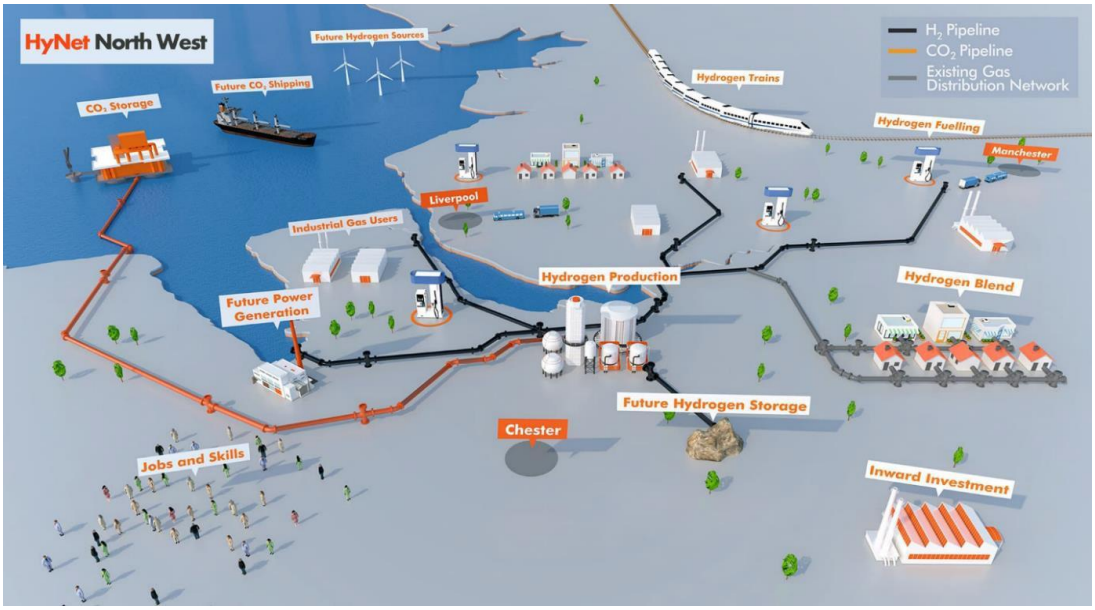
HyNet Low Carbon Hydrogen Plant



EQUIPMENT DATASHEET
MP STEAM BOILER
10-AAJ-B-101

Project Document No: **5194812-000-45ED-4-0013**
Member Document No: **805459-0001-I-45-EDS-0007**

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Revision **: 03** Date **: 15-SEP-2020**

03	15-Sep-2020	Issued for Use	AP	WB	HS	MW
02	27-Aug-2020	Issued for Consortium Review	WB	AP	HS	MW
01	16-Jul-2020	Issued for Internal Review	WB	AP	HS	MW
REV	**DATE**	**ISSUE DESCRIPTION**	**AUTHOR**	**CHECKER**	**QA/QC/SHSE**	**APPROVER**

PROJECT DOC NO: **5194812-000-45ED-4-0013**	REVISION: **03**	DATE: **15-SEP-2020**	
MEMBER DOC NO: **805459-0001-I-45-EDS-0007**	REVISION: **C1**		
DOCUMENT TITLE: **STEAM BOILER DATASHEET**		PAGE: **2 OF 17**	

REVISION	COMMENTS
01	Issued for Internal Review.
02	Issued for Consortium Review.
03	Issued for Use.

HOLDS	
HOLD DESCRIPTION / REFERENCE	
HOLD 1	SNC-Lavalin & JM Piping / Layout to confirm available plot space later. 10m x 10m assumed currently.
HOLD 2	Stack height and restrictions to be confirmed later. 15m tall self supported required at this time.

The holds section is only to be used during document development and can be removed once all holds are released and the document is approved for use.

ACRONYMS	
ACRONYM	**DESCRIPTION**
HHV	Higher Heating Value
JM	Johnson Matthey
LHV	Lower Heating Value
MCR	Maximum Continuous Rating
MP	Medium Pressure
STA	SUPPLIER to Advise
STC	SUPPLIER to Confirm
TBC	To Be confirmed
TOC	Total Organic Carbon

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Technical Data Sheet

WATER TUBE STEAM BOILER DATA SHEET

PROJECT No.	5194812	**DOCUMENT No.**	5194812-000-45ED-4-0013
PROJECT NAME	Hynet Low Carbon Hydrogen Plant	**REVISION**	03
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Rev											
	1	UNIT	**MP Steam Boiler**			NUMBER REQUIRED	**1**				
	2	MANUFACTURER	**TBC**			SERVICE	**MP Steam Boiler**				
	3	TYPE OF BOILER	**30 T/h Water tube for outdoor operation**			CLIENT	**ESSAR OIL (UK) LIMITED**				
	4	MAXIMUM CONTINUOUS RATING	**22.0**	MW		LOCATION	**Stanlow Refinery NW England**				
	5	**PROCESS DESIGN CONDITIONS (SEE NOTE P1)**									
	6	OPERATING CASE				**MCR**	**PEAK**	**MIN**			
	7	MAXIMUM STEAM FLOW		kg/h			**MCR + 10%**	**40%**			
	8	FEEDWATER TEMPERATURE		°C		**PROCESS DATA AS PER 5194812-100-49ED-3-0005**					
	9	FEEDWATER PRESSURE		barg							
	10	OUTLET STEAM TEMPERATURE		°C							
	11	OUTLET STEAM PRESSURE		barg		**(SEE NOTE P1)**					
	12	REQUIRED STEAM PURITY (MAXIMUM CONTAMINANTS)		ppm							
	13	TOTAL PRESSURE DROP, ALLOWABLE (CLEAN / FOULED)		bar							
	14	TOTAL PRESSURE DROP, CALCULATED (CLEAN / FOULED)		bar							
	15										
	16	**FEEDWATER QUALITY**	FEEDWATER FROM:			**Deaerator**					
	17	Conductivity at 25C		MicroS/cm		**0.2**					
	18	Hardness		mg/kg		**0.02**					
	19	Carbon Dioxide at Co2		mg/kg		**None**					
	20	pH at 25C		mg/kg		**>9**					
	21	Oxygen		mg/kg		**0.02**					
	22	Silica as SiO2		mg/kg		**0.02**					
	23	total Iron as Fe		mg/kg		**0.05**					
	24	Total Copper as Cu		mg/kg		**0.01**					
	25	Potassium permanganate consumption		mg/kg		**10.0**					
	26	oil		mg/kg		**1.0**					
	27										
	28										
	29	**SECTION**				**SUPERHEATER 10-AAJ-E-108**	**MP STEAM BOILER 10-AAJ-E-107**	**BFW PRE-HEATER 10-AAJ-E-109**			
	30	HEAT ABSORPTION		MW							
	31	MASS FLOW RATE		kg/h							
	32	INLET TEMPERATURE		°C							
	33	OUTLET TEMPERATURE		°C							
	34	INLET PRESSURE		barg							
	35	PRESSURE DROP, CALCULATED (CLEAN / FOULED)		bar							
	36	AVERAGE FLUX DENSITY, ALLOWABLE		W/m^2							
	37	AVERAGE FLUX DENSITY, CALCULATED		W/m^2							
	38	MAXIMUM FLUX DENSITY (BARE TUBE)		W/m^2							
	39	MAXIMUM ALLOW./ CALC. INSIDE FILM TEMPERATURE		°C							
	40	FOULING FACTOR	(INTERNAL / EXTERNAL)	m^2 K/W							
	41										
	42										
	43										
	44	**NOTES:**	**All Proces data contained within JM Process datasheet 5194812-100-49ED-3-0005.**								
	45										
	46										
	47										

