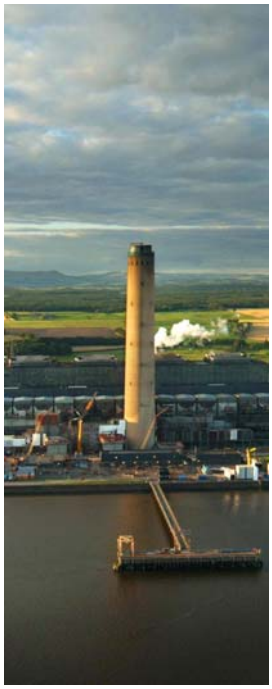

UK Carbon Capture and Storage Demonstration Competition

UKCCS - KT - S7.15 - ACC - 001

Aker Clean Carbon Datasheets/Specifications

April 2011

ScottishPower CCS Consortium

SCOTTISHPOWER nationalgrid

Carbon Capture & Storage Consortium

UK Carbon Capture and Storage Demonstration Competition

UKCCS - KT - S7.15 - ACC - 001

Aker Clean Carbon Datasheets/Specifications

April 2011

ScottishPower CCS Consortium

ScottishPower Generation Limited
Longannet Power Station
Kincardine on Forth
Clackmannanshire
Scotland

Reference	Equipment
ACC-001	Absorber
ACC-002	Amine 1 tank
ACC-003	Amine Solution Holding Tank
ACC-004	Centrifugal Pumps General Specification
ACC-005	CO2 Compressor anti-surge Cooler
ACC-006	CO2 Compressor Datasheet
ACC-007	CO2 Compressor Discharge Cooler
ACC-008	CO2 Compressor Discharge KO Vessel
ACC-009	CO2 Compressor Inlet KO Vessel
ACC-010	CO2 Drying Package Datasheet
ACC-011	CO2 Pre-Conditioning Vessel
ACC-012	CO2 Pre-Conditioning Vessel Bed
ACC-013	Condensate Drum
ACC-014	Cooling Water Cooler
ACC-015	Cooling Water Expansion Vessel
ACC-016	DCC Cooler
ACC-017	DCC Internal
ACC-018	Flue Gas Fan
ACC-019	Fuel Gas Conditioning Skid
ACC-020	Gas Turbines Package
ACC-021	General Project Specification for Mechanical Equipment
ACC-022	HP / LP PRDS Valves
ACC-023	HP / MP PRDS Valves
ACC-024	Lean Amine Cooler
ACC-025	Lean Amine Filter Package
ACC-026	Lean Amine Pump
ACC-027	Lean/Rich Amine Exchangers
ACC-028	LP Desuperheater
ACC-029	MP / LP Steam Control Valve
ACC-030	NaOH Tank
ACC-031	Process Drain Tank
ACC-032	Process Water Tank
ACC-033	Reclaimer System
ACC-034	Rich Amine Pump
ACC-035	Sea Water Filter
ACC-036	Specification for Design and Manufacture of Plate Type Heat Exchangers
ACC-037	Specification for Design and Manufacture of unfired pressure vessels
ACC-038	Specification for Supervisory Control System
ACC-039	Stripper System
ACC-040	Stripper Condenser
ACC-041	Stripper Overhead Receiver

Client:	**To be determined**
Plant Location:	**To be specified**

Item: Mechanical Datasheet Absorber Systems

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESIGN & OPERATING DATA			Rev
	OVERALL DUTY	**Units**		
	FLUID HANDLED			
	NATURE OF CONTENTS			
	MAX. LIQUID DENSITY [FOR MECHANICAL DESIGN]	kg/m^3		
	MAX. LIQ. HEIGHT ABOVE BOTTOM TAN [MECH. DES]	mm		
	MIN OPERATING PRESSURE	barA		
	NORM OPERATING PRESSURE	barA		
	MAX OPERATING PRESSURE	barA		
	MIN OPERATING TEMPERATURE	^oC		
	NORM OPERATING TEMPERATURE	^oC		
	MAX OPERATING TEMPERATURE	^oC		
	MAX DESIGN PRESSURE	barG		
	MIN DESIGN PRESSURE	barG		
	MAX DESIGN TEMPERATURE	^oC		
	MIN DESIGN TEMPERATURE	^oC		
	MIN AMBIENT TEMPERATURE	^oC		
	TOTAL PRESSURE DROP	mbar		
	MATERIALS OF CONSTRUCTION (MOC)			
	COLUMN SHELL & HEADS		DISTRIBUTORS	
	PACKING		COLLECTOR TRAYS	
	SUPPORT BEAMS		DEMISTER	
	SUPPORT GRIDS		BOLTING	
	WALL WIPERS		GASKETS	
	DIMENSIONS			
	INTERNAL DESIGN			
	BED HEIGHT			
	STRUCTURED/RANDOM			
	TYPE (GENERIC, OR TYPICAL VENDOR DESIGNATION)			
	TYPICAL MODEL LIQUID DISTRIBUTOR (ABOVE ABSORBER BED)			
	LIQUID DISTRIBUTOR (ABOVE WATER WASH BED)			
	TYPICAL MODEL COLLECTOR			
	TYPICAL MODEL SUPPORT GRID/HOLD DOWN GRID			
	TYPICAL MODEL DEMISTER			
	ADDITIONAL SPECIFICATIONS & STANDARDS			
1	PROCESS DATASHEET			
2	SPECIFICATION FOR DESIGN & MANUFACTURE OF COLUMN INTERNALS			
3	VENDOR DOCUMENTATION REQUIREMENTS - DOCUMENT CONTROL			
4	VENDOR DOCUMENTATION REQUIREMENTS - ENGINEERING			
5	**GENERAL NOTES**			
6				
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION	UNITS	DATA				Rev
1	**DESIGN & OPERATING DATA**						
2			**HOT FLUID**		**COLD FLUID**		
3			**In**	**Out**	**In**	**Out**	
4	**FLUID**						
5	**TOTAL FLUID FLOW**	**kg/hr**					
6	**VAPOUR FLOW**	**kg/hr**					
7	**LIQUID FLOW**	**kg/hr**					
8	**LIQUID DENSITY**	**kg/m³**					
9	**LIQUID SPECIFIC HEAT**	**kJ/kg°C**					
10	**LIQUID VISCOSITY**	**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**	**W/m°C**					
12	**LIQUID SURFACE TENSION**	**Dyn/cm**					
13	**LATENT HEAT**	**kJ/kg**					
14	**VAPOUR DENSITY**	**kg/m³**					
15	**VAPOUR SPECIFIC HEAT**	**kJ/kg°C**					
16	**VAPOUR VISCOSITY**	**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**	**W/m°C**					
18	**MOLECULAR WEIGHT**						
19	**OPERATING TEMPERATURE**	**°C**					
20	**OPERATING PRESSURE (Normal Inlet/Max. Inlet)**	**Bar a**					
21	**PRESSURE DROP Allow/Calc**	**Bar**					
22	**No. OF PASSES**						
23	**WALL SHEAR RATE**	**Pa.**					
24	**FOULING ALLOWANCE**	**m²C/W**					
25	**MAP (DESIGN PRESSURE)**	**bar g**					
26	**TEST PRESSURE New/Corroded**	**bar g**					
27	**DESIGN TEMPERATURE**	**°C**					
28	**HEAT DUTY**	**MW**					
29	**H.T. COEFFICIENT Service / Clean**	**W/m²C**					
30	**LMTD**	**°C**					
31	**HEAT TRANSFER SURFACE AREA**	**m²**					
32	**DESIGN MARGIN**	**%**					
33							
34							

35	**CONSTRUCTION & MATERIALS**				
36	**DESIGN CODES:**		**Type:**		
37	**PED FLUID PHASE & GROUP No:**	**HOT SIDE:**	**COLD SIDE:**		
38	**PED EQUIPMENT CATEGORY:**		**PED CONFORMITY MODULES:**		
39	**HEAT Ex. PLATE: MATERIAL:**		**END PLATE: MATERIAL:**		
40	**THICKNESS:**		**THICKNESS:**		
41	**No. OFF:**		**TIE BARS: MATERIAL:**		
42	**GASKET MATERIAL:**		**No. OFF:**		
43	**GASKET TYPE:**		**DIAMETER:**		
44	**NOZZLES:**	**HOT SIDE**	**COLD SIDE**		
45	**MATERIAL:**				
46	**SIZE:**				
47	**RATING:**				
48	**LINING:**				
49	**POSITION:**				
50	**CONNECTION TYPE:**				
51	**MINIMUM N.D.T.**		**INSPECTION BY:**		
52	**ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID**	**kg**			
53	**ESTIM'D WEIGHT INSTALLED FULL OF WATER**	**kg**			

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION		UNITS	DATA				Rev
1	**ALTERNATE CASE & OPERATING DATA**							
2				**HOT FLUID**		**COLD FLUID**		
3				**In**	**Out**	**In**	**Out**	
4	**FLUID**							
5	**FLUID FLOW**		**kg/hr**					
6	**VAPOUR FLOW**		**kg/hr**					
7	**LIQUID FLOW**		**kg/hr**					
8	**LIQUID DENSITY**		**kg/m3**					
9	**LIQUID SPECIFIC HEAT**		**kJ/kg°C**					
10	**LIQUID VISCOSITY**		**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**		**W/m°C**					
12	**LIQUID SURFACE TENSION**		**Dyn/cm**					
13	**LATENT HEAT**		**kJ/kg**					
14	**VAPOUR DENSITY**		**kg/m3**					
15	**VAPOUR SPECIFIC HEAT**		**kJ/kg°C**					
16	**VAPOUR VISCOSITY**		**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**		**W/m°C**					
18	**MOLECULAR WEIGHT**							
19	**OPERATING TEMPERATURE**		**°C**					
20	**OPERATING PRESSURE**		**Bar(g)**					
21	**PRESSURE DROP**	**Allow/Calc**	**bar**					
22	**HEAT DUTY**		**MW**					
23	**H.T. COEFFICIENT**	**Service / Clean**	**W/m²C**					
24	**LMTD**		**°C**					
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Mechanical Datasheet - Absorber Systems	DOC NO. Not Applicable
	PAGE NO. 7 of 45
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION	UNITS	DATA				Rev
1	**TURNDOWN & OPERATING DATA**						
2			**HOT FLUID**		**COLD FLUID**		
3			**In**	**Out**	**In**	**Out**	
4	**FLUID**						
5	**FLUID FLOW**	**kg/hr**					
6	**VAPOUR FLOW**	**kg/hr**					
7	**LIQUID FLOW**	**kg/hr**					
8	**LIQUID DENSITY**	**kg/m3**					
9	**LIQUID SPECIFIC HEAT**	**kJ/kg°C**					
10	**LIQUID VISCOSITY**	**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**	**W/m°C**					
12	**LIQUID SURFACE TENSION**	**Dyn/cm**					
13	**LATENT HEAT**	**kJ/kg**					
14	**VAPOUR DENSITY**	**kg/m3**					
15	**VAPOUR SPECIFIC HEAT**	**kJ/kg°C**					
16	**VAPOUR VISCOSITY**	**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**	**W/m°C**					
18	**MOLECULAR WEIGHT**						
19	**OPERATING TEMPERATURE**	**°C**					
20	**OPERATING PRESSURE**	**Bar(g)**					
21	**PRESSURE DROP** **Allow/Calc**	**bar**					
22	**HEAT DUTY**	**kW**					
23	**H.T. COEFFICIENT** **Service / Clean**	**W/m²C**					
24	**LMTD**	**°C**					
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35	**APPLICABLE DESIGN CODES & STANDARDS:**						
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

CLIENT	**To be determined**	ISSUE				
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PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	INSPECTION TASKS			Rev
1	**INSPECTION TASKS**			
2	All tasks identified below shall be included on the vendors quality plan.			
3	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
4	These certificates shall be included in the exchanger certification dossier.			
5				
6	**MC1**	**C**	Review material certificates (EN-10204, 3.1.standard).	
7	**MC2**	**C**	Check certified chemical & mechanical properties of all materials.	
8				
9	**WRod1**		Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
10	**WRod2**		Check method of distribution of welding consumables and means of storage on the shop floor.	
11				
12	**WeldPr**	**C**	Check weld procedures and qualifications.	
13	**Welder**	**C**	Check weld map and welders qualifications.	
14				
15	**TrHtNos**		Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
16				
17	**Plate**		Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas	
18			susceptible to thinning.	
19	**Lamin**	**C**	Inspect edges of material for weld preparation and for discontinuities and laminations.	
20				
21	**Fitup**		Inspect assembly including alignment of main seams prior to welding.	
22	**Nozzles**		Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of	
23			bolt holes.	
24				
25	**Welding**		Survey welding and back gouging and ensure that approved procedures are followed.	
26	**InspWeld**	**C**	Inspect finished welds for freedom from undercut and surface defects.	
27				
28	**DimChk**	**C**	Check dimensions to approved drawing and code.	
29	**IntFinish**	**C**	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
30				
31	**MPT**	**C**	Check MPT procedure and operators qualifications and survey the testing of all exchanger welds.	
32	**RT**	**C**	Ensure radiography of exchanger welds is in accordance with approved drawing and specified code.	
33			Review radiographs.	
34	**UT**	**C**	Witness ultrasonic examination of welds and review reports.	
35				
36	**HydrT**	**C**	Witness hydraulic test. Check test set up and pressure gauge certificates. Check test water certificate.	
37			Check that the exchanger is clean and dry after testing.	
38				
39	**Final-1**	**C**	Check that the equipment is clean and dry before sealing.	
40	**Final-2**	**C**	Check general workmanship and completeness of supply.	
41	**Final-3**	**C**	Check Paint or other finishes for continuity and against specification.	
42	**Final-4**	**C**	Check copy of nameplate.	
43	**Final-5**	**C**	Check Equipment packed and protected ready for shipment.	
44	**Final-6**		Review Dossier.	
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Mechanical Datasheet - Absorber Systems	DOC NO. Not Applicable
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	PROJECT NO.
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	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION	UNITS	DATA				Rev
1	**DESIGN & OPERATING DATA**						
2			**HOT FLUID**		**COLD FLUID**		
3			**In**	**Out**	**In**	**Out**	
4	**FLUID**						
5	**TOTAL FLUID FLOW**	**kg/hr**					
6	**VAPOUR FLOW**	**kg/hr**					
7	**LIQUID FLOW**	**kg/hr**					
8	**LIQUID DENSITY**	**kg/m³**					
9	**LIQUID SPECIFIC HEAT**	**kJ/kg°C**					
10	**LIQUID VISCOSITY**	**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**	**W/m°C**					
12	**LIQUID SURFACE TENSION**	**Dyn/cm**					
13	**LATENT HEAT**	**kJ/kg**					
14	**VAPOUR DENSITY**	**kg/m³**					
15	**VAPOUR SPECIFIC HEAT**	**kJ/kg°C**					
16	**VAPOUR VISCOSITY**	**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**	**W/m°C**					
18	**MOLECULAR WEIGHT**						
19	**OPERATING TEMPERATURE**	**°C**					
20	**OPERATING PRESSURE (Normal Inlet/Max. Inlet)**	**Bar a**					
21	**PRESSURE DROP Allow/Calc**	**Bar**					
22	**No. OF PASSES**						
23	**WALL SHEAR RATE**	**Pa.**					
24	**FOULING ALLOWANCE**	**m²C/W**					
25	**MAP (DESIGN PRESSURE)**	**bar g**					
26	**TEST PRESSURE New/Corroded**	**bar g**					
27	**DESIGN TEMPERATURE**	**°C**					
28	**HEAT DUTY**	**MW**					
29	**H.T. COEFFICIENT Service / Clean**	**W/m²C**					
30	**LMTD**	**°C**					
31	**HEAT TRANSFER SURFACE AREA**	**m²**					
32	**DESIGN MARGIN**	**%**					
33							
34							
35	**CONSTRUCTION & MATERIALS**						
36	**DESIGN CODES:**		**Type:**				
37	**PED FLUID PHASE & GROUP No:**	**HOT SIDE:**	**COLD SIDE:**				
38	**PED EQUIPMENT CATEGORY:**		**PED CONFORMITY MODULES:**				
39	**HEAT Ex. PLATE: MATERIAL:**		**END PLATE:**	**MATERIAL:**			
40	**THICKNESS:**			**THICKNESS:**			
41	**No. OFF:**		**TIE BARS:**	**MATERIAL:**			
42	**GASKET MATERIAL:**			**No. OFF:**			
43	**GASKET TYPE:**			**DIAMETER:**			
44	**NOZZLES:**		**HOT SIDE**		**COLD SIDE**		
45	**MATERIAL:**						
46	**SIZE:**						
47	**RATING:**						
48	**LINING:**						
49	**POSITION:**						
50	**CONNECTION TYPE:**						
51	**MINIMUM N.D.T.**		**INSPECTION BY:**				
52	**ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID**	**kg**					
53	**ESTIM'D WEIGHT INSTALLED FULL OF WATER**	**kg**					

Mechanical Datasheet - Absorber Systems	DOC NO. Not Applicable
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	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION		UNITS	DATA				Rev
1	**ALTERNATE CASE & OPERATING DATA**							
2				**HOT FLUID**		**COLD FLUID**		
3				**In**	**Out**	**In**	**Out**	
4	**FLUID**							
5	**FLUID FLOW**		**kg/hr**					
6	**VAPOUR FLOW**		**kg/hr**					
7	**LIQUID FLOW**		**kg/hr**					
8	**LIQUID DENSITY**		**kg/m3**					
9	**LIQUID SPECIFIC HEAT**		**kJ/kg°C**					
10	**LIQUID VISCOSITY**		**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**		**W/m°C**					
12	**LIQUID SURFACE TENSION**		**Dyn/cm**					
13	**LATENT HEAT**		**kJ/kg**					
14	**VAPOUR DENSITY**		**kg/m3**					
15	**VAPOUR SPECIFIC HEAT**		**kJ/kg°C**					
16	**VAPOUR VISCOSITY**		**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**		**W/m°C**					
18	**MOLECULAR WEIGHT**							
19	**OPERATING TEMPERATURE**		**°C**					
20	**OPERATING PRESSURE**		**Bar(g)**					
21	**PRESSURE DROP**	**Allow/Calc**	**bar**					
22	**HEAT DUTY**		**MW**					
23	**H.T. COEFFICIENT**	**Service / Clean**	**W/m²C**					
24	**LMTD**		**°C**					
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION		UNITS	DATA				Rev
	TURNDOWN & OPERATING DATA							
1				**HOT FLUID**		**COLD FLUID**		
2				**In**	**Out**	**In**	**Out**	
3	**FLUID**							
4	**FLUID FLOW**		**kg/hr**					
5	**VAPOUR FLOW**		**kg/hr**					
6	**LIQUID FLOW**		**kg/hr**					
7	**LIQUID DENSITY**		**kg/m3**					
8	**LIQUID SPECIFIC HEAT**		**kJ/kg°C**					
9	**LIQUID VISCOSITY**		**cP**					
10	**LIQUID THERMAL CONDUCTIVITY**		**W/m°C**					
11	**LIQUID SURFACE TENSION**		**Dyn/cm**					
12	**LATENT HEAT**		**kJ/kg**					
13	**VAPOUR DENSITY**		**kg/m3**					
14	**VAPOUR SPECIFIC HEAT**		**kJ/kg°C**					
15	**VAPOUR VISCOSITY**		**cP**					
16	**VAPOUR THERMAL CONDUCTIVITY**		**W/m°C**					
17	**MOLECULAR WEIGHT**							
18	**OPERATING TEMPERATURE**		**°C**					
19	**OPERATING PRESSURE**		**Bar(g)**					
20	**PRESSURE DROP**	**Allow/Calc**	**bar**					
21	**HEAT DUTY**		**kW**					
22	**H.T. COEFFICIENT**	**Service / Clean**	**W/m²C**					
23	**LMTD**		**°C**					
24								
25								
26								
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30								
31								
32								
33								
34	**APPLICABLE DESIGN CODES & STANDARDS:**							
35								
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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	INSPECTION TASKS			Rev
	INSPECTION TASKS			
	All tasks identified below shall be included on the vendors quality plan.			
	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
1	These certificates shall be included in the exchanger certification dossier.			
2				
3	**MC1**	**C**	Review material certificates (EN-10204, 3.1.standard).	
4	**MC2**	**C**	Check certified chemical & mechanical properties of all materials.	
5				
6	**WRod1**		Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
7	**WRod2**		Check method of distribution of welding consumables and means of storage on the shop floor.	
8				
9	**WeldPr**	**C**	Check weld procedures and qualifications.	
10	**Welder**	**C**	Check weld map and welders qualifications.	
11				
12	**TrHtNos**		Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
13				
14	**Plate**		Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas	
15			susceptible to thinning.	
16	**Lamin**	**C**	Inspect edges of material for weld preparation and for discontinuities and laminations.	
17				
18	**Fitup**		Inspect assembly including alignment of main seams prior to welding.	
19	**Nozzles**		Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of	
20			bolt holes.	
21				
22	**Welding**		Survey welding and back gouging and ensure that approved procedures are followed.	
23	**InspWeld**	**C**	Inspect finished welds for freedom from undercut and surface defects.	
24				
25	**DimChk**	**C**	Check dimensions to approved drawing and code.	
26	**IntFinish**	**C**	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
27				
28	**MPT**	**C**	Check MPT procedure and operators qualifications and survey the testing of all exchanger welds.	
29	**RT**	**C**	Ensure radiography of exchanger welds is in accordance with approved drawing and specified code.	
30			Review radiographs.	
31	**UT**	**C**	Witness ultrasonic examination of welds and review reports.	
32				
33	**HydrT**	**C**	Witness hydraulic test. Check test set up and pressure gauge certificates. Check test water certificate.	
34			Check that the exchanger is clean and dry after testing.	
35				
36	**Final-1**	**C**	Check that the equipment is clean and dry before sealing.	
37	**Final-2**	**C**	Check general workmanship and completeness of supply.	
38	**Final-3**	**C**	Check Paint or other finishes for continuity and against specification.	
39	**Final-4**	**C**	Check copy of nameplate.	
40	**Final-5**	**C**	Check Equipment packed and protected ready for shipment.	
41	**Final-6**		Review Dossier.	
42				
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESIGN & OPERATING DATA		Rev
2	APPLICATION STANDARD (DESIGN CODE)		
3	PED CONFORMANCE CATEGORY (PREFERED MODULE)		
4	VESSEL SPECIFICATION		
5	GENERAL PROJECT SPECIFICATION FOR MECHANICAL EQUIPMENT		
6	PIPING DESIGN NOZZLE LOADING FOR STATIC EQUIPMENT		
7	VENDOR DOCUMENTATION REQUIREMENTS - DOCUMENT CONTROL		
8	VENDOR DOCUMENTATION REQUIREMENTS - ENGINEERING		
9	DESIGN PRESSURE @ TEMPERATURE		
10	OPERATING PRESSURE @ TEMPERATURE		
11	CORROSION/EROSION ALLOWANCE (internal / external)		
12	STRESS RELIEF/PWHT		
13	RADIOGRAPHY		
14	JOINT COEFFICIENT		
15	HYDRAULIC TEST PRESSURE		
16	AIR TEST PRESSURE (with soap suds)		
17	BASIC WIND SPEED		
18	SEISMIC CRITERIA		
19	CYCLIC SERVICE		
20	CREEP RANGE		
21	NATURE OF CONTENTS		
22	MAX. OPERATING STATIC HEAD		
23	INTERNAL FINISH		
24	INTERNAL COATING		
25	EXTERNAL FINISH		
26	EXTERNAL PAINTING		
27	INSULATION		
28	FIREPROOFING (by site contractor)		
29	INSPECTION AUTHORITY		
30			
31			
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	MATERIAL SPECIFICATIONS				
37	HEADS & SHELL		STIFFENING RINGS		
38	NOZZLE: FLANGES		SUPPORT SKIRT		
39	NOZZLE: NECKS		EXT. ATTACHMENTS		
40	BOLTING: EXTERNAL		FLANGE FINISH		
41	BOLTING: INTERNAL				
42	GASKETS: EXTERNAL		MATERIAL CERTS		
43	GASKETS: INTERNAL				
44	FIXED INTERNALS				
45	REMOVABLE INT'LS				
46					
47					

	CAPACITY & WEIGHTS				
49	ESTIM'D WEIGHT FABRICATED (EMPTY)	kg	S.G. OF OPERATING FLUID		
50	ESTIM'D WEIGHT INTERNALS	kg	VOLUME OF OPERATING FLUID	m^3	
51	ESTIM'D WEIGHT INSULATION	kg	WEIGHT OF OPERATING FLUID (MAX)	kg	
52	ESTIM'D WEIGHT LADDERS & PLATFORMS	kg	Vessel CAPACITY (GROSS) - APPROXIMATE	m^3	
53	ESTIM'D WEIGHT INSTALLED (EMPTY)	kg			
54	ESTIM'D WEIGHT INSTALLED OPERATING	kg			
55	ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID	kg			
56	ESTIM'D WEIGHT INSTALLED FULL OF WATER	kg			

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

BRANCH DUTY

Ref	Service	DN	No Off	Flange	PN	Standout	Notes	Rev

Nozzle standouts are measured from Vessel centre-line to flange face.

ADDITIONAL SPECIFICATIONS & STANDARDS

NOTES

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

1	**NOTES (Continued)**
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Mechanical Datasheet - Absorber System	DOC NO. Not Applicable
	PAGE NO. 21 of 45
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
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PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

				Rev
1			**INSPECTION TASKS**	
2	**INSPECTION TASKS**			
3	All tasks identified below shall be included on the vendors quality plan.			
4	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
5	These certificates shall be included in the Vessel certification dossier.			
6	1.	C	Review material certificates (EN-10204. 3.1 standard.)	
7	2.	-	Check certified chemical & mechanical properties of all materials.	
8	3.	-		
9	4.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding	
10	5.	-	procedures.	
11	6.	C	Check method of distribution of welding consumables and means of storage on the shop floor..	
12	7.	-		
13	8.	C	Check weld procedures and qualifications.	
14	9.	C	Check weld map and welders qualifications.	
15	10.	-		
16	11.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast	
17	12.	-	numbers.	
18	13.	-		
19	14.	C	Identify formed roof plates and check shape, dimensions and thickness.	
20	15.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas	
21	16.	-	susceptible to thinning.	
22	17.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
23	18.	-		
24	19.	C	Inspect assembly including alignment of main seams prior to welding .	
25	20.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and	
26	21.	-	location of bolt holes.	
27	22.	-		
28	23.	C	Check weld preparation, material identification and stamping.	
29	24.	-		
30	25.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
31	26.	-		
32	27.	C	Inspect finished welds for freedom from undercut and surface defects.	
33	28.	-		
34	29.	C	Check dimensions to approved drawing and tolerances given in specifications and code.	
35	30.	-		
36	31.	-		
37	32.	C	Inspect internal finish and weld dressing.	
38	33.	-		
39	34.	C	Check DPI procedure and operaters qualifications and survey the testing of all Vessel welds.	
40	35.	C	Ensure radiography of Vessel welds is in accordance with approved drawing and specified code. Review	
41	36.	-	radiographs.	
42	37.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
43	38.	C	Witness vacuum box testing of bottom plate welds.	
44	39.	-		
45	40.	-	Gauge check Vessel internal diameter.	
46	41.	C	Check test set up and witness hydraulic test.	
47	42.	-		
48	43.	C	Check that the Vessel is clean and dry before sealing	
49	44.	C	Check general workmanship and completeness of supply.	
50	45.	C	Check Paint or other finishes for continuity and against specification.	
51	46.	C	Check copy of nameplate	
52	47.	C	Check Equipment packed and protected ready for shipment	
53	48.	-	Review Dossier	
54				
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Project No

Equipment **Absorber System**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA		REV.
1	**GENERAL**					
2	Manufacturer					
3	Model / Size					
4	Design Code					
5	Location					
6						
7	**OPERATING CONDITIONS**					
8	Operation Mode					
9	Hazardous Area Classification			ZONE GAS GROUP TEMP CLASS DUST HAZARD		
10						
11	Case Description			**Design Case**	**Minimum Flow Case**	
12	Fluid Pumped					
13	Fluid Characteristics					
14						
15	Operating Temperature	Minimum	°C			
16		Normal	°C			
17		Maximum	°C			
18	Vapour Pressure at normal temperature		bara			
19	Density at normal temperature		kg/m^3			
20	Specific Heat		kJ/kg°C			
21	Viscosity at (temperature)	Operating	Cp			
22		At start-up cold	Cp			
23	Composition		% w/w			
24	Solids Content		kg/m^3			
25						
26						
27						
28	Atmospheric Boiling Point		°C			
29	Capacity	Minimum	m^3/h			
30		Normal	m^3/h			
31		Design (rated)	m^3/h			
32			m^3/h			
33	Suction Pressure	Design	barg			
34	Discharge Pressure		barg			
35	Differential Pressure		bar			
36	Differential Head		m			
37	NPSHA		m			
38						
39	**PERFORMANCE**					
40	Pump Speed	Normal	rpm			
41		1st critical	rpm			
42	Impeller Diameter	Minimum	mm			
43		Rated	mm			
44		Maximum	mm			
45	Number of Stages					
46	NPSHR		m			
47	Suction Specific Speed	Stage1 / Stage2	$m^3/h.m.rpm$			
48	Minimum Continuous Flow	For stable operation	m^3/h			
49						
50	Efficiency	Rated	%			
51		Maximum	%			
52	Maximum Head	Rated Impeller	barg			
53		Maximum Impeller	barg			
54	Head Rise to Maximum	Relative to duty flow	%			
55	Shut off Head		m			

Project No
Equipment **Absorber System**
Equipment No
Number Off

	DESCRIPTION		UNITS	DATA	REV.
1	**PERFORMANCE (Cont.)**				
2	Absorbed Power Rated Impeller	Rated flow	kW		
3		End of Curve	kW		
4	Absorbed Power Max Impeller	Rated flow	kW		
5		End of Curve	kW		
6	Power Consumed by Seal		kW		
7	Proposal Curve No				
8					
9					
10					
11	**UTILITY REQUIREMENTS**				
12					
13					
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31	**CONNECTIONS**						
32	SERVICE / PURPOSE	DESIG'N	TYPE	RATING	ND (mm)	POSITION	
33	Suction						
34	Discharge						
35	Casing Vent						
36	Casing Drain						
37							
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39							
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Project No

Equipment **Absorber System**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA	REV.
1	**MATERIALS OF CONSTRUCTION**				
2	Casing				
3	Barrel				
4	Bowls				
5	Diffuser				
6	Impeller				
7	Casing Wear Rings				
8	Impeller Wear Rings				
9	Shaft				
10	Shaft Sleeve				
11	Seal Housing				
12	Seal Plate				
13	Throat Bush				
14	Gaskets				
15	Seals				
16					
17	Bearing Housing				
18	Drive Guard				
19	Baseplate				
20					
21	Seal Vessel				
22					
23	Seal Flush Piping				
24	Mechanical Seal				
25	Stationary Seat	Inboard / Outboard			
26	Rotating Face	Inboard / Outboard			
27	Metallic Parts	Inboard / Outboard			
28	Elastomers	Inboard / Outboard			
29					
30					
31					
32					
33	**MECHANICAL DATA**				
34	Pump Type				
35					
36	Casing Design Pressure		barg		
37	Casing Design Temperature		°C		
38	Casing Test Pressure		barg		
39					
40	Lube Oil Cooler Design Pressure		barg		
41	Lube Oil Cooler Design Temperature		°C		
42	Lube Oil Cooler Test Pressure		barg		
43					
44	Casing	Mounting			
45		Split			
46		Corrosion allowance			
47		Type			
48	Impeller	Type			
49		No. vanes			
50	Rotor	Type			
51	Rotation (facing coupling end)				
52	Shaft	Diameter at sleeve	mm		
53		Diameter at coupling	mm		
54		Diameter at bearings	mm		
55		Bearing span	mm		

Project No

Equipment **Absorber System**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA	REV.
1	**MECHANICAL DATA (Cont.)**				
2	Coupling	Manufacturer			
3		Model			
4		Type			
5		Rating			
6		Lubrication			
7		Spacer length			
8		Service factor			
9		Guard			
10	Bearings	Radial			
11		Thrust			
12		Life L10			
13	Bearing Seals	Type			
14		Manufacturer			
15	Lubrication	Method			
16		Lubricant			
17					
18	Baseplate	Type			
19					
20	Shaft Seal Type				
21	Manufacturer				
22	API Code				
23	Manufacturer Code				
24	Circulation / Flush Plan				
25					
26	Sealant Vessel Model Ref				
27	Vessel Capacity				
28	Vessel Design Code				
29	Independent Inspection Authority				
30	Vessel Design Conditions				
31	Vessel Test Pressure				
32	Coil Design Conditions				
33	Coil Test Pressure				
34					
35	Cooling System				
36	API Plan				
37					
38					
39					
40					
41					
42	**INSTRUMENTATION & CONTROL**				
43	Instrumentation / Interlocks Fitted				
44	FUNCTION			INDICATION / ALARM / TRIP	
45	Seal System				
46					
47					
48	Lube Oil System				
49					
50					
51	Pump Condition Monitoring				
52					
53					
54				L = Local LP = Local Panel R = Remote	
55					

Project No
Equipment **Absorber System**
Equipment No
Number Off

	DESCRIPTION	UNITS	DATA	REV.
1	**DRIVE ARRANGEMENT / TRANSMISSION**			
2	Driver Type			
3	Manufacturer			
4	Driver Specification			
5	Electrical Supply			
6	Rated Power/Speed			
7	Enclosure			
8	Driver Data Sheet No			
9				
10				
11				
12	**SCOPE OF SUPPLY**			
13	Pump			
14	Driver			
15	Drive Arrangement			
16	Baseplate			
17	Coupling & Guard			
18	Sealant System			
19	Nozzle Gaskets & Fasteners			
20	Lube Oil System			
21				
22	Special Tools			
23	Commissioning Spares			
24	Two Years Operating Spares			
25	Capital Spares			
26	First Fill of Lubricant			
27	Holding Down Bolts			
28				
29				
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41				
42				
43	**WEIGHTS & DIMENSIONS**			
44	WEIGHTS			
45	Pump	kg		
46	Driver	kg		
47	Baseplate	kg		
48				
49				
50	Total	kg		
51				
52	Maximum Maintenance Weight	kg		
53				
54				
55	Baseplate Footprint Length x Width	mm		

Project No
Equipment **Absorber System**
Equipment No
Number Off

					REV.
1	**INSPECTION, TESTING AND CERTIFICATION**				
2	**EQUIPMENT QUALITY LEVEL:-** N/A				
3					
4	All tasks listed below shall be included on the Vendor's Quality Plan for this package as a minimum and shall be performed at the vendor's works.				
5	Refer also to detailed inspection, testing & certification requirements specified on reference documents.				
6					
7	**TASK DESCRIPTION**	WITNESS	OBSERVE	REVIEW	
8					
9	Review material certificates (BS EN 10204 - 3.1standard.)				
10	Identify materials against material certificate/cast numbers.				
11	Check certified chemical properties of materials.				
12	Check certified results of mechanical test of materials.				
13	Review material guarantee.				
14	Check heat treatment certificates, including temperature records.				
15	Check operator qualifications and suitability of all NDT operators.				
16	Check certified results of NDT tests of materials and welds.				
17	Inspect radiographs & extent of radiography.				
18	Check qualification of welders and operators.				
19	Part dimensional check for site erection purposes to certified drawings.				
20	General workmanship and completeness of supply.				
21	Machined casing for general workmanship, finish and cleanliness.				
22	Examine impellers, check construction.				
23	Paint or other finish for continuity.				
24	Auxiliary piping and fittings against requirements of item specification.				
25	Flange face finish against requirements of item specification.				
26	Guards to correct standard and are securely attached.				
27	Alignment of driver with driven unit.				
28	Fabrication of baseplate against requirements of item specification.				
29	Hydrostatic test of all pressure retaining parts (Pump casing, coolers, Seal water piping etc.)				
30	Dynamic balancing of impeller or complete rotating element				
31	Copy of machine rating plate.				
32	Overspeed test on impeller.				
33	Mechanical run test at rated speed .				
34	NPSH(R) test on pump (Option)				
35	Performance test of pump.				
36	Vibration amplitude during performance test.				
37	Each item is suitably prepared for shipment.				
38					
39					
40	ELECTRIC MOTORS				
41	Routine works test certificate.				
42	Type test certificate.				
43	Earthing and bonding. Continuity between equipment items and earth tag.				
44	Compliance with specification, correct enclosure, termination arrangements, etc.				
45	Hazardous area classification certificates.				
46					
47	INSTRUMENTATION				
48	Tag labels are fitted.				
49	Material certificate for each item.				
50	Calibration certificate for each item.				
51	Hazardous area classification certificates for each item.				
52					
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Project No	
Equipment	**Absorber System**
Equipment No	
Number Off	

		REV.
1	**REFERENCE DOCUMENTS**	
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20	**GENERAL NOTES**	
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Project No	
Equipment	**Absorber System**
Equipment No	
Number Off	

		REV.
1	**SKETCH**	

Project No

Equipment **Absorber System**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA		REV.
1	**GENERAL**					
2	Manufacturer					
3	Model / Size					
4	Design Code					
5	Location					
6						
7	**OPERATING CONDITIONS**					
8	Operation Mode					
9	Hazardous Area Classification			ZONE GAS GROUP TEMP CLASS DUST HAZARD		
10						
11	Case Description			**Design Case**	**Minimum Flow Case**	
12	Fluid Pumped					
13	Fluid Characteristics					
14	Operating Temperature	Minimum	°C			
15		Normal	°C			
16		Maximum	°C			
17	Vapour Pressure at normal temperature		bara			
18	Density at normal temperature		kg/m^3			
19	Specific Heat		kJ/kg°C			
20	Viscosity at (temperature)	Operating	Cp			
21		At start-up cold	Cp			
22	Composition		%W/W			
23	Solids Content		kg/m^3			
24	Suspended Solids Size		µm			
25	Suspended Solids Density		kg/m^3			
26	Chloride Content		ppm			
27	Atmospheric Boiling Point		°C			
28	Capacity	Minimum	m^3/h			
29		Normal	m^3/h			
30		Design (rated)	m^3/h			
31	Recirculation Capacity		m^3/h			
32	Suction Pressure	Design	barg			
33	Discharge Pressure		barg			
34	Differential Pressure		bar			
35	Differential Head		m			
36	NPSHA		m			
37						
38						
39	**PERFORMANCE**					
40	Pump Speed	Normal	rpm			
41		1st critical	rpm			
42	Impeller Diameter	Minimum	mm			
43		Rated	mm			
44		Maximum	mm			
45	Number of Stages					
46	NPSHR		bar			
47	Suction Specific Speed	Stage 1 / Stage 2	$m^3/h.m.rpm$			
48	Minimum Continuous Flow	For stable operation	ppm			
49		Thermal	ppm			
50	Efficiency	Rated	%			
51		Maximum	%			
52	Maximum Head	Rated Impeller	barg			
53		Maximum Impeller	barg			
54	Head Rise to Maximum	Relative to duty flow	%			
55	Shut off Head		m			

Project No
Equipment **Absorber System**
Equipment No
Number Off

	DESCRIPTION		UNITS	DATA	REV.
1	**PERFORMANCE (Cont.)**				
2	Absorbed Power Rated Impeller	Rated flow	kW		
3		End of Curve	kW		
4	Absorbed Power Max Impeller	Rated flow	kW		
5		End of Curve	kW		
6	Power Consumed by Seal		kW		
7	Proposal Curve No.				
8					
9					
10					
11	**UTILITY REQUIREMENTS**				
12					
13					
14					
15					
16					
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18					
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30					
31	**CONNECTIONS**				

	SERVICE / PURPOSE	DESIGN	TYPE	RATING	ND (mm)	POSITION	
32							
33	Suction						
34	Discharge						
35	Casing Vent						
36	Casing Drain						
37							
38							
39							
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Project No
Equipment **Absorber System**
Equipment No
Number Off

	DESCRIPTION		UNITS	DATA	REV.
1	**MATERIALS OF CONSTRUCTION**				
2	Casing				
3	Barrel				
4	Bowls				
5	Diffuser				
6	Impeller				
7	Casing Wear Rings				
8	Impeller Wear Rings				
9	Shaft				
10	Shaft Sleeve				
11	Seal Housing				
12	Seal Plate				
13	Throat Bush				
14	Gaskets				
15	Seals				
16					
17	Bearing Housing				
18	Drive Guard				
19	Baseplate				
20					
21	Seal Vessel				
22					
23	Seal Flush Piping				
24	Mechanical Seal				
25	Stationary Seat	Inboard / Outboard			
26	Rotating Face	Inboard / Outboard			
27	Metallic Parts	Inboard / Outboard			
28	Elastomers	Inboard / Outboard			
29					
30					
31					
32					
33	**MECHANICAL DATA**				
34	Pump Type				
35					
36	Casing Design Pressure		barg		
37	Casing Design Temperature		°C		
38	Casing Test Pressure		barg		
39					
40	Lube Oil Cooler Design Pressure		barg		
41	Lube Oil Cooler Design Temperature		°C		
42	Lube Oil Cooler Test Pressure		barg		
43					
44	Casing	Mounting			
45		Split			
46		Corrosion allowance			
47		Type			
48	Impeller	Type			
49		No. vanes			
50	Rotor	Type			
51	Rotation (facing coupling end)				
52	Shaft	Diameter at sleeve	mm		
53		Diameter at coupling	mm		
54		Diameter at bearings	mm		
55		Bearing span	mm		

Project No

Equipment **Absorber System**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA	REV.
1	**MECHANICAL DATA (Cont.)**				
2	Coupling	Manufacturer			
3		Model			
4		Type			
5		Rating			
6		Lubrication			
7		Spacer length			
8		Service factor			
9		Guard			
10	Bearings	Radial			
11		Thrust			
12		Life L10			
13	Bearing Seals	Type			
14		Manufacturer			
15	Lubrication	Method			
16		Lubricant			
17					
18	Baseplate	Type			
19					
20	Shaft Seal Type				
21	Manufacturer				
22	API Code				
23	Manufacturer Code				
24	Circulation / Flush Plan API				
25					
26	Sealant Vessel Model Ref				
27	Vessel Capacity				
28	Vessel Design Code				
29	Independent Inspection Authority				
30	Vessel Design Conditions				
31	Vessel Test Pressure				
32	Coil Design Conditions				
33	Coil Test Pressure				
34					
35	Cooling System				
36	API Plan				
37					
38					
39					
40					
41					
42	**INSTRUMENTATION & CONTROL**				
43	Instrumentation / Interlocks Fitted				
44	FUNCTION			INDICATION / ALARM / TRIP	
45	Seal System				
46					
47					
48	Lube Oil System				
49					
50					
51	Pump Condition Monitoring				
52					
53					
54				L = Local LP = Local Panel R = Remote	
55					

Aker CleanCarbon

AkerSolutions part of Aker

Project No
Equipment **Absorber System**
Equipment No
Number Off

	DESCRIPTION	UNITS	DATA	REV.
1	**DRIVE ARRANGEMENT / TRANSMISSION**			
2	Driver Type			
3	Manufacturer			
4	Driver Specification			
5	Electrical Supply			
6	Rated Power/Speed			
7	Enclosure			
8	Driver Data Sheet No			
9				
10				
11				
12	**SCOPE OF SUPPLY**			
13	Pump			
14	Driver			
15	Drive Arrangement			
16	Baseplate			
17	Coupling & Guard			
18	Sealant System			
19	Nozzle Gaskets & Fasteners			
20	Lube Oil System			
21				
22	Special Tools			
23	Commissioning Spares			
24	Two Years Operating Spares			
25	Capital Spares			
26	First Fill of Lubricant			
27	Holding Down Bolts			
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42				
43	**WEIGHTS & DIMENSIONS**			
44	WEIGHTS			
45	Pump	kg		
46	Driver	kg		
47	Baseplate	kg		
48				
49				
50	Total	kg		
51				
52	Maximum Maintenance Weight	kg		
53				
54				
55	Baseplate Footprint Length x Width	mm		

Project No
Equipment **Absorber System**
Equipment No
Number Off

	DESCRIPTION	UNITS	DATA			REV.
1	**INSPECTION, TESTING AND CERTIFICATION**					
2	**EQUIPMENT QUALITY LEVEL:- N/A**					
3						
4	All tasks listed below shall be included on the Vendor's Quality Plan for this package as a minimum and shall be performed at the vendor's works.					
5	Refer also to detailed inspection, testing & certification requirements specified on reference documents.					
6						
7	**TASK DESCRIPTION**			WITNESS	OBSERVE	REVIEW
8						
9	Review material certificates (BS EN 10204 - 3.1standard.)					
10	Identify materials against material certificate/cast numbers.					
11	Check certified chemical properties of materials.					
12	Check certified results of mechanical test of materials.					
13	Review material guarantee.					
14	Check heat treatment certificates, including temperature records.					
15	Check operator qualifications and suitability of all NDT operators.					
16	Check certified results of NDT tests of materials and welds.					
17	Inspect radiographs & extent of radiography.					
18	Check qualification of welders and operators.					
19	Part dimensional check for site erection purposes to certified drawings.					
20	General workmanship and completeness of supply.					
21	Machined casing for general workmanship, finish and cleanliness.					
22	Examine impellers, check construction.					
23	Paint or other finish for continuity.					
24	Auxiliary piping and fittings against requirements of item specification.					
25	Flange face finish against requirements of item specification.					
26	Guards to correct standard and are securely attached.					
27	Alignment of driver with driven unit.					
28	Fabrication of baseplate against requirements of item specification.					
29	Hydrostatic test of all pressure retaining parts (Pump casing, coolers, Seal water piping etc.)					
30	Dynamic balancing of impeller or complete rotating element					
31	Copy of machine rating plate.					
32	Overspeed test on impeller.					
33	Mechanical run test at rated speed .					
34	NPSH(R) test on pump (Option)					
35	Performance test of pump.					
36	Vibration amplitude during performance test.					
37	Each item is suitably prepared for shipment.					
38						
39						
40	ELECTRIC MOTORS					
41	Routine works test certificate.					
42	Type test certificate.					
43	Earthing and bonding. Continuity between equipment items and earth tag.					
44	Compliance with specification, correct enclosure, termination arrangements, etc.					
45	Hazardous area classification certificates.					
46						
47	INSTRUMENTATION					
48	Tag labels are fitted.					
49	Material certificate for each item.					
50	Calibration certificate for each item.					
51	Hazardous area classification certificates for each item.					
52						
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Project No

Equipment **Absorber System**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA	REV.
1	**REFERENCE DOCUMENTS**			
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20	**GENERAL NOTES**			
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Project No

Equipment **Absorber System**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA	REV.
1	**SKETCH**			
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESIGN & OPERATING DATA		Rev
2	APPLICATION STANDARD (DESIGN CODE)		
3	PED CONFORMANCE CATEGORY (PREFERED MODULE)		
4	VESSEL SPECIFICATION		
5	GENERAL PROJECT SPECIFICATION FOR MECHANICAL EQUIPMENT		
6	PIPING DESIGN NOZZLE LOADING FOR STATIC EQUIPMENT		
7	VENDOR DOCUMENTATION REQUIREMENTS - DOCUMENT CONTROL		
8	VENDOR DOCUMENTATION REQUIREMENTS - ENGINEERING		
9	DESIGN PRESSURE @ TEMPERATURE		
10	OPERATING PRESSURE @ TEMPERATURE		
11	CORROSION/EROSION ALLOWANCE (internal / external)		
12	STRESS RELIEF/PWHT		
13	RADIOGRAPHY		
14	JOINT COEFFICIENT		
15	HYDRAULIC TEST PRESSURE		
16	AIR TEST PRESSURE (with soap suds)		
17	BASIC WIND SPEED		
18	SEISMIC CRITERIA		
19	CYCLIC SERVICE		
20	CREEP RANGE		
21	NATURE OF CONTENTS		
22	MAX. OPERATING STATIC HEAD		
23	INTERNAL FINISH		
24	INTERNAL COATING		
25	EXTERNAL FINISH		
26	EXTERNAL PAINTING		
27	INSULATION		
28	FIREPROOFING (by site contractor)		
29	INSPECTION AUTHORITY		
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	MATERIAL SPECIFICATIONS				
37	HEADS & SHELL		STIFFENING RINGS		
38	NOZZLE: FLANGES		SUPPORT SKIRT		
39	NOZZLE: NECKS		EXT. ATTACHMENTS		
40	BOLTING: EXTERNAL		FLANGE FINISH		
41	BOLTING: INTERNAL				
42	GASKETS: EXTERNAL		MATERIAL CERTS		
43	GASKETS: INTERNAL				
44	FIXED INTERNALS				
45	REMOVABLE INT'LS				
46					
47					

	CAPACITY & WEIGHTS				
49	ESTIM'D WEIGHT FABRICATED (EMPTY)	kg	S.G. OF OPERATING FLUID		
50	ESTIM'D WEIGHT INTERNALS	kg	VOLUME OF OPERATING FLUID	m^3	
51	ESTIM'D WEIGHT INSULATION	kg	WEIGHT OF OPERATING FLUID (MAX)	kg	
52	ESTIM'D WEIGHT LADDERS & PLATFORMS	kg	Vessel CAPACITY (GROSS) - APPROXIMATE	m^3	
53	ESTIM'D WEIGHT INSTALLED (EMPTY)	kg			
54	ESTIM'D WEIGHT INSTALLED OPERATING	kg			
55	ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID	kg			
56	ESTIM'D WEIGHT INSTALLED FULL OF WATER	kg			

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

Rev

BRANCH DUTY

Ref	Service	DN	No Off	Flange	PN	Standout	Notes

Nozzle standouts are measured from Vessel centre-line to flange face.

ADDITIONAL SPECIFICATIONS & STANDARDS

NOTES

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

NOTES (Continued)

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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Mechanical Datasheet - Aborber System	DOC NO. Not Applicable
	PAGE NO. 44 of 45
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

				Rev
1			**INSPECTION TASKS**	
2	**INSPECTION TASKS**			
3	All tasks identified below shall be included on the vendors quality plan.			
4	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
5	These certificates shall be included in the Vessel certification dossier.			
6	1.	C	Review material certificates (EN-10204. 3.1 standard.)	
7	2.	-	Check certified chemical & mechanical properties of all materials.	
8	3.	-		
9	4.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding	
10	5.	-	procedures.	
11	6.	C	Check method of distribution of welding consumables and means of storage on the shop floor..	
12	7.	-		
13	8.	C	Check weld procedures and qualifications.	
14	9.	C	Check weld map and welders qualifications.	
15	10.	-		
16	11.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast	
17	12.	-	numbers.	
18	13.	-		
19	14.	C	Identify formed roof plates and check shape, dimensions and thickness.	
20	15.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas	
21	16.	-	susceptible to thinning.	
22	17.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
23	18.	-		
24	19.	C	Inspect assembly including alignment of main seams prior to welding .	
25	20.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and	
26	21.	-	location of bolt holes.	
27	22.	-		
28	23.	C	Check weld preparation, material identification and stamping.	
29	24.	-		
30	25.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
31	26.	-		
32	27.	C	Inspect finished welds for freedom from undercut and surface defects.	
33	28.	-		
34	29.	C	Check dimensions to approved drawing and tolerances given in specifications and code.	
35	30.	-		
36	31.	-		
37	32.	C	Inspect internal finish and weld dressing.	
38	33.	-		
39	34.	C	Check DPI procedure and operaters qualifications and survey the testing of all Vessel welds.	
40	35.	C	Ensure radiography of Vessel welds is in accordance with approved drawing and specified code. Review	
41	36.	-	radiographs.	
42	37.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
43	38.	C	Witness vacuum box testing of bottom plate welds.	
44	39.	-		
45	40.	-	Gauge check Vessel internal diameter.	
46	41.	C	Check test set up and witness hydraulic test.	
47	42.	-		
48	43.	C	Check that the Vessel is clean and dry before sealing	
49	44.	C	Check general workmanship and completeness of supply.	
50	45.	C	Check Paint or other finishes for continuity and against specification.	
51	46.	C	Check copy of nameplate	
52	47.	C	Check Equipment packed and protected ready for shipment	
53	48.	-	Review Dossier	
54				
55				
56				
57				

Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet Amine 1 Tank

Mechanical Datasheet Amine 1 Tank	DOC. NO. Not Applicable
	PAGE NO. 2 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT		ISSUE				
LOCATION		QUALITY LEVEL				
PLANT		DATE				

			Rev
1	**DESIGN & OPERATING DATA (TANK)**		
2	APPLICATION STANDARD (DESIGN CODE)		
3	TANK DESIGN PRESSURE @ TEMPERATURE (MAX/MIN)		
4	TANK OPERATING PRESSURE @ TEMPERATURE		
5	TANK CORROSION/EROSION ALLOWANCE (internal / external)		
6	STRESS RELIEF/PWHT		
7	RADIOGRAPHY		
8	VACUUM BOX TESTING		
9	JOINT COEFFICIENT		
10	HYDRAULIC TEST PRESSURE		
11	AIR TEST PRESSURE (with soap suds)		
12	BASIC WIND SPEED		
13	SEISMIC CRITERIA		
14	CYCLIC SERVICE		
15	CREEP RANGE		
16	NATURE OF CONTENTS (AMINE SOLUTION)		
17	MAX. OPERATING STATIC HEAD		
18	INTERNAL FINISH		
19	INTERNAL COATING		
20	EXTERNAL FINISH		
21	EXTERNAL PAINTING		
22	INSULATION		
23	FIREPROOFING (by site contractor)		
24	INSPECTION AUTHORITY		
25	**DESIGN & OPERATING DATA (COIL)**		
26	COIL DESIGN PRESSURE @ TEMPERATURE (MAX/MIN)		
27	COIL OPERATING PRESSURE @ TEMPERATURE		
28	COIL CORROSION/EROSION ALLOWANCE (internal / external)		
29	COIL DESIGN CODE		
30	STRESS RELIEF/PWHT		
31	RADIOGRAPHY		
32	JOINT COEFFICIENT		
33	HYDRAULIC TEST PRESSURE		
34	NATURE OF CONTENTS (COIL)		
35	COIL CONTENTS / PED FLUID PHASE & GROUP No.		

36	**MATERIAL SPECIFICATIONS**				
37	SHELL		STIFFENING RINGS		
38	ROOF		ANCHOR CHAIRS:		
39	BOTTOM PLATE		EXT. ATTACHMENTS		
40	NOZZLE: FLANGES		FLANGE FINISH		
41	NOZZLE: NECKS				
42	BOLTING: EXTERNAL		MATERIAL CERTS		
43	BOLTING: INTERNAL				
44	GASKETS: EXTERNAL		COIL PIPE		
45	GASKETS: INTERNAL		COIL FLANGES		
46	FIXED INTERNALS				
47	REMOVABLE INT'LS				

48	**CAPACITY & WEIGHTS**					
49	ESTIM'D WEIGHT FABRICATED (EMPTY)	kg	S.G. OF OPERATING FLUID (TANK)			
50	ESTIM'D WEIGHT INTERNALS	kg	VOLUME OF OPERATING FLUID	m^3		
51	ESTIM'D WEIGHT INSULATION	kg	WEIGHT OF OPERATING FLUID (MAX)	kg		
52	ESTIM'D WEIGHT LADDERS & PLATFORMS	kg	TANK CAPACITY (GROSS) - APPROXIMATE	m^3		
53	ESTIM'D WEIGHT INSTALLED (EMPTY)	kg	S.G. OF OPERATING FLUID (COIL)			
54	ESTIM'D WEIGHT INSTALLED OPERATING	kg				
55	ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID	kg				
56	ESTIM'D WEIGHT INSTALLED FULL OF WATER	kg				

Mechanical Datasheet Amine 1 Tank	DOC. NO. Not Applicable
	PAGE NO. 3 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT		ISSUE				
LOCATION		QUALITY LEVEL				
PLANT		DATE				

	Rev
1	**BRANCH DUTY**

Ref	Service	DN	No Off	Flange	PN	Standout	Notes

Nozzle standouts are measured from tank centre-line to flange face.

