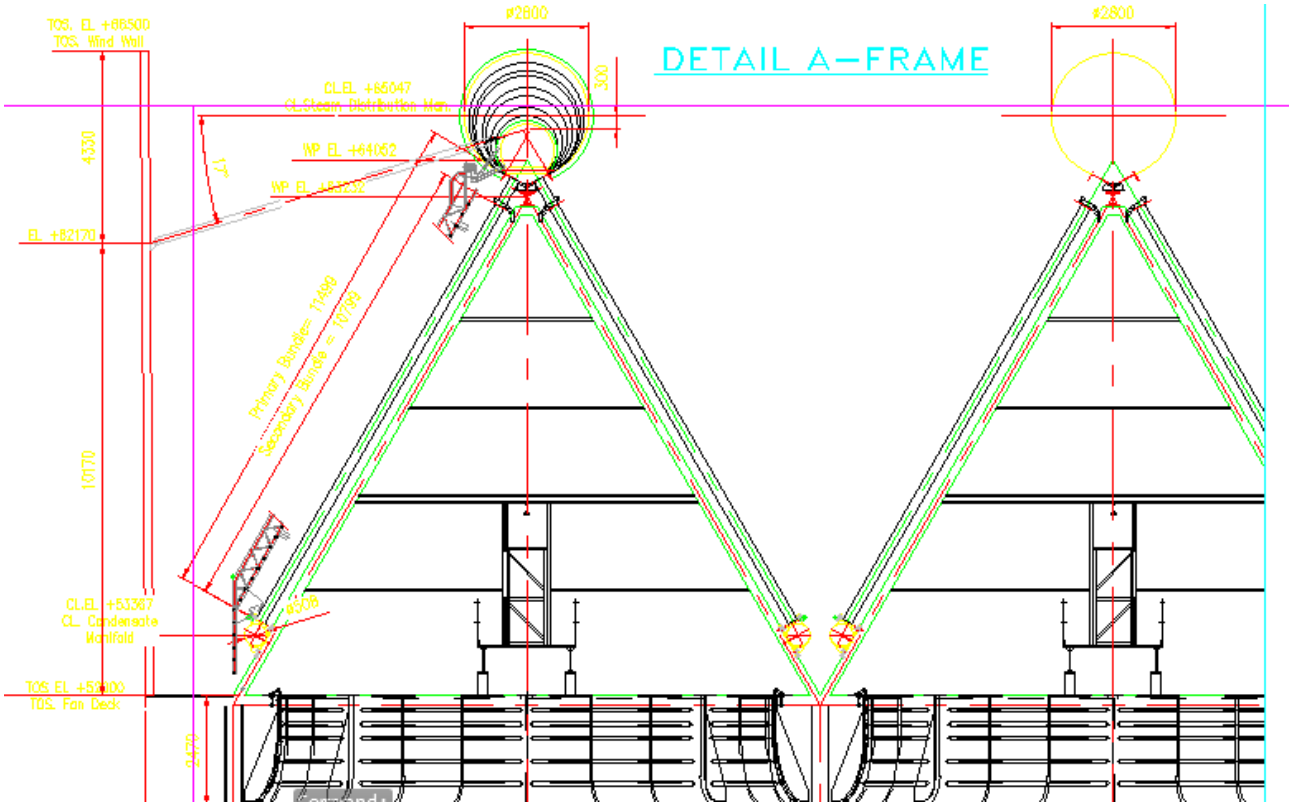
PTT ACC UNIT 1-2-3 Transversal and Longitudinal Wind wall Layout NE AJ-C9