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Rev		BOILER PERFORMANCE			MCR	PEAK	MIN	
	1	OPERATION						
	2	FUEL			FUEL COMPOSITION SHOWN IN 5194812-100-49ED-3-0005			
	3	EVAPORATION		kg/h				
	4	BLOWDOWN		kg/h				
	5	FEEDWATER		kg/h				
	6	TEMPERATURE OF FEEDWATER		°C				
	7	TEMPERATURE OF WATER LEAVING ECONOMISER		°C				
	8	TEMPERATURE OF STEAM LEAVING DRUM		°C				
	9	TEMPERATURE OF STEAM LEAVING SUPERHEATER		°C				
	10	STEAM PURITY		ppm				
	11	PRESSURE OF STEAM LEAVING DRUM		barg				
	12	PRESSURE OF STEAM LEAVING SUPERHEATER		barg				
	13	PRESSURE DROP IN ECONOMISER		bar				
	14	PRESSURE DROP IN SUPERHEATER		bar				
	15	FUEL FLOW	kg/h /	Nm³/h				
	16	HEAT RELEASE		W/m³				
	17							
	18	EXCESS AIR		%				
	19	AIR WEIGHT ENTERING FAN		kg/h				
	20	AIR WEIGHT LEAVING AIR PREHEATER		kg/h				
	21	GAS WEIGHT LEAVING BOILER		kg/h				
	22	GAS WEIGHT LEAVING AIR PREHEATER		kg/h				
	23							
	24	TEMPERATURE OF AIR ENTERING FAN		°C	AMBIENT AIR: TEMP 35 Max / -15 Min			
	25	TEMPERATURE OF AIR ENTERING AIR PREHEATER		°C				
	26	TEMPERATURE OF AIR LEAVING AIR PREHEATER		°C				
	27	TEMPERATURE OF GAS LEAVING ECONOMISER		°C				
	28	TEMPERATURE OF GAS LEAVING AIR PREHEATER (UNCORR.)		°C				
	29	TEMPERATURE OF GAS LEAVING AIR PREHEATER (CORR.)		°C				
	30							
	31	DRAFT LOSSES:	FURNACE	Pa				
	32		SUPERHEATER	Pa				
	33		BOILER	Pa				
	34		ECONOMIZER	Pa				
	35		AIR HEATER	Pa				
	36		DUCTS	Pa				
	37		PRECIPITATOR	Pa				
	38		TOTAL	Pa				
	39							
	40	AIR LOSSES:	BURNERS	Pa				
	41		DUCTS	Pa				
	42		AIR HEATER	Pa				
	43		TOTAL	Pa				
	44							
	45	HEAT LOSSES:	DRY GAS	%				
	46		WATER IN FUEL	%				
	47		UNBURNED COMBUSTIBLE	%				
	48		RADIATION	%				
	49		MARGIN	%				
	50		TOTAL	%				
	51							
	52	OVERALL EFFICIENCY		%				
	53							
	54	**REMARKS:**						
	55							

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Rev		COMBUSTION DESIGN CONDITIONS						
	1	OPERATING CASE			MCR	PEAK	MIN	
	2	TYPE OF FUEL			FUEL COMPOSITION SHOWN IN 5194812-100-49ED-3-0005			
	3	EXCESS AIR		%				
	4	CALCULATED HEAT RELEASE (LHV)		MW				
	5	FUEL EFFICIENCY CALCULATED (LHV)		%				
	6	FUEL EFFICIENCY GUARANTEED (LHV)		%				
	7	RADIATION LOSS, % OF HEAT RELEASE (LHV)		%				
	8	FLUE GAS TEMPERATURE LEAVING	SUPERHEATER	°C				
	9		CONVECTION SECTION	°C				
	10		ECONOMISER	°C				
	11		AIR PREHEATER	°C				
	12	FLUE GAS QUANTITY		kg/h				
	13	FLUE GAS MASS VELOCITY THROUGH CONVECTION SECTION		kg/s m²				
	14	DRAFT	AT ARCH	Pa				
	15		AT BURNERS	Pa				
	16	AMBIENT AIR TEMPERATURE, EFFICIENCY CALCULATION		°C				
	17	AMBIENT AIR TEMPERATURE, STACK DESIGN		°C				
	18	ALTITUDE ABOVE SEA LEVEL		m				
	19	VOLUMETRIC HEAT RELEASE (LHV)		W/m³				
	20	EMISSION LIMITS (DRY):	CORRECTED TO 3% O_2	mg/m³	NO_X: **50**	CO: **50**	SO_X:	
	21		(LHV) (HHV)	kJ/kg	UHC:	Particulates:		
	22	FUEL CHARACTERISTICS (See Note P1)						
	23	GAS TYPE **Hydrogen Rich process gas**		LIQUID TYPE		OTHER TYPE **(start-up) Natural Gas**		
	24	LHV kJ/kg kJ/Nm³		LHV kJ/kg kJ/Nm³		LHV kJ/kg kJ/Nm³		
	25	HHV kJ/kg kJ/Nm³		HHV kJ/kg kJ/Nm³		HHV kJ/kg kJ/Nm³		
	26	PRESSURE @ BURNER barg		PRESSURE @ BURNER barg		PRESSURE @ BURNER barg		
	27	TEMPERATURE @ BURNER °C		TEMPERATURE @ BURNER °C		TEMPERATURE @ BURNER °C		
	28	RELATIVE MOLECULAR WEIGHT		VISCOSITY @ °C mPa-s		RELATIVE MOLECULAR WEIGHT		
	29			ATOMIZING STEAM TEMP. °C				
	30	COST OF FUEL US$/Nm³		ATOMIZING STEAM PRESSURE barg		COST OF FUEL US$/Nm³		
	31	US$/kg		COST OF FUEL US$/kg		US$/kg		
	32	COMPONENT	MOLE %	COMPONENT	WEIGHT %	COMPONENT	WEIGHT %	
	33							
	34							
	35							
	36			VANADIUM ppm				
	37			SODIUM ppm				
	38			SULPHUR				
	39			ASH				
	40	BURNER DATA						
	41	MANUFACTURER		SIZE / MODEL NO		NUMBER		
	42	TYPE		LOCATION		ORIENTATION		
	43	HEAT RELEASE / BURNER: MW		DESIGN NORMAL		MINIMUM		
	44	PRESSURE DROP ACROSS BURNER @ DESIGN HEAT RELEASE			Pa			
	45	DISTANCE BURNER CENTRE LINE TO TUBE CENTRE LINE:		HORIZONTAL	mm	VERTICAL	mm	
	46	DISTANCE BURNER CENTRE LINE TO UNSHIELDED REFRACTORY:		HORIZONTAL	mm	VERTICAL	mm	
	47	PILOT, TYPE		CAPACITY	MW	FUEL		
	48	IGNITION METHOD :						
	49	FLAME DETECTION TYPE		LOCATION		NUMBER		
	50	**REMARKS:**						
	51							
	52							
	53							