ADDITIONAL SPECIFICATIONS & STANDARDS	

NOTES

CLIENT		ISSUE				
LOCATION		QUALITY LEVEL				
PLANT		DATE				

NOTES (Continued)

Mechanical Datasheet Amine 1 Tank	DOC. NO. Not Applicable
	PAGE NO. 5 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT		ISSUE				
LOCATION		QUALITY LEVEL				
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Mechanical Datasheet Amine 1 Tank	DOC. NO. Not Applicable
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CLIENT		ISSUE				
LOCATION		QUALITY LEVEL				
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				Rev
1			**INSPECTION TASKS**	
2	**INSPECTION TASKS**			
3	All tasks identified below shall be included on the vendors quality plan.			
4	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
5	These certificates shall be included in the tank certification dossier.			
6	1.	C	Review material certificates (EN-10204. 3.1 standard.)	
7	2.	-	Check certified chemical & mechanical properties of all materials.	
8	3.	-		
9	4.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
10	5.	C	Check method of distribution of welding consumables and means of storage on the shop floor.	
11	6.	-		
12	7.	C	Check weld procedures and qualifications.	
13	8.	C	Check weld map and welders qualifications.	
14	9.	-		
15	10.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
16	11.	-		
17	12.	C	Identify formed roof plates and check shape, dimensions and thickness.	
18	13.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.	
19	14.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
20	15.	-		
21	16.	C	Inspect assembly including alignment of main seams prior to welding.	
22	17.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.	
23	18.	-		
24	19.	C	Check weld preparation, material identification and stamping.	
25	20.	-		
26	21.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
27	22.	-		
28	23.	C	Inspect finished welds for freedom from undercut and surface defects.	
29	24.	-		
30	25.	C	Check dimensions to approved drawing and tolerances given in specifications and code.	
31	26.	-		
32	27.	C	Inspect internal finish and weld dressing.	
33	28.	-		
34	29.	C	Check DPI procedure and operators qualifications and survey the testing of all tank welds.	
35	30.	C	Ensure radiography of tank welds is in accordance with approved drawing and specified code. Review radiographs.	
36	31.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
37	32.	C	Witness vacuum box testing of bottom plate welds.	
38	33.	-		
39	34.	-	Gauge check tank internal diameter.	
40	35.	C	Check test set up and witness hydraulic test.	
41	36.	-		
42	37.	C	Check that the tank is clean and dry before sealing	
43	38.	C	Check general workmanship and completeness of supply.	
44	39.	C	Check Paint or other finishes for continuity and against specification.	
45	40.	C	Check copy of nameplate.	
46	41.	C	Check Equipment packed and protected ready for shipment.	
47	42.	-	Review Dossier.	
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Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet Amine Solution Holding Tank

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

			Rev
1	**DESIGN & OPERATING DATA (TANK)**		
2	APPLICATION STANDARD (DESIGN CODE)		
3	DESIGN PRESSURE @ TEMPERATURE (MAX/MIN)		
4	OPERATING PRESSURE @ TEMPERATURE		
5	CORROSION/EROSION ALLOWANCE (internal / external)		
6	STRESS RELIEF/PWHT		
7	RADIOGRAPHY		
8	VACUUM BOX TESTING		
9	JOINT COEFFICIENT		
10	HYDRAULIC TEST PRESSURE		
11	AIR TEST PRESSURE (with soap suds)		
12	BASIC WIND SPEED		
13	SEISMIC CRITERIA		
14	CYCLIC SERVICE		
15	CREEP RANGE		
16	NATURE OF CONTENTS		
17	MAX. OPERATING STATIC HEAD		
18	INTERNAL FINISH		
19	INTERNAL COATING		
20	EXTERNAL FINISH		
21	EXTERNAL PAINTING		
22	INSULATION		
23	FIREPROOFING (by site contractor)		
24	INSPECTION AUTHORITY		
25	**DESIGN & OPERATING DATA (COIL)**		
26	COIL DESIGN PRESSURE @ TEMPERATURE (MAX/MIN)		
27	COIL OPERATING PRESSURE @ TEMPERATURE		
28	COIL CORROSION/EROSION ALLOWANCE (internal / external)		
29	COIL DESIGN CODE		
30	STRESS RELIEF/PWHT		
31	RADIOGRAPHY		
32	JOINT COEFFICIENT		
33	HYDRAULIC TEST PRESSURE		
34	NATURE OF CONTENTS (COIL)		
35	COIL CONTENTS / PED FLUID PHASE & GROUP No.		
36	**MATERIAL SPECIFICATIONS**		

37	SHELL		STIFFENING RINGS	
38	ROOF		ANCHOR CHAIRS:	
39	BOTTOM PLATE		EXT. ATTACHMENTS	
40	NOZZLE: FLANGES		FLANGE FINISH	
41	NOZZLE: NECKS			
42	BOLTING: EXTERNAL		MATERIAL CERTS	
43	BOLTING: INTERNAL			
44	GASKETS: EXTERNAL		COIL PIPE	
45	GASKETS: INTERNAL		COIL FLANGES	
46	FIXED INTERNALS			
47	REMOVABLE INT'LS			

48	**CAPACITY & WEIGHTS**				
49	ESTIM'D WEIGHT FABRICATED (EMPTY)	kg	S.G. OF OPERATING FLUID (TANK)		
50	ESTIM'D WEIGHT INTERNALS	kg	VOLUME OF OPERATING FLUID (MAX)	m^3	
51	ESTIM'D WEIGHT INSULATION	kg	WEIGHT OF OPERATING FLUID (MAX)	kg	
52	ESTIM'D WEIGHT LADDERS & PLATFORMS	kg	TANK CAPACITY (GROSS) - APPROXIMATE	m^3	
53	ESTIM'D WEIGHT INSTALLED (EMPTY)	kg	S.G. OF OPERATING FLUID (COIL)		
54	ESTIM'D WEIGHT INSTALLED OPERATING	kg			
55	ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID	kg			
56	ESTIM'D WEIGHT INSTALLED FULL OF WATER	kg			

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

BRANCH DUTY

Ref	Service	DN	No Off	Flange	PN	Standout	Notes	Rev

Nozzle standouts are measured from tank centre-line to flange face.

ADDITIONAL SPECIFICATIONS & STANDARDS

NOTES

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

NOTES (Continued)

Mechanical Datasheet Amine Solution Holding Tank	DOC. NO. Not Applicable
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Mechanical Datasheet Amine Solution Holding Tank	DOC. NO. Not Applicable
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Client:	**To be determined**
Plant Location:	**To be specified**

Centrifugal Pumps General Specification

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Aker CleanCarbon™

AkerSolutions™

part of Aker

Contents

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1. Introduction

1.1 This specification relates to the general design, supply and testing of centrifugal pumps for the Carbon Capture Demonstration Project. Specific data for each pump is given in the appropriate data sheets.

1.2 The Vendor shall advise of any non-compliance with this specification and/or data sheets. The Vendor shall also advise of any exclusion, which is not included with the Vendor's scope of supply.

2. Location

2.1 The Plant is to be built at Longannet, UK.

2.2 The pumps will be situated outdoors in a coastal location; the operating environment will be damp and corrosive with airborne dust.

2.3 The hazardous area classification where applicable is stated on each pump data sheet.

3. Duty Requirements

3.1 The Vendor shall ensure that the pumps perform the rated duties and any other specified duty set out in the individual pump data sheets.

3.2 It is the Vendor's responsibility to bring promptly to the Purchaser's attention, any discrepancies that are found to exist between this specification and the individual pump data sheets. In the event of any conflicting requirements the pump data sheets shall govern.

4. General Requirements

4.1 It is the intention of this specification to allow the choice of pumps from different Vendors offering pumps built to well known international standards. In general pumps and their auxiliaries shall be to ISO 5199 or ISO 13709 as modified by any referenced Specifications and by the individual pump data sheets. The preferred pump specification will be as specified on the specific pump data sheet.

4.1.1 Deviations from the above stated specifications will also be considered on their merits but these must be clearly stated in the Vendor's offer. Many of the duties for this process are slurry applications, which may well require other deviations.

4.2 The Vendor shall submit a Technical summary sheet with his bid for each pump offered.

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4.3 Noise Level

4.3.1 The noise levels must meet the acceptable levels specified for the project.

4.3.2 If the pump and driver package does not meet the acceptable levels, the Vendor shall offer an option for an acoustic enclosure (and ventilation fan if required) to enclose the components developing a high noise level.

5. Design Requirements

5.1 General

5.1.1 Screw plugs are not acceptable in the pump casings. Casing drains and where applicable, casing vents shall be welded or screwed and seal welded to the casing. Each drain or vent shall have a welded flange and be fitted with a blank or a suitable isolation valve with blank flange where specified on the pump data sheet.

5.1.2 Pumps that are required to run in parallel shall have a stable characteristic, with identical shut off heads to within 0% to +2%. The curve shall have a steady head rise of 20% from the rated duty point to the shut off point.

5.1.3 Unless specified in the pump datasheet, the pumps shall be suitable for 8500 hours per annum continuous operation with up to 100 starts per annum.

5.1.4 The finish on the gasket surface of pads and flanges is to be medium turned in the range of 3.2 to 6.3 microns Ra. This corresponds to ISO 1302 roughness grade N9 to N8.

5.1.5 The Vendor shall state in his offer the minimum continuous flow requirement for each pump.

In addition, the Vendor shall state the continuous operating range for each pump, from minimum to maximum flow.

5.1.6 The separation margin of encroachment from all lateral modes shall be at least 20% over maximum continuous speed for rigid rotor systems.

5.1.7 Replaceable wear rings shall be fitted where impeller diameters exceed 150 mm and replaceable impeller neck rings where diameters exceed 250 mm. All wear rings shall be a press fit on or in their respective component and positively locked against rotation.

5.1.8 The pump unit and all removable components greater than 10 kg in weight shall be fitted with suitable lifting lugs or eyes to facilitate all erection and maintenance tasks.

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5.2 Bearings

5.2.1 Bearings shall have a rated L10 life of at least 25,000 hours and not less than 16,000 hours at maximum load.

5.2.2 The preferred bearing arrangement is one double row angular contact bearing for heavy thrust loads in either direction and radial loads plus one single row angular contact bearing or one single row roller bearing for the main radial loads. The use of bearings capable of taking thrust loadings as a floating bearing shall be avoided.

5.2.3 Plastic cage bearings shall not be used.

5.2.4 Oil lubricated bearing housings shall be equipped with labyrinth seals. Oil seals shall be replaceable without major dismantling of the pump.

5.2.5 Oil lubricated bearing housings shall be fitted with a means of drainage, a visual oil level indicator and a constant level oiler.

5.2.6 Grease lubrication may be offered where re-lubrication intervals are no less than 1000 hours. Where pumps are grease lubricated and re-lubrication interval is less than 2 years they shall be suitable for re-greasing on line (i.e. during operation).

5.2.7 For pumps with grease lubrication, brass caged rolling element bearings shall not be used.

5.2.8 Where sleeve bearings are used, bearing shells shall be replaceable without the need to remove the shaft.

5.3 Baseplates, Couplings & Motors

5.3.1 Pump baseplates shall be of heavy-duty construction sufficiently rigid to be mounted without grouting and shall also satisfy the shaft displacement criteria of the relevant pump specification at the pump coupling for the allowable piping loads.

5.3.2 The Vendor shall state the motor manufacturer and take into account any costs incurred by the Vendor in ordering and fitting motors from a nominated manufacturer, when specified.

5.3.3 Motors shall be sized for the greater of the following power requirements:-

5.3.3.1 The nearest standard power rating higher than the maximum power requirement along the complete characteristic curve for the rated impeller.

5.3.3.2 For absorbed powers of 0 to 55kW the motor power shall be the nearest standard power rating higher than the predicted absorbed power plus 25% up to 18.5kW and 15% for 18.5kW up to 55kW.

5.3.3.3 Motors above 55kW shall as a minimum be the next standard power rating higher than the predicted absorbed power plus 10%. The pump Vendor shall declare what (if any) correction to the clean water performance of the pump is required to cope with any potential head or efficiency decrease in his opinion.

5.3.4 Couplings shall be of the non-lubricated type. Metal (SS) diaphragm or rubber tyre type couplings are required.

5.3.5 Coupling guards of the non-sparking type and conforming to project requirements shall be provided.

5.4 Impellers

5.4.1 All pumps shall be offered with impellers of no greater than 90% of maximum diameter. Spare impellers shall be supplied at 100% of maximum diameter.

5.4.2 Impeller retaining nuts or screws shall not have any thread exposed to the pumped fluid. The impeller retaining nut/screw shall be mechanically locked or maintained tight by virtue of the normal direction of rotation.

5.4.3 Balancing shall be achieved by machining, not by the addition of weights.

5.5 Pump Materials

5.5.1 Materials of construction of components that can be in contact with the process fluid shall be suitable for the duty.

5.5.2 Pump shafts shall be of solid one-piece construction. Where a Vendor intends to offer anything else (e.g. shaft corrodible by process fluid but protected by a sleeve) he shall clearly state this in his offer and must justify his reasons for such a proposal.

5.5.3 The Vendor shall provide a list of all gaskets and 'O' ring specifications proposed for the pumps with his offer. Asbestos containing materials are not permitted.

5.6 Pump Shaft Sealing

5.6.1 It is envisaged that all pumps will be sealed by mechanical seals. Cartridge seals with integral sleeves shall be offered, and the pump stuffing box details shall be such as to allow the fitment of ISO 21049 or similar size cartridge mechanical seals.

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5.6.2 Since the cartridge seal will have a shaft sleeve, preference will be given to those options that do not require a separate shaft sleeve.

5.6.3 Magnetic drive and canned pump options may be considered for suitable applications. Magnetic drive pumps shall be supplied with a means of secondary containment and a liquid sensor to detect any leakage.

5.6.4 Gland packing shall not be used for pump sealing duties with the exception of standby water pumps for Emergency Fire Water Service.

5.7 Mechanical Seals

5.7.1 Scope

5.7.1.1 This section is for general pump mechanical seals. It is not intended to preclude other solutions and Vendors should be prepared to offer other solutions as an option if they believe there are technical or commercial advantages in so doing.

5.7.1.2 When a nominated seal supplier is specified any additional costs incurred by the pump Vendor in ordering, fitting seals and supplying engineering data & documentation from the nominated seal Vendor shall be included in his bid.

5.7.2 Seal Types

5.7.2.1 Seal seat and face materials shall be of proven design for the duty and appropriate for the process conditions. A typical selection for a standard mechanical seal would be a silicon free sintered silicon carbide seat with a resin impregnated carbon rotating face.

5.7.2.2 Where seals use a PTFE wedge, or where a dynamic 'O'-ring is used against the seal sleeve, the sleeve shall be hard faced, and Vendor shall provide a specification for the hard facing.

5.7.2.3 In the event that double mechanical seals are used with different elastomer specifications for the inboard and outboard seals, the seals shall be so designed that the 'O'-rings cannot be installed in the wrong position (e.g. by having different sized seals and 'O'-rings between inboard and outboard or by using different coloured 'O' rings).

5.7.2.4 The inboard seal of all double mechanical seals shall have reverse pressure capability, and the Vendor shall state the amount of reverse pressure capability for each duty.

5.7.2.5 Shaft float shall be compatible with the seal manufacturer's tolerances.

5.7.2.6 Wherever possible single mechanical seals shall be interchangeable with the inboard seal of double mechanical seals. Based on this the Vendor should optimise and quote for spares.

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5.7.2.7 Where seals are flushed with a sealing fluid, the seal faces should remain closed in the event of loss of the flushing fluid.

5.8 Sealant Systems

5.8.1 Where double seals are specified a “Plan 53” sealant system shall be supplied mounted from the pump baseplate.

5.8.2 If cooling of the seal flush fluid is required this shall be by an air-cooled heat exchanger mounted from the pump baseplate. Should an air-cooled heat exchanger not satisfy the required duty a water cooled heat exchanger fabricated from Titanium may be supplied.

5.8.3 Seal Flush fluid will be demineralised water.

5.8.4 Seal flush system including piping and instruments shall be adequately supported from the pump base plate by the Vendor. The location of Seal Flush system components shall not restrict access to the pump casing for normal maintenance purposes.

5.8.5 The flush connections shall be such that the inlet is at the lowest point and the exit at the highest point of the seal. The seal housing flush connections shall be rated for the pressure of the seal flush system and be compatible with the process fluid being sealed. Details shall be submitted for review by the Purchaser. Screwed fittings shall only be used for the connection to the seal housing.

5.9 Electrical Supply

The Vendor shall ensure that electrical equipment supplied with the pumps is suitable for the electrical supplies available on site.

6. Scope of Supply

The Vendor's scope of supply shall consist of but not necessarily be limited to:-

6.1 Pump and Baseplate / Baseframe.

6.2 Drive system complete with motor (from nominated manufacturer if specified).

6.3 Lube oil system (if required).

6.4 Pump seal (purchased from nominated seal Vendor if specified).

6.5 Seal Flush System.

6.6 “Special” Foundation bolts.

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6.7 Any special tools for maintenance and/or erection, which shall include any special lifting tackle.

6.8 Drawings and documentation.

6.9 Instrumentation (if required) wired to terminal box suitable for the specified area classification (junction box shall be included).

6.10 Export packing.

6.11 Agreed spares as identified in the purchase order.

7. Exclusions

The following are excluded from the Vendor's scope:-

7.1 Motor starters.

7.2 Foundations and civil works.

7.3 Offloading and erection.

7.4 Cabling and wiring other than between instruments and terminal box (es).

7.5 First and subsequent fill of lubricants (However Vendor to advise recommended type and quantity)

8. Inspection and Testing

8.1 Inspection, testing and certification of equipment shall be in accordance with the task descriptions identified on the individual Pump Data Sheets.

8.2 All pumps shall be subject to a hydrostatic pressure test and a performance test in the Vendor's shop prior to despatch. Where a witnessed test or inspection is requested, the Vendor shall give at least 10 working days notice to the Purchaser's Inspection Department.

8.3 The water used for hydrostatic testing and flushing, including the performance testing shall have a maximum chloride content of 30 ppm Cl. The Vendor shall certify the chloride content of all test water and include a copy of the certificate in the certification dossier.

8.4 Pump castings requiring weld repair shall be non-destructively tested after such weld repair. All weld repairs shall be carried out using duly authorised weld procedures that have been reviewed by the Purchaser, and major repairs shall only be carried out after

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approval from the Purchaser. The casting must be subjected to a solution heat-treatment according to the relevant specification after completion of weld repairs. Weld maps of all repaired areas shall be supplied.

8.5 Any pump, where NPSHR is within 1.0m of the stated NPSHA on the pump data sheet, shall be subject to a NPSH test at the Vendor's works.

8.6 Pump casings and associated pipework shall be pressure tested to the standard margin over the pump casing design pressure and not to the standard margin above the maximum pressure on the pump data sheet.

9. Data Required from Vendor

9.1 Relevant drawings and documentation shall be provided by the Vendor in accordance with the requirements of the Purchaser's Vendor Documentation Schedule.

9.2 The Vendor shall confirm that drawings and information shall be submitted by the dates indicated.

10. Painting and Corrosion Protection

10.1 All items shall be finish painted in accordance with the Vendor's standard. Proposed painting procedure to be submitted for approval by the Purchaser.

10.2 Finished units shall be prepared for sea transport and long term outdoor storage (up to 9 months) for in a chemical plant environment.

11. Process Guarantees

11.1 The Vendor shall guarantee that his equipment will perform the duties specified in the individual pump data sheets.

12. Deviations

12.1 It is not the intention to exclude equipment which is not strictly in accordance with this Specification. If not in strict accordance then the Vendor shall include a list under the heading "Deviations". If no such list is included then the Vendor's offer shall be understood to be in strict compliance with the Specification.

13. References

This specification refers to the following documents: -

ISO 5199 (2002)	Technical Specification for Centrifugal Pumps.
ASTM E446 – 10 (2010)	Standard Reference Radiographs for Steel Castings.
ISO 13709 (2003)	Centrifugal Pumps for General Refinery Service.
ISO 1302 (2002)	Geometrical Product Specifications (GPS) – Indication of Surface Texture in Technical Product Documentation.
ASTM A351 / A351M (2010)	Specification for Steel Castings, Austenitic, for Pressure Containment Parts.
ISO 21049 (2004)	Pumps – Shaft Sealing Systems for Centrifugal & Rotary Pumps

Client:	**To be determined**
Plant Location:	**To be specified**

Item: Mechanical Datasheet CO2 Compressor Anti-Surge Cooler

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION		UNITS	DATA				
1	**DESIGN & OPERATING DATA**							**Rev**
2				**SHELLSIDE (HOT FLUID)**		**TUBESIDE (COLD FLUID)**		
3				**In**	**Out**	**In**	**Out**	
4	**FLUID**							
5	**TOTAL FLUID FLOW**		**kg/hr**					
6	**VAPOUR FLOW**		**kg/hr**					
7	**LIQUID FLOW**		**kg/hr**					
8	**LIQUID DENSITY**		**kg/m³**					
9	**LIQUID SPECIFIC HEAT**		**kJ/kg°C**					
10	**LIQUID VISCOSITY**		**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**		**W/m°C**					
12	**LIQUID SURFACE TENSION**		**Dyn/cm**					
13	**LATENT HEAT**		**kJ/kg**					
14	**VAPOUR DENSITY**		**kg/m³**					
15	**VAPOUR SPECIFIC HEAT**		**kJ/kg°C**					
16	**VAPOUR VISCOSITY**		**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**		**W/m°C**					
18	**MOLECULAR WEIGHT**							
19	**OPERATING TEMPERATURE**		**°C**					
20	**OPERATING PRESSURE**		**Bar a**					
21	**PRESSURE DROP**	**Allow/Calc**	**bar**					
22	**No. OF PASSES**							
23	**VELOCITY OF FLOW**		**m/s**					
24	**FOULING ALLOWANCE**		**m²C/W**					
25	**MAP (DESIGN PRESSURE)**		**bar g**					
26	**TEST PRESSURE**	**New/Corroded**	**bar g**					
27	**DESIGN TEMPERATURE**		**°C**					
28	**HEAT DUTY**		**MW**					
29	**H.T. COEFFICIENT**	**Required / Actual**	**W/m²C**					
30	**LMTD**		**°C**					
31								
32								
33	**CONSTRUCTION & MATERIALS**							
34	**DESIGN CODES:**							
35	**SHELL PER UNIT:**	**TYPE:**		**SERIES:**	**PARALLEL:**			
36	**SURFACE PER UNIT:**			**SURFACE PER SHELL:**				
37	**PED FLUID PHASE & GROUP No:**	**HOT SIDE:**		**COLD SIDE:**				
38	**PED EQUIPMENT CATEGORY:**			**PED CONFORMITY MODULES:**				
39	**TUBE:**		**No Off:**	**THICKNESS**				
40	**TUBE O/DIA:**	**LENGTH:**	**PITCH:**					
41	**SHELL:**	**I/DIA:**	**SHELL COVER:**					
42	**CHANNEL:**		**CHANNEL COVER:**					
43	**STATIONARY TUBESHEET:**			**FLOATING HEAD COVER:**				
44	**FLOATING TUBESHEET:**		**LONGITUDINAL BAFFLES:**					
45	**SUPPORT BAFFLES:**		**TYPE:**	**FLOW:**				
46	**BAFFLE CUT:**	**PITCH:**	**No OFF:**					
47	**GASKETS:** **Shellside:**		**CORROSION ALLOWANCE:**	**Shellside:**				
48	**Tubeside:**			**Tubeside:**				
49	**BRANCHES:** **Shellside:**		**INLET:**	**OUTLET:**	**RATING:**			
50	**Tubeside:**		**INLET:**	**OUTLET:**	**RATING:**			
51	**STRESS RELIEVE:** **(Shellside / Tubeside):**							
52	**RADIOGRAPHY:** **(Shellside / Tubeside):**							
53	**INSPECTION BY:**							
54								
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION		UNITS	DATA			
1	**DESIGN & OPERATING DATA**						
2				**SHELLSIDE (HOT FLUID)**		**TUBESIDE (COLD FLUID)**	
3				**In**	**Out**	**In**	**Out**
4	**FLUID**						
5	**TOTAL FLUID FLOW**		**kg/hr**				
6	**VAPOUR FLOW**		**kg/hr**				
7	**LIQUID FLOW**		**kg/hr**				
8	**LIQUID DENSITY**		**kg/m³**				
9	**LIQUID SPECIFIC HEAT**		**kJ/kg°C**				
10	**LIQUID VISCOSITY**		**cP**				
11	**LIQUID THERMAL CONDUCTIVITY**		**W/m°C**				
12	**LIQUID SURFACE TENSION**		**Dyn/cm**				
13	**LATENT HEAT**		**kJ/kg**				
14	**VAPOUR DENSITY**		**kg/m³**				
15	**VAPOUR SPECIFIC HEAT**		**kJ/kg°C**				
16	**VAPOUR VISCOSITY**		**cP**				
17	**VAPOUR THERMAL CONDUCTIVITY**		**W/m°C**				
18	**MOLECULAR WEIGHT**						
19	**OPERATING TEMPERATURE**		**°C**				
20	**OPERATING PRESSURE**		**Bar a**				
21	**PRESSURE DROP**	**Allow/Calc**	**bar**				
22	**No. OF PASSES**						
23	**VELOCITY OF FLOW**		**m/s**				
24	**FOULING ALLOWANCE**		**m²C/W**				
25	**MAP (DESIGN PRESSURE)**		**bar g**				
26	**TEST PRESSURE**	**New/Corroded**	**bar g**				
27	**DESIGN TEMPERATURE**		**°C**				
28	**HEAT DUTY**		**MW**				
29	**H.T. COEFFICIENT**	**Required / Actual**	**W/m²C**				
30	**LMTD**		**°C**				
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

APPLICABLE DESIGN CODES & STANDARDS:

TUBESHEET & BELLOWS DESIGN DATA

The following coincident pressures and their coincident temperatures are possible and must be used in the design of the tubesheets and the determination of bellows requirements.
The use of differential pressure design methods is not permitted.

	Case No.	Minimum Design Cycle Life of Bellows	Shellside Pressure [barg]	Shell Metal Temp. [°C]	Tubeside Pressure [barg]	Tube Metal Temp. [°C]
NORMAL OPERATION	1					
SHELLSIDE FLOW FAILURE	2					
TUBESIDE FLOW FAILURE	3					
BELLOWS EXPANSION	4					
BELLOWS COMPRESSION	5					
START-UP	6					
SHUT-DOWN	7					
EMERGENCY CONDITIONS	8					
EMERGENCY CONDITIONS	9					
EMERGENCY CONDITIONS	10					
SHELLSIDE HYDROTEST	11					
TUBESIDE HYDROTEST	12					

NOTES

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	NOTES (Continued)
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

SKETCH

Ref	Service	Size	Rating	Standout (mm)	Remarks

Drawing not to scale
All dimensions in mm

ESTIMATED WEIGHTS (kg)	
Fabricated	
Operating	
Full of water	

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

SKETCH

TUBESHEET LAYOUT

Drawing not to scale
All dimensions in mm

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

SKETCH

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

INSPECTION TASKS

INSPECTION TASKS:

All tasks identified below shall be included on the vendors quality plan. Where inspection task numbers have a suffix "C", a certificate shall be supplied. These certificates shall be included in the exchanger certification dossier. The quality plan shall also include all additional inspection tasks required by the Independent Third Party Inspection Agency.

MC1	**C**	Review material certificates (EN-10204, 3.1 standard).
MC2	**C**	Check certified chemical & mechanical properties of all materials.
MC3	**C**	Check that ultrasonic testing of base plate has been carried out before cladding.
MC4	**C**	Check that bond strength tests and ultrasonic testing of cladding bond have been carried out.
MC5	**C**	Check cladding thickness.
WRod1		Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.
WRod2		Check method of distribution of welding consumables and means of storage on the shop floor.
WeldPr	**C**	Check weld procedures and qualifications.
Welder	**C**	Check weld map and welders qualifications for shell and tube end welds.
TrHtNos		Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.
Head	**C**	Identify heads and check shape, dimensions and thickness.
Plate		Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.
Lamin	**C**	Inspect edges of material for weld preparation and for discontinuities and laminations.
Fitup		Inspect assembly including alignment of main seams prior to welding.
Nozzles		Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.
Coupon1		Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material identification and stamping.
Welding		Survey welding and back gouging and ensure that approved procedures are followed.
Tube holes		Check tube holes are free from burrs and the finish, grooving and tolerances are in accordance with the approved drawing and code.
Tubes		Check that the tubes are free from surface defects and thinning after expanding and witness soapy water test of tube end welds.
Baffles		Check baffles to approved drawing and that the shell is correctly sized and free of obstructions for tube bundle insertion.
Coupon2	**C**	Witness welding of test plates and review test results.
InspWeld	**C**	Inspect finished welds for freedom from undercut and surface defects.
DimChk	**C**	Check dimensions to approved drawing and specified tolerances given in TEMA.
IntFinish	**C**	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.
MPT	**C**	Check MPT procedure and operators qualifications and survey the testing of all exchanger welds.
RT	**C**	Ensure radiography of exchanger welds is in accordance with approved drawing and specified code. Review radiographs.
UT	**C**	Witness ultrasonic examination of welds and review reports.
PWHT1	**C**	Check PWHT procedure for exchanger. Inspect thermocouple certificates and attachment. Check final temperature charts.
preHydrT	**C**	Witness pre-final-hydraulic test before titanium battons are installed. Check test set up and pressure gauge certificates.
Weld-Ti		Survey welding of battens, nozzle inserts and internals and ensure that approved procedures are followed.
RT-Ti	**C**	Witness radiographic technique test for titanium.
IntFinish	**C**	Inspect internal finish, weld dressing and shell/nozzle radii of flush nozzles.
pPWHT	**C**	Check pre-PWHT of titanium nozzle inserts and other welded titanium sub-assemblies.
PWHT2	**C**	Check PWHT procedure for Ti welds. Inspect thermocouple certificates and attachment. Check final temperature charts.
HydrT	**C**	Witness hydraulic test. Check test set up and pressure gauge certificates. Check that the exchanger is clean and dry after testing.
	C	Check Hot Gas Cyle Test Procedure, Inspect thermocouple certificates and attachment. Check final temperature charts.
DPT-Ti	**C**	Check DPT procedure and operators qualifications and survey the testing of internal Ti welds after the Hot Gas Cycle Test.
HelT	**C**	Check that helium test is carried out in line with the approved procedure and review results.
Final-1	**C**	Check that the equipment is clean and dry before sealing.
Final-2	**C**	Check general workmanship and completeness of supply.
Final-3	**C**	Check Paint or other finishes for continuity and against specification. (check insulation and cladding)
Final-4	**C**	Check copy of nameplate.
Final-5	**C**	Check Equipment packed and protected ready for shipment.
Final-6		Review Dossier.

Client:	**To be determined**
Plant Location:	**To be specified**

CO_2 Compressor Data Sheet

Project No	
Equipment	**CO_2 Compressor Package**
Equipment No	
Number Off	

	DESCRIPTION	UNITS	DATA				REV.
1	**GENERAL**						
2	Manufacturer						
3	Model / Size						
4	Design / Fabrication Code						
5	Location		INDOORS / OUTDOORS / UNDERCOVER / EXPOSED				
6	Heated / Unheated						
7	Tropicalisation						
8	Winterisation						
9	Height above Grade						
10	Dust						
11	Fumes						
12	**OPERATING CONDITIONS**						
13	Purpose						
14							
15	Operation Mode		CONTINUOUS / INTERMITTENT				
16	Hazardous Area Classification		ZONE GAS GROUP TEMP CLASS DUST HAZARD				
17							
18							
19	Fluid Handled						
20	Fluid Composition						
21							
22							
23							
24							
25							
26							
27	Fluid Properties						
28	Flammable / Explosive / Corrosive / Erosive / Toxic						
29	Average Molecular Weight						
30							
31			Guarantee	Normal	Turndown	Minimum	
32	Delivered Flow	A m^3/h					
33	Mass Flow (Wet)	kg/h					
34	Mass Flow (Dry)	kg/h					
35	**INLET CONDITIONS**						
36	Nominal Pressure	bara					
37	Corrected Pressure	bara					
38	Temperature	°C					
39	Compressibility						
40	Cp/Cv						
41							
42	**DISCHARGE CONDITIONS**						
43	Nominal Pressure Maximum	bara					
44	Normal	bara					
45	Minimum	bara					
46	Corrected Pressure	bara					
47	Temperature	°C					
48	Compressibility						
49	Cp/Cv						
50							
51							
52							
53							
54							
55							

Project No
Equipment **CO2 Compressor Package**
Equipment No
Number Off

	DESCRIPTION	UNITS	DATA						REV.
1	**PERFORMANCE**								
2	Number of Stages								
3	Number of Impellers								
4			1st	2nd	3rd	4th	5th	6th	
5	Speed	rev/min							
6	Diameter	mm							
7	Tip Speed	m/s							
8									
9	Maximum Head @ Rated Speed								
10									
11	Input Speed	rev/min							
12									
13	Maximum Absorbed Power	kW							
14	Specific Absorbed Power per 100 m³/h Gas Delivered	kW							
15									
16	Estimated Surge (At Above Speed)								
17	Acceptance Point								
18	Performance Curve No								
19									
20	**UTILITY REQUIREMENTS**								
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35	**CONNECTIONS**								
36			Type		Rating		Size		
37	Package Suction								
38	Package Discharge								
39	Package Cooling Water Inlet								
40	Package Cooling Water Discharge								
41	Package Seal Gas Inlet								
42	Package Seal Gas Discharge								
43									
44									
45									
46									
47	PERMISSIBLE PIPING FORCES & MOMENTS								
48	FORCES	N	F (X)		F (Y)		F (Z)	F (R)	
49	Suction								
50	Discharge								
51									
52	MOMENTS	Nm	M (X)		M (Y)		M (Z)	M (R)	
53	Suction								
54	Discharge								
55									

Project No
Equipment **CO2 Compressor Package**
Equipment No
Number Off

	DESCRIPTION	UNITS	DATA						REV.
1	**MECHANICAL DATA**								
2	STAGE CASING		1st	2nd	3rd	4th	5th	6th	
3	Split (Vertical/Horizontal)								
4	Construction (Cast/Weld)								
5	Thickness	mm							
6	Corrosion Allowance	mm							
7	Max Working Pressure	barg							
8	Min / Max. Operating Temperature	°C							
9	Design Pressure	barg							
10	Hydrostatic Test Pressure	barg							
11	Design Temperature	°C							
12									
13	IMPELLER								
14	Type (Open/Closed)								
15	Construction (Cast/Weld/Machined)								
16									
17									
18	SHAFT SEAL								
19	Type								
20	Manufacturer								
21	Model Ref								
22									
23	COOLERS Position						Anti-Surge		
24	Type								
25	Heat Transfer Area	m^2							
26	Shell Design Pressure	barg							
27	Shell Design Temperature	°C							
28	Tube Design Pressure	barg							
29	Tube Design Temperature	°C							
30									
31	COUPLING								
32	Type								
33	Manufacturer								
34	Design Rating								
35									
36									
37	GEARBOX								
38	Type								
39	Manufacturer								
40	Design Rating								
41									
42									
43	LUBE OIL SYSTEM								
44	Scope								
45	Pump Type								
46	Heat Exchanger Type								
47	Filter Type								
48	Reservoir Capacity								
49	Run-down Arrangement								
50									
51	SEALANT SYSTEM								
52	Scope								
53									
54									
55									

Project No	
Equipment	**CO2 Compressor Package**
Equipment No	
Number Off	

	DESCRIPTION		UNITS	DATA	REV.
1	**MECHANICAL DATA (cont.)**				
2	SYSTEM DESIGN CONDITIONS				
3	Design Temperature	Maximum / Minimum	°C		
4	Design Pressure	Maximum / Minimum	barg		
5					
6					
7					
8					
9	**MATERIALS OF CONSTRUCTION**				
10	Casing				
11	Impellers				
12	Shaft Sleeve				
13	Labyrinths				
14	Bull Gear Shaft				
15	Bull Gear Rim				
16	Bull Gear Centre				
17	Pinions				
18	Bearing Housings				
19	Mech. Seal				
20	Metallic Parts				
21	Seal/Face				
22	'O' Rings				
23	Gearbox Housing				
24	Flow Element				
25	Bypass Valve				
26	Inline Instrumentation				
27	Guide Vane Casing				
28	Guide Vanes				
29					
30	Intercooler Shells				
31	Intercooler Tubes / Tubesheets				
32	AntiSurge Cooler Shell				
33	AntiSurge Cooler Tubes / Tubesheet				
34	KO Vessels				
35					
36	Lube Oil Reservoir				
37	Lube Oil Pumps				
38	Lube Oil Cooler				
39	Lube Oil Filters				
40					
41	Process Piping				
42	Lube Oil Piping				
43	Cooling Water Piping				
44	Seal System Piping				
45					
46	**CONTROL & INSTRUMENTATION**				
47	Capacity Control Method				
48					
49	Compressor Package Control System				
50					
51	Condition Monitoring				
52					
53	Anti-Surge System				
54					
55					

Project No
Equipment **CO2 Compressor Package**
Equipment No
Number Off

	DESCRIPTION	UNITS	DATA	REV.
1	**DRIVE ARRANGEMENT / TRANSMISSION**			
2	Drive Arrangement			
3	Drive Motor			
4	Installed Power / Operating Speed	kW / rev/min		
5	Manufacturer			
6	Enclosure			
7				
8	**SCOPE OF SUPPLY**			
9	Compressor			
10	Drive Arrangement			
11	Drive Motor			
12	Inlet Guide Vanes			
13	Intercoolers			
14				
15	Anti-Surge System			
16	Anti-Surge Cooler			
17	Aftercooler			
18	Common Skid Frame			
19	Packaged Lube Oil System			
20	Suction Strainer			
21	Interconnecting Gas Pipework & Valves			
22	Interconnecting Oil Pipework & Valves			
23	Interconnecting Water Pipework & Valves			
24	Discharge Non-Return Valve & Relief Valve			
25	Seal System Pipework & Valves			
26	Instrumentation			
27	Package Wiring to Skid Mounted Junction Box			
28	Local Control Panel			
29	PLC Control Panel			
30				
31				
32	Insulation & Cladding			
33				
34				
35				
36				
37				
38	Independent Inspection Authority			
39	Special Tools			
40	Commissioning Spare Parts			
41	Two Years Operating Spare Parts			
42	Capital Spare Parts			
43				
44				
45				
46	**WEIGHTS & DIMENSIONS**			
47	Compressor / Driver Baseplate Footprint	mm		
48				
49	Compressor Weight	kg		
50	Driver Weight	kg		
51	Lube Oil System Weight	kg		
52	Intercooler Weights	kg		
53	Anti-Surge Cooler Weight	kg		
54				
55				

Project No	
Equipment	**CO2 Compressor Package**
Equipment No	
Number Off	

						REV.
1	**INSPECTION, TESTING AND CERTIFICATION**					
2	**QUALITY LEVEL:-** Not Applicable					
3						
4	All tasks listed below shall be included on the Vendor's Quality Plan for this package as a minimum and shall be performed at the vendor's works.					
5	Refer also to inspection requirements specified on reference documents.					
6						
7	**TASK DESCRIPTION**	WITNESS	OBSERVE	REVIEW		
8	Review material certificates (BS EN 10204-3.1 standard.)					
9	Identify materials against material certificate/cast numbers.					
10	Check certified chemical properties of materials.					
11	Check certified results of mechanical test of materials.					
12	Review material guarantee.					
13	Check heat treatment certificates, including temperature records.					
14	Check operator qualifications and suitability of all NDT operators.					
15	Check certified results of NDT tests of materials and welds.					
16	Inspect radiographs & extent of radiography.					
17	Check qualification of welders and operators.					
18	Part dimensional check for site erection purposes to certified drawings.					
19	General workmanship and completeness of supply.					
20	Machined casing for general workmanship, finish and cleanliness.					
21	Examine impellers, check construction.					
22	Paint or other finish for continuity.					
23	Auxiliary piping and fittings against requirements of item specification.					
24	Flange face finish against requirements of item specification.					
25	Guards to correct standard and are securely attached.					
26	Alignment of driver with driven unit.					
27	Fabrication of baseplate against requirements of item specification.					
28	Hydrostatic test of pressure retaining parts.					
29	Dynamic balancing of impeller or complete rotating element					
30	Copy of machine rating plate.					
31	Overspeed test on impeller.					
32	Mechanical run test at rated speed in accordance with Vendor's Standard Procedure					
33	Finite Element Analysis of Impeller					
34	Compressor performance test in complete train, with Project Driver / Shop Driver					
35	Spare rotating element dimensional check					
36	Spare rotating element fit-up check					
37	Test of Project Lube Oil / Seal Oil System					
38	Vibration amplitude during performance test.					
39	Each item is suitably prepared for shipment.					
40						
41	**Motor**					
42	Hazardous area classification certificate.					
43	Routine works test certificate.					
44	Type test certificate.					
45	Earthing and bonding. Continuity between equipment items and earth tag.					
46	Compliance with specification, correct enclosure, termination arrangements, etc.					
47						
48	**Instrumentation**					
49	Tag labels are fitted.					
50	Material certificate for each item.					
51	Calibration certificate for each item.					
52	Hazardous area classification certificates for each item.					
53	Control System Functional Test					
54						
55						

Project No	
Equipment	**CO2 Compressor Package**
Equipment No	
Number Off	

	INSPECTION, TESTING AND CERTIFICATION (Cont.)				REV.
1					
2	**TASK DESCRIPTION**	WITNESS	OBSERVE	REVIEW	
3	**Pressure Vessels & Heat Exchangers**				
4	Review material certificates (BS EN 10204-3.1 standard.)				
5	Identify materials against material certificate/cast numbers.				
6	Check heat treatment certificates, including temperature records.				
7	Check operator qualifications and suitability of all NDT operators.				
8	Check certified results of NDT tests of materials and welds.				
9	Check qualification of welders and operators.				
10	Hydrostatic test of pressure retaining parts.				
11					
12					
13					
14					
15	**REFERENCE DOCUMENTS**				
16					
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38	**GENERAL NOTES**				
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Project No	
Equipment	**CO2 Compressor Package**
Equipment No	
Number Off	

	GENERAL NOTES (Cont.)	REV.
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Project No	
Equipment	**CO2 Compressor Package**
Equipment No	
Number Off	

	GENERAL NOTES (Cont.)	REV.
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Client:	**To be determined**
Plant Location:	**To be specified**

Item: Mechanical Datasheet CO2 Compressor Discharge Cooler

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION		UNITS	DATA				
1	**DESIGN & OPERATING DATA**							**Rev**
2				**SHELLSIDE (HOT FLUID)**		**TUBESIDE (COLD FLUID)**		
3				**In**	**Out**	**In**	**Out**	
4	**FLUID**							
5	**TOTAL FLUID FLOW**		**kg/hr**					
6	**VAPOUR FLOW**		**kg/hr**					
7	**LIQUID FLOW**		**kg/hr**					
8	**LIQUID DENSITY**		**kg/m³**					
9	**LIQUID SPECIFIC HEAT**		**kJ/kg°C**					
10	**LIQUID VISCOSITY**		**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**		**W/m°C**					
12	**LIQUID SURFACE TENSION**		**Dyn/cm**					
13	**LATENT HEAT**		**kJ/kg**					
14	**VAPOUR DENSITY**		**kg/m³**					
15	**VAPOUR SPECIFIC HEAT**		**kJ/kg°C**					
16	**VAPOUR VISCOSITY**		**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**		**W/m°C**					
18	**MOLECULAR WEIGHT**							
19	**OPERATING TEMPERATURE**		**°C**					
20	**OPERATING PRESSURE**		**Bar a**					
21	**PRESSURE DROP**	**Allow/Calc**	**bar**					
22	**No. OF PASSES**							
23	**VELOCITY OF FLOW**		**m/s**					
24	**FOULING ALLOWANCE**		**m²C/W**					
25	**MAP (DESIGN PRESSURE)**		**bar g**					
26	**TEST PRESSURE**	**New/Corroded**	**bar g**					
27	**DESIGN TEMPERATURE**		**°C**					
28	**HEAT DUTY**		**MW**					
29	**H.T. COEFFICIENT**	**Required / Actual**	**W/m²C**					
30	**LMTD**		**°C**					
31								
32								

33	**CONSTRUCTION & MATERIALS**					
34	**DESIGN CODES:**					
35	**SHELL PER UNIT:**	**TYPE:**		**SERIES:**	**PARALLEL:**	
36	**SURFACE PER UNIT:**			**SURFACE PER SHELL:**		
37	**PED FLUID PHASE & GROUP No:**	**HOT SIDE:**		**COLD SIDE:**		
38	**PED EQUIPMENT CATEGORY:**			**PED CONFORMITY MODULES:**		
39	**TUBE:**		**No Off:**		**THICKNESS**	
40	**TUBE O/DIA:**	**LENGTH:**	**PITCH:**			
41	**SHELL:**	**I/DIA:**	**SHELL COVER:**			
42	**CHANNEL:**		**CHANNEL COVER:**			
43	**STATIONARY TUBESHEET:**				**FLOATING HEAD COVER:**	
44	**FLOATING TUBESHEET:**		**LONGITUDINAL BAFFLES:**			
45	**SUPPORT BAFFLES:**		**TYPE:**		**FLOW:**	
46	**BAFFLE CUT:**	**PITCH:**	**No OFF:**			
47	**GASKETS:** **Shellside:**		**CORROSION ALLOWANCE:**		**Shellside:**	
48	**Tubeside:**				**Tubeside:**	
49	**BRANCHES:** **Shellside:**		**INLET:**	**OUTLET:**	**RATING:**	
50	**Tubeside:**		**INLET:**	**OUTLET:**	**RATING:**	
51	**STRESS RELIEVE:** **(Shellside / Tubeside):**					
52	**RADIOGRAPHY:** **(Shellside / Tubeside):**					
53	**INSPECTION BY:**					
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION		UNITS	DATA			
1	**DESIGN & OPERATING DATA**						
2				**SHELLSIDE (HOT FLUID)**		**TUBESIDE (COLD FLUID)**	
3				**In**	**Out**	**In**	**Out**
4	**FLUID**						
5	**TOTAL FLUID FLOW**		**kg/hr**				
6	**VAPOUR FLOW**		**kg/hr**				
7	**LIQUID FLOW**		**kg/hr**				
8	**LIQUID DENSITY**		**kg/m³**				
9	**LIQUID SPECIFIC HEAT**		**kJ/kg°C**				
10	**LIQUID VISCOSITY**		**cP**				
11	**LIQUID THERMAL CONDUCTIVITY**		**W/m°C**				
12	**LIQUID SURFACE TENSION**		**Dyn/cm**				
13	**LATENT HEAT**		**kJ/kg**				
14	**VAPOUR DENSITY**		**kg/m³**				
15	**VAPOUR SPECIFIC HEAT**		**kJ/kg°C**				
16	**VAPOUR VISCOSITY**		**cP**				
17	**VAPOUR THERMAL CONDUCTIVITY**		**W/m°C**				
18	**MOLECULAR WEIGHT**						
19	**OPERATING TEMPERATURE**		**°C**				
20	**OPERATING PRESSURE**		**Bar a**				
21	**PRESSURE DROP**	**Allow/Calc**	**bar**				
22	**No. OF PASSES**						
23	**VELOCITY OF FLOW**		**m/s**				
24	**FOULING ALLOWANCE**		**m²C/W**				
25	**MAP (DESIGN PRESSURE)**		**bar g**				
26	**TEST PRESSURE**	**New/Corroded**	**bar g**				
27	**DESIGN TEMPERATURE**		**°C**				
28	**HEAT DUTY**		**MW**				
29	**H.T. COEFFICIENT**	**Required / Actual**	**W/m²C**				
30	**LMTD**		**°C**				
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

APPLICABLE DESIGN CODES & STANDARDS:

TUBESHEET & BELLOWS DESIGN DATA

The following coincident pressures and their coincident temperatures are possible and must be used in the design of the tubesheets and the determination of bellows requirements.
The use of differential pressure design methods is not permitted.

	Case No.	Minimum Design Cycle Life of Bellows	Shellside Pressure [barg]	Shell Metal Temp. [°C]	Tubeside Pressure [barg]	Tube Metal Temp. [°C]
NORMAL OPERATION	1					
SHELLSIDE FLOW FAILURE	2					
TUBESIDE FLOW FAILURE	3					
BELLOWS EXPANSION	4					
BELLOWS COMPRESSION	5					
START-UP	6					
SHUT-DOWN	7					
EMERGENCY CONDITIONS	8					
EMERGENCY CONDITIONS	9					
EMERGENCY CONDITIONS	10					
SHELLSIDE HYDROTEST	11					
TUBESIDE HYDROTEST	12					

NOTES

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	NOTES (Continued)
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Mechanical Datasheet - CO_2 Compressor Discharge Cooler	DOC. NO. Not Applicable
	PAGE NO. 6 of 9
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

SKETCH

Ref	Service	Size	Rating	Standout (mm)	Remarks

Drawing not to scale
All dimensions in mm

ESTIMATED WEIGHTS (kg)	
Fabricated	
Operating	
Full of water	

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

SKETCH

TUBESHEET LAYOUT

Drawing not to scale
All dimensions in mm

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

SKETCH

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

INSPECTION TASKS

INSPECTION TASKS:

All tasks identified below shall be included on the vendors quality plan. Where inspection task numbers have a suffix "C", a certificate shall be supplied. These certificates shall be included in the exchanger certification dossier. The quality plan shall also include all additional inspection tasks required by the Independent Third Party Inspection Agency.

MC1	**C**	Review material certificates (EN-10204, 3.1 standard).
MC2	**C**	Check certified chemical & mechanical properties of all materials.
MC3	**C**	Check that ultrasonic testing of base plate has been carried out before cladding.
MC4	**C**	Check that bond strength tests and ultrasonic testing of cladding bond have been carried out.
MC5	**C**	Check cladding thickness.
WRod1		Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.
WRod2		Check method of distribution of welding consumables and means of storage on the shop floor.
WeldPr	**C**	Check weld procedures and qualifications.
Welder	**C**	Check weld map and welders qualifications for shell and tube end welds.
TrHtNos		Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.
Head	**C**	Identify heads and check shape, dimensions and thickness.
Plate		Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.
Lamin	**C**	Inspect edges of material for weld preparation and for discontinuities and laminations.
Fitup		Inspect assembly including alignment of main seams prior to welding.
Nozzles		Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.
Coupon1		Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material identification and stamping.
Welding		Survey welding and back gouging and ensure that approved procedures are followed.
Tube holes		Check tube holes are free from burrs and the finish, grooving and tolerances are in accordance with the approved drawing and code.
Tubes		Check that the tubes are free from surface defects and thinning after expanding and witness soapy water test of tube end welds.
Baffles		Check baffles to approved drawing and that the shell is correctly sized and free of obstructions for tube bundle insertion.
Coupon2	**C**	Witness welding of test plates and review test results.
InspWeld	**C**	Inspect finished welds for freedom from undercut and surface defects.
DimChk	**C**	Check dimensions to approved drawing and specified tolerances given in TEMA.
IntFinish	**C**	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.
MPT	**C**	Check MPT procedure and operators qualifications and survey the testing of all exchanger welds.
RT	**C**	Ensure radiography of exchanger welds is in accordance with approved drawing and specified code. Review radiographs.
UT	**C**	Witness ultrasonic examination of welds and review reports.
PWHT1	**C**	Check PWHT procedure for exchanger. Inspect thermocouple certificates and attachment. Check final temperature charts.
preHydrT	**C**	Witness pre-final-hydraulic test before titanium battons are installed. Check test set up and pressure gauge certificates.
Weld-Ti		Survey welding of battens, nozzle inserts and internals and ensure that approved procedures are followed.
RT-Ti	**C**	Witness radiographic technique test for titanium.
IntFinish	**C**	Inspect internal finish, weld dressing and shell/nozzle radii of flush nozzles.
pPWHT	**C**	Check pre-PWHT of titanium nozzle inserts and other welded titanium sub-assemblies.
PWHT2	**C**	Check PWHT procedure for Ti welds. Inspect thermocouple certificates and attachment. Check final temperature charts.
HydrT	**C**	Witness hydraulic test. Check test set up and pressure gauge certificates. Check that the exchanger is clean and dry after testing.
	C	Check Hot Gas Cyle Test Procedure, Inspect thermocouple certificates and attachment. Check final temperature charts.
DPT-Ti	**C**	Check DPT procedure and operators qualifications and survey the testing of internal Ti welds after the Hot Gas Cycle Test.
HelT	**C**	Check that helium test is carried out in line with the approved procedure and review results.
Final-1	**C**	Check that the equipment is clean and dry before sealing.
Final-2	**C**	Check general workmanship and completeness of supply.
Final-3	**C**	Check Paint or other finishes for continuity and against specification. (check insulation and cladding)
Final-4	**C**	Check copy of nameplate.
Final-5	**C**	Check Equipment packed and protected ready for shipment.
Final-6		Review Dossier.

Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet

Item: CO_2 Compressor Discharge KO Vessel

Mechanical Datasheet-CO2 Compressor Discharge KO Vessel	DOC. NO. Not Applicable
	PAGE NO. 2 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESIGN & OPERATING DATA		Rev
2	APPLICATION STANDARD (DESIGN CODE)		
3	PED CONFORMANCE CATEGORY (PREFERRED MODULE)		
4	VESSEL SPECIFICATION		
5	GENERAL PROJECT SPECIFICATION FOR MECHANICAL EQUIPMENT		
6	PIPING DESIGN NOZZLE LOADING FOR STATIC EQUIPMENT		
7	VENDOR DOCUMENTATION SPECIFICATION		
8	SHELL MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS		
9	SHELL MAP (DES. PRESSURE ext.) at top @ TEMPERATURE		
10	SHELL OPERATING PRESSURE @ TEMPERATURE (Min/Norm/Max)		
11	JACKET MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS		
12	JACKET MAP (DES. PRESSURE ext.) at top @ TEMPERATURE		
13	JACKET OPERATING PRESSURE @ TEMPERATURE		
14	CORROSION/EROSION ALLOWANCE (internal / external)		
15	STRESS RELIEF/PWHT		
16	RADIOGRAPHY		
17	JOINT COEFFICIENT (PED ESR 7.2)		
18	HYDRAULIC TEST PRESSURE		
19	AIR TEST PRESSURE (with soap suds)		
20	BASIC WIND SPEED		
21	SEISMIC CRITERIA		
22	CYCLIC SERVICE		
23	CREEP RANGE		
24	VESSEL CONTENTS/PED FLUID PHASE & GROUP No.		
25	NATURE OF CONTENTS		
26	MAX. OPERATING STATIC HEAD		
27	INTERNAL FINISH		
28	WELD DRESSING (internal / external)		
29	INTERNAL COATING		
30	EXTERNAL FINISH		
31	EXTERNAL PAINTING		
32	INSULATION (by Vendor)		
33	FIREPROOFING (by site contractor)		
34	INSPECTION AUTHORITY		

	MATERIAL SPECIFICATIONS				
36	HEADS & SHELL		JACKET		
37	CLADDING				
38	BODY FLANGE				
39	NOZZLE: FLANGES		SUPPORT LEGS		
40	NOZZLE: NECKS		EXT. ATTACHMENTS		
41	BOLTING: EXTERNAL		FLANGE FINISH		
42	BOLTING: INTERNAL		PMA REQUIRED		
43	GASKETS: EXTERNAL		MATERIAL CERTS		
44	GASKETS: INTERNAL		IMPACT TEST REQ.		
45	FIXED INTERNALS		ELONGATION REQ.		
46	REMOVABLE INT'LS		WELDING QUALS		

	CAPACITY & WEIGHTS					
48	ESTIM'D WEIGHT FABRICATED (EMPTY)	kg		S.G. OF OPERATING FLUID		
49	ESTIM'D WEIGHT INTERNALS	kg		VOLUME OF OPERATING FLUID	Litres	
50	ESTIM'D WEIGHT ATTACHMENTS	kg		WEIGHT OF OPERATING FLUID	kg	
51	ESTIM'D WEIGHT INSTALLED (EMPTY)	kg		VESSEL CAPACITY (GROSS)	m^3	
52	ESTIM'D WEIGHT INSTALLED OPERATING	kg		JACKET CAPACITY (GROSS)	m^3	
53	ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID	kg				
54	ESTIM'D WEIGHT INSTALLED FULL OF WATER	kg				

Mechanical Datasheet-CO2 Compressor Discharge KO Vessel	DOC. NO. Not Applicable
	PAGE NO. 3 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

	Ref	Service	DN	No Off	Flange	Rating	Standout	Notes	Rev
1	**BRANCH DUTY**								
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21	Nozzle standouts are measured from vessel centre-line to flange face.								
22	**ADDITIONAL SPECIFICATIONS & STANDARDS**								
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41	**NOTES**								
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

NOTES (Continued)

Mechanical Datasheet-CO2 Compressor Discharge KO Vessel	DOC. NO. Not Applicable
	PAGE NO. 5 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	SKETCH	Rev
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53	All dimensions in millimetres	
54	Drawing not to scale	
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Mechanical Datasheet-CO2 Compressor Discharge KO Vessel	DOC. NO. Not Applicable
	PAGE NO. 6 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	SKETCH	Rev
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53	All dimensions in millimetres	
54	Drawing not to scale	
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

			INSPECTION TASKS	Rev
1			**INSPECTION TASKS**	
2			All tasks identified below shall be included on the vendors quality plan.	
3			Where inspection task numbers have a suffix "C", a certificate shall be supplied.	
4			These certificates shall be included in the vessel certification dossier.	
5	1.	C	Review material certificates (EN-10204. 3.1 standard).	
6	2.	-	Check certified chemical & mechanical properties of all materials.	
7	3.	-		
8	4.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
9	5.	C	Check method of distribution of welding consumables and means of storage on the shop floor.	
10	6.	-		
11	7.	C	Check weld procedures and qualifications.	
12	8.	C	Check weld map and welders qualifications.	
13	9.	-		
14	10.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
15	11.	-		
16	12.	C	Identify heads and check shape, dimensions and thickness.	
17	13.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.	
18	14.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
19	15.	-		
20	16.	C	Inspect assembly including alignment of main seams prior to welding.	
21	17.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.	
22	18.	-		
23	19.	C	Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material identification and stamping.	
24	20.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
25	21.	C	Witness welding of test plates and review test results.	
26	22.	C	Inspect finished welds for freedom from undercut and surface defects.	
27	23.	-		
28	24.	C	Check dimensions to approved drawing and tolerances given in specifications & design code.	
29	25.	-		
30	26.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
31	27.	-		
32	28.	C	Check DPI procedure and operators qualifications and survey the testing of all vessel welds.	
33	29.	C	Ensure radiography of vessel welds is in accordance with approved drawing and specified code. Review radiographs.	
34	30.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
35	31.	-		
36	32.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
37	33.	-	Gauge check column internal diameter.	
38	34.	C	Witness hydraulic test. Check test set up and pressure gauge certificates.	
39	35.	-		
40	36.	C	Check that the vessel is clean and dry before sealing.	
41	37.	C	Check general workmanship and completeness of supply.	
42	38.	C	Check Paint or other finishes for continuity and against specification.	
43	39.	C	Check copy of nameplate.	
44	40.	C	Check Equipment packed and protected ready for shipment.	
45	41.	-	Review Dossier.	
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Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet

Item: CO_2 Compressor Inlet KO Vessel

Mechanical Datasheet-CO2 Compressor Inlet KO Vessel	DOC. NO. Not Applicable
	PAGE NO. 2 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESIGN & OPERATING DATA		Rev
2	APPLICATION STANDARD (DESIGN CODE)		
3	PED CONFORMANCE CATEGORY (PREFERRED MODULE)		
4	VESSEL SPECIFICATION		
5	GENERAL PROJECT SPECIFICATION FOR MECHANICAL EQUIPMENT		
6	PIPING DESIGN NOZZLE LOADING FOR STATIC EQUIPMENT		
7	VENDOR DOCUMENTATION SPECIFICATION		
8	SHELL MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS		
9	SHELL MAP (DES. PRESSURE ext.) at top @ TEMPERATURE		
10	SHELL OPERATING PRESSURE @ TEMPERATURE (Min/Norm/Max)		
11	JACKET MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS		
12	JACKET MAP (DES. PRESSURE ext.) at top @ TEMPERATURE		
13	JACKET OPERATING PRESSURE @ TEMPERATURE		
14	CORROSION/EROSION ALLOWANCE (internal / external)		
15	STRESS RELIEF/PWHT		
16	RADIOGRAPHY		
17	JOINT COEFFICIENT (PED ESR 7.2)		
18	HYDRAULIC TEST PRESSURE		
19	AIR TEST PRESSURE (with soap suds)		
20	BASIC WIND SPEED		
21	SEISMIC CRITERIA		
22	CYCLIC SERVICE		
23	CREEP RANGE		
24	VESSEL CONTENTS/PED FLUID PHASE & GROUP No.		
25	NATURE OF CONTENTS		
26	MAX. OPERATING STATIC HEAD		
27	INTERNAL FINISH		
28	WELD DRESSING (internal / external)		
29	INTERNAL LINING		
30	EXTERNAL FINISH		
31	EXTERNAL PAINTING		
32	INSULATION (by Vendor)		
33	FIREPROOFING (by site contractor)		
34	INSPECTION AUTHORITY		

	MATERIAL SPECIFICATIONS				
36	HEADS & SHELL		JACKET		
37	CLADDING				
38	BODY FLANGE				
39	NOZZLE: FLANGES		SUPPORT SKIRT		
40	NOZZLE: NECKS		EXT. ATTACHMENTS		
41	BOLTING: EXTERNAL		FLANGE FINISH		
42	BOLTING: INTERNAL		PMA REQUIRED		
43	GASKETS: EXTERNAL		MATERIAL CERTS		
44	GASKETS: INTERNAL		IMPACT TEST REQ.		
45	FIXED INTERNALS		ELONGATION REQ.		
46	REMOVABLE INT'LS		WELDING QUALS		

	CAPACITY & WEIGHTS				
48	ESTIM'D WEIGHT FABRICATED (EMPTY)	kg	S.G. OF OPERATING FLUID		
49	ESTIM'D WEIGHT INTERNALS	kg	VOLUME OF OPERATING FLUID	Litres	
50	ESTIM'D WEIGHT ATTACHMENTS	kg	WEIGHT OF OPERATING FLUID	kg	
51	ESTIM'D WEIGHT INSTALLED (EMPTY)	kg	VESSEL CAPACITY (GROSS)	m^3	
52	ESTIM'D WEIGHT INSTALLED OPERATING	kg	JACKET CAPACITY (GROSS)	m^3	
53	ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID	kg			
54	ESTIM'D WEIGHT INSTALLED FULL OF WATER	kg			

Mechanical Datasheet-CO2 Compressor Inlet KO Vessel	DOC. NO. Not Applicable
	PAGE NO. 3 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	Rev

BRANCH DUTY

Ref	Service	DN	No Off	Flange	Rating	Standout	Notes

Nozzle standouts are measured from vessel centre-line to flange face.