PTT ACC UNIT 1-2-3 Transversal and Longitudinal Wind wall Layout SW AA-A1



PTT ACC TYPICAL TRANSVERSAL SECTION – A Frames and Longitudinal Wind Wall



Recommended Erection Sequences for the wind wall

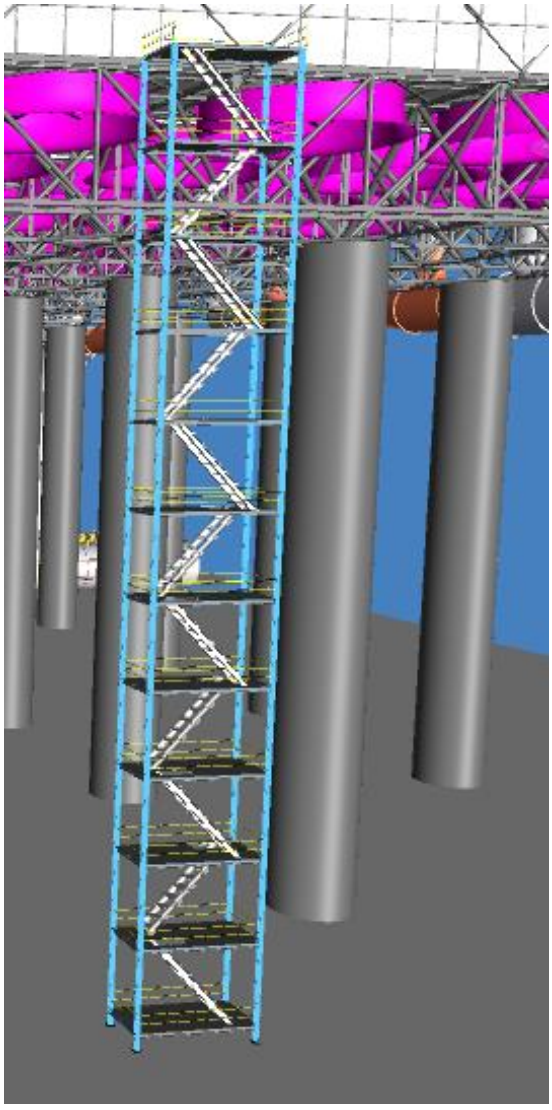
- All supporting structure: Under structure and Transversal -Longitudinal walk ways should be installed. Bolt Torqued
- SDM STREE 1 and 8 must be installed because of Longitudinal wind wall modules securing with bracings between wind wall and SDM
- In case of above and below recommended wind wall modules pre-assembly and installation it is recommended to install wind wall panels on Transversal Grids before STREET MED Risers installation
- Wind wall structure panels-modules with sheeting will be preassembled on ground zero in horizontal position follow the Cell modules on Transversal Y=13.200mm and Longitudinal X=15.620mm direction
- For modules turning from horizontal position to vertical on the Structure columns bottom plate will be installed temporary, Legs ,, to avoid overlapping sheeting damages and easy modules turning
- Once modules is lifted to up-right position temporary legs will be removed
- Sheeting panel between modules will be installed later, after bolted joints completion

- EC will decide wind wall modules pre-assembly and erection details

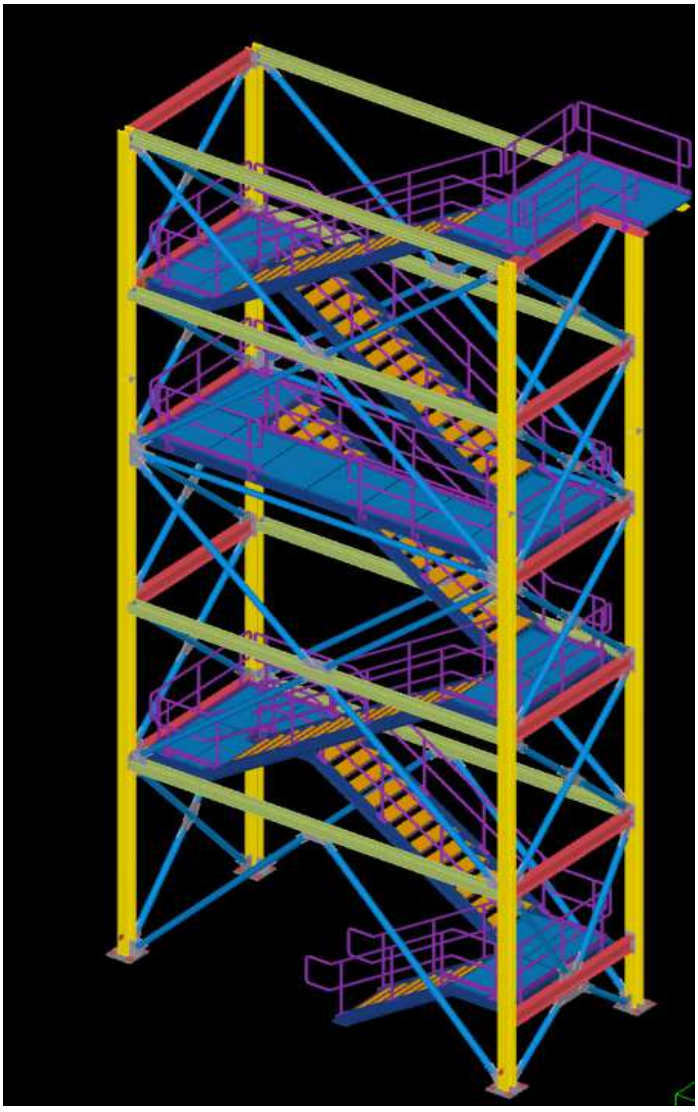
6.7. STAIR CASE TOWER & ELEVATOR / LIFT ERECTION

- Total 4 x Stair Case & 2 x Lifts should be installed at ACC UNIT 1-2-3
- Location: ACC Unit 1 Grid A1 /AD-AE & AJ /A5-A6 .ACC Unit 3 Grid C9 /AD-AE & AJ /C1-C2

PTT Stair Case -Tower



Stair Case – Tower Typical



Recommended Erection Sequences for the Stair Case Tower and Lift /Elevator

- Foundations verification – anchor bolts and shear key slots position
- Stair Case and Elevator Structure pre-assembly in four sections on Ground zero. Handrails and Gratings will be installed. Bolts torqued
- Lift – Install bottom section. Align bottom section with shims and fix base plates with anchor bolts