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Technical Data Sheet

WATER TUBE STEAM BOILER DATA SHEET

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Rev														
		MECHANICAL DESIGN CONDITIONS												
	1	PLOT LIMITATIONS	**10m x 10m (HOLD 1)**					STACK LIMITATIONS	**Self supported > 15m tall (HOLD 2)**					
	2	TUBE LIMITATIONS	**Tube design to ASME VIII Div. 1**					NOISE LIMITATIONS	**85**	dB(A)	@	**1**	m	
	3	STRUCTURAL DESIGN DATA	WIND VELOCITY	**23**		m/s		WIND OCCURANCE	**Prevailing wind from SW - Max Gust 168km/h**					
	4		SNOW LOAD	**0.5**		kg/m²		SEISMIC ZONE	**nil**					
	5	MIN / NORM / MAX AMBIENT AIR TEMPERATURE		**-15**	**20**	**35**	°C	RELATIVE HUMIDITY	**Min 40 / Max 100**					%
	6	**BOILER SECTION**						**BOILER**	**SUPERHEATER**		**ECONOMISER**			
	7	SERVICE / TAG NUMBER						**10-AAJ-E-107**	**10-AAJ-E-108**		**TBA**			
	8	**COIL DESIGN**												
	9	DESIGN BASIS: TUBE WALL THICKNESS (CODE OR SPEC.)						**ASME VIII Div. 1**						
	10	RUPTURE STRENGTH (MINIMUM OR AVERAGE)												
	11	STRESS-TO-RUPTURE BASIS					hr							
	12	DESIGN PRESSURE, ELASTIC / RUPTURE					barg							
	13	DESIGN FLUID TEMPERATURE					°C							
	14	TEMPERATURE ALLOWANCE					°C							
	15	CORROSION ALLOWANCE, TUBES / FITTINGS					mm							
	16	HYDROSTATIC TEST PRESSURE					barg	**PER CODE**						
	17	POST WELD HEAT TREATMENT (YES OR NO)						**PER CODE**						
	18	PERCENT OF WELDS FULLY RADIOGRAPHED					%	**PER CODE**						
	19	MAXIMUM (CLEAN) TUBE METAL TEMPERATURE					°C							
	20	DESIGN TUBE METAL TEMPERATURE					°C							
	21	INSIDE FILM COEFFICIENT					W/m².K							
	22	**COIL ARRANGEMENT**												
	23	TUBE ORIENTATION: (VERTICAL / HORIZONTAL OR ANGLE)												
	24	TUBE MATERIAL (ASTM SPECIFICATION AND GRADE)												
	25	TUBE OUTSIDE DIAMETER					mm							
	26	TUBE WALL THICKNESS, (MINIMUM) (AVERAGE)					mm							
	27	NUMBER OF FLOW PASSES												
	28	NUMBER OF TUBES												
	29	NUMBER OF TUBES / ROW (CONVECTION SECTION)												
	30	OVERALL TUBE LENGTH					m							
	31	EFFECTIVE TUBE LENGTH					m							
	32	BARE TUBES	NUMBER											
	33		TOTAL EXPOSED SURFACE				m²							
	34	EXTENDED SURFACE TUBES	NUMBER											
	35		TOTAL EXPOSED SURFACE				m²							
	36	TUBE LAYOUT (IN LINE OR STAGGERED)												
	37	TUBE SPACING, CENT.-CENT.: HORIZ. x DIAG. (OR VERT.)					mm							
	38	TUBE SPACING, CENT. TO FURNACE WALL (MIN.)					mm							
	39	CORBELS (YES OR NO)												
	40	CORBEL WIDTH					mm							
	41	**DESCRIPTION OF EXTENDED SURFACE**												
	42	TYPE : (STUDS) (SERRATED FINS) (SOLID FINS)												
	43	MATERIAL												
	44	DIMENSIONS (HEIGHT x DIAMETER / THICKNESS)					mm							
	45	SPACING (FINS / m) (STUDS / PLANE)												
	46	MAXIMUM TIP TEMPERATURE (CALCULATED)					°C							
	47	EXTENSION RATIO (TOTAL AREA / BARE AREA)												
	48	**DRUMS**						**STEAM DRUM - 10-AAJ-V-110**						
	49	INTERNAL DIAMETER					mm							
	50	LENGTH					mm							
	51	VOLUME					m³							
	52	DESIGN PRESSURE					barg	**47.5 Max / FV Min**						
	53	DESIGN TEMPERATURE					°C	**256 Max / -20 MDMT**						
	54	TUBESHEET THICKNESS					mm							
	55	WRAPPER THICKNESS					mm							
	56	TYPE OF INTERNALS												
	57	STEAM PURITY (AMOUNT OF SOLIDS OR OTHER CONTAMINANTS)					ppm							
	58	VESSEL DATA SHEET REFERENCE:						**5194812-100-49ED-3-0005**						

