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South Tyneside NHS
NHS Foundation Trust

South Shields General Hospital – New Energy Centre

PLANNING SUBMISSION – Chimney Height

Rev C2

16th Sept 2019

1.0 INTRODUCTION

This document has been produced in collaboration with Malones to assist with gaining approval of the proposed Chimney height which forms a planning requirement for the new Energy Centre currently being built on the grounds of South Tyneside General Hospital.

The Chimney height requires approval from an Environmental Health Officer (EHO) before an order can be placed and as such this element is time sensitive to the project.

The pre-fabricated multi-core Chimney comprises; external windshield, 6No. individual flue liners, Y-spar ladder with fall arrest system, 2No. internal platforms for inspection of the flue liners and windshield, internal LED lighting, lightning protection earth bosses and external steeple jack access bosses at 1.5m intervals up the full height of the chimney.

Each internal flue liner is also provided with a clean out door.

The windshield (the outer sheath of the chimney) is to be shot blasted to a RAL 7035 (grey) with the top 2 meters to be finished in an acid resistant black resin.

2.0 METHODOLOGY

The chimney height has been based on D1 calculation.

The nearest building is Ward 17 and it is 15meter high.

The thermal plant comprises;

- 4MW LTHW Boiler – dual fuel
- 4MW LTHW Boiler – dual fuel
- 7 tonne Steam Boiler – dual fuel
- 3.5 tonne Steam Boiler – dual fuel
- 3.5 tonne Steam Boiler – dual fuel
- 532kWe Combined Heat and Power Unit – gas only

All boilers are dual fuel, capable of burning either natural gas or 35 second gas oil; therefore, 2 scenarios have been evaluated;

- Normal operation – all duty/priming* gas fired plant in operation
- Back-up operation – all duty/priming* fuel oil fired plant in operation

*The 7tonne steam boiler provides resilience to both the LTHW (by means of a steam to LTHW plate heat exchanger) and Steam Systems i.e. this boiler is only active if one other boiler is down for maintenance; therefore, the worst case is if one of the 3.5tonne steam boilers is down for maintenance. For clarity see table below for details;

PLANT	NATURAL GAS SCENARIO	FUEL OIL SCENARIO	COMMENT
4MW LTHW Boiler	On	On	-
4MW LTHW Boiler	On	On	-
7 tonne Steam Boiler	On	On	Providing the back up to the 3.5tonne steam boiler
3.5 tonne Steam Boiler	On	On	-
3.5 tonne Steam Boiler	Off	Off	Down for maintenance
532kWe CHP Unit	On	Off	Gas only

3.0 RESULTS

The D1 calculation provided the following results;

Scenario 1 Natural Gas: 17meters
Scenario 2 Fuel Oil: 20 meters

Refer to the appendix for the detailed calculations including supporting evidence and Chimney drawings.

4.0 CONCLUSION

To protect against any event the current proposal shall be based on scenario 2 i.e. Chimney height of 20 meters.

To guarantee the performance and payback of the Combined Heating and Power Unit the thermal plant shall be run on natural gas whenever possible. The back-up fuel source, 35 second gas oil, will only be used in an emergency during a gas outage.

5.0 AGREEMENT WITH THE EHO

From discussions with the Local Authority, the Environment Health Officer requested further calculations to be carried out in line with regulations using the *Environment Protection UK CHP Air Quality Tool.*

It was noted that site fell into an Air Quality Management Area.

The result from the *Environment Protection UK CHP Air Quality Tool* then had to be added to the background No_2 level of 17.40 ug/m^3 recorded for the area.

It was advised that a pass would only be granted if the total did not exceed a threshold limit of 40 ug/m^3.

Also the following calculations were taken from correspondence from Centrica regarding their CHP and its emissions;

1	Convert exhaust mass flow rate to a normalised volumetric flow rate (Nm³/h):			
	V = (m*Rs*T)/P			
	P	101325	Pa	
	m	2924	kg/h	
	Rs	287.05	J/kgK	Specifc gas constant for dry air
	T	273	K	
	V	2261	Nm3/h	
2	Correct NOx emissions to 0% O2:			
	c = 20.9/(20.9 - x)			
	x	5	% O2	
	NOx	250	mg/Nm3 @ % O2	
	NOx_0%	329	mg/Nm3 @ 0% O2	
3	Calculate mg/kWh_elec:			
	A = (V*NOx_0%)/kWe			
	kWe	530		
	A	1402	mg/kWh elec	

On this basis, a chimney height of 20meters failed i.e. 31.03 + 17.40 = 48.43 ug/m³ - refer to appendices for details.

A subsequent calculation using a chimney height of 22 meters resulted in a pass i.e. 0.39 + 17.40 = 17.79 ug/m³ - refer to appendices for details.

6.0 APPENDIX

- D1 calculation Natural Gas
- D1 calculation Fuel Oil
- STGH DM4000LN data – LTHW Boiler performance data
- STGH YSXALN7000IE data – 7tonne Steam Boiler performance data
- STGH YSXALN3500IE data – 3.5tonne Steam Boiler performance data
- E530M (250NOx) Technical Datasheet – CHP performance data
- Flue Fabrication Drawing
- Flue Design Drawing

- Clean Air Act Tool
- *Environment Protection UK CHP Air Quality Too - fail*
- *Environment Protection UK CHP Air Quality Tool - pass*

Exhaust Discharge Height Calculation To D1

Project:- **STDH Energy Centre**
Customer:-
Engineer:-
Cal.Ref.:- **Gas Blrs - Scenario 1**
Quote.Ref.:-
Date.:- **20/07/2018** **Page 1**

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Nottinghamshire, NG19 0FQ
Tel:01623 8899219 Fax:423733
sales@jeremias-fluesystems.co.uk
www.jeremias-fluesystems.co.uk

Exhaust Ref.:-	**1**	**2**	**3**	**4**	**5**	**6**
Input Details:-						
Appliance Type.	CHP	Boiler	Boiler	Boiler	Boiler	Boiler
Make.	CHP	Byworth	Byworth	Byworth	Byworth	Byworth
Model.		DM4000LN	DM4000LN	YSXALN7000I	YSXALN3500I	YSXALN3500I
Fuel Type.	N.Gas	N.Gas	N.Gas	N.Gas	N.Gas	N.Gas
Fuel Su%.	0.0	0.0	0.0	0.0	0.0	0.0
Exh.Gas Flow.	2924.0	7668.0	7668.0	7776.0	3960.0	3960.0
Exh.Gas Units.	kg/hr	m3/hr	m3/hr	m3/hr	m3/hr	m3/hr
Exh.Gas Temp(in).(C)	120	154	154	122	129	129
Exh.Gas Temp(exit).(C)	110	141	141	110	110	110
Exh.Exit Dia.(mm)	300	550	500	700	600	600
Exh.Gas Emm. NO	225	95	95	95	95	95
Exh.NO Units	mg/Nm3(dry) @5%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2
Exh.Gas Emm. NO2	25	5	5	5	5	5
Exh.NO2 Units	mg/Nm3(dry) @5%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2
Exh.Gas %H2O	11.0	16.0	16.0	16.0	16.0	16.0
Exh.Gas %O2	10.0	4.0	4.0	4.0	4.0	4.0
Appliance Input	1512.0	4761.0	4761.0	5141.0	2580.0	2580.0
App.Input Units	kw(gross.Cv)	kw(gross.Cv)	kw(gross.Cv)	kw(gross.Cv)	kw(gross.Cv)	kw(gross.Cv)

Location:- Major city center / Heavy industrial area.