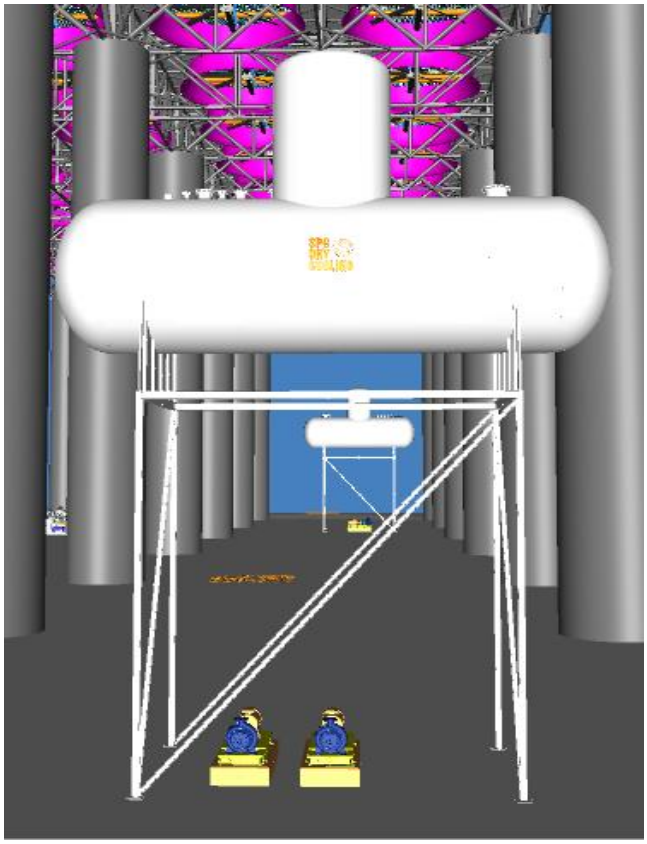
- Continues upper section with installation and top section fixation onto under structure. Continues with corrosion protection touch-up
- Release bottom section base plates for grouting
- Continues with Lift-Elevator mechanical installation

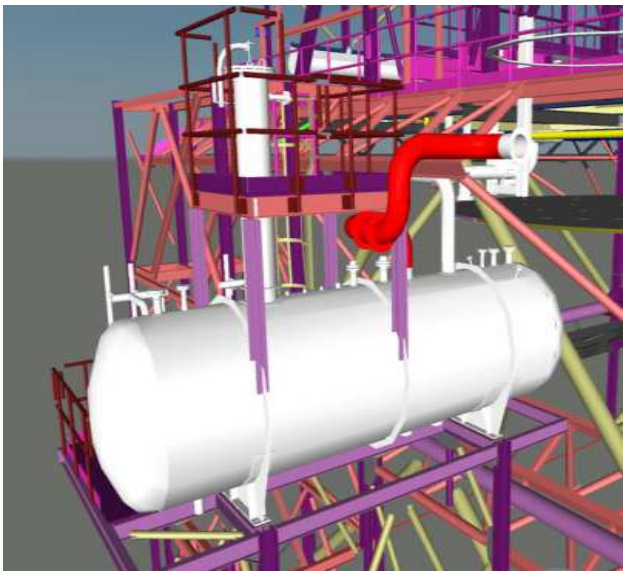
Stair Case and Lift-Elevator Structure Installation details

6.8. ACC CT CONDENSATE TANK V=261m3 and STRUCTURE ERECTION

- Prior ACC CT Structure installation concrete foundations must be checked and documented
- ACC CT /Condensate Tank V=261m3 with make-up dome will installed on Steel Structure. CL of Installed Tank is + 17.115
- ACC CT Structure with Stair Case will be installed, bolts torqued and Column Base plates grouted
- Pay attention for the ACC CT orientation – Fixed and Sliding points position
- Double check ACCCT Nozzles position for ACC Equipment and Piping as TP for the third party
- All related Equipment and piping will be installed after ACCCT Installation completion and survey protocol acceptance