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Rev		MECHANICAL DESIGN CONDITIONS (continued)											
	1	**REFRACTORY DESIGN BASIS**											
	2	AMBIENT TEMPERATURE	**35 / -15**	°C	WIND VELOCITY	**23**	m/s	CASING TEMPERATURE					°C
	3	**EXPOSED VERTICAL WALLS**											
	4	LINING THICKNESS		mm	HOT FACE TEMPERATURE:		DESIGN		°C		CALCULATED		°C
	5	WALL CONSTRUCTION											
	6												
	7	ANCHOR (MATERIAL & TYPE)											
	8	CASING MATERIAL:			THICKNESS		mm	TEMPERATURE					°C
	9	**SHIELDED VERTICAL WALLS**											
	10	LINING THICKNESS		mm	HOT FACE TEMPERATURE:		DESIGN		°C		CALCULATED		°C
	11	WALL CONSTRUCTION											
	12												
	13	ANCHOR (MATERIAL & TYPE)											
	14	CASING MATERIAL:			THICKNESS		mm	TEMPERATURE					°C
	15	**ARCH**											
	16	LINING THICKNESS		mm	HOT FACE TEMPERATURE:		DESIGN		°C		CALCULATED		°C
	17	WALL CONSTRUCTION											
	18												
	19	ANCHOR (MATERIAL & TYPE)											
	20	CASING MATERIAL:			THICKNESS		mm	TEMPERATURE					°C
	21	**FLOOR**											
	22	LINING THICKNESS		mm	HOT FACE TEMPERATURE:		DESIGN		°C		CALCULATED		°C
	23	FLOOR CONSTRUCTION											
	24												
	25	CASING MATERIAL:			THICKNESS		mm	TEMPERATURE					°C
	26	MINIMUM FLOOR ELEVATION		m	FREE SPACE BELOW PLENUM								m
	27	**CONVECTION SECTION**											
	28	LINING THICKNESS		mm	HOT FACE TEMPERATURE:		DESIGN		°C		CALCULATED		°C
	29	WALL CONSTRUCTION											
	30												
	31	ANCHOR (MATERIAL & TYPE)											
	32	CASING MATERIAL:			THICKNESS		mm	TEMPERATURE					°C
	33	**INTERNAL WALL**											
	34	TYPE			MATERIAL								
	35	DIMENSIONS: HEIGHT		mm	WIDTH		mm						

		DUCTS	**FLUE GAS**			**COMBUSTION AIR**	
	36						
	37	LOCATION / SECTION					
	38	SIZE OR NET FREE AREA m or m²					
	39	CASING MATERIAL					
	40	CASING THICKNESS mm					
	41	LINING INTERNAL / EXTERNAL					
	42	THICKNESS mm					
	43	MATERIAL					
	44	ANCHOR MATERIAL					
	45	ANCHOR TYPE					
	46	CASING TEMPERATURE °C					

	47	**PLENUM CHAMBER (AIR) :**					
	48	TYPE OF PLENUM (COMMON OR INTEGRAL)					
	49	CASING MATERIAL:	THICKNESS	mm	SIZE		mm
	50	LINING MATERIAL			THICKNESS		mm
	51	ANCHOR (MATERIAL & TYPE)					
	52	**NOTES:**					
	53						
	54						
	55						
	56						

Rev		MECHANICAL DESIGN CONDITIONS (continued)											
	1	**STACK OR STACK HUB**											
	2	NUMBER	**1 OFF**		SELF-SUPPORTED OR GUYED	**Self Supported**		LOCATION	**Part of Package**				
	3	CASING MATERIAL			CORROSION ALLOWANCE		mm	MINIMUM THICKNESS		mm			
	4	INSIDE METAL DIAMETER		m	HEIGHT ABOVE GRADE	**0**	m	STACK LENGTH	**15 (HOLD 2)**	m			
	5	LINING MATERIAL						THICKNESS		mm			
	6	ANCHOR (MATERIAL AND TYPE)											
	7	EXTENT OF LINING			INTERNAL OR EXTERNAL								
	8	DESIGN FLUE GAS VELOCITY		m/s	FLUE GAS TEMPERATURE		°C						
	9	**DAMPERS**											
	10	LOCATION											
	11	TYPE (CONTROL, TIGHT SHUT-OFF, ETC.)											
	12	MATERIAL: BLADE											
	13	SHAFT											
	14	MULTIPLE / SINGLE LEAF											
	15	OPERATION (MANUAL OR AUTO)											
	16	OPERATOR TYPE (CABLE OR PNEUMATIC)											
	17	**MISCELLANEOUS**											
	18	**PLATFORMS:** LOCATION	NUMBER		WIDTH		LENGTH / ARC	STAIRS / LADDER		ACCESS FROM			
	19	**SACK PLATFORMS**	**1**					**Ladder**		**Grade**			
	20	**PACKAGE SKID (STA)**											
	21	**PACKAGE SKID (STA)**											
	22												
	23												
	24	TYPE OF FLOORING											
	25	**DOORS**			NUMBER		LOCATION	SIZE		BOLTED / HINGED			
	26	ACCESS											
	27												
	28	OBSERVATION											
	29												
	30	TUBE REMOVAL											
	31												
	32	**INSTRUMENT CONNECTIONS**			REQUIRED		NUMBER	SIZE		TYPE			
	33	COMBUSTION AIR TEMPERATURE			**YES**								
	34	FLUE GAS TEMPERATURE			**YES**								
	35	COMBUSTION AIR PRESSURE			**YES**								
	36	FLUE GAS AIR PRESSURE			**NO**								
	37	FLUE GAS SAMPLE	**(O2 / Nox Analyser)**		**YES**		**4**						
	38	SNUFFING STEAM / PURGE			**STA**								
	39	FUEL GAS PRESSURE			**YES**								
	40	INSTRUMENT AIR PRESSURE			**YES**								
	41	VENTS / DRAINS			**YES / YES**								
	42	PROCESS FLUID TEMPERATURE / PRESSURE			**YES / YES**								
	43	TUBESKIN THERMOCOUPLES			**STA**								
	44	**PAINTING REQUIREMENTS**	**SURFACE PREPARATION, PAINTING AND COATING SHALL BE AS PER 000761-0009-T-ME-SPE-0020**										
	45	INTERNAL COATING											
	46	GALVANIZING REQUIREMENTS											
	47	ARE PAINTERS TROLLEY & RAIL INCLUDED?	**Not Required**										
	48	SPECIAL EQUIPMENT:	SOOT BLOWERS										
	49		AIR PREHEATER										
	50		FAN(S)										
	51		OTHER										
	52												
	53	**NOTE 1. ADDITIONAL PRESSURE CONNECTIONS TO BE SUPPLIED:**	**BURNER FLOOR**										
	54		**UPSTREAM & DOWNSTREAM OF CONVECTION SECTION**										
	55		**UPSTREAM & DOWNSTREAM OF DAMPERS**										
	56	**NOTE 2. ADDITIONAL TEMPERATURE CONNECTIONS IN FLUE GAS EXIT FROM RADIANT SECTION TO PROVIDE ALARM AND TRIP ON HIGH TEMPERATURE.**											
	57												
	58	NOTE 3. EMISSION MONITORING IN THE STACKS TO COMPLY WITH THE REQUIREMENTS OF BS EN 15259:2007.											

