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•INTERNAL



Process
Process Data Sheet
Cover

Cryogenics & Lurgi
technologies

•INTERNAL

Business Owner Process Department Team Leader
Distribution List Check Project ACL (Access Control List)

621001C12

PROCESS DATA - WET FEED GAS COMPRESSOR

2	AFI	Approved for Inquiry	All	2026-06-05	M. JACQUEMIN	F. PÈRE	L. GRANADOS
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0	AFI	Approved for Inquiry	All	2025-05-13	Z.BONDOUX	M.HEINRCH	L.GRANADOS
Rev.	Status	Description	Sheet	Date	Prepared by	Checked by	Approved by

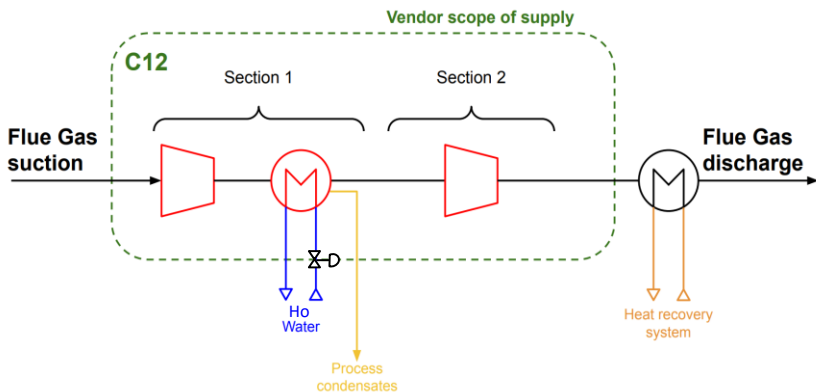
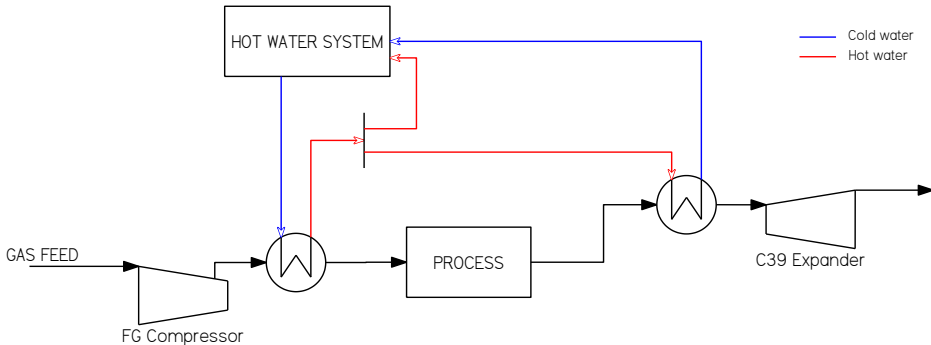
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Case-Name: N/A