PTT ACCCT V=261m3



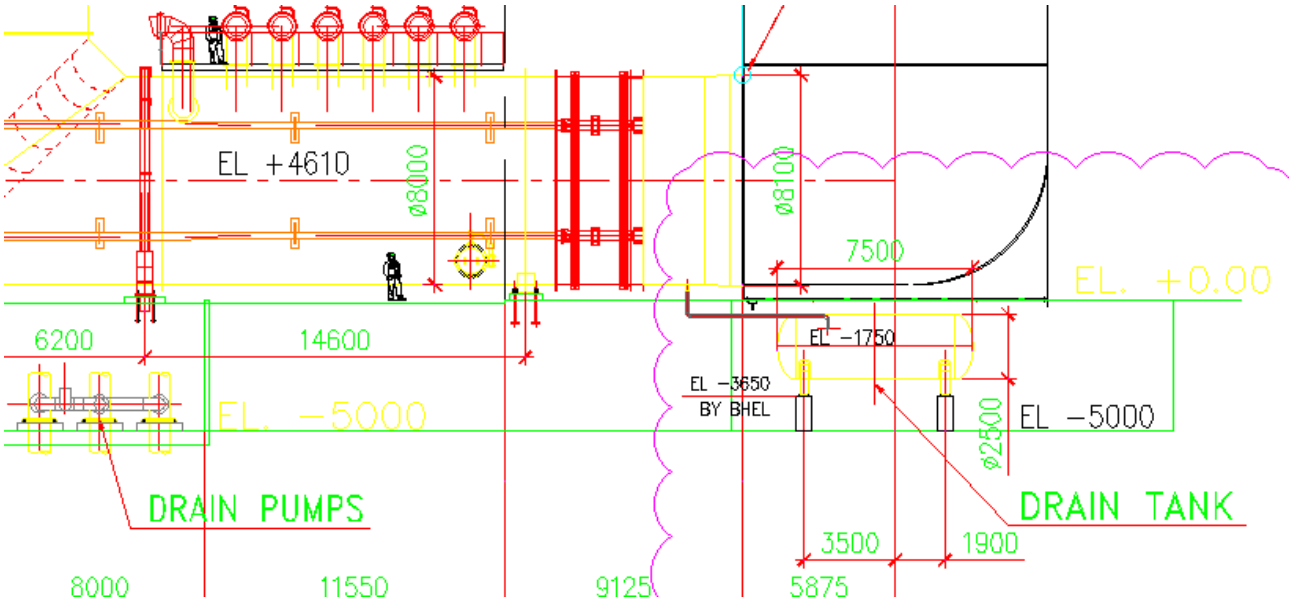


Installed ACC CT with related piping

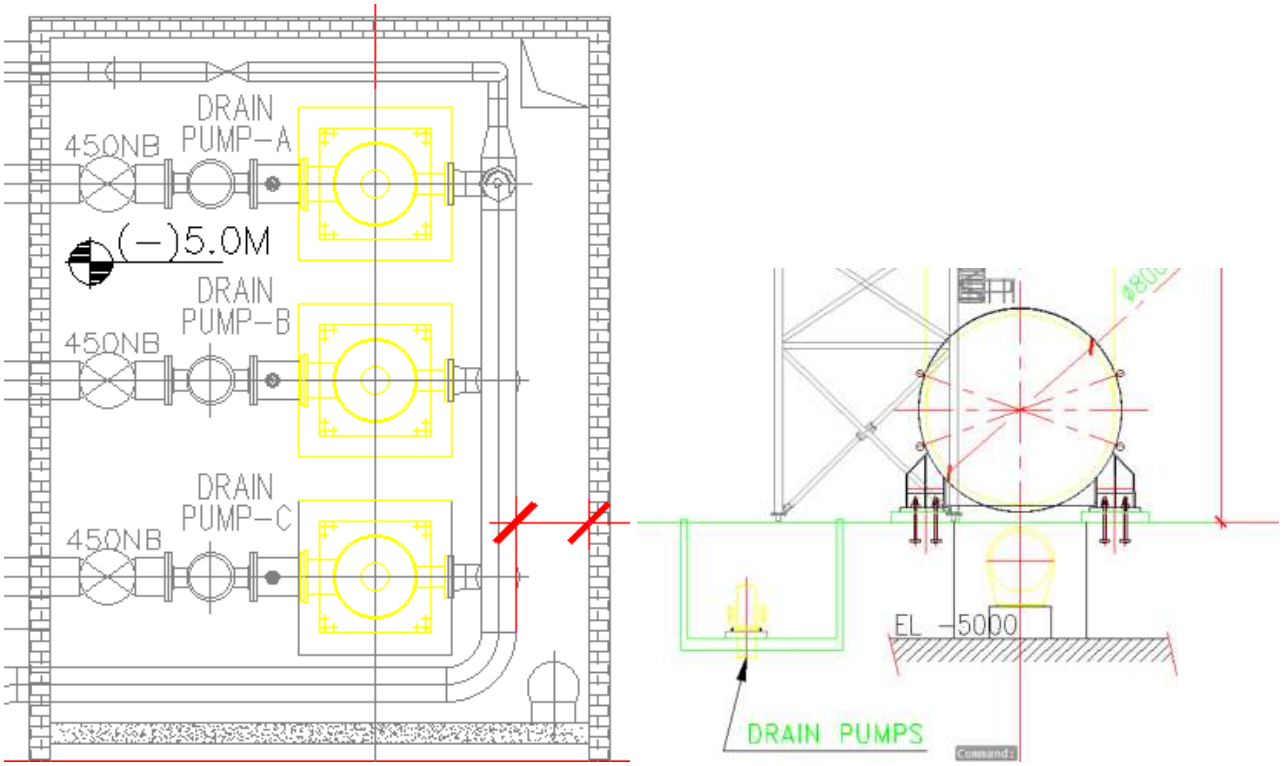
6.9. HOTWELL - DRAIN TANK V=34m3 - CONDENSATE DRAIN PUMPS 3 x 100% & RELATED EQUIPMENT ERECTION

- Hotwell Drain Tank V=34m3 location is inside of TH on – 5.000 Level. CL of Installed and aligned Tank is – 1.750
- Three Condensate Drain Recovery pumps 3 x100 % WKTB are located on LCM Pit Level -5.000 .
- Concrete Foundation survey will be done and documented for the Tank and all three CDR Pump. Pay attention for the all three pumps foundation as pit position. X-Y-Z distances are important because of Suction and discharge piping installation
- Once all three pumps will be installed and aligned by EC pump supplier should be invited to do shaft and flexible metaflex couplings final alignment because of pumps warranty
- Do not overstress flanged joints between pumps and related LCM Piping
- All small bore piping as : Gland seal water ,vent lines ,drain lines will be installed according Isometrics
- NOTE : Hotwell Tank should be installed before other Items over the tank installation