ADDITIONAL SPECIFICATIONS & STANDARDS

NOTES

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

NOTES (Continued)

Mechanical Datasheet-CO2 Compressor Inlet KO Vessel	DOC. NO. Not Applicable
	PAGE NO. 5 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	SKETCH	Rev
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53	All dimensions in millimetres	
54	Drawing not to scale	
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56		

Mechanical Datasheet-CO2 Compressor Inlet KO Vessel	DOC. NO. Not Applicable
	PAGE NO. 6 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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52		
53	All dimensions in millimetres	
54	Drawing not to scale	
55		
56		

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

			INSPECTION TASKS	Rev
1			**INSPECTION TASKS**	
2			All tasks identified below shall be included on the vendors quality plan.	
3			Where inspection task numbers have a suffix "C", a certificate shall be supplied.	
4			These certificates shall be included in the vessel certification dossier.	
5	1.	C	Review material certificates (EN-10204. 3.1 standard).	
6	2.	C	Check certified chemical & mechanical properties of all materials.	
7	3.	C	Check that ultrasonic testing of base plate has been carried out before cladding.	
8	4.	C	Check that bond strength tests and ultrasonic testing of cladding bond have been carried out.	
9	5.	C	Check cladding thickness.	
10	6.			
11	7.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
12	8.	C	Check method of distribution of welding consumables and means of storage on the shop floor.	
13	9.	-		
14	10.	C	Check weld procedures and qualifications.	
15	11.	C	Check weld map and welders qualifications.	
16	12.	-		
17	13.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
18	14.	-		
19	15.	C	Identify heads and check shape, dimensions and thickness.	
20	16.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.	
21	17.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
22	18.	-		
23	19.	C	Inspect assembly including alignment of main seams prior to welding.	
24	20.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.	
25	21.	-		
26	22.	C	Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material identification and stamping.	
27	23.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
28	24.	C	Witness welding of test plates and review test results.	
29	25.	C	Inspect finished welds for freedom from undercut and surface defects.	
30	26.	-		
31	27.	C	Check dimensions to approved drawing and tolerances given in specifications & design code.	
32	28.	-		
33	29.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
34	30.	-		
35	31.	C	Check DPI procedure and operators qualifications and survey the testing of all vessel welds.	
36	32.	C	Ensure radiography of vessel welds is in accordance with approved drawing and specified code. Review radiographs.	
37	33.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
38	34.			
39	35.	C	Check PWHT procedure for exchanger. Inspect thermocouple certificates and attachment. Check final temperature charts.	
40	36.			
41	37.	C	Witness pre-final-hydraulic test before battons are installed. Check test set up and pressure gauge certificates.	
42	38.			
43	39.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
44	40.	-	Gauge check column internal diameter.	
45	41.	C	Witness hydraulic test. Check test set up and pressure gauge certificates.	
46	42.	-		
47	43.	C	Check that the vessel is clean and dry before sealing.	
48	44.	C	Check general workmanship and completeness of supply.	
49	45.	C	Check Paint or other finishes for continuity and against specification.	
50	46.	C	Check copy of nameplate.	
51	47.	C	Check Equipment packed and protected ready for shipment.	
52	48.	-	Review Dossier.	
53				
54				
55				

Client:	**To be determined**
Plant Location:	**To be specified**

CO_2 Drying Package Data Sheet

Project No

Equipment **CO_2 Drying Package**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA	REV.
1	**GENERAL**				
2	Manufacturer				
3	Model / Size				
4	Design / Fabrication Code				
5	Location			INDOORS / OUTDOORS / UNDERCOVER / EXPOSED	
6	Heated / Unheated				
7	Tropicalisation				
8	Winteristaion				
9	Height above Grade				
10	Dust				
11	Fumes				
12					
13	**OPERATING CONDITIONS**				
14	Purpose				
15					
16	Operation Mode			CONTINUOUS / INTERMITTENT	
17	Hazardous Area Classification			ZONE GAS GROUP TEMP CLASS DUST HAZARD	
18					
19	**INLET CONDITIONS**				
20	Gas Flowrate	Normal	kg/h		
21		Design	kg/h		
22	Pressure		bara		
23	Temperature		°C		
24					
25	**INLET GAS COMPOSITION (TYPICAL)**			Normal Maximum	
26					
27					
28					
29					
30					
31					
32	Particulate Size				
33					
34	**OUTLET CONDITIONS**				
35	Gas Flowrate		kg/h		
36	Pressure		bara		
37	Temperature		°C		
38					
39	**OUTLET GAS COMPOSITION (TYPICAL)**			Normal Maximum	
40					
41					
42					
43					
44					
45	**REGENERATING GAS**				
46					
47					
48					
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Project No
Equipment **CO_2 Drying Package**
Equipment No
Number Off

	DESCRIPTION	UNITS	DATA	REV.
1	**PERFORMANCE**			
2	Regeneration Method			
3				
4	**OPERATING CYCLE**			
5	Drying Period	h		
6	Regeneration Period	h		
7	Cooling Period	h		
8				
9	Total Cycle Period	h		
10				
11	**DESICCANT TYPE**			
12	Desiccant Bed Charge / Adsorber	kg		
13	Estimated Bed Operating Life at maxiumum duty	Years		
14	Bed Support Material			
15	Bed Charge / Adsorber	kg		
16				
17	Regeneration Heat Input	kW		
18				
19	Pressure Differential across complete package	bar		
20	pre-filter	bar		
21	after-filter	bar		
22				
23				
24				
25				
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27				
28	**UTILITY REQUIREMENTS**			
29				
30				
31				
32				
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40				
41				
42	**CONNECTIONS**			

	SERVICE		TYPE	RATING	SIZE	POSITION	
43							
44	Wet Gas Flow to Package						
45	Dry Gas Flow From Package						
46							
47							
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Project No

Equipment **CO_2 Drying Package**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA		REV.
1	**MATERIALS OF CONSTRUCTION**				
2					
3	Drier Vessel Shell				
4	Drying Medium				
5	Vessel Internals (Metallic)				
6	Gas Heater Shell				
7	Gas Heater Internals				
8	Gas Cooler Shell				
9	Gas Cooler Internals				
10	Knock-out Vessel Shell				
11	Knock-out Vessel Internals				
12	Pre-Filter Shell				
13	Pre-Filter Elements				
14	After-Filter Shell				
15	After-Filter Elements				
16	Gas Blower Contact Parts				
17	Wet Gas Pipework				
18	Wet Gas Valves				
19	Dry Gas Pipework				
20	Dry Gas Valves				
21	Piping Gaskets				
22	Structural Steelwork, Supports & Platforms				
23					
24	**MECHANICAL DATA**				
25	**FILTERS**		Pre-Filter	After-Filter	
26	Type				
27	Design Pressure	barg			
28	Design Temperature	°C			
29	Test Pressure	barg			
30	Design / Fabrication Code				
31	Corrosion Allowance	mm			
32	Independent Inspection Authority				
33	Filter Area (Total)	m^2			
34	No. Off Elements				
35	Element Length / Diameter	mm			
36	Element Rating				
37	Element Efficiency				
38					
39	**DRIER VESSELS**				
40	Number Off				
41	Design Pressure	barg			
42	Cyclic Pressure Range	bar			
43	Test Pressure	barg			
44	Design Temperature	°C			
45	Design / Fabrication Code				
46	Corrosion Allowance	mm			
47	Independent Inspection Authority				
48	Vessel Internals				
49	Vessel Length	mm			
50	Vessel Diameter	mm			
51					
52					
53					
54					
55					

Project No

Equipment **CO_2 Drying Package**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA	REV.
1	**MECHANICAL DATA cont.**			
2	**GAS HEATER**			
3	Type			
4	Design Pressure	barg		
5	Cyclic Pressure Range	bar		
6	Design Temperature	°C		
7	Design / Fabrication Code			
8	Independent Inspection Authority			
9				
10	**GAS COOLER**			
11	Type			
12	Design Pressure	barg		
13	Cyclic Pressure Range	bar		
14	Design Temperature	°C		
15	Design / Fabrication Code			
16	Independent Inspection Authority			
17				
18	**KNOCK-OUT VESSEL**			
19	Type			
20	Design Pressure	barg		
21	Cyclic Pressure Range	bar		
22	Design Temperature	°C		
23	Design / Fabrication Code			
24	Independent Inspection Authority			
25	Vessel Internals			
26				
27	**GAS BLOWER**			
28	Type			
29	Manufacturer			
30	Operating Speed			
31	Drive Arrangement			
32	Seal Type			
33				
34				
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38				
39	**ACTUATED VALVES**			
40	Valve Type			
41	Valve Manufacturer			
42	Actuator Type			
43	Actuator Manufacturer			
44				
45	**PIPING**			
46	Design & Fabrication Standard			
47	Design Pressure	barg		
48	Design Temperature	°C		
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Project No	
Equipment	**CO_2 Drying Package**
Equipment No	
Number Off	

	DESCRIPTION	UNITS	DATA			REV.
1	**CONTROL & INSTRUMENTATION**					
2	Method of Package Control					
3						
4	INSTRUMENTATION / INTERLOCKS FITTED					
5	FUNCTION		INDICATION	ALARM	TRIP	
6						
7						
8						
9	**DRIVE ARRANGEMENT / TRANSMISSION**					
10	BLOWER DRIVE					
11	Drive Arrangement					
12	Driver Type					
13	Electrical Supply					
14	Drive Motor Installed Power / Speed	kW / rev/min				
15	Drive Motor Enclosure					
16	Driver Mounting					
17	Manufacturer					
18						
19	**SCOPE OF SUPPLY**					
20	Prefilter					
21	Gas Drier Vessels					
22	Afterfilters					
23	Gas Blower					
24	Gas Heater					
25	Gas Cooler					
26	Knock-Out Vessel					
27	Access Ladders, Plaforms & Walkways					
28	Common Skid Frame					
29	Interconnecting Pipework & Valves					
30	Package Wiring to Skid Mounted Junction Box					
31	Local Control Panel					
32	Insulation & Cladding					
33	PLC Control Panel					
34	Desiccant & Support Material					
35						
36	Independent Inspection Authority					
37	Special Tools					
38	Commissioning Spare Parts					
39	Two Years Operating Spare Parts					
40	Capital Spare Parts					
41						
42						
43	**WEIGHTS & DIMENSIONS**					
44	**WEIGHTS**					
45	Dryer Column (Each) With Desiccant/Without Desiccant	kg				
46	Pre-Filter	kg				
47	After-Filter (Each)	kg				
48	Total Skid Mounted Package	kg				
49						
50	**DIMENSIONS**					
51	Dryer Column Height x Dia	mm				
52	Package Skid	mm				
53						
54						
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Project No	
Equipment	**CO_2 Drying Package**
Equipment No	
Number Off	

						REV.
1	**INSPECTION, TESTING AND CERTIFICATION**					
2	**QUALITY LEVEL:-** Not Applicable					
3						
4	All tasks listed below shall be included on the Vendor's Quality Plan for this package as a minimum and shall be performed at the vendor's works.					
5	Refer also to inspection requirements specified on reference documents.					
6						
7	**TASK DESCRIPTION**	WITNESS	OBSERVE	REVIEW		
8	Review material certificates (EN 10204.3.1 standard)					
9	Identify materials against material certificate/cast numbers.					
10	Check certified chemical properties of materials.					
11	Check certified results of mechanical test of materials.					
12	Review material guarantee.					
13	Check heat treatment certificates, including temperature records.					
14	Check operator qualifications and suitability of all NDT operators.					
15	Check certified results of NDT tests of materials and welds.					
16	Inspect radiographs & extent of radiography.					
17	Check qualification of welders and operators.					
18	Part dimensional check for site erection purposes to certified drawings.					
19	General workmanship finish, cleanliness and completeness of supply.					
20	Paint or other finish for continuity.					
21	Auxiliary piping and fittings against requirements of item specification.					
22	Flange face finish against requirements of item specification.					
23	Guards to correct standard and are securely attached.					
24	Alignment of driver with driven unit. (Blower)					
25	Fabrication of baseplate against requirements of item specification.					
26	Hydrostatic test of pressure retaining parts.					
27	Copy of package rating plate.					
28	Mechanical run test at rated speed. (Blower)					
29	Each item is suitably prepared for shipment.					
30						
31	**PRESSURE VESSELS & HEAT EXCHANGERS**					
32	Review material certificates (EN 10204.3.1 standard)					
33	Check certified results of NDT tests of materials and welds.					
34	Hydrostatic test of pressure retaining parts.					
35	Part dimensional check for site erection purposes to certified drawings.					
36	General workmanship and completeness of supply.					
37						
38	**INSTRUMENTATION / CONTROL SYSTEM**					
39	Ensure that correct tag labels are fitted.					
40	Check materials of construction are to specification and obtain certificate for each item.					
41	Obtain calibration certificate for each item.					
42	Hazardous area classification certificates for each item.					
43	Factory Acceptance Test					
44						
45	**ELECTRIC MOTORS**					
46	Hazardous area classification certificate.					
47	Routine works test certificate.					
48	Type test certificate.					
49	Earthing and bonding. Continuity between equipment items and earth tag.					
50	Compliance with specification, correct enclosure, termination arrangements, etc.					
51						
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Project No	
Equipment	**CO_2 Drying Package**
Equipment No	
Number Off	

		REV.
1	**REFERENCE DOCUMENTS**	
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22	**GENERAL NOTES**	
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Project No	
Equipment	**CO_2 Drying Package**
Equipment No	
Number Off	

		REV.
1	**GENERAL NOTES (CONT.)**	
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Project No	
Equipment	**CO_2 Drying Package**
Equipment No	
Number Off	

		REV.
1	**GENERAL NOTES (CONT.)**	
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Project No	
Equipment	**CO_2 Drying Package**
Equipment No	
Number Off	

		REV.
1	**SKETCH**	
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Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet
Item: CO_2 Pre-Conditioning Vessel

Mechanical Datasheet - CO2 Pre-Conditioning Vessel	DOC. NO. Not Applicable
	PAGE NO. 2 of 7
	PROJECT NO.
	ITE
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESIGN & OPERATING DATA		Rev
2	APPLICATION STANDARD (DESIGN CODE)		
3	PED CONFORMANCE CATEGORY (PREFERED MODULE)		
4	VESSEL SPECIFICATION		
5	GENERAL PROJECT SPECIFICATION FOR MECHANICAL EQUIPMENT		
6	PIPING DESIGN NOZZLE LOADING FOR STATIC EQUIPMENT		
7	VENDOR DOCUMENTATION REQUIREMENTS - DOCUMENT CONTROL		
8	VENDOR DOCUMENTATION REQUIREMENTS - ENGINEERING		
9	SHELL MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS		
10	SHELL MAP (DES. PRESSURE ext.) at top @ TEMPERATURE		
11	SHELL OPERATING PRESSURE @ TEMPERATURE (Min/Norm/Max)		
12	JACKET MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS		
13	JACKET MAP (DES. PRESSURE ext.) at top @ TEMPERATURE		
14	JACKET OPERATING PRESSURE @ TEMPERATURE		
15	CORROSION/EROSION ALLOWANCE (internal / external)		
16	STRESS RELIEF/PWHT		
17	RADIOGRAPHY		
18	JOINT COEFFICIENT (PED ESR 7.2)		
19	HYDRAULIC TEST PRESSURE		
20	AIR TEST PRESSURE (with soap suds)		
21	BASIC WIND SPEED		
22	SEISMIC CRITERIA		
23	CYCLIC SERVICE		
24	CREEP RANGE		
25	VESSEL CONTENTS/PED FLUID PHASE & GROUP No.		
26	NATURE OF CONTENTS		
27	MAX. OPERATING STATIC HEAD		
28	INTERNAL FINISH		
29	WELD DRESSING (internal / external)		
30	INTERNAL COATING		
31	EXTERNAL FINISH		
32	EXTERNAL PAINTING		
33	INSULATION (by site contractor)		
34	FIREPROOFING (by site contractor)		
35	INSPECTION AUTHORITY		

	MATERIAL SPECIFICATIONS			
37	HEADS & SHELL		JACKET	
38	NOZZLE: FLANGES		BODY FLANGE	
39	NOZZLE: NECKS		SUPPORT LEGS	
40	BOLTING: EXTERNAL		EXT. ATTACHMENTS	
41	BOLTING: INTERNAL		FLANGE FINISH	
42	GASKETS: EXTERNAL		PMA REQUIRED	
43			MATERIAL CERTS	
44	GASKETS: INTERNAL		IMPACT TEST REQ.	
45	FIXED INTERNALS		ELONGATION REQ.	
46	REMOVABLE INT'LS		WELDING QUALS	

	CAPACITY & WEIGHTS				
48	ESTIM'D WEIGHT FABRICATED (EMPTY)	kg	S.G. OF OPERATING FLUID		
49	ESTIM'D WEIGHT INTERNALS	kg	VOLUME OF OPERATING FLUID	Litres	
50	ESTIM'D WEIGHT ATTACHMENTS (INSULATION)	kg	WEIGHT OF OPERATING FLUID	kg	
51	ESTIM'D WEIGHT INSTALLED (EMPTY)	kg	VESSEL CAPACITY (GROSS)	m^3	
52	ESTIM'D WEIGHT INSTALLED OPERATING	kg	JACKET CAPACITY (GROSS)	m^3	
53	ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID	kg			
54	ESTIM'D WEIGHT INSTALLED FULL OF WATER	kg			

Mechanical Datasheet - CO2 Pre-Conditioning Vessel	DOC. NO. Not Applicable
	PAGE NO. 3 of 7
	PROJECT NO.
	ITE
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

Rev

BRANCH DUTY

Ref	Service	DN	No Off	Flange	Rating	Standout	Notes

Nozzle standouts are measured from vessel centre-line to flange face.

ADDITIONAL SPECIFICATIONS & STANDARDS

NOTES

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

NOTES (Continued)

Mechanical Datasheet - CO2 Pre-Conditioning Vessel	DOC. NO. Not Applicable
	PAGE NO. 5 of 7
	PROJECT NO.
	ITE
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	SKETCH	Rev
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Mechanical Datasheet - CO2 Pre-Conditioning Vessel	DOC. NO. Not Applicable
	PAGE NO. 6 of 7
	PROJECT NO.
	ITE
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

			INSPECTION TASKS	Rev
1			**INSPECTION TASKS**	
2			All tasks identified below shall be included on the vendors quality plan.	
3			Where inspection task numbers have a suffix "C", a certificate shall be supplied.	
4			These certificates shall be included in the vessel certification dossier.	
5	1.	C	Review material certificates (EN-10204. 3.1 standard.)	
6	2.	-	Check certified chemical & mechanical properties of all materials.	
7	3.	-		
8	4.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding	
9	5.	-	procedures.	
10	6.	C	Check method of distribution of welding consumables and means of storage on the shop floor..	
11	7.	-		
12	8.	C	Check weld procedures and qualifications.	
13	9.	C	Check weld map and welders qualifications.	
14	10.	-		
15	11.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast	
16	12.	-	numbers.	
17	13.	-		
18	14.	C	Identify heads and check shape, dimensions and thickness.	
19	15.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas	
20	16.	-	susceptible to thinning.	
21	17.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
22	18.	-		
23	19.	C	Inspect assembly including alignment of main seams prior to welding .	
24	20.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and	
25	21.	-	location of bolt holes.	
26	22.	-		
27	23.	C	Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material	
28	24.	-	identification and stamping.	
29	25.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
30	26.	C	Witness welding of test plates and review test results.	
31	27.	C	Inspect finished welds for freedom from undercut and surface defects.	
32	28.	-		
33	29.	C	Check dimensions to approved drawing and tolerances given in specifications.	
34	30.	-		
35	31.	-		
36	32.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
37	33.	-		
38	34.	C	Check DPI procedure and operaters qualifications and survey the testing of all vessel welds.	
39	35.	C	Ensure radiography of vessel welds is in accordance with approved drawing and specified code. Review	
40	36.	-	radiographs.	
41	37.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
42	38.	-		
43	39.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
44	40.	-	Gauge check column internal diameter.	
45	41.	C	Witness hydraulic test. Check test set up and pressure gauge certificates.	
46	42.	-		
47	43.	C	Check that the vessel is clean and dry before sealing	
48	44.	C	Check general workmanship and completeness of supply.	
49	45.	C	Check Paint or other finishes for continuity and against specification.	
50	46.	C	Check copy of nameplate	
51	47.	C	Check Equipment packed and protected ready for shipment	
52	48.	-	Review Dossier	
53				
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Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet
Item: CO_2 Pre-Conditioning Vessel Bed

SCOTTISHPOWER **Mechanical Datasheet - CO2 Pre-Conditioning Vessel Bed**	**TECHNICAL DATA SHEET VESSEL INTERNALS**	DOCUMENT NO. SHEET NO. 2 of 2 PROJECT NO. ITEM NO. NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

			Rev
1	**GENERAL**		
1	**ADDITIONAL SPECIFICATIONS & STANDARDS**		
2	**PROCESS DATASHEET**		
3	**VESSEL DATASHEET**		
4	**VENDOR DOCUMENTATION REQUIREMENTS - DOCUMENT CONTROL**		
5	**VENDOR DOCUMENTATION REQUIREMENTS - ENGINEERING**		
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Aker CleanCarbon

AkerSolutions

Client:	**To be determined**
Plant Location:	**To be specified**

Item: Mechanical Datasheet Condensate Drum

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

1	**DESIGN & OPERATING DATA**	**Rev**
2	**APPLICATION STANDARD (DESIGN CODE)**	
3	**PED CONFORMANCE CATEGORY (PREFERED MODULE)**	
4	**VESSEL SPECIFICATION**	
5	**GENERAL PROJECT SPECIFICATION FOR MECHANICAL EQUIPMENT**	
6	**PIPING DESIGN NOZZLE LOADING FOR STATIC EQUIPMENT**	
7	**VENDOR DOCUMENTATION REQUIREMENTS - DOCUMENT CONTROL**	
8	**VENDOR DOCUMENTATION REQUIREMENTS - ENGINEERING**	
9	**SHELL MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS**	
10	**SHELL MAP (DES. PRESSURE ext.) at top @ TEMPERATURE**	
11	**SHELL OPERATING PRESSURE @ TEMPERATURE (MIN/NORM/MAX)**	
12	**JACKET MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS**	
13	**JACKET MAP (DES. PRESSURE ext.) at top @ TEMPERATURE**	
14	**JACKET OPERATING PRESSURE @ TEMPERATURE**	
15	**CORROSION/EROSION ALLOWANCE (internal / external)**	
16	**STRESS RELIEF/PWHT**	
17	**RADIOGRAPHY**	
18	**JOINT COEFFICIENT (PED ESR 7.2)**	
19	**HYDRAULIC TEST PRESSURE**	
20	**AIR TEST PRESSURE (with soap suds)**	
21	**BASIC WIND SPEED**	
22	**SEISMIC CRITERIA**	
23	**CYCLIC SERVICE**	
24	**CREEP RANGE**	
25	**VESSEL CONTENTS/PED FLUID PHASE & GROUP No.**	
26	**NATURE OF CONTENTS**	
27	**MAX. OPERATING STATIC HEAD**	
28	**INTERNAL FINISH**	
29	**WELD DRESSING (internal / external)**	
30	**INTERNAL COATING**	
31	**EXTERNAL FINISH**	
32	**EXTERNAL PAINTING**	
33	**INSULATION (by Vendor)**	
34	**FIREPROOFING (by site contractor)**	
35	**INSPECTION AUTHORITY**	

36	**MATERIAL SPECIFICATIONS**			
37	**HEADS & SHELL**		**JACKET**	
38	**CLADDING**			
39	**BODY FLANGE**			
40	**NOZZLE: FLANGES**		**SUPPORT LEGS**	
41	**NOZZLE: NECKS**		**EXT. ATTACHMENTS**	
42	**BOLTING: EXTERNAL**		**FLANGE FINISH**	
43	**BOLTING: INTERNAL**		**PMA REQUIRED**	
44	**GASKETS: EXTERNAL**		**MATERIAL CERTS**	
45	**GASKETS: INTERNAL**		**IMPACT TEST REQ.**	
46	**FIXED INTERNALS**		**ELONGATION REQ.**	
47	**REMOVABLE INT'LS**		**WELDING QUALS**	

48	**CAPACITY & WEIGHTS**					
49	**ESTIM'D WEIGHT FABRICATED (EMPTY)**	**kg**		**S.G. OF OPERATING FLUID**		
50	**ESTIM'D WEIGHT INTERNALS**	**kg**		**VOLUME OF OPERATING FLUID**	Litres	
51	**ESTIM'D WEIGHT ATTACHMENTS (INSULATION)**	**kg**		**WEIGHT OF OPERATING FLUID**	kg	
52	**ESTIM'D WEIGHT INSTALLED (EMPTY)**	**kg**		**VESSEL CAPACITY (GROSS)**	m^3	
53	**ESTIM'D WEIGHT INSTALLED OPERATING**	**kg**		**JACKET CAPACITY (GROSS)**	m^3	
54	**ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID**	**kg**				
55	**ESTIM'D WEIGHT INSTALLED FULL OF WATER**	**kg**				
56						

Aker CleanCarbon

AkerSolutions

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

Rev

BRANCH DUTY

Ref	Service	DN	No. Off	Flange	Rating	Standout	Notes

Nozzle standouts are measured from vessel centre-line to flange face.

ADDITIONAL SPECIFICATIONS & STANDARDS

NOTES

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	SKETCH	Rev
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All Dimensions are in millimetres
Not drawn to scale

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

				Rev
			INSPECTION TASKS	
1	**INSPECTION TASKS**			
2	All tasks identified below shall be included on the vendors quality plan.			
3	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
4	These certificates shall be included in the vessel certification dossier.			
5	1.	C	Review material certificates (EN-10204. 3.1 standard.)	
6	2.	-	Check certified chemical & mechanical properties of all materials.	
7	3.	-		
8	4.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
9	5.	C	Check method of distribution of welding consumables and means of storage on the shop floor.	
10	6.	-		
11	7.	C	Check weld procedures and qualifications.	
12	8.	C	Check weld map and welders qualifications.	
13	9.	-		
14	10.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
15	11.	-		
16	12.	C	Identify heads and check shape, dimensions and thickness.	
17	13.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.	
18	14.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
19	15.	-		
20	16.	C	Inspect assembly including alignment of main seams prior to welding.	
21	17.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.	
22	18.	-		
23	19.	C	Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material identification and stamping.	
24	20.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
25	21.	C	Witness welding of test plates and review test results.	
26	22.	C	Inspect finished welds for freedom from undercut and surface defects.	
27	23.	-		
28	24.	C	Check dimensions to approved drawing and tolerances given in specifications.	
29	25.	-		
30	26.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
31	27.	-		
32	28.	C	Check DPI procedure and operators qualifications and survey the testing of all vessel welds.	
33	29.	C	Ensure radiography of vessel welds is in accordance with approved drawing and specified code. Review radiographs.	
34	30.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
35	31.	-		
36	32.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
37	33.	-	Gauge check column internal diameter.	
38	34.	C	Witness hydraulic test. Check test set up and pressure gauge certificates.	
39	35.	-		
40	36.	C	Check that the vessel is clean and dry before sealing.	
41	37.	C	Check general workmanship and completeness of supply.	
42	38.	C	Check Paint or other finishes for continuity and against specification.	
43	39.	C	Check copy of nameplate.	
44	40.	C	Check Equipment packed and protected ready for shipment.	
45	41.	-	Review Dossier.	
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Client:	**To be determined**
Plant Location:	**To be specified**

Item: Mechanical Datasheet Cooling Water Cooler

CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

	DESCRIPTION		UNITS	DATA				
1	**DESIGN & OPERATING DATA**							**Rev**
2				**SHELLSIDE (HOT FLUID)**		**TUBESIDE (COLD FLUID)**		
3				**In**	**Out**	**In**	**Out**	
4	**FLUID**							
5	**TOTAL FLUID FLOW**		**kg/hr**					
6	**VAPOUR FLOW**		**kg/hr**					
7	**LIQUID FLOW**		**kg/hr**					
8	**LIQUID DENSITY**		**kg/m³**					
9	**LIQUID SPECIFIC HEAT**		**kJ/kg°C**					
10	**LIQUID VISCOSITY**		**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**		**W/m°C**					
12	**LIQUID SURFACE TENSION**		**Dyn/cm**					
13	**LATENT HEAT**		**kJ/kg**					
14	**VAPOUR DENSITY**		**kg/m³**					
15	**VAPOUR SPECIFIC HEAT**		**kJ/kg°C**					
16	**VAPOUR VISCOSITY**		**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**		**W/m°C**					
18	**MOLECULAR WEIGHT**							
19	**OPERATING TEMPERATURE**		**°C**					
20	**OPERATING PRESSURE**		**Bar a**					
21	**PRESSURE DROP**	**Allow/Calc**	**bar**					
22	**No. OF PASSES**							
23	**VELOCITY OF FLOW**		**m/s**					
24	**FOULING ALLOWANCE**		**m²C/W**					
25	**MAP (DESIGN PRESSURE)**		**bar g**					
26	**TEST PRESSURE**	**New/Corroded**	**bar g**					
27	**DESIGN TEMPERATURE**		**°C**					
28	**HEAT DUTY**		**MW**					
29	**H.T. COEFFICIENT**	**Required / Actual**	**W/m²C**					
30	**LMTD**		**°C**					
31								
32								
33	**CONSTRUCTION & MATERIALS**							
34	**DESIGN CODES:**							
35	**SHELL PER UNIT:**	**TYPE:**		**SERIES:**	**PARALLEL:**			
36	**SURFACE PER UNIT:**			**SURFACE PER SHELL:**				
37	**PED FLUID PHASE & GROUP No:**	**HOT SIDE:**		**COLD SIDE:**				
38	**PED EQUIPMENT CATEGORY:**			**PED CONFORMITY MODULES:**				
39	**TUBE:**		**No Off:**	**THICKNESS**				
40	**TUBE O/DIA:**	**LENGTH:**	**PITCH:**					
41	**SHELL:**	**I/DIA:**	**SHELL COVER:**					
42	**CHANNEL:**		**CHANNEL COVER:**					
43	**STATIONARY TUBESHEET:**			**FLOATING HEAD COVER:**				
44	**FLOATING TUBESHEET:**		**LONGITUDINAL BAFFLES:**					
45	**SUPPORT BAFFLES:**		**TYPE:**	**FLOW:**				
46	**BAFFLE CUT:**	**PITCH:**	**No OFF:**					
47	**GASKETS:** **Shellside:**		**CORROSION ALLOWANCE:**	**Shellside:**				
48	**Tubeside:**			**Tubeside:**				
49	**BRANCHES:** **Shellside:**		**INLET:**	**OUTLET:**	**RATING:**			
50	**Tubeside:**		**INLET:**	**OUTLET:**	**RATING:**			
51	**STRESS RELIEVE:** **(Shellside / Tubeside):**							
52	**RADIOGRAPHY:** **(Shellside / Tubeside):**							
53	**INSPECTION BY:**							
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION	UNITS	DATA			
1	**DESIGN & OPERATING DATA**					
2			**SHELLSIDE (HOT FLUID)**		**TUBESIDE (COLD FLUID)**	
3			**In**	**Out**	**In**	**Out**
4	**FLUID**					
5	**TOTAL FLUID FLOW**	**kg/hr**				
6	**VAPOUR FLOW**	**kg/hr**				
7	**LIQUID FLOW**	**kg/hr**				
8	**LIQUID DENSITY**	**kg/m³**				
9	**LIQUID SPECIFIC HEAT**	**kJ/kg°C**				
10	**LIQUID VISCOSITY**	**cP**				
11	**LIQUID THERMAL CONDUCTIVITY**	**W/m°C**				
12	**LIQUID SURFACE TENSION**	**Dyn/cm**				
13	**LATENT HEAT**	**kJ/kg**				
14	**VAPOUR DENSITY**	**kg/m³**				
15	**VAPOUR SPECIFIC HEAT**	**kJ/kg°C**				
16	**VAPOUR VISCOSITY**	**cP**				
17	**VAPOUR THERMAL CONDUCTIVITY**	**W/m°C**				
18	**MOLECULAR WEIGHT**					
19	**OPERATING TEMPERATURE**	**°C**				
20	**OPERATING PRESSURE**	**Bar a**				
21	**PRESSURE DROP** **Allow/Calc**	**bar**				
22	**No. OF PASSES**					
23	**VELOCITY OF FLOW**	**m/s**				
24	**FOULING ALLOWANCE**	**m²C/W**				
25	**MAP (DESIGN PRESSURE)**	**bar g**				
26	**TEST PRESSURE** **New/Corroded**	**bar g**				
27	**DESIGN TEMPERATURE**	**°C**				
28	**HEAT DUTY**	**MW**				
29	**H.T. COEFFICIENT** **Required / Actual**	**W/m²C**				
30	**LMTD**	**°C**				
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

APPLICABLE DESIGN CODES & STANDARDS:

TUBESHEET & BELLOWS DESIGN DATA

The following coincident pressures and their coincident temperatures are possible and must be used in the design of the tubesheets and the determination of bellows requirements.
The use of differential pressure design methods is not permitted.

	Case No.	Minimum Design Cycle Life of Bellows	Shellside Pressure [barg]	Shell Metal Temp. [°C]	Tubeside Pressure [barg]	Tube Metal Temp. [°C]
NORMAL OPERATION	1					
SHELLSIDE FLOW FAILURE	2					
TUBESIDE FLOW FAILURE	3					
BELLOWS EXPANSION	4					
BELLOWS COMPRESSION	5					
START-UP	6					
SHUT-DOWN	7					
EMERGENCY CONDITIONS	8					
EMERGENCY CONDITIONS	9					
EMERGENCY CONDITIONS	10					
SHELLSIDE HYDROTEST	11					
TUBESIDE HYDROTEST	12					

NOTES

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

NOTES (Continued)

Mechanical Datasheet - Cooling Water Cooler	DOC. NO. Not Applicable
	PAGE NO. 6 of 9
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

SKETCH

Ref	Service	Size	Rating	Standout (mm)	Remarks

Drawing not to scale
All dimensions in mm

ESTIMATED WEIGHTS (kg)	
Fabricated	
Operating	
Full of water	

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

SKETCH

TUBESHEET LAYOUT

Drawing not to scale
All dimensions in mm

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

SKETCH

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

INSPECTION TASKS

INSPECTION TASKS:

All tasks identified below shall be included on the vendors quality plan. Where inspection task numbers have a suffix "C", a certificate shall be supplied. These certificates shall be included in the exchanger certification dossier. The quality plan shall also include all additional inspection tasks required by the Independent Third Party Inspection Agency.

MC1	**C**	Review material certificates (EN-10204, 3.1 standard).
MC2	**C**	Check certified chemical & mechanical properties of all materials.
MC3	**C**	Check that ultrasonic testing of base plate has been carried out before cladding.
MC4	**C**	Check that bond strength tests and ultrasonic testing of cladding bond have been carried out.
MC5	**C**	Check cladding thickness.
WRod1		Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.
WRod2		Check method of distribution of welding consumables and means of storage on the shop floor.
WeldPr	**C**	Check weld procedures and qualifications.
Welder	**C**	Check weld map and welders qualifications for shell and tube end welds.
TrHtNos		Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.
Head	**C**	Identify heads and check shape, dimensions and thickness.
Plate		Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.
Lamin	**C**	Inspect edges of material for weld preparation and for discontinuities and laminations.
Fitup		Inspect assembly including alignment of main seams prior to welding.
Nozzles		Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.
Coupon1		Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material identification and stamping.
Welding		Survey welding and back gouging and ensure that approved procedures are followed.
Tube holes		Check tube holes are free from burrs and the finish, grooving and tolerances are in accordance with the approved drawing and code.
Tubes		Check that the tubes are free from surface defects and thinning after expanding and witness soapy water test of tube end welds.
Baffles		Check baffles to approved drawing and that the shell is correctly sized and free of obstructions for tube bundle insertion.
Coupon2	**C**	Witness welding of test plates and review test results.
InspWeld	**C**	Inspect finished welds for freedom from undercut and surface defects.
DimChk	**C**	Check dimensions to approved drawing and specified tolerances given in TEMA.
IntFinish	**C**	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.
MPT	**C**	Check MPT procedure and operators qualifications and survey the testing of all exchanger welds.
RT	**C**	Ensure radiography of exchanger welds is in accordance with approved drawing and specified code. Review radiographs.
UT	**C**	Witness ultrasonic examination of welds and review reports.
PWHT1	**C**	Check PWHT procedure for exchanger. Inspect thermocouple certificates and attachment. Check final temperature charts.
preHydrT	**C**	Witness pre-final-hydraulic test before titanium battons are installed. Check test set up and pressure gauge certificates.
Weld-Ti		Survey welding of battens, nozzle inserts and internals and ensure that approved procedures are followed.
RT-Ti	**C**	Witness radiographic technique test for titanium.
IntFinish	**C**	Inspect internal finish, weld dressing and shell/nozzle radii of flush nozzles.
pPWHT	**C**	Check pre-PWHT of titanium nozzle inserts and other welded titanium sub-assemblies.
PWHT2	**C**	Check PWHT procedure for Ti welds. Inspect thermocouple certificates and attachment. Check final temperature charts.
HydrT	**C**	Witness hydraulic test. Check test set up and pressure gauge certificates. Check that the exchanger is clean and dry after testing.
	C	Check Hot Gas Cyle Test Procedure, Inspect thermocouple certificates and attachment. Check final temperature charts.
DPT-Ti	**C**	Check DPT procedure and operators qualifications and survey the testing of internal Ti welds after the Hot Gas Cycle Test.
HelT	**C**	Check that helium test is carried out in line with the approved procedure and review results.
Final-1	**C**	Check that the equipment is clean and dry before sealing.
Final-2	**C**	Check general workmanship and completeness of supply.
Final-3	**C**	Check Paint or other finishes for continuity and against specification. (check insulation and cladding)
Final-4	**C**	Check copy of nameplate.
Final-5	**C**	Check Equipment packed and protected ready for shipment.
Final-6		Review Dossier.

Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet

Item: Cooling Water Expansion Vessel

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

1	**DESIGN & OPERATING DATA**	**Rev**
2	**APPLICATION STANDARD (DESIGN CODE)**	
3	**PED CONFORMANCE CATEGORY (PREFERRED MODULE)**	
4	**VESSEL SPECIFICATION**	
5	**GENERAL PROJECT SPECIFICATION FOR MECHANICAL EQUIPMENT**	
6	**PIPING DESIGN NOZZLE LOADING FOR STATIC EQUIPMENT**	
7	**VENDOR DOCUMENTATION SPECIFICATION**	
8	**SHELL MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS**	
9	**SHELL MAP (DES. PRESSURE ext.) at top @ TEMPERATURE**	
10	**SHELL OPERATING PRESSURE @ TEMPERATURE (Min/Norm/Max)**	
11	**JACKET MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS**	
12	**JACKET MAP (DES. PRESSURE ext.) at top @ TEMPERATURE**	
13	**JACKET OPERATING PRESSURE @ TEMPERATURE**	
14	**CORROSION/EROSION ALLOWANCE (internal / external)**	
15	**STRESS RELIEF/PWHT**	
16	**RADIOGRAPHY**	
17	**JOINT COEFFICIENT (PED ESR 7.2)**	
18	**HYDRAULIC TEST PRESSURE**	
19	**AIR TEST PRESSURE (with soap suds)**	
20	**BASIC WIND SPEED**	
21	**SEISMIC CRITERIA**	
22	**CYCLIC SERVICE**	
23	**CREEP RANGE**	
24	**VESSEL CONTENTS/PED FLUID PHASE & GROUP No.**	
25	**NATURE OF CONTENTS**	
26	**MAX. OPERATING STATIC HEAD**	
27	**INTERNAL FINISH**	
28	**WELD DRESSING (internal / external)**	
29	**INTERNAL COATING**	
30	**EXTERNAL FINISH**	
31	**EXTERNAL PAINTING**	
32	**INSULATION (by Vendor)**	
33	**FIREPROOFING (by site contractor)**	
34	**INSPECTION AUTHORITY**	

35	**MATERIAL SPECIFICATIONS**				
36	**HEADS & SHELL**		**JACKET**		
37	**CLADDING**				
38	**BODY FLANGE**				
39	**NOZZLE: FLANGES**		**SUPPORT LEGS**		
40	**NOZZLE: NECKS**		**EXT. ATTACHMENTS**		
41	**BOLTING: EXTERNAL**		**FLANGE FINISH**		
42	**BOLTING: INTERNAL**		**PMA REQUIRED**		
43	**GASKETS: EXTERNAL**		**MATERIAL CERTS**		
44	**GASKETS: INTERNAL**		**IMPACT TEST REQ.**		
45	**FIXED INTERNALS**		**ELONGATION REQ.**		
46	**REMOVABLE INT'LS**		**WELDING QUALS**		

47	**CAPACITY & WEIGHTS**					
48	**ESTIM'D WEIGHT FABRICATED (EMPTY)**	**kg**		**S.G. OF OPERATING FLUID**		
49	**ESTIM'D WEIGHT INTERNALS**	**kg**		**VOLUME OF OPERATING FLUID**	Litres	
50	**ESTIM'D WEIGHT ATTACHMENTS**	**kg**		**WEIGHT OF OPERATING FLUID**	kg	
51	**ESTIM'D WEIGHT INSTALLED (EMPTY)**	**kg**		**VESSEL CAPACITY (GROSS)**	m^3	
52	**ESTIM'D WEIGHT INSTALLED OPERATING**	**kg**		**JACKET CAPACITY (GROSS)**	m^3	
53	**ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID**	**kg**				
54	**ESTIM'D WEIGHT INSTALLED FULL OF WATER**	**kg**				

Mechanical Datasheet-Cooling Water Expansion Vessel	DOC. NO. Not Applicable
	PAGE NO. 3 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

									Rev
1	**BRANCH DUTY**								
2	**Ref**	**Service**	**DN**	**No Off**	**Flange**	**Rating**	**Standout**	**Notes**	
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21	Nozzle standouts are measured from vessel centre-line to flange face.								
22	**ADDITIONAL SPECIFICATIONS & STANDARDS**								
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

NOTES (Continued)

Mechanical Datasheet-Cooling Water Expansion Vessel	DOC. NO. Not Applicable
	PAGE NO. 5 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	SKETCH	Rev
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53	All dimensions in millimetres	
54	Drawing not to scale	
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Mechanical Datasheet-Cooling Water Expansion Vessel	DOC. NO. Not Applicable
	PAGE NO. 6 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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53	All dimensions in millimetres	
54	Drawing not to scale	
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Mechanical Datasheet-Cooling Water Expansion Vessel	DOC. NO. Not Applicable
	PAGE NO. 7 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

				Rev
			INSPECTION TASKS	
1	**INSPECTION TASKS**			
2	All tasks identified below shall be included on the vendors quality plan.			
3	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
4	These certificates shall be included in the vessel certification dossier.			
5	1.	C	Review material certificates (EN-10204. 3.1 standard).	
6	2.	-	Check certified chemical & mechanical properties of all materials.	
7	3.	-		
8	4.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
9	5.	C	Check method of distribution of welding consumables and means of storage on the shop floor.	
10	6.	-		
11	7.	C	Check weld procedures and qualifications.	
12	8.	C	Check weld map and welders qualifications.	
13	9.	-		
14	10.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
15	11.	-		
16	12.	C	Identify heads and check shape, dimensions and thickness.	
17	13.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.	
18	14.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
19	15.	-		
20	16.	C	Inspect assembly including alignment of main seams prior to welding.	
21	17.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.	
22	18.	-		
23	19.	C	Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material identification and stamping.	
24	20.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
25	21.	C	Witness welding of test plates and review test results.	
26	22.	C	Inspect finished welds for freedom from undercut and surface defects.	
27	23.	-		
28	24.	C	Check dimensions to approved drawing and tolerances given in specifications & design code.	
29	25.	-		
30	26.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
31	27.	-		
32	28.	C	Check DPI procedure and operators qualifications and survey the testing of all vessel welds.	
33	29.	C	Ensure radiography of vessel welds is in accordance with approved drawing and specified code. Review radiographs.	
34	30.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
35	31.	-		
36	32.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
37	33.	-	Gauge check column internal diameter.	
38	34.	C	Witness hydraulic test. Check test set up and pressure gauge certificates.	
39	35.	-		
40	36.	C	Check that the vessel is clean and dry before sealing.	
41	37.	C	Check general workmanship and completeness of supply.	
42	38.	C	Check Paint or other finishes for continuity and against specification.	
43	39.	C	Check copy of nameplate.	
44	40.	C	Check Equipment packed and protected ready for shipment.	
45	41.	-	Review Dossier.	
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Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet DCC Cooler

Mechanical Datasheet - DCC Cooler	DOC. NO. Not Applicable
	PAGE NO. 2 of 6
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION	UNITS	DATA				Rev
1	**DESIGN & OPERATING DATA**						
2			**HOT FLUID**		**COLD FLUID**		
3			**In**	**Out**	**In**	**Out**	
4	**FLUID**						
5	**TOTAL FLUID FLOW**	**kg/hr**					
6	**VAPOUR FLOW**	**kg/hr**					
7	**LIQUID FLOW**	**kg/hr**					
8	**LIQUID DENSITY**	**kg/m³**					
9	**LIQUID SPECIFIC HEAT**	**kJ/kg°C**					
10	**LIQUID VISCOSITY**	**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**	**W/m°C**					
12	**LIQUID SURFACE TENSION**	**Dyn/cm**					
13	**LATENT HEAT**	**kJ/kg**					
14	**VAPOUR DENSITY**	**kg/m³**					
15	**VAPOUR SPECIFIC HEAT**	**kJ/kg°C**					
16	**VAPOUR VISCOSITY**	**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**	**W/m°C**					
18	**MOLECULAR WEIGHT**						
19	**OPERATING TEMPERATURE**	**°C**					
20	**OPERATING PRESSURE (Normal Inlet/Max. Inlet)**	**Bar a**					
21	**PRESSURE DROP Allow/Calc**	**Bar**					
22	**No. OF PASSES**						
23	**WALL SHEAR RATE**	**Pa.**					
24	**FOULING ALLOWANCE**	**m²C/W**					
25	**MAP (DESIGN PRESSURE)**	**bar g**					
26	**TEST PRESSURE New/Corroded**	**bar g**					
27	**DESIGN TEMPERATURE**	**°C**					
28	**HEAT DUTY**	**MW**					
29	**H.T. COEFFICIENT Service / Clean**	**W/m²C**					
30	**LMTD**	**°C**					
31	**HEAT TRANSFER SURFACE AREA**	**m²**					
32	**DESIGN MARGIN**	**%**					
33							
34							
35							
36							

37	**CONSTRUCTION & MATERIALS**			
38	**DESIGN CODES:**		**Type:**	
39	**PED FLUID PHASE & GROUP No:**	**HOT SIDE:**	**COLD SIDE:**	
40	**PED EQUIPMENT CATEGORY:**		**PED CONFORMITY MODULES:**	
41	**HEAT Ex. PLATE: MATERIAL:**		**END PLATE: MATERIAL:**	
42	**THICKNESS:**		**THICKNESS:**	
43	**No. OFF:**		**TIE BARS: MATERIAL:**	
44	**GASKET MATERIAL:**		**No. OFF:**	
45	**GASKET TYPE:**		**DIAMETER:**	
46	**NOZZLES:**	**HOT SIDE**	**COLD SIDE**	
47	**MATERIAL:**			
48	**SIZE:**			
49	**RATING:**			
50	**LINING:**			
51	**POSITION:**			
52	**CONNECTION TYPE:**			
53	**MINIMUM N.D.T.**		**INSPECTION BY:**	
54	**ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID**	**kg**		
55	**ESTIM'D WEIGHT INSTALLED FULL OF WATER**	**kg**		

Mechanical Datasheet - DCC Cooler	DOC. NO. Not Applicable
	PAGE NO. 3 of 6
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION	UNITS	DATA				Rev
1	**TURNDOWN & OPERATING DATA**						
2			**HOT FLUID**		**COLD FLUID**		
3			**In**	**Out**	**In**	**Out**	
4	**FLUID**						
5	**FLUID FLOW**	**kg/hr**					
6	**VAPOUR FLOW**	**kg/hr**					
7	**LIQUID FLOW**	**kg/hr**					
8	**LIQUID DENSITY**	**kg/m3**					
9	**LIQUID SPECIFIC HEAT**	**kJ/kg°C**					
10	**LIQUID VISCOSITY**	**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**	**W/m°C**					
12	**LIQUID SURFACE TENSION**	**Dyn/cm**					
13	**LATENT HEAT**	**kJ/kg**					
14	**VAPOUR DENSITY**	**kg/m3**					
15	**VAPOUR SPECIFIC HEAT**	**kJ/kg°C**					
16	**VAPOUR VISCOSITY**	**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**	**W/m°C**					
18	**MOLECULAR WEIGHT**						
19	**OPERATING TEMPERATURE**	**°C**					
20	**OPERATING PRESSURE**	**Bar(g)**					
21	**PRESSURE DROP** **Allow/Calc**	**bar**					
22	**HEAT DUTY**	**MW**					
23	**H.T. COEFFICIENT** **Service / Clean**	**W/m²C**					
24	**LMTD**	**°C**					
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35	**APPLICABLE DESIGN CODES & STANDARDS:**						
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	SKETCH	Rev
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	INSPECTION TASKS			Rev
1	**INSPECTION TASKS**			
2	All tasks identified below shall be included on the vendors quality plan.			
3	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
4	These certificates shall be included in the exchanger certification dossier.			
5				
6	**MC1**	**C**	Review material certificates (EN-10204, 3.1.standard).	
7	**MC2**	**C**	Check certified chemical & mechanical properties of all materials.	
8				
9	**WRod1**		Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
10	**WRod2**		Check method of distribution of welding consumables and means of storage on the shop floor.	
11				
12	**WeldPr**	**C**	Check weld procedures and qualifications.	
13	**Welder**	**C**	Check weld map and welders qualifications.	
14				
15	**TrHtNos**		Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
16				
17	**Plate**		Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas	
18			susceptible to thinning.	
19	**Lamin**	**C**	Inspect edges of material for weld preparation and for discontinuities and laminations.	
20				
21	**Fitup**		Inspect assembly including alignment of main seams prior to welding.	
22	**Nozzles**		Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of	
23			bolt holes.	
24				
25	**Welding**		Survey welding and back gouging and ensure that approved procedures are followed.	
26	**InspWeld**	**C**	Inspect finished welds for freedom from undercut and surface defects.	
27				
28	**DimChk**	**C**	Check dimensions to approved drawing and code.	
29	**IntFinish**	**C**	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
30				
31	**MPT**	**C**	Check MPT procedure and operators qualifications and survey the testing of all exchanger welds.	
32	**RT**	**C**	Ensure radiography of exchanger welds is in accordance with approved drawing and specified code.	
33			Review radiographs.	
34	**UT**	**C**	Witness ultrasonic examination of welds and review reports.	
35				
36	**HydrT**	**C**	Witness hydraulic test. Check test set up and pressure gauge certificates. Check test water certificate.	
37			Check that the exchanger is clean and dry after testing.	
38				
39	**Final-1**	**C**	Check that the equipment is clean and dry before sealing.	
40	**Final-2**	**C**	Check general workmanship and completeness of supply.	
41	**Final-3**	**C**	Check Paint or other finishes for continuity and against specification.	
42	**Final-4**	**C**	Check copy of nameplate.	
43	**Final-5**	**C**	Check Equipment packed and protected ready for shipment.	
44	**Final-6**		Review Dossier.	
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Client:	**To be determined**
Plant Location:	**To be specified**

Item: Mechanical Datasheet DCC Internals

Mechanical Data Sheet - DCC Internals	DOC. NO. Not Applicable
	PAGE NO. 2 of 4
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESIGN & OPERATING DATA				Rev
	OVERALL DUTY	**Units**			
	FLUID HANDLED				
	NATURE OF CONTENTS				
	MAX. LIQUID DENSITY [FOR MECHANICAL DESIGN]	kg/m^3			
	MAX. LIQ. HEIGHT ABOVE BOTTOM TAN [MECH. DES]	mm			
	MIN OPERATING PRESSURE	barG			
	NORM OPERATING PRESSURE	barG			
	MAX OPERATING PRESSURE	barG			
	MIN OPERATING TEMPERATURE	^{o}C			
	NORM OPERATING TEMPERATURE	^{o}C			
	MAX OPERATING TEMPERATURE	^{o}C			
	MAX DESIGN PRESSURE	barG			
	MIN DESIGN PRESSURE	barG			
	MAX DESIGN TEMPERATURE	^{o}C			
	MIN DESIGN TEMPERATURE	^{o}C			
	MIN AMBIENT TEMPERATURE	^{o}C			
	TOTAL PRESSURE DROP	mbar			

	MATERIALS OF CONSTRUCTION (MOC)		Rev
	COLUMN SHELL & HEADS	DISTRIBUTORS	
	PACKING		
	SUPPORT BEAMS	DEMISTER	
	SUPPORT GRIDS	BOLTING	
	WALL WIPERS	GASKETS	

	DIMENSIONS	Rev

	INTERNAL DESIGN		Rev
	BED HEIGHT		
	STRUCTURED/RANDOM	Structured	
	TYPE (GENERIC, OR TYPICAL VENDOR DESIGNATION)	Vendor to Advise	
	TYPICAL MODEL HOLD DOWN GRID	Vendor to Advise	
	TYPICAL MODEL DEMISTER	Vendor to Advise	

	ADDITIONAL SPECIFICATIONS & STANDARDS	Rev
	PROCESS DATASHEET	
	DESIGN & MANUFACTURE OF COLUMN INTERNALS	
	VENDOR DOCUMENTATION REQUIREMENTS - DOCUMENT CONTROL	
	VENDOR DOCUMENTATION REQUIREMENTS - ENGINEERING	

	GENERAL NOTES	Rev

Aker CleanCarbon

AkerSolutions

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

		Rev
1	**GENERAL NOTES (Continued)**	
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Mechanical Data Sheet - DCC Internals	DOC. NO. Not Applicable
	PAGE NO. 4 of 4
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	SKETCH	Rev
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Client:	**To be determined**
Plant Location:	**To be specified**

Flue Gas Fan Data Sheet

Project No

Equipment **Flue Gas Fan**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA			REV.
1	**GENERAL**					
2	MANUFACTURER					
3	MODEL / SIZE					
4	DESIGN CODE					
5	LOCATION					
6						
7	**OPERATING CONDITIONS**					
8	OPERATION MODE					
9	HAZARDOUS AREA CLASSIFICATION		ZONE	GAS GROUP	TEMP CLASS / DUST HAZARD	
10						
11	Gas Handled					
12	Gas Characteristics :Flammable / Explosive / Corrosive / Erosive					
13	Entrained solids					
14	Entrained liquids					
15						
16	Relative Humidity	%				
17	Compressibility / Cp/Cv (Normal Flowrate case)					
18	Density at Max / Norm / Min Flowrates Inlet	kg/m³				
19	Specific Heat Inlet	kJ/kg.°C				
20	Viscosity Inlet					
21	Solids Content / Size					
22	Dew Point Exit Fluid					
23			Minimum	Normal	Maximum	
24	Operating Temperature	° C				
25	Capacity at Inlet	kg/h				
26	Inlet Pressure	bara				
27	Discharge Pressure	bara				
28	Differential Pressure	bar				
29						
30	Minimum Design Pressure	barg				
31	Design Temperature	°C				
32						
33	Capacity Control Arrangement					
34						
35	Discharge Temperature	°C				
36			Minimum	Normal	Maximum	
37	Actual Volume flow at suction conditions	m3 /hr				
38						
39						
40	Molecular Weight					
41						
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Flue Gas Fan Data Sheet

Project No	
Equipment	**Flue Gas Fan**
Equipment No	
Number Off	

	DESCRIPTION		UNITS	DATA				REV.
1	**PERFORMANCE**							
2	Number of Stages							
3	Fan Speed	Normal	rpm					
4		1st Critical	rpm					
5	Impeller Diameter	Minimum	rpm					
6		Rated	rpm					
7		Maximum	rpm					
8	Impeller Tip Speed		m/s					
9								
10	Suction Velocity		m/s					
11	Discharge Velocity		m/s					
12								
13	Efficiency		%					
14	Absorbed Power at Rated Conditions		kW					
15	Absorbed Power Maximum		kW					
16								
17	**UTILITY REQUIREMENTS**							
18	Electric Supply							
19	Seal Fluid	Type						
20		Pressure	barg					
21		Temperature	° C					
22		Flowrate	l/hr					
23								
24	**CONNECTIONS**							
25				TYPE	RATING	SIZE	POSITION	
26	Suction							
27	Discharge							
28								
29	Casing Drain							
30	Seal Purge Inlet							
31	Seal Purge Outlet							
32								
33								
34								
35	**MATERIALS OF CONSTRUCTION**			(note 4)				
36	Casing							
37	Impeller(s)							
38	Shaft							
39	Sleeve							
40	Bearing Housing							
41	Gaskets & Seals							
42	Shaft Seal							
43	Seal Housing							
44	Baseframe							
45	Coupling Guard							
46	Interstage Packing							
47	Flexibles							
48	Flexible Reinforcing Rings / Backing Flanges							
49	Coupling Spacer							
50	Coupling Discs							
51	Drain Pipework							
52	Drain Valves							
53	Seal Purge Piping							
54	Cooling Fan							
55								

Project No.

Equipment **Flue Gas Fan**

Equipment No.