	SO2	NO	NO2	CO	SPM
Guideline Con.s(mg/m3)	0.44	1.0	0.2	57.0	0.3
Background Con.s(mg/m3)	0.16	0.4	0.17		0.4

Exhaust Discharge Height Calculation To D1

jeremias CHIMNEY SYSTEMS

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Project:- **STDH Energy Centre**
Customer:-
Engineer:-
Cal.Ref.:- **Gas Blrs - Scenario 1**
Quote.Ref.:-
Date.:- **20/07/2018** **Page 1**

Exhaust Ref.:-	**1**	**2**	**3**	**4**	**5**	**6**
Results:-						
Appliance Status	ON	ON	ON	ON	ON	OFF
Exh.Gas Vol. @ Exit(M3/s)	0.93	2.07	2.07	2.09	1.05	0.0
Exh.Gas Vel. @ Exit(m/s)	13.16	8.69	10.52	5.44	3.71	0.0
Exh.Gas Emm. NO(g/s)	0.091	0.1026	0.1026	0.1125	0.0563	0.0
Exh.Gas Emm. NO2(g/s)	0.0101	0.0054	0.0054	0.0059	0.003	0.0
Exh.Gas Emm. CO(g/s)	0.3034	0.0676	0.0406	0.0445	0.0371	0.0
Pollution Index NO	152	171	171	187	94	
Pollution Index NO2	337	180	180	197	99	
Pollution Index CO	5	1	1	1	1	
Heat Release Q(MW)	0.08	0.23	0.23	0.19	0.09	0.0
Exit Momentum M(m^4/s)	9.04	12.27	14.85	8.42	2.87	0.0
Um(m)	2.33	1.83	1.94	1.62	1.43	0.0
Um/2(m)	1.17	0.91	0.97	0.81	0.72	0.0
5Um(m)	11.65	9.15	9.72	8.11	7.17	0.0
Method of Calculation	Single Source					
Pollution Index	993					
Total Q(MW)	0.82					
Total M(m^4/s)	47.45					
Ub(m)	2.37					
Um(m)	2.82					
5Um(m)	14.1					
No of Buildings	1					
No. 1Height / Width	15.0x >Ht					
Hm	15.0					
Tm						
Calculated Height C(m)	17.0					
Adj.for Min. Requirements(m)	0.0					
Final Discharge Height(m)	**17.0**					
(Above ground level.)						

Comments:

1. The final chimney height of all chimneys must be approved by the Local Environmental Health Department who may specify a further adjustment in overall height in light of particular local circumstances.

CE HETAS Constructionline SafeContractor APPROVED CHAS BFCMA BRITISH FLUE & CHIMNEY MANUFACTURERS ASSOCIATION

Exhaust Discharge Height Calculation To D1

Project:- **STDH Energy Centre**
Customer:-
Engineer:-
Cal.Ref.:- **Oil Blrs Scenario 2_1**
Quote.Ref.:-
Date.:- **20/07/2018** **Page 1**

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Exhaust Ref.:-	**1**	**2**	**3**	**4**	**5**	**6**
Input Details:-						
Appliance Type.	CHP	Boiler	Boiler	Boiler	Boiler	Boiler
Make.	CHP	Byworth	Byworth	Byworth	Byworth	Byworth
Model.		DM4000LN	DM4000LN	YSXALN7000I	YSXALN3500I	YSXALN3500I
Fuel Type.	N.Gas	Gas Oil	Gas Oil	Gas Oil	Gas Oil	Gas Oil
Fuel Su%.	0.0	0.1	0.1	0.1	0.1	0.1
Exh.Gas Flow.	2924.0	4979.0	4979.0	7776.0	3960.0	3960.0
Exh.Gas Units.	kg/hr	Nm3/hr	Nm3/hr	m3/hr	m3/hr	m3/hr
Exh.Gas Temp(in).(C)	120	148	148	121	127	127
Exh.Gas Temp(exit).(C)	110	141	141	110	110	110
Exh.Exit Dia.(mm)	300	550	550	700	600	600
Exh.Gas Emm. NO	225	190	190	190	190	190
Exh.NO Units	mg/Nm3(dry) @5%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2
Exh.Gas Emm. NO2	25	10	10	10	10	10
Exh.NO2 Units	mg/Nm3(dry) @5%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2	mg/Nm3(dry) @3%O2
Exh.Gas %H2O	11.0	10.0	10.0	10.0	10.0	10.0
Exh.Gas %O2	10.0	5.0	5.0	5.0	5.0	5.0
Appliance Input	1512.0	4558.0	4558.0	4931.0	2473.0	2473.0
App.Input Units	kw(gross.Cv)	kw(gross.Cv)	kw(gross.Cv)	kw(gross.Cv)	kw(gross.Cv)	kw(gross.Cv)

Location:- Major city center / Heavy industrial area.

	SO2	NO	NO2	CO	SPM
Guideline Con.s(mg/m3)	0.44	1.0	0.2	57.0	0.3
Background Con.s(mg/m3)	0.16	0.4	0.17		0.4

Exhaust Discharge Height Calculation To D1

Project:- **STDH Energy Centre**
Customer:-
Engineer:-
Cal.Ref.:- **Oil Blrs Scenario 2_1**
Quote.Ref.:-
Date.:- **20/07/2018** **Page 1**

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Exhaust Ref.:-	**1**	**2**	**3**	**4**	**5**	**6**
Results:-						
Appliance Status	OFF	ON	ON	ON	ON	OFF
Exh.Gas Vol. @ Exit(M3/s)	0.0	2.1	2.1	2.1	1.05	0.0
Exh.Gas Vel. @ Exit(m/s)	0.0	8.83	8.83	5.46	3.73	0.0
Exh.Gas Emm. SO2(g/s)	0.0	0.1999	0.1999	0.2163	0.1085	0.0
Exh.Gas Emm. NO(g/s)	0.0	0.2101	0.2101	0.2273	0.114	0.0
Exh.Gas Emm. NO2(g/s)	0.0	0.0111	0.0111	0.012	0.006	0.0
Exh.Gas Emm. CO(g/s)	0.0	0.0692	0.0692	0.0749	0.0376	0.0
Exh.Gas Emm. g/s)	0.0	0.0	0.0	0.0	0.0	0.0
Pollution Index SO2		714	714	772	387	
Pollution Index NO		350	350	379	190	
Pollution Index NO2		369	369	399	200	
Pollution Index CO		1	1	1	1	
Heat Release Q(MW)	0.0	0.23	0.23	0.19	0.09	0.0
Exit Momentum M(m^4/s)	0.0	12.66	12.66	8.46	2.9	0.0
Um(m)	0.0	3.73	3.73	4.7	4.16	0.0
Um/2(m)	0.0	1.87	1.87	2.35	2.08	0.0
5Um(m)	0.0	18.66	18.66	23.51	20.78	0.0
Method of Calculation	Single Source					
Pollution Index	2588					
Total Q(MW)	0.74					
Total M(m^4/s)	36.68					
Ub(m)	3.84					
Um(m)	6.75					
5Um(m)	33.73					
No of Buildings	1					
No. 1Height / Width	15.0x >Ht					
Hm	15.0					
Tm						
Calculated Height C(m)	20.02					
Adj.for Min. Requirements(m)	0.0					
Final Discharge Height(m)	**20.0**					
(Above ground level.)						

Comments:

1. The final chimney height of all chimneys must be approved by the Local Environmental Health Department who may specify a further adjustment in overall height in light of particular local circumstances.

DALESMAN HOT WATER MODEL	DM	4000	LT	LN
REQUIRED BOILER MAXIMUM OUTPUT	kW	4000		
WATER FLOW TEMPERATURE FROM BOILER	DegC	95		
WATER RETURN TEMPERATURE INTO BOILER	DegC	75		
Water Flow Rate Through Boiler	kg/hr	171983		
	L/sec	47.77		
Standard Flow and Return Connection Size	mm	150		
Customer Connection Sizes if Different	mm	150		
Boiler Operating Pressure	barg	3	43.5	psig
Ambient Air Temp	degC	21		