PTT Cross section – Hotwell Drain Tank and Condensate Drain Recovery Pumps 3 x 100%



Contract Name : **PATRATU**
Contract Number : **WB1-101-000568**
Document Title : **Erection Manual Guide**

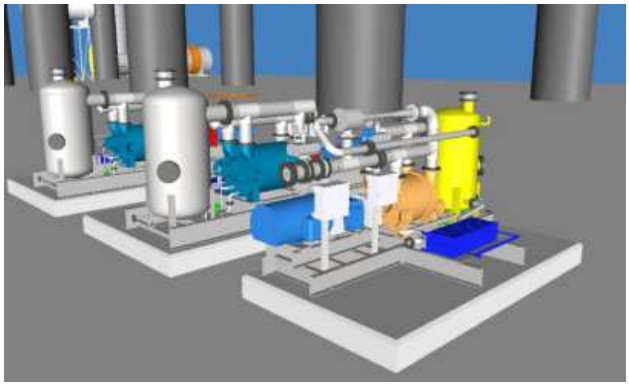


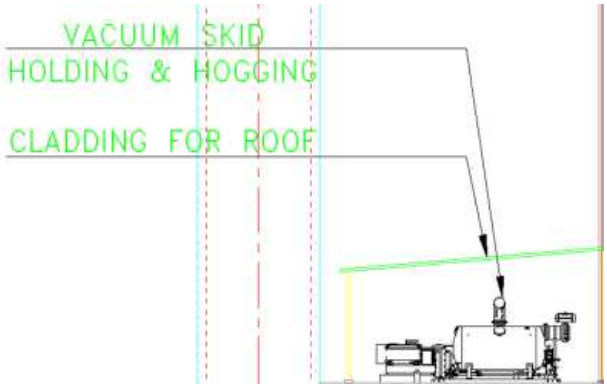
INSTALLED CONDENSATE PUMPS 3x100 % & HOTWELL DRAIN TANK UNDER MED

6.10. VACUUM SKID -HOLDING & HOGGING ERECTION

- Holding and Hogging Vacuum Skids are installed under the ACC on Ground zero
- Holding and Hogging Vacuum Skids will be installed on Concrete foundations prepared by others. Good alignment and X-Y-Z positioning is required
- Related MAJ Piping will be installed according to Isometrics as P&ID

PTT Vacuum Skid Details





Installed similar Vacuum skid for reference


2010/12/16

6.11. CLEANING SYSTEM EQUIPMENT & PIPING - SDA ERECTION

Cleaning System will be assembled from the Items listed below

- Cleaning system piping from the TP – Potable water supply to the High-Pressure Pump quick coupling connection. Depended of system: HPP can be located on Ground zero or Movable HPP on Transversal walk way
- High Pressure Pump with Flexible hoses and quick couplings
- Total 16 Movable cleaning ladders per Unit. 2 External and 14 Internal ladders
- Electrical & control Equipment /JB, Cables etc.
- Movable Cleaning Ladders Bottom and Top Rails Installed on the bottom -Cleaning Ladder walk way and Top on the SDM

See Photos below for illustration

Movable cleaning ladders

cleaning ladder walk way -central

External movable cleaning ladder

HPP on Transversal walk way

HPP & Cleaning Ladder Electrical – Control Equipment

Cleaning ladder brakes

Nozzle beam drive

6.12. INTERCONNECTING -SMALL BORE PIPING, VALVES & PIPE SUPPORTS ERECTION

- All Interconnecting – Small Bore piping will be installed according to Isometrics and P&ID
- Related Valves and PS Pipe Supports will be installed according to Isometrics and P & ID
- LCA Condensate Piping. These piping are condensate evacuation lines. Drains from CCM to ACCCT . Drains from CCM are running from CCM Nozzles via LCA Headers and Cascaded down pipe to ACC CT
- MAJ Air Take Off /Vacuum piping running from the Secondary Tube bundles toward Vacuum skids installed on Ground zero. MAJ Vent line from ACCCT & Hotwel Drain Tank
- LCM Condensate Drain Pumps - Recovery piping. These piping will be installed on Condensate Drain Pit : Between Condensate Drain Recovery Pumps – Hotwell Drain Tank and ACCCT . Here are three main lines: Suction lines between Pumps and Hotwell Tank and Discharge Line between Pumps and ACCCT
- LCM Small bore piping: Gland Seal water, Vent Lines, Drain Lines ,Recirculation lines etc. will be installed according Isometrics & Site runs. Red Line and AS Built Isometrics will cover Site Runs small bore piping
- LCM System will be Hydro Tested after installation completion
- SDA Cleaning System piping will be installed according to Isometrics – P&ID