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		Process Process Data Sheet Compressor			
01	Item Number	C12		Unit No.	N/A
02				Unit Name	
03	Designation	WET FLUE GAS COMPRESSOR			
04	Number required	1		Supplier/Type	
05	Driver	Electrical Motor			
06					
07	TABLE OF CONTENTS				
08					
09				Page	
10	Process description and vendor scope of supply				2
11	Process gas characteristics for the design of the machine				3
12	Hot water characteristics and utilities				4
13	Design Philosophy				5
14	Design Philosophy - continuation				6
15	Process gas composition and physical characteristics				7
16					
17	PROCESS DESCRIPTION AND VENDOR SCOPE OF SUPPLY				
18					
19	PROCESS SCHEME				
20					
21					
22					
23					
24					
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26					
27					
28					
29					
30					
31					
32					
33	PROCESS DESCRIPTION				
34					
35	The WET FLUE GAS COMPRESSOR (C12) compresses wet flue gas from low to medium pressure and is divided into two sections.				
36	The WET FLUE GAS contains acidic components (e.g HNO3, H2SO4) that can condense in the intercooler of section 1 of the compressor; vendor to advise on material selection.				
37	Section 2 is adiabatic in order to recover heat at the compressor discharge with a heat recovery system (outside vendor scope of supply). This heat will be used to preheat the gas going through the expander side of the compander of the plant, see below scheme. Compressor discharge temperature will then be calculated according to needed temperature at the inlet of the expander, see design philosophy page 5 and 6.				
38					
39					
40					
41	This datasheet contains the process specifications for DESIGN, NOMINAL, TURNDOWN and START-UP cases.				
42	Vendor to optimize the compressor operation and TCO considering all cases and power evaluation.				
43	Heat integration is performed on the first stage intercooler, pressure ratio to be chosen to reach specified temperature at the inlet of intercooler.				
44	Vendor to advise the number of compression stages and intercoolers in both sections.				
45	Vendor to advise the sealing gas configuration.				
46					
47					
48					
49					
50					
51					
52					
53					
54					
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		Process Item Specifications & Data Sheets Process Data Sheet Compressor						
01	Item Number		621001C12					
02								
03	Designation		PROCESS DATA - WET FEED GAS COMPRESSOR					
04								
05								
06	CASE		RATED DESIGN	NOMINAL WINTER	NOMINAL SUMMER	START UP		
07								
08								
09	HOT WATER							
10	ME- Glycol content in hot water		% vol	0				
11	Hot water flowrate		m³/h	v.t.a	v.t.a	v.t.a		
12	Hot water intercooler outlet temperature		°C	v.t.a	Gas T in - 6°C (8)	v.t.a	2	
13	Water fouling factor		m²h°C/kcal	0.0001				
14	Water inlet pressure		bar(a)	19.5				
15	Allowable water pressure drop (skid)		mbar	2 500				
16	Design pressure		barg	25.0				
17	Design temperature		min. / max. °C	-20 / 230				
18								
19								
20	COOLING WATER (for auxiliary equipment)							
21	ME- Glycol content in cooling water		% vol	0				
22	Cooling water temperature - process design		°C	23.1	13.4	18.7	23.1	
23	Cooling water supply pressure		bar (a)	4.0				
24	Temperature elevation in equipment (skid)		°C	15.0				
25	Allowable water pressure drop (skid)		mbar	1 000				
26								
27								
28	UTILITIES							
29	Seal gas nature			(9)				
30	Seal gas flowrate (standstill / normal operation)		Nm³/h					
31	Seal gas leakage into process section (overall)		Nm³/h					
32	Seal gas leakage to atmosphere (overall)		Nm³/h					
33	Minimum seal gas pressure		bara					
34	Instrument air flowrate		Nm³/h					
35	Frequency		Hz	50.0				
36								
37								
38	Notes: Nm³ = m³ reduced to 0°C and 1.013 bar abs.							
39								
40								
41	(8) See page 5 for design philosophy. Minimum hot water temperature is 118°C.							
42	(9) Please refer to Technical Requisition Summary.							
43								
44	: values to be advised by vendor.							
45								
46	: values to be guaranteed by vendor with the following tolerances : Pressure (- 0 %) ; Power construction tolerances (+ 0 %) ;							
47	Power measurement tolerances (< 1.5 %, advise if different) ; Discharged flow (- 0 %) ; Temperature (+ 1°C) ;							
48	Water flow (+ 5 %) ; Leakage flowrate of process gas (+ 0 %)							
49								
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02			
03	Designation	PROCESS DATA - WET FEED GAS COMPRESSOR	
04			
05	Number required	1	Supplier/Type
06	Driver	Electrical Motor	

DESIGN PHILOSOPHY

Step 1 → Componder - Expander side

Determine the temperature needed at the inlet of the expander (= a1) to reach 2°C after the expansion. Use a1 in the following formula to determine the temperature needed at the outlet of the Flue Gas Compressor (= z1) :

$$z1 = a1 + 45^{\circ}\text{C} \text{ and minimum } z1 \text{ value should be } 181^{\circ}\text{C}$$

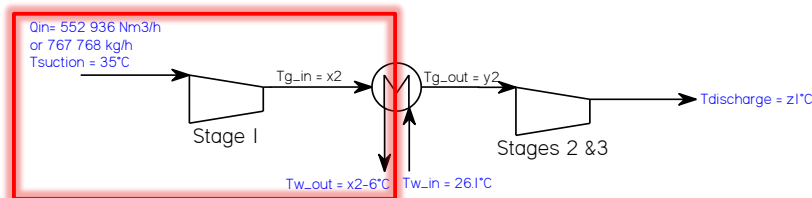
212°C

STEP 1		
Variables	Fixed values	Calculated values
a1	2°C after expansion	z1

Step 2 → Flue Gas Compressor - Nominal Winter Case

On this case, determine the optimum pressure at the outlet of the first stage. Make sure that the gas temperature is high enough so that the hot water temperature is not lower than 118°C. Use formula $T_{w_out} = T_{g_in} - 6^{\circ}\text{C}$:

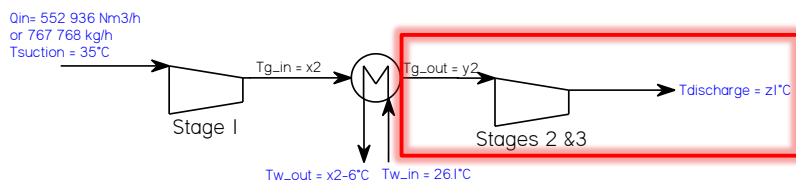
STEP 2		
Variables	Fixed values	Calculated values
Intermediate P	T_{g_in}	T_{w_out}



Step 3 → Flue Gas Compressor - Nominal Winter Case

Still on the Nominal Winter case, work on the second section of the compressor to determine which intercooler gas outlet temperature (=y2) allows to reach calculated specification on discharge temperature (=z1) :

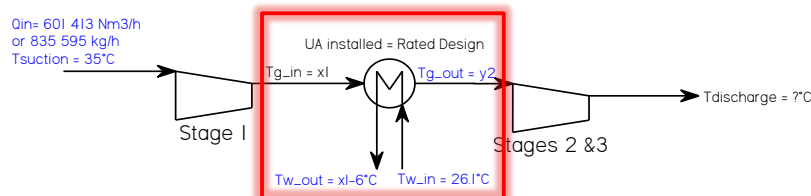
STEP 3		
Variables	Fixed values	Calculated values
y2	z1	-