Number Off

	DESCRIPTION	UNITS	DATA	REV.
1	**MECHANICAL DATA**			
2	Fan Type			
3	Casing Mounting			
4	Casing Design Pressure	barg		
5	Casing Split			
6	Casing Corrosion Allowance	mm		
7	Casing Design Temperature	° C		
8	Impeller Type			
9	Number of Vanes			
10	Shaft Diameter at sleeve	mm		
11	Diameter at coupling	mm		
12	Diameter at bearings	mm		
13	Bearing span	mm		
14	Balancing Grade			
15	Seal Manufacturer			
16	Type			
17	No rings			
18				
19	Coupling Manufacturer			
20	Model / type			
21	Rating	Nm		
22	Lubrication			
23	Spacer length	mm		
24	Service factor			
25	Guard			
26	Bearings Type			
27	Impeller end/ Coupling end			
28	Lubrication Type			
29	Lubricant			
30	Baseplate Type			
31				
32	Casing Inspection Opening Type			
33	Size	mm		
34	Casing Drain Size	mm		
35				
36	**CONTROL & INSTRUMENTATION**			
37				
38				
39				
40				
41				
42				
43				
44	**DRIVE ARRANGEMENT**			
45	Drive Arrangement			
46	Drive Motor			
47	Manufacturer			
48	Enclosure / Ingress Protection			
49	Installed Power / Speed			
50	Gearbox Type			
51	Ratio			
52	Drive Belt Type			
53	Drive Belts - No off			
54				
55				

Project No

Equipment **Flue Gas Fan**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA	REV.
1	**SCOPE OF SUPPLY**			
2	Fan			
3	Drive Motor			
4	Drive Coupling & Guard			
5	Shaft Seals			
6	Combined Heavy Duty Baseplate			
7	Anti-Vibration Mounts			
8	Acoustic Insulation / cladding			
9	Silencers			
10	Suction & Discharge Flexible Connections			
11	Stage Casing Drains with Isolation Valves			
12	Commissioning Spare Parts			
13	Two Years Operating Spare Parts			
14	Capital Spare Parts			
15	First Fill of Lubrication			
16	Special Tools			
17				
18				
19	**WEIGHTS & DIMENSIONS**			
20	Fan Weight	kg		
21	Driver Weight	kg		
22	Total Weight	kg		
23				
24	Assembly Overall Size (L x W x H)	mm		
25				
26				
27				
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29				
30				
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Project No

Equipment **Flue Gas Fan**

Equipment No

Number Off

					REV.
1	**INSPECTION, TESTING AND CERTIFICATION**				
2	**QUALITY LEVEL:-** N/A				
3					
4	All tasks listed below shall be included on the Vendor's Quality Plan for this package as a minimum and shall be performed at the Vendor's works.				
5	Refer also to inspection requirements specified on reference documents.				
6					
7	**TASK DESCRIPTION**	WITNESS	OBSERVE	REVIEW	
8	FAN ASSEMBLY				
9	Review material certificates (EN 10204-3.1 standard.)				
10	Identify materials against material certificate/cast numbers.				
11	Check certified chemical properties of materials.				
12	Check certified results of mechanical test of materials.				
13	Review material guarantee.				
14	Check heat treatment certificates, including temperature records.				
15	Check operator qualifications and suitability of all NDT operators.				
16	Check certified results of NDT tests of materials and welds.				
17	Check qualification of welders and operators.				
18	Part dimensional check for site erection purposes to certified drawings.				
19	General workmanship and completeness of supply.				
20	Check machined casing for general workmanship, finish and cleanliness.				
21	Paint or other finish for continuity.				
22	Flange face finish against requirements of item specification.				
23	Guards to correct standard and are securely attached.				
24	Alignment of driver with driven unit.				
25	Fabrication of baseplate against requirements of item specification.				
26	Pressure test of pressure retaining parts				
27	Copy of machine rating plate.				
28	Dynamic balancing check of rotating impeller assembly (including spare assembly if appropriate)				
29	Mechanical run test at rated speed.				
30	Functional Test of the capacity control system				
31	Performance test across complete range of capacity rising and falling. (Option)				
32	Each item is suitably prepared for shipment.				
33					
34	ELECTRIC MOTORS				
35	Hazardous area classification certificate.				
36	Routine works test certificate.				
37	Type test certificate.				
38	Earthing and bonding. Continuity between equipment items and earth tag.				
39	Compliance with specification, correct enclosure, termination arrangements, etc.				
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Project No

Equipment **Flue Gas Fan**

Equipment No

Number Off

		REV.
1	**REFERENCE DOCUMENTS**	
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20	**GENERAL NOTES**	
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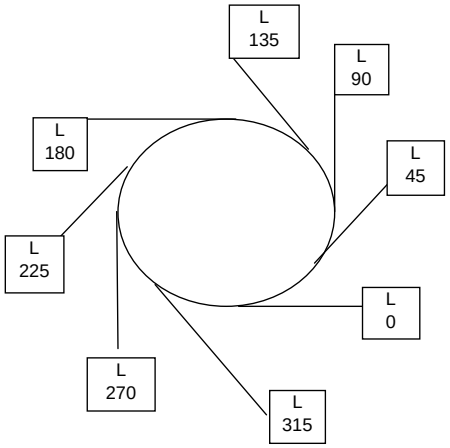
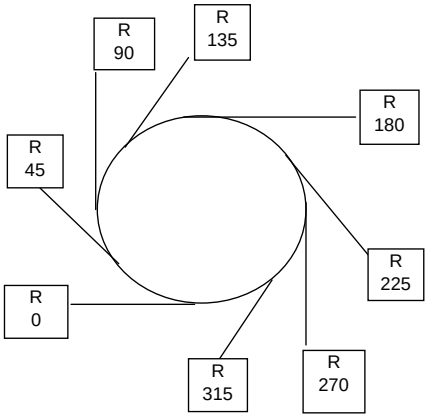
Project No	
Equipment	**Flue Gas Fan**
Equipment No	
Number Off	

SKETCH of Discharge Connections & Drive Positions

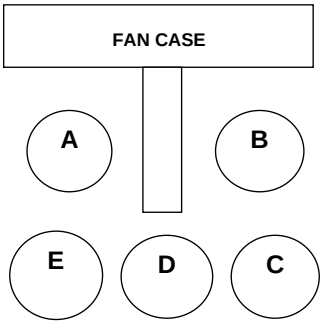
Anti-Clockwise Rotation Viewed from Drive End



Clockwise Rotation viewed from Drive End



REQUIRED DISCHARGE NOZZLE POSITION



REQUIRED MOTOR POSITION

Client:	**To be determined**
Plant Location:	**To be specified**

FUEL GAS CONDITIONING SKID MECHANICAL DATASHEET

Datasheet **Gas Pressure Reducing Stations**	Issue				
	Purpose				
	Prepared by				
	Checked by				
	Approved by				
	Date				

Project No. :	Tag No. :	**Page:**	**2 of 4**
Client : **To be determined**	Equipment Name : **Gas Pressure Reducing Skids 1 & 2**		
Location : **To be specified**	Process Area :		
Plant :	P & ID No. :		
	Doc. No. : Not Applicable		

1.0 Introduction

2.0 Process Data for Gas Pressure Reducing Stations

2.1 Gas Inlet to PRS 1

Gas inlet

				Notes
Gas inlet pressure				
	Max		bara	
	Norm		bara	
	Min		bara	
Gas inlet temperature				
	Max		°C	
	Norm		°C	
	Min		°C	
	Design	VTA		
Gas inlet mass flowrate				
	Max		te/h	
	Norm		te/h	
	Min		te/h	

2.2 PRS1 Outlet Gas

Gas outlet

				Notes
Gas outlet pressure from PRS1				
	Max		bara	
	Norm		bara	
	Min		bara	
Gas outlet temperature from PRS1				
	Max		°C	
	Norm		°C	
	Min		°C	
Gas outlet mass flowrate				
	Max		te/h	
	Norm		te/h	
	Min		te/h	
	Trip Condition			

Datasheet **Gas Pressure Reducing Stations**	Issue				
	Purpose				
	Prepared by				
	Checked by				
	Approved by				
	Date				

Project No. :		Tag No. :	Page: 3 of 4
Client :	**To be determined**	Equipment Name :	**Gas Pressure Reducing Skid**
Location :	**To be specified**	Process Area :	
Plant :		P & ID No. :	
		Doc. No. : Not Applicable	

2.3 Inlet Gas - PRS2 to auxiliary boiler Gas inlet

					Notes
Gas inlet pressure					
	Max		bara		
	Norm		bara		
	Min		bara		
Gas inlet temperature					
	Max		°C		
	Norm		°C		
	Min		°C		
	Design				
Gas inlet mass flowrate					
	Max		te/h		
	Norm		te/h		
	Min		te/h		

2.4 Outlet Gas - PRS2 to auxiliary boiler Gas outlet

				Notes
Gas outlet pressure to aux. boiler				
	Max		bara	
	Norm		bara	
	Min		bara	
Gas outlet temperature to aux. boiler				
	Max		°C	
	Norm		°C	
	Min		°C	
Gas outlet mass flowrate				
	Max		te/h	
	Norm		te/h	
	Min		te/h	
Trip Condition				

Datasheet **Gas Pressure Reducing Stations**	Issue				
	Purpose				
	Prepared by				
	Checked by				
	Approved by				
	Date				

Project No. :		Tag No. :	Page: 4 of 4
Client :	**To be determined**	Equipment Name :	**Gas Pressure Reducing Skid**
Location :	**To be specified**	Process Area :	Steam & Power Supply
Plant :		P & ID No. :	
		Doc. No. : Not Applicable	

3.0 Filtration efficiency for gas turbine:

3.1 Filtration efficiency for HRSG:

Client:	**To be determined**
Plant Location:	**To be specified**

Gas Turbine Package Mechanical Datasheet

AkerSolutions

PROJECT TITLE

GAS TURBINE PACKAGE MECHANICAL DATASHEET

Doc. No. Not Applicable

APPLICABLE TO: ● PROPOSAL ○ PURCHASE ○ AS BUILT ITEM

FOR UNIT

SITE SERIAL NUMBER

SERVICE NUMBER REQUIRED

● CONTINUOUS ○ INTERMITTENT ○ STANDBY DRIVEN EQUIPMENT

MANUFACTURER ☐ MODEL ISO RATING @ RPM

NOTE: INFORMATION TO BE COMPLETED: ○ BY PURCHASER ☐ BY MANUFACTURER ◯ BY MFR IF NOT BY PURCHASER

GENERAL

CYCLE: ○ REGEN ○ SIMPLE ● EXHAUST HEAT RECOVERY TYPE: ◯ SINGLE SHAFT ◯ MULTI SHAFT

DRIVEN EQUIPMENT: NORMAL SHAFT, kW @ RPM RATED SHAFT kW @ RPM

OUTPUT SHAFT SPEED RANGE ◯ MIN ◯ MAX RPM

○ DESIRED MINIMUM SITE POWER kW @ RPM

OPERATION ○ ATTENDED ● UNATTENDED ☐ POTENTIAL MAXIMUM POWER **SEE BELOW** kW

FOR PROCESS DATA SEE DATA SHEET:

PERFORMANCE

GAS TURBINE INCLUDING ALL LOSSES

	SITE RATED	NORMAL DUTY	SITE MAX TEMP	SITE MIN TEMP
● DRY BULB TEMP, °C				
● RELATIVE HUMIDITY %				-
● BAROMETER, BAR				
☐ OUTPUT,kW				
☐ HEAT RATE,LHV, MJ/kW-HR				
☐ OUTPUT SHAFT SPEED, RPM				
☐ AIR FLOW kg/SEC				
☐ EXHAUST FLOW kg/SEC				
☐ FIRING TEMPERATURE, °C				
☐ GAS GEN. EXHAUST TEMP., °C				
☐ PT EXHAUST TEMP., °C				
○ CERTIFIED POINT				

(1) INCLUDING ○ STEAM ○ WATER EFFECTS FOR

◯ EMISSION CONTROL ◯ AUGMENTATION

☐ STEAM FLOW, kg/HR

☐ WATER FLOW, m^3/HR

● EXHAUST GAS BACK PRESSURE -

APPLICABLE SPECIFICATIONS:

○ GOVERNING SPECIFICATION (IF DIFFERENT)

● VENDOR HAVING UNIT RESPONSIBILITY

SHIPMENT:

○ DOMESTIC ○ EXPORT ○ EXPORT BOXING REQUIRED

○ OUTDOOR STORAGE MORE THAN 6 MONTHS

SPARE ROTOR ASSEMBLY PACKAGED FOR

○ DOMESTIC ○ EXPORT SHIPMENT

COMMENTS: Sub-contractor required to offload therefore packing - own requirements

LOCATION

○ INDOOR ● OUTDOOR ○ GRADE

○ HEATED ○ UNDER ROOF ○ MEZZANINE

● UNHEATED ○ PARTIAL SIDES ○

ELECTRICAL AREA CLASSIFICATION

○ NON-HAZARDOUS ○ HAZARDOUS

APPLICABLE CODE: ○ NEC 500 ○ NEC 505 ○ IEC

CLASS: GROUP: DIVISION :

AREA CLASSIFICATION ○ DIVISION ○ ZONE

○ THIRD PARTY CERTIFICATION REQUIRED

● WINTERIZATION REQD

○ TROPICALIZATION REQD

UNUSUAL CONDITIONS: ○ DUST ○ FUMES

○ CORROSIVE AGENTS

○ OTHER

NOISE SPECIFICATIONS:

○ APPLICABLE TO MACHINE:

SEE SPECIFICATION

MAX. SOUND PRESS. LEVEL REQ'D

- SEE SPECIFICATION & PROCES DATA SHEET

PAINTING:

● MANUFACTURER'S STANDARD

● OTHER **SEE OWNER'S PAINTING SPEC. FOR COLOUR CODES**

NOTE: All Data Sheets References to GG=Gas Generator, SS = Single Shaft, and PT = Power Turbine

REMARKS:

Rev	Status	Date	Prp.	Check.	App.	Rev	Status	Date	Prp.	Check.	App.

AkerSolutions

PROJECT TITLE

GAS TURBINE PACKAGE MECHANICAL DATASHEET

Doc. No. Not Applicable

FUEL SYSTEM:

TYPE: ● GAS ○ LIQUID ○ DUAL

DUAL SYSTEM REQMTS: ○ GAS/GAS ○ GAS/LIQUID ○ LIQUID/LIQUID

● COMPLETE FUEL RECEIVING SYSTEM

○ MAXIMUM TIME ALLOWED TO COMPLETE TRANSFER SEC.

GAS FUELS

● FUEL ANALYSIS - MOL %

FOR FUEL SPECIFICATION SEE PROCESS GAS TURBINE DATA SHEET

COMPOSITION:

Methane	
Ethane	
Propane	
iso - Butane	
n - Butane	
C5	
C6	
C7	
C8	
C9	
Carbon Dioxide	
Nitrogen	
AVG. MOL. WT.	

TEMPERATURE ° C BELOW GRND:

ABOVE GRND:

PRESSURE bar a

MAX. AVAILABLE FUEL PRESS., bara

☐ FUEL PRESSURE REQUIRED

MAX./MIN., barg ___/___/___

COMPRESSION SYS REQD ○ YES ○ NO

HEATER REQD ☐ YES ☐ NO

○ RATE OF CHANGE OF LHV

REMARKS:

FUEL SYSTEM PIPING

○ BY PASS AND VENT VALVE

○ TWIN Y-TYPE STRAINER WITH CONTINUOUS FLOW

○ TRANSFER VALVE

☐ ISOLATION BLOCK VALVES ◎ ANSI FLANGE RATING

☐ NACE MATERIAL STANDARDS

LUBRICATION

LUBRICATION SYSTEMS

○ SEE DATA SHEETS

■ LUBE OIL VISCOSITY , ISO GRADE:

COMMON TO ◎ GAS GENERATOR/SINGLE SHAFT TURBINE

● FREE POWER TURBINE ● LOAD GEAR

● DRIVEN EQUIPMENT ● AUXILIARIES

○ (COMBINED) (SEPARATE) LUBE/SEAL SYSTEM

○ SYSTEM DESIGNED FOR SYNTHETIC LUBRICANT

LUBE SPECIFICATION

COMMON TO ◎ GAS GENERATOR ◎ POWER TURBINE

◎ LOAD GEAR ◎ DRIVEN EQUIPMENT

◎ AUXILIARIES

■ **OIL REQUIREMENTS**	FLOW m^3/HR	PRESSURE barg	HEAT LOAD MJ/HR
GG OR SS TURBINE			
DRIVEN EQUIPMENT			
GEAR			
COUPLINGS			
POWER TURBINE			
TOTAL			

MOUNTING ARRANGEMENT

○ CONSOLE ○ COLUMN ○ BASEPLATE

☐ WEIGHTS

	DRY INSTALLED WT. (kg)	SHIPPING WT. (kg)	DIMEN LxWxH (m)
GG OR SS TURBINE			
SS TURB. ROTOR			
POWER TURBINE			
P.T. ROTOR			
LUBE SYSTEM			
DRIVEN EQUIPMENT			
FILTER			
INLET SILENCER			
EXHAUST SILENCER			
DUCTING			
FIRE & GAS PACKAGE			
ESTIMATED TOTAL			

MAX ERECTION WEIGHT (kg) ITEM

MAX MAINTENANCE WEIGHT (kg) ITEM

REMARKS:

AkerSolutions

PROJECT TITLE

GAS TURBINE PACKAGE MECHANICAL DATASHEET

Doc. No. Not Applicable

UTILITIES: CONNECTIONS

○ **UTILITY CONDITIONS:**

TREATED WATER

- INLET TEMPERATURE
- OUTLET TEMPERATURE
- SUPPLY PRESSURE
- ALLOWABLE PRSSURE DROP
- DESIGN PRESSURE
- DESIGN TEMPERATURE

HEATING MEDIUM

- PRESSURE operating
- TEMPERATURE inlet/outlet
- DESIGN PRESSURE
- DESIGN TEMPERATURE
- ALLOWABLE PRESSURE DROP
- FOULING FACTOR

ELECTRICITY: ○ PILOT LIGHT INDICATORS

	MOTORS	HEATING	CONTROL	SHUTDOWN
VOLTAGE		See remarks		-
HERTZ				-
PHASE				-

COOLING WATER:

INLET TEMPERATURE °C MAX RETURN °C

DESIGN TEMPERATURE °C

NORM PRESS barg MIN RETURN barg

DESIGN PRESS barg MAX ALLOW D P bar

WATER SOURCE Closed circuit

INSTRUMENT AIR PRESSURE DESIGN, barg

MAX NORMAL MIN

REMARKS:

Heating:	VOLTAGE	HERTZ	PHASE
Motor Anti Condensation	=		
Enclosure/Wall Heaters	=		
Process Heater(Lube oil)	=		
Trace Heating	=		

☐ **TOTAL UTILITY CONSUMPTION:**

- COOLING WATER m^3/HR
- STEAM LEVEL barg barg barg
- STEAM, NORMAL kg/HR
- STEAM, MAX kg/HR
- INSTRUMENT AIR Nm^3/HR
- MOTORS (AUXILIARIES) kW
- BATTERY CHARGERS kW
- HEATERS kW
- PURGE (AIR OR N_2) Nm^3/HR

TURBINE AIR EXTRACTION REQUIRED:

- ○ NM^3/HR NO @ barg
- ☐ MAXIMUM PRESSURE AVAILABLE AT MINIMUM SPEED: barg
- ☐ MINIMUM SPEED: RPM
- ☐ DISCHARGE TEMPERATURE: °C
- ☒ COMPRESSOR EXTRACTION STAGE NUMBER:

REMARKS:

PURCHASER CONNECTIONS

CONNECTION	○ DESIGN APPROVAL REQUIRED	☐ SIZE	☐ FACING and RATING	○ POSITION	◎ FLANGED OR STUDDED	○ MATING FLG & GASKET BY VENDOR	☐ GAS VELOCITY M/SEC
INLET							
EXHAUST							
FUEL SUPPLY							
STEAM							
WATER							

Client:	**To be determined**
Plant Location:	**To be specified**

General Project Specification for Mechanical Equipment

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Contents

Appendix Contents

1. General

This specification shall form part of the detailed specification for each individual equipment item/package.

1.1 Precedence

In the event of a conflict of technical requirements within the requisition documents, the order of precedence shall be:-

- Local Laws and Regulations
- Equipment Data Sheets and Specifications
- Requisition/Purchase Order
- This Specification
- Referenced Project Specifications
- Referenced Design Codes and Standards

Notwithstanding the above, it is the Vendor's responsibility to contact the Purchaser to secure a formal, written, resolution of any conflict between the requirements stated within the above referenced documents.

1.2 Deviations

It is not the intention to exclude equipment that is not strictly in accordance with this or other referenced specifications and documents.

The Vendor shall clearly state in his quotation under the heading `Deviations from Specifications' each exception and/or qualification to the requirements of this specification, and others referenced herein. These exceptions/qualifications will be subject to review and discussion, and where agreed, included for in the purchase specification/requisition. Where no exceptions/qualifications are stated, it shall be understood that the offer is in full compliance with the specified requirements.

Compliance by the Vendor with the provisions of this specification does not relieve him of his responsibility to furnish equipment and accessories of a proper design to meet the specified service conditions, and/or local codes or standards governing health and safety.

Subsequent to acceptance of a purchase order, any requests for deviations shall be routed through the Purchaser's official `Concession Request Procedure'.

1.3 Definitions

For the purpose of this specification the following definitions apply:-

Shall - The word "shall" denotes that the requirement is mandatory.

Should - The word "should" denotes that the requirement is highly recommended but is not mandatory.

Purchaser - The word "purchaser" refers to the Purchaser unless otherwise stated.

Vendor - The word "Vendor" refers to the supplier of the equipment against the purchase order. The Vendor may or may not be the equipment manufacturer.

Manufacturer - The word "manufacturer" refers to the producer of the equipment. The manufacturer may or may not be the equipment Vendor.

2. Site Location

The site is located at Longannet, UK.

3. Site Ambient Conditions

Equipment shall be suitable for the ambient conditions found on site.

4. Units of Measurement

The SI system of units shall be used with the exception that pressures are to be stated in bar(g) for mechanical design conditions.

5. Available Utilities

5.1 Vendor shall confirm all utilities required for the operation of his equipment.

5.2 Consumption of all utilities shall be subject to guarantee. Vendor shall state the guaranteed maximum consumption of all utilities required by the equipment within his scope of supply.

5.3 Sea Water cooling shall be used generally throughout the plant, consequently all metallic components it contacts with Sea Water shall be fabricated from Titanium.

6. Equipment Rating

6.1 Equipment shall be rated such that the specified design duties are achieved at the nominal electrical supply frequency of 50 Hz. Vendors shall take into account any frequency variation specified and where this variation is expected to have a significant effect on the equipment duty the vendor shall make the Purchaser aware at the quotation stage.

6.2 Unless otherwise stated in the equipment specification/data sheet, all equipment including seals and bearings shall be suitable for maintenance free, continuous operation for 24,000 hours. Where the design life of components does not meet this requirement, the Vendor shall identify these at the quotation stage.

6.3 All equipment shall be of good industrial quality such as to have a minimum life expectancy of 15 years assuming normal levels of care and maintenance.

6.4 Where rotating machines and equipment are subjected to cyclical loading, such equipment shall be designed by the Vendor to a standard that shall ensure that the fracture of any metallic components by a fatigue mechanism shall not occur in less than 130,000 hours total operation life. The Vendor shall submit a certificate of compliance with this requirement.

6.5 Unless otherwise specified in the equipment specification/data sheet, or unless the Vendor's standard grade of balance is superior, rotating assemblies for pumps shall be balanced to Quality Grade G 6.3 according to ISO 1940-1 (2003); Mechanical Vibration – Balance Quality Requirements For Rotors In A Constant (Rigid) state.

Rotating assemblies for compressors shall be balanced to Quality Grade G 6.3.

7. Earthing of Equipment

7.1 All equipment shall be earthed to prevent the build-up of static electrical charges. Equipment earthing shall comply with PD CLC/TR 50404: 2003 (or alternative equivalent International standard).

7.2 Each equipment item/package shall be fitted with a minimum of one earthing termination connection. If any of the external plan dimensions exceed 2.0m then an earthing termination connection shall be fitted at each end of the item/package on diagonally opposed corners.

7.3 Earthing termination connections shall be as specified on the individual equipment item/package requisition.

7.4 The Vendor shall be responsible for ensuring that all items of equipment/pipework within his scope of supply have electrical continuity with the earthing termination point(s).

7.5 Flanged connections shall be provided with a positive means of maintaining electrical continuity across the joint. Any flexible connection shall be fitted with a means to provide electrical continuity across the flexible connection.

8. Lubrication

8.1 Provision shall be made for suitable lubrication wherever necessary to ensure smooth operation and freedom from undue wear and heat removal. Provision shall be made for the efficient lubrication of all bearings, including ball and roller bearings by the use of separate oil cups, self-sealing nipples or oil bath.

The Vendor shall complete and return copies of the Lubrication Schedule giving the grades, application frequencies and quantities of all lubricants required for the equipment within his supply.

8.2 Vendor shall select suitable grades of lubricants from a range of lubricants using International standards and the relevant ISO lubricant number shall be given.

8.3 Where a single lubricant grade is unsuitable for the complete operating/ambient temperature range the Vendor shall specify a minimum number of grades to cover the temperature range.

8.4 Where components are supplied with lubricant "Sealed for Life" the Vendor shall include these components on the Lubrication Schedule but state "Sealed for Life". The anticipated life of the component (i.e. bearing life) shall also be stated.

8.5 Gearboxes and oil baths shall be provided with filling and drain plugs, both of adequate size, and shall be provided with an approved means of oil level indication. Drain ports shall be located such that an adequate sized container can be placed underneath them or piped to such a position. Where a large quantity of oil is involved a drain valve shall be provided at the point of discharge.

9. Bolting

9.1 Bolting supplied for PN rated standard flanges shall be to metric standards in accordance with BS 4882. All other equipment bolting shall be supplied with metric screw threads to ISO 261 (Coarse series). All stud bolts shall be threaded full length. Preferred sizes shall be used whenever possible however, the Vendor may request a concession where this is not possible or impractical.

9.2 Nuts shall be heavy series.

9.3 Bolts/studs shall not protrude more than three threads from the face of the nut.

9.4 Unless otherwise specified, hot dip galvanized bolts shall be preferred for flange bolting for all materials. Stainless steel bolting may be selected for stainless steel. Bolting screwed into corrosion resistant materials shall be of a material compatible with the equipment material, also taking into consideration differences in heat expansion.

9.5 Bolts shall be of a different grade to nuts or, if of the same grade, shall have different hardness properties of at least 10BHN.

9.6 External ferritic stud bolts shall be treated with a graphite base lubricant.

9.7 The use of gasket dope, lubricant, etc. is prohibited.

9.8 All internal bolting in contact with the process fluid shall be positively locked, preferably by double nuts to prevent accidental loosening.

9.9 To eliminate the possibility of Liquid Metal Embrittlement, all fasteners used in pressure containing positions shall not be metal coated or plated nor shall thread lubricant containing metal be used.

10. Noise

10.1 Unless otherwise specified in the item specification, the sound pressure level of each individual item of equipment within the Vendor's supply shall not exceed 80 dB(A) at 1 metre from the equipment surface in a free-field environment.

10.2 Where the Vendor's standard equipment does not meet the required noise level, the Vendor shall make recommendations for the noise control of his equipment to bring it within the specified noise level (where it is impractical to redesign the equipment). The noise control measures shall in no way conflict with the requirements of other specifications for the equipment.

10.3 The Vendor shall complete the Purchaser's Noise Data Sheet, which shall state the maximum anticipated and average sound pressure levels at 1m from the equipment surface for the equipment offered (in dB(A) and octave bands), when operating in the normal condition and any other design or expected mode of operation. The Vendor shall also state the sound power levels (in octave bands) for the equipment offered.

10.4 The Vendor shall state how the noise levels in 10.3 were derived, giving full details of the tests involved.

10.5 If acoustic treatment is necessary to achieve specified levels, the Vendor shall quote a separate price and describe in detail the parts of the machinery requiring such treatment.

10.6 The Purchaser may call for noise tests to be carried out on specific equipment at the Vendor's works or on site.

11. Foundation Bolts

11.1 Unless otherwise specified in the equipment specification/data sheet, all necessary foundation/holding down bolts and baseplate levelling shims/packing pieces shall be supplied by the Purchaser. Vendor shall advise recommended size, type and quantity of foundation/holding down bolts for each piece of equipment, support, etc as appropriate within his scope of supply.

11.2 The Vendor shall detail any special holding down requirements in his quotation.

11.3 Levelling shims/packing pieces used by the Vendor for mounting equipment onto support baseplates shall be manufactured in austenitic stainless steel.

12. Proscribed Materials

12.1 The following materials in any form shall not be included in the Vendor's equipment for any purpose unless specified by the Purchaser elsewhere. The Vendor may request a concession where his 'standard' equipment incorporates proscribed materials.

Proscribed materials:-

Aluminium
Asbestos
Cadmium
Antimony
Arsenic
Polyurethane Foams
Components containing CFCs & HCFCs
Paints containing Lead
Mercury

12.2 Galvanised/zinc coated components shall not be installed in direct or close contact with austenitic stainless steel items or components.

13. Piping

13.1 All terminal points to which connection is made by others shall be flanged to EN 1092-1.

13.2 Piping within the scope of supply of mechanical equipment or package shall be welded or flanged according to EN 1092-1 unless otherwise stated in the individual equipment specification.

13.3 On small diameter pipework (seal flushing, oil lubrication etc.) screwed or compression fittings shall be minimised.

13.4 Screwed connections shall not be used on piping greater than 50mm ND and then only on non-critical air and water services. Where screwed connections are unavoidable these shall conform to EN 10226-1

13.5 Piping less than 20mm ND shall not be used unless specifically agreed with the Purchaser.

13.6 Where, for some extreme reason, the Vendor is not able to supply flanges to the Purchaser's specification, the non-standard flange shall be supplied complete with counter weld neck flange, gasket and bolting. The use of non-standard flanges shall be subject to approval by the Purchaser and where supplied, the Vendor shall also supply 2 spare gaskets and 1 spare set of fasteners.

13.7 The Vendor shall provide all terminal point flanges with a finish that shall be subject to approval by the Purchaser.

13.8 All package terminal connections shall be located in convenient positions at the periphery of the package and all piping shall be adequately supported, such that excessive loads are not imposed on equipment. Supports shall ensure that the piping is not damaged by vibration and/or external loads.

13.9 The Vendor shall include all appropriate fasteners and gaskets to connect all piping and ducting flanged connections within his scope of supply. The Vendor shall also include suitable fasteners and gaskets for all non-standard piping/ducting/chute connections at the periphery of his scope of supply. For these connections, the Vendor shall also supply 2 spare gaskets and 1 spare set of fasteners.

13.10 Piping calculations for 25mm ND. and above (higher than 100°C) shall be provided on request and made available for inspection in accordance with EN 13480-3 Metallic Industrial Piping Standard.

14. Cleaning and Temporary Corrosion Protection

14.1 The equipment shall be delivered with adequate corrosion protection measures suitable for shipment to site by sea freight and storage on site before commissioning for up to 24 months.

14.2 The Vendor shall ensure that all equipment, especially that which has been hydraulically tested, is thoroughly dry and free from corrosion and contamination before application of the corrosion protection medium. Timber, metal or plastic closures/blanks shall be used on all connections.

14.3 Non 'product' contact surfaces shall be treated with suitable corrosion preventives. The Vendor shall recommend suitable Manufacturer and grades based on good previous relevant experience. Relevant Material Data Sheets shall be included in the 'Final' documentation.

14.4 Electrical and Instrument items shall be sealed in polythene envelopes. Desiccant shall be enclosed within the envelope for motors, switchgear and control panels, etc. Warning labels shall indicate that desiccant is contained within.

14.5 Surfaces that will be in contact with process streams or utilities shall not be treated with temporary corrosion preventatives. The Vendor shall propose suitable treatment, e.g. Desiccant, Nitrogen purge, etc.

15. Preparation for Shipment/Long Term Preservation

15.1 After completion of all inspection and testing, and receipt of a formal release note from the Purchaser, the equipment shall be prepared for shipment.

15.2 The amount of dismantling shall be minimal to limit quantity of shipped loose items. All ancillary equipment and spares which are supplied loose shall be suitably tagged and clearly identified on the Vendor's packing list.

15.3 Refer also to 'Conditions of Purchase' included in the Commercial Package for details of 'Protection and Packaging/Shipping Instructions'.

15.4 Vendor shall state in the quotation, any recommendations for long term outdoor storage (up to 9 months) in a chemical plant environment.

15.5 Equipment filled with Nitrogen shall have warning signs attached to warn of the danger to personnel.

16. Painting and Finishes

16.1 All material, unless specified elsewhere, shall be finish painted at the Vendor's works prior to final inspection/despatch.

16.2 The Vendor shall submit their standard cleaning/painting system specification for approval.

16.4 The Vendor shall identify any items of equipment which will require painting on site.

16.5 The Purchaser reserves the right to specify final finish colours which shall be identified by the Purchaser.

16.6 The following parts shall not be painted:-

- Copper/Brass
- Titanium/Stainless Steel/Duplex SS/Hastelloy/Nickel alloy components,
- Machined mating surfaces
- Components with other surface finishes, e.g. galvanising

16.7 The coating manufacturer's instructions for application shall be strictly complied with and shall comply with BS EN ISO 12944.

16.8 Special internal finishing requirements shall be as specified in the individual equipment specification/data sheet.

16.9 The Vendor shall be responsible for providing all necessary equipment to verify the agreed finishing standard.

17. Insulation

17.1 Where insulation is necessary for heat conservation, personnel protection and for noise control, the Vendor shall indicate areas requiring insulation on a suitable drawing. The Purchaser will specify thickness required.

17.2 Insulation for personnel protection will be supplied where equipment and piping surface temperatures exceed 50°C during normal operation and are within reach of an operator from normal access route or platform. Insulation will be provided by others unless otherwise stated.

17.3 Guarding may be used for hot surfaces where insulation is impracticable.

17.4 Insulation clips or suitable guarding shall be included in the Vendor's supply as necessary. Insulation clips or guarding brackets where attached to equipment shall be of the same material as that of the equipment component to which it is attached.

17.5 Where either insulation or guarding is impracticable then notices warning of hot surfaces will be considered, subject to an agreement with the Purchaser.

18. Safety, Guarding and Interlocks

18.1 Guards shall be provided for all exposed moving parts. Machinery guards shall be designed in accordance with BS PD 5304 and BS EN 953 (or alternative equivalent International standards) and other standards or specifications referenced in the equipment specification.

18.2 Guards that allow operators to contact any part of the moving equipment will be rejected.

18.3 Guards shall be designed to be easily removable with appropriate tools and the Vendor shall ensure that access to lubrication points is achieved without removal of the guards.

18.4 The materials of construction for the guards shall be the Vendor's standard suitable for the operating conditions and location unless specified on specific equipment data sheets.

18.5 Guards shall be sufficiently robust to prevent any contact with moving parts with the application of a 100kg load applied in any direction.

18.6 All equipment guards shall be non-sparking and comply with requirements of the Machinery Safety Directive and ATEX. Aluminium shall not be used in the construction of non-sparking guards.

19. Pressure/Explosion Relief Devices

19.1 The Vendor shall be responsible for pressure relief arrangements within his package.

19.2 Where equipment may contain explosive mixtures the equipment shall be fitted with explosive relief devices arranged for safe venting, including reciprocating compressor crankcases.

19.3 All relief devices (valve, bursting disc, fusible plug, etc.) shall be designed to protect the subject equipment from overpressure under all foreseen circumstances. Sizing and selection of these devices shall be in accordance with API-520.

19.4 The Vendor shall provide the information as detailed in Appendix 'A' to enable the Purchaser to complete the necessary relief stream calculations.

19.5 All relief devices shall have the discharge piped/ducted to a safe location.

19.6 Pressure relief valves shall be full nozzle, full lift type and thermal relief valves shall be modified nozzle type.

19.7 Steel bodies with stainless steel trim shall be used for all pressure relieving devices unless piping specifications require alloy construction.

19.8 Rupture discs shall be provided with a local bursting indication. Combination of rupture disc and safety valve shall include a local indication to indicate leakage burst.

20. Drives

20.1 Belt drives shall be limited to 150kW unless by specific agreement with The Purchaser. They shall be either integral, multi-V, or multiple V-belts supplied in matched sets. A minimum of two V-belts shall be provided. For this minimum configuration, capacity of each belt shall not be less than 150% of the transmitted power.

20.2 All drive belts shall be fire resistant, oil resisting and shall be certified anti-static to ISO 1813 (or alternative equivalent International standard).

20.3 All drive belts shall comply dimensionally with BS 3790, ISO 4184 or DIN 2215 (or alternative equivalent International standard).

20.4 It shall be possible to check belt/chain tension and adjust the tension without the need to remove the drive guard.

20.5 Coupling flexible elements shall be heat resistant, anti-static type and non-lubricated couplings shall be used. For all types of coupling, it shall be possible to remove the half-coupling bolts or coupling bolts in-situ without moving the driving or driven equipment including gearboxes.

20.6 Gearbox ratings shall be based on the installed power of the motors (not machine absorbed power) and shall have a minimum AGMA service factor of 2.0.

21. Trial Assembly

21.1 All equipment shall be assembled at the Vendor's works or Sub-Vendor's works to check fits and alignment, and that the capability for further adjustment remains.

21.2 All equipment supplied in a completely or partly dismantled state shall have match marking adjacent to mating surfaces and connections to ensure correct re-assembly at site.

22. Operation and Maintenance Access

Equipment shall be designed and constructed to facilitate safe maintenance access. In particular, items requiring regular checking/replacement of parts shall be accessible with minimum dismantling.

23. Nameplates, Labels and Warning Notices

23.1 All nameplates, labels, warning notices and operating notices shall be supplied by the equipment Vendor in the English language.

23.2 All necessary warning notices/safety signs shall be in the Vendor's scope of supply. Notices shall be fabricated from a permanent durable material affixed to the appropriate equipment in a prominent position. The warning signs/symbols shall comply with internationally recognised standards e.g. ISO or BS 5499.

23.3 All nameplates shall be fabricated from stainless steel, or similar non-corrosive material, unless otherwise specified by the Purchaser. Nameplates shall be firmly secured and by fasteners of a similar material (in a prominent position) which do not penetrate machine casings. Nameplates shall not be secured with adhesive.

23.4 Each equipment item shall display a nameplate, a package shall also display an overall nameplate in addition to the individual equipment item nameplates.

23.5 Unless otherwise specified by the Purchaser elsewhere, nameplates shall contain the following data as a minimum:-

- Vendor's Name
- Vendor's Serial No.
- Size/Type/Model Reference
- Purchase Order No.
- Item No.
- Year of Manufacture
- Rated Duty (as appropriate)
- Weight (Empty / Operating)

- CE Mark (see also Section 27)

23.6 An additional nameplate may supplement the Vendor's standard nameplate if it does not contain the minimum data.

23.7 Nameplate lettering shall be a minimum of 5mm high and be engraved or die-stamped. Electric pencil etching is not acceptable.

23.8 All rotating equipment shall carry an arrow in a prominent position to indicate the direction of rotation. The arrow shall be cast on if possible or of a material and fixing method as indicated in paragraph 23.3 above.

23.9 Equipment specified for low temperature operation or installation shall not be directly stamped.

23.10 Each and every instrument item shall be supplied with a stainless steel tag wired to the instrument item. The tag shall contain the Project Instrument Tag Number or the Vendors identification Tag Number if no such Project Tag Number exists.

24. Instruments & Electrical Terminal Connections

24.1 The Purchaser will advise, on receipt of completed project motor data sheet and any additional necessary motor details, the size and type of the power supply cables that will be supplied. The Vendor shall supply terminal boxes drilled and tapped to the details indicated on the motor data sheet to accept gland(s), which will be supplied by others.

24.2 All instrument junction boxes shall be supplied with a gland to suit the size and type of cable specified.

24.3 Equipment fitted with proximity type rotation sensors shall be supplied with the appropriate monitor unit to convert the pulses to a suitable signal for use with the control system. The monitor unit shall be supplied "loose" for mounting in the Purchaser's control cabinet.

25. Special Tools/Lifting Devices

25.1 The equipment vendor shall supply all special tools, dismantling jigs, etc., necessary for dis-assembly, maintenance, and re-assembly and commissioning of the equipment in his supply as well as lists of the special tools with working instructions.

25.2 The Vendor shall include any "special" lifting devices, spreader beams, etc, required for transportation, installation or maintenance of equipment items or packages. All such items shall be supplied with calculations for review and shall be suitably proof tested by a recognised competent authority employed by the Vendor.

25.3 Lifting attachments and accessories supplied with equipment whether permanently fixed or removable shall be suitably designed, manufactured, tested and inspected. Documentation and/or certification to verify the design and satisfactory manufacture of the attachments and accessories shall be provided by a "Competent Person" employed by the Vendor.

25.4 All removable components greater than 10kg in weight shall be fitted with suitable lifting eyes/lugs to facilitate all installation and maintenance tasks.

26. Spare Parts

26.1 The Vendor shall provide with his quotation, separate itemised price lists of spare parts, split into the following three sections:-

a) Commissioning spares
b) Capital spares (where specified)
c) 2 years operating spares

26.2 The required minimum list of 2 years spares required will be shown in each of the Purchaser's item specifications where applicable. Vendor shall show itemised prices for these, plus any further items that in the Vendor's opinion are strongly recommended for 2 years operation.

26.3 When selecting equipment, the Vendor should compare the cost of standardising specifications against the additional spares costs of installing equipment to different specifications.

26.4 Following the placement of any order the Vendor shall complete and submit the Project Spare Parts Interchangeability Record (SPIR) Form.

27. Compliance with Directives

27.1 The Vendor is responsible for implementing any regulations or directives, which are mandatory by government decree in the country of installation.

27.2 For all equipment the Vendor is responsible for complying with all the relevant EC Directives, including but not limited to, all of those listed below:

Low Voltage Directive (2006/95/EC)
Electromagnetic Compatibility Directive (89/336/EEC)
Simple Pressure Vessel Directive (87/404/EEC)
Construction Products Directive (89/106/EEC)

Machinery Safety Directive (98/37/EC)
Personal Protective Equipment Directive (89/686/EEC)
Pressure Equipment Directive (97/23/EC)
ATEX Directive (94/9/EC)
Including any statutory amendment or re-enactment thereof.

27.3 The Vendor shall be the 'Responsible' person under the EC Directive and shall be responsible for issuing the Declaration of Conformity and to mark the equipment with the suitable CE marking in accordance with the CE Marking Directive (93/68/EEC).

27.4 A Certificate of Incorporation is not acceptable unless specifically agreed with the Purchaser in writing prior to any order being placed.

27.5 The Vendor shall advise the Purchaser of any safety requirements for related equipment and/or systems outside the Vendor's scope of supply that must be met to enable the Vendor to issue the Declaration of Conformity.

28. Quality Control

28.1 Inspection – General

28.1.1 Equipment and ancillaries shall be subject to inspection and witnessed testing by the Purchaser, and any other person or persons appointed by him, including an Independent Inspection Authority.

28.1.2 Inspection shall take place at the Vendor's works and where necessary the Sub-Vendor's works, both during and on completion of manufacture.

28.1.3 No goods shall be packed, sealed or despatched prior to receipt of a written release note by the Purchaser or his appointed agent.

28.1.4 Where a witnessed test or inspection task is indicated, the Vendor shall give at least 10 days clear notice to the Purchaser's inspectorate.

28.1.5 Inspection and tests witnessed by the Purchaser shall not relieve the Vendor of any guarantees, responsibilities or obligations to provide satisfactory equipment.

28.1.6 Refer also to the requirements of the Conditions of Purchase.

28.2 Quality Plans

28.2.1 Vendor shall prepare and submit a quality plan that sets out specific quality practices and activities relevant to all the equipment being supplied.

28.2.2 Note that the Quality Plan shall cover the main equipment items and also the associated ancillary equipment.

28.3 Certification

28.3.1 The Vendor shall provide a Certificate for those inspections/tests indicated on the Inspection Data Sheet, where the task number has a suffix 'C'.

28.3.2 Vendor shall collate all certification and submit to the Purchaser, a Certification Dossier. Note that where necessary certificates shall be stamped as approved by a recognised Independent Inspection Authority.

29. Test Water

Water used for hydro testing and/or performance/mechanical testing of equipment and components fabricated from stainless steel shall have a maximum chloride content of 30 ppm Cl. The Vendor shall certify the chloride content of all test water and include a copy of the certificate in the certification dossier.

30. Documentation

30.1 Relevant drawings and documentation shall be provided by the Vendor in accordance with the requirements of the Purchaser's Vendor Documentation Schedule.

30.2 Documentation shall comply with project requirements regarding content, format and submission details.

30.3 Documentation certifying the equipment as suitable for the defined type of protection issued by a recognised National Certifying Authority shall be provided. Any supplementary applicable certificates shall also be supplied, e.g. ATEX certification and CE Marking.

31. Guarantees

31.1 The Vendor guarantees that the equipment will achieve the duty set forth in the relevant Equipment Specification and/or Data Sheet.

31.2 The Vendor shall in all cases satisfy himself that the materials and/or design features indicated by the Purchaser are adequate for the design, design duty, test conditions and methods of manufacture and handling to be encountered. In the case of any doubt, the Vendor shall consult the Purchaser before commencing with work of fabrication.

31.3 Refer also to the 'Conditions of Purchase' included in the Commercial Package.

32. Reference Documents

The following listed standards and specifications shall apply and form an integral part of this specification.

It shall be the Vendor's responsibility to ensure he has in his possession all referenced specifications and standards.

EN 1092-1 (2007)	Flanges and their Joints – Circular Flanges for Pipes, Valves, Fittings and Accessories, PN Designated - Part 1: Steel Flanges
EN 13480-3 (2002 + A4:2010)	Metallic Industrial Piping
EN 10226-1 (2004)	Pipe threads where pressure tight joints are made on the threads
BS 4882 (1990)	Specification for Bolting for Flanges and Pressure Retaining Purposes
BS EN 953 (1997 + A1:2009)	Safety of Machinery. Guards
BS PD 5304 (2005)	Guidance on the Safe use of Machinery
BS EN 60204 Pt1 (2006 + A1:2009)	Safety of Machinery, Electrical Equipment of Machines
PD CLC/TR 50404 (2003)	Electrostatics - Code of Practice for the Avoidance of Hazards due to Static Electricity.
BS ISO 261 (1998)	ISO General Purpose Metric Screw Threads – General Plan.
BS ISO 262 (1998)	ISO General Purpose Metric Screw Threads – Selected Sizes for Screws, Bolts and Nuts

ISO 1940-1 (2003)	Mechanical Vibration-Balance Quality Requirements For Rotors In A Constant (Rigid) State.
ISO 1813 (1998)	Vee Belts – Vee Ribbed Belts.
BS 3790 (2001)	Specification for Endless Wedge Belt Drives and Endless V-Belt Drives.
ISO 4184 (1992)	Belt Drives – Classical and Narrow V-Belts – Lengths in Datum System.
DIN 2215 (1998)	Endless V-Belts – Classical V-Belts – Dimensions.
API RP 520 (8th Edition, 2008)	Sizing, Selection and Installation of Pressure Relieving Devices.
BS 5499	Graphical Symbols & Signs
BS EN ISO 12944	Paints & Varnishes – Corrosion Protection of Steel Structures by Protective Paint Systems

Appendix A – Information Required for Safety/Relief Valves supplied as part of Vendor's Packages

1. Relief valve tag number.
2. Equipment which the relief valve is protecting.
3. Set pressure (Note 1).
4. Inlet size/flange rating.
5. Outlet size/flange rating.
6. Orifice size.
7. Coefficient of discharge (state whether de-rated).
8. Contingencies considered during sizing of relief valve e.g.:-
   - pumping against closed head
   - upstream control valve fails open
   - heat exchanger tube rupture
   - thermal expansion
   - fire
   - etc.
9. Composition of relieved material (state also phase i.e. gas, liquid or 2-phase).
10. Required capacities calculated for contingencies identified in 8. (Supporting calculations required.)
11. Relief valve sizing calculations for flows identified in 10.
12. Identification of governing case determined by the calculations in 10 and 11.
13. Details of upstream and downstream piping (with isometrics and stress calculations, if available).
14. Upstream and downstream pressure drops (with supporting calculations, if available).
15. Vendor's data sheet for relief valve (Note 2).

Notes:

(1) Where pressures are stated, there should be clear identification of whether these are gauge or absolute.

(2) Where the Vendor's data sheet provides the data needed, e.g. for items 3, 4, 5, 6, 7 & 9, the latter data need not be provided separately.

Client:	**To be determined**
Plant Location:	**To be specified**
Project Number:	

MECHANICAL DEPARTMENT
HP / LP PRDS VALVES
DATASHEET

1.0 Description

2.0 Duty

2.1 Normal Operating Conditions

		PRDS inlet (steam side)	Spraywater valve inlet	PRDS outlet (steam side)
Flow	kg/h			
Pressure	bar a			
Temperature	°C			
Stream Enthalpy	kJ/kg			

3.0 Piping Connections:

Steam Inlet piping

Steam Outlet piping

Water valve piping

4.0 Installation

Revision				
Status				
Prepared By / Date				
Checked By / Date				
Authorised By / Date				

5.0 Noise

6.0 Control

#

Revision				
Status				
Prepared By / Date				
Checked By / Date				
Authorised By / Date				

Client:	**To be determined**
Plant Location:	**To be specified**
Project Number:	

MECHANICAL DEPARTMENT
HP / MP PRDS VALVE
DATASHEET

SERVICE: HP / MP PRDS Item Number: Number Required:

1.0 Description

2.0 Duty

2.1 Normal Operating Conditions

		PRDS inlet (steam side)	Spraywater valve inlet	PRDS outlet (steam side)
Flow	kg/h			
Pressure	bar a			
Temperature	°C			
Stream Enthalpy	kJ/kg			

3.0 Piping Connections:

Steam Inlet piping

Steam Outlet piping

Water valve piping

4.0 Installation

Revision				
Status				
Prepared By / Date				
Checked By / Date				
Authorised By/Date				

SERVICE: HP / MP PRDS Item Number: Number Required:

5.0 Noise

6.0 Control

Revision				
Status				
Prepared By / Date				
Checked By / Date				
Authorised By/Date				

Client:	**To be determined**
Plant Location:	**To be specified**

Item: Mechanical Datasheet Lean Amine Cooler

CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

	DESCRIPTION		UNITS	DATA				
1	**DESIGN & OPERATING DATA**							**Rev**
2				**SHELLSIDE (HOT FLUID)**		**TUBESIDE (COLD FLUID)**		
3				**In**	**Out**	**In**	**Out**	
4	**FLUID**							
5	**TOTAL FLUID FLOW**		**kg/hr**					
6	**VAPOUR FLOW**		**kg/hr**					
7	**LIQUID FLOW**		**kg/hr**					
8	**LIQUID DENSITY**		**kg/m³**					
9	**LIQUID SPECIFIC HEAT**		**kJ/kg°C**					
10	**LIQUID VISCOSITY**		**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**		**W/m°C**					
12	**LIQUID SURFACE TENSION**		**Dyn/cm**					
13	**LATENT HEAT**		**kJ/kg**					
14	**VAPOUR DENSITY**		**kg/m³**					
15	**VAPOUR SPECIFIC HEAT**		**kJ/kg°C**					
16	**VAPOUR VISCOSITY**		**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**		**W/m°C**					
18	**MOLECULAR WEIGHT**							
19	**OPERATING TEMPERATURE**		**°C**					
20	**OPERATING PRESSURE**		**Bar a**					
21	**PRESSURE DROP**	**Allow/Calc**	**bar**					
22	**No. OF PASSES**							
23	**VELOCITY OF FLOW**		**m/s**					
24	**FOULING ALLOWANCE**		**m²C/W**					
25	**MAP (DESIGN PRESSURE)**		**bar g**					
26	**TEST PRESSURE**	**New/Corroded**	**bar g**					
27	**DESIGN TEMPERATURE**		**°C**					
28	**HEAT DUTY**		**MW**					
29	**H.T. COEFFICIENT**	**Required / Actual**	**W/m²C**					
30	**LMTD**		**°C**					
31								
32								

33	**CONSTRUCTION & MATERIALS**					
34	**DESIGN CODES:**					
35	**SHELL PER UNIT:**	**TYPE:**		**SERIES:**	**PARALLEL:**	
36	**SURFACE PER UNIT:**			**SURFACE PER SHELL:**		
37	**PED FLUID PHASE & GROUP No:**	**HOT SIDE:**		**COLD SIDE:**		
38	**PED EQUIPMENT CATEGORY:**			**PED CONFORMITY MODULES:**		
39	**TUBE:**		**No Off:**		**THICKNESS**	
40	**TUBE O/DIA:**	**LENGTH:**	**PITCH:**			
41	**SHELL:**	**I/DIA:**	**SHELL COVER:**			
42	**CHANNEL:**		**CHANNEL COVER:**			
43	**STATIONARY TUBESHEET:**				**FLOATING HEAD COVER:**	
44	**FLOATING TUBESHEET:**		**LONGITUDINAL BAFFLES:**			
45	**SUPPORT BAFFLES:**		**TYPE:**		**FLOW:**	
46	**BAFFLE CUT:**	**PITCH:**	**No OFF:**			
47	**GASKETS:** **Shellside:**		**CORROSION ALLOWANCE:**		**Shellside:**	
48	**Tubeside:**				**Tubeside:**	
49	**BRANCHES:** **Shellside:**		**INLET:**	**OUTLET:**	**RATING:**	
50	**Tubeside:**		**INLET:**	**OUTLET:**	**RATING:**	
51	**STRESS RELIEVE:** **(Shellside / Tubeside):**					
52	**RADIOGRAPHY:** **(Shellside / Tubeside):**					
53	**INSPECTION BY:**					
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION		UNITS	DATA			
1	**DESIGN & OPERATING DATA**						
2				**SHELLSIDE (HOT FLUID)**		**TUBESIDE (COLD FLUID)**	
3				**In**	**Out**	**In**	**Out**
4	**FLUID**						
5	**TOTAL FLUID FLOW**		**kg/hr**				
6	**VAPOUR FLOW**		**kg/hr**				
7	**LIQUID FLOW**		**kg/hr**				
8	**LIQUID DENSITY**		**kg/m³**				
9	**LIQUID SPECIFIC HEAT**		**kJ/kg°C**				
10	**LIQUID VISCOSITY**		**cP**				
11	**LIQUID THERMAL CONDUCTIVITY**		**W/m°C**				
12	**LIQUID SURFACE TENSION**		**Dyn/cm**				
13	**LATENT HEAT**		**kJ/kg**				
14	**VAPOUR DENSITY**		**kg/m³**				
15	**VAPOUR SPECIFIC HEAT**		**kJ/kg°C**				
16	**VAPOUR VISCOSITY**		**cP**				
17	**VAPOUR THERMAL CONDUCTIVITY**		**W/m°C**				
18	**MOLECULAR WEIGHT**						
19	**OPERATING TEMPERATURE**		**°C**				
20	**OPERATING PRESSURE**		**Bar a**				
21	**PRESSURE DROP**	**Allow/Calc**	**bar**				
22	**No. OF PASSES**						
23	**VELOCITY OF FLOW**		**m/s**				
24	**FOULING ALLOWANCE**		**m²C/W**				
25	**MAP (DESIGN PRESSURE)**		**bar g**				
26	**TEST PRESSURE**	**New/Corroded**	**bar g**				
27	**DESIGN TEMPERATURE**		**°C**				
28	**HEAT DUTY**		**MW**				
29	**H.T. COEFFICIENT**	**Required / Actual**	**W/m²C**				
30	**LMTD**		**°C**				
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

APPLICABLE DESIGN CODES & STANDARDS:

TUBESHEET & BELLOWS DESIGN DATA

The following coincident pressures and their coincident temperatures are possible and must be used in the design of the tubesheets and the determination of bellows requirements.
The use of differential pressure design methods is not permitted.

	Case No.	Minimum Design Cycle Life of Bellows	Shellside Pressure [barg]	Shell Metal Temp. [°C]	Tubeside Pressure [barg]	Tube Metal Temp. [°C]
NORMAL OPERATION	1					
SHELLSIDE FLOW FAILURE	2					
TUBESIDE FLOW FAILURE	3					
BELLOWS EXPANSION	4					
BELLOWS COMPRESSION	5					
START-UP	6					
SHUT-DOWN	7					
EMERGENCY CONDITIONS	8					
EMERGENCY CONDITIONS	9					
EMERGENCY CONDITIONS	10					
SHELLSIDE HYDROTEST	11					
TUBESIDE HYDROTEST	12					

NOTES

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

NOTES (Continued)

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Mechanical Datasheet - Lean Amine Cooler	DOC. NO. Not Applicable
	PAGE NO. 6 of 9
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

SKETCH

Ref	Service	Size	Rating	Standout (mm)	Remarks

Drawing not to scale
All dimensions in mm

ESTIMATED WEIGHTS (kg)	
Fabricated	
Operating	
Full of water	

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

SKETCH

TUBESHEET LAYOUT

Drawing not to scale
All dimensions in mm

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

SKETCH

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

INSPECTION TASKS

INSPECTION TASKS:

All tasks identified below shall be included on the vendors quality plan. Where inspection task numbers have a suffix "C", a certificate shall be supplied. These certificates shall be included in the exchanger certification dossier. The quality plan shall also include all additional inspection tasks required by the Independent Third Party Inspection Agency.

MC1	**C**	Review material certificates (EN-10204, 3.1 standard).
MC2	**C**	Check certified chemical & mechanical properties of all materials.
MC3	**C**	Check that ultrasonic testing of base plate has been carried out before cladding.
MC4	**C**	Check that bond strength tests and ultrasonic testing of cladding bond have been carried out.
MC5	**C**	Check cladding thickness.
WRod1		Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.
WRod2		Check method of distribution of welding consumables and means of storage on the shop floor.
WeldPr	**C**	Check weld procedures and qualifications.
Welder	**C**	Check weld map and welders qualifications for shell and tube end welds.
TrHtNos		Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.
Head	**C**	Identify heads and check shape, dimensions and thickness.
Plate		Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.
Lamin	**C**	Inspect edges of material for weld preparation and for discontinuities and laminations.
Fitup		Inspect assembly including alignment of main seams prior to welding.
Nozzles		Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.
Coupon1		Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material identification and stamping.
Welding		Survey welding and back gouging and ensure that approved procedures are followed.
Tube holes		Check tube holes are free from burrs and the finish, grooving and tolerances are in accordance with the approved drawing and code.
Tubes		Check that the tubes are free from surface defects and thinning after expanding and witness soapy water test of tube end welds.
Baffles		Check baffles to approved drawing and that the shell is correctly sized and free of obstructions for tube bundle insertion.
Coupon2	**C**	Witness welding of test plates and review test results.
InspWeld	**C**	Inspect finished welds for freedom from undercut and surface defects.
DimChk	**C**	Check dimensions to approved drawing and specified tolerances given in TEMA.
IntFinish	**C**	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.
MPT	**C**	Check MPT procedure and operators qualifications and survey the testing of all exchanger welds.
RT	**C**	Ensure radiography of exchanger welds is in accordance with approved drawing and specified code. Review radiographs.
UT	**C**	Witness ultrasonic examination of welds and review reports.
PWHT1	**C**	Check PWHT procedure for exchanger. Inspect thermocouple certificates and attachment. Check final temperature charts.
preHydrT	**C**	Witness pre-final-hydraulic test before titanium battons are installed. Check test set up and pressure gauge certificates.
Weld-Ti		Survey welding of battens, nozzle inserts and internals and ensure that approved procedures are followed.
RT-Ti	**C**	Witness radiographic technique test for titanium.
IntFinish	**C**	Inspect internal finish, weld dressing and shell/nozzle radii of flush nozzles.
pPWHT	**C**	Check pre-PWHT of titanium nozzle inserts and other welded titanium sub-assemblies.
PWHT2	**C**	Check PWHT procedure for Ti welds. Inspect thermocouple certificates and attachment. Check final temperature charts.
HydrT	**C**	Witness hydraulic test. Check test set up and pressure gauge certificates. Check that the exchanger is clean and dry after testing.
	C	Check Hot Gas Cyle Test Procedure, Inspect thermocouple certificates and attachment. Check final temperature charts.
DPT-Ti	**C**	Check DPT procedure and operators qualifications and survey the testing of internal Ti welds after the Hot Gas Cycle Test.
HelT	**C**	Check that helium test is carried out in line with the approved procedure and review results.
Final-1	**C**	Check that the equipment is clean and dry before sealing.
Final-2	**C**	Check general workmanship and completeness of supply.
Final-3	**C**	Check Paint or other finishes for continuity and against specification. (check insulation and cladding)
Final-4	**C**	Check copy of nameplate.
Final-5	**C**	Check Equipment packed and protected ready for shipment.
Final-6		Review Dossier.