LCA Lines under FDL with Cascaded Downpipe DN1000 to ACCCT

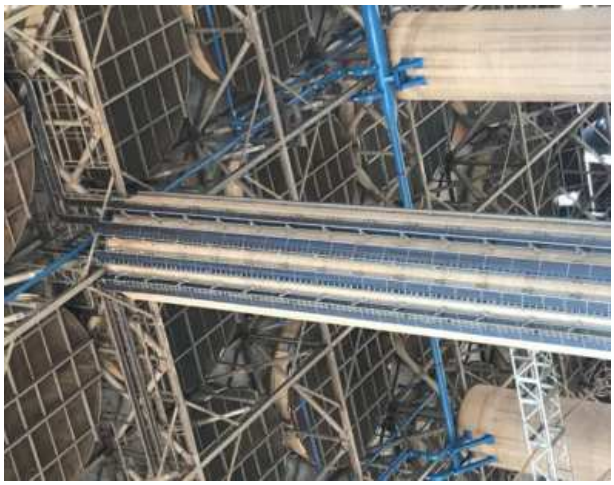
LCA Cascaded down pipe ,,Blue,, and Equalizing Line ,,Green ,, MED -ACCCT

LCM Discharge Line Hotwell – ACC CT

MAJ Vacuum Lines

6.13. E & I ELECTRIC & INSTRUMENTATION ERECTION EC SCOPE of WORK TBA

- Main Cable Trays -Racks & Conduits from the MCC to ACC Motors and Transmitters for the Power and Signal Cables
- JB's Installation on ACC & Condensate Drain Pit
- Signal and Power Cables installation Between MCC and Motors – Instruments – JB
- Instrumentation TP Installation



6.14. MAINTENANCE HOIST – LONGITUDINAL and TRANSVERSAL ERECTION

Maintenance hoist Longitudinal beams will be installed together with A Frames. After installation must be good aligned according to tolerances. All bolts torqued
Maintenance Transversal Hoist will be installed – brackets fixed onto Transversal wind wall columns
Electrical or Manual Hoist will be installed after beam-rails alignment
Load test is required for all Lifting Hoist

7. ACCEPTANCE OF FOUNDATIONS

- EC shall, prior to start of work on the job site inspect and certify acceptance of the foundations constructed by others. This acceptance is limited to foundation elevation, orientation, location and position of anchoring bolts or pockets that are to be checked and found compliant within the construction tolerances as indicated on EPC drawings. An acceptance report shall be issued accordingly part of QA/QC documentation including the EC's own measuring report.

- EC shall not place equipment bases on foundation pads and floors before the top surface of the foundation pad or floor area, where base is to be mounted, has been properly chipped off, roughened and cleaned for grouting by the civil company.

- It is the responsibility of the EC to check if the interfaces provided by the Civil Works are acceptable as per the EPC contractual specifications and the concerned SPGDC drawings. Positions of the anchors will be carefully checked by the EC and the measures collected on a report to be transmitted to SPGDC.

- EC is required to take over these interfaces prior to start erections works.

8. ACCEPTANCE OF ERECTION, STORAGE AND PRE-ASSEMBLY AREAS

- Following site establishment and prior to the first delivery of materials, EC shall ensure that they have thoroughly surveyed, inspected and accepted allotted storage, pre-assembly and erection areas for compliance with these conditions stipulated within the Contract.

- EC shall immediately inform EPC, in writing, of any deficiency discovered, giving full details of such. Should no deficiency be found, and then EC shall accept the erection and storage areas, in writing.

- If laydown and pre-assembly areas are provided with an insufficient ground bearing capacity for proper and safe activities, EC shall notify EPC prior to site activities.

- If drainage is required for proper and safe activities, EC shall notify EPC prior to site activities.

9. GOODS RECEIVED INSPECTION

- All structural steelwork is delivered to the site with piece mark numbers, corresponding with the mark numbers indicated on the erection drawings.

- EC shall receive, off load, inspect and store all material and equipment on site in accordance with written procedures and using all means of elevations and transportation for that purpose. EC will remove/unload all materials from containers, trucks, flatbeds, etc, and will proceed after with all the material segregation in order to start with the erection

- Identification of components as received against the bills of quantity. Material identification in accordance with tag numbers as per P&I diagrams or erection drawings. All free issue materials will be inspected on receipt by the EC in conjunction with SPGDC and/or EPC representative for any apparent damage.

- Preparation of material receipt reports of overage, shortage and damage (OSD reports) immediately after arrival of the materials at the job site.

- Inspection against drawing, equipment lists or another technical document.
- Remove all temporary tack welds, spiders and shipping bracings used for safety and shipping of duct segments.
- Move, store and correctly handle steel packages once removed from shipping containers with the use of EC supplied lifting equipment, such as cranes, forklifts, shackles, cables and slings, spreader beam, etc.
- Remove and dispose of all shipping materials, shipping frames and the loading rails from containers.
- Quarantine of damaged and any non-conform materials.
- Storage of material and equipment safely and with due regard for damage and contamination in storage. In particular, EC shall ensure that sufficient and suitable timbers are on site, prior to the first delivery of steelwork, to enable such to be stored off the ground.
- Organization of storage and shake out of materials that corresponds to the sequence of erection and minimizes the need for double handling. This shall include storage of steelwork for each street segregated by use of piece mark numbers.
- Storage will be organised with a numbering system allowing a quick equipment research when required to be erected.
- Hook up space heaters on all motors as required during storage and also after erection to their final position on the ACC.
- Off-loading, handling, transport and storage shall be done as per SPGDC and EPC's instructions of all materials either for intermediate storage on site or immediate lifting in position. Special attention should be taken with the instrument, rupture disks and other fragile equipment such as motorised valves etc.
- EC shall issue material reception reports and will be responsible for checking the status of material delivery. In case damaged items are accepted, the EC will have to install these equipment's by making the necessary adjustments/repairs.
- Special attention will be taken to painted sheets and structure to avoid damage. Painted sheets will be stored vertically whenever possible. The quality of the painted steel structure is of prime importance and must be kept intact.
- Special attention is to be paid against wind action on flat pieces such as sheeting, plates, even tube bundles; they must be fastened by safe fixing systems.
- Supply of special covered storage facilities for equipment requiring special protection from the weather such as instrumentation, welding material, small valves, etc.
- Welding materials will be stored on site as per storage specifications given by the supplier.
- Piping will be stored outside area on plain timbers, suitable wedges shall be used to prevent rolling.
- Pipes shall be stored on flat well drained ground wherever possible.
- All piping openings shall be protected by caps or closed off to prevent ingress of rain and other foreign materials.