FUEL HEATING VALUES

GASEOUS FUEL

NATURAL GAS

GCV	52.97 *Mj/kg*	40.55 MJ/Ncu mtre
NCV	47.75 *Mj/kg*	36.55 MJ/Ncu mtre

LIQUID FUEL

CLASS A2 AND D -FUEL OIL

GCV	46.89 *Mj/kg*	40.22 Mj/litre
NCV	43.98 *Mj/kg*	37.73 Mj/litre

BOILER PERFORMANCE			CLASS A2 AND D -FUEL OIL					NATURAL GAS					
Load		%	100	75	50	25	20	100	75	50	25	15	
		kw	4000	3000	2000	1000	800	4000	3000	2000	1000	600	
Nett Furnace Heat Release		mw/m^3	**1.237**	**0.927**	**0.618**	**0.311**	**0.250**	**1.246**	**0.933**	**0.622**	**0.313**	**0.190**	
Nett Heat Input		mw	**4.295**	**3.218**	**2.145**	**1.079**	**0.868**	**4.327**	**3.241**	**2.162**	**1.088**	**0.661**	
Gross Furnace Heat Release		mw/m3	**1.312**	**0.983**	**0.655**	**0.330**	**0.265**	**1.371**	**1.027**	**0.685**	**0.345**	**0.209**	
Front Smoke BoxTemperature		deg C	327	295	256	203	190	353	319	276	218	185	
Boiler Outlet Temperature		deg C	148	138	126	112	109	154	143	130	115	107	
			Exhaust Temp at or near Dew Point					Exhaust Temp at or near Dew Point					
Combustion Products	CO2	%	12.50	12.00	11.50	11.00	10.50	10.30	9.80	9.20	8.50	8.30	
	O2	%	3.80	4.49	5.17	5.86	6.55	2.66	3.55	4.62	5.87	6.22	
Total Gas Weight		kg/h	6438	5004	3466	1814	1524	6338	4958	3493	1886	1170	
Max CO_2 Emissions		kg/hr	1100					862					
Boiler Efficiency on GCV		%	88.12	88.26	88.37	88.15	87.77	84.36	84.51	84.60	84.31	83.72	EN12953
Boiler Efficiency on NCV		%	93.90	94.04	94.15	94.00	93.59	93.50	93.66	93.75	93.52	92.84	EN12953
Total Draught Loss		inchwg	3.87	2.30	1.09	0.29	0.21	3.97	2.38	1.16	0.33	0.09	
		mbar	9.67	5.75	2.72	0.74	0.53	9.92	5.96	2.90	0.83	0.22	
Combustion air volume		Sm^3/s	1.379	1.074	0.746	0.391	0.329	1.363	1.068	0.755	0.409	0.254	
Exit Gas Volume from Boiler		Am^3/s	2.130	1.616	1.088	0.549	0.458	2.130	1.623	1.109	0.575	0.350	
		Nm^3/s	1.383	1.07475	0.7444	0.3897	0.327	1.361	1.065	0.750	0.405	0.251	
Fuel consumption		kg/h	349.93	262.20	174.77	87.89	70.76	323.56	242.42	161.66	81.38	49.44	kg/h
		litre/h	407.85	305.60	203.70	102.44	82.47	446.18	334.28	222.92	112.22	68.18	Sm^3/h
								422.75	316.73	211.21	106.32	64.60	Nm^3/h
	kWhr	Gross	4557.5	3414.9	2276.3	1144.7	921.5	4760.5	3566.6	2378.4	1197.3	727.45	kWhr Gross
HydraulicPressure Drop across Boiler for Actual Connection Sizes		mbar	122	4.1	ft head								
Duct / chimney size @ velocity of 12 m/s and 15m/s			470	420	mm I/Dia								
Actual Chimney Connection Size			493		mm I/Dia								

Dalesman Boiler Performance Data

YORKSHIREMAN LOW NOX MODEL	YSLN	7000	IE

Boiler working pressure	barg	6.9	100.05	psig
Saturation Temperature	degC	169.9		
Ambient Air Temp	degC	21		

REQUIRED BOILER DUTY 7000						
	Percentage Load	%	100	75	50	25
	Heat Output	kw	4389.5	3292.1	2194.7	1097.4
	F&A 100DegC	kg/h	7000	5250	3500	1750
		lb/h	15435	11576	7717.5	3858.8
Actual Boiler Output with Feed Water		kg/hr	6550.3	4912.7	3275.1	1637.6
Temperature of 85	degC	lb/hr	14443	10833	7221.7	3610.8

FUEL HEATING VALUES

Natural Gas			
GCV	52.97	*Mj/kg*	40.5 MJ/Ncu mtre
NCV	47.75	*Mj/kg*	36.6 MJ/Ncu mtre
ClassA2 and D-Fuel Oil			
GCV	46.89	*Mj/kg*	
NCV	43.98	*Mj/kg*	

BOILER PERFORMANCE		ClassA2 and D-Fuel Oil				Natural Gas			
Percentage Load	%	100	75	50	25	100	75	50	25
Nett Heat Release	mw/m^3	**1.12**	**0.90**	**0.60**	**0.30**	**1.13**	**0.93**	**0.63**	**0.32**
Nett Heat Input	mw	**4.65**	**3.71**	**2.48**	**1.26**	**4.67**	**3.87**	**2.59**	**1.32**
Gross Heat Release Rate	mw/m^3	**1.19**				**1.24**			
Front Smoke BoxTemperature	deg C	310	287	259	224	327	301	271	233
Boiler Outlet Temperature	deg C	187	183	178	174	190	185	180	174
ECONOMISER FITTED TO BOILER ROWS 6		Exhaust Temp approaching Acid Dew Pnt							
Economiser Gas Outlet Temperature	degC	121	119	117	117	122	120	117	117
Econ Feed Water Outlet Temperature	degC	103	103	103	103	104	104	104	104
Economiser Duty	kW	148	111	74	36	148	111	74	36
Total Gas Weight	kg/h	6964	5433	3781	1995	6945	5374	3806	2072
Max CO_2 Emissions	kg/hr	1190				944			

Boiler Efficiency on GCV with Econ	%	90.79	90.64	90.31	89.46	88.03	87.91	87.59	86.81	EN12953
Boiler Efficiency on NCV with Econ	%	95.40	95.19	94.80	93.71	95.30	95.08	94.64	93.46	EN12953

Total Draught Loss	inchwg	5.91	3.35	1.62	0.46	6.02	3.45	1.72	0.51
	mbar	14.77	8.39	4.05	1.14	15.07	8.64	4.29	1.27
Combustion air volume	Sm^3/s	1.49	1.17	0.81	0.43	1.49	1.16	0.82	0.45
Exit Gas Volume from Economiser	Am^3/s	2.16	1.67	1.16	0.61	2.16	1.66	1.17	0.64

Fuel consumption									
	kg/h	378.51	284.65	190.64	96.63	349.33	262.77	176.13	89.44	kg/h
	litre/h	440.88	331.55	222.05	112.56	481.71	362.35	242.87	123.33	Sm^3/h
						456.41	343.32	230.12	116.85	Nm^3/h
	kWhr Gross	4930.8	3708.1	2483.5	1258.8	5140.7	3866.9	2591.9	1316.2	kWhr Gross

Steam Release Area	m^2	9.19	Duct / chimney size @ velocity of 12 m/s	mm	478	inside diameter
Steam Release Rate	m/sec	0.0482	Duct / chimney size @ velocity of 15 m/s	mm	428	inside diameter

Yorkshireman Boiler Performance Data

YORKSHIREMAN LOW NOX MODEL			YSLN	3500	IE
Boiler working pressure	barg	6.9	100.05	psig	
Saturation Temperature	degC	169.9			
Ambient Air Temp	degC	21			

REQUIRED BOILER DUTY 3500			100	75	50	25
	Percentage Load	%				
	Heat Output	kw	2194.7	1646	1097.4	548.68
	F&A 100DegC	kg/h	3500	2625	1750	875
		lb/h	7717.5	5788.1	3858.8	1929.4
Actual Boiler Output with Feed Water Temperature of 85 degC		kg/hr	3275.1	2456.4	1637.6	818.8
		lb/hr	7221.7	5416.3	3610.8	1805.4

FUEL HEATING VALUES		
Natural Gas		
GCV	52.97 Mj/kg	40.5 MJ/Ncu mtre
NCV	47.75 Mj/kg	36.6 MJ/Ncu mtre
ClassA2 and D-Fuel Oil		
GCV	46.89 Mj/kg	
NCV	43.98 Mj/kg	

BOILER PERFORMANCE		ClassA2 and D-Fuel Oil				Natural Gas			
Percentage Load	%	100	75	50	25	100	75	50	25
Nett Heat Release	mw/m^3	**1.14**	**0.91**	**0.61**	**0.31**	**1.15**	**0.95**	**0.64**	**0.32**
Nett Heat Input	mw	**2.33**	**1.86**	**1.24**	**0.63**	**2.34**	**1.94**	**1.30**	**0.66**
Gross Heat Release Rate	mw/m^3	**1.21**				**1.27**			
Front Smoke BoxTemperature	deg C	363	334	300	253	388	355	317	267
Boiler Outlet Temperature	deg C	206	198	189	179	210	201	192	181
ECONOMISER FITTED TO BOILER ROWS 6		Exhaust Temp approaching Acid Dew Pnt							
Economiser Gas Outlet Temperature	degC	127	124	121	120	129	125	121	120
Econ Feed Water Outlet Temperature	degC	107	106	106	104	108	107	106	105
Economiser Duty	kW	87	64	41	19	87	64	41	19
Total Gas Weight	kg/h	3493	2723	1894	999	3485	2695	1907	1038
Max CO_2 Emissions	kg/hr	**597**				**474**			
Boiler Efficiency on GCV with Econ	%	90.47	90.36	90.10	89.31	87.75	87.68	87.41	86.71 EN12953
Boiler Efficiency on NCV with Econ	%	95.00	94.83	94.50	93.45	94.85	94.69	94.31	93.19 EN12953