Client:	**To be determined**
Plant Location:	**To be specified**

Lean Amine Filter Package Data Sheet

Project No

Equipment **Lean Amine Filter Package**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA	Rev.
1	**GENERAL**				
2	Manufacturer				
3	Model / Size				
4	Design / Fabrication Code				
5	Location			INDOORS / OUTDOORS / UNDERCOVER / EXPOSED	
6	Heated / Unheated				
7	Tropicalisation				
8	Winterisation				
9	Height above Grade				
10	Dust				
11	Fumes				
12					
13	**OPERATING CONDITIONS**				
14	Purpose				
15					
16	Operation Mode			CONTINUOUS / INTERMITTENT	
17	Hazardous Area Classification			ZONE GAS GROUP TEMP CLASS DUST HAZARD	
18					
19					
20	**Feed Supply**				
21	Fluid Composition				
22					
23	Fluid Properties				
24	Flammable / Explosive / Corrosive / Erosive / Toxic				
25					
26					
27	**Operating Conditions**				
28	Flowrate	@Max solids flow	m^3/h		
29		@Min solids flow	m^3/h		
30	Operating Pressure		bara		
31	Operating Temperature		°C		
32	Density (Fluid)		kg/m^3		
33	Viscosity (Fluid)		cP		
34	Solids Content		wt%		
35					
36	Allowable Pressure Drop Across Package	Clean/Dirty	bar		
37					
38	Required Particle Retention	Pre-Filter	µm		
39		Post Filter	µm		
40					
41					
42					
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Project No

Equipment **Lean Amine Filter Package**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA				Rev.
1	**PERFORMANCE**						
2							
3							
4							
5							
6							
7							
8							
9	**UTILITY REQUIREMENTS**						
10							
11							
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21							
22	**CONNECTIONS**						
23	SERVICE		TYPE	RATING	SIZE	POSITION	
24	Process Inlet						
25	Process Outlet						
26	Demineralised Water Supply						
27	Carbon Filter Drain						
28	Vent						
29	Pre-Filter Drain						
30	Post-Filter Drain						
31							
32							
33							
34	**MATERIALS OF CONSTRUCTION**						
35	Pre-Filter Shell						
36	Pre-Filter Elements						
37							
38	Carbon Filter Shell						
39	Carbon Filter Internals						
40							
41	Post-Filter Shell						
42	Post-Filter Elements						
43							
44	Process Pipework						
45	Process Valves						
46							
47	Demineralised Water Pipework						
48	Demineralised Water Valves						
49							
50	Vent / Drain Pipework						
51	Vent / Drain Valves						
52							
53	Structural Steel / Supports						
54							
55							

Project No

Equipment **Lean Amine Filter Package**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA	Rev.
1	**MECHANICAL DATA**			
2	**PRE-FILTER**			
3	Type / Model			
4	Manufacturer			
5	Cleaning Arrangement			
6	Design Pressure	barg		
7	Design Temperature	°C		
8	Test Pressure	barg		
9	Design Code			
10	Independent Inspection Authority			
11	Element Type			
12	Filtration Rating / Efficiency	µm / %		
13	Total Filtration Area	m^2		
14	Number of Elements			
15	Element Dimensions	mm		
16	Clean Pressure Drop	bar		
17	Dirty (Max) Pressure Drop	bar		
18				
19				
20	**CARBON FILTER**			
21	Type / Model			
22	Manufacturer			
23	Cleaning Arrangement			
24	Design Pressure	barg		
25	Design Temperature	°C		
26	Test Pressure	barg		
27	Design Code			
28	Independent Inspection Authority			
29	Vessel Dimensions	mm		
30	Vessel Gross Volume	m^3		
31	Carbon Bed Type			
32	Carbon Bed Volume	m^3		
33	Head Free Volume	m^3		
34	Residence Time	min		
35	Bed Removal/Replacement Method			
36	Clean Pressure Drop	bar		
37	Dirty (Max) Pressure Drop	bar		
38				
39				
40	**POST-FILTER**			
41	Type / Model			
42	Manufacturer			
43	Cleaning Arrangement			
44	Design Pressure	barg		
45	Design Temperature	°C		
46	Test Pressure	barg		
47	Design Code			
48	Independent Inspection Authority			
49	Element Type			
50	Filtration Rating / Efficiency	µm / %		
51	Total Filtration Area	m^2		
52	Number of Elements			
53	Element Dimensions	mm		
54	Clean Pressure Drop	bar		
55	Dirty (Max) Pressure Drop	bar		

Project No

Equipment **Lean Amine Filter Package**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA			Rev.
1	**MECHANICAL DATA (Cont.)**					
2	**PROCESS PIPEWORK**					
3	Design Code					
4	Flange Specification					
5						
6	**DEMINERALISED WATER PIPEWORK**					
7	Design Code					
8	Flange Specification					
9						
10	**VENT / DRAIN SYSTEM PIPEWORK**					
11	Design Code					
12	Flange Specification					
13						
14						
15	**CONTROL & INSTRUMENTATION**					
16						
17	Method of Package Control					
18						
19						
20	INSTRUMENTATION / INTERLOCKS FITTED					
21	FUNCTION		INDICATION	ALARM	TRIP	
22						
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32	**SCOPE OF SUPPLY**					
33	Pre-Filter					
34	Carbon Filter					
35	Post-Filter					
36	Baseframe					
37	Maintenance Platforms & Access Ladders					
38	Control Panel					
39	Instrumentation					
40	Control Valves					
41	Interconnecting Pipework					
42	Heat Tracing / Insulation					
43	PLC Control System					
44	Nozzle Gaskets & Fasteners					
45	Employment of Independent Inspection Authority					
46	Holding Down Bolts					
47	Special Tools					
48	Start-up & Commissioning Spare Parts					
49	Two Years Operating Spare Parts					
50	Capital Spare Parts					
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Project No

Equipment **Lean Amine Filter Package**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA	Rev.
1	**WEIGHTS & DIMENSIONS**			
2	**WEIGHTS**			
3	Pre-Filter including elements	kg		
4	Carbon Filter including carbon bed	kg		
5	Post-Filter including elements	kg		
6				
7	Total Skid Mounted Package	kg		
8	Maximum Maintenance Lift	kg		
9				
10		kg		
11		kg		
12				
13				
14	**DIMENSIONS**			
15	Skid Baseframe Footprint	mm		
16	Skid Package Height	mm		
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Project No

Equipment **Lean Amine Filter Package**

Equipment No

Number Off

					Rev.
1	**INSPECTION, TESTING AND CERTIFICATION**				
2	**QUALITY LEVEL:-** Not Applicable				
3					
4	All tasks listed below shall be included on the Vendor's Quality Plan for this package as a minimum and shall be performed at the Vendor's works.				
5	Refer also to inspection requirements specified on reference documents.				
6					
7	**TASK DESCRIPTION**	WITNESS	OBSERVE	REVIEW	
8	Review material certificates (EN 10204.3.1 standard)				
9	Identify materials against material certificate/cast numbers.				
10	Check certified chemical properties of materials.				
11	Check certified results of mechanical test of materials.				
12	Review material guarantee.				
13	Check heat treatment certificates, including temperature records.				
14	Check operator qualifications and suitability of all NDT operators.				
15	Check certified results of NDT tests of materials and welds.				
16	Inspect radiographs & extent of radiography.				
17	Check qualification of welders and operators.				
18	Part dimensional check for site erection purposes to certified drawings.				
19	General workmanship finish, cleanliness and completeness of supply.				
20	Paint or other finish for continuity.				
21	Auxiliary piping and fittings against requirements of item specification.				
22	Flange face finish against requirements of item specification.				
23	Fabrication of baseplate against requirements of item specification.				
24	Hydrostatic test of pressure retaining parts.				
25	Copy of machine rating plate.				
26	Each item is suitably prepared for shipment.				
27					
28					
29	**PRESSURE VESSELS**				
30	Review material certificates (EN 10204.3.1 standard)				
31	Check certified results of NDT tests of materials and welds.				
32	Hydrostatic test of pressure retaining parts.				
33	Part dimensional check for site erection purposes to certified drawings.				
34	General workmanship and completeness of supply.				
35					
36					
37	**INSTRUMENTATION**				
38	Ensure that correct tag labels are fitted.				
39	Check materials of construction are to specification and obtain certificate for each item.				
40	Obtain calibration certificate for each item.				
41	Hazardous area classification certificates for each item.				
42					
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Project No	
Equipment	**Lean Amine Filter Package**
Equipment No	
Number Off	

		Rev.
1	**REFERENCE DOCUMENTS**	
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19	**GENERAL NOTES**	
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Client:	**To be determined**
Plant Location:	**To be specified**

Lean Amine Pump Datasheet

Project No

Equipment **Lean Amine Pump**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA		REV.
1	**GENERAL**					
2	Manufacturer					
3	Model / Size					
4	Design Code					
5	Location					
6						
7	**OPERATING CONDITIONS**					
8	Operation Mode					
9	Hazardous Area Classification			ZONE GAS GROUP TEMP CLASS DUST HAZARD		
10						
11	Case Description			**Design Case**	**Turndown Case**	
12	Fluid Pumped					
13	Fluid Characteristics					
14						
15	Operating Temperature	Minimum	°C			
16		Normal	°C			
17		Maximum	°C			
18	Vapour Pressure at normal temperature		bara			
19	Density at normal temperature		kg/m^3			
20	Specific Heat		kJ/kg°C			
21	Viscosity at (temperature)	Operating	Cp			
22		At start-up cold	Cp			
23	Composition		%W/W			
24	Solids Content		kg/m^3			
25	Suspended Solids Size		µm			
26	Suspended Solids Density		kg/m^3			
27	Chloride Content		ppm			
28	Atmospheric Boiling Point		°C			
29	Capacity	Minimum	m^3/h			
30		Normal	m^3/h			
31		Design (rated)	m^3/h			
32	Recirculation Capacity		m^3/h			
33	Suction Pressure	Design	barg			
34	Discharge Pressure		barg			
35	Differential Pressure		bar			
36	Differential Head		m			
37	NPSHA		m			
38						
39	**PERFORMANCE**					
40	Pump Speed	Normal	rpm			
41		1st critical	rpm			
42	Impeller Diameter	Minimum	mm			
43		Rated	mm			
44		Maximum	mm			
45	Number of Stages					
46	NPSHR		m			
47	Suction Specific Speed	Stage1 / Stage2	$m^3/h.m.rpm$			
48	Minimum Continuous Flow	For stable operation	m^3/h			
49		Thermal	m^3/h			
50	Efficiency	Rated	%			
51		Maximum	%			
52	Maximum Head	Rated Impeller	barg			
53		Maximum Impeller	barg			
54	Head Rise to Maximum	Relative to duty flow	%			
55	Shut off Head		m			

Project No

Equipment **Lean Amine Pump**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA	REV.
1	**PERFORMANCE (Cont.)**				
2	Absorbed Power Rated Impeller	Rated flow	kW		
3		End of Curve	kW		
4	Absorbed Power Max Impeller	Rated flow	kW		
5		End of Curve	kW		
6	Power Consumed by Seal		kW		
7	Proposal Curve No				
8					
9					
10					
11	**UTILITY REQUIREMENTS**				
12					
13					
14					
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31	**CONNECTIONS**						
32	SERVICE / PURPOSE		DESIG'N	TYPE	RATING	ND (mm)	POSITION
33	Suction						
34	Discharge						
35	Casing Vent						
36	Casing Drain						
37							
38							
39							
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Project No

Equipment **Lean Amine Pump**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA	REV.
1	**MATERIALS OF CONSTRUCTION**				
2	Casing				
3	Barrel				
4	Bowls				
5	Diffuser				
6	Impeller				
7	Casing Wear Rings				
8	Impeller Wear Rings				
9	Shaft				
10	Shaft Sleeve				
11	Seal Housing				
12	Seal Plate				
13	Throat Bush				
14	Gaskets				
15	Seals				
16					
17	Bearing Housing				
18	Drive Guard				
19	Baseplate				
20					
21	Seal Vessel				
22					
23	Seal Flush Piping				
24	Mechanical Seal				
25	Stationary Seat	Inboard / Outboard			
26	Rotating Face	Inboard / Outboard			
27	Metallic Parts	Inboard / Outboard			
28	Elastomers	Inboard / Outboard			
29					
30					
31					
32					
33	**MECHANICAL DATA**				
34	Pump Type				
35					
36	Casing Design Pressure		barg		
37	Casing Design Temperature		°C		
38	Casing Test Pressure		barg		
39					
40	Lube Oil Cooler Design Pressure		barg		
41	Lube Oil Cooler Design Temperature		°C		
42	Lube Oil Cooler Test Pressure		barg		
43					
44	Casing	Mounting			
45		Split			
46		Corrosion allowance			
47		Type			
48	Impeller	Type			
49		No. vanes			
50	Rotor	Type			
51	Rotation (facing coupling end)				
52	Shaft	Diameter at sleeve	mm		
53		Diameter at coupling	mm		
54		Diameter at bearings	mm		
55		Bearing span	mm		

Project No

Equipment **Lean Amine Pump**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA			REV.
1	**MECHANICAL DATA (Cont.)**						
2	Coupling	Manufacturer					
3		Model					
4		Type					
5		Rating					
6		Lubrication					
7		Spacer length					
8		Service factor					
9		Guard					
10	Bearings	Radial					
11		Thrust					
12		Life L10					
13	Bearing Seals	Type					
14		Manufacturer					
15	Lubrication	Method					
16		Lubricant					
17							
18	Baseplate	Type					
19							
20	Shaft Seal Type						
21	Manufacturer						
22	API Code						
23	Manufacturer Code						
24	Circulation / Flush Plan						
25							
26	Sealant Vessel Model Ref						
27	Vessel Capacity						
28	Vessel Design Code						
29	Independent Inspection Authority						
30	Vessel Design Conditions						
31	Vessel Test Pressure						
32	Coil Design Conditions						
33	Coil Test Pressure						
34							
35	Cooling System						
36	API Plan						
37							
38							
39							
40							
41							
42	**INSTRUMENTATION & CONTROL**						
43	Instrumentation / Interlocks Fitted						
44	FUNCTION			INDICATION	ALARM	TRIP	
45	Seal System						
46							
47							
48	Lube Oil System						
49							
50							
51	Pump Condition Monitoring						
52							
53							
54				L = Local LP = Local Panel R = Remote			
55							

Project No

Equipment **Lean Amine Pump**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA	REV.
1	**DRIVE ARRANGEMENT / TRANSMISSION**			
2	Driver Type			
3	Manufacturer			
4	Driver Specification			
5	Electrical Supply			
6	Rated Power/Speed			
7	Enclosure			
8	Driver Data Sheet No			
9				
10				
11				
12	**SCOPE OF SUPPLY**			
13	Pump			
14	Driver			
15	Drive Arrangement			
16	Baseplate			
17	Coupling & Guard			
18	Sealant System			
19	Nozzle Gaskets & Fasteners			
20	Lube Oil System			
21				
22	Special Tools			
23	Commissioning Spares			
24	Two Years Operating Spares			
25	Capital Spares			
26	First Fill of Lubricant			
27	Holding Down Bolts			
28				
29				
30				
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36				
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39				
40				
41				
42				
43	**WEIGHTS & DIMENSIONS**			
44				
45	Pump	kg		
46	Driver	kg		
47	Baseplate	kg		
48				
49				
50	Total	kg		
51				
52	Maximum Maintenance Weight	kg		
53				
54				
55	Baseplate Footprint Length x Width	mm		

Project No

Equipment **Lean Amine Pump**

Equipment No

Number Off

					REV.
1	**INSPECTION, TESTING AND CERTIFICATION**				
2	**EQUIPMENT QUALITY LEVEL:- N/A**				
3					
4	All tasks listed below shall be included on the Vendor's Quality Plan for this package as a minimum and shall be performed at the vendor's works.				
5	Refer also to detailed inspection, testing & certification requirements specified on reference documents.				
6					
7	**TASK DESCRIPTION**	WITNESS	OBSERVE	REVIEW	
8					
9	Review material certificates (BS EN 10204 - 3.1standard.)				
10	Identify materials against material certificate/cast numbers.				
11	Check certified chemical properties of materials.				
12	Check certified results of mechanical test of materials.				
13	Review material guarantee.				
14	Check heat treatment certificates, including temperature records.				
15	Check operator qualifications and suitability of all NDT operators.				
16	Check certified results of NDT tests of materials and welds.				
17	Inspect radiographs & extent of radiography.				
18	Check qualification of welders and operators.				
19	Part dimensional check for site erection purposes to certified drawings.				
20	General workmanship and completeness of supply.				
21	Machined casing for general workmanship, finish and cleanliness.				
22	Examine impellers, check construction.				
23	Paint or other finish for continuity.				
24	Auxiliary piping and fittings against requirements of item specification.				
25	Flange face finish against requirements of item specification.				
26	Guards to correct standard and are securely attached.				
27	Alignment of driver with driven unit.				
28	Fabrication of baseplate against requirements of item specification.				
29	Hydrostatic test of all pressure retaining parts (Pump casing, coolers, Seal water piping etc.)				
30	Dynamic balancing of impeller or complete rotating element				
31	Copy of machine rating plate.				
32	Overspeed test on impeller.				
33	Mechanical run test at rated speed .				
34	NPSH(R) test on pump (Option)				
35	Performance test of pump.				
36	Vibration amplitude during performance test.				
37	Each item is suitably prepared for shipment.				
38					
39					
40	ELECTRIC MOTORS				
41	Routine works test certificate.				
42	Type test certificate.				
43	Earthing and bonding. Continuity between equipment items and earth tag.				
44	Compliance with specification, correct enclosure, termination arrangements, etc.				
45	Hazardous area classification certificates.				
46					
47	INSTRUMENTATION				
48	Tag labels are fitted.				
49	Material certificate for each item.				
50	Calibration certificate for each item.				
51	Hazardous area classification certificates for each item.				
52					
53					
54					
55					

Project No	
Equipment	**Lean Amine Pump**
Equipment No	
Number Off	

		REV.
1	**REFERENCE DOCUMENTS**	
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20	**GENERAL NOTES**	
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Project No	
Equipment	**Lean Amine Pump**
Equipment No	
Number Off	

		REV.
1	**SKETCH**	
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Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet
Item: Lean/Rich Amine Exchangers

DOCUMENT NO.	
SHEET NO.	2 of 6
PROJECT NO.	
ITEM NO.	
NO. OFF	

Mechanical Datasheet - Lean / Rich Amine Exchangers

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION	UNITS	DATA				Rev
1	**DESIGN & OPERATING DATA**						
2			**HOT FLUID**		**COLD FLUID**		
3			**In**	**Out**	**In**	**Out**	
4	**FLUID**						
5	**TOTAL FLUID FLOW**	**kg/hr**					
6	**VAPOUR FLOW**	**kg/hr**					
7	**LIQUID FLOW**	**kg/hr**					
8	**LIQUID DENSITY**	**kg/m³**					
9	**LIQUID SPECIFIC HEAT**	**kJ/kg°C**					
10	**LIQUID VISCOSITY**	**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**	**W/m°C**					
12	**LIQUID SURFACE TENSION**	**Dyn/cm**					
13	**LATENT HEAT**	**kJ/kg**					
14	**VAPOUR DENSITY**	**kg/m³**					
15	**VAPOUR SPECIFIC HEAT**	**kJ/kg°C**					
16	**VAPOUR VISCOSITY**	**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**	**W/m°C**					
18	**MOLECULAR WEIGHT**						
19	**OPERATING TEMPERATURE**	**°C**					
20	**OPERATING PRESSURE (Normal Inlet/Max. Inlet)**	**Bar a**					
21	**PRESSURE DROP Allow/Calc**	**Bar**					
22	**No. OF PASSES**						
23	**WALL SHEAR RATE**	**Pa.**					
24	**FOULING ALLOWANCE**	**m²C/W**					
25	**MAP (DESIGN PRESSURE)**	**bar g**					
26	**TEST PRESSURE New/Corroded**	**bar g**					
27	**DESIGN TEMPERATURE**	**°C**					
28	**HEAT DUTY**	**MW**					
29	**H.T. COEFFICIENT Service / Clean**	**W/m²C**					
30	**LMTD**	**°C**					
31	**HEAT TRANSFER SURFACE AREA**	**m²**					
32	**DESIGN MARGIN**	**%**					
33							
34							

35	**CONSTRUCTION & MATERIALS**				
36	**DESIGN CODES:**		**Type:**		
37	**PED FLUID PHASE & GROUP No:**	**HOT SIDE:**	**COLD SIDE:**		
38	**PED EQUIPMENT CATEGORY:**		**PED CONFORMITY MODULES:**		
39	**HEAT Ex. PLATE:**	**MATERIAL:**	**END PLATE:**	**MATERIAL:**	
40		**THICKNESS:**		**THICKNESS:**	
41		**No. OFF:**	**TIE BARS:**	**MATERIAL:**	
42	**GASKET MATERIAL:**			**No. OFF:**	
43	**GASKET TYPE:**			**DIAMETER:**	
44	**NOZZLES:**		**HOT SIDE**	**COLD SIDE**	
45		**MATERIAL:**			
46		**SIZE:**			
47		**RATING:**			
48		**LINING:**			
49		**POSITION:**			
50		**CONNECTION TYPE:**			
51	**MINIMUM N.D.T.**		**INSPECTION BY:**		
52	**ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID**	**kg**			
53	**ESTIM'D WEIGHT INSTALLED FULL OF WATER**	**kg**			

			DOCUMENT NO.				
			SHEET NO.				3 of 6
			PROJECT NO.				
			ITEM NO.				
Mechanical Datasheet - Lean / Rich Amine Exchangers			NO. OFF				
CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

	DESCRIPTION	UNITS	DATA				Rev
1	**TURNDOWN & OPERATING DATA**						
2			**HOT FLUID**		**COLD FLUID**		
3			**In**	**Out**	**In**	**Out**	
4	**FLUID**						
5	**FLUID FLOW**	**kg/hr**					
6	**VAPOUR FLOW**	**kg/hr**					
7	**LIQUID FLOW**	**kg/hr**					
8	**LIQUID DENSITY**	**kg/m3**					
9	**LIQUID SPECIFIC HEAT**	**kJ/kg°C**					
10	**LIQUID VISCOSITY**	**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**	**W/m°C**					
12	**LIQUID SURFACE TENSION**	**Dyn/cm**					
13	**LATENT HEAT**	**kJ/kg**					
14	**VAPOUR DENSITY**	**kg/m3**					
15	**VAPOUR SPECIFIC HEAT**	**kJ/kg°C**					
16	**VAPOUR VISCOSITY**	**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**	**W/m°C**					
18	**MOLECULAR WEIGHT**						
19	**OPERATING TEMPERATURE**	**°C**					
20	**OPERATING PRESSURE**	**Bar(g)**					
21	**PRESSURE DROP** **Allow/Calc**	**bar**					
22	**HEAT DUTY**	**kW**					
23							
24							
25							
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34							
35	**APPLICABLE DESIGN CODES & STANDARDS:**						Rev
36	**UNFIRED PRESSURE VESSELS**						
37	**PRESSURE EQUIPMENT DIRECTIVE**						
38	**PLATE HEAT EXCHANGERS FOR GENERAL REFINERY SERVICES**						
39	**FLANGES AND THEIR JOINTS**						
40							
41	**SPECIFICATION FOR PRESSURE VESSEL**						
42	**GASKETED PLATE TYPE HEAT EXCHANGERS**						
43	**TECHNICAL PRACTICE REGARDING PED REQUIREMENT**						
44	**GENERAL PROJECT SPECIFICATION FOR MECHANICAL EQUIPMENT**						
45	**PAINTING SPECIFICATION**						
46	**VENDOR DOCUMENTATION SPECIFICATION**						
47	**EARTHING BOSS**						
48	**NAMEPLATE & BRACKET FOR HEAT EXCHANGERS**						
49	**WIND LOADING SPECIFICATION**						
50							
51	**NOZZLE LOADING**						
52							
53	**VENDOR DOCUMENTATION SPECIFICATION- ENG. REQUIREMENTS**						
54							
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Mechanical Datasheet - Lean / Rich Amine Exchangers

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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			DOCUMENT NO.				
			SHEET NO.				5 of 6
			PROJECT NO.				
			ITEM NO.				
Mechanical Datasheet - Lean / Rich Amine Exchangers			NO. OFF				
CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

	SKETCH	Rev
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Mechanical Datasheet - Lean / Rich Amine Exchangers

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	INSPECTION TASKS			Rev
1	**INSPECTION TASKS**			
2	All tasks identified below shall be included on the vendors quality plan.			
3	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
4	These certificates shall be included in the exchanger certification dossier.			
5				
6	**MC1**	**C**	Review material certificates (EN-10204, 3.1.standard).	
7	**MC2**	**C**	Check certified chemical & mechanical properties of all materials.	
8				
9	**WRod1**		Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
10	**WRod2**		Check method of distribution of welding consumables and means of storage on the shop floor.	
11				
12	**WeldPr**	**C**	Check weld procedures and qualifications.	
13	**Welder**	**C**	Check weld map and welders qualifications.	
14				
15	**TrHtNos**		Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
16				
17	**Plate**		Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas	
18			susceptible to thinning.	
19	**Lamin**	**C**	Inspect edges of material for weld preparation and for discontinuities and laminations.	
20				
21	**Fitup**		Inspect assembly including alignment of main seams prior to welding.	
22	**Nozzles**		Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of	
23			bolt holes.	
24				
25	**Welding**		Survey welding and back gouging and ensure that approved procedures are followed.	
26	**InspWeld**	**C**	Inspect finished welds for freedom from undercut and surface defects.	
27				
28	**DimChk**	**C**	Check dimensions to approved drawing and code.	
29	**IntFinish**	**C**	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
30				
31	**MPT**	**C**	Check MPT procedure and operators qualifications and survey the testing of all exchanger welds.	
32	**RT**	**C**	Ensure radiography of exchanger welds is in accordance with approved drawing and specified code.	
33			Review radiographs.	
34	**UT**	**C**	Witness ultrasonic examination of welds and review reports.	
35				
36	**HydrT**	**C**	Witness hydraulic test. Check test set up and pressure gauge certificates. Check test water certificate.	
37			Check that the exchanger is clean and dry after testing.	
38				
39	**Final-1**	**C**	Check that the equipment is clean and dry before sealing.	
40	**Final-2**	**C**	Check general workmanship and completeness of supply.	
41	**Final-3**	**C**	Check Paint or other finishes for continuity and against specification.	
42	**Final-4**	**C**	Check copy of nameplate.	
43	**Final-5**	**C**	Check Equipment packed and protected ready for shipment.	
44	**Final-6**		Review Dossier.	
45				
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Client:	**To be determined**
Plant Location:	**To be specified**
Project Number:	

MECHANICAL DEPARTMENT
LP DESUPERHEATER
DATASHEET

SERVICE: LP Desuperheater Item Number: Number Required:

1.0 Description

2.0 Duty

2.2 Normal Operating Conditions

		DS inlet	Spraywater valve inlet	DS outlet
Flow	kg/s			
Pressure	bar a			
Temperature	°C			
Stream Enthalpy	kJ/kg			

2.1 Maximum Steam Outlet Temperature / Design operating data:

		DS inlet (steam side)	Spraywater valve inlet	DS outlet (steam side)
Flow	kg/h			
Pressure	bar a			
Temperature	°C			
Stream Enthalpy	kJ/kg			

2.2 Maximum Water Spray Flow Condition

		DS inlet	Spraywater valve inlet	DS outlet
Flow	kg/s			
Pressure	bar a			
Temperature	°C			
Stream Enthalpy	kJ/kg			

Revision				
Status				
Prepared By / Date				
Checked By / Date				
Authorised By / Date				

3.0 Piping Connections:

Desuperheater Steam piping

Desuperheater Water inlet piping

4.0 Installation

5.0 Noise

6.0 Control

Revision				
Status				
Prepared By / Date				
Checked By / Date				
Authorised By / Date				

Client:	**To be determined**
Plant Location:	**To be specified**
Project Number:	

MECHANICAL DEPARTMENT
MP / LP PRDS
DATASHEET

1.0 Description

2.0 Duty

2.1 Normal Operating Data:

		PRDS inlet (steam side)	Spray Water	PRDS outlet (steam side)
Flow	kg/h			
Pressure	bar a			
Temperature	°C			
Stream Enthalpy	kJ/kg			

3.0 Piping Connections:

Steam Inlet piping

Steam Outlet piping

Spray Water Inlet

4.0 Installation

Vendor to provide valve specific installation requirements for upstream and downstream straight lengths.

5.0 Supply

Revision				
Status				
Prepared By / Date				
Checked By / Date				
Authorised By / Date				

Aker CleanCarbon™

AkerSolutions™ part of Aker

SERVICE: MP / LP PRDS Item Number: Number Required:

6.0 Noise

7.0 Control

Revision				
Status				
Prepared By / Date				
Checked By / Date				
Authorised By/Date				

Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet

Item: NaOH Tank

Mechanical Datasheet-NaOH Tank	DOC. NO. Not Applicable
	PAGE NO. 2 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESIGN & OPERATING DATA		Rev
2	APPLICATION STANDARD (DESIGN CODE)		
3	PED CONFORMANCE CATEGORY (PREFERRED MODULE)		
4	VESSEL SPECIFICATION		
5	GENERAL PROJECT SPECIFICATION FOR MECHANICAL EQUIPMENT		
6	PIPING DESIGN NOZZLE LOADING FOR STATIC EQUIPMENT		
7	VENDOR DOCUMENTATION SPECIFICATION		
8	SHELL MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS		
9	SHELL MAP (DES. PRESSURE ext.) at top @ TEMPERATURE		
10	SHELL OPERATING PRESSURE @ TEMPERATURE (Min/Norm/Max)		
11	JACKET MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS		
12	JACKET MAP (DES. PRESSURE ext.) at top @ TEMPERATURE		
13	JACKET OPERATING PRESSURE @ TEMPERATURE		
14	CORROSION/EROSION ALLOWANCE (internal / external)		
15	STRESS RELIEF/PWHT		
16	RADIOGRAPHY		
17	JOINT COEFFICIENT (PED ESR 7.2)		
18	HYDRAULIC TEST PRESSURE		
19	AIR TEST PRESSURE (with soap suds)		
20	BASIC WIND SPEED		
21	SEISMIC CRITERIA		
22	CYCLIC SERVICE		
23	CREEP RANGE		
24	VESSEL CONTENTS/PED FLUID PHASE & GROUP No.		
25	NATURE OF CONTENTS		
26	MAX. OPERATING STATIC HEAD		
27	INTERNAL FINISH		
28	WELD DRESSING (internal / external)		
29	INTERNAL COATING		
30	EXTERNAL FINISH		
31	EXTERNAL PAINTING		
32	INSULATION (by Vendor)		
33	FIREPROOFING (by site contractor)		
34	INSPECTION AUTHORITY		

	MATERIAL SPECIFICATIONS			
36	HEADS & SHELL		JACKET	
37	CLADDING			
38	BODY FLANGE			
39	NOZZLE: FLANGES		SUPPORT LEGS	
40	NOZZLE: NECKS		EXT. ATTACHMENTS	
41	BOLTING: EXTERNAL		FLANGE FINISH	
42	BOLTING: INTERNAL		PMA REQUIRED	
43	GASKETS: EXTERNAL		MATERIAL CERTS	
44	GASKETS: INTERNAL		IMPACT TEST REQ.	
45	FIXED INTERNALS		ELONGATION REQ.	
46	REMOVABLE INT'LS		WELDING QUALS	

	CAPACITY & WEIGHTS				
48	ESTIM'D WEIGHT FABRICATED (EMPTY)	kg	S.G. OF OPERATING FLUID		
49	ESTIM'D WEIGHT INTERNALS	kg	VOLUME OF OPERATING FLUID	Litres	
50	ESTIM'D WEIGHT ATTACHMENTS	kg	WEIGHT OF OPERATING FLUID	kg	
51	ESTIM'D WEIGHT INSTALLED (EMPTY)	kg	VESSEL CAPACITY (GROSS)	m^3	
52	ESTIM'D WEIGHT INSTALLED OPERATING	kg	JACKET CAPACITY (GROSS)	m^3	
53	ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID	kg			
54	ESTIM'D WEIGHT INSTALLED FULL OF WATER	kg			

Mechanical Datasheet-NaOH Tank	DOC. NO. Not Applicable
	PAGE NO. 3 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

Rev

BRANCH DUTY

Ref	Service	DN	No Off	Flange	Rating	Standout	Notes

Nozzle standouts are measured from vessel centre-line to flange face.

ADDITIONAL SPECIFICATIONS & STANDARDS

NOTES

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

NOTES (Continued)

Mechanical Datasheet-NaOH Tank	DOC. NO. Not Applicable
	PAGE NO. 5 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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53	All dimensions in millimetres	
54	Drawing not to scale	
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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53	All dimensions in millimetres	
54	Drawing not to scale	
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Mechanical Datasheet-NaOH Tank	DOC. NO. Not Applicable
	PAGE NO. 7 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

			INSPECTION TASKS	Rev
1	**INSPECTION TASKS**			
2	All tasks identified below shall be included on the vendors quality plan.			
3	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
4	These certificates shall be included in the vessel certification dossier.			
5	1.	C	Review material certificates (EN-10204. 3.1 standard).	
6	2.	-	Check certified chemical & mechanical properties of all materials.	
7	3.	-		
8	4.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
9	5.	C	Check method of distribution of welding consumables and means of storage on the shop floor.	
10	6.	-		
11	7.	C	Check weld procedures and qualifications.	
12	8.	C	Check weld map and welders qualifications.	
13	9.	-		
14	10.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
15	11.	-		
16	12.	C	Identify heads and check shape, dimensions and thickness.	
17	13.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.	
18	14.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
19	15.	-		
20	16.	C	Inspect assembly including alignment of main seams prior to welding.	
21	17.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.	
22	18.	-		
23	19.	C	Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material identification and stamping.	
24	20.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
25	21.	C	Witness welding of test plates and review test results.	
26	22.	C	Inspect finished welds for freedom from undercut and surface defects.	
27	23.	-		
28	24.	C	Check dimensions to approved drawing and tolerances given in specifications & design code.	
29	25.	-		
30	26.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
31	27.	-		
32	28.	C	Check DPI procedure and operators qualifications and survey the testing of all vessel welds.	
33	29.	C	Ensure radiography of vessel welds is in accordance with approved drawing and specified code. Review radiographs.	
34	30.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
35	31.	-		
36	32.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
37	33.	-	Gauge check column internal diameter.	
38	34.	C	Witness hydraulic test. Check test set up and pressure gauge certificates.	
39	35.	-		
40	36.	C	Check that the vessel is clean and dry before sealing.	
41	37.	C	Check general workmanship and completeness of supply.	
42	38.	C	Check Paint or other finishes for continuity and against specification.	
43	39.	C	Check copy of nameplate.	
44	40.	C	Check Equipment packed and protected ready for shipment.	
45	41.	-	Review Dossier.	
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Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet Process Drain Tank

Mechanical Datasheet Process Drain Tank	DOC. NO. Not appl
	PAGE NO. 2 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**o be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

					Rev
1	**DESIGN & OPERATING DATA (TANK)**				
2	APPLICATION STANDARD (DESIGN CODE)				
3	TANK DESIGN PRESSURE @ TEMPERATURE				
4	TANK OPERATING PRESSURE @ TEMPERATURE				
5	TANK CORROSION/EROSION ALLOWANCE (internal / external)				
6	STRESS RELIEF/PWHT				
7	RADIOGRAPHY				
8	JOINT COEFFICIENT				
9	HYDRAULIC TEST PRESSURE				
10	AIR TEST PRESSURE (with soap suds)				
11	BASIC WIND SPEED				
12	SEISMIC CRITERIA				
13	CYCLIC SERVICE				
14	CREEP RANGE				
15	NATURE OF CONTENTS				
16	MAX. OPERATING STATIC HEAD				
17	INTERNAL FINISH				
18	INTERNAL COATING				
19	EXTERNAL FINISH				
20	EXTERNAL PAINTING				
21	INSULATION				
22	FIREPROOFING (by site contractor)				
23	INSPECTION AUTHORITY				
24	**DESIGN & OPERATING DATA (COIL)**				
25	COIL DESIGN PRESSURE @ TEMPERATURE				
26	COIL OPERATING PRESSURE @ TEMPERATURE				
27	COIL CORROSION/EROSION ALLOWANCE (internal / external)				
28	COIL DESIGN CODE				
29	STRESS RELIEF/PWHT				
30	RADIOGRAPHY				
31	JOINT COEFFICIENT				
32	HYDRAULIC TEST PRESSURE				
33	NATURE OF CONTENTS (COIL)				
34	COIL CONTENTS / PED FLUID PHASE & GROUP No.				
35	**MATERIAL SPECIFICATIONS**				
36	SHELL				
37	HEADS		SADDLE SUPPORTS		
38	NOZZLE: FLANGES		EXT. ATTACHMENTS		
39	NOZZLE: NECKS		FLANGE FINISH		
40	BOLTING: EXTERNAL				
41	BOLTING: INTERNAL		MATERIAL CERTS		
42	GASKETS: EXTERNAL				
43	GASKETS: INTERNAL		COIL PIPE		
44	FIXED INTERNALS		COIL FLANGES		
45	REMOVABLE INT'LS				
46	**CAPACITY & WEIGHTS**				
47	ESTIM'D WEIGHT FABRICATED (EMPTY) kg		S.G. OF OPERATING FLUID (TANK)		
48	ESTIM'D WEIGHT INTERNALS kg		VOLUME OF OPERATING FLUID m^3		
49	ESTIM'D WEIGHT INSULATION kg		WEIGHT OF OPERATING FLUID (MAX) kg		
50	ESTIM'D WEIGHT ATTACHMENTS kg		TANK CAPACITY (GROSS) - APPROXIMATE m^3		
51	ESTIM'D WEIGHT INSTALLED (EMPTY) kg		S.G. OF OPERATING FLUID (COIL)		
52	ESTIM'D WEIGHT INSTALLED OPERATING kg				
53	ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID kg				
54	ESTIM'D WEIGHT INSTALLED FULL OF WATER kg				

Aker CleanCarbon

AkerSolutions

Mechanical Datasheet Process Drain Tank	DOC. NO. Not appl
	PAGE NO. 3 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**o be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

BRANCH DUTY

Ref	Service	DN	No Off	Flange	PN	Standout	Notes	Rev

Nozzle standouts are measured from tank centre-line to flange face.

ADDITIONAL SPECIFICATIONS & STANDARDS

NOTES

CLIENT	**o be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	NOTES (Continued)
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Mechanical Datasheet Process Drain Tank	DOC. NO. Not appl
	PAGE NO. 5 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**o be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	SKETCH	Rev
40	Drawing Not To Scale	
41	All Dimension in millimetres	

CLIENT	**o be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

1	SKETCH	Rev
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CLIENT	**o be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

				Rev
1			**INSPECTION TASKS**	
2	**INSPECTION TASKS**			
3	All tasks identified below shall be included on the vendors quality plan.			
4	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
5	These certificates shall be included in the tank certification dossier.			
6	1.	C	Review material certificates (EN-10204. 3.1 standard.)	
7	2.	-	Check certified chemical & mechanical properties of all materials.	
8	3.	-		
9	4.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
10	5.	C	Check method of distribution of welding consumables and means of storage on the shop floor.	
11	6.	-		
12	7.	C	Check weld procedures and qualifications.	
13	8.	C	Check weld map and welders qualifications.	
14	9.	-		
15	10.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
16	11.	-		
17	12.	C	Identify formed heads and check shape, dimensions and thickness.	
18	13.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.	
19	14.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
20	15.	-		
21	16.	C	Inspect assembly including alignment of main seams prior to welding.	
22	17.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.	
23	18.	-		
24	19.	C	Check weld preparation, material identification and stamping.	
25	20.	-		
26	21.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
27	22.	-		
28	23.	C	Inspect finished welds for freedom from undercut and surface defects.	
29	24.	-		
30	25.	C	Check dimensions to approved drawing and tolerances given in specifications and code.	
31	26.	-		
32	27.	C	Inspect internal finish and weld dressing.	
33	28.	-		
34	29.	C	Check DPI procedure and operators qualifications and survey the testing of all tank welds.	
35	30.	C	Ensure radiography of tank welds is in accordance with approved drawing and specified code. Review radiographs.	
36	31.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
37	32.	-		
38	33.	-	Gauge check tank internal diameter.	
39	34.	C	Check test set up and witness hydraulic test.	
40	35.	-		
41	36.	C	Check that the tank is clean and dry before sealing	
42	37.	C	Check general workmanship and completeness of supply.	
43	38.	C	Check Paint or other finishes for continuity and against specification.	
44	39.	C	Check copy of nameplate.	
45	40.	C	Check Equipment packed and protected ready for shipment.	
46	41.	-	Review Dossier.	
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Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet Process Water Tank

Mechanical Datasheet Process Water Tank	DOCU. NO. Not Applicable
	PAGE NO. 2 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

			Rev
1	**DESIGN & OPERATING DATA**		
2	APPLICATION STANDARD (DESIGN CODE)		
3	DESIGN PRESSURE @ TEMPERATURE		
4	OPERATING PRESSURE @ TEMPERATURE		
5	CORROSION/EROSION ALLOWANCE (internal / external)		
6	STRESS RELIEF/PWHT		
7	RADIOGRAPHY		
8	VACUUM BOX TESTING		
9	JOINT COEFFICIENT		
10	HYDRAULIC TEST PRESSURE		
11	AIR TEST PRESSURE (with soap suds)		
12	BASIC WIND SPEED		
13	SEISMIC CRITERIA		
14	CYCLIC SERVICE		
15	CREEP RANGE		
16	NATURE OF CONTENTS		
17	MAX. OPERATING STATIC HEAD		
18	INTERNAL FINISH		
19	INTERNAL COATING		
20	EXTERNAL FINISH		
21	EXTERNAL PAINTING		
22	INSULATION		
23	FIREPROOFING (by site contractor)		
24	INSPECTION AUTHORITY		
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34	**MATERIAL SPECIFICATIONS**				
35	SHELL		STIFFENING RINGS		
36	ROOF		ANCHOR CHAIRS:		
37	BOTTOM PLATE		EXT. ATTACHMENTS		
38	NOZZLE: FLANGES		FLANGE FINISH		
39	NOZZLE: NECKS				
40	BOLTING: EXTERNAL		MATERIAL CERTS		
41	BOLTING: INTERNAL				
42	GASKETS: EXTERNAL				
43	GASKETS: INTERNAL				
44	FIXED INTERNALS				
45	REMOVABLE INT'LS				

46	**CAPACITY & WEIGHTS**					
47	ESTIM'D WEIGHT FABRICATED (EMPTY)	kg	S.G. OF OPERATING FLUID			
48	ESTIM'D WEIGHT INTERNALS	kg	VOLUME OF OPERATING FLUID	m^3		
49	ESTIM'D WEIGHT INSULATION	kg	WEIGHT OF OPERATING FLUID (MAX)	kg		
50	ESTIM'D WEIGHT LADDERS & PLATFORMS	kg	TANK CAPACITY (GROSS) - APPROXIMATE	m^3		
51	ESTIM'D WEIGHT INSTALLED (EMPTY)	kg				
52	ESTIM'D WEIGHT INSTALLED OPERATING	kg				
53	ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID	kg				
54	ESTIM'D WEIGHT INSTALLED FULL OF WATER	kg				

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Mechanical Datasheet Process Water Tank	DOCU. NO. Not Applicable
	PAGE NO. 3 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

									Rev
1	**BRANCH DUTY**								
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20	Nozzle standouts are measured from tank centre-line to flange face.								
21	**ADDITIONAL SPECIFICATIONS & STANDARDS**								
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

NOTES (Continued)

Mechanical Datasheet Process Water Tank	DOCU. NO. Not Applicable
	PAGE NO. 5 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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Mechanical Datasheet Process Water Tank	DOCU. NO. Not Applicable
	PAGE NO. 6 of 7
	PROJECT NO.
	ITEM NO.
	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

1	**SKETCH**	**Rev**
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

				Rev
1			**INSPECTION TASKS**	
2	**INSPECTION TASKS**			
3	All tasks identified below shall be included on the vendors quality plan.			
4	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
5	These certificates shall be included in the tank certification dossier.			
6	1.	C	Review material certificates (EN-10204. 3.1 standard.)	
7	2.	-	Check certified chemical & mechanical properties of all materials.	
8	3.	-		
9	4.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
10	5.	C	Check method of distribution of welding consumables and means of storage on the shop floor.	
11	6.	-		
12	7.	C	Check weld procedures and qualifications.	
13	8.	C	Check weld map and welders qualifications.	
14	9.	-		
15	10.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
16	11.	-		
17	12.	C	Identify formed roof plates and check shape, dimensions and thickness.	
18	13.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.	
19	14.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
20	15.	-		
21	16.	C	Inspect assembly including alignment of main seams prior to welding.	
22	17.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.	
23	18.	-		
24	19.	C	Check weld preparation, material identification and stamping.	
25	20.	-		
26	21.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
27	22.	-		
28	23.	C	Inspect finished welds for freedom from undercut and surface defects.	
29	24.	-		
30	25.	C	Check dimensions to approved drawing and tolerances given in specifications and code.	
31	26.	-		
32	27.	C	Inspect internal finish and weld dressing.	
33	28.	-		
34	29.	C	Check DPI procedure and operators qualifications and survey the testing of all tank welds.	
35	30.	C	Ensure radiography of tank welds is in accordance with approved drawing and specified code. Review radiographs.	
36	31.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
37	32.	C	Witness vacuum box testing of bottom plate welds.	
38	33.	-		
39	34.	-	Gauge check tank internal diameter.	
40	35.	C	Check test set up and witness hydraulic test.	
41	36.	-		
42	37.	C	Check that the tank is clean and dry before sealing	
43	38.	C	Check general workmanship and completeness of supply.	
44	39.	C	Check Paint or other finishes for continuity and against specification.	
45	40.	C	Check copy of nameplate.	
46	41.	C	Check Equipment packed and protected ready for shipment.	
47	42.	-	Review Dossier.	
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Client:	**To be determined**
Plant Location:	**To be specified**

Reclaimer System

Project No

Equipment **Reclaimer System**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA	Rev.
1	**GENERAL**			
2	Manufacturer			
3	Model / Size			
4	Design / Fabrication Code			
5	Location		INDOORS / OUTDOORS / UNDERCOVER / EXPOSED	
6	Heated / Unheated			
7	Tropicalisation			
8	Winterisation			
9	Height above Grade			
10	Dust			
11	Fumes			
12				
13	**OPERATING CONDITIONS**			
14	Purpose			
15				
16	Operation Mode		CONTINUOUS / INTERMITTENT	
17	Hazardous Area Classification		ZONE GAS GROUP TEMP CLASS DUST HAZARD	
18				
19				
20	**Feed Supply**			
21	Fluid Composition			
22	Amine	wt%		
23	CO_2	wt%		
24	Degredation Products	wt%		
25	Water	wt%		
26	Fluid Properties			
27	Flammable / Explosive / Corrosive / Erosive / Toxic			
28				
29				
30	**Operating Conditions**		Inlet | Outlet	
31	Flowrate Normal	kg/h		
32	Design	kg/h		
33	Operating Pressure	barg		
34	Operating Temperature	°C		
35	Density	kg/m^3		
36	Viscosity	cP		
37	Specific Heat	kJ/kg°C		
38				
39	**Reclaimer Fluid**			
40	Fluid Composition			
41	Amine	wt%		
42	Degredation Products	wt%		
43	Water	wt%		
44				
45	Density @ 60°C / 140°C	kg/m^3		
46	Viscosity @ 60°C / 140°C	cP		
47	pH			
48				
49	Flowrate Normal	kg/h		
50	Design	kg/h		
51	Operating Pressure	barg		
52	Operating Temperature	°C		
53				
54				
55				

Project No

Equipment **Reclaimer System**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA	Rev.
1	**OPERATING CONDITIONS (Cont.)**				
2					
3	**NaOH Supply**				
4	Composition		wt%		
5					
6	Flowrate	Normal	l/h		
7		Design			
8	Operating Pressure	(Refer to Note 8)	bara		
9	Operating Temperature		°C		
10					
11	**Water Supply**				
12	Flowrate	Normal	l/h		
13		Design			
14	Operating Pressure		bara		
15	Operating Temperature		°C		
16					
17					
18	**PERFORMANCE**				
19					
20					
21					
22					
23					
24					
25					
26	**UTILITY REQUIREMENTS**				
27	**Refer to Data Sheet 51209830-000-0HK00-111-EPI-0002 for Utility Conditions**				
28	**DEMINERALISED / PROCESS WATER**				
29	Required Flowrate		m^3/h		
30	Required Pressure		barg		
31	Required Temperature		°C		
32					
33	**PLANT AIR**				
34	Required Flowrate		Nm^3/h		
35	Required Pressure		barg		
36					
37	**INSTRUMENT AIR**				
38	Required Flowrate		Nm^3/h		
39	Required Pressure		barg		
40					
41	**COOLING WATER**				
42	Required Flowrate	Normal / Design	m^3/h		
43	Pressure Inlet / Outlet		barg		
44	Temperature Inlet / Outlet		°C		
45					
46	**MP STEAM**				
47	Required Flowrate	Normal / Design	kg/h		
48	Pressure Inlet / Outlet		barg		
49	Temperature Inlet / Outlet		°C		
50					
51					
52					
53					
54	Electrical Power		kW		
55					

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Equipment **Reclaimer System**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA				Rev.
1	**CONNECTIONS**						
2	SERVICE		TYPE	RATING	SIZE	POSITION	
3							
4							
5							
6							
7							
8							
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22							
23	**MATERIALS OF CONSTRUCTION**						
24							
25	Vessel						
26	Demister						
27	Heater Process Side						
28	Heating Fluid Side						
29							
30							
31	Circulation Pump						
32	Cooler Process Side						
33	Cooling Water Side						
34	Waste Handling System						
35	Vapour Pipework						
36	Fluid Pipework						
37	Fluid Valves						
38	Cooling Water Pipework						
39	Cooling Water Valves						
40	Steam Pipework						
41	Steam Valves						
42	Condensate Pipework						
43	Condensate Valves						
44	Vent / Drain Pipework						
45	Vent / Drain Valves						
46							
47	Structural Steel / Supports						
48							
49							
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Project No

Equipment **Reclaimer System**

Equipment No

Number Off

	DESCRIPTION		UNITS	DATA	Rev.
1	**MECHANICAL DATA**				
2	**VESSEL**				
3	Capacity of Vessel	Working / Total	m^3		
4	Vessel Dimensions	Height T-T / Diameter	mm		
5	Design Pressure		barg		
6	Design Temperature		°C		
7	Test Pressure		barg		
8	Design Code				
9	Independent Inspection Authority				
10					
11	**DEMISTER**				
12	Type				
13	Mesh density / Mesh wire diameter				
14					
15	**HEATER**				
16	Type				
17	Thermal Rating		kW		
18	Design Pressure	Process Side/Heating Side	barg		
19	Design Temperature	Process Side/Heating Side	°C		
20	Test Pressure	Process Side/Heating Side	barg		
21	Design Code				
22	Independent Inspection Authority				
23					
24					
25	**CIRCULATION PUMP**				
26	Type				
27	Manufacturer				
28	Pump Speed		rev/min		
29	Shaft Seal Arrangement				
30	Casing Design Conditions	Temperature/Pressure	°C / barg		
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46	**COOLER**				
47	Type				
48	Thermal Rating		kW		
49	Design Pressure	Process Side/Cooling Side	barg		
50	Design Temperature	Process Side/Cooling Side	°C		
51	Test Pressure	Process Side/Cooling Side	barg		
52	Design Code				
53	Independent Inspection Authority				
54					
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Equipment **Reclaimer System**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA			Rev.
1	**MECHANICAL DATA (Cont.)**					
2	**PROCESS FLUID PIPEWORK**					
3	Design Code					
4	Flange Specification					
5						
6	**SUMP FLUID PIPEWORK**					
7	Design Code					
8	Flange Specification					
9						
10	**COOLING WATER PIPEWORK**					
11	Design Code					
12	Flange Specification					
13						
14	**STEAM PIPEWORK**					
15	Design Code					
16	Flange Specification					
17						
18	**VENT / DRAIN SYSTEM PIPEWORK**					
19	Design Code					
20	Flange Specification					
21						
22						
23						
24	**CONTROL & INSTRUMENTATION**					
25						
26	Method of Package Control					
27						
28						
29	INSTRUMENTATION / INTERLOCKS FITTED					
30	FUNCTION		INDICATION	ALARM	TRIP	
31						
32						
33						
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35						
36						
37						
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39						
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41						
42	**DRIVE ARRANGEMENT / TRANSMISSION**					
43						
44	Drive Arrangement					
45	Driver Type					
46	Drive Motor Installed Power / Speed	kW / rev/min				
47	Drive Motor Enclosure					
48	Driver Mounting					
49	Manufacturer					
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Project No

Equipment **Reclaimer System**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA	Rev.
1	**SCOPE OF SUPPLY**			
2	Vessel			
3	Heater			
4				
5				
6	Pump			
7				
8	Feed Pump			
9	Cooler			
10				
11				
12	Baseframe			
13	Control Panel			
14	Instrumentation			
15	Control Valves			
16	Pipework			
17	Valves			
18	Heat Tracing / Insulation			
19	Control System			
20	Nozzle Gaskets & Fasteners			
21	Holding Down Bolts			
22	Special Tools			
23	Start-up & Commissioning Spare Parts			
24	Two Years Operating Spare Parts			
25	Capital Spare Parts			
26				
27				
28				
29				
30				
31				
32				
33	**WEIGHTS & DIMENSIONS**			
34	**WEIGHTS**			
35	Vessel	kg		
36	Heater	kg		
37	Pump	kg		
38				
39				
40	Cooler	kg		
41				
42	Total Skid Mounted Package	kg		
43	Maximum Maintenance Lift	kg		
44				
45				
46	**DIMENSIONS**			
47	Skid Baseframe Footprint	mm		
48	Skid Package Height	mm		
49				
50				
51				
52				
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Project No

Equipment **Reclaimer System**

Equipment No

Number Off

					Rev.
1	**INSPECTION, TESTING AND CERTIFICATION**				
2	**QUALITY LEVEL:-** Not Applicable				
3					
4	All tasks listed below shall be included on the Vendor's Quality Plan for this package as a minimum and shall be performed at the vendor's works.				
5	Refer also to inspection requirements specified on reference documents.				
6					
7	**TASK DESCRIPTION**	WITNESS	OBSERVE	REVIEW	
8	Review material certificates (EN 10204.3.1 standard)				
9	Identify materials against material certificate/cast numbers.				
10	Check certified chemical properties of materials.				
11	Check certified results of mechanical test of materials.				
12	Review material guarantee.				
13	Check heat treatment certificates, including temperature records.				
14	Check operator qualifications and suitability of all NDT operators.				
15	Check certified results of NDT tests of materials and welds.				
16	Inspect radiographs & extent of radiography.				
17	Check qualification of welders and operators.				
18	Part dimensional check for site erection purposes to certified drawings.				
19	General workmanship finish, cleanliness and completeness of supply.				
20	Paint or other finish for continuity.				
21	Auxiliary piping and fittings against requirements of item specification.				
22	Flange face finish against requirements of item specification.				
23	Guards to correct standard and are securely attached.				
24	Alignment of driver with driven unit.				
25	Fabrication of baseplate against requirements of item specification.				
26	Hydrostatic test of pressure retaining parts.				
27	Copy of machine rating plate.				
28	Dynamic balancing of impeller or complete rotating element				
29	Mechanical run test at rated speed .				
30	Performance test of pump.				
31	Vibration amplitude during performance test.				
32	Each item is suitably prepared for shipment.				
33					
34	**PRESSURE VESSELS & HEAT EXCHANGERS**				
35	Review material certificates (EN 10204.3.1 standard)				
36	Check certified results of NDT tests of materials and welds.				
37	Hydrostatic test of pressure retaining parts.				
38	Part dimensional check for site erection purposes to certified drawings.				
39	General workmanship and completeness of supply.				
40					
41	**INSTRUMENTATION / CONTROL SYSTEM**				
42	Ensure that correct tag labels are fitted.				
43	Check materials of construction are to specification and obtain certificate for each item.				
44	Obtain calibration certificate for each item.				
45	Hazardous area classification certificates for each item.				
46	Factory Acceptance Test				
47					
48	**ELECTRIC MOTORS**				
49	Hazardous area classification certificate.				
50	Routine works test certificate.				
51	Type test certificate.				
52	Earthing and bonding. Continuity between equipment items and earth tag.				
53	Compliance with specification, correct enclosure, termination arrangements, etc.				
54					
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Project No

Equipment **Reclaimer System**

Equipment No

Number Off

		Rev.
1	**REFERENCE DOCUMENTS**	
2		
3		
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24		
25	**GENERAL NOTES**	
26		
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Project No	
Equipment	**Reclaimer System**
Equipment No	
Number Off	

		Rev.
1	**GENERAL NOTES (Cont.)**	
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Equipment	**Reclaimer System**
Equipment No	
Number Off	

		Rev.
1	**SKETCH**	
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Client:	**ScottishPower**
Plant Location:	**Longannet, UK**

UK CCS Demonstration Competition
ScottishPower Consortium

Specification for Design & Manufacture Of Unfired Pressure Vessels

Aker CleanCarbon™

AkerSolutions™
part of Aker

Contents

1. Introduction

1.1 This specification states the minimum requirements for the mechanical design, fabrication, inspection and testing of fusion welded unfired pressure vessels.