10. DEFECT NOTIFICATION, DOUBTS AND DEVIATION

- All defects shall be notified to the BUYER/SPGDC by **Non-Conformance Report (NCR).** Technical solutions shall be agreed with the EPC/SPGDC prior to implementation. If required by EPC an estimation of man-hours or cost shall be notified on NCR prior to site modification; effective man-hours or cost shall be agreed by the end of the modification.

- EC shall submit a **Concession Request** to the EPC/SPGDC should they wish to deviate from any requirement with this requisition, drawings or erection manual guide.

- Any technical query, question or doubts originating on site should be submitted to the EPC's and SPGDC site office on the pro-forma provided as a **Technical Query.**

11. ERECTION METHOD STATEMENT AND RISK ASSESSMENT (RAMS)

- Erection method statements shall constitute the exact methodology of working adopted by the EC and must be carried out in a Health and Safety way on site. This method of statements must be available in a file on site at any time.

- Erection method statements shall be in compliance with site and country regulation.

- Erection method statements will be considered as controlled document and subject to the same approval mechanism for the original issue for any amendment.

- EC shall produce method statements before starting of work. Additional method statements may be required prior to the erection phase and shall not give rise to a claim for additional expense from the EC.

- Erection method statements shall be in accordance with standards of good working practice, personnel welfare, health and safety and environmental concerns, goods received and storage of materials and equipment.

- Erection method statements shall be in adherence to erection schedule.

- Such detailed method statements shall each include at least:

  - Risk assessment.
  - Health, safety and environmental requirements (HSE)
  - A lifting plan study
  - A quality control study
  - Additional stresses induced on structure and equipment.
  - Tools and lifting device documentation
  - Power consumption list

- SPGDC proposes the following non-exhaustive list of method statement / risk assessment if applicable:

  - Site establishment

- Acceptance of foundations working and storage areas
- Goods inwards inspection off loading, storage and preservation
- Erection of under structure steelwork
- Erection of stairs, walkways and platforms
- Assembling, lifting and alignment of fan bells and fan screens
- Fan blade assembling
- Installation of motor and gearbox hoist
- Preassembling and installation of motor/gearbox bridges
- Erection of a-frames
- Erection of wind wall
- Installation of tube bundles
- Preassembly and lifting of SDM
- Preassembly and lifting of CCM
- Welding of tube bundles, steam distribution manifolds and condensate collecting manifolds
- Lifting and installation of cleaning moveable ladders
- Erection of wind wall sheeting, air seals and flashing
- Preassembly installation and welding of exhaust duct
- Preassembly installation and welding of exhaust duct risers
- Installation of air take off pipe work with supports and accessories
- Installation of condensate pipe work with supports and accessories
- Installation and alignment of duct drain pumps and flash tank
- Installation of balancing line with supports
- Installation of condensate drain collector work
- Installation of air vacuum pumps
- Installation of condensate tank and de-aerators domes
- Installation of electrical
- Installation of instrumentation
- Installation of insulation
- Touch-up and final painting with scaffoldings
- Cold commissioning activities
- Commissioning and testing activities
- Site demobilization

12. PLANNING

- Respect to the planning shall be in accordance with BUYER's decision and SPGDC supervision advices

13. ACCEPTANCE OF SITE AND COUNTRY REGULATIONS

- Respect to the rules shall be in accordance with EPC and site regulations,

14. SAFETY, HEALTH AND SECURITY

- Respect to the rules shall be in accordance with EPC and site regulations and SPGDC supervision advices

15. QUALITY AND TESTING

- In accordance to EC quality control plan revised by EPC and SPGDC supervision advises.