Total Draught Loss	inchwg	4.29	2.37	1.14	0.32	4.34	2.44	1.21	0.35	
	mbar	10.74	5.93	2.84	0.79	10.86	6.11	3.02	0.88	
Combustion air volume	Sm^3/s	0.75	0.58	0.41	0.22	0.75	0.58	0.41	0.22	
Exit Gas Volume from Economiser	Am^3/s	1.10	0.85	0.59	0.31	1.10	0.84	0.59	0.32	
Fuel consumption	kg/h	189.84	142.69	95.50	48.37	175.29	131.78	88.26	44.78	**kg/h**
	litre/h	221.12	166.20	111.24	56.34	241.72	181.72	121.71	61.75	Sm^3/h
						229.02	172.18	115.32	58.51	Nm^3/h
	kWhr Gross	2473.0	1858.8	1244.1	630.1	2579.5	1939.3	1298.9	659.0	kWhr Gross

Steam Release Area	m^2	5.58	Duct / chimney size @ velocity of 12 m/s	mm	342	inside diameter
Steam Release Rate	m/sec	0.0397	Duct / chimney size @ velocity of 15 m/s	mm	306	inside diameter

Yorkshireman Boiler Performance Data

Technical Datasheet

E530M 250NOx Natural Gas CHP Unit

Energy Balance and Load Data at Power Factor 1		Units	100%	75%***	50%***
Electrical Output	(+/-3%)	kW	520	390	260
Electrical Efficiency (Net)	(+/-5%)	%	38.0%	37.3%	35.9%
Heat Output	(+/-10%)	kW	687	534	374
Thermal Efficiency (Net)	(+/-8%)	%	50.3%	51.1%	51.7%
Fuel Input (Net / Gross)*	(+/-5%)	kW	1367 / 1512	1045 / 1156	724 / 801
Total Efficiency (Net)	(+/-8%)	%	88.3%	88.4%	87.6%
Heat Output from Jacket Water	(+/-7%)	kW	358	267	181
Heat Output from Exhaust Gas @ Outlet Temp.	(+/-7%)	kW	329	267	193
Aftercooler Heat Output	(+/-7%)	kW	38	29	19
Radiated Heat Output	(+/-7%)	kW	55	32	20
Combustion Air Flow (30 °C, 100 kPa, 30% RH)**	(+/-5%)	m^3/h	2426	1833	1239
Fuel Mass Flow (ρ = 0.75kg/Nm³)	(+/-5%)	kg/h	102.5	78.4	54.3
Fuel Volume Flow (LHV = 10kWh/Nm³)	(+/-5%)	Nm3/h	136.7	104.5	72.4
Exhaust Mass Flow (Wet)	(+/-5%)	kg/h	2924	2210	1495
Exhaust Volume Flow @ Outlet Temp.	(+/-5%)	m^3/h	3257	2461	1665

*Natural gas Net and Gross fuel input figures are based on 36MJ/Nm3 and 39.8MJ/Nm3 respectively. The Gross figure is used when establishing UK fuel costs. Net figures are provided for ease of performance comparison with other technologies. Fuel must comply with engine manufacturer's fuel quality guide, supplied seperately.

**Engine technical data is based on Standard Conditions according to DIN ISO 3046-1 but engine de-rate applies when Combustion Air Temperature is >25°C.

*** If operating at part load for long periods of time, the unit should be run at full load for at least 5 hours in a given 24 hour period.

Engine Details

Manufacturer	MAN
Model	E 3262 LE 202
Fuel Type	Natural Gas
Min. Methane Number	80
Cylinders	12
Aspiration	Turbocharged
Speed rpm	1500
Aftercooler	Yes

Hot Water Details

Max. Water In/Out Temp. °C	78/90°C
Max. Water Flow Rate* l/s	14.09
Max. Glycol Content %	30
Connection Size mm	100
Flange Type	PN16
Pressure Loss** kPa	28.9
Max. Test Pressure Bar	9.75

* Assuming Cp = 4.2 kJ/kg·K and ρ = 968.55 kg/m³

** Pressure loss figures stated are at max. water flow rate. Internal unit only.

Exhaust Details

Connection Size	mm	250
Flange Type		PN10
Outlet Temp***.	°C	120
Allowable Backpressure	Pa	1300
Allowable Backpressure with Catalyst	Pa	TBC

*** For engines with exhaust bypass, please request exhaust bypass temp. from ECPL.

Ventilation Details

Connection Size	mm	710
Ventilation Rate****	m^3/s	5.39
Max. Air Inlet Temp.	°C	30
Max. Air Outlet Temp.	°C	45
Enclosure Pressure Drop	Pa	210

**** Vent rate is stated at max. air outlet temp, 100kPa

Aftercooler Details

Max. Water Inlet Temp.	°C	42
Water Flow Rate	l/s	1.85
Connection Size	mm	40
Flange Type		PN16
Pressure Loss	kPa	200
Max. Test Pressure	Bar	6
Ethylene Glycol Content	%	45

Generator Details

Manufacturer		Stamford
Model		HCI634H-311
Type		Synchronous
Rating	kVA	940
Voltage	V	400
Phase	Ph	3
Frequency	Hz	50
Protection Class		IP23
Rated Power Factor	PF	0.8
Xd Dir. Axis Synchronous		2.7
X'd Dir. Axis Transient		0.23
X"d Dir. Axis Sub-Transient		0.16
T" Sub-Transient Time Const.		0.025
T'do O.C Field Time Const.		2.44
CHP Protection Device	A/Ph	TBC
Indicative Client Protection Device	A/Ph	TBC
Current Per Phase @ 0.8PF	A	929
Current Per Phase @ 0.95PF	A	788
Efficiency @ 0.8PF	%	95.7%
Efficiency @ 0.95PF	%	96.5%
Indicative Main Cable Size [a] †	mm^2	TBC
Indicative Earth Cable Size [b] †	mm^2	TBC

[a] 4-Core XLPE/SWA/PVC to BS5467, Max 50 meters.

[b] 1-Core 6491B to BS7211, Max 50 meters.

† Sizes and lengths based on IET 17TH Edition BS7671, Installation method 31.

Fuel Details

Connection Size	mm	65
Flange Type		PN16
Min/Max. Supply Pressure	mbar	25/50

Emissions @ 5% O2

NOx	mg/Nm^3	250
CO	mg/Nm^3	700
NOx (With Catalyst)	mg/Nm^3	<N/A
CO (With Catalyst)	mg/Nm^3	<TBC

Weight Details

Enclosure (Dry) STD/PREM.	See Sales Drawing
Container (Dry) STD/PREM.	See Sales Drawing

Noise Data

Enclosure SPL @ 1m SN/LN	dB(A)	70/64.92
Container SPL @ 1m SN/LN	dB(A)	75/65

NB: Output figures are based on operation at DIN ISO 3046-1 conditions with the exception of exhaust output, which is quoted to 120°C/180°C for Natural Gas/Biogas respectively, figures are stated from manufacturer's declared performance figures subject to the manufacturer's tolerances and subject to change without notice. Values for de-rated units are estimates only. Energy balance data assumes perfect combustion. All information detailed is for guidance only and is subject to change without notice due to our commitment to continuous improvement - all values should be confirmed with ENER-G Combined Power Ltd on a project specific basis.