1.2 The Vendor is responsible for implementing any regulations concerning the design, fabrication or inspection of pressure vessels which are mandatory by government decree in the country of installation. Within the EC and EFTA states these include compliance with the Pressure Equipment Directive (PED).

1.3 The standard drawings listed on the vessel specification sheets and issued with the requisition form part of this specification and indicate the requirements for design details.

1.4 This specification shall be read in conjunction with the Vessel Specification Sheet. The requirements contained in this specification supplement the pressure vessel code. Any conflict between any given data, national or code requirements shall be brought to the immediate attention of Aker Solutions for resolution.

1.5 The following shall be the order of precedence:-

i) Mandatory government decree requirements

ii) Regulations implementing the PED

iii) The vessel specification sheet

iv) This specification

v) The pressure vessel code

Note: It is the Vendor's responsibility to ensure that the item will meet the minimum requirements of the applicable pressure vessel code.

1.6 All documentation shall be in the English language.

1.7 The SI system of units shall be used with the exception that pressures are to be stated in bar(g) for mechanical design conditions.

1.8 The Vendor shall include in the quotation a list of specific deviations, otherwise the quotation shall be considered to be in accordance with the enquiry documents. Subsequent claims for extra costs arising from compliance with the specifications/ standards will not be considered.

2. Mechanical Design and Fabrication Codes

2.1 The vessel shall be designed and fabricated in accordance with EN 13445, 2009 Edition, unless otherwise stated on the vessel specification sheet.

2.2 Vessels operating under full or partial vacuum shall be designed for an external pressure of 1.013 bar.

2.3 The Vendor is responsible for design calculations for all pressure and structural parts of the vessel; for ensuring that the equipment design is adequate to withstand all internal and external loads, and for meeting the relevant code requirements for design, fabrication, testing and certification.

2.4 Unless otherwise stated on the vessel specification sheet all carbon and low alloy steel pressure parts shall have a minimum corrosion allowance of 1.0 mm.

3. Mechanical Design

3.1 General

3.1.1 Vessels requiring entry for removal of trays or other internals, or which are to be internally lined or insulated, shall not be less than 915 mm inside diameter unless agreed in writing by Aker Solutions.

3.1.2 Thicknesses given on vessel specification sheets are minimum finished including corrosion allowance to which must be added material for thinning during forming and fabrication operations or removal during machining. These thicknesses are initially indicative only and must be confirmed by Vendor's calculations.

3.1.3 Designs shall avoid all features likely to promote crevice corrosion.

3.1.4 All carbon and low alloy steel units in caustic, foul amine service or "weak acid" service and all deaerators shall be heat treated unless otherwise stated by Aker Solutions.

3.2 Shells and Dished Heads

3.2.1 Where shell strakes differ in thickness the inside diameter of the unit shall be constant.

3.2.2 Longitudinal seams of adjacent courses shall be displaced from each other by a minimum distance of 100 mm or four times the thickness, whichever is the greater, measured from the toes of the welds.

3.2.3 For vessels fabricated of carbon, low alloy steel or austenitic/duplex stainless steel the minimum shell or head thickness (notwithstanding the minimum thickness allowed by the design code) **before** corrosion allowance is added shall not be less than the following:-

Diameter (mm)	Carbon Steel (mm)	Stainless Steel (mm)
Up to 1200	5	5
1201 - 2000	6.5	5
Over 2000	8.0	6

3.2.4 Semi-ellipsoidal heads are preferred. Torispherical heads having dimensions within the design code are acceptable. Ratios of major to minor axes of elliptical or approximately elliptical shapes shall be as near to 2:1 as possible. Head shapes proposed, together with dimensional details must be stated in the Vendor's quotation and on the working drawings.

3.2.5 Thin heads are to be avoided on agitated vessels where excessive deflection/resonance can occur.

3.2.6 Reference shall be made to paragraphs 7.2.2 and 7.2.4.

3.3 Clad Construction

3.3.1 No account shall be taken of cladding thickness in strength calculations.

3.3.2 Explosion bonded cladding is preferred. Rolled cladding of some material combinations may be acceptable for shell cylinder components. The use of rolled cladding must be agreed with Aker Solutions at the quotation stage.

3.3.3 The use of loose lining must be agreed with Aker Solutions at the quotation stage.

3.3.4 For weld deposited facings, the Vendor shall provide effective welding control with preheat where necessary to avoid crack generation. Each weld deposited layer shall be carefully examined for cracks. The final surface shall be finish machined and checked by dye penetrant examination. The weld procedure qualification record must include all tests as defined by EN ISO 15614-7 in addition to any other code requirements.

3.3.5 For loaded internal attachments, including tray support rings, the cladding shall be stripped back to allow alloy support parts to be welded to the carbon steel shell. The cladding shall be welded to the support parts in a manner which will ensure adequate corrosion protection. Details shall be submitted to Aker Solutions for prior approval.

3.4 Girth Flanges

3.4.1 Bolt holes shall straddle the horizontal and vertical centre lines in elevation and the north/south centre line in plan, unless otherwise stated.

3.4.2 Flanges shall be designed to take the maximum of the following defined bolt loads (i.e. design for the use of torque limiting devices is not acceptable, except to prevent overstressing of the bolt material):-

a) **Bolt Load 1**

i) When the actual bolt root area is less than or equal to 130% of the required bolt area as designated by the design code:-

Design bolt load is to equal that required by the design code.

ii) When the actual bolt root area is greater than 130% of the required root area designated by the design code:-

The full bolt root area is to be used in the calculation of the bolt load, i.e. formula 11.5-16 in EN 13445-3 shall read:

$W = A_B \cdot f_{B,A}$

b) **Bolt Load 2**

The bolt load required to withstand the hydrostatic test pressure if the joint is not to be broken down following hydrostatic test.

3.4.3 The flange gasket facing machine finish will normally be specified by Aker Solutions. When not specified it is the Vendor's responsibility to ensure that this facing is suitable for the gasket used.

3.4.4 Hub flanges shall not be manufactured from plate.

3.5 Nozzles

3.5.1 All nozzle necks up to and including 300 mm (12") NB shall be of seamless construction unless otherwise agreed by Aker Solutions.

3.5.2 Minimum nozzle size shall be 25 mm (1") NB flanged.

3.5.3 For nozzles smaller than 50 mm NB the attachment to the vessel wall shall be 50 mm nominal bore and incorporate a forged reducer or be constructed from an integrally long

forged long weld neck (LWN) not less than 40 mm outside diameter. Nozzles 50 mm NB and larger shall be constructed using LWN or seamless pipe. Unless otherwise specified, the minimum wall thickness shall be standard wall. Nozzles 300 mm NB and larger may be from formed plate instead of pipe.

3.5.4 Bottom nozzles on towers and other vessels when specified on the vessel specification sheet with skirts, shall be connected to an elbow and pipe extended beyond the skirt and flanged.

3.5.5 All nozzle reinforcing pads or seal welded sections thereof, shall be provided with ¼" NPT threaded tell-tale holes which, for insulated vessels, shall be provided with a vent pipe projecting 25 mm beyond the insulation.

3.5.6 Nozzles and shells shall be designed to accommodate the nozzle local loads specified by Aker Solutions.

3.5.7 All nozzle connections shall be of full penetration set-in construction unless otherwise agreed by Aker Solutions. If set-on nozzles are used on carbon and low alloy steels, the shell plate around the hole shall be checked for laminations by ultrasonic inspection and for surface defects by dye-penetrant examination or magnetic particle inspection.

3.5.8 Where pad connections are specified the Vendor shall supply studs, nuts and gaskets.

3.5.9 Nozzles shall not pass through weld seams.

3.6 Nozzle Flanges

3.6.1 Nozzle flanges shall be PN designated and shall comply with EN 1092-1 in all respects. The flange rating and facing shall be as stated on the vessel specification sheet.

3.6.2 The flange gasket facing machine finish will normally be specified by Aker Solutions. When not specified it is the Vendor's responsibility to ensure that this facing is suitable for the gasket used.

3.6.3 Bolt holes for flanges shall straddle the horizontal and vertical centre-lines in elevation and the north/south centre-line in plan.

3.7 Manholes and Handholes

3.7.1 Manholes shall have a minimum inside diameter of 590 mm. If the column diameter precludes this, one flanged head is required.

3.7.2 All manholes, handholes and other blanked off nozzles shall be furnished complete with covers, bolting and gaskets.

3.7.3 Davits in shall be furnished for all manhole and handhole covers and blind flanges weighing in excess of 34 kg. Hinges shall be furnished for covers weighing between 17 kg and 34kg. Covers of 17 kg and less shall be supplied with two handles.

3.7.4 Vessels less than 915 mm inside diameter may be provided with handholes in lieu of manholes. All other pressure vessels shall be provided with manholes. Where requirements differ from the applicable design code, the more stringent of the two will govern.

Generally the requirements of BS 470 shall be satisfied.

3.7.5 Hand grips shall be provided where entry is made horizontally through manholes. If a manhole is more than 1500 mm from the bottom of a vessel an internal ladder or rungs shall be provided.

3.7.6 Manholes for vertical vessels without trays shall be located near the bottom of the shell with one 150mm vent, minimum, in the top head of the vessel.

Manhole location for horizontal vessels shall normally be in the heads unless otherwise dictated by plant arrangement.

3.7.7 Manhole necks shall have inside sharp corners rounded off and internal welds dressed smooth.

3.7.8 A manhole shall be provided in any large division plate, unless otherwise stated, to permit access to all parts of the interior of the vessel. If this is not possible, additional manholes shall be provided in the vessel shell.

3.7.9 If access to the interior of a vessel cannot be via manways, a minimum of one 150 mm or larger inspection opening shall be provided. If approved, a piping nozzle may be used as an inspection opening if piping can be removed. Inspection openings should be located such that representative shell joints and critical parts of the interior of the vessel can be inspected.

3.7.10 Adequate nozzles and/or manways shall be provided to meet venting requirements for gas freeing vessels and ventilation for mechanical work such as welding.

3.7.11 Manholes shall not pass through weld seams.

3.8 Bolting and Gaskets

3.8.1 All studbolts shall be metric in accordance with the requirements of EN 1515 and shall be threaded full length.

3.8.2 Type of thread shall be either coarse thread or above M39 fine thread with 4mm pitch.

3.8.3 Bolts shall extend at least two clear threads from the nut.

3.8.4 Unless otherwise specified external bolts for temperature range -100°C to 450°C shall be in accordance with EN 10269 Grade 42 CrMo4. If other bolting is specified the nuts shall be softer than the bolts.

3.8.5 Bolt materials 4.6 and 6.8 shall not be used in the scope of the Pressure Equipment Directive.

3.8.6 Internal bolting shall be compatible with the contacting fluid and the materials being bolted.

3.8.7 External ferritic studbolts shall be treated with a graphite base lubricant.

3.8.8 Consideration shall be given to allow hydraulic bolt tensioning equipment to be used on bolting M39 diameter and greater.

3.8.9 One piece gaskets shall be used unless otherwise agreed with Aker Solutions.

3.8.10 Asbestos materials are not permitted.

3.8.11 The use of gasket dope, lubricant, etc. is prohibited.

3.9 Internals

3.9.1 Provision shall be made for the self-draining of all internals.

3.9.2 All baffles, tray support beams or other internals spanning a chord or diameter of the vessel shall be provided with a means of allowing for differential expansion between the part and the vessel shell or be subject to special design consideration. For cartridge trays the maximum gap between the tray periphery and the shell shall be 6 mm. The tray Vendor shall produce a three dimensional template of the cartridge for the vessel Vendor to carry out a pull-through tolerance check.

3.9.3 For towers less than 915 mm internal diameter, internals, whether trays or packings, shall be designed to permit removal without internal access. The design shall ensure that internal fittings cannot be loosened by vibration.

3.9.4 Packed bed supporting elements shall be designed to support the packaged bed weights plus entrained liquid equivalent to 10% volume of the bed free space.

3.9.5 Flanges for internal non-pressure piping may be fabricated from plate. For alloy or alloy clad vessels, pipe and flanges shall be fabricated of the same material as the inside shell

unless otherwise specified. When flanges are made from plate, the facing and drilling shall comply with EN 1092-1, PN6 to accommodate standard size gaskets.

3.9.6 Internal pressure piping shall be fabricated from forged flanges and seamless pipe to the same specification as the external connected pipe.

3.9.7 Wear plates or impingement baffles shall be installed at inlet nozzles where erosion could be caused.

3.9.8 All other internals (fixed and removable) shall be supplied and installed by the Vendor unless otherwise stated. Removable internals shall pass through vessel manholes.

3.9.9 Non-removable internals such as internal heads, tray rings, internal stiffening, etc., including attachment welds shall have the full specified corrosion allowance applied to both sides to ensure the element can withstand design loadings in the fully corroded condition. Removable internals shall have half the specified corrosion allowance added to both sides. Corrosion allowance shall be zero on removable internals made of austenitic stainless steel, duplex stainless steel, other high alloy steels or non-ferrous metals.

3.10 Supports

3.10.1 Vertical vessels shall be supported on steel skirts, legs or lugs as denoted on the vessel data sheet; horizontal vessels on two steel saddles. Lugs are preferred for vessels that are supported by structural steelwork.

3.10.2 The top section of a skirt must be the same material as the bottom head, minimum length 500mm.

3.10.3 Legs design shall be verified by calculation.

3.10.4 No vessel shall have more than two saddles unless discussed and agreed by Aker Solutions. Only one saddle shall be fixed to the foundation.

3.10.5 When a vertical vessel has been designed for dynamic loading the skirt shall not be less than the thickness of the bottom shell course.

3.10.6 The thickness of the skirt at the bottom portion containing the anchor bolt chairs shall be checked to withstand the effects of the bolt chair reaction.

3.10.7 All openings in the skirt shall be reinforced as may be required to compensate for loss of material at these points.

3.10.8 The minimum number of anchor bolts for skirt supported vessels shall be four and thereafter in multiples of four. Unless otherwise specified, the bolts shall straddle the

north/south centre-line. The minimum size of anchor bolts shall be M24. The allowable anchor bolt stress shall be 120 N/mm^2 unless otherwise stated on the vessel specification sheet, calculated on the root area of the bolts. Distance between bolts should be no less than 12 x bolt diameter.

3.10.9 Vessel supports and foundations shall be designed to take the weight of the vessel filled with water, regardless of the test conditions.

3.10.10 The maximum concrete bearing stress for foundations shall be 5 N/mm^2 unless otherwise agreed with Aker Solutions for individual cases.

3.10.11 For equipment mounted in steelwork, M20 shall be the minimum anchor bolt size.

3.10.12 Supports and wrapper plates shall be continuously welded to the shell. Each saddle wrapper plate or each part thereof seal welded to the shell shall have a 10 mm diameter air release hole.

3.10.13 Skirt mounted vertical vessels should be provided with quantity two baseplate templates 10mm thickness carbon steel, clearly marked with plant north. These templates to be drilled together with the skirt baseplate and delivered to site as soon as they have been completed.

3.11 Fittings

3.11.1 Forged steel eye-bolts of one piece construction or plate lugs shall be provided by the Vendor for each vessel or removable component weighing more than 17 kg. On insulated units the lugs shall be extended to project beyond the insulation. The weight of heavy items shall be stamped (etched in the case of equipment in cold service) on the periphery of the main flanges.

3.11.2 Where required, insulation lugs, cleats and/or support rings shall be supplied by the Vendor.

3.11.3 Horizontal equipment required to be finish coated at the manufacturer's works shall be provided with lifting lugs on each side of the saddle supports in order to facilitate lifting without damage to the coating.

3.11.4 Two earthing bosses in accordance with Aker Solutions Standard shall be provided and welded to the saddles support brackets or skirt.

3.11.5 Pressure containing fittings (e.g. sight glasses) shall have a pressure rating compatible with the hydrostatic test pressure of the vessel.

3.11.6 Vertical vessels shall be fitted with lifting lugs/trunnions. These shall be capable of lifting the vessel in its intended lifting state (e.g. fully dressed) using a load factor of 2 for less than 10 Te and 1.5 for 10 Te or greater. Where lifting beams are specified as being in the Vendor's scope of supply they shall be subjected to proof testing.

3.12 Wind and Weight Loadings

3.12.1 Vessels shall be self-supporting and designed to withstand the specified wind loading based on the maximum vertical projection of exposed surfaces, which shall include insulation, platforms (1 m^2 at each manway) ladders (150 mm wide for vessel height), pipework, overhead vapour lines and other equipment associated with the vessel.

3.12.2 Wind loading shall be evaluated in accordance with the requirements of BS EN 1991-1-4 (Eurocode 1) and the UK National Annex BS EN 1991-1-4 NA.

Site Conditions are as follows:

- Basic Wind Speed = 25 m/s
- Altitude of the site, A = 5.000 m
- Directional Factor, c_{dir} = 1
- Seasonal factor, c_{season} = 1
- Shape parameter, K = 0.2
- Exponent, n = 0.5
- Annual probability of exceedence, p = 0.02

3.12.3 Snow loading shall be evaluated in accordance with the requirements of BS EN 1991-1-3 (Eurocode 1) and the UK National Annex BS EN 1991-1-3 NA. Snow load at ground level 0.5 KN/m2.

3.12.4 Eccentric moments induced by the weight of equipment supported from the vessel and overhead vapour lines shall be additive to wind moments. These loadings where applicable will be indicated on the appropriate drawings.

3.12.5 The vessel shall be designed to withstand the following combined loadings in the corroded condition:-

i) Totalled bending moment, internal design pressure and empty weight at the coincident design temperature.

ii) Totalled bending moment, external design pressure if applicable and operating weight at the coincident design temperature.

iii) Totalled bending moment and operating weight at the coincident design temperature (pressure shutdown).

iv) 30% of wind moment plus eccentric moments and hydrostatic test pressure.

3.12.6 Vessel supports shall be designed for the following conditions of loading:-

- Snow load.
- Wind moment, together with other moment loadings if applicable and the operating weight for design of support and its attachment weld to vessel.
- Vessel full of test water assuming that site testing is not carried out in high winds but allowing 30 percent of the total wind moment.
- Wind movement, together with other loading if applicable, with the vessel empty.

3.12.7 The vessel shall be designed to withstand all loadings, including shock, during lifting (see 3.11.6).

3.12.8 **Vibration**

Vertical vessels with a height to diameter ratio in excess of 10 shall be checked and designed as required for dynamic loading. This rule however should not specifically preclude other vessels from dynamic analysis. Also the requirements of the design code or local regulations must be considered. Where calculations indicate that vibrations are critical the vessel shall be stepped in thickness to withstand the dynamic effect.

3.12.9 **Deflection**

For vessels in the corroded condition the maximum static deflection allowed shall be 100 mm per 20.0 metres of length when the vessel is subject to the design wind loading.

3.13 Weights

The following weights are to be determined and incorporated in all design calculations and general arrangement drawings. The weights if shown on the vessel specification sheets which accompany either the enquiry or purchase requisition represent an assessment made during initial design studies.

The Vendor shall compute fabricated weights based on the finalised design of the vessel from which empty, operating and test weights can then be more accurately established. For weight calculation purposes the density of insulation (cellular glass) shall be taken to be 120 kg/m^3.

3.13.1 **Fabricated Weight** shall be the weight of the vessel including all non-removable internal and external attachments excluding insulation.

3.13.2 **Component Weights** shall be the weight of all removable components.

3.13.3 **Erected Weight** shall be the fabricated weight plus trays, packing, grids and other removable internal components plus platforms, ladders, piping weight supported from the vessel, insulation and all other removable external appurtenances.

3.13.4 **Operating Weight** shall be the erected weight plus operating liquid including tray liquid or packing entrained liquid (see 3.9.4) and bottom liquid plus piping liquid weight supported from the vessel.

3.13.5 **Weight Full of Water** shall be the erected weight plus weight of water in the vessel and piping supported from the vessel.

3.13.6 **Weight Full of Operating Liquid** shall be the erected weight plus weight of operating liquid in the vessel when flooded and weight of operating liquid in piping supported from the vessel when flooded.

3.14 Miscellaneous Requirements

3.14.1 Nozzle compensation pads and support wrapper plate/pads shall not cover any longitudinal or circumferential welds.

3.14.2 Unless otherwise agreed with Aker Solutions, the minimum distance between the edges of adjacent weld seams and between the edges of nozzle welds and weld seams shall be the greater of 50 mm or three times the thickness of the thickest weld seam concerned.

3.14.3 The equipment shall be designed so that the stresses at test conditions do not exceed 90% of yield but the test pressure must comply with the more onerous of the design code and the Pressure Equipment Directive, Annex I, Paragraph 7.4.

3.14.4 Vertical vessels containing packing or removable trays and those having relief valves of 80 mm size or greater shall be fitted with a top davit.

3.14.5 The Vendor shall furnish and attach all insulation support rings, pipe supports, platforms and ladder clips, lifting lugs and other attachments as and where required by the appropriate vessel specification sheet.

3.14.6 Vortex breakers shall be fitted to pump-out nozzles.

3.14.7 Lifting trunnions and nozzle locations shall be such as to not interfere with the top and tail movement of the vessel.

4. Field Fabricated Vessels

For any large vessel which is to be fully or partly fabricated on site, the design, construction, inspection and testing of the vessel are to be discussed and agreed with Aker Solutions at an early stage in the design of the vessel, together with any limitations on foundation loading which may in any way restrict the normal requirement of Aker Solutions for the hydrostatic testing of the vessel on completion at site.

5. Materials

5.1 All materials shall be of the type and grade specified on the individual vessel specification sheet.

5.2 Carbon and low alloy steel plates 40 mm and over in thickness shall be ultrasonically tested in accordance with EN 10160.

5.3 No substitution of material may be made without the written consent of Aker Solutions.

5.4 Structural quality steels are not acceptable for pressure retaining parts.

5.5 Only fully killed steel shall be used.

5.6 All carbon and carbon manganese steels shall be normalised for all thicknesses.

5.7 For carbon and carbon manganese steels the maximum carbon content shall be 0.25% and the carbon equivalent calculated from the formula below shall not exceed 0.43%.

$$CE = \frac{\%C + \%Mn}{6} \text{ (for plain carbon steels)}$$

5.8 All stainless steel material shall be in the solution treated condition.

5.9 Reinforcing pads shall be of the same material as the component to which they are attached.

5.10 Non-pressure parts attached to pressure parts by welding shall be of the same general type of material as the shell or interior cladding if welded to the cladding material.

5.11 Should any materials prove unsatisfactory during fabrication they shall be rejected notwithstanding any previous certification of satisfactory examination or tests.

6. Material Markings

6.1 Identification marks (cast number, etc.) shall be stamped (see 6.3) in a prominent position on all materials.

6.2 The equipment item number shall be stamped (see 6.3) in a prominent position on all materials.

6.3 For carbon and low alloy steel vessels having a design temperature below 0°C all marking shall be etched. The unit shall not be hard stamped, chisel or pop-marked. In certain instances low stress dot matrix stamping will be accepted, subject to the prior agreement of Aker Solutions.

6.4 The following shall be excluded from use:-

a) Chloride or sulphide bearing paints, marker pens or tape on stainless steels.

b) Cadmium or cadmium bearing materials.

7. Fabrication and Welding

7.1 General

No fabrication may begin until the Vendor has received written acceptance of detailed shop drawings from Aker Solutions.

7.2 Dished Heads

7.2.1 Welds in formed heads fabricated from more than one plate and welds in heads built up from formed sections shall be fully radiographed **AFTER** completion of all welding, forming and any required heat treatment.

7.2.2 Cold formed carbon or low alloy steel heads and hot spun heads shall be normalised on completion of the forming process.

7.2.3 Hot pressed carbon or low alloy steel heads must be normalised subsequent to the pressing operation unless the manufacturer can ensure that no forming will be done below the normalising temperature.

7.2.4 Provided that there is not a risk of stress corrosion cracking due to the contents and temperature, stainless steel heads cold formed from material <15 mm thick will not require subsequent heat treatment if the elongation of the material is >40% before forming. Should a risk of stress corrosion cracking be considered possible then heads will require

solution annealing. Stainless steel heads cold formed from material >15 mm thick shall be solution annealed.

7.2.5 Forming by local heating and/or local deformation is not permitted. Cold forming by hammering is not permitted.

7.2.6 Heavy scale remaining after hot forming is to be removed by grit blasting (non-metallic for stainless steel). For stainless steel a preferred method is by pickling using a procedure to be agreed with Aker Solutions.

7.3 Cutting and Preparation for Welding

7.3.1 Any materials which are cut by thermal processes must be dressed back to clean metal.

7.3.2 Arc air gouging is not permitted on stainless steel.

7.3.3 All weld preparations are to be checked for flaws, cracks, laminations, etc. to a method agreed with Aker Solutions. Following any rectification, the weld preparation must comply with the relevant joint detail.

7.4 Weld Procedures

7.4.1 Weld Procedure Specifications (WPS's) for all welds (including fillets), together with the supporting procedure qualification records (PQR's) shall be submitted to Aker Solutions for review **BEFORE** commencement of fabrication.

7.4.2 Procedure qualification records will not be accepted as weld procedure specifications.

7.4.3 Welders' qualifications will be checked for acceptability by the Aker Solutions Inspector.

7.5 Welding Processes

7.5.1 The Vendor shall ensure that the welding processes which he proposes to use shall be compatible with the materials and thicknesses being joined and that the process in no way impairs the mechanical properties and corrosion resistance of the material.

7.5.2 Short arc welding processes (dip transfer CO_2 shielded) are not permitted for the welding of any of the pressure parts or major load bearing structures.

7.5.3 Electroslag welding shall not be used.

7.6 Welding General

7.6.1 Where no preheat has been specified, but the ambient temperature is below 0°C the base metal shall be heated to 10°C minimum.

7.6.2 The Vendor shall determine the degree of preheating required, if any, other than as dictated by the code to prevent cold cracking, excessive hardness in the heat affected zone and excessive distortion.

7.6.3 Permanent backing strips are not acceptable.

7.6.4 Seams in supporting skirts shall be double-butt welded.

7.7 Heat Treatment

7.7.1 Heat Treatment shall be carried out strictly in accordance with the code requirements.

7.7.2 All flange faces shall be suitably protected against oxidation during heat treatment.

7.7.3 All vessels shall be heat treated as a complete unit where this is practicable. The top portion of supporting skirts at least shall be welded to the shell before heat treatment.

7.7.4 During heat treatment, metal temperatures shall be recorded and copies of the chart(s) included in the documentation dossier.

7.7.5 All components subjected to post weld heat treatment shall be permanently labelled "STRESS RELIEVED. DO NOT WELD OR BURN ON THIS VESSEL".

8. Inspection

8.1 General

8.1.1 A Quality Plan containing all inspection stages and tests shall be submitted to Aker Solutions for comment **BEFORE** commencement of fabrication. A Quality Plan is required for each item.

8.1.2 Aker Solutions' duly authorised agents and/or representatives shall have free access to those sections of the Vendor's facilities and, where necessary, any sub-contractor's works utilised in any manner for the construction of vessels under this specification. This shall include the right of review of all records, logs, reports, certificates etc., connected or concerned in any manner with the construction of vessels under this specification. They may reject any work, materials or procedure deemed defective or sub-standard.

8.1.3 It is the responsibility of the Vendor to advise Aker Solutions when the equipment will be ready for stage inspection. The Vendor shall give at least 10 days clear notice to the Purchaser's inspectorate.

8.1.4 The Vendor shall supply, at his own expense, all appropriate equipment and facilities to perform the required inspection and testing.

8.1.5 The acceptance of any piece of equipment or component by an inspector or representative of Aker Solutions shall not diminish or in any way affect the Vendor's sole responsibility for the freedom of the vessel from defects and for the observance of all the terms and conditions of the order.

8.2 Material Identification and Certification

8.2.1 The Vendor shall provide arrangements whereby any part of the vessel can be identified with the material from which it was cut and its material certificate.

8.2.2 All material which is to be used in the manufacture of the vessel shall, prior to the commencement of fabrication, be submitted for inspection by Aker Solutions together with certificates showing the results obtained from tests and analyses carried out in accordance with the relevant specification for the material for that part of the vessel.

8.2.3 Where the Vendor proposes to use material from his own stock, he shall produce test certificates for the material, and the Aker Solutions Inspector shall positively identify the material as that covered by the certificate.

8.2.4 When Aker Solutions is not satisfied that identification is positive, or where no certificate is available, the material shall be tested, in the presence of the Aker Solutions Inspector, in accordance with the requirements of the appropriate specification. The costs of these tests shall be to the Vendor's account.

8.2.5 Material certificates shall be in accordance with EN 10204 Certificate 3.1. For equipment specified under the EC Pressure Equipment directive, all material shall be supplied by a material manufacturer having an ISO 9000 quality assurance system (covering manufacture of materials) certified by a competent body established within the European Community. These must be either original mill certificates or "wet stamped" by a responsible person as being true copies. The use of ASTM and ASME materials requires "Particular Material Appraisals" (PMA).

8.3 Fabrication Tolerances

Fabrication tolerances shall be those specified in the design code.

9. Testing

9.1 General

9.1.1 All tests shall be carried out in a safe manner by qualified personnel and unless otherwise agreed, in the presence of an Aker Solutions Inspector.

9.1.2 Unless otherwise stated all testing shall be carried out after completion of the part concerned, including heat treatment if applicable, but before the unit is painted.

9.2 Radiography

9.2.1 Radiography shall mean X-ray. Gamma-ray shall only be used with the express agreement of Aker Solutions.

9.2.2 The extent of radiography shall be in accordance with the most stringent requirements of the relevant design code, Aker Solutions vessel specification sheet or the following paragraphs. Unless otherwise approved by Aker Solutions, vessels shall be designed and fabricated with a minimum of spot radiographic examination.

9.2.3 For radiography of dished heads see 7.2.1.

9.2.4 In special cases ultrasonic examination may be used in lieu of radiography, but only with the written agreement of Aker Solutions.

9.3 Dye Penetrant Examination

The following welds shall be dye penetrant or magnetic particle examined:-

a) Root runs of longitudinal and circumferential seams, where roots are not to be subsequently removed, and nozzle to shell welds before commencement of filler runs.

b) Final weld runs of nozzle to shell welds.

c) Final weld runs of slip-on flange to nozzle pipe welds.

d) Final weld runs of slip-on girth flange to shell welds.

e) All welds on nozzle compensation plates.

f) All welds on supports and lifting lugs.

9.4 Air and Soapy Water Testing

Air and soapy water tests shall be performed on nozzle compensation pads by applying 1 bar(g) air for 5 minutes, subsequently reduced to 0.2 bar(g) before applying soap solution.

(**Note**: Nitrogen may be substituted for air)

9.5 Hydrostatic Testing

9.5.1 The vessel complete with all pressure containing parts, shall be hydrostatically tested on the completion of all other tests, to a procedure agreed by Aker Solutions.

9.5.2 Gaskets used for testing shall be the service gaskets unless the joint is broken after hydrostatic testing, in which case the test gaskets shall be identical in every aspect to the service gaskets.

9.5.3 In the case of a vertical vessel tested horizontally in the shop, the test pressure shall relate to the design pressure adjusted for static head when the unit is in the vertical position. It must be ensured that no part of the vessel will be subject to a higher stress when tested vertically at site in its corroded condition, than it experiences during its initial test. If a vessel is not to be designed for testing in the vertical position on site, this will be stated on the vessel specification sheet.

The nameplate and the general arrangement drawing shall state "Tested Horizontally" alongside the shop test pressure figure.

If a vessel is designed to withstand only partial filling with liquid the nameplate shall state the design pressures at both the top and bottom of the vessel.

If part of a vessel is not self-venting during operation or hydrotest, means of venting, e.g. by a vent pipe or a vent nozzle shall be specified.

9.5.4 All vessels shall be hydrostatically tested, to code requirements, using fresh water. The specified test pressure shall be held for at least one hour. See also 3.14.3.

9.5.5 The test water shall be of sufficient temperature that the risk of brittle fracture is avoided (see EN 13445-2 Annex B).

9.5.6 Water used to test austenitic stainless steel vessels shall have a chloride content not greater than 30 ppm. Certification verifying this requirement shall be provided. Alternatively (subject to the written consent of Aker Solutions) this chloride restriction may be waived provided that all internal surfaces are subsequently thoroughly rinsed with demineralised water.

9.5.7 Vessels shall be internally cleaned before testing and thoroughly dried after testing.

10. Nameplate

Each vessel shall carry a stainless steel nameplate which shall be fitted in a conspicuous position on brackets projecting 25 mm from the vessel or insulation as applicable (see also 9.5.3).

11. Painting

11.1 The Vendor is to include for surface preparation and painting of vessels.

11.2 No painting shall be performed until completion of hydrostatic testing.

11.3 The painted surfaces shall also include flange faces (outside the gasket seating surface) and inside of flange bolt holes. Only this painting may be completed before hydrostatic test.

11.4 If a vessel is not required to be painted, then the vessel shall have a clean finish with all weld discolorations, scale, manufacturing marking and other foreign matter removed.

11.5 All machined and bright finish surfaces shall be coated with an easily removable corrosion preventative.

12. Preparation for Shipment

12.1 Flanged openings shall be protected with bolted metal covers and rubber gaskets. All tapped connections except tell-tale holes shall be fitted with plugs and all exposed threads fitted with screwed bushes. Tell-tale holes shall be filled with heavy grease. Vent pipes, where fitted, shall be capped.

12.2 Spare gaskets, bolts, nuts, etc. and any other loose items shall be boxed separately from the main equipment. Such boxes shall be suitable for site storage and clearly and permanently marked to show:-

- Aker Solutions Order Number
- Aker Solutions Item Number (for which the parts are intended)

12.3 The Vendor shall be responsible for loading, anchoring and protecting vessels to prevent damage during shipment. Care shall be taken when loading and unloading to ensure that lifting hawsers, ropes, chains, etc., do not damage any finish coating surface. Shipping saddles shall be provided.

12.4 Vessels shipped as part loads shall not be in contact with any other part of the consignment.

12.5 Stainless steel vessels that are to be shipped by sea shall be crated and marked "NOT FOR DECK CARGO". Where this is impracticable due to size or any other reason the equipment shall be suitably protected by some means to be agreed with Aker Solutions.

12.6 A white line 50 mm wide x 915 mm long shall be marked on the outside of vertical vessels to indicate the "Plant North".

13. Guarantee

The Vendor shall guarantee the mechanical design and the suitability of the materials of construction for the duties required.

14. Scope of Supply

The Vendor shall include all of the following within his supply:-

i) The vessel as defined in the specification, completely assembled, tested and prepared for shipment.

ii) All documentation, including individual vessel documentation dossiers.

iii) Service gaskets and three extra sets of gaskets for all blanked flanges and other gasketed joints for commissioning.

iv) Service bolting and 10% additional bolting (minimum four) of all sizes.

v) All insulation rings, clips and fittings.

vi) Connecting bolts and service and commissioning gaskets for mating flanges of vessels close coupled to other vessels or tanks where specified.

vii) If stated on the vessel data sheet, all necessary test equipment to enable the vessel to be hydrostatically tested on site.

viii) Special lifting equipment (e.g. spreader beams) for safe handling of vessels on site where specified.

15. Data with Quotation

The Vendor shall give the following information in the Quotation:-

- Specification and grade of materials of construction
- Any deviation from the Enquiry Specification
- Weight, empty and full of water
- Recommendation for two years operational spares (see 16)
- Vessel shell, head and support thicknesses

16. Two Years Spares

The Vendor shall give in the quotation a recommendation of spares for 2 years operation together with itemised prices. It is envisaged that the following will be the minimum recommendation:-

- 300% gaskets
- 10% bolting (minimum 4 of any size)

17. References

This specification refers to the following documents. (These documents shall be taken as the latest issue including all amendments and appendices at the date specified for the contract):-

(i) European Standards

EN 1092-1	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 1: Steel flanges
EN 1515	Flanges and their Joints - Bolting
EN 10160	Ultrasonic Testing of Steel Flat Product of Thickness Equal or Greater than 6 mm (Reflection Method)
EN 10204	Metallic Products - Types of Inspection Documents
EN 10269	Steels and Nickel Alloys for Fasteners with Specified Elevated and/or Low Temperature Properties
EN 13445	Unfired Pressure Vessels
BS EN 1991-1-3	Eurocode 1: Actions on Structures – Part 1-3: General

	Actions – Snow Loads
BS EN 1991-1-3 NA	UK National Annex To Eurocode 1 - Actions On Structures - Part 1-3: General Actions – Snow Loads
BS EN 1991-1-4	Eurocode 1: Actions on Structures – Part 1-4: General Actions - Wind Actions
BS EN 1991-1-4 NA	UK National Annex To Eurocode 1 - Actions On Structures - Part 1-4: General Actions - Wind Actions
EN ISO 15614-7	Specification and Qualification of Welding Procedures for Metallic Materials - Welding Procedure Test - Part 7: Overlay Welding

(iii) **Other Standards**

BS 470	Specification for Inspection, Access and Entry Openings for Pressure Vessels

Client:	**To be determined**
Plant Location:	**To be specified**

Sea Water Filter Data Sheet

Project No

Equipment **Sea Water Filter**

Equipment No

Number Off

	DESCRIPTION	UNITS	DATA	Rev.
1	**GENERAL**			
2	Manufacturer			
3	Model / Size			
4	Design / Fabrication Code			
5	Location			
6	Heated / Unheated			
7	Tropicalisation			
8	Winterisation			
9	Height above Grade			
10	Dust			
11	Fumes			
12				
13	**OPERATING CONDITIONS**			
14	Purpose			
15				
16	Operation Mode			
17	Hazardous Area Classification			
18				
19	**Feed Supply**			
20	**Fluid Properties and Operating Conditions**			
21	Flammable / Explosive / Corrosive / Erosive / Toxic			
22	Fluid to be filtered			
23				
24	Flowrate	m^3/h		
25	Inlet Operating Pressure	barg		
26	Inlet Operating Temperature	°C		
27	Estuary Water Density	kg/m^3		
28	Estuary Water Viscosity	cP		
29	Solid Content	wt%		
30	Solid Size after filter	mm		
31	Cleaning Requirements			
32	Allowable Pressure Drop Across Filter, Clean/Maximum Dirty	bar		
33				
34	**Design Conditions**			
35	Max Design Pressure	barg		
36	Min Design Pressure	barg		
37	Max Design Temperature	°C		
38	Min Design Temperature	°C		
39				
40	PED Fluid Group			
41	PED Category			
42				
43	Radiography			
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52				

Project No:

Equipment **Sea Water Filter**

Equipment No:

	DESCRIPTION	UNITS	DATA	Rev.
1	**PERFORMANCE**			
2	The sea water filters are used to prevent clogging and			
3	fouling of downstream plate heat exchangers with silt.			
4				
5				
6				
7				
8				
9	**UTILITY REQUIREMENTS**			
10				
11				
12	Required Flowrate	m^3/h		
13	Required Pressure	barg		
14	Required Temperature	°C		
15				
16	**INSTRUMENT AIR**			
17	Required Flowrate	Nm^3/h		
18	Required Pressure	barg		
19	Supply Pressure	barg		
20				
21	**ELECTRICITY SUPPLY**			
22	Electricity power	V		
23	Instruments	V		
24	**CONNECTIONS**			

	Ref	SERVICE		TYPE	RATING	SIZE	REMARK	
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								

36	**MATERIALS OF CONSTRUCTION**			
37	Shell			
38	Shell internal lining			
39	Bolts and nuts (external)			
40	Internal parts			
41	Nozzle pipe			
42	Nozzle flange			
43	Structural Steel / Supports			
44	Shell body gaskets			
45	Flushing Valve			
46	Actuators and Limit switched			
47	Control Panel			
48	Surface treatment and Painting			
49				
50				
51				
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Project No

Equipment **Sea Water Filter**

Equipment No

	DESCRIPTION	UNITS	DATA			Rev.
1	**MECHANICAL DATA (Cont.)**					
2						
3						
4						
5						
6						
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11						
12						
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14						
15	**CONTROL & INSTRUMENTATION**					
16						
17	Method of Control					
18	PLC Panel					
19	Signal Exchange Requirements					
20	Interfaces to supervisory control system					
21	Project Instrument and Control Specifications listed					
22	on sheet 8 shall be followed.					
23	INSTRUMENTATION / CONTROLS					
24	FUNCTION		INDICATION	ALARM	TRIP	
25	(VTA)					
26						
27						
28						
29						
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31						
32						
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35						
36	**SCOPE OF SUPPLY**					
37	Filters and Associated Control System	Yes				
38	Filter Suppor Saddles	Yes				
39	PLC Control Panel	Yes				
40	Instrumentation - pressure transducers, limit switches (VTA)	Yes				
41	Flushing Valves	Yes				
42	Nozzle Gaskets & Fasteners	No				
43	Holding Down Bolts	No				
44	Special Tools	Yes				
45	Start-up & Commissioning Spare Parts	Yes				
46	Two Years Operating Spare Parts	Yes				
47	Capital Spare Parts	Yes				
48	Attendance at HAZOP Meeting	Yes				
49						
50						
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Project No

Equipment **Sea Water Filter**

Equipment No

	DESCRIPTION	UNITS	DATA	Rev.
1	**WEIGHTS & DIMENSIONS**			
2	**WEIGHTS**			
3	Empty weight including all elements per filter	kg		
4	Operating including all elements per filter	kg		
5	Maximum Maintenance Lift per filter	kg		
6				
7	**DIMENSIONS**	mm		
8	Footprint per unit and total	mm		
9	Height			
10				
11				
12	**SKETCH (VTC)**			
13				
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Project No

Equipment **Sea Water Filter**

Equipment No

					Rev.
1	**INSPECTION, TESTING AND CERTIFICATION**				
2					
3					
4	All tasks listed below shall be included on the Vendor's Quality Plan for this package as a minimum and shall be performed at the Vendor's				
5	works. Refer also to inspection requirements specified on reference documents.				
6					
7	**TASK DESCRIPTION**	WITNESS	OBSERVE	REVIEW	
8	Review material certificates (EN 10204.3.1 standard)			X	
9	Identify materials against material certificate/cast numbers.			X	
10	Check certified chemical properties of materials.			X	
11	Check certified results of mechanical test of materials.			X	
12	Review material guarantee.			X	
13	Check heat treatment certificates, including temperature records.			X	
14	Check operator qualifications and suitability of all NDT operators.			X	
15	Check certified results of NDT tests of materials and welds.			X	
16	Inspect radiographs & extent of radiography.			X	
17	Check qualification of welders and operators.			X	
18	Part dimensional check for site erection purposes to certified drawings.	X			
19	General workmanship finish, cleanliness and completeness of supply.	X			
20	Paint or other finish for continuity.	X			
21	Auxiliary piping and fittings against requirements of item specification.	X			
22	Flange face finish against requirements of item specification.	X			
23	Fabrication of baseplate against requirements of item specification.	X			
24	Hydrostatic test of pressure retaining parts.	X			
25	Copy of name plate.			X	
26	Each item is suitably prepared for shipment.	X			
27					
28					
29	**PRESSURE VESSELS**				
30	Review material certificates (EN 10204.3.1 standard)			X	
31	Check certified results of NDT tests of materials and welds.			X	
32	Hydrostatic test of pressure retaining parts.	X			
33	Part dimensional check for site erection purposes to certified drawings.	X			
34	General workmanship and completeness of supply.	X			
35	CE Certification			X	
36					
37	**INSTRUMENTATION**				
38	Ensure that correct tag labels are fitted.	X			
39	Check materials of construction are to specification and obtain certificate for each item.			X	
40	Obtain calibration certificate for each item.			X	
41	Hazardous area classification certificates for each item.			X	
42	Control panel FAT	X			
43	CE Certification			X	
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Project No

Equipment **Sea Water Filter**

Equipment No

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Client:	**ScottishPower**
Plant Location:	**Longannet, UK**

UK CCS Demonstration Competition
ScottishPower Consortium

Specification for Design & Manufacture of Plate Type Heat Exchangers

.

Aker CleanCarbon™

AkerSolutions™
part of Aker

Contents

1. Introduction

1.1 This specification applies to proprietary gasketed, semi-welded and fully welded plate in frame heat exchangers. It states the minimum requirements for the thermal and mechanical design, fabrication, inspection and testing in addition to any code requirements.

1.2 The Vendor is responsible for implementing any regulations concerning the design, fabrication or inspection of heat exchangers which are mandatory by government decree in the country of installation. Within the EC and EFTA states these include compliance with the Pressure Equipment Directive (PED).

1.3 The standard drawings listed on the heat exchanger specification sheets and issued with the requisition form part of this specification and indicate the requirements for design details.

1.4 The requirements contained in this specification supplement the pressure vessel code. Any conflict between any given data, national or code requirements shall be brought to the immediate attention of Aker Solutions for resolution.

1.5 The following shall be the order of precedence:

i) Mandatory government decree requirements

ii) Regulations implementing the PED

iii) The heat exchanger specification sheet

iv) This specification

v) The pressure vessel code

Note: It is the Vendor's responsibility to ensure that the item will meet the minimum requirements of the applicable pressure vessel code.

1.6 All documentation shall be in the English language.

1.7 The SI system of units shall be used with the exception of:

i) Dynamic viscosity to be stated in centipoises.

ii) Pressures are to be stated in bar (a) for process operating conditions and in bar (g) for mechanical design conditions.

iii) Force in kN, MN.

iv) Moments in kNm

v) Mass in kg or Te

1.8 The Vendor shall include in the quotation a list of specific deviations, otherwise the quotation shall be considered to be in accordance with the enquiry documents. Subsequent claims for extra costs arising from compliance with the specifications/ standards will not be considered.

1.9 No deviations from codes, regulations or specifications are permitted unless specifically agreed by Aker Solutions in writing.

2. Thermal Design

2.1 The Vendor shall be responsible for the thermal design of the plate type heat exchangers.

2.2 The Vendor shall thermally design the heat exchanger for the full range of duties and all conditions of operation.

2.3 Fouling resistances shall normally be specified on the heat exchanger specification sheet. Where not specified the Vendor shall incorporate a design margin of at least 20% to allow for fouling. The design margin is defined as:

$$\left[\left(\frac{\text{Uclean}}{\text{Uservice}} \right) - 1 \right] \times 100 = 20\%$$ where U is overall heat transfer coefficient.

2.4 When fouling resistances are stated on the heat exchanger specification sheet, the Vendor shall quote the estimated equivalent true “oversurface” in his quotation.

2.5 Single pass counterflow plate exchangers having all connections on the fixed plate shall be used unless otherwise specified on the exchanger specification sheet.

2.6 Gasketed plate heat exchanger frames shall not be filled to more than 80% of the maximum frame capacity unless otherwise agreed by Aker Solutions.

3. Mechanical Design and Fabrication Codes

3.1 Plate type exchangers shall be designed, fabricated, tested and inspected in accordance with EN 13445 Unfired Pressure Vessels and EN ISO 15547 (API 662) unless otherwise stated on the heat exchanger specification sheet.

The European Pressure Equipment Directive, 97/23/EC (PED), places full responsibility upon the manufacturer of pressure equipment to fully comply with the provisions of the Directive.

Under the Regulations, pressure equipment and assemblies above specified pressure/volume thresholds must:

- Be safe.
- Meet essential safety requirements covering design, manufacturing and testing.
- Satisfy appropriate conformity assessment procedures.
- Carry the CE marking and other information.

3.2 The design and operating temperatures and pressures shall be as stated on the heat exchanger specification sheet.

3.3 Heat exchangers operating under full or partial vacuum shall be designed for an external pressure of 1.013 Bar.

3.4 The mechanical design shall take into account the most arduous combination of temperature and pressure to which the unit may be subjected, including maximum differential between chambers. Account shall be taken of start-up, shutdown, operating, and process failure and test conditions. Venting and draining shall be applied as necessary.

3.5 The basic allowable stresses for pressure parts shall be in accordance with the values established by the applicable Code.

3.6 The Vendor is responsible for design calculations for all pressure and structural parts of the exchangers; for ensuring that the equipment design is adequate to withstand all internal and external loads, and for meeting the relevant code requirements for design, fabrication, testing and certification.

3.7 Plate heat exchanger plate thickness shall not be less than 0.5 mm unless agreed by Aker Solutions, in writing.

3.8 Unless otherwise stated on the heat exchanger specification sheet, the minimum corrosion allowance for carbon and low alloy (5% Cr or less) steel pressure parts shall be 1.0 mm except for components in contact with cooling water where the minimum corrosion allowance shall be 3.0 mm. Corrosion allowances shall not be applied to flange faces.

3.9 Plate heat exchanger gaskets shall be securely located at the plate edges and around the ports to prevent the gasket being blown out under pressure. The corner ports carrying a different process or service stream to that on the plate shall incorporate double gaskets with the space between the gaskets vented directly to atmosphere. Any gasket support bars not intended to hold pressure shall be open to atmosphere.

3.10 Plate heat exchangers shall be enclosed on the top and sides by a removable stainless steel protective shroud for mechanical protection unless otherwise specified by Aker Solutions.

For plate heat exchangers with 316 stainless steel material of construction the shroud must also be water proof.

3.11 Supports and foundation bolts shall be designed to allow for wind and snow conditions.

4. General Mechanical Design

4.1 Nozzles and Flanges

4.1.1 Nozzle flanges shall be PN designated and shall comply with EN 1092-1 in all respects. The flange rating and facing shall be as stated on the vessel specification sheet. Studded connections shall be suitable for mating flanges to EN 1092-1.

4.1.2 The flange gasket facing machine finish will normally be specified on the heat exchanger specification sheet. When not specified it is the Vendor's responsibility to ensure that this facing is suitable for the gasket used.

4.1.3 Welding neck hub thickness shall not be less than the thickness of the nozzle neck to which it is welded.

4.1.4 Values of the allowable nozzle loads shall be provided by the Vendor. For minimum allowable forces and moments refer to API 662 (ISO15547) table 2 “Severe Services Nozzle Loading” and individual plate exchanger datasheets.

4.2 Bolting

Vendor shall supply bolting for studded connections.

4.3 Gaskets

4.3.1 Gasket materials are stated on the heat exchanger specification sheet.

4.3.2 The Vendor shall confirm in the quotation that the stated material is suitable for the intended service.

4.3.3 Asbestos materials are not permitted.

4.4 Fittings

4.4.1 Each exchanger shall be provided with two stainless steel earthing bosses.

4.4.2 One piece forged steel eye-bolts or plate lifting lugs shall be provided on any unit or removable part weighing more than 17 kg.

4.4.3 Anchor bolts to be cast into foundations to be specified (bolt size and grade) by Vendor, agreed by Aker Solutions and supplied by civil contractor.

4.4.4 The Vendor shall supply a nameplate in accordance with Aker Solutions standard. The Vendor's standard nameplate may be fitted in addition.

4.4.5 The nameplate shall be fitted in a conspicuous position on a bracket protruding at least 25 mm beyond any insulation.

4.5 Weights

4.5.1 The following weights shall be determined by the Vendor and incorporated in all design calculations and general arrangement drawings.

Fabricated Weight shall be the weight of the exchanger including all non-removable internal and external attachments excluding insulation.

Component Weights shall be the weight of all removable components.

Operating Weight shall be the erected weight plus operating liquid including piping liquid weight supported from the exchanger.

Weight Full of Water shall be the erected weight plus weight of water in the exchanger and piping supported from the exchanger.

5. Materials

5.1 All materials shall be of the type and grade specified on the individual vessel specification sheet.

5.2 Carbon and low alloy steel plates 40 mm and over in thickness shall be ultrasonically tested in accordance with EN 10160.

5.3 No substitution of material may be made without the written consent of Aker Solutions.

5.4 Structural quality steels are not acceptable for pressure retaining parts.

5.5 Only fully killed steel shall be used.

5.6 All carbon and carbon manganese steels shall be normalised for all thicknesses.

5.7 For carbon and carbon manganese steels the maximum carbon content shall be 0.25% and the carbon equivalent calculated from the formula below shall not exceed 0.43%.

$$CE = \frac{\%C + \%Mn}{6} \text{ (for plain carbon steels)}$$

5.8 All stainless steel material shall be in the solution treated condition.

5.9 Reinforcing pads shall be of the same material as the component to which they are attached.

5.10 Non-pressure parts attached to pressure parts by welding shall be of the same general type of material as the shell or interior cladding if welded to the cladding material.

5.11 Should any materials prove unsatisfactory during fabrication they shall be rejected notwithstanding any previous certification of satisfactory examination or tests.

6. Material Markings

6.1 Identification marks (cast number, etc.) shall be stamped (see 6.3) in a prominent position on all materials.

6.2 The equipment item number shall be stamped (see 6.3) in a prominent position on all materials.

6.3 For carbon and low alloy steel vessels having a design temperature below 0°C all marking shall be etched. The unit shall not be hard stamped, chisel or pop-marked. In

certain instances low stress dot matrix stamping will be accepted, subject to the prior agreement of Aker Solutions.

6.4 The following shall be excluded from use:-

a) Chloride or sulphide bearing paints, marker pens or tape on stainless steels.

b) Cadmium or cadmium bearing materials.

7. Fabrication and Welding

7.1 No fabrication may begin until the Supplier has received acceptance of detailed shop fabrication drawings from the Contractor.

7.2 If any welding is undertaken, weld procedures, together with the supporting welding procedure qualification records, shall be submitted to the Contractor for comment before the commencement of fabrication.

7.3 All welding shall be carried out by Code approved welders.

7.4 Only full penetration welds shall be used on pressure retaining parts.

7.5 As a minimum all welds shall be dye penetrant examined.

8. Inspection and Testing

8.1 General

8.1.1 A Quality Plan containing all inspection stages and tests shall be submitted to Aker Solutions for comment before commencement of fabrication. A Quality Plan is required for each item.

8.1.2 Aker Solutions' duly authorised agents and/or representatives shall have free access to those sections of the Vendor's facilities and, where necessary, any sub-contractor's works utilised in any manner for the construction of vessels under this specification. This shall include the right of review of all records, logs, reports, certificates etc., connected or concerned in any manner with the construction of vessels under this specification. They may reject any work, materials or procedure deemed defective or sub-standard.

8.1.3 It is the responsibility of the Vendor to advise Aker Solutions when the equipment will be ready for stage inspection. The Vendor shall give at least 10 days clear notice to the Purchaser's inspectorate.

8.1.4 The Vendor shall supply, at his own expense, all appropriate equipment and facilities to perform the required inspection and testing.

8.1.5 The acceptance of any piece of equipment or component by an inspector or representative of Aker Solutions shall not diminish or in any way affect the Vendor's sole responsibility for the freedom of the vessel from defects and for the observance of all the terms and conditions of the order.

8.2 Material Identification and Certification

8.2.1 The Vendor shall provide arrangements whereby any part of the vessel can be identified with the material from which it was cut and its material certificate.

8.2.2 All material which is to be used in the manufacture of the vessel shall, prior to the commencement of fabrication, be submitted for inspection by Aker Solutions together with certificates showing the results obtained from tests and analyses carried out in accordance with the relevant specification for the material for that part of the vessel.

8.2.3 Where the Vendor proposes to use material from his own stock, he shall produce test certificates for the material, and the Aker Solutions Inspector shall positively identify the material as that covered by the certificate.

8.2.4 When Aker Solutions is not satisfied that identification is positive, or where no certificate is available, the material shall be tested, in the presence of the Aker Solutions Inspector, in accordance with the requirements of the appropriate specification. The costs of these tests shall be to the Vendor's account.

8.2.5 Material certificates shall be in accordance with EN 10204 Certificate 3.1. For equipment specified under the EC Pressure Equipment directive, all material shall be supplied by a material manufacturer having an ISO 9000 quality assurance system (covering manufacture of materials) certified by a competent body established within the European Community. These must be either original mill certificates or "wet stamped" by a responsible person as being true copies. The use of ASTM and ASME materials requires “Particular Material Appraisals” (PMA).

8.3 Non-Destructive Testing

8.3.1 General

8.3.1.1 The extent of testing and test procedures shall be in accordance with the most stringent requirements of the design code, heat exchanger specification sheet and other requirements specified by the Aker Solutions.

8.3.1.2 All tests shall be carried out in a safe manner by qualified personnel and unless otherwise agreed in the presence of the Aker Solutions' Inspector.

8.3.2 Dye-Penetrant and Magnetic Particle Inspection

All pressure containing welds shall be inspected using dye penetrant.

Lifting lug welds shall be subjected to magnetic particle inspection.

8.3.3 Light Box Testing

All plates shall be examined for cracks by light box method.

8.4 Hydrostatic Testing

8.4.1 Each side of the exchangers shall be tested in accordance with the code.

8.4.2 At no point in the vessel shall the general membrane stress induced during the test exceed 90% of yield stress of the material.

8.4.3 Hydrostatic test pressure shall be held for a minimum time of one hour.

8.4.4 Potable water only shall be held for hydrostatic testing. Test water for exchangers made from austenitic stainless steel shall not contain more than 1 ppm chlorides, if the operating temperature is equal to or above 60°C, or 30 ppm for operation below 60°C.

Certification verifying test water quality to be provided.

8.4.5 Vessels shall be internally cleaned before testing and thoroughly dried after testing.

9. Preparation for Shipment

9.1 Before shipment all equipment shall be thoroughly cleaned, dry and free of scale, machined and bright finish surfaces of carbon or low alloy shall be coated with an easily removable corrosion preventative.

9.2 The interior of the equipment shall be thoroughly dried before the equipment is sealed for shipment.

9.3 External carbon steel surfaces shall be prepared and painted with a protective coating suitable for transportation and site storage for up to 12 months.

9.4 Flanged openings shall be protected with 10mm thick metal covers, a minimum of four bolts and rubber gaskets.

9.5 The use of Denso tape or equivalent on austenitic stainless steel exchangers is not permitted.

9.6 Spare gaskets, bolts, nuts, etc., and any other loose items shall be boxed separately from the main equipment. Such boxes shall be suitable for site storage and clearly and permanently marked to show:-

c) Purchase Order number and Item Number prominently painted on the side of each item and/or part of the item.

d) The use of the wineglass symbol should be used for correct position up.

9.7 All removable parts shall be vibro-etched with the equipment number.

9.8 The Vendor's proposed method for the corrosion protection of plate pack compression bolting shall be submitted to Aker Solutions for review.

9.9 Details of the Supplier's proposed surface preparation and painting shall be submitted to the Contractor for review.

9.10 The Vendor shall be responsible for loading, anchoring and protecting equipment to prevent damage during shipment. Care should be taken when loading and unloading to ensure that lifting hawsers, ropes, chains, etc., do not damage any finish coating surface.

9.11 Austenitic stainless steel heat exchangers that are to be shipped by sea shall be crated and marked "NOT FOR DECK CARGO". Where this is impracticable due to size or any other reason the equipment shall be suitably protected by some means to be agreed with the Purchaser.

9.12 The Vendor's recommended slinging points for shipment shall be shown on a shipping drawing.

9.13 Specific instructions will be issued as part of the enquiry/purchase documents when any special packaging and protection is required.