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Rev		NOTES
	1	
	2	**MECHANICAL NOTES**
	3	
	4	**M1** The boiler is classified as "Safe" in accordance with API RP 505. 2018: However around any valve or flange containing flammable fluid to a radius of 3m
	5	shall be defined as "hazardous" area Zone 1, IIC, T4.
	6	
	7	**M2** SUPPLIER shall complete the data in this equipment datasheet and submit with his proposal.
	8	
	9	**M3** SUPPLIER shall advise if DeNOx unit is required to meet the emissions restrictions at the site location. If DeNOx unit is required, SUPPLIER shall include the aqueous amm
	10	information (flow, temp, etc.) required for PURCHASER to ensure supply from outside the Boiler package boundary.
	11	
	12	
	13	**PROCESS NOTES**
	14	**P1** See JM Process datasheet 5194812-100-49ED-3-0005.
	15	
	16	**P2** Estimated Emissions to atmosphere via the fluegas stack. SUPPLIER shall confirm.

			Units	NG firing	Tailgas firing	
17						
18		Flowrate – normal	kNm³/hr	**24.9**	**24.9**	
19		Flowrate – design	kNm³/hr	**30.8**	**30.8**	
20		Temperature	°C	**140**	**140**	
21		**Composition**				
22		Water	mol %		**30.35**	
23		Carbon Dioxide	mol %		**2.3**	
24		Oxygen	mol %		**1.39**	
25		NO_x (ppmv)	ppmv	**20**	**20**	
26		SO_2 (ppmv)	ppmv	**0.5**	**5-35**	
27		Particulates (yearly average)	ppmv	**5**	**5**	
28		CO	ppmv	**<5-30 (Indicative), <100**	**<5-30 (Indicative), <100**	
29		Ammonia	ppmv	**<5-15**		
30		HCl	ppmv		**<1-5 av samples/yr**	
31		HF	ppmv		**<1-2 av samples/yr**	
32		PCDD/F	ppmv		**<0.012 - 0.036 ng I-TEQ/Nm3'**	
33		VOC	ppmv		**0.6 - 12**	

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Technical Data Sheet

BURNER DATA SHEET

Based on API 560 4th Edition (ISO 13705:2006)

PROJECT No.	5194812	**DOCUMENT No.**	5194812-000-45ED-4-0013
PROJECT NAME	Hynet Low Carbon Hydrogen Plant	**REVISION**	03
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Rev							
	1	**GENERAL DATA**					
	2	TYPE OF HEATER					
	3	ALTITUDE ABOVE SEA LEVEL	m	**0**			
	4	AIR SUPPLY					
	5	AMBIENT / PREHEATED AIR / GAS TURBINE EXHAUST		**AMBIENT**			
	6	TEMERATURE (MINIMUM / MAXIMUM / DESIGN)	°C	**-15**	**20**	**35**	
	7	RELATIVE HUMIDITY	%	**Min 40 / Max 100**			
	8	DRAFT TYPE: FORCED / NATURAL / INDUCED		**FORCED (STC)**			
	9	DRAFT AVAILABLE: ACROSS BURNER	Pa				
	10	ACROSS PLENUM	Pa				
	11	REQUIRED TURNDOWN		**40% applied to duty and flow**			
	12	BURNER WALL LINING THICKNESS	mm				
	13	HEATER CASING THICKNESS	mm				
	14	FIREBOX HEIGHT	m				
	15	TUBE CIRCLE DIAMETER	m				
	16	**BURNER DATA**					
	17	MANUFACTURER					
	18	TYPE OF BURNER					
	19	MODEL / SIZE					
	20	DIRECTION OF FIRING					
	21	LOCATION (ROOF / FLOOR / SIDEWALL)					
	22	NUMBER REQUIRED					
	23	MINIMUM DISTANCE BURNER CENTRELINE					
	24	TO TUBE CENTRELINE (HORIZONTAL / VERTICAL)	m				
	25	TO ADJACENT BURNER CENTRELINE (HORIZONTAL / VERT.)	m				
	26	TO UNSHIELDED REFRACTORY (HORIZONTAL / VERTICAL)	m				
	27	BURNER CIRCLE DIAMETER	m				
	28	PILOTS					
	29	NUMBER REQUIRED					
	30	TYPE					
	31	IGNITION METHOD					
	32	FUEL					
	33	FUEL PRESSURE	barg				
	34	CAPACITY	MW				
	35	**OPERATING DATA**					
	36	FUEL		**FUEL COMPOSITION SHOWN IN 5194812-100-49ED-3-0005**			
	37	HEAT RELEASE PER BURNER:					
	38	DESIGN (LHV)	MW				
	39	NORMAL (LHV)	MW				
	40	MINIMUM (LHV)	MW				
	41	EXCESS AIR @ DESIGN HEAT RELEASE	%				
	42	AIR TEMPERATURE	°C				
	43	DRAFT LOSS					
	44	DESIGN	Pa				
	45	NORMAL	Pa				
	46	MINIMUM	Pa				
	47	FUEL PRESSURE REQUIRED	barg				
	48	FLAME LENGTH @ DESIGN HEAT RELEASE	m				
	49	FLAME SHAPE (ROUND, FLAT, ETC.)					
	50	ATOMIZING MEDIUM / OIL RATIO	kg/kg				
	51	**NOTES**					
	52						
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Technical Data Sheet

BURNER DATA SHEET

Based on API 560 4th Edition (ISO 13705:2006)