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DOCUMENT ISSUE REGISTER

PROJECT REF: STDH – New Energy Center

PROJECT NO: 2976

ISSUED TO: John Bewick ; Keith Mason -Metnor

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DAY	23	26	30	04	08	15	22	29	30	31	01	04	06					
MONTH	04	04	04	05	05	05	05	05	05	05	06	06	06					
YEAR	18	18	18	18	18	18	18	18	18	18	18	18	18					
FORMAT	E	E	E	E	E	E	E	E	E	E	E	E	E					

P = POST E = EMAIL H = HAND CD = CD F = FAX

DOCUMENT TITLE	REVISION
TS001; Jeremias – Multicore Chimney, design input & summary Sheet, base plate & holding down bolt stress calculation	X A
TS002; Ener-G – Drawing 21924; CHP unit drawing; APPROVAL/ COMMENT	X
TS003 Honeywell Fire Alarm Components; APPROVAL/ COMMENT	X
TS004; Phenolic 50mm thick bracket insert, Roller and Chair for LTHW 250mm mains in duct.	X
TS005; Flue D1 Calculation	X
TS006; Intruder Alarms	X
TS007; CHP Unit; Provisional Technical Submission	X
TS008; Ingham Report	X A
TS009; Theatre Report	X A
TS010; Drawing 2976_M_704	2
TS011; Mistras Magnetic Particle Examination Procedure MPI 1.2 Rev 03.	X
TS012; Access Control Equipment	X
TS013; LPC Switchgear Ltd; Section Board Drg Q9285B (2 Pages) ; Main switchboard Drg Q9285A (2 Pages)	X
TS014; Hepple Lightning Protection Layout; 4238/E/801 Rev 0	X
TS015; Hepple CCTV equipment	X
TS016; Hattersley Valves	X
TS017; SPECIALIST FLUE DESIGN	X
TS018; STEAM AND CONDENSATE REPORT	X
TS019; External Perimeter Lighting	X
TS020; District Heating Report	X
TS021; Jeremias Flue Chimney System; Wind Shield Drawings 3314-3 & 3314-4 Rev P0.	X P1

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MALONE
mechanical services engineers

SOUTH TYNESIDE DISTRICT HOSPITAL NEW ENERGY CENTRE

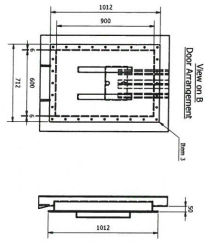
TECHNICAL SUBMISSION

Date: 06/06/2018

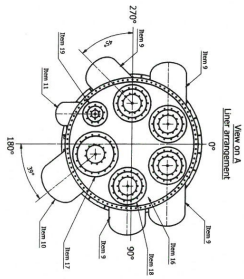
Number: TS 021 Rev A

For: Approval/ Comment

Description: Jeremias Flue Wind Shield Drawing
3314-3 P1
3314-4 P1
Branch Height Revision

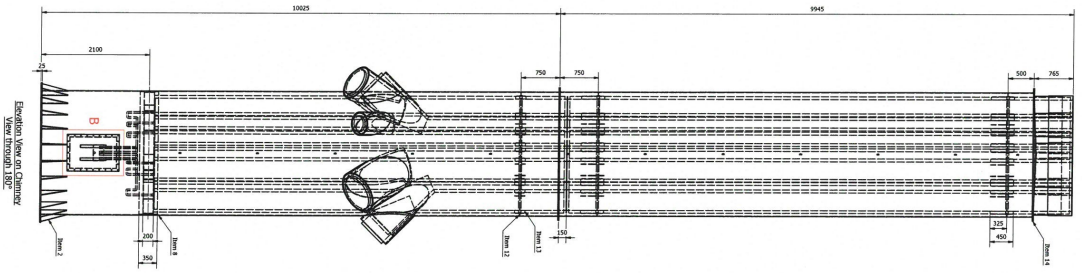


View on B
Door Arrangement

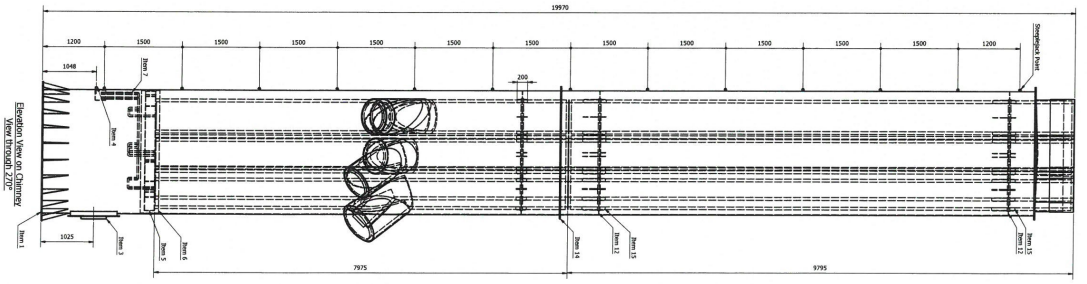


View on A
Liner arrangement

REF. NO	DESCRIPTION TABLE Description	Quantity
1	3mm Thick S275 JR Steel Baseplate Baseplate OD 2700mm Baseplate ID 2350mm	1
2	10mm Thick S275 JR Steel Chimney Gusset Dimensions according to calculations	24
3	6mm S275 JR Steel Access Door 1012x772mm Door plate	1
4	2mm Box Stainless Steel External drainage by others	1
5	200x65 S275 JR Parallel Flat Channel 2100mm Long	6
6	330x10mm Thick S275 Steel Support Gusset	6
7	1mm NB Drain Pipe	1
8	6mm Thick S275 JR Steel Chimney stitched shell Steel OD 2700mm	6
9	Stainless Steel Liner with 50mm Lamella Insulation Liner ID 2550mm	2
10	Stainless Steel Liner with 50mm Lamella Insulation Liner ID 2500mm	4
11	Stainless Steel Liner with 50mm Lamella Insulation Liner ID 2450mm	1
12	25mm Thick 304 Stainless Steel Liner with 50mm Lamella Insulation 6mm Thick S275 Steel Gable Plate with 50mm bar	1 3
13	6mm Thick 304 Stainless Steel Slider Plate 200x80mm	24
14	12mm S275 JR Steel Intumescent Flange Flange OD 2562mm Flange ID 2400mm	4
15	6mm Thick 304 Stainless Steel Slider Plate 200x80mm	48
16	6mm Thick S275 50mm Domed Top Cap Top Flat OD 240mm	1
17	50x50x5 S275 Stainless Steel Downstand Saddle to 700mm ID Liner	1
18	50x50x5 S275 Stainless Steel Downstand Saddle for 550mm ID Liner	4
19	50x50x5 S275 Stainless Steel Downstand Saddle for 300mm ID Liner	1
20	INTERNAL 'J' Spar Type 'F' all Across ladder system over the full height of the chimney	1
21	INTERNAL: Standard pole-staironete bulkhead lights every 3 metres	



Elevation View on Chimney
View through 180°



Elevation View on Chimney
View through 270°

Execution Class 2: +/- 3mm
Execution Class 2: +/- 2mm
Non-Execution Class: +/- 5mm

Tolerance Level: Execution Class 2

IF IN DOUBT ASK

MANUFACTURED TO EXECUTION CLASS LEVEL: 2

CONTRACT EXCLUSIONS
All builders work - Internal/External

All scaffolding and/or access equipment over 3 metres in height to be supplied by the client at the time of installation.

If the flashing/s are to be supplied by JEREMIAS UK LTD, All roof openings and weather by the clients roofing contractor at the time of installation. If storm collar is removed after our visit, and found to leak at a later date, we shall not be held responsible.

JEREMIAS UK LTD accept no responsibility for any services or fittings installed between our site survey and installations which obstruct the flue run, the supposrs or installation access.

JEREMIAS UK LTD are not responsible for any electrical wiring to our installed equipment.

Any notes contained on this drawing concerning removal of pipes, cable trays ect. must be adhered to prior to our installation.

Pipework from drain points.