Step 4 → Flue Gas Compressor - Rated Case step 3

On the rated case, reinject the temperature y2 determined in step 2 as the gas outlet temperature and design the intercooler on the Rated case conditions. Use an approach of 6°C between gas inlet temperature and water outlet temperature :

STEP 4		
Variables	Fixed values	Calculated values
Hot water flow	y2 ; T_{w_in}	x1 ; intercooler UA ; T_{w_out} ; $T_{discharge}$



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INTERNAL

Derived from G-TPL-13-0-1, Rev. 1, issued 26-Jun-18

Rev. 0

AL_CRYO_PROCESS_DS_TEMPLATE_COMPRESSOR



Process
Process Data Sheet
Compressor

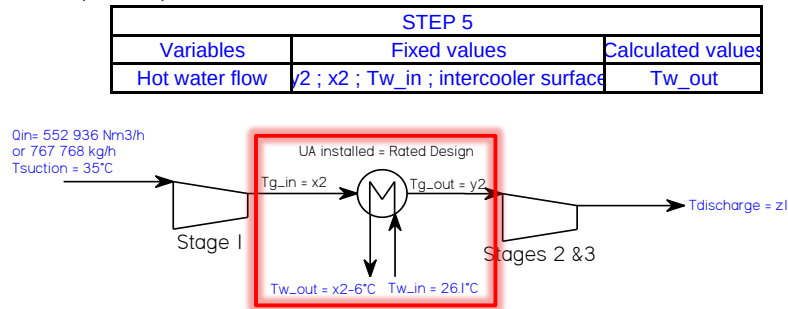
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01	Item Number	621001C12	
02			
03	Designation	PROCESS DATA - WET FEED GAS COMPRESSOR	
04			
05	Number required	1	Supplier/Type
06	Driver	Electrical Motor	

DESIGN PHILOSOPHY - CONTINUATION

Step 5 → Flue Gas Compressor – Nominal Winter and Summer cases check

The purpose of this step is not to design anything but only to predict and estimate performances based on the design that was calculated in the previous steps. Inject the intercooler surface calculated in step 4 in the Nominal Winter and Summer cases. Update corresponding water flow to still reach the correct outlet temperature y2 :



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		Process Process Data Sheet Compressor					
01	Item Number		621001C12				
02							
03	Designation		PROCESS DATA - WET FEED GAS COMPRESSOR				
04							
05	Number required		1				
06	Driver		Electrical Motor				
07							
08							
09	CASES		RATED DESIGN	NOMINAL WINTER	NOMINAL SUMMER	START UP	
10							
11	FLUID		Flue gas	Flue gas	Flue gas	Air	
12	Composition (wet basis)						
13	Carbon dioxide (CO ₂)	%mol	19.77	19.76	20.03	0.040	2
14	Water (H ₂ O)	%mol	4.10	4.18	2.83	1.90	2
15	Nitrogen (N ₂)	%mol	68.31	68.41	69.37	76.60	2
16	Oxygen (O ₂)	%mol	6.75	6.75	6.85	20.55	2
17	Argon (Ar)	%mol	0.89	0.82	0.83	0.91	2
18	Carbon monoxide (CO)	%mol	0.147	0.070	0.071	-	2
19	Nitric oxide (NO)	ppmm	260.3	188.9	191.6	-	2
20	Nitric dioxide (NO ₂)	ppmm	29.8	8.6	8.9	-	2
21	Sulfur dioxide (SO ₂)	ppmm	10.0	10.0	10.0	-	2
22	Sulfur trioxide (SO ₃)	ppmm	0.1	0.1	0.1	-	2
23	Methane (CH ₄)	ppmm	17.2	17.1	17.3	-	2
24	Ammonia (NH ₃)	ppmm	< 2			-	
25	Formaldehyde	ppmm	< 1			-	
26	Acetaldehyde	ppmm	< 1			-	
27	Others						
28	Total Mercury (Hg)	µg/Nm ³	< 10 dry @10%O ₂			-	
29	PCDD / PCDF	ng/Nm ³	0.05 dry @10%O ₂			-	
30	HAP - EPA	µg/Nm ³	5.0 dry @10%O ₂			-	
31	BTEX	mg/Nm ³	1.0 dry @10%O ₂			-	
32	Mass density (10)	kg/m ³	1.205	1.204	1.237	1.014	2
33	Molecular Weight (10)	g/mol	31.14	31.12	31.31	28.76	2
34	Molar Heat Capacity (10)	kcal/Nm ³ /°C	0.333	0.333	0.332	0.313	2
35	Viscosity (10)	kg/m/h	0.065	0.065	0.065	0.071	2
36							
37	Notes : Nm ³ = m ³ reduced to 0°C and 1.013 bar abs.						
38	(10) Physical properties at suction						
39							
40	Dust content						
41	Dust content	µg/Nm ³