16. FIELD WELDING

- EC shall furnish all welding equipment and all welding rods required.
- Weld controls could be done on duct, manifolds and piping and structure
- All non-destructive examination NDE and testing shall be as per EC quality inspection plan.
- EC shall be responsible for the welding performed and shall establish a detailed welding procedure to be submitted to SPGDC and EPC for approval, prior any site welding work.
- Welders shall be qualified in accordance with Section IX of ASME Boiler and pressure vessel code or EN equivalent.
- The appointed Quality/welding Engineer shall be of a suitable calibre to be fully conversant with all pertinent welding technology including knowledge of acceptance criteria to the relevant codes and practices.
- The Quality/Welding Engineer shall be responsible for compiling, checking and submitting the following welding documentation to the SPGDC and EPC, prior to commencement of welding on site;
  - WPS's and register of such
  - PQR's and register of such
  - Welder qualifications and register of such
  - Methodology of NDT and NDT operator qualifications
  - Weld maps indexed to WPS's and PQR's
- SELLER shall ensure that the following welding documentation is submitted to the SPGDC and EPC for approval and included in the Site Erection Dossier;
  - Inspection records for visual approval of welds
  - Marked-up weld maps tracing welder to each weld

- NDT results

➢ The Quality/welding Engineer shall inspect on-going welding to ensure compliance to the WPS and any other relevant requirements, such as EPC guidelines.

17. Recommended Bolt Tightening Torque Table

BOLT DIAMETER	APPLICABLE VALUES FOR EUROCODE, AISC LRFD and AISC ASD											
	BOLT CLASS 8,8 / A325			**BOLT CLASS 10,9 / A490**			**BOLT CLASS 8,8 / A325**			**BOLT CLASS 10,9 / A490**		
	thread friction coefficient = 0,14 **lubricated with oil or grease**			thread friction coefficient = 0,14 **lubricated with oil or grease**			thread friction coefficient = 0,17 **DRY (not lubricated)**			thread friction coefficient = 0,17 **DRY (not lubricated)**		
	bolt head bearing surface friction coefficient = 0,14 **lubricated with oil or grease**			bolt head bearing surface friction coefficient = 0,14 **lubricated with oil or grease**			bolt head bearing surface friction coefficient = 0,19 **DRY (not lubricated)**			bolt head bearing surface friction coefficient = 0,19 **DRY (not lubricated)**		
	Minimum pretension for fully tightened bolts (table J3,7)	**Minimum tightening torque for slip critical joints**	**recommended tightening torque for bearing type connections**	**Minimum pretension for fully tightened bolts (table J3,7)**	**Minimum tightening torque for slip critical joints**	**recommended tightening torque for bearing type connections**	**Minimum pretension for fully tightened bolts (table J3,7)**	**Minimum tightening torque for slip critical joints**	**recommended tightening torque for bearing type connections**	**Minimum pretension for fully tightened bolts (table J3,7)**	**Minimum tightening torque for slip critical joints**	**recommended tightening torque for bearing type connections**
	(kN)	(daN m)	(daN m)	(kN)	(daN m)	(daN m)	(kN)	(daN m)	(daN m)	(kN)	(daN m)	(daN m)
M12	41,9	8,5	4,2	52,4	10,6	5,3	41,9	10,6	5,3	52,4	13,2	6,6
M14	57,5	13,5	6,8	71,9	16,9	8,4	57,5	17,0	8,5	71,9	21,2	10,6
M16	79,2	21,0	10,5	99,0	26,2	13,1	79,2	26,4	13,2	99,0	33,0	16,5
M18	96,2	29,0	14,5	120,3	36,2	18,1	96,2	36,4	18,2	120,3	45,5	22,7
M20	123,7	41,0	20,5	154,6	51,3	25,6	123,7	51,6	25,8	154,6	64,5	32,3
M22	154,7	56,0	28,0	193,3	70,0	35,0	154,7	70,6	35,3	193,3	88,2	44,1
M24	178,1	70,9	35,4	222,7	88,6	44,3	178,1	89,2	44,6	222,7	111,5	55,8
M27	234,6	104,0	52,0	293,3	130,0	65,0	234,6	131,3	65,6	293,3	164,1	82,0
M30	285,1	141,0	70,5	356,4	176,2	88,1	285,1	177,7	88,9	356,4	222,2	111,1
M33	355,5	192,0	96,0	444,4	240,0	120,0	355,5	242,5	121,3	444,4	303,2	151,6
M36	417	247	123	521	308	154	417	311	156	521	389	194
M39	502	319	160	627	399	200	502	404	202	627	504	252
M42	574	395	197	718	494	247	574	499	249	718	623	312
M45	672	493	247	841	616	308	672	624	312	841	780	390
M48	756	593	297	945	741	371	756	750	375	945	937	469
M52	908	767	383	1135	959	479	908	971	485	1135	1213	607
M56	1047	954	477	1308	1192	596	1047	1207	603	1308	1508	754
M60	1224	1189	595	1529	1486	743	1224	1506	753	1529	1883	942
M64	1384	1437	718	1730	1796	898	1384	1820	910	1730	2275	1137
M68	1587	1743	872	1983	2179	1090	1587	2210	1105	1983	2762	1381
M72	1803	2090	1045	2253	2613	1306	1803	2652	1326	2253	3315	1658
M76	2033	2480	1240	2541	3100	1550	2033	3150	1575	2541	3937	1969
M80	2277	2915	1458	2846	3644	1822	2277	3706	1853	2846	4632	2316
M85	2601	3528	1764	3251	4410	2205	2601	4488	2244	3251	5610	2805
M90	2947	4220	2110	3683	5275	2637	2947	5373	2686	3683	6716	3358