Foundation Loads (Non-Factored)
Overturning Moment - 1137.872 kNm
Windshear at base 69.729 kN
Approximate self weight - 16541.329kg OR 162.270 kN

No.	Revision	Date	Drn
P-1	Branch Height Revision	5/6/18	AP

Project: South Tyneside Hospital Chimney

Drawing Title: Chimney Overview GA

Customer: H Malone and Sons

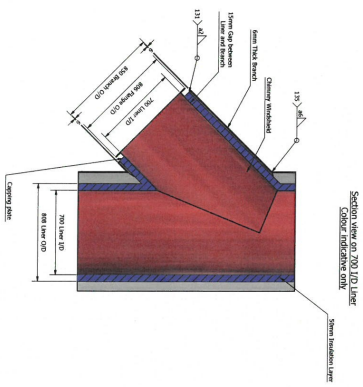
Site Address: Harton Ln, South Shields, NE34 0PL

Welding check	Dimension Check	Final Sign off

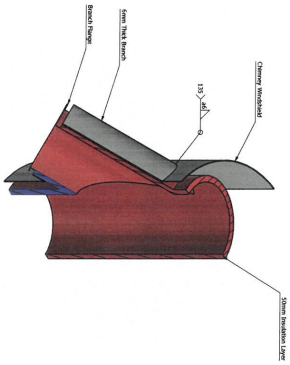
Date	Drawn By	
5/6/2018	A.P	PRELIMINARY FOR APPROVAL / CONSTRUCTION / AS INSTALLED

Drawing No	Revision	Scale
3314-3	P-1	Do Not Scale

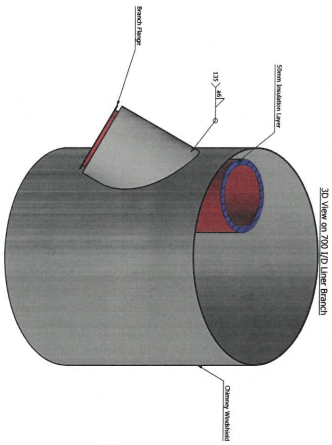
jeremias chimney systems
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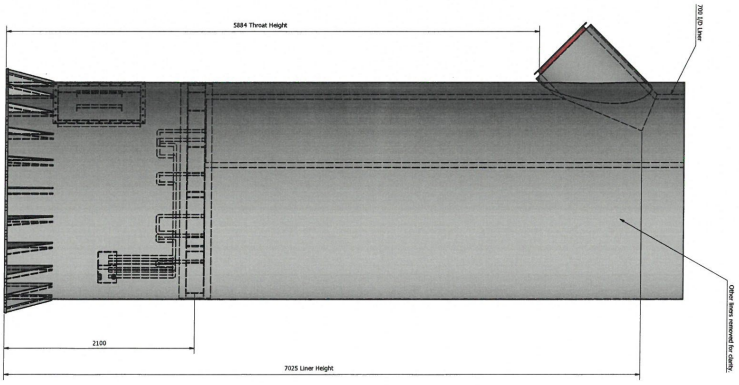
Section view on 700 I.D Liner
Colour indicative only



3D Section View on 700 I.D Liner Branch



3D View on 700 I.D Liner Branch



IF IN DOUBT ASK

MANUFACTURED TO EXECUTION CLASS LEVEL: 2

CONTRACT EXCLUSIONS

All builders work - Internal/External

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Pipework from drain points.

Foundation Loads (Non-Factored)

Overturning Moment - 1137.872 kNm
Windshear at base 69.729 kN
Approximate self weight - 16541.329kg OR 162.270 kN

No.	Revision	Date	Drn
P-1	Branch Height Revision	5/6/18	AP

Project: South Tyneside Hospital Chimney

Drawing Title: Branch Detail Drawing

Customer: H Malone and Sons

Site Address: Harton Ln, South Shields, NE34 0PL

Welding check | Dimension Check | Final Sign off

Date	Drawn By	
5/6/2018	A.P	PRELIMINARY FOR APPROVAL: X; CONSTRUCTION: ; AS INSTALLED:

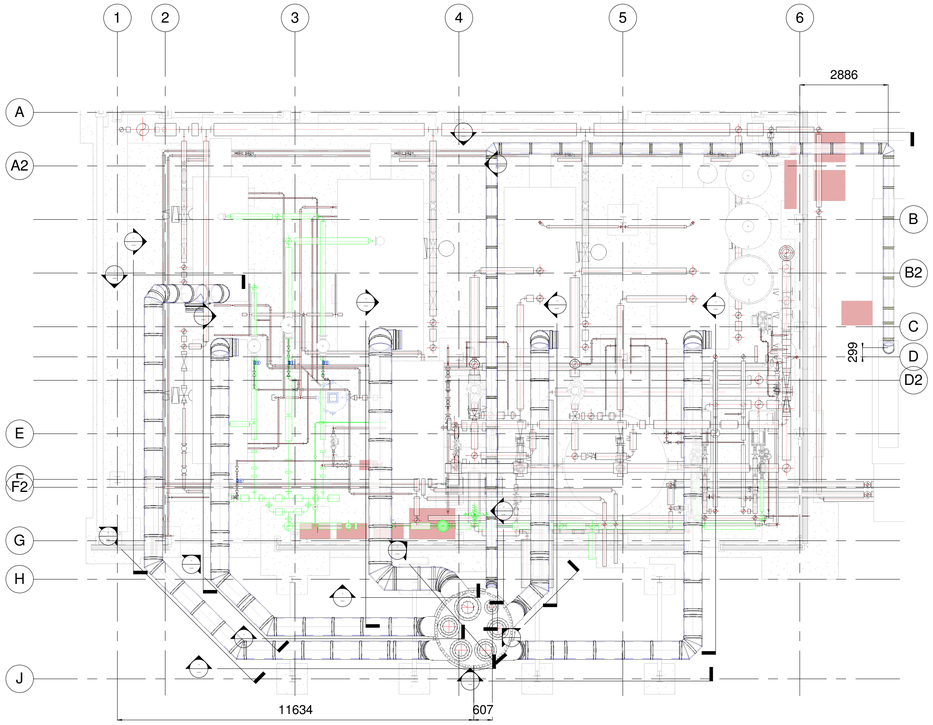
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Tolerance Level: Execution Class 2

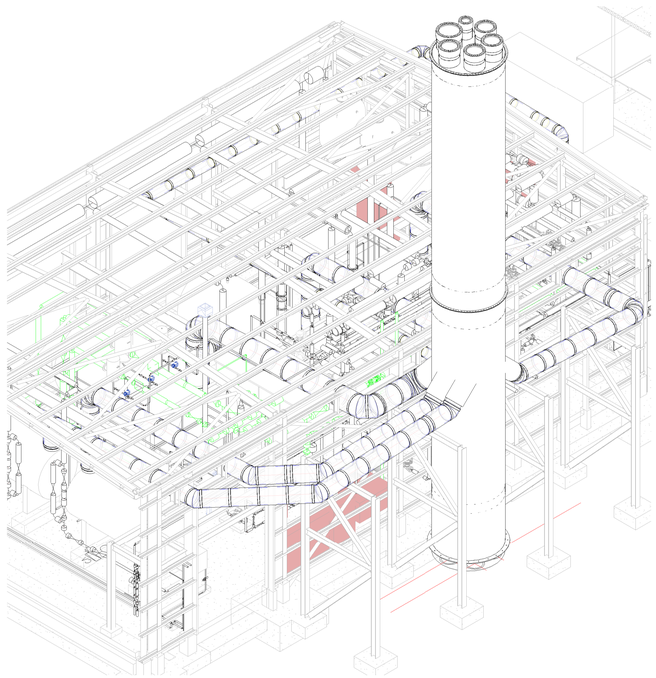
Execution Class 2: +/- 2mm
Execution Class 3: +/- 2mm
Non-Execution Class: +/- 5mm