PROJECT No.	5194812
PROJECT NAME	Hynet Low Carbon Hydrogen Plant

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Rev		GAS FUEL CHARACTERISTICS (See Note P1)				
	1	FUEL TYPE				
	2	HEATING VALUE	(LHV)	kJ/kg	kJ/Nm³	
	3	RELATIVE DENSITY (AIR = 1.0)				
	4	MOLECULAR WEIGHT				
	5	FUEL TEMPERATURE @ BURNER			°C	
	6	FUEL PRESSURE; AVAILABLE @ BURNER			barg	
	7	FUEL GAS COMPOSITION:	H_20		Mole %	
	8		H_2S		Mole %	
	9		H_2		Mole %	
	10		C_1		Mole %	FUEL COMPOSITION SHOWN IN 5194812-100-49ED-3-0005
	11		C_2=		Mole %	
	12		C_2		Mole %	
	13		C_3=		Mole %	
	14		C_3		Mole %	
	15		C_4=		Mole %	
	16		iC_4		Mole %	
	17		nC_4		Mole %	
	18				Mole %	
	19					
	20	TOTAL			Mole %	
	21	LIQUID FUEL CHARACTERISTICS				
	22	FUEL TYPE				
	23	HEATING VALUE	(LHV)	kJ/kg	kJ/Nm³	
	24	SPECIFIC GRAVITY			@ 15 °C	
	25	H/C RATIO (BY WEIGHT)				
	26	VISCOSITY AT		°C	mPa-s	
	27	VISCOSITY AT		°C	mPa-s	
	28	VANADIUM			ppm	
	29	POTASSIUM			ppm	
	30	SODIUM			ppm	
	31	NICKEL			ppm	
	32	FIXED NITROGEN			ppm	
	33	SULPHUR			% wt	
	34	ASH			% wt	
	35	WATER			% wt	
	36	LIQUIDS: ASTM INITIAL BOILING POINT			°C	
	37	ASTM MID-POINT			°C	
	38	ASTM END POINT			°C	
	39	FUEL TEMPERATURE @ BURNER			°C	
	40	FUEL PRESSURE AVAILABLE @ BURNER			barg	
	41	ATOMIZING MEDIUM: AIR / STEAM / MECHANICAL				
	42	TEMPERATURE			°C	
	43	PRESSURE			barg	
	44	**NOTES**				
	45					
	46					
	47					
	48					

PROJECT No.	5194812	**DOCUMENT No.**	5194812-000-45ED-4-0013
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Rev		MISCELLANEOUS			
	1	BURNER PLENUM	COMMON / INTEGRAL		
	2		MATERIAL		
	3		PLATE THICKNESS	mm	
	4		INTERNAL INSULATION		
	5	INLET AIR CONTROL	DAMPER OR REGISTERS		
	6		MODE OF OPERATION		
	7		LEAKAGE	%	
	8	BURNER TILE	COMPOSITION		
	9		MINIMUM SERVICE TEMPERATURE	°C	
	10	NOISE SPECIFICATION			**85 dB(A) @ 1 m**
	11	ATTENUATION METHOD			
	12	PAINTING REQUIREMENTS			**AS PER 000761-0009-T-ME-SPE-0020**
	13	IGNITION PORT	SIZE / NO		
	14	SIGHT PORT	SIZE / NO		
	15	FLAME DETECTION	TYPE		
	16		NUMBER		
	17	SCANNER CONNECTION	SIZE / NO		
	18	SAFETY INTERLOCK SYSTEM FOR ATOMIZING MEDIUM & OIL			
	19	PERFORMANCE TEST REQUIRED (YES OR NO)			**YES (on 1 Burner only if multpile supplied)**
	20	**EMISSION LIMITS (See Note P2)**			
	21	FIREBOX BRIDGEWALL TEMPERATURE		°C	
	22	NOx	(LHV) (HHV) mg/Nm³ or	g/GJ	
	23	CO	(LHV) (HHV) mg/Nm³ or	g/GJ	
	24	UHC	(LHV) (HHV) mg/Nm³ or	g/GJ	
	25	PARTICULATES	(LHV) (HHV)	g/GJ	
	26	SOx	(LHV) (HHV) mg/Nm³ or	g/GJ	
	27				
	28	CORRECTED TO 3% O_2 (DRY BASIS @ DESIGN HEAT RELEASE)			
	29				
	30	**NOTE 1**	**AT DESIGN CONDITIONS, MINIMUM OF 90% OF THE AVAILABLE DRAFT WITH AIR REGISTER FULLY OPEN SHALL BE UTILIZED ACROSS THE BURNER. IN ADDITION, A MINIMUM OF 75% OF THE AIR SIDE PRESSURE DROP WITH AIR REGISTERS FULL OPEN SHALL BE UTILISED ACROSS BURNER THROAT.**		
	31				
	32	**NOTE 2**	**SUPPLIER TO GUARANTEE BURNER FLAME LENGTH.**		
	33				
	34	**NOTE 3**	**SUPPLIER TO GUARANTEE EXCESS AIR, HEAT RELEASE AND DRAFT LOSS ACROSS BURNER.**		
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Technical Data Sheet

AIR-PREHEATER DATA SHEET

Based on API 560 4th Edition (ISO 13705:2006)

PROJECT No.	5194812	**DOCUMENT No.**	5194812-000-45ED-4-0013
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Rev								
	1	MANUFACTURER						
	2	MODEL						
	3	NUMBER REQUIRED						
	4	HEATING SURFACE			m²			
	5	WEIGHT			kg			
	6	APPROXIMATE DIMENSIONS (H x W x L)			mm	x	x	
	7	**PERFORMANCE DATA**						
	8	OPERATING CASE				**MCR**	**PEAK**	**MIN**
	9	AIR SIDE:	FLOW ENTERING		kg/h			
	10		INLET TEMP		°C			
	11		OUTLET TEMP		°C			
	12		PRESSURE DROP ALLOWED		Pa			
	13		PRESSURE DROP CALCULATED		Pa			
	14		HEAT ABSORBED		MW			
	15	FLUE GAS SIDE:	FLOW ENTERING		kg/h			
	16		INLET TEMP		°C			
	17		OUTLET TEMP		°C			
	18		PRESSURE DROP ALLOWED		Pa			
	19		PRESSURE DROP CALCULATED		Pa			
	20		HEAT ABSORBED		MW			
	21	AIR BYPASS			kg/h			
	22	TOTAL AIR FLOW TO BURNERS			kg/h			
	23	MIX AIR TEMPERATURE			°C			
	24	FLUE GAS COMPOSITION:	O_2		mole %			
	25		N_2		mole %			
	26		H_20		mole %			
	27		CO_2		mole %			
	28		Ar		mole %			
	29		SO_x		mole %			
	30	FLUE GAS SPEC HEAT			kJ/kg.K			
	31	FLUE GAS ACID DEW POINT TEMPERATURE			°C			
	32	MINIMUM METAL TEMPERATURE:	ALLOWABLE		°C			
	33		CALCULATED		°C			
	34	**MISCELLANEOUS**						
	35	MINIMUM AMBIENT AIR TEMPERATURE			°C	**-15**		
	36	SITE ELEVATION ABOVE SEA LEVEL			m	**0**		
	37	RELATIVE HUMIDITY			%	**100% MAX / 40% Min**		
	38	EXTERNAL COLD AIR BY-PASS (YES / NO)						
	39	COLD END THERMOCOUPLES (YES / NO) NUMBER REQUIRED						
	40	ACCESS DOORS: NUMBER / SIZE / LOCATION						
	41	INSULATION (INTERNAL / EXTERNAL)						
	42	CLEANING MEDIUM	STEAM OR WATER			**WATER preferred (STC)**		
	43		PRESSURE		bar			
	44		TEMPERATURE		°C			
	45	**MECHANICAL DESIGN:**						
	46	DESIGN FLUE GAS TEMPERATURE			°C			
	47	DESIGN PRESSURE DIFFERENTIAL			Pa			
	48	SIESMIC FACTOR						
	49	PAINTING REQUIREMENTS				**AS PER 000761-0009-T-ME-SPE-0020**		
	50	LEAK TEST						
	51	STRUCTURAL WIND LOAD			kg/m²	**Design Wind Speed 23 m/s**		
	52	AIR LEAKAGE (GUARANTEED)			%			
	53	**NOTES:** (All data on per unit basis.)						
	54							