10. Scope of Supply

The Vendor shall include all of the following within his scope of supply:-

10.1 The heat exchanger as defined in the specification, completely assembled, tested and prepared for shipment.

10.2 All documentation necessary for the review and approval of equipment design and manufacture.

11. Data with Quotation

The Vendor shall supply the following information:-

- Model type and size.
- Plate size, number and thickness.
- Nozzle sizes.
- Recommendation for two years operational spares.
- Total surface area.
- Pressure drops, hot and cold fluids.
- Film coefficients, hot and cold fluids.
- Number of passes, hot and cold fluids.
- Specification and grade of all materials of construction (including bolting and gasket materials).
- Any deviation from the enquiry specification.
- Weight, empty and full of water.
- Details of proposed surface preparation and painting.

12. Guarantee

12.1 The Vendor shall guarantee the mechanical design and the thermal performance.

12.2 The Vendor shall guarantee the suitability of the materials of construction for the duties required even if the type and grade of material to be used is specified on the heat exchanger specification sheet. If the material is specified on the heat exchanger specification sheet the Vendor shall not be responsible for the corrosion characteristics of the material with regard to the process fluid.

13. Spares

The following spare gaskets are required:-

- 10% channel plate gaskets.
- 1 off each frame plate gaskets.
- 1 off each pressure plate gasket.
- 1 off each connection lining (excluding metal liners).

14. References

This specification refers to the following documents (These documents shall be taken as the latest issue including all amendments and appendices at the date of order):-

i) European Standards

EN 13445	Unfired Pressure Vessels
EN 1092-1	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated.
EN ISO 15547 (API 662)	Plate Heat Exchangers for General Refinery Services

ii) Other Standards

97/23/EC Pressure Equipment Directive

Client:	**ScottishPower**
Plant Location:	**Longannet, UK**

UK CCS Demonstration Competition
ScottishPower Consortium

Specification for Design & Manufacture Of Unfired Pressure Vessels

Aker CleanCarbon™

AkerSolutions™
part of Aker

Contents

1. Introduction

1.1 This specification states the minimum requirements for the mechanical design, fabrication, inspection and testing of fusion welded unfired pressure vessels.

1.2 The Vendor is responsible for implementing any regulations concerning the design, fabrication or inspection of pressure vessels which are mandatory by government decree in the country of installation. Within the EC and EFTA states these include compliance with the Pressure Equipment Directive (PED).

1.3 The standard drawings listed on the vessel specification sheets and issued with the requisition form part of this specification and indicate the requirements for design details.

1.4 This specification shall be read in conjunction with the Vessel Specification Sheet. The requirements contained in this specification supplement the pressure vessel code. Any conflict between any given data, national or code requirements shall be brought to the immediate attention of Aker Solutions for resolution.

1.5 The following shall be the order of precedence:-

i) Mandatory government decree requirements

ii) Regulations implementing the PED

iii) The vessel specification sheet

iv) This specification

v) The pressure vessel code

Note: It is the Vendor's responsibility to ensure that the item will meet the minimum requirements of the applicable pressure vessel code.

1.6 All documentation shall be in the English language.

1.7 The SI system of units shall be used with the exception that pressures are to be stated in bar(g) for mechanical design conditions.

1.8 The Vendor shall include in the quotation a list of specific deviations, otherwise the quotation shall be considered to be in accordance with the enquiry documents. Subsequent claims for extra costs arising from compliance with the specifications/ standards will not be considered.

2. Mechanical Design and Fabrication Codes

2.1 The vessel shall be designed and fabricated in accordance with EN 13445, 2009 Edition, unless otherwise stated on the vessel specification sheet.

2.2 Vessels operating under full or partial vacuum shall be designed for an external pressure of 1.013 bar.

2.3 The Vendor is responsible for design calculations for all pressure and structural parts of the vessel; for ensuring that the equipment design is adequate to withstand all internal and external loads, and for meeting the relevant code requirements for design, fabrication, testing and certification.

2.4 Unless otherwise stated on the vessel specification sheet all carbon and low alloy steel pressure parts shall have a minimum corrosion allowance of 1.0 mm.

3. Mechanical Design

3.1 General

3.1.1 Vessels requiring entry for removal of trays or other internals, or which are to be internally lined or insulated, shall not be less than 915 mm inside diameter unless agreed in writing by Aker Solutions.

3.1.2 Thicknesses given on vessel specification sheets are minimum finished including corrosion allowance to which must be added material for thinning during forming and fabrication operations or removal during machining. These thicknesses are initially indicative only and must be confirmed by Vendor's calculations.

3.1.3 Designs shall avoid all features likely to promote crevice corrosion.

3.1.4 All carbon and low alloy steel units in caustic, foul amine service or "weak acid" service and all deaerators shall be heat treated unless otherwise stated by Aker Solutions.

3.2 Shells and Dished Heads

3.2.1 Where shell strakes differ in thickness the inside diameter of the unit shall be constant.

3.2.2 Longitudinal seams of adjacent courses shall be displaced from each other by a minimum distance of 100 mm or four times the thickness, whichever is the greater, measured from the toes of the welds.

3.2.3 For vessels fabricated of carbon, low alloy steel or austenitic/duplex stainless steel the minimum shell or head thickness (notwithstanding the minimum thickness allowed by the design code) **before** corrosion allowance is added shall not be less than the following:-

Diameter (mm)	Carbon Steel (mm)	Stainless Steel (mm)
Up to 1200	5	5
1201 - 2000	6.5	5
Over 2000	8.0	6

3.2.4 Semi-ellipsoidal heads are preferred. Torispherical heads having dimensions within the design code are acceptable. Ratios of major to minor axes of elliptical or approximately elliptical shapes shall be as near to 2:1 as possible. Head shapes proposed, together with dimensional details must be stated in the Vendor's quotation and on the working drawings.

3.2.5 Thin heads are to be avoided on agitated vessels where excessive deflection/resonance can occur.

3.2.6 Reference shall be made to paragraphs 7.2.2 and 7.2.4.

3.3 Clad Construction

3.3.1 No account shall be taken of cladding thickness in strength calculations.

3.3.2 Explosion bonded cladding is preferred. Rolled cladding of some material combinations may be acceptable for shell cylinder components. The use of rolled cladding must be agreed with Aker Solutions at the quotation stage.

3.3.3 The use of loose lining must be agreed with Aker Solutions at the quotation stage.

3.3.4 For weld deposited facings, the Vendor shall provide effective welding control with preheat where necessary to avoid crack generation. Each weld deposited layer shall be carefully examined for cracks. The final surface shall be finish machined and checked by dye penetrant examination. The weld procedure qualification record must include all tests as defined by EN ISO 15614-7 in addition to any other code requirements.

3.3.5 For loaded internal attachments, including tray support rings, the cladding shall be stripped back to allow alloy support parts to be welded to the carbon steel shell. The cladding shall be welded to the support parts in a manner which will ensure adequate corrosion protection. Details shall be submitted to Aker Solutions for prior approval.

3.4 Girth Flanges

3.4.1 Bolt holes shall straddle the horizontal and vertical centre lines in elevation and the north/south centre line in plan, unless otherwise stated.

3.4.2 Flanges shall be designed to take the maximum of the following defined bolt loads (i.e. design for the use of torque limiting devices is not acceptable, except to prevent overstressing of the bolt material):-

a) **Bolt Load 1**

i) When the actual bolt root area is less than or equal to 130% of the required bolt area as designated by the design code:-

Design bolt load is to equal that required by the design code.

ii) When the actual bolt root area is greater than 130% of the required root area designated by the design code:-

The full bolt root area is to be used in the calculation of the bolt load, i.e. formula 11.5-16 in EN 13445-3 shall read:

$W = A_B \cdot f_{B,A}$

b) **Bolt Load 2**

The bolt load required to withstand the hydrostatic test pressure if the joint is not to be broken down following hydrostatic test.

3.4.3 The flange gasket facing machine finish will normally be specified by Aker Solutions. When not specified it is the Vendor's responsibility to ensure that this facing is suitable for the gasket used.

3.4.4 Hub flanges shall not be manufactured from plate.

3.5 Nozzles

3.5.1 All nozzle necks up to and including 300 mm (12") NB shall be of seamless construction unless otherwise agreed by Aker Solutions.

3.5.2 Minimum nozzle size shall be 25 mm (1") NB flanged.

3.5.3 For nozzles smaller than 50 mm NB the attachment to the vessel wall shall be 50 mm nominal bore and incorporate a forged reducer or be constructed from an integrally long

forged long weld neck (LWN) not less than 40 mm outside diameter. Nozzles 50 mm NB and larger shall be constructed using LWN or seamless pipe. Unless otherwise specified, the minimum wall thickness shall be standard wall. Nozzles 300 mm NB and larger may be from formed plate instead of pipe.

3.5.4 Bottom nozzles on towers and other vessels when specified on the vessel specification sheet with skirts, shall be connected to an elbow and pipe extended beyond the skirt and flanged.

3.5.5 All nozzle reinforcing pads or seal welded sections thereof, shall be provided with ¼" NPT threaded tell-tale holes which, for insulated vessels, shall be provided with a vent pipe projecting 25 mm beyond the insulation.

3.5.6 Nozzles and shells shall be designed to accommodate the nozzle local loads specified by Aker Solutions.

3.5.7 All nozzle connections shall be of full penetration set-in construction unless otherwise agreed by Aker Solutions. If set-on nozzles are used on carbon and low alloy steels, the shell plate around the hole shall be checked for laminations by ultrasonic inspection and for surface defects by dye-penetrant examination or magnetic particle inspection.

3.5.8 Where pad connections are specified the Vendor shall supply studs, nuts and gaskets.

3.5.9 Nozzles shall not pass through weld seams.

3.6 Nozzle Flanges

3.6.1 Nozzle flanges shall be PN designated and shall comply with EN 1092-1 in all respects. The flange rating and facing shall be as stated on the vessel specification sheet.

3.6.2 The flange gasket facing machine finish will normally be specified by Aker Solutions. When not specified it is the Vendor's responsibility to ensure that this facing is suitable for the gasket used.

3.6.3 Bolt holes for flanges shall straddle the horizontal and vertical centre-lines in elevation and the north/south centre-line in plan.

3.7 Manholes and Handholes

3.7.1 Manholes shall have a minimum inside diameter of 590 mm. If the column diameter precludes this, one flanged head is required.

3.7.2 All manholes, handholes and other blanked off nozzles shall be furnished complete with covers, bolting and gaskets.

3.7.3 Davits in shall be furnished for all manhole and handhole covers and blind flanges weighing in excess of 34 kg. Hinges shall be furnished for covers weighing between 17 kg and 34kg. Covers of 17 kg and less shall be supplied with two handles.

3.7.4 Vessels less than 915 mm inside diameter may be provided with handholes in lieu of manholes. All other pressure vessels shall be provided with manholes. Where requirements differ from the applicable design code, the more stringent of the two will govern.

Generally the requirements of BS 470 shall be satisfied.

3.7.5 Hand grips shall be provided where entry is made horizontally through manholes. If a manhole is more than 1500 mm from the bottom of a vessel an internal ladder or rungs shall be provided.

3.7.6 Manholes for vertical vessels without trays shall be located near the bottom of the shell with one 150mm vent, minimum, in the top head of the vessel.

Manhole location for horizontal vessels shall normally be in the heads unless otherwise dictated by plant arrangement.

3.7.7 Manhole necks shall have inside sharp corners rounded off and internal welds dressed smooth.

3.7.8 A manhole shall be provided in any large division plate, unless otherwise stated, to permit access to all parts of the interior of the vessel. If this is not possible, additional manholes shall be provided in the vessel shell.

3.7.9 If access to the interior of a vessel cannot be via manways, a minimum of one 150 mm or larger inspection opening shall be provided. If approved, a piping nozzle may be used as an inspection opening if piping can be removed. Inspection openings should be located such that representative shell joints and critical parts of the interior of the vessel can be inspected.

3.7.10 Adequate nozzles and/or manways shall be provided to meet venting requirements for gas freeing vessels and ventilation for mechanical work such as welding.

3.7.11 Manholes shall not pass through weld seams.

3.8 Bolting and Gaskets

3.8.1 All studbolts shall be metric in accordance with the requirements of EN 1515 and shall be threaded full length.

3.8.2 Type of thread shall be either coarse thread or above M39 fine thread with 4mm pitch.

3.8.3 Bolts shall extend at least two clear threads from the nut.

3.8.4 Unless otherwise specified external bolts for temperature range -100°C to 450°C shall be in accordance with EN 10269 Grade 42 CrMo4. If other bolting is specified the nuts shall be softer than the bolts.

3.8.5 Bolt materials 4.6 and 6.8 shall not be used in the scope of the Pressure Equipment Directive.

3.8.6 Internal bolting shall be compatible with the contacting fluid and the materials being bolted.

3.8.7 External ferritic studbolts shall be treated with a graphite base lubricant.

3.8.8 Consideration shall be given to allow hydraulic bolt tensioning equipment to be used on bolting M39 diameter and greater.

3.8.9 One piece gaskets shall be used unless otherwise agreed with Aker Solutions.

3.8.10 Asbestos materials are not permitted.

3.8.11 The use of gasket dope, lubricant, etc. is prohibited.

3.9 Internals

3.9.1 Provision shall be made for the self-draining of all internals.

3.9.2 All baffles, tray support beams or other internals spanning a chord or diameter of the vessel shall be provided with a means of allowing for differential expansion between the part and the vessel shell or be subject to special design consideration. For cartridge trays the maximum gap between the tray periphery and the shell shall be 6 mm. The tray Vendor shall produce a three dimensional template of the cartridge for the vessel Vendor to carry out a pull-through tolerance check.

3.9.3 For towers less than 915 mm internal diameter, internals, whether trays or packings, shall be designed to permit removal without internal access. The design shall ensure that internal fittings cannot be loosened by vibration.

3.9.4 Packed bed supporting elements shall be designed to support the packaged bed weights plus entrained liquid equivalent to 10% volume of the bed free space.

3.9.5 Flanges for internal non-pressure piping may be fabricated from plate. For alloy or alloy clad vessels, pipe and flanges shall be fabricated of the same material as the inside shell

unless otherwise specified. When flanges are made from plate, the facing and drilling shall comply with EN 1092-1, PN6 to accommodate standard size gaskets.

3.9.6 Internal pressure piping shall be fabricated from forged flanges and seamless pipe to the same specification as the external connected pipe.

3.9.7 Wear plates or impingement baffles shall be installed at inlet nozzles where erosion could be caused.

3.9.8 All other internals (fixed and removable) shall be supplied and installed by the Vendor unless otherwise stated. Removable internals shall pass through vessel manholes.

3.9.9 Non-removable internals such as internal heads, tray rings, internal stiffening, etc., including attachment welds shall have the full specified corrosion allowance applied to both sides to ensure the element can withstand design loadings in the fully corroded condition. Removable internals shall have half the specified corrosion allowance added to both sides. Corrosion allowance shall be zero on removable internals made of austenitic stainless steel, duplex stainless steel, other high alloy steels or non-ferrous metals.

3.10 Supports

3.10.1 Vertical vessels shall be supported on steel skirts, legs or lugs as denoted on the vessel data sheet; horizontal vessels on two steel saddles. Lugs are preferred for vessels that are supported by structural steelwork.

3.10.2 The top section of a skirt must be the same material as the bottom head, minimum length 500mm.

3.10.3 Legs design shall be verified by calculation.

3.10.4 No vessel shall have more than two saddles unless discussed and agreed by Aker Solutions. Only one saddle shall be fixed to the foundation.

3.10.5 When a vertical vessel has been designed for dynamic loading the skirt shall not be less than the thickness of the bottom shell course.

3.10.6 The thickness of the skirt at the bottom portion containing the anchor bolt chairs shall be checked to withstand the effects of the bolt chair reaction.

3.10.7 All openings in the skirt shall be reinforced as may be required to compensate for loss of material at these points.

3.10.8 The minimum number of anchor bolts for skirt supported vessels shall be four and thereafter in multiples of four. Unless otherwise specified, the bolts shall straddle the

north/south centre-line. The minimum size of anchor bolts shall be M24. The allowable anchor bolt stress shall be 120 N/mm^2 unless otherwise stated on the vessel specification sheet, calculated on the root area of the bolts. Distance between bolts should be no less than 12 x bolt diameter.

3.10.9 Vessel supports and foundations shall be designed to take the weight of the vessel filled with water, regardless of the test conditions.

3.10.10 The maximum concrete bearing stress for foundations shall be 5 N/mm^2 unless otherwise agreed with Aker Solutions for individual cases.

3.10.11 For equipment mounted in steelwork, M20 shall be the minimum anchor bolt size.

3.10.12 Supports and wrapper plates shall be continuously welded to the shell. Each saddle wrapper plate or each part thereof seal welded to the shell shall have a 10 mm diameter air release hole.

3.10.13 Skirt mounted vertical vessels should be provided with quantity two baseplate templates 10mm thickness carbon steel, clearly marked with plant north. These templates to be drilled together with the skirt baseplate and delivered to site as soon as they have been completed.

3.11 Fittings

3.11.1 Forged steel eye-bolts of one piece construction or plate lugs shall be provided by the Vendor for each vessel or removable component weighing more than 17 kg. On insulated units the lugs shall be extended to project beyond the insulation. The weight of heavy items shall be stamped (etched in the case of equipment in cold service) on the periphery of the main flanges.

3.11.2 Where required, insulation lugs, cleats and/or support rings shall be supplied by the Vendor.

3.11.3 Horizontal equipment required to be finish coated at the manufacturer's works shall be provided with lifting lugs on each side of the saddle supports in order to facilitate lifting without damage to the coating.

3.11.4 Two earthing bosses in accordance with Aker Solutions Standard shall be provided and welded to the saddles support brackets or skirt.

3.11.5 Pressure containing fittings (e.g. sight glasses) shall have a pressure rating compatible with the hydrostatic test pressure of the vessel.

3.11.6 Vertical vessels shall be fitted with lifting lugs/trunnions. These shall be capable of lifting the vessel in its intended lifting state (e.g. fully dressed) using a load factor of 2 for less than 10 Te and 1.5 for 10 Te or greater. Where lifting beams are specified as being in the Vendor's scope of supply they shall be subjected to proof testing.

3.12 Wind and Weight Loadings

3.12.1 Vessels shall be self-supporting and designed to withstand the specified wind loading based on the maximum vertical projection of exposed surfaces, which shall include insulation, platforms (1 m^2 at each manway) ladders (150 mm wide for vessel height), pipework, overhead vapour lines and other equipment associated with the vessel.

3.12.2 Wind loading shall be evaluated in accordance with the requirements of BS EN 1991-1-4 (Eurocode 1) and the UK National Annex BS EN 1991-1-4 NA.

Site Conditions are as follows:

- Basic Wind Speed = 25 m/s
- Altitude of the site, A = 5.000 m
- Directional Factor, c_{dir} = 1
- Seasonal factor, c_{season} = 1
- Shape parameter, K = 0.2
- Exponent, n = 0.5
- Annual probability of exceedence, p = 0.02

3.12.3 Snow loading shall be evaluated in accordance with the requirements of BS EN 1991-1-3 (Eurocode 1) and the UK National Annex BS EN 1991-1-3 NA. Snow load at ground level 0.5 KN/m2.

3.12.4 Eccentric moments induced by the weight of equipment supported from the vessel and overhead vapour lines shall be additive to wind moments. These loadings where applicable will be indicated on the appropriate drawings.

3.12.5 The vessel shall be designed to withstand the following combined loadings in the corroded condition:-

i) Totalled bending moment, internal design pressure and empty weight at the coincident design temperature.

ii) Totalled bending moment, external design pressure if applicable and operating weight at the coincident design temperature.

iii) Totalled bending moment and operating weight at the coincident design temperature (pressure shutdown).

iv) 30% of wind moment plus eccentric moments and hydrostatic test pressure.

3.12.6 Vessel supports shall be designed for the following conditions of loading:-

- Snow load.
- Wind moment, together with other moment loadings if applicable and the operating weight for design of support and its attachment weld to vessel.
- Vessel full of test water assuming that site testing is not carried out in high winds but allowing 30 percent of the total wind moment.
- Wind movement, together with other loading if applicable, with the vessel empty.

3.12.7 The vessel shall be designed to withstand all loadings, including shock, during lifting (see 3.11.6).

3.12.8 **Vibration**

Vertical vessels with a height to diameter ratio in excess of 10 shall be checked and designed as required for dynamic loading. This rule however should not specifically preclude other vessels from dynamic analysis. Also the requirements of the design code or local regulations must be considered. Where calculations indicate that vibrations are critical the vessel shall be stepped in thickness to withstand the dynamic effect.

3.12.9 **Deflection**

For vessels in the corroded condition the maximum static deflection allowed shall be 100 mm per 20.0 metres of length when the vessel is subject to the design wind loading.

3.13 Weights

The following weights are to be determined and incorporated in all design calculations and general arrangement drawings. The weights if shown on the vessel specification sheets which accompany either the enquiry or purchase requisition represent an assessment made during initial design studies.

The Vendor shall compute fabricated weights based on the finalised design of the vessel from which empty, operating and test weights can then be more accurately established. For weight calculation purposes the density of insulation (cellular glass) shall be taken to be 120 kg/m^3.

3.13.1 **Fabricated Weight** shall be the weight of the vessel including all non-removable internal and external attachments excluding insulation.

3.13.2 **Component Weights** shall be the weight of all removable components.

3.13.3 **Erected Weight** shall be the fabricated weight plus trays, packing, grids and other removable internal components plus platforms, ladders, piping weight supported from the vessel, insulation and all other removable external appurtenances.

3.13.4 **Operating Weight** shall be the erected weight plus operating liquid including tray liquid or packing entrained liquid (see 3.9.4) and bottom liquid plus piping liquid weight supported from the vessel.

3.13.5 **Weight Full of Water** shall be the erected weight plus weight of water in the vessel and piping supported from the vessel.

3.13.6 **Weight Full of Operating Liquid** shall be the erected weight plus weight of operating liquid in the vessel when flooded and weight of operating liquid in piping supported from the vessel when flooded.

3.14 Miscellaneous Requirements

3.14.1 Nozzle compensation pads and support wrapper plate/pads shall not cover any longitudinal or circumferential welds.

3.14.2 Unless otherwise agreed with Aker Solutions, the minimum distance between the edges of adjacent weld seams and between the edges of nozzle welds and weld seams shall be the greater of 50 mm or three times the thickness of the thickest weld seam concerned.

3.14.3 The equipment shall be designed so that the stresses at test conditions do not exceed 90% of yield but the test pressure must comply with the more onerous of the design code and the Pressure Equipment Directive, Annex I, Paragraph 7.4.

3.14.4 Vertical vessels containing packing or removable trays and those having relief valves of 80 mm size or greater shall be fitted with a top davit.

3.14.5 The Vendor shall furnish and attach all insulation support rings, pipe supports, platforms and ladder clips, lifting lugs and other attachments as and where required by the appropriate vessel specification sheet.

3.14.6 Vortex breakers shall be fitted to pump-out nozzles.

3.14.7 Lifting trunnions and nozzle locations shall be such as to not interfere with the top and tail movement of the vessel.

4. Field Fabricated Vessels

For any large vessel which is to be fully or partly fabricated on site, the design, construction, inspection and testing of the vessel are to be discussed and agreed with Aker Solutions at an early stage in the design of the vessel, together with any limitations on foundation loading which may in any way restrict the normal requirement of Aker Solutions for the hydrostatic testing of the vessel on completion at site.

5. Materials

5.1 All materials shall be of the type and grade specified on the individual vessel specification sheet.

5.2 Carbon and low alloy steel plates 40 mm and over in thickness shall be ultrasonically tested in accordance with EN 10160.

5.3 No substitution of material may be made without the written consent of Aker Solutions.

5.4 Structural quality steels are not acceptable for pressure retaining parts.

5.5 Only fully killed steel shall be used.

5.6 All carbon and carbon manganese steels shall be normalised for all thicknesses.

5.7 For carbon and carbon manganese steels the maximum carbon content shall be 0.25% and the carbon equivalent calculated from the formula below shall not exceed 0.43%.

$$CE = \frac{\%C + \%Mn}{6} \text{ (for plain carbon steels)}$$

5.8 All stainless steel material shall be in the solution treated condition.

5.9 Reinforcing pads shall be of the same material as the component to which they are attached.

5.10 Non-pressure parts attached to pressure parts by welding shall be of the same general type of material as the shell or interior cladding if welded to the cladding material.

5.11 Should any materials prove unsatisfactory during fabrication they shall be rejected notwithstanding any previous certification of satisfactory examination or tests.

6. Material Markings

6.1 Identification marks (cast number, etc.) shall be stamped (see 6.3) in a prominent position on all materials.

6.2 The equipment item number shall be stamped (see 6.3) in a prominent position on all materials.

6.3 For carbon and low alloy steel vessels having a design temperature below 0°C all marking shall be etched. The unit shall not be hard stamped, chisel or pop-marked. In certain instances low stress dot matrix stamping will be accepted, subject to the prior agreement of Aker Solutions.

6.4 The following shall be excluded from use:-

a) Chloride or sulphide bearing paints, marker pens or tape on stainless steels.

b) Cadmium or cadmium bearing materials.

7. Fabrication and Welding

7.1 General

No fabrication may begin until the Vendor has received written acceptance of detailed shop drawings from Aker Solutions.

7.2 Dished Heads

7.2.1 Welds in formed heads fabricated from more than one plate and welds in heads built up from formed sections shall be fully radiographed **AFTER** completion of all welding, forming and any required heat treatment.

7.2.2 Cold formed carbon or low alloy steel heads and hot spun heads shall be normalised on completion of the forming process.

7.2.3 Hot pressed carbon or low alloy steel heads must be normalised subsequent to the pressing operation unless the manufacturer can ensure that no forming will be done below the normalising temperature.

7.2.4 Provided that there is not a risk of stress corrosion cracking due to the contents and temperature, stainless steel heads cold formed from material <15 mm thick will not require subsequent heat treatment if the elongation of the material is >40% before forming. Should a risk of stress corrosion cracking be considered possible then heads will require

solution annealing. Stainless steel heads cold formed from material >15 mm thick shall be solution annealed.

7.2.5 Forming by local heating and/or local deformation is not permitted. Cold forming by hammering is not permitted.

7.2.6 Heavy scale remaining after hot forming is to be removed by grit blasting (non-metallic for stainless steel). For stainless steel a preferred method is by pickling using a procedure to be agreed with Aker Solutions.

7.3 Cutting and Preparation for Welding

7.3.1 Any materials which are cut by thermal processes must be dressed back to clean metal.

7.3.2 Arc air gouging is not permitted on stainless steel.

7.3.3 All weld preparations are to be checked for flaws, cracks, laminations, etc. to a method agreed with Aker Solutions. Following any rectification, the weld preparation must comply with the relevant joint detail.

7.4 Weld Procedures

7.4.1 Weld Procedure Specifications (WPS's) for all welds (including fillets), together with the supporting procedure qualification records (PQR's) shall be submitted to Aker Solutions for review **BEFORE** commencement of fabrication.

7.4.2 Procedure qualification records will not be accepted as weld procedure specifications.

7.4.3 Welders' qualifications will be checked for acceptability by the Aker Solutions Inspector.

7.5 Welding Processes

7.5.1 The Vendor shall ensure that the welding processes which he proposes to use shall be compatible with the materials and thicknesses being joined and that the process in no way impairs the mechanical properties and corrosion resistance of the material.

7.5.2 Short arc welding processes (dip transfer CO_2 shielded) are not permitted for the welding of any of the pressure parts or major load bearing structures.

7.5.3 Electroslag welding shall not be used.

7.6 Welding General

7.6.1 Where no preheat has been specified, but the ambient temperature is below 0°C the base metal shall be heated to 10°C minimum.

7.6.2 The Vendor shall determine the degree of preheating required, if any, other than as dictated by the code to prevent cold cracking, excessive hardness in the heat affected zone and excessive distortion.

7.6.3 Permanent backing strips are not acceptable.

7.6.4 Seams in supporting skirts shall be double-butt welded.

7.7 Heat Treatment

7.7.1 Heat Treatment shall be carried out strictly in accordance with the code requirements.

7.7.2 All flange faces shall be suitably protected against oxidation during heat treatment.

7.7.3 All vessels shall be heat treated as a complete unit where this is practicable. The top portion of supporting skirts at least shall be welded to the shell before heat treatment.

7.7.4 During heat treatment, metal temperatures shall be recorded and copies of the chart(s) included in the documentation dossier.

7.7.5 All components subjected to post weld heat treatment shall be permanently labelled "STRESS RELIEVED. DO NOT WELD OR BURN ON THIS VESSEL".

8. Inspection

8.1 General

8.1.1 A Quality Plan containing all inspection stages and tests shall be submitted to Aker Solutions for comment **BEFORE** commencement of fabrication. A Quality Plan is required for each item.

8.1.2 Aker Solutions' duly authorised agents and/or representatives shall have free access to those sections of the Vendor's facilities and, where necessary, any sub-contractor's works utilised in any manner for the construction of vessels under this specification. This shall include the right of review of all records, logs, reports, certificates etc., connected or concerned in any manner with the construction of vessels under this specification. They may reject any work, materials or procedure deemed defective or sub-standard.

8.1.3 It is the responsibility of the Vendor to advise Aker Solutions when the equipment will be ready for stage inspection. The Vendor shall give at least 10 days clear notice to the Purchaser's inspectorate.

8.1.4 The Vendor shall supply, at his own expense, all appropriate equipment and facilities to perform the required inspection and testing.

8.1.5 The acceptance of any piece of equipment or component by an inspector or representative of Aker Solutions shall not diminish or in any way affect the Vendor's sole responsibility for the freedom of the vessel from defects and for the observance of all the terms and conditions of the order.

8.2 Material Identification and Certification

8.2.1 The Vendor shall provide arrangements whereby any part of the vessel can be identified with the material from which it was cut and its material certificate.

8.2.2 All material which is to be used in the manufacture of the vessel shall, prior to the commencement of fabrication, be submitted for inspection by Aker Solutions together with certificates showing the results obtained from tests and analyses carried out in accordance with the relevant specification for the material for that part of the vessel.

8.2.3 Where the Vendor proposes to use material from his own stock, he shall produce test certificates for the material, and the Aker Solutions Inspector shall positively identify the material as that covered by the certificate.

8.2.4 When Aker Solutions is not satisfied that identification is positive, or where no certificate is available, the material shall be tested, in the presence of the Aker Solutions Inspector, in accordance with the requirements of the appropriate specification. The costs of these tests shall be to the Vendor's account.

8.2.5 Material certificates shall be in accordance with EN 10204 Certificate 3.1. For equipment specified under the EC Pressure Equipment directive, all material shall be supplied by a material manufacturer having an ISO 9000 quality assurance system (covering manufacture of materials) certified by a competent body established within the European Community. These must be either original mill certificates or "wet stamped" by a responsible person as being true copies. The use of ASTM and ASME materials requires "Particular Material Appraisals" (PMA).

8.3 Fabrication Tolerances

Fabrication tolerances shall be those specified in the design code.

9. Testing

9.1 General

9.1.1 All tests shall be carried out in a safe manner by qualified personnel and unless otherwise agreed, in the presence of an Aker Solutions Inspector.

9.1.2 Unless otherwise stated all testing shall be carried out after completion of the part concerned, including heat treatment if applicable, but before the unit is painted.

9.2 Radiography

9.2.1 Radiography shall mean X-ray. Gamma-ray shall only be used with the express agreement of Aker Solutions.

9.2.2 The extent of radiography shall be in accordance with the most stringent requirements of the relevant design code, Aker Solutions vessel specification sheet or the following paragraphs. Unless otherwise approved by Aker Solutions, vessels shall be designed and fabricated with a minimum of spot radiographic examination.

9.2.3 For radiography of dished heads see 7.2.1.

9.2.4 In special cases ultrasonic examination may be used in lieu of radiography, but only with the written agreement of Aker Solutions.

9.3 Dye Penetrant Examination

The following welds shall be dye penetrant or magnetic particle examined:-

a) Root runs of longitudinal and circumferential seams, where roots are not to be subsequently removed, and nozzle to shell welds before commencement of filler runs.

b) Final weld runs of nozzle to shell welds.

c) Final weld runs of slip-on flange to nozzle pipe welds.

d) Final weld runs of slip-on girth flange to shell welds.

e) All welds on nozzle compensation plates.

f) All welds on supports and lifting lugs.

9.4 Air and Soapy Water Testing

Air and soapy water tests shall be performed on nozzle compensation pads by applying 1 bar(g) air for 5 minutes, subsequently reduced to 0.2 bar(g) before applying soap solution.

(**Note**: Nitrogen may be substituted for air)

9.5 Hydrostatic Testing

9.5.1 The vessel complete with all pressure containing parts, shall be hydrostatically tested on the completion of all other tests, to a procedure agreed by Aker Solutions.

9.5.2 Gaskets used for testing shall be the service gaskets unless the joint is broken after hydrostatic testing, in which case the test gaskets shall be identical in every aspect to the service gaskets.

9.5.3 In the case of a vertical vessel tested horizontally in the shop, the test pressure shall relate to the design pressure adjusted for static head when the unit is in the vertical position. It must be ensured that no part of the vessel will be subject to a higher stress when tested vertically at site in its corroded condition, than it experiences during its initial test. If a vessel is not to be designed for testing in the vertical position on site, this will be stated on the vessel specification sheet.

The nameplate and the general arrangement drawing shall state "Tested Horizontally" alongside the shop test pressure figure.

If a vessel is designed to withstand only partial filling with liquid the nameplate shall state the design pressures at both the top and bottom of the vessel.

If part of a vessel is not self-venting during operation or hydrotest, means of venting, e.g. by a vent pipe or a vent nozzle shall be specified.

9.5.4 All vessels shall be hydrostatically tested, to code requirements, using fresh water. The specified test pressure shall be held for at least one hour. See also 3.14.3.

9.5.5 The test water shall be of sufficient temperature that the risk of brittle fracture is avoided (see EN 13445-2 Annex B).

9.5.6 Water used to test austenitic stainless steel vessels shall have a chloride content not greater than 30 ppm. Certification verifying this requirement shall be provided. Alternatively (subject to the written consent of Aker Solutions) this chloride restriction may be waived provided that all internal surfaces are subsequently thoroughly rinsed with demineralised water.

9.5.7 Vessels shall be internally cleaned before testing and thoroughly dried after testing.

10. Nameplate

Each vessel shall carry a stainless steel nameplate which shall be fitted in a conspicuous position on brackets projecting 25 mm from the vessel or insulation as applicable (see also 9.5.3).

11. Painting

11.1 The Vendor is to include for surface preparation and painting of vessels.

11.2 No painting shall be performed until completion of hydrostatic testing.

11.3 The painted surfaces shall also include flange faces (outside the gasket seating surface) and inside of flange bolt holes. Only this painting may be completed before hydrostatic test.

11.4 If a vessel is not required to be painted, then the vessel shall have a clean finish with all weld discolorations, scale, manufacturing marking and other foreign matter removed.

11.5 All machined and bright finish surfaces shall be coated with an easily removable corrosion preventative.

12. Preparation for Shipment

12.1 Flanged openings shall be protected with bolted metal covers and rubber gaskets. All tapped connections except tell-tale holes shall be fitted with plugs and all exposed threads fitted with screwed bushes. Tell-tale holes shall be filled with heavy grease. Vent pipes, where fitted, shall be capped.

12.2 Spare gaskets, bolts, nuts, etc. and any other loose items shall be boxed separately from the main equipment. Such boxes shall be suitable for site storage and clearly and permanently marked to show:-

- Aker Solutions Order Number
- Aker Solutions Item Number (for which the parts are intended)

12.3 The Vendor shall be responsible for loading, anchoring and protecting vessels to prevent damage during shipment. Care shall be taken when loading and unloading to ensure that lifting hawsers, ropes, chains, etc., do not damage any finish coating surface. Shipping saddles shall be provided.

12.4 Vessels shipped as part loads shall not be in contact with any other part of the consignment.

12.5 Stainless steel vessels that are to be shipped by sea shall be crated and marked "NOT FOR DECK CARGO". Where this is impracticable due to size or any other reason the equipment shall be suitably protected by some means to be agreed with Aker Solutions.

12.6 A white line 50 mm wide x 915 mm long shall be marked on the outside of vertical vessels to indicate the "Plant North".

13. Guarantee

The Vendor shall guarantee the mechanical design and the suitability of the materials of construction for the duties required.

14. Scope of Supply

The Vendor shall include all of the following within his supply:-

i) The vessel as defined in the specification, completely assembled, tested and prepared for shipment.

ii) All documentation, including individual vessel documentation dossiers.

iii) Service gaskets and three extra sets of gaskets for all blanked flanges and other gasketed joints for commissioning.

iv) Service bolting and 10% additional bolting (minimum four) of all sizes.

v) All insulation rings, clips and fittings.

vi) Connecting bolts and service and commissioning gaskets for mating flanges of vessels close coupled to other vessels or tanks where specified.

vii) If stated on the vessel data sheet, all necessary test equipment to enable the vessel to be hydrostatically tested on site.

viii) Special lifting equipment (e.g. spreader beams) for safe handling of vessels on site where specified.

15. Data with Quotation

The Vendor shall give the following information in the Quotation:-

- Specification and grade of materials of construction
- Any deviation from the Enquiry Specification
- Weight, empty and full of water
- Recommendation for two years operational spares (see 16)
- Vessel shell, head and support thicknesses

16. Two Years Spares

The Vendor shall give in the quotation a recommendation of spares for 2 years operation together with itemised prices. It is envisaged that the following will be the minimum recommendation:-

- 300% gaskets
- 10% bolting (minimum 4 of any size)

17. References

This specification refers to the following documents. (These documents shall be taken as the latest issue including all amendments and appendices at the date specified for the contract):-

(i) European Standards

EN 1092-1	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 1: Steel flanges
EN 1515	Flanges and their Joints - Bolting
EN 10160	Ultrasonic Testing of Steel Flat Product of Thickness Equal or Greater than 6 mm (Reflection Method)
EN 10204	Metallic Products - Types of Inspection Documents
EN 10269	Steels and Nickel Alloys for Fasteners with Specified Elevated and/or Low Temperature Properties
EN 13445	Unfired Pressure Vessels
BS EN 1991-1-3	Eurocode 1: Actions on Structures – Part 1-3: General

	Actions – Snow Loads
BS EN 1991-1-3 NA	UK National Annex To Eurocode 1 - Actions On Structures - Part 1-3: General Actions – Snow Loads
BS EN 1991-1-4	Eurocode 1: Actions on Structures – Part 1-4: General Actions - Wind Actions
BS EN 1991-1-4 NA	UK National Annex To Eurocode 1 - Actions On Structures - Part 1-4: General Actions - Wind Actions
EN ISO 15614-7	Specification and Qualification of Welding Procedures for Metallic Materials - Welding Procedure Test - Part 7: Overlay Welding

(iii) **Other Standards**

BS 470	Specification for Inspection, Access and Entry Openings for Pressure Vessels

Client:	**ScottishPower**
Plant Location:	**Longannet, UK**

UK CCS Demonstration Competition
ScottishPower Consortium

Specification for Supervisory Control System (SCS)

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Aker CleanCarbon™

AkerSolutions™
part of Aker

Contents

Appendix Contents

1. Glossary of Terms and Definitions

1.1 Glossary of Terms

AC	Alternating Current
AI	Analogue Input
AO	Analogue Output
ATEX	Atmosphères Explosives
CCTV	Closed Circuit Television
CEMS	Continuous Emissions Monitoring System
CMRR	Common Mode Rejection Ratio
DC	Direct Current
DCS	Distributed Control System
DI	Digital Input
DO	Digital Output
EMI	Electro Magnetic Interference
ESD	Emergency Shut Down
FAT	Factory Acceptance Test
FDS	Functional Design Specification
FGS	Fire and Gas System
HART	Highway Addressable Remote Transducer Protocol
HMI	Human Machine Interface
HVAC	Heating, Ventilation and Air Conditioning
I/O	Input / Output
IFAT	Integrated Factory Acceptance Test
IEC	International Electrotechnical Commission
IPF	Instrumented Protective Function
IS	Intrinsically Safe
MTTR	Mean Time to Repair
N/A	Not Applicable
NIS	Non Intrinsically Safe

NMRR	Normal Mode Rejection Ratio
OPC	Object linking and embedding for Process Control
PLC	Programmable Logic Controller
RFI	Radio Frequency Interference
RIO	Remote I/O
SAI	Serial Analogue Input
SAO	Serial Analogue Output
SCS	Supervisory Control System (The SYSTEM)
SAT	Site Acceptance Test
SDI	Serial Digital Input
SDO	Serial Digital Output
SIRL	Supplier Information Requirement List
UPS	Uninterruptible Power Supply
VAC	Volts, Alternating Current
VDC	Volts, Direct Current
VDU	Visual Display Unit

1.2 Definitions

SELLER	SCS Supplier
OWNER (PURCHASER)	Aker Clean Carbon
CONTRACTOR	Aker Solutions
COMPANY	Scottish Power
VENDOR	Third party Supplier

2. Introduction

This specification covers the minimum technical requirements for the design, manufacture, assembly, inspection, testing, delivery and site supervision of installation of the SCS (Supervisory Control System) for the Carbon Capture Plant at Longannet Power Station, Scotland, UK.

The SCS is comprised of DCS and ESD control systems, and their interfaces with all other plant elements. (Including but not limited to Vendor Package PLCs, MCCs, CEMS, existing Longannet PLCs, National Grid Downstream PLCs.)

The chosen ESD should be engineered using a software-based equivalent of equal or greater integrity that is specifically intended for safety related applications. The system shall be based on Dual redundant (Quad) or triple redundant processor technology.

The ESD and DCS will be connected via a redundant communications link.

The DCS and the ESD will be independent systems, utilising independent transmitter's logic and control elements.

Whilst setting out the requirements, this document does not in any way remove the SELLER'S responsibility to provide a DCS/ESD that is 'fit for purpose'. Any errors or logical inconsistencies that are found in this document must be brought to the Engineering Contractor's attention as soon as possible.

This document assumes that the standard facilities of the SELLER'S DCS/ESD will be used where possible. It also assumes that all standard facilities shown in the SELLER'S literature are included within the quotation price.

The SCS shall be designed for a minimum design life of twenty five (25) years. Additionally equipment shall be selected from manufacturer's ranges with declared support periods of at least ten years from the time of Plant take over.

2.1 Safety Classification

The type of logic solver used for the ESD system must be certified for use in SIL3 systems (as defined in IEC61508) and shall be used as a part of SIL2 system.

SIL2 certified components shall be used for the sub-systems such as Repeaters, Isolators etc.

The SELLER will provide certification for the entire ESD system.

2.2 SELLER References

The Control System must have a proven track record for us in both the Chemical and Power industries. The SELLER will provide a suitable reference list.

The SELLER shall operate a design policy incorporating compatibility between versions/generations of equipment.

The SELLER shall have Engineering support facilities in place at the plant location.

3. Project Overview

3.1 UK CCS Demonstration Project

Flue gasses are taken from existing Longannet Power Station. CO_2 is extracted from these gasses. The CO_2 is then compressed and dried and exported to NG pipeline.

4. Environmental

4.1 Site Conditions

NOT USED

4.2 Control Room

4.2.1 Control Room Conditions

The SCS will be located in an air conditioned environment which will be to ISA S71.04, G3 classification.

Normal operating condition will be:

22 $\pm$ 2°C and 50% Relative Humidity

Air flow shall be from bottom to top for cabinet design.

4.2.2 Short Term

However, in case of failure of air conditioning system the cabinets and the components in them shall be capable of operating for a maximum period of 48 hours (continuous) in 30 days, without any damage or degradation in the performance, when the cabinets and the components will be subjected to extreme temperature and humidity conditions specified –

- Temperature : 0 ~ 35°C (32 ~ 95°F)

- Relative Humidity : 10 ~ 90% @ 32°non condensing

4.2.3 Vibration

Maximum 0.2G 20 ~ 300 Hz

Maximum displacement 0.01", 5 ~ 20 Hz

4.2.4 Dust Contamination

Air conditioning system for this project shall be designed as per IEC 60654-4 Moderate Air Borne Contamination (class 2)

Air conditioning filtration shall be capable of filtering 95% of 5 microns particle size for re-circulated air and 0.5 microns fresh air.

The air shall be free from corrosive contaminants.

Dust contamination shall be kept to a minimum. The system and environment shall be thoroughly cleaned before operation.

4.2.5 Shock

Below 10 G vertical direction only (exception for standard servers and PC's – limitation for server and hard disk equipment)

4.2.6 Static

Precautions shall be taken to guard against static electricity discharge.

4.2.7 Component Protection

All components, equipments and cable shall be resistant to bacterial and fungal attack and airborne chemical attack. The SELLER shall specify acceptable level of such contaminants.

4.2.8 Heat Load

The SELLER shall specify the heat load of each separate equipment unit.

The SELLER shall specify if the equipment requires forced or convection cooling. It is preference that all printed circuit boards are mounted in vertical planes.

4.2.9 Power Consumption

The SELLER shall specify the power consumption of each separate equipment unit.

The SELLER shall also specify if any heating is required for the Field Remote I/O boxes based on the site condition indicated in clause no. 3.1.

5. Codes, Standards and Specification

5.1 Codes and Standards

The SELLER is responsible for implementing any regulations concerning the design, fabrication, inspection and testing of the equipments which are mandatory by government in the country of installation.

All design materials, construction and performance shall conform to the latest issues of all relevant internationally recognised codes and standards.

5.2 Conflicts

Any conflicts between the requirements of this specification, related contract documents, data sheets, International Standards and Codes of Practice shall be referred to the CONTRACTOR / OWNER for clarification. During conflict the order of precedence shall be, unless otherwise agreed –

a) Statutory Regulatory Requirements

b) International Standards

c) This Specification

Compliance by the SELLER with the provisions of this specification does not relieve him of his responsibility to furnish equipment and accessories of a proper design, suited to meet the specified conditions, and/or local codes governing health and safety.

5.3 Deviations

The SELLER shall highlight all the deviations from the project specifications / requirements with proper justification and alternative solutions and ensure that the system performance / availability is not compromised or degraded.

6. Seller Responsibility and Scope of Supply

The SELLER shall accept total responsibility for the overall system as specified. This includes system design, procurement, fabrication, assembly, FAT, packing, shipment, supervision of site installation, SAT, pre-commissioning and commissioning assistance.

The SELLER shall supply all hardware, cabinets, termination facilities, power supply units, peripherals, system cables, communication cables, documentation, licences, dongles, workstations, furniture and other equipment required for a fully functional, operable, reliable and maintainable system.

7. SCS Hardware Requirements

This section covers the hardware requirement definition of a SCS (Supervisory Control System) for the Carbon Capture and Storage plant at Longannet Power Station, Scotland. The SCS will comprise of a Distributed Control System (DCS) performing analogue sequence and control functions, and an Emergency Shutdown System (ESD).

For the SCS system, only SELLER standard components, field-proven in Chemical and Power industry environment for at least three years prior to the date of delivery and which can be configured to meet the requirements of this specification shall be used.

The system shall be microprocessor based and shall exceed the performance of a conventional analogue system with respect to dynamic response, reliability, accuracy and repeatability.

The general architecture of the system shall be modular with full integration of logic and analogue operations, sequencing, interlocking and data logging per module.

The system architecture shall be designed to minimise process upset in case of hardware/software failure.

All data within the SCS shall be global in nature, i.e. available at any system user and at any VDU.

Process variables shall be under continuous, real-time control.

Control, monitoring, sequencing and interlock functions shall be distributed and/or utilise spares in such a manner that upsets or shutdowns are minimised should any component fail. In the event of such a failure, the system shall bring the operation to a safe shutdown.

The SCS shall require minimum maintenance and routine calibration. The system shall have comprehensive self-checking calibration and self-diagnostic fault capabilities including self-test failure alarms. Comprehensive system status information shall be available on standard operator consoles.

All cabinets and operator interface equipment (rack-mounted equipment, disk drives, etc.) supplied by the SELLER shall have fixed engraved nameplates. The nameplate shall indicate device type and device name or number. Nameplates are not required for keyboards and monitors.

All SELLER supplied equipment shall be protected against external EMI/RFI. SELLER shall state level of EMI/RFI protection for each component.

SELLER is advised that its representatives must follow all accident prevention rules at OWNERS's plant site.

Hardware shall consist of the following as minimum –

a) DCS Controllers

b) ESD Logic Solvers

c) Process Input / Output modules (for all types of signal listed under I/O list)

d) Communication interface modules between the DCS and RIO and 3rd party package.

e) Communication interface modules between the DCS and RIO and CEMS.

f) Servers

g) System cabinets

h) Fibre optic patch panel and cables

i) Applicable network devices and cables

j) All cabinet internal hardware like terminal strips, fuses etc

k) Communication interface module or network device for integration with MIS

l) Time synchronizing equipment including cable for SCS and 3rd party packages.

m) Serial link (OPC) cables between SCS and 3rd party packages.

n) HART Management System

o) OPC Servers

p) Communication interface module or network device for integration with MCC

q) ESD Panels

r) Workstations + Control Room Furniture

s) Data Historian

7.1 Reliability

The main objective is to provide a secure and highly reliable and available control system, which minimizes the process downtime caused by the failure of any system component.

The Control System will be deigned such that the process will continue to operate if there are internal system malfunctions.

A minimum of 2 devices shall perform the functions of control, communications and operator interface.

The SELLER will supply availability details for their proposed DCS and ESD systems. It is expected that this be in the 99.99% region.

The SCS shall be able to withstand harsh industrial environments such as temperatures, severe power line transients and power dips.

The number of control loops per controller shall be limited to a number consistent with controller hardware reliability.

The system design is to minimize the potential for data corruption, by permanently establishing the controller operating system and control functions in non-volatile memory.

7.2 Cabinet

SCS cabinets shall be free standing type. The dimensions of DCS and ESD cabinet will be 800 (D) x 800 (W) x 2100 (H) and will be located in the Auxiliary Room.

All cabinets shall be of same make for the whole Scottish Power complex.

Cabinets and equipment shall be in compliance with IEC61000-4-3 EMC testing and Measurement techniques.

The DCS and ESD cabinet shall have only front access with double leaf hinged lift off doors. For server cabinet and PC client cabinet the front and rear access shall be considered subject to the cabinet layout and is to be reviewed by the CONTRACTOR.

The free standing cabinet layout shall be such as to provide clear access to the internals for maintenance.

Where cabinets are located side by side, proper insulation (side panels) shall be provided between the two cabinets.

Ventilation fans and louvers backed by dust filters shall be provided in each cabinet.

All self standing cabinets shall be provided with internal illumination activated by door switch.

All electronic cards shall have unique serial number and node number (where applicable) which shall be indicated on the hardware test report.

Spare capacities shall be as indicated in clause no. 7.12 of this specification.

Cables entering the SCS cabinet shall be properly clamped with armour grounding.

All terminals carrying more than 24 VDC shall be protected against accidental contact by means of removable cover and shall be labelled accordingly. Signals of different voltage levels shall be run in separate trunking and shall be segregated on the terminal board.

The indoor cabinets shall have an ingress protection of IP21 as minimum.

SELLER cabinets will be installed in the Auxiliary Room which has a computer type floor with an under floor void. Suitable under floor support frame work will be provided by CONTRACTOR.

Cable entry to cabinets will be from below. All openings remaining after entry of all cables shall be sealed. The seals shall be easily removable to enable entry of cables for future use.

All cabinet colours shall be RAL 7035.

Dual 240 VAC UPS power supply to individual cabinet shall be provided by the CONTRACTOR. The SELLER shall include a main circuit breaker in all cabinets. Individual breakers shall be provided for 24 VDC power supply, rack power supply and output modules. Each output shall be individually fused.

Cabinet lighting and receptacles for maintenance shall be provided with normal 240 VAC 50Hz from electrical distribution board. Each cabinet shall be provided with separate incoming breakers.

Cabinets shall be supplied completely wired, assembled, tested and ready for installation.

Cabinet temperature rise calculations shall be undertaken by the SELLER to determine if supplemental cooling is required to protect the components within the enclosure. Cooling fans shall be provided wherever required. Cooling fan noise level shall not

exceed 65 dBA measured at a distance of 1 meter from source with cabinet doors closed. Filters associated with cooling mechanisms should be readily and easily accessible and replaceable.

Each cabinet with a power supply shall provide a temperature alarm, a ventilation fan failure alarm in DCS. All hardware for above alarms should be included by SELLER.

A common key shall be provided for all locks, with one key per lock supplied.

No equipment / components shall be mounted on doors or side panels.

Cabinets should include a document/drawing pocket on the inside of the door.

7.3 Remote I/O Cabinet

SELLER shall be responsible for the design, fabrication and construction of the RIO cabinet to the requirements of this specification.

Cabinets and equipment shall be in compliance with IEC61000-4-3 EMC testing and Measurement techniques.

The RIO will be located out in the open hence a suitable rain and snow protective hood shall be provided by the SELLER.

The RIO cabinets shall be wall mounting type and SELLER shall prepare and submit detailed mechanical construction and layout drawings for approval by CONTRACTOR prior to commencement of construction.

The SELLER shall provide redundant communications cables between the RIO cabinets and the SCS Controllers in the Auxiliary Room. The distance between the RIO cabinets and the Auxiliary Room is 350m.

The SELLER shall provide detail cabinet drawing with all dimensions for approval of the CONTRACTOR.

RIO cabinets shall be produced from sheet stainless steel of consistent thickness, smooth appearance and be free from blemishes. The cabinets shall have only front access. Stainless steel bolts, nuts and washers shall be used.

Anti-condensation heating shall be installed inside the RIO cabinets.

Cable entry shall be from the bottom and via multi cable transit blocks. All cables shall be clamped.

The field cables shall be terminated at knife edge screw clamp type terminals. Screws must not make direct contact with the cable core. Blue terminals shall be provided for intrinsically safe field cables and grey terminals for Non-IS cables.

Intrinsic safety wiring shall be blue in colour.

Trunking for IS cables shall be blue in colour, for non-IS cables, the trunking should be grey.

Conductor size for internal signal wiring shall be 1.0 sq. mm minimum.

Conductor shall be stranded type terminated with crimped wire lugs.

The system cables shall be plug in type and shall be terminated at sockets to SELLER standard.

IS and non-IS wiring shall be correctly segregated according to IEC standard.

All electronic cards shall have unique serial number and node number (where applicable) which shall be indicated on the hardware test report.

No single defect or failure in any I/O card shall affect any other I/O card.

Short circuit in the field shall not damage I/O cards.

All I/O cards shall be replaceable under full operating conditions without requiring SCS unit shutdown. Other I/O modules shall not be affected.

Installation of additional I/O cards shall be possible without shutdown of SCS system.

Spare capacities shall be as indicated in clause no. 7.12 of this specification.

All terminals carrying more than 24 VDC shall be protected against accidental contact by means of removable cover and shall be labelled accordingly. Signals of different voltage levels shall be run in separate trunking and shall be segregated on the terminal board.

The outdoor RIO cabinets shall have an ingress protection of IP65 as minimum.

Dual 240 VAC UPS power supply to individual RIO cabinet shall be provided by the CONTRACTOR. The SELLER shall include a main circuit breaker in all cabinets. Individual breakers shall be provided for 24 VDC power supply, rack power supply and output modules. Each output shall be individually fused.

RIO cabinets are installed in Hazardous area and shall be certified for use in Zone 2 gas group IIB temperature class T3.

RIO cabinet shall be provided with a plant earth (P.E) bus bar and an isolated earth (I.E) bus bar for terminating the screen wire of IS and non-IS cable.

A common key shall be provided for all locks, with one key per lock supplied. No equipment / components shall be mounted on the side panels.

RIO cabinets shall be supplied completely wired, assembled, tested and ready for installation.

Cabinets should include a document/drawing pocket on the inside of the door.

7.4 Input / Output Sub-System

The input/output sub-system shall consist of I/O modules located inside the RIO cabinets in the field and SCS cabinets in the Auxiliary Room.

The input/output sub-system shall be microprocessor based and shall consist of different modules for different types of input and output signals, such as analogue, contacts, etc.

The I/O modules shall permit the use of HART protocol communication for smart instruments.

Remote I/O modules shall be IS and have inbuilt barrier with the exception of DO cards which are non IS.

Local I/O modules shall be non IS.

The I/O modules shall be capable of accepting the following types of inputs and outputs:

- Analogue inputs (4-20 mA DC) (HART pass through)
- Pulse input (frequency input)
- Digital inputs (volt free contacts)
- Analogue outputs (4-20 mA DC)
- Digital outputs (volt free contacts)
- Digital outputs (relays)
- Proximity Switches (Namur Contacts)
- Serial Interface with TCP RS232 / RS485 / RS422 on various protocol of communication (MODBUS/ASCII /etc)

The digital outputs activating relays shall have 24V DC power supply with minimum contact rating of 2.0 Amps at 24V DC.

Output modules shall source current. Current sinking modules should not be used.

Digital output cards for solenoid valves shall be capable of driving 8W solenoids.

The digital inputs shall sense volt free contacts of field switches with 24V DC power supplied from the SCS system.

The input / output sub-system shall be capable of providing software characterisation of inputs. This will include the following as a minimum:

- Thermocouple characterisation
- Square root extraction

Each input shall be provided with digital filter with adjustable time constant.

The analogue input cards shall provide 24 VDC power supply to field transmitters. Each transmitter power supply shall be protected against short circuit.

Digital I/O shall be configured with dead band filters to prevent chattering.

The process input / output modules shall be capable of supporting process signals from all types of process sensors and contact closure devices without external or auxiliary signal conditioning devices.

7.4.1 Analogue to Digital Conversion

- Resolution - 12 bits minimum
- Linearity - Least significant bit
- Repeatability - ½ least significant bit
- Accuracy - 0.1% of full scale
- CMRR - 120 dB from DC TO 60Hz
- NMRR - 60 dB at 50Hz

The system shall be able to detect bad measurements on both open circuits, short circuit, off limit values of input and on thermocouple / RTD burnouts. Up-scale or downscale for Thermocouple / RTD burnout shall be selectable.

7.4.2 Digital to Analogue Conversion

- Resolution - 12 bits minimum
- Linearity - Least significant bit
- Repeatability - ½ least significant bit
- Accuracy - 0.25 % of full scale

For inputs and outputs which cannot be provided by means of standard input / output cards, option shall be quoted (relay converters).

7.5 Identification

Each cabinet shall have an identifying nameplate fixed on the front and rear with screws. OWNER tagging system shall be used and the format of which will be advised to the SELLER.

Internally mounted equipment shall be clearly identified by name plates using traffolyte type White / Black / White labels.

Live parts of equipment and terminations carrying voltages more than 24 volts shall be covered with a transparent insulation plate bearing the appropriate warning text.

7.6 Cabling and Wiring

The cable requirement for the SCS system shall be flame retardant to IEC 60332, fire resistant and halogen free to IEC 60092-359.