jeremias chimney systems

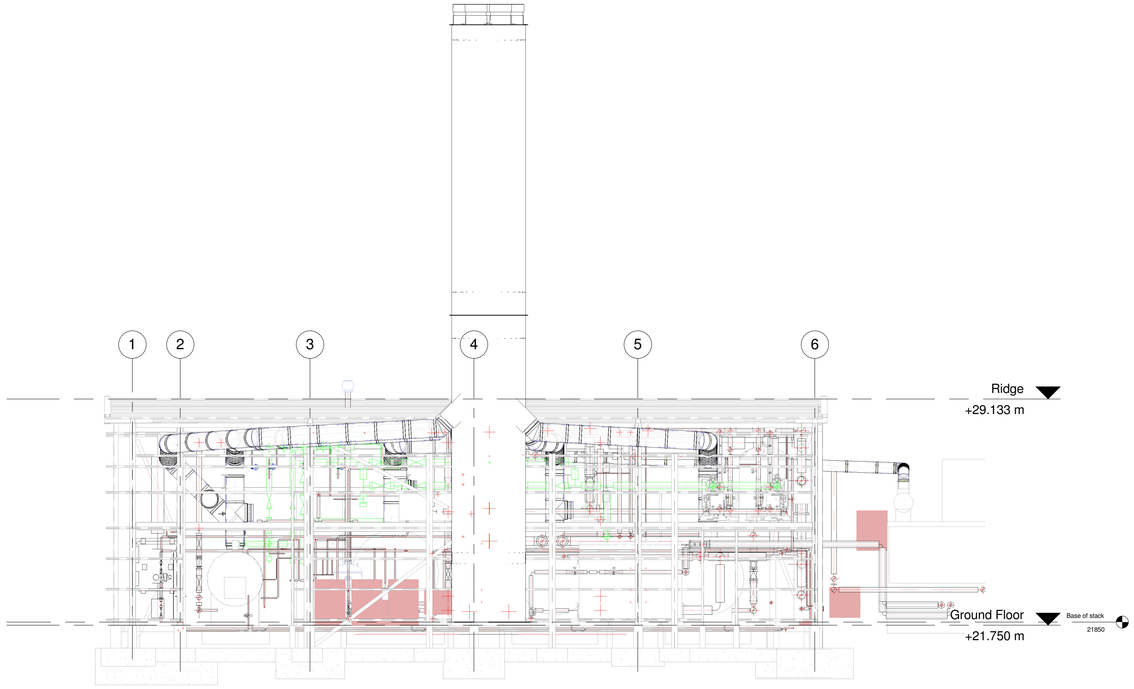
HETAS



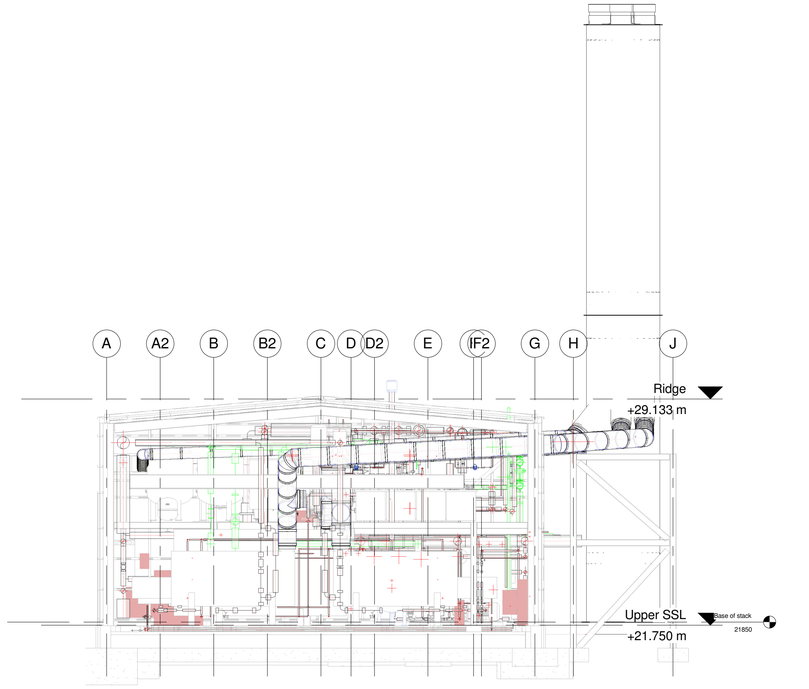
1 0 - Flue Copy 1
1 : 100



4 3D



2 South - Flue
1 : 100



3 West - Flue
1 : 100

jeremias chimney systems

CONTRACT EXCLUSIONS/STANDARD NOTES

All builders work - Internal/External

All scaffolding and/or access equipment over 3 metres in height to be supplied by the client at the time of installation

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JEREMIAS UK LTD are not responsible for any electrical wiring to our installed equipment.

Any notes contained on this drawing concerning removal of pipes, cable tray's etc. must be adhered to prior to our installation.

Pipework from drain points. All drains within the system will require pipe work by others to gulleys.

For all termination heights and final position of our flue systems, you must seek approval from the relevant local Environmental officer, in line with the current regulations using either Clean Air Act (and memorandum)/LAQM (09)/D1 Ministry of Pollution dependant on the appliances being selected for the project. We at Jeremias are not responsible for sourcing the necessary approvals, we can only presume at the time of this tender, it has obtained already by the professional team.

We presume the building structure is capable of taking all the necessary imposed loads of the expansion devices/lateral load/weight bearing brackets.

Unpon receipt of drawing approval, manufacture will proceed in accordance with the details and dimensions shown on this drawing. It is the clients responsibility to ensure that the flue route is kept clear from obstruction by other services. Please ensure that this drawing is issued to your site contract manager.

Please ensure this flue route is passed on to your appliance manufacturer to avoid any issues at commissioning and to ensure that the proposed flue route is suitable for the appliance/s. By design we can prove that this flue system works within the appliance characteristics available in their literature, however information is not always available within their literature for every eventuality/site conditions for the flue route. if they decline to comment (saying they are not flue specialists) and there is an issue at commissioning stage, then any costs for recommendations by themselves to correct the flue system will be passed onto yourselves.

Without confirmation/comments we will not proceed with manufacture.

SPECIFIC PROJECTS NOTES

Please note their will be signs of pluming on this type of system at the flue outlet.

Please be aware BS EN 15287 and IGE UP10 (edition 4) calls for flues to be laid to a fall which is important when dealing with condensing and high efficiency appliances. This is also a requirement of most boiler manufacturers installation instructions. please bear this in mind when selecting appliances and designing/laying out the flue runs as we cannot be held responsible for any problems if the required fall is not available.

Please note that due to the length of the horizontal flue run, it has not been possible to allow for a 3deg fall back to the boilers, so therefore we can not be held responsible to any future leaks within this area.

Rev	Description	Date	By
A	Datum level alteration	05/06/18	

Preliminary	For Approval	X	Construction	As Constructed

Drawing No: 7466 - 001

REV: A

Systems Materials:
Boiler: DW-ECO 304
CHP: DW-FS 316

Scale: 1 : 100 @ A1 (DO NOT SCALE)

Drawn By: J.meynell

Date: 01/06/18

Title: Boiler & CHP Flue

Customer: H Malone & Sons Ltd

Project: South Tyneside District Hospital

Site Address:
Horton Lane
South Shields
NE34 0PL

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CHP TOOL

You can record details of your CHP Here:	**South Tyneside General Hospital**
Additional comments:	Scenario 1: 520kWe CHP Chimney Height Based on D1 Calc 20meters

CHP AQ Tool v1.3

This tool is in 4 Sections. Please complete each section as required by entering information in the yellow cells.
Yellow cells will appear as you make your selections.
If you wish to change your selections part way through, it is recommended you clear the contents from yellow cells manually as only yellow cells are used in the calculations.
You can also click the Clear AQ Tool Button on the right (you must have macros enabled - see Info on Macros)

Info on Macros:
This tool used Macros to clear cells but they are not required for calculations. Macros may have been automatically disabled and will need to be enabled to use the Clear buttons. Please contact your IT deparment or use the Help functions.

Section 1

		Help Column
Select CHP Technology	Gas Engine	Select Type of CHP from Drop Down Menu. Gas Engine is same as Internal Combustion Engine
Select Engine Type	Spark Ignition	
Select Fuel Type	Natural Gas	
Select to specify ELV or use assumptions based on Power Output Range of Gas Engine CHP (kWe)	Using installation specific data or have an ELV	Select from Drop down list. If compliance with an ELV can be guaranteed, inputting the ELV will ensure the most reliable result. If no ELV is available, impact will be estimated based on the review of UK CHP emissions
	Please go to Section 2	

Your Notes:

CHP TOOL

CHP AQ Tool v1.3

You can record details of your CHP Here:	**South Tyneside General Hospital**
Additional comments:	Scenario 1: 520kWe CHP Chimney Height Based on D1 Calc 20meters

Section 2

For users wishing to input installation specific information on Exhaust flow-rate and/or NOx in-stack concentrations.

Please complete the yellow cells as they appear based on your choices.

Enter the Power Output of your CHP (kWe)	520	Enter a number from 1 to 20000 kWe (20MWe)
Please select which data you wish to provide	Emission Factor NOx g/kWh	Select from Drop Down List. Choose emission factor , tonnes/year, or Emission Limit Value
Enter Emission Factor NOx g/kWh	1.4	
	Please go to Section 4 Impact Calculator Below	

CHP TOOL

You can record details of your CHP Here:	**South Tyneside General Hospital**
Additional comments:	Scenario 1: 520kWe CHP Chimney Height Based on D1 Calc 20meters

CHP AQ Tool v1.3

Section 3: Determination of Emissions factors and Emissions based on Section 1 or 2

Based on sections 1 or 2, the following are calculated for the CHP

Your Notes:

NOx Emission Factor (grams/kWh)	1.402	Based on installation specific emission factor provided in Section 2
NOx Emission Rate (grams/second/kWe Output)	0.00039	Based on installation specific emission factor provided in Section 2
NOx Emission Rate (g/sec)	0.20	Based on the installation specific information provided in Section 2.
Annual Emissions NOx (tonnes/year)	6.39	Based on the intallation specific information provided in Section 2.
	Please go to Section 4 Air Quality Impacts Calculator.	