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Rev		CONSTRUCTION DATA				
	1	**I CAST IRON:**				
	2		NUMBER OF PASSES			
	3		NUMBER OF TUBES PER BLOCK			
	4		NUMBER OF BLOCKS			
	5		TYPE OF SURFACE			
	6		TUBE MATERIAL			
	7		TUBE THICKNESS	mm		
	8		GLASS BLOCK (YES/NO)			
	9		NUMBER OF GLASS TUBES			
	10	AIR CROSS OVER DUCT:	NUMBER			
	11		BOLTED / WELDED			
	12		SUPPLIED WITH CLIPS			
	13	WATER WASH	YES/NO			
	14		TYPE (OFF-LINE OR ON-LINE)			
	15		LOCATION			
	16					
	17	**II PLATE TYPE:**				
	18		NUMBER OF PASSES			
	19		NUMBER OF PLATES PER BLOCK			
	20		NUMBER OF BLOCKS			
	21		PLATE THICKNESS	mm		
	22		WIDTH OF AIR CHANNEL	mm		
	23		WIDTH OF FLUE GAS CHANNEL	mm		
	24		AIR SIDE RIB PITCH	mm		
	25		FLUE GAS SIDE RIB PITCH	mm		
	26	MATERIAL	PLATE			
	27		RIB			
	28		FRAME			
	29	AIR CROSS OVER DUCT:	NUMBER			
	30		BOLTED / WELDED			
	31		SUPPLIED WITH CLIPS			
	32	WATER WASH	YES/NO			
	33		TYPE (OFF-LINE OR ON-LINE)			
	34		LOCATION			
	35					
	36	**III HEAT PIPE:**				
	37		NUMBER OF TUBES			
	38		TUBE OUTER DIAMETER / WALL THICKNESS	mm		
	39		TUBE MATERIAL			
	40		TUBES PER ROW			
	41		NUMBER OF ROWS			
	42		TUBE PITCH (SQUARE OR TRIANGULAR)	mm		
	43				AIR SIDE	GAS SIDE
	44	FINS:	TYPE			
	45		HEIGHT / THICKNESS	mm		
	46		NUMBER / m			
	47		MATERIAL			
	48		EFFECTIVE LENGTH	m		
	49		HEATING SURFACE	m²		
	50		MAXIMUM ALLOWABLE SOAK TEMPERATURE	°C		
	51	SOOT BLOWER	YES/NO			
	52		TYPE (OFF-LINE OR ON-LINE)			
	53		LOCATION			
	54	**NOTES:**				
	55					
	56					

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Technical Data Sheet

FAN DATA SHEET

Based on API 560 4th Edition (ISO 13705:2006)

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Rev							
	1	FAN MANUFACTURER			MODEL / SIZE		
	2	SERVICE	**Ambient Air Service**		ARRANGEMENT **1 x 100% (STC)**	NUMBER REQUIRED	**1**
	3	DRIVE SYSTEM	**Electric Motor**		FAN ROTATION FROM DRIVEN END	☐ CW ☐ CCW	
	4	GAS HANDLED	**Ambient Air**		MOLECULAR WEIGHT	**Ambient Air**	
	5	SITE ELEVATION, m	**0**		FAN LOCATION	**Within / Near Package**	
	6	**OPERATING CONDITIONS**					
	7	OPERATING CONDITION / CASE :			**NORMAL (MCR)**	**PEAK**	**MIN**
	8	MASS FLOW-RATE CAPACITY		kg/h			
	9	VOLUME FLOW-RATE CAPACITY		Am³/h			
	10	DENSITY		kg/m³			
	11	TEMPERATURE		°C			
	12	RELATIVE HUMIDITY		%			
	13	STATIC PRESSURE @ INLET		Pa			
	14	STATIC PRESSURE @ OUTLET		Pa			
	15	PERFORMANCE:					
	16	POWER @ TEMPERATURE (ALL LOSSES INCLUDED)		kW			
	17	FAN SPEED		rpm			
	18	STATIC PRESSURE RISE ACROSS FAN		Pa			
	19	INLET DAMPER / VANE POSITION					
	20	DISCHARGE DAMPER POSITION					
	21	FAN STATIC EFFICIENCY		%			
	22	STEAM RATE (TURBINE ONLY)		kg/kW-hr			
	23	FAN CONTROL:			DRIVER:		
	24	AIR SUPPLY	**AMBIENT AIR**		MAKE	TYPE	
	25	FAN CONTROL FURNISHED BY	**SUPPLIER**		RATED kW	SPEED	rpm
	26	METHOD **(STA)**	☐ INLET DAMPER	● OUTLET DAMPER	ELECTRICAL AREA CLASSIFICATION		
	27		☐ INLET GUIDE VANES	☐ VARIABLE SPEED	ZONE **1**	GROUP **IIC**	TEMP. CLASS **T4**
	28	STARTING METHOD	**DIRECT ONLINE**		POWER	VOLTS	PHASE HZ
	29	**CONSTRUCTION FEATURES**					
	30	HOUSING:			BEARINGS:		
	31	MATERIAL	**CS (STC)**	THICKNESS mm	☐ HYDRODYNAMIC	☐ ANTI-FRICTION	
	32	SPLIT FOR WHEEL REMOVAL	● YES	☐ NO	TYPE		
	33	DRAINS (NO / SIZE)			LUBRICATION		
	34	ACCESS DOORS (NO / SIZE)			COOLING WATER	m³/h @	°C
	35	BLADES:			THERMOSTATICALLY CONTROLLED HEATERS	● YES	☐ NO
	36	TYPE			TEMPERATURE DETECTORS	● YES	☐ NO
	37	NUMBER		THICKNESS mm	VIBRATION DETECTORS	● YES	☐ NO
	38	MATERIAL					
	39	HUB:			SPEED DETECTORS:		
	40	☐ SHRINK FIT	☐ KEYED		● NON-CONTACT PROBE		
	41	MATERIAL			☐ SPEED SWITCH		
	42	SHAFT:			☐ OTHER		
	43	MATERIAL			COUPLINGS:		
	44	DIAMETER AT BEARINGS, mm			TYPE		
	45	SHAFT SLEEVES:			MAKE		
	46	MATERIAL			MODEL		
	47	SHAFT SEALS:			SERVICE FACTOR		
	48	TYPE			MOUNT COUPLING HALVES		
	49				☐ FAN	☐ DRIVER	
	50	INERTIA (ωr2), kg-m²			SPACER ☐ YES	☐ NO LENGTH	mm
	51	**NOTES:** (ALL DATA ON PER UNIT BASIS)					
	52						
	53						
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Technical Data Sheet