The colour coding for the power cable shall be as defined below –

- +24 VDC Black
- 0 VDC Blue
- Non-IS cable Grey
- IS cable Blue

All system cables, communication cables including fibre optic cables, ribbon cables, serial interface cables, SCS data highways, printer cables etc. shall be within SELLER scope.

Cable schedules / block diagram shall be provided to enable quick hook-up at site.

All wires shall be tagged using slip-on heat shrink type markers / printed type. Tag numbering shall be subject to approval by CONTRACTOR.

7.7 Field Instrumentation

All field instrumentation connected to SCS will be intrinsically safe to the extent possible and where not possible will be flame proof. All field instruments will be certified for use in Zone 2 Gas group IIB temperature class T3.

SMART field devices using 4-20mA signal for control and HART data for diagnostic shall be used.

7.8 Redundancy Requirements

The following parts of the system shall be redundant –

- Power supply Redundant
- Communication subsystem Redundant
- Controller Redundant
- I/O Cards Single
- Interfaces Redundant

Vendor shall supply hardware for all functions required for on-line historical sample data collection, storage, averaging and retrieval. Redundant hardware is not required for equipment dedicated solely to archival data storage.

7.9 Power Sources

All components of the SCS topology will be powered from a dual 240 VAC, 50 Hz UPS (supplied by others) from substation power distribution providing redundant power to each unit.

The UPS is sized to provide power for 120 minutes.

The SELLER shall include miniature circuit breakers for AC supply to each power supply unit and sub-distribution within the system.

Sufficient isolation facilities on the DC sub-system shall be provided to enable maintenance of components with minimum disturbance to healthy devices.

All power supply modules provided in the SCS unit including RIO cards shall be dual redundant and replaceable under full operating conditions.

Each power supply shall be designed for 150% of normal consumption or based upon a modular system, which can be expandable without rewiring.

The SELLER is to state power supply tolerance limits of the system without a UPS attached, the degree of immunity of the system to mains-borne noise and interference without a UPS system and the system response under “burnout” and transient over voltage conditions without a UPS system.

The fault discrimination shall be such that minimal equipment will be affected by any particular fault. Power distribution to control devices shall be arranged such that the loss of an individual circuit does not result in complete loss of control capability or create unsafe operation conditions. An alarm shall be generated to alert the operator to loss of power to a device.

All the 24 V DC power suppliers for the system shall be supplied and mounted on system racks by the SELLER and made redundant with both continuously active. It shall be possible to remove at least one power supply for maintenance without affecting the overall load requirements of the system. The power supplies shall have separate fusing and diode isolation. For easy access and maintenance, DIN rail mounting provision for Bulk Power Supply is preferable.

There shall be provision to power all field transmitters, analogue outputs, digital inputs and digital outputs from the 24 volt system. SELLER shall state the current rating for each power supply.

All 4-wire instruments will have 240v AC power. These will be fed from the UPS distribution board.

Alarms for power supply failures, fuses, earth fault detectors, fans etc shall be made available in the Control Room.

7.10 Earthing

SCS equipment shall be provided with protective and signal earth.

7.10.1 General

- Dedicated noise free earth of less than 1 Ohm rising to a maximum of 10 Ohms
- Shall be away from any heavy plant or high noise.

- The earth shall be as short and straight as possible via a heavy cable preferably a flat copper strap.
- The environment shall be such as to reduce the likelihood of static build up and discharge by using antistatic materials for floors, chairs and other surfaces.

7.10.2 Protective Earth

- All metal components must be connected to a protective earth system.
- Flexible conduits, soldered joints or door hinges are not accepted as earth returns.
- All earth connections must be made direct to the earth point for all system cabinets.
- Looping for field remote I/O cabinets is acceptable.
- The SELLER shall provide all earth continuity links required for his equipment.

7.10.3 Signal Earth

Signal earth must be totally separate from the power earth and must be of very high integrity. IS and Non-IS screen earth is connected to this earth bar.

7.10.4 RIO Earthing

IS and Non-IS instrument earth bar, mounted on insulators shall be provided in each RIO cabinet and system cabinet. It will be used to ground zero volt references and signal cable screens.

Signal cable screens and spare cores of all multi-core cables shall be terminated on the IS instrument earth bars via terminals.

7.11 RFI Immunity

Standard UHF (Ultra high frequency) and VHF (Very high frequency) personal radio equipment will be operated in close proximity (less than 1 metre) of the system equipment. The system shall have total immunity from the UHF/VHF radios used for plant communications in accordance with IEC 60079.

7.12 Requirements of Spare Capacity

Spare philosophy shall be as follows:

RIO level (Wired): 20%

Spares space – RIO: 20%

Cabinet space: 20%

Terminals spare: 30%

Spare % shall be applied to each type of I/O's.

Spare cores of all field cables shall be terminated in the RIO cabinet on to the terminals and then accounted for spare %.

SELLER shall provide separate lump sum price for spare parts for commissioning.

SELLER shall provide separate lump sum price for 2 year operational spare parts and special tools (if any).

SELLER shall guarantee availability of spares for at least 15 years from the date of completion of the SAT.

7.13 Electrical System Interface

The interface between the DCS and the electrical system shall be via redundant serial link. DCS Controllers for each Plant Area will have a redundant serial connection to the intelligent MCCs.

The signals passed between the DCS and the MCCs will be dependant upon the MCC manufacturer selected.

Where the ESD system is required to trip a drive this will be hardwired, via remote I/O in the electrical substation.

The number of motors within each controller is defined in Section 12.

Where a motor is tripped by the ESD it will still have the standard redundant serial link connection with the DCS.

There is a PLC for Monitoring and Control of the Electrical System. This will be located in the Electrical Substation under the control of the Electrical Supervisor. There will be a redundant serial link between this PLC and the DCS.

7.14 Remote Access

The DCS shall be capable of supporting access from web-clients for remote interrogation.

The system shall support web-based HMI functionality from an Internet Explorer Browser window via an Internet or TCP/IP connection to the DCS system.

7.15 Clock Module

Vendor shall supply a clock module, based on the use of the Constellation Global Positioning Satellite, for daily time synchronization of the SCS system and the third party Vendor interface. Time synchronization shall be done via MODBUS protocol.

7.16 Third Party (Vendor) Package Integration

Where possible the monitoring and control of small packages will be integrated into the DCS system by connecting it to DCS remote (Field) I/O.

For larger packages requiring specialist control the package supplier will provide a PLC with the package. The common Remote I/O philosophy used for DCS and ESD will be adopted for Package PLCs also, with package vendor supplied remote I/O panels close to the equipment, and vendor PLCs in a vendor supplied cabinet in the Auxiliary Room.

The vendor PLC cabinet will incorporate a vendor standard HMI. The PLC vendor will provide suitable equipment to allow for maintenance and modification of the PLC software.

The DCS will provide standard graphics allowing start-up/shutdown sequencing of these packaged items.

Signals used for control and sequencing handshakes will be hardwired between the DCS and the Package PLC (Both in cabinets in the Auxiliary Room).

Where it is required that the ESD system trip the package, or an event in the package is required to trip external equipment, then these signals will be hardwired between the vendor PLC and the ESD system (both in cabinets in the Auxiliary Room).

There will be a software link between the DCS and each vendor PLC to allow the DCS to monitor and display parameters and variables. The preferred option is for the communication between the DCS and package PLC to be via OPC, however other protocols such as Profibus or Modbus will be considered.

All data transferred to the SCS shall be globally available in the SCS for process control, historical trending, graphics display, etc.

7.17 Interfaces with Longannet Control System

There is a requirement for a small number of signals for communication between the SCS and existing Longannet Power Station PLCs. These will be via an OPC Connection between the DCS and the existing iFix System.

7.18 Interfaces with National Grid Control System

There is a requirement for a small number of signals for communication between the SCS and a new National Grid Control System.

The National Grid system will have a new PLC for this purpose. There will be some hardwired signals between DCS and this PLC. These are included in the quantities in section 12.

There will also be a redundant serial link between DCS and this System. (OPC preferred)

7.19 Vibration and Temperature Monitoring (VTMS)

Several of the Mechanical Packages will be supplied with a VTMS. These will reside in the same cabinet as the Mechanical Package PLC.

These VTMS Systems will have hardwired outputs to the MCCs to initiate machinery trips.

Unlike other systems the vibration monitoring systems will not utilise remote I/O.

Packages with VTMS are listed in section 7.16.

In addition to the Vibration and Temperature Monitoring for the packaged equipment, major fans and pumps will also be connected to a VTMS supplied by CONTRACTOR. This will be located in a cabinet in the Auxiliary Room, and will be of the same type as the VTMS for the packages.

The VTMS will have a redundant serial connection to the DCS for indication purposes. The preferred option is for the communication between the DCS and VTMS to be via OPC, however other protocols such as Profibus or Modbus will be considered.

Each VTMS will be connected to the Condition Monitoring system (supplied by CONTRACTOR).

The Condition Monitoring System shall be provided with a dedicated workstation which will be located in the Engineering Room. The Condition Monitoring System will provide

analytical tools for the analysis of measured data. This data will be used for machinery health monitoring, and predictive maintenance purposes.

The Condition Monitoring System shall be capable of allowing third party remote analysis of data via the COMPANY's wide area network and firewall at the head office in Glasgow.

7.20 Continuous Emissions Monitoring System (CEMS)

There are two (2) Analyser Houses. Each Analyser House contains a dedicated PLC for stream selection.

Each PLC will have a redundant communication link to the DCS.

The preferred option is for the communication between the DCS and package PLC to be via OPC, however other protocols such as Profibus or Modbus will be considered.

7.21 HART Management System

The SELLER shall provide a HART Management System to allow for the interrogation of SCS HART instruments.

The ESD instruments will be configured to be read-only by the HART Management System.

The HART Management system workstation will be located in the Engineering Room.

7.22 Management Information System (MIS)

The Management Information System shall be connected to the SCS unit in such a way that all data in the SCS units can be selected, processed and presented on the MIS terminal and in reporting form.

MIS shall be configured with hardware and software for connection to the installation office data network.

The MIS shall have the programming tools that make it easy to create historical reports for production data, operational data, maintenance data etc.

The MIS will be supplied by the COMPANY.

The SCS will have the capability to communicate with the MIS via TCIP.

7.23 Interfaces With Employer Standard Operational Software

The SCS will interface with existing Employer Standard operational Software. These systems are:

Maximo – Maintenance Management Software

Eclipse – Safety Documentation Software

PRAD – Risk Assessment Software

EXP – Predictive Maintenance Software

The SELLER's quotation should include interfacing with the above systems as additional costed items.

7.24 Interfaces with Other Future Systems

The SCS system shall have the capability and provision made for interfacing with other future applications of any hardware and software combination. Other applications can be one or more of the following –

- Advanced Process Control (FUTURE)
- Process Optimization (FUTURE)

The SELLER's quotation should include interfacing with the above systems as additional costed items.

7.25 Operating Consoles

The SELLER shall supply operating stations (Monitors, keyboards, printers, etc.)

There will be four (5) Operating Consoles in the Central Control Room, CCS1, CCS2, SPS, UTILITY and Electrical. Each operating Console shall accommodate two (2) Dual Screen Operator Workstations. Each Console will also have a large screen display.

Each Operating shall accommodate the following:

CCS1	2 x (Dual Screen) Operator Workstation 1 x ESD Panel 1 x Printer

	1 x Large Screen Display
CCS2	2 x (Dual Screen) Operator Workstation 1 x ESD Panel 1 x Printer 1 x Large Screen Display
SPS	3 x (Dual Screen) Operator Workstation 1 x ESD Panel 1 x Printer 1 x Large Screen Display
UTIL	2 x (Dual Screen) Operator Workstation 1 x ESD Panel 1 x Printer 1 x Large Screen Display 1 x Screen for F&G System
ELEC	1 x (Dual Screen) Operator Workstation

The Large screen displays shall be (2.1 meters x 0.8 meters) with 2560 x 1024 pixel resolution.

The SELLER shall provide 1 additional screen which will be located on the Utility Console for use by the Fire and Gas System.

Each Operating Console shall contain an ESD panel containing ESD lamps and pushbuttons. Each ESD panel shall take up the same amount of space as 1 standard control system screen.

Each Operating Console shall include one (1) event printer.

The Operator Workstations shall communicate with the DCS and ESD controllers via a dual redundant data highway.

Each Operating Workstation will allow the operators to perform all control and monitoring functions associated with that consoles process cells.

Each Operator Workstation shall consist of two (2) 21" colour LCD, a single mouse/keyboard combination and an engineers keyboard. The operator and engineering keyboards may be combined.

The SELLER shall supply all furniture required for installing the Operating Consoles and printers in the Control Room.

The final requirements for the furniture will be agreed between all parties during Detailed Design.

7.26 Engineering Console

The Engineering Console shall include two (2) dual screen Engineering Workstations.

The Engineering Console shall include one (1) colour ink jet printer.

The Engineering Console shall be capable of completing all tasks required for the SCS configuration. From the Engineering Console it shall be possible to have access to the entire database.

The SELLER shall supply all furniture required for installing the Engineering Console and colour printer in the Engineering Room.

The Engineering room will also contain a workstation for the HART management System.

7.27 Data Historian

Archive data shall be stored on hard disk for a duration of at least 180 days. It shall be possible to export the contents of the archive automatically or on-request to an external data carrier, which shall be included in the scope of supply. Storage of the following data shall be considered as a minimum:

- All Alarms and Events
- Measured values and plant status inputs
- Post Trip records

- Pre-selected curves with reduced resolution
- Pre-configured protocols, on request and periodic protocols
- Pre-selected critical Parameters

The data historian shall normally be accessed by the remote station via the web link. The remote station shall be able to access the historian data even when the Operator Workstations are not in operation.

To be properly utilised, it shall not be necessary to detail what is to be stored; therefore, all inputs shall be stored at all times, even if not in alarm. The system shall have provision for printing previous trip reports and periodic reports.

Historian data shall be stored on the hard disk of the historian node. The user shall be able to trend any value stored in the historical database, including analogue, calculated and digital values. All digital points/alarms shall be stored on status changes for latest 10,000 points minimum. Sampling frequency for analogue points shall be 1 second. The format and the content in the reports for data retrieval from the historian shall be subject to approval by the CONTRACTOR.

8. SCS Software Requirements

The SELLER is responsible for providing fully functional and tested software including:

DCS Database,

DCS Continuous Control

DCS Logic

DCS Sequences

DCS Graphics

ESD Database

ESD Logic

ESD Graphics

Configuration of interfaces to 3rd Party Packages

Configuration of interfaces to MCCs

Configuration of interfaces to high level systems (MIS, Hart management System)

Further details of the above control requirements will be provided during Detailed Design.

Software will include all necessary licences for use.

9. Third Party Vendor Interface

After purchase order award, the CONTRACTOR will inform the SELLER about the selected Third Party Vendor(s) (including tentative schedule dates) for the supply of the equipment, analyzer, etc.

In order to execute the SCS serial interface portion of the project with the Third Party Vendors, the following will be required -

- Start definition phase/functional specification for hardware and application software.
- OPC / MODBUS / Profibus intermediate testing at SCS SELLER premises.
- Finalisation of definition phase and functional specification of hardware and application software.
- Application testing during FAT at SCS SELLER premises
- Final acceptance at site (after SAT of SCS)

The SCS SELLER shall issue a declaration of full compliance stating protocol compatibility with all third party systems. The SELLER shall be responsible for correct implementation with respect to I/O mapping, data polling and error handling mechanisms. The OWNER / CONTRACTOR shall define the required application/functionality of Third Party Vendor data relative to SCS monitoring, alarming and control requirements.

All transferred data to the SCS shall be globally available in the SCS for process control, historical trending and graphics.

10. System Performance

During periods of high SCS loading such as plant start-up or shutdown, the SCS must continue to meet all requirements of this specification and SELLER published specifications. In particular, the SCS must suffer no loss of performance with respect to specifications concerning control processing, alarm processing, historical data collection and display call up speed.

SELLER shall advise on system layout in view of system loading and integrity.

If the system fails to meet any aspect of this specification or SELLER published specifications, SELLER shall upgrade existing hardware and/or software or add additional equipment necessary to achieve specified performance at no additional cost to the OWNER or the CONTRACTOR.

SELLER shall not charge additional cost for any upgrade required to achieve specified performance, even if such an upgrade also provides new and/or enhanced system functions or performance over and above the specified requirements.

Operator Workstations shall be capable of displaying at least 200 live data points per display. Display call-up time, including initial live data display, shall not exceed two seconds. Display refresh time for live data update shall not exceed one second.

All Operator Workstations shall be capable of simultaneously displaying data from any combination of any third party controller and package interface.

Commands from the Operators Console to activate field devices shall be executed within 0.5 second.

Analogue signals shall be measured at a rate of two scans per point per second or better. Digital signals shall be measured at a rate of two scans per point per second (normal) up to ten scans per second for fast events.

The system shall have the capability to provide faster scan rates for some selected analogue and digital points. A scan rate of 100 milliseconds per point or better shall be possible.

11. Alarm Handling

The SCS will have an advanced alarm reporting system, incorporating suppression of nuisance alarms, and alarm flood suppression capabilities.

The SCS will have at least 4 levels of alarm priority.

The SCS will provide as standard functionality the facility to remove alarm “chattering” via configurable alarm delay times, and alarm hysteresis.

For each alarm generated, the SCS should indicate to the Operator what response should be taken.

The occurrence of all alarms shall be printed out on the events printer upon Operator initiation in time tagged chronological order.

Each of the Operating Consoles will generate audible alarms. The Audible alarm will not be the loudspeakers of a computer.

All significant status inputs and all Operator actions that affect the operation of the plant or computer system shall be included in the events reporting system and shall be printed out on the events printer in time tagged, sequential and chronological order.

The alarm display must have the following functions:

- Sorting by Priority
- Sorting by chronological order
- Sorting by Process Area
- Colour coding for Priority
- Use of flashing/steady colour to indicate unaccepted/accepted alarms.

12. Control Structure

The process is divided into Plant Areas. There will be Five (5) redundant DCS Controllers and One (1) redundant ESD Logic Solver to facilitate the control of the plant.

The breakdown of Plant Areas by controller is shown in the table below:

Plant Area	DCS	ESD	Operator Console
CCS1 - Carbon Capture & Storage 1	Controller 1	Logic Solver 1	CCS1
CCS2 - Carbon Capture & Storage 2	Controller 2		CCS2
Utilities	Controller 1 & 2		UTILITY
Steam and Power Supply 1	Controller 3		SPS
Steam and Power Supply 2	Controller 4		SPS
Electrical Switchgear	Controller 5		ELEC

Remote IO will be Intrinsically Safe (EEXi), with the exception of Digital Outputs which are EExd.

Analogue Inputs will be System (DCS) powered.

Local I/O is for interface signals between DCS and Package PLCs or between ESD and package PLCs and will be non-IS.

12.1 Controller1 Breakdown

I/O Quantities (CCS1)

	AI	AO	DI	DO	Total
REMOTE IO	399	50	92	49	543
LOCAL IO	9	9	22	22	62
					605

These quantities include spare I/O requirements

Remote I/O Cabinet Count

Number of Remote I/O Cabinets	17

Motor Count

Number of Motors	70

12.2 Controller2 Breakdown

I/O Quantities (CCS2)

	AI	AO	DI	DO	Total
REMOTE IO	399	50	92	49	543
LOCAL IO	9	9	22	22	62
					605

These quantities include spare I/O requirements

Remote I/O Cabinet Count

Number of Remote I/O Cabinets	17

Motor Count

Number of Motors	70

12.3 Controller3 Breakdown

I/O Quantities (SPS1)

	AI	AO	DI	DO	Total
REMOTE IO	374	144	588	267	1374

LOCAL IO	9	9	23	23	64
					1438

These quantities include spare I/O requirements

Remote I/O Cabinet Count

Number of Remote I/O Cabinets	8

Motor Count

Number of Motors	35

12.4 Controller4 Breakdown

I/O Quantities (SPS2)

	AI	AO	DI	DO	Total
REMOTE IO	374	144	588	267	1374
LOCAL IO	9	9	23	23	64
					1438

These quantities include spare I/O requirements

Remote I/O Cabinet Count

Number of Remote I/O Cabinets	8

Motor Count

Number of Motors	35

12.5 Controller5 Breakdown

I/O Quantities (ELEC)

	AI	AO	DI	DO	Total
REMOTE IO Elec Substation (Safe Area)	100	0	100	100	300
REMOTE IO 275KV Substation	16	0	16	16	48

(Safe Area)					
					348

These quantities include spare I/O requirements

Remote I/O Cabinet Count

Number of Remote I/O Cabinets	As per SCS Supplier Design

12.6 Logic Solver1 Breakdown

I/O Quantities

	AI	AO	DI	DO
REMOTE IO	131	0	200	137
LOCAL IO	0	0	12	12

These quantities include spare I/O requirements

Remote I/O Cabinet Count

Number of Remote I/O Cabinets	5

Motor Count

Number of Motors	36

12.7 Serial Interface Breakdown

The following serial links will be provided:

1	CCS1 - CO_2 Compression
2	CCS2 - CO_2 Compression
3	CCS1 - CO_2 Drying
4	CCS2 - CO_2 Drying
5	SPS1 – Combustion Gas Turbine
6	SPS2 – Combustion Gas Turbine
7	SPS1 – HRSG (BMS)
8	SPS1 – HRSG (BMS)
9	SPS1 – HRSG (BMS)
10	SPS1 – Steam Turbine
11	Longannet Control System
12	National Grid Control System
13	VTMS

14	CEMS

The following links to high level systems will be provided:

1	Management Information System
2	Employer Standard operational Software
3	Other Future Systems

Appendix 1 – Table of Compliance

General Notes

The SELLER is obliged to submit with his tender the completed table of compliance. For each (sub-) paragraph and attachment of this requisition, SELLER shall indicate the applicable degree of compliance. The SELLER is to use the following categories:

Enhancement	The capability exceeds the stated functional or design requirements.
Conforms	Fully meets the functional or design requirements.
Variation	Meets the requirements but minor variations need to be clarified.
Alternate	Does not meet the stated specification, requirement however, an alternate that provides the equivalent function is offered.
Exception	Does not meet the stated specification, requirement.
Noted & Understood	SELLER acknowledges items as instructions, guidelines or background information including in the specification for classification purposes
Clarification Note	SELLER has appended a clarification note.

Note:

The terms "variation" and "alternate" always require a clarification note. For the terms "enhancement" and "exception", a clarification note will be appreciated for classification purposes.

Spec. Para	Enhancement	Conforms	Variation	Exception	Noted & Understood	Clarification Note
1.0						
1.1						
1.2						
2.0						
2.1						
3.0						
3.1						
3.2						
3.2.1						
3.2.2						
3.2.3						
3.2.4						
3.2.5						
3.2.6						
3.2.7						
3.2.8						
3.2.9						
4.0						
4.1						
4.2						
4.3						
5.0						
5.1						
5.2						
6.0						

Spec. Para	Enhancement	Conforms	Variation	Exception	Noted & Understood	Clarification Note
7.0						
7.1						
7.2						
7.3						
7.4						
7.4.1						
7.4.2						
7.5						
7.6						
7.7						
7.8						
7.9						
7.10						
7.10.1						
7.10.2						
7.10.3						
7.10.4						
7.11						
7.12						
7.13						
7.14						
7.15						
7.16						
7.17						
7.18						
7.19						

Spec. Para	Enhancement	Conforms	Variation	Exception	Noted & Understood	Clarification Note
7.20						
7.21						
7.22						
7.23						
7.24						
7.25						
7.26						
7.27						
8.0						
9.0						
10.0						
11.0						
12.0						
12.1						
12.2						
12.3						
12.4						
12.5						
App2						
App3						
App4						
App5						
App6						
App7						
App8						
App9						

Spec. Para	Enhancement	Conforms	Variation	Exception	Noted & Understood	Clarification Note
App10						
App11						
App12						
App13						

Appendix 2 – Serial Interfaces Execution Plan

1. Serial Interfaces with Main SCS System

The purpose of this procedure is to describe the main responsibilities, crucial communication patterns and efforts required between the involved parties, related to the development and establishment of serial interfaces protocol with the OWNER SCS system.

2. Definitions

Third Party Vendors: supplies a fully compatible and functional system interface for an external subsystem which has to be integrated as a slave and capable of interfacing with the main SCS system.

SELLER: supplies the main SCS system with Interface cards for the establishment of the serial data link with the foreign devices.

The main SCS system will function as the master device in any communications.

FAT = Factory Acceptance Testing.

CAT = Configuration Acceptance Testing.

SAT = Site Acceptance Testing.

IFAT = Integrated Factory Acceptance Testing

3. Third Party Vendor's Responsibilities

The Third Party Vendor shall be responsible for his internal applications and the I/O mapping to be established with the main SCS system. During an early phase of the project, the Third party Vendor shall forward the data structures and I/O mapping requirements of his equipments to the SCS SELLER. After investigation by the Third party Vendor of actual compatibility requirements with respect to the main SCS system, the Third party Vendor shall inform the CONTRACTOR in writing that the system hardware/software (modems and/or line drivers) and application software meets all necessary application requirements. The OWNER / CONTRACTOR shall define the application software requirements.

4. SCS Seller Responsibilities

The main SCS SELLER shall be responsible for his internal SCS applications and the I/O mapping to be established in accordance with the Third Party Vendor's subsystem.

The SELLER is responsible for the provision of communication cables between the SCS and the Third Party Vendor equipment.

During an early phase of the project, the Third Party Vendor shall forward the data structures and I/O mapping requirements of his equipment and supporting hardware and software to SCS SELLER for validation of compliance with the protocol as required by main SCS system. The Third Party Vendor shall investigate the actual compatibility requirements of the main SCS system and submit the results to the main SCS SELLER. The main SCS SELLER shall provide the CONTRACTOR with written confirmation, that the system hardware/software (modems and/or line drivers) as supplied by the main SCS SELLER and the Third Party Vendor, including the application software on the main SCS, meets all necessary application requirements. The OWNER / CONTRACTOR shall define the application software requirements.

5. Serial Link Testing

The Third Party Vendor and the main SCS SELLER shall co-ordinate all necessary activities and shall provide all necessary hardware and software to guarantee a successful hardware and software integration test. The test will be performed at the main SCS SELLER premises or on site, depending on the time at which the Third Party Vendor has completed his application for testing.

This serial link testing, in conjunction with the IFAT, shall be considered as the overall acceptance testing by OWNER / CONTRACTOR of both the main SCS SELLER hardware and system and application software of the main SCS system. In addition, it will serve as the final configuration acceptance (only the CAT and not the SAT) of the application of the Third Party Vendor as well as the overall acceptance of the concerned serial link. During these functional tests, the OWNER / CONTRACTOR shall witness together with the client the performance of these serial links.

Prior to testing, the main SCS SELLER will submit a detailed test procedure to the Third Party Vendor and OWNER / CONTRACTOR for comments. This test method shall describe in sufficient detail the timing of testing, error handling procedures and simulation to be executed with respect to the serial links. Upon successful testing of the serial links, the main SCS SELLER shall prepare an official test report and acceptance certificate which has to be undersigned by all three parties.

In the event of unsuccessful testing, both the Third Party Vendor and the main SCS SELLER will generate a test report highlighting all deficiencies, if any, with suggestions identifying corrective actions. After corrective actions have been taken, testing shall be repeated with the participation of all parties.

6. Error Handling

Full compatibility shall be verified by the Third Party Vendor with main SCS SELLER concerning the requirements related to error handling and error code generation, exception responses and interpretation by the main SCS system, the number of retries, etc.

Programming or operation errors are those involving illegal data in a message, no response from and to its interface unit and difficulty communicating with a slave. These errors should result in an exception response from either the main SCS software communication handler or the Third party slave, depending on the type of error.

The exception response codes as utilized by the [MODBUS] protocol are to be verified by the Third Party Vendor on true compatibility with main DCS [MODBUS] interface sub-system and software.

The Third Party Vendor shall verify true compatibility with respect to the time interval for I/O update and retrials by the main SCS system. In addition, the Third party vendor shall verify:

- Data frame detection and validation based on [MODBUS] protocol
- Communication link monitoring and error detection
- Scanning and baud rate related to the communication link
- Data mapping, transmission and receipt.

Main SCS SELLER shall co-operate in an efficient manner to provide the Third Party Vendor with specific details related to the serial link being established. It is suggested that the SCS SELLER produces a Serial Interface Specification that will be provided to the Third Party Vendor.

Client:	**To be determined**
Plant Location:	**To be specified**

Item: Mechanical Datasheet Stripper System

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

				Rev
1	**DESIGN & OPERATING DATA**			
2	APPLICATION STANDARD (DESIGN CODE)			
3	PED CONFORMANCE CATEGORY (PREFERED MODULE)			
4	VESSEL SPECIFICATION			
5	GENERAL PROJECT SPECIFICATION FOR MECHANICAL EQUIPMENT			
6	PIPING DESIGN NOZZLE LOADING FOR STATIC EQUIPMENT			
7	VENDOR DOCUMENTATION REQUIREMENTS - DOCUMENT CONTROL			
8	VENDOR DOCUMENTATION REQUIREMENTS - ENGINEERING			
9	SHELL MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS			
10	SHELL MAP (DES. PRESSURE int.) at bottom @ TEMPERATURE - PS			
11	SHELL MAP (DES. PRESSURE ext.) at top @ TEMPERATURE			
12	SHELL OPERATING PRESSURE @ TEMPERATURE (TOP/BOTTOM)			
13	JACKET MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS			
14	JACKET MAP (DES. PRESSURE ext.) at top @ TEMPERATURE			
15	JACKET OPERATING PRESSURE @ TEMPERATURE			
16	CORROSION/EROSION ALLOWANCE (internal / external)			
17	STRESS RELIEF/PWHT			
18	RADIOGRAPHY			
19	JOINT COEFFICIENT (PED ESR 7.2)			
20	HYDRAULIC TEST PRESSURE			
21	AIR TEST PRESSURE (with soap suds)			
22	BASIC WIND SPEED			
23	SEISMIC CRITERIA			
24	CYCLIC SERVICE			
25	CREEP RANGE			
26	VESSEL CONTENTS/PED FLUID PHASE & GROUP No.			
27	NATURE OF CONTENTS			
28	MAX. OPERATING STATIC HEAD			
29	INTERNAL FINISH			
30	WELD DRESSING (internal / external)			
31	INTERNAL COATING			
32	EXTERNAL FINISH			
33	EXTERNAL PAINTING			
34	INSULATION (by Vendor)			
35	FIREPROOFING (by site contractor)			
36	INSPECTION AUTHORITY			

37	**MATERIAL SPECIFICATIONS**				
38	HEADS & SHELL		JACKET		
39	CLADDING		SUPPORT SKIRT		
40	BODY FLANGE		EXT. ATTACHMENTS		
41	NOZZLE: FLANGES		PLATFORMS/LADDERS		
42	NOZZLE: NECKS				
43	BOLTING: EXTERNAL		FLANGE FINISH		
44	BOLTING: INTERNAL		PMA REQUIRED		
45	GASKETS: EXTERNAL		MATERIAL CERTS		
46	GASKETS: INTERNAL		IMPACT TEST REQ.		
47	FIXED INTERNALS		ELONGATION REQ.		
48	REMOVABLE INT'LS		WELDING QUALS		

49	**CAPACITY & WEIGHTS (Vendor to Confirm)**					
50	ESTIM'D WEIGHT FABRICATED (EMPTY)	kg		S.G. OF OPERATING FLUID		
51	ESTIM'D WEIGHT INTERNALS	kg		VOLUME OF OPERATING FLUID	Litres	
52	ESTIM'D WEIGHT ATTACHMENTS (See note 14)	kg		WEIGHT OF OPERATING FLUID	kg	
53	ESTIM'D WEIGHT INSTALLED (EMPTY)	kg		VESSEL CAPACITY (GROSS)	m^3	
54	ESTIM'D WEIGHT INSTALLED OPERATING	kg		JACKET CAPACITY (GROSS)	m^3	
55	ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID	kg				
56	ESTIM'D WEIGHT INSTALLED FULL OF WATER	kg				

Mechanical Datasheet - Stripper System	DOC. NO.	Not Applicable
	PAGE NO.	3 of 20
	PROJECT NO.	
	ITEM NO.	
	NO. OFF	

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	Ref	Service	DN	No Off	Flange	Rating	Standout	Notes	Rev
1	**BRANCH DUTY**								
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29									
30	Nozzle standouts are measured from vessel centre-line to flange face.								
31	**ADDITIONAL SPECIFICATIONS & STANDARDS**								
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51	**NOTES**								
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57									

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

NOTES (Continued)

Mechanical Datasheet - Stripper System	DOC. NO.	Not Applicable
	PAGE NO.	5 of 20
	PROJECT NO.	
	ITEM NO.	
	NO. OFF	

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

				Rev
			INSPECTION TASKS	
1			**INSPECTION TASKS**	
2			All tasks identified below shall be included on the vendors quality plan.	
3			Where inspection task numbers have a suffix "C", a certificate shall be supplied.	
4			These certificates shall be included in the vessel certification dossier.	
5				
6	1.	C	Review material certificates (EN-10204. 3.1 standard.)	
7	2.	-	Check certified chemical & mechanical properties of all materials.	
8	3.	-		
9	4.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding	
10	5.	-	procedures.	
11	6.	C	Check method of distribution of welding consumables and means of storage on the shop floor.	
12	7.	-		
13	8.	C	Check weld procedures and qualifications.	
	9.	C	Check weld map and welders qualifications.	
1	10.	-		
2	11.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast	
3	12.	-	numbers.	
4	13.	-		
5	14.	C	Identify heads and check shape, dimensions and thickness.	
6	15.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas	
7	16.	-	susceptible to thinning.	
8	17.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
9	18.	-		
10	19.	C	Inspect assembly including alignment of main seams prior to welding.	
11	20.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and	
12	21.	-	location of bolt holes.	
13	22.	-		
14	23.	C	Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material	
15	24.	-	identification and stamping.	
16	25.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
17	26.	C	Witness welding of test plates and review test results.	
18	27.	C	Inspect finished welds for freedom from undercut and surface defects.	
19	28.	-		
20	29.	C	Check dimensions to approved drawing and tolerances given in specifications.	
21	30.	-		
22	31.	-		
23	32.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
24	33.	-		
25	34.	C	Check DPI procedure and operators qualifications and survey the testing of all vessel welds.	
26	35.	C	Ensure radiography of vessel welds is in accordance with approved drawing and specified code. Review	
27	36.	-	radiographs.	
28	37.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
29	38.	-		
30	39.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
31	40.	-	Gauge check column internal diameter.	
32	41.	C	Witness hydraulic test. Check test set up and pressure gauge certificates.	
33	42.	-		
34	43.	C	Check that the vessel is clean and dry before sealing.	
35	44.	C	Check general workmanship and completeness of supply.	
36	45.	C	Check Paint or other finishes for continuity and against specification.	
37	46.	C	Check copy of nameplate.	
38	47.	C	Check Equipment packed and protected ready for shipment.	
39	48.	-	Review Dossier.	
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

					Rev
1	**DESIGN & OPERATING DATA**				
2	**OVERALL DUTY**	**Units**			
3	FLUID HANDLED				
4	NATURE OF CONTENTS				
5	MAX. LIQUID DENSITY [FOR MECHANICAL DESIGN]	kg/m^3			
6	MAX. LIQ. HEIGHT ABOVE BOTTOM TAN [MECH. DES]	mm			
7	MIN OPERATING PRESSURE	barA			
8	NORM OPERATING PRESSURE (TOP/BOTTOM)	barA			
9	MAX OPERATING PRESSURE	barA			
10	MIN OPERATING TEMPERATURE	°C			
11	NORM OPERATING TEMPERATURE (TOP/BOTTOM)	°C			
12	MAX OPERATING TEMPERATURE	°C			
13	MAX DESIGN PRESSURE (TOP/BOTTOM)	barG			
14	MIN DESIGN PRESSURE	barG			
15	MAX DESIGN TEMPERATURE	°C			
16	MIN DESIGN TEMPERATURE	°C			
17	MIN AMBIENT TEMPERATURE	°C			
18	TOTAL PRESSURE DROP	mbar			
19	**MATERIALS OF CONSTRUCTION (MOC)**				
20	COLUMN SHELL & HEADS		DISTRIBUTORS		
21	PACKING		COLLECTOR TRAYS		
22	SUPPORT BEAMS		DEMISTER		
23	SUPPORT GRIDS		BOLTING		
24	WALL WIPERS		GASKETS		
25	**DIMENSIONS (REFER TO VESSEL DATASHEET FOR MORE DETAIL)**				
26	DIAMETER	mm	TOTAL HEIGHT TAN/TAN	mm	
27	**INTERNAL DESIGN**				
28	BED HEIGHT	mm	Water Wash Bed -	Amine Stripper Bed -	
29	STRUCTURED/RANDOM		Structured	Structured	
30	TYPE (GENERIC, OR TYPICAL VENDOR DESIGNATION)		VTA	VTA	
31	TYPICAL MODEL DISTRIBUTOR		VTA		
32	TYPICAL MODEL COLLECTOR		VTA		
33	TYPICAL MODEL SUPPORT GRID/ HOLD DOWN GRID		VTA		
34	TYPICAL MODEL DEMISTER		VTA		
35	**ADDITIONAL SPECIFICATIONS & STANDARDS**				
36	VESSEL DATASHEET				
37	PROCESS DATASHEET				
38	DESIGN & MANUFACTURE OF COLUMN INTERNALS				
39	VENDOR DOCUMENTATION REQUIREMENTS - DOCUMENT CONTROL				
40	VENDOR DOCUMENTATION REQUIREMENTS - ENGINEERING				
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46	**GENERAL NOTES**				
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	To be determined	ISSUE					
LOCATION	To be specified	QUALITY LEVEL					
PLANT	To be specified	DATE					

	DESCRIPTION		UNITS	DATA			
1	**DESIGN & OPERATING DATA**						
2				SHELLSIDE (HOT FLUID)		TUBESIDE (COLD FLUID)	
3				In	Out	In	Out
4	FLUID						
5	TOTAL FLUID FLOW		kg/hr				
6	VAPOUR FLOW		kg/hr				
7	LIQUID FLOW		kg/hr				
8	LIQUID DENSITY		kg/m³				
9	LIQUID SPECIFIC HEAT		kJ/kg°C				
10	LIQUID VISCOSITY		cP				
11	LIQUID THERMAL CONDUCTIVITY		W/m°C				
12	LIQUID SURFACE TENSION		Dyn/cm				
13	LATENT HEAT		kJ/kg				
14	VAPOUR DENSITY		kg/m³				
15	VAPOUR SPECIFIC HEAT		kJ/kg°C				
16	VAPOUR VISCOSITY		cP				
17	VAPOUR THERMAL CONDUCTIVITY		W/m°C				
18	MOLECULAR WEIGHT						
19	OPERATING TEMPERATURE		°C				
20	OPERATING PRESSURE		Bar a				
21	PRESSURE DROP	Allow/Calc	bar				
22	No. OF PASSES						
23	VELOCITY OF FLOW		m/s				
24	FOULING ALLOWANCE		m²C/W				
25	MAP (DESIGN PRESSURE)		bar g				
26	TEST PRESSURE	New/Corroded	bar g				
27	DESIGN TEMPERATURE		°C				
28	HEAT DUTY		MW				
29	H.T. COEFFICIENT	Required / Actual	W/m²C				
30	LMTD		°C				
31							
32							

33	**CONSTRUCTION & MATERIALS**				
34	DESIGN CODES:				
35	SHELL PER UNIT:	TYPE:	SERIES:	PARALLEL:	
36	SURFACE PER UNIT:		SURFACE PER SHELL:		
37	PED FLUID PHASE & GROUP No:	HOT SIDE:	COLD SIDE:		
38	PED EQUIPMENT CATEGORY:		PED CONFORMITY MODULES:		
39	TUBE:		No Off:	THICKNESS	
40	TUBE O/DIA:	LENGTH:	PITCH:		
41	SHELL:	I/DIA:	SHELL COVER: --		
42	CHANNEL:		CHANNEL COVER:		
43	STATIONARY TUBESHEET:			FLOATING HEAD COVER:	
44	FLOATING TUBESHEET:		LONGITUDINAL BAFFLES:		
45	SUPPORT BAFFLES:		TYPE:	FLOW:	
46	BAFFLE CUT:	PITCH:	No OFF:		
47	GASKETS: Shellside:		CORROSION ALLOWANCE:	Shellside:	
48	Tubeside:			Tubeside:	
49	BRANCHES: Shellside:		INLET:	OUTLET:	RATING:
50					
51	Tubeside:		INLET:	OUTLET:	RATING:
52	STRESS RELIEVE: (Shellside / Tubeside):				
53	RADIOGRAPHY: (Shellside / Tubeside):				
54	INSPECTION BY:				
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CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

	APPLICABLE DESIGN CODES & STANDARDS:

TUBESHEET & BELLOWS DESIGN DATA

The following coincident pressures and their coincident temperatures are possible and must be used in the design of the tubesheets and the determination of bellows requirements. The use of differential pressure design methods is not permitted.

	Case No.	Minimum Design Cycle Life of Bellows	Shellside Pressure [barg]	Shell Metal Temp. [°C]	Tubeside Pressure [barg]	Tube Metal Temp. [°C]
NORMAL OPERATION						
SHELLSIDE FLOW FAILURE						
TUBESIDE FLOW FAILURE						
MAX.SHELLSIDE PRESSURE						
MAX.TUBESIDE PRESSURE						
START-UP						
SHUT-DOWN						
EMERGENCY CONDITIONS						
SHELLSIDE HYDROTEST						
TUBESIDE HYDROTEST						
BELLOWS EXPANSION						
BELLOWS COMPRESSION						

CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

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CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

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CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

HEAT RELEASE CURVES

CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

HEAT RELEASE CURVES

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CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

SKETCH

Ref	Service	Size	Rating	Standout (mm)	Remarks

Drawing not to scale
All dimensions in mm

ESTIMATED WEIGHTS (kg)	
Fabricated	
Operating	
Full of water	

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CLIENT	**To be determined**	ISSUE					
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PLANT	**To be specified**	DATE					

SKETCH

Drawing not to scale
All dimensions in mm

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CLIENT	**To be determined**	ISSUE						
LOCATION	**To be specified**	QUALITY LEVEL						
PLANT	**To be specified**	DATE						

SKETCH

Drawing not to scale
All dimensions in mm

CLIENT	**To be determined**	ISSUE					
LOCATION	**To be specified**	QUALITY LEVEL					
PLANT	**To be specified**	DATE					

INSPECTION TASKS

INSPECTION TASKS:

All tasks identified below shall be included on the vendors quality plan. Where inspection task numbers have a suffix "C", a certificate shall be supplied. These certificates shall be included in the exchanger certification dossier.

MC1	**C**	Review material certificates (EN-10204, 3.1 standard).
MC2	**C**	Check certified chemical & mechanical properties of all materials.
MC3	**C**	Check that ultrasonic testing of base plate has been carried out before cladding.
MC4	**C**	Check that bond stength tests and ultrasonic testing of cladding have been cariied out.
MC5	**C**	Check cladding thickness
WRod1		Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.
WRod2		Check method of distribution of welding consumables and means of storage on the shop floor.
WeldPr	**C**	Check weld procedures and qualifications.
Welder	**C**	Check weld map and welders qualifications for shell and tube end welds.
TrHtNos		Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.
Head	**C**	Identify heads and check shape, dimensions and thickness.
Plate		Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.
Lamin	**C**	Inspect edges of material for weld preparation and for discontinuities and laminations.
Fitup		Inspect assembly including alignment of main seams prior to welding.
Nozzles		Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.
Coupon1		Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material identification and stamping.
Welding		Survey welding and back gouging and ensure that approved procedures are followed.
Tube holes		Check tube holes are free from burrs and the finish, grooving and tolerances are in accordance with the approved drawing and code.
Tubes		Check that the tubes are free from surface defects and thinning after expanding and witness soapy water test of tube end welds.
Baffles		Check baffles to approved drawing and that the shell is correctly sized and free of obstructions for tube bundle insertion.
Coupon2	**C**	Witness welding of test plates and review test results.
InspWeld	**C**	Inspect finished welds for freedom from undercut and surface defects.
DimChk	**C**	Check dimensions to approved drawing and specified tolerances given in TEMA.
IntFinish	**C**	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.
MPT	**C**	Check MPT procedure and operators qualifications and survey the testing of all exchanger welds.
RT	**C**	Ensure radiography of exchanger welds is in accordance with approved drawing and specified code. Review radiographs.
UT	**C**	Witness ultrasonic examination of welds and review reports.
PWHT1	**C**	Check PWHT procedure for exchanger. Inspect thermocouple certificates and attachment. Check final temperature charts.
		Deleted
HydrT	**C**	Witness hydraulic test. Check test set up and pressure gauge certificates. Check that the exchanger is clean and dry after testing.
Final-1	**C**	Check that the equipment is clean and dry before sealing.
Final-2	**C**	Check general workmanship and completeness of supply.
Final-3	**C**	Check Paint or other finishes for continuity and against specification. (check insulation and cladding)
Final-4	**C**	Check copy of nameplate.
Final-5	**C**	Check Equipment packed and protected ready for shipment.
Final-6		Review Dossier.

Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet Stripper Condenser

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION	UNITS	DATA				Rev
1	**DESIGN & OPERATING DATA**						
2			**HOT FLUID**		**COLD FLUID**		
3			**In**	**Out**	**In**	**Out**	
4	**FLUID**						
5	**TOTAL FLUID FLOW**	**kg/hr**					
6	**VAPOUR FLOW**	**kg/hr**					
7	**LIQUID FLOW**	**kg/hr**					
8	**LIQUID DENSITY**	**kg/m³**					
9	**LIQUID SPECIFIC HEAT**	**kJ/kg°C**					
10	**LIQUID VISCOSITY**	**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**	**W/m°C**					
12	**LIQUID SURFACE TENSION**	**Dyn/cm**					
13	**LATENT HEAT**	**kJ/kg**					
14	**VAPOUR DENSITY**	**kg/m³**					
15	**VAPOUR SPECIFIC HEAT**	**kJ/kg°C**					
16	**VAPOUR VISCOSITY**	**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**	**W/m°C**					
18	**MOLECULAR WEIGHT**						
19	**OPERATING TEMPERATURE**	**°C**					
20	**OPERATING PRESSURE (Normal Inlet/Max. Inlet)**	**Bar a**					
21	**PRESSURE DROP Allow/Calc**	**Bar**					
22	**No. OF PASSES**						
23	**WALL SHEAR RATE**	**Pa.**					
24	**FOULING ALLOWANCE**	**m²C/W**					
25	**MAP (DESIGN PRESSURE)**	**bar g**					
26	**TEST PRESSURE New/Corroded**	**bar g**					
27	**DESIGN TEMPERATURE**	**°C**					
28	**HEAT DUTY**	**MW**					
29	**H.T. COEFFICIENT Service / Clean**	**W/m²C**					
30	**LMTD**	**°C**					
31	**HEAT TRANSFER SURFACE AREA**	**m²**					
32	**DESIGN MARGIN**	**%**					
33							
34							
35	**CONSTRUCTION & MATERIALS**						
36	**DESIGN CODES:**		**Type:**				
37	**PED FLUID PHASE & GROUP No:** **HOT SIDE:**		**COLD SIDE:**				
38	**PED EQUIPMENT CATEGORY:**		**PED CONFORMITY MODULES:**				
39	**HEAT Ex. PLATE: MATERIAL:**		**SHELL I** **MATERIAL:**				
40	**THICKNESS:**		**THICKNESS:**				
41	**No. OFF:**		**MATERIAL:**				
42	**GASKET MATERIAL:**		**No. OFF:**				
43	**GASKET TYPE:**		**DIAMETER:**				
44	**NOZZLES:**	**HOT SIDE**	**COLD SIDE**				
45	**MATERIAL:**						
46	**SIZE:**						
47	**RATING:**						
48	**LINING:**						
49	**POSITION:**						
50	**CONNECTION TYPE:**						
51	**MINIMUM N.D.T.**		**INSPECTION BY:**				
52	**ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID** **kg**						
53	**ESTIM'D WEIGHT INSTALLED FULL OF WATER** **kg**						

Mechanical Datasheet - Stripper Condenser

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CLIENT	**To be determined**	ISSUE				
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	DESCRIPTION		UNITS	DATA				Rev
1	**TURNDOWN & OPERATING DATA**							
2				**HOT FLUID**		**COLD FLUID**		
3				**In**	**Out**	**In**	**Out**	
4	**FLUID**							
5	**FLUID FLOW**		**kg/hr**					
6	**VAPOUR FLOW**		**kg/hr**					
7	**LIQUID FLOW**		**kg/hr**					
8	**LIQUID DENSITY**		**kg/m3**					
9	**LIQUID SPECIFIC HEAT**		**kJ/kg°C**					
10	**LIQUID VISCOSITY**		**cP**					
11	**LIQUID THERMAL CONDUCTIVITY**		**W/m°C**					
12	**LIQUID SURFACE TENSION**		**Dyn/cm**					
13	**LATENT HEAT**		**kJ/kg**					
14	**VAPOUR DENSITY**		**kg/m3**					
15	**VAPOUR SPECIFIC HEAT**		**kJ/kg°C**					
16	**VAPOUR VISCOSITY**		**cP**					
17	**VAPOUR THERMAL CONDUCTIVITY**		**W/m°C**					
18	**MOLECULAR WEIGHT**							
19	**OPERATING TEMPERATURE**		**°C**					
20	**OPERATING PRESSURE**		**Bar(g)**					
21	**PRESSURE DROP**	**Allow/Calc**	**bar**					
22	**HEAT DUTY**		**MW**					
23	**H.T. COEFFICIENT**	**Service / Clean**	**W/m²C**					
24	**LMTD**		**°C**					
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	DESCRIPTION	UNITS	DATA	Rev
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43	**APPLICABLE DESIGN CODES & STANDARDS:**			
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
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PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	INSPECTION TASKS			Rev
1	**INSPECTION TASKS**			
2	All tasks identified below shall be included on the vendors quality plan.			
3	Where inspection task numbers have a suffix "C", a certificate shall be supplied.			
4	These certificates shall be included in the exchanger certification dossier.			
5				
6	**MC1**	**C**	Review material certificates (EN-10204, 3.1.standard).	
7	**MC2**	**C**	Check certified chemical & mechanical properties of all materials.	
8				
9	**WRod1**		Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
10	**WRod2**		Check method of distribution of welding consumables and means of storage on the shop floor.	
11				
12	**WeldPr**	**C**	Check weld procedures and qualifications.	
13	**Welder**	**C**	Check weld map and welders qualifications.	
14				
15	**TrHtNos**		Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
16				
17	**Plate**		Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas	
18			susceptible to thinning.	
19	**Lamin**	**C**	Inspect edges of material for weld preparation and for discontinuities and laminations.	
20				
21	**Fitup**		Inspect assembly including alignment of main seams prior to welding.	
22	**Nozzles**		Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of	
23			bolt holes.	
24				
25	**Welding**		Survey welding and back gouging and ensure that approved procedures are followed.	
26	**InspWeld**	**C**	Inspect finished welds for freedom from undercut and surface defects.	
27				
28	**DimChk**	**C**	Check dimensions to approved drawing and code.	
29	**IntFinish**	**C**	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
30				
31	**MPT**	**C**	Check MPT procedure and operators qualifications and survey the testing of all exchanger welds.	
32	**RT**	**C**	Ensure radiography of exchanger welds is in accordance with approved drawing and specified code.	
33			Review radiographs.	
34	**UT**	**C**	Witness ultrasonic examination of welds and review reports.	
35				
36	**HydrT**	**C**	Witness hydraulic test. Check test set up and pressure gauge certificates. Check test water certificate.	
37			Check that the exchanger is clean and dry after testing.	
38				
39	**Final-1**	**C**	Check that the equipment is clean and dry before sealing.	
40	**Final-2**	**C**	Check general workmanship and completeness of supply.	
41	**Final-3**	**C**	Check Paint or other finishes for continuity and against specification.	
42	**Final-4**	**C**	Check copy of nameplate.	
43	**Final-5**	**C**	Check Equipment packed and protected ready for shipment.	
44	**Final-6**		Review Dossier.	
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Client:	**To be determined**
Plant Location:	**To be specified**

Mechanical Datasheet Stripper Overhead Receiver

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	NO. OFF

CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

							Rev
1	**DESIGN & OPERATING DATA**						
2	APPLICATION STANDARD (DESIGN CODE)						
3	PED CONFORMANCE CATEGORY (PREFERED MODULE)						
4	VESSEL SPECIFICATION						
5	GENERAL PROJECT SPECIFICATION FOR MECHANICAL EQUIPMENT						
6	PIPING DESIGN NOZZLE LOADING FOR STATIC EQUIPMENT						
7	SHELL MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS						
8	SHELL MAP (DES. PRESSURE ext.) at top @ TEMPERATURE						
9	SHELL OPERATING PRESSURE @ TEMPERATURE (TOP/BOTTOM)						
10	JACKET MAP (DES. PRESSURE int.) at top @ TEMPERATURE - PS						
11	JACKET MAP (DES. PRESSURE ext.) at top @ TEMPERATURE						
12	JACKET OPERATING PRESSURE @ TEMPERATURE						
13	CORROSION/EROSION ALLOWANCE (internal / external)						
14	STRESS RELIEF/PWHT						
15	RADIOGRAPHY						
16	JOINT COEFFICIENT (PED ESR 7.2)						
17	HYDRAULIC TEST PRESSURE						
18	AIR TEST PRESSURE (with soap suds)						
19	BASIC WIND SPEED						
20	SEISMIC CRITERIA						
21	CYCLIC SERVICE						
22	CREEP RANGE						
23	VESSEL CONTENTS/PED FLUID PHASE & GROUP No.						
24	NATURE OF CONTENTS						
25	MAX. OPERATING STATIC HEAD						
26	INTERNAL FINISH						
27	WELD DRESSING (internal / external)						
28	INTERNAL COATING						
29	EXTERNAL FINISH						
30	EXTERNAL PAINTING						
31	INSULATION (by Vendor)						
32	FIREPROOFING (by site contractor)						
33	INSPECTION AUTHORITY						
34	**MATERIAL SPECIFICATIONS**						
35	HEADS & SHELL			JACKET			
36	CLADDING			SUPPORT SKIRT			
37	BODY FLANGE			EXT. ATTACHMENTS			
38	NOZZLE: FLANGES			FLANGE FINISH			
39	NOZZLE: NECKS			PMA REQUIRED			
40	BOLTING: EXTERNAL			MATERIAL CERTS			
41	BOLTING: INTERNAL			IMPACT TEST REQ.			
42	GASKETS: EXTERNAL			ELONGATION REQ.			
43	GASKETS: INTERNAL			WELDING QUALS			
44	FIXED INTERNALS						
45	REMOVABLE INT'LS						
46	**CAPACITY & WEIGHTS (Vendor to Confirm)**						
47	ESTIM'D WEIGHT FABRICATED (EMPTY)	kg		S.G. OF OPERATING FLUID			
48	ESTIM'D WEIGHT INTERNALS	kg		VOLUME OF OPERATING FLUID	Litres		
49	ESTIM'D WEIGHT ATTACHMENTS (INSULATION)	kg		WEIGHT OF OPERATING FLUID	kg		
50	ESTIM'D WEIGHT INSTALLED (EMPTY)	kg		VESSEL CAPACITY (GROSS)	m^3		
51	ESTIM'D WEIGHT INSTALLED OPERATING	kg		JACKET CAPACITY (GROSS)	m^3		
52	ESTIM'D WEIGHT INSTALLED FULL OF OPERATING FLUID	kg					
53	ESTIM'D WEIGHT INSTALLED FULL OF WATER	kg					

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	Rev
1	**BRANCH DUTY**

	Ref	Service	DN	No Off	Flange	Rating	Standout	Notes
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30 Nozzle standouts are measured from vessel centre-line to flange face.

31	**ADDITIONAL SPECIFICATIONS & STANDARDS**
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51	**NOTES**
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

	NOTES (Continued)	Rev
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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

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CLIENT	**To be determined**	ISSUE				
LOCATION	**To be specified**	QUALITY LEVEL				
PLANT	**To be specified**	DATE				

			INSPECTION TASKS	Rev
1			**INSPECTION TASKS**	
2			All tasks identified below shall be included on the vendors quality plan.	
3			Where inspection task numbers have a suffix "C", a certificate shall be supplied.	
4			These certificates shall be included in the vessel certification dossier.	
5				
6	1.	C	Review material certificates (EN-10204. 3.1 standard.)	
7	2.	-	Check certified chemical & mechanical properties of all materials.	
8	3.	-		
9	4.	C	Check the storage and baking of covered electrodes and fluxes is in accordance with approved welding procedures.	
10	5.	C	Check method of distribution of welding consumables and means of storage on the shop floor.	
11	6.	-		
12	7.	C	Check weld procedures and qualifications.	
13	8.	C	Check weld map and welders qualifications.	
14	9.	-		
15	10.	C	Identify original and transferred certificate/cast numbers of all materials against material certificate/cast numbers.	
16	11.	-		
17	12.	C	Identify heads and check shape, dimensions and thickness.	
18	13.	C	Inspect plates cut to size and check thickness. Inspect plates after forming and check thicknesses of areas susceptible to thinning.	
19	14.	C	Inspect edges of material for weld preparation and for discontinuities and laminations.	
20	15.	-		
21	16.	C	Inspect assembly including alignment of main seams prior to welding.	
22	17.	C	Inspect assembly of nozzles prior to welding for weld preparation, alignment, orientation, flange face and location of bolt holes.	
23	18.	-		
24	19.	C	Inspect production weld test plates (coupon plates) fixed in position. Check weld preparation, material identification and stamping.	
25	20.	C	Survey welding and back gouging and ensure that approved procedures are followed.	
26	21.	C	Witness welding of test plates and review test results.	
27	22.	C	Inspect finished welds for freedom from undercut and surface defects.	
28	23.	-		
29	24.	C	Check dimensions to approved drawing and tolerances given in specifications & design code.	
30	25.	-		
31	26.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
32	27.	-		
33	28.	C	Check DPI procedure and operators qualifications and survey the testing of all vessel welds.	
34	29.	C	Ensure radiography of vessel welds is in accordance with approved drawing and specified code. Review radiographs.	
35	30.	C	Witness ultrasonic examination of welds (if applicable) and review reports.	
36	31.	-		
37	32.	C	Inspect internal finish, weld dressing and shell/nozzle radiuses of flush nozzles.	
38	33.	-	Gauge check vessel internal diameter.	
39	34.	C	Witness hydraulic test. Check test set up and pressure gauge certificates.	
40	35.	-		
41	36.	C	Check that the vessel is clean and dry before sealing	
42	37.	C	Check general workmanship and completeness of supply.	
43	38.	C	Check Paint or other finishes for continuity and against specification.	
44	39.	C	Check copy of nameplate.	
45	40.	C	Check Equipment packed and protected ready for shipment.	
46	41.	-	Review Dossier.	
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