Section 4: Air Quality Impacts Calculator

This calculator is based on LAQM.TG(09) Industrial Nomograms for NO_2. The CHP screening tool calculates only with the annual mean NO_2 impact, and is based on the relevant nomograms for industrial sources in LAQM.TG(09) – Figures 5.2 and 5.3 - which in turn are based on ADMS2 dispersion modelling runs for both tall stacks and near-ground level releases (i.e. when a nearby building renders the effective stack height as less than 10 m). The result of the Excel-based spreadsheet is the maximum, annual mean ground level NO_2 concentration; therefore, re-iterative runs of the tool would be necessary to derive a minimum permissible stack height to achieve a given ground level NO_2 concentration.

Please complete the yellow cells as they appear based on your choices.

If you wish to change your selections part way through, it is recommended you clear the contents from yellow cells manually as only yellow cells are used in the calculations. You can also click the Clear Impacts tool on the right . (you must have macros enabled - see Note: Info on Macros)

Enter Stack Height (m)	20	If your stack height is more than 10m you may enter building information below. If your stack height is =<10m (i.e.Ground Level/Fugitive) then building height is not applicable.
Enter Building Height (m). This the height of the dominant large building near the stack. It can be the building on which the stack sits.	15	Enter height of the tallest building within 5 stack heights of the stack. If no building then leave blank or enter 0.
Enter Stack Diameter (m)	2.7	Enter Stack Diameter between 0.5m and 11.9m. Leaving blank assumes a short stack/fugitve source.
Calculated Effective Stack Height (m). This method for calculating the effective stack height is consistent with that as set out in LAQM.TG(09)	8.3	
	A short stack/ground level source will be assumed by impacts calculator.	
The effective stack height is less than 10m, a low stack height will be assumed. Therefore you need to enter the distance to the nearest receptor (m)	12	Enter the distance to nearest receptor between 1 and 200m

Results

CHP Tonnes NOx per Annum (based on Sections 1,2 or 3)	6.39	The tool includes all the assumptions/limitations inherent in LAQM.TG(09) i.e. a 10 – 25 m/s efflux velocity
Estimated Maximum Annual Mean NO_2 Contribution from CHP (ug/m^3), or Contribution from CHP at nearest receptor (ug/m3) for short stacks	**31.03**	The CHP screening tool does not take account of background NO_2 level; it calculates only the contribution of the stack to the maximum NO_2 annual mean concentration at the worst-case location. This locations will be different for varying stack heights and diameters.

The result from this tool is conservative, and errs on the side of caution. Only ground level impacts are considered. It is likely that the application of a detailed dispersion model using installation-specific values for exit velocity, volumetric flow-rate and flue gas temperature, and local meteorological data, would give a lower result.

CHP TOOL

You can record details of your CHP Here:	**South Tyneside General Hospital**
Additional comments:	Scenario 2: 520kWe CHP Chimney Height Based on Contract 22meters

CHP AQ Tool v1.3

This tool is in 4 Sections. Please complete each section as required by entering information in the yellow cells.
Yellow cells will appear as you make your selections.
If you wish to change your selections part way through, it is recommended you clear the contents from yellow cells manually as only yellow cells are used in the calculations.
You can also click the Clear AQ Tool Button on the right (you must have macros enabled - see Info on Macros)

Info on Macros:
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Section 1

		Help Column
Select CHP Technology	Gas Engine	Select Type of CHP from Drop Down Menu. Gas Engine is same as Internal Combustion Engine
Select Engine Type	Spark Ignition	
Select Fuel Type	Natural Gas	
Select to specify ELV or use assumptions based on Power Output Range of Gas Engine CHP (kWe)	Using installation specific data or have an ELV	Select from Drop down list. If compliance with an ELV can be guaranteed, inputting the ELV will ensure the most reliable result. If no ELV is available, impact will be estimated based on the review of UK CHP emissions
	Please go to Section 2	

Your Notes:

CHP TOOL

You can record details of your CHP Here:	**South Tyneside General Hospital**
Additional comments:	Scenario 2: 520kWe CHP Chimney Height Based on Contract 22meters

CHP AQ Tool v1.3

Section 2

For users wishing to input installation specific information on Exhaust flow-rate and/or NOx in-stack concentrations.

Please complete the yellow cells as they appear based on your choices.

Enter the Power Output of your CHP (kWe)	520	Enter a number from 1 to 20000 kWe (20MWe)
Please select which data you wish to provide	Emission Factor NOx g/kWh	Select from Drop Down List. Choose emission factor , tonnes/year, or Emission Limit Value
Enter Emission Factor NOx g/kWh	1.4	
	Please go to Section 4 Impact Calculator Below	

CHP TOOL

You can record details of your CHP Here:	**South Tyneside General Hospital**	**CHP AQ Tool v1.3**
Additional comments:	Scenario 2: 520kWe CHP Chimney Height Based on Contract 22meters	

Section 3: Determination of Emissions factors and Emissions based on Section 1 or 2

Based on sections 1 or 2, the following are calculated for the CHP

Your Notes:

NOx Emission Factor (grams/kWh)	1.402	Based on installation specific emission factor provided in Section 2
NOx Emission Rate (grams/second/kWe Output)	0.00039	Based on installation specific emission factor provided in Section 2
NOx Emission Rate (g/sec)	0.20	Based on the installation specific information provided in Section 2.
Annual Emissions NOx (tonnes/year)	6.39	Based on the intallation specific information provided in Section 2.
	Please go to Section 4 Air Quality Impacts Calculator.	

Section 4: Air Quality Impacts Calculator

This calculator is based on LAQM.TG(09) Industrial Nomograms for NO_2. The CHP screening tool calculates only with the annual mean NO_2 impact, and is based on the relevant nomograms for industrial sources in LAQM.TG(09) – Figures 5.2 and 5.3 - which in turn are based on ADMS2 dispersion modelling runs for both tall stacks and near-ground level releases (i.e. when a nearby building renders the effective stack height as less than 10 m). The result of the Excel-based spreadsheet is the maximum, annual mean ground level NO_2 concentration; therefore, re-iterative runs of the tool would be necessary to derive a minimum permissible stack height to achieve a given ground level NO_2 concentration.

Please complete the yellow cells as they appear based on your choices.

If you wish to change your selections part way through, it is recommended you clear the contents from yellow cells manually as only yellow cells are used in the calculations. You can also click the Clear Impacts tool on the right . (you must have macros enabled - see Note: Info on Macros)

Enter Stack Height (m)	22	If your stack height is more than 10m you may enter building information below. If your stack height is =<10m (i.e.Ground Level/Fugitive) then building height is not applicable.
Enter Building Height (m). This the height of the dominant large building near the stack. It can be the building on which the stack sits.	15	Enter height of the tallest building within 5 stack heights of the stack. If no building then leave blank or enter 0.
Enter Stack Diameter (m)	2.7	Enter Stack Diameter between 0.5m and 11.9m. Leaving blank assumes a short stack/fugitve source.
Calculated Effective Stack Height (m). This method for calculating the effective stack height is consistent with that as set out in LAQM.TG(09)	11.62	
	A tall stack with height greater than 10m will be assumed by impacts calculator.	
	12	

Results

CHP Tonnes NOx per Annum (based on Sections 1,2 or 3)	6.39	The tool includes all the assumptions/limitations inherent in LAQM.TG(09) i.e. a 10 – 25 m/s efflux velocity
Estimated Maximum Annual Mean NO_2 Contribution from CHP (ug/m^3), or Contribution from CHP at nearest receptor (ug/m3) for short stacks	**0.39**	The CHP screening tool does not take account of background NO_2 level; it calculates only the contribution of the stack to the maximum NO_2 annual mean concentration at the worst-case location. This locations will be different for varying stack heights and diameters.

The result from this tool is conservative, and errs on the side of caution. Only ground level impacts are considered. It is likely that the application of a detailed dispersion model using installation-specific values for exit velocity, volumetric flow-rate and flue gas temperature, and local meteorological data, would give a lower result.