FAN DATA SHEET

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Rev

CONSTRUCTION FEATURES (continued)

1	**MISCELLANEOUS:**			
2	■ COMMON BASEPLATE (FAN / DRIVER)	■ SILENCER (INLET) (OUTLET)	■ INLET (SCREEN) (FILTER)	
3	■ BEARING PEDESTAL / SOLEPLATES	■ EVASE	■ HOUSING DRAIN CONNECTION	
4	■ PERFORMANCE CURVES	■ VIBRATION ISOLATION	■ SPARK RESISTANT COUPLING GUARD	
5	■ SECTIONAL DRAWING	☐ TYPE	☐ INSULATION CLIPS	
6	■ OUTLINE DRAWING	☐ SPECIAL COATINGS	■ INSPECTION ACCESS	
7	■ INLET BOXES	☐ CONTROL PANEL	☐ HEAT SHIELDS	

8	**NOISE ATTENUATION**			**WEIGHTS**			
9	MAX ALLOWABLE SOUND PRESSURE LEVEL	**85**	dB(A) @ 1 m	FAN	kg	DRIVER	kg
10	PREDICTED SOUND PRESSURE LEVEL		dB(A) @ 1 m	BASE	kg	SOUND TRUNK	kg
11	ATTENUATION METHOD			EVASE			kg
12	FURNISHED BY	**Fan Supplier**		TOTAL SHIPPING WEIGHT			kg

13	**PAINTING**			**CONNECTIONS**			
14	☐ MANUFACTURER'S STANDARD				SIZE	RATING	ORIENTATION
15	● **000761-0009-T-ME-SPE-0020**			INLET			
16	**SHIPMENT**			OUTLET			
17	☐ DOMESTIC ■ EXPORT ■ EXPORT BOXING REQUIRED			DRAINS			
18							
19	**ERECTION**						
20	■ ASSEMBLED			**TESTS**			
21	☐ PARTLY ASSEMBLED			■ MECHANICAL RUN IN (NO LOAD)			
22	■ OUTDOOR STORAGE OVER 6 MONTHS			■ WITNESSED PERFORMANCE			
23				■ ROTOR BALANCE			
24	**APPLICABLE SPECIFICATIONS**			■ SHOP INSPECTION			
25				■ ASSEMBLY AND FIT- UP CHECK			
26				■ LATERAL CRITICAL SPEED			
27				☐ TORSIONAL CRITICAL SPEED			

28	**NOTES:**
29	ITEMS MARKED ■ TO BE INCLUDED IN VENDOR SCOPE OF SUPPLY
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Technical Data Sheet

SOOTBLOWER DATA SHEET

Based on API 560 4th Edition (ISO 13705:2006)

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Rev								
	1	**OPERATING DATA:**						
	2	FUEL OIL TYPE						
	3	SPECIFIC GRAVITY OR °API						
	4	SULPHUR	% wt					
	5	VANADIUM	ppm (wt)					
	6	NICKEL	ppm (wt)					
	7	ASH	% wt					
	8	LANE LOCATION						
	9	FLUE GAS TEMPERATURE AT BLOWER, MAXIMUM	°C					
	10	FLUE GAS PRESSURE AT BLOWER, MAXIMUM	barg					
	11	CLEANING MEDIUM						
	12							
	13	**UTILITY DATA:**						
	14	STEAM	barg @		°C		kg/h per blower	
	15	AIR	barg		Nm³/h per blower			
	16	POWER	Volts		Phase		Hz	
	17							
	18	**LAYOUT DATA:**						
	19	TUBE OUTSIDE DIAMETER	mm					
	20	TUBE LENGTH	mm					
	21	TUBE SPACING	mm					
	22	(STAGGERED) (IN-LINE)						
	23	BANK WIDTH	m					
	24	NUMBER OF INTERMEDIATE TUBE SHEETS						
	25	LANE DIMENSION (MINIMUM CLEARANCE)	mm					
	26	MAXIMUM CLEANING RADIUS	m					
	27	EXTENDED SURFACE TYPE						
	28	NUMBER OF FINNED ROWS						
	29	LINING THICKNESS	mm					
	30	**BLOWER DATA:**						
	31	MANUFACTURER						
	32	TYPE (RETRACTABLE OR ROTARY)						
	33	MODEL						
	34	NUMBER REQUIRED						
	35	NUMBER OF LANES (ROWS)						
	36	NUMBER PER LANE						
	37	ARRANGEMENT						
	38	OPERATION						
	39	CONTROL REQUIRED (AUTO OR MANUAL)						
	40	CONTROL PANEL LOCATION (LOCAL OR REMOTE)						
	41	DRIVER TYPE (MANUAL, PNEUMATIC OR ELECTRICAL MOTOR)						
	42	ELECTRICAL AREA CLASSIFICATION						
	43	MOTOR STARTERS CLASSIFICATION						
	44	MOTOR	RATED POWER	kW				
	45		ENCLOSURE					
	46		SPEED	rpm				
	47	LANCE TRAVEL SPEED		m/s				
	48	HEAD: MATERIAL & RATING						
	49	WALL BOX ISOLATION						
	50							
	51	NOTES:						
	52							
	53							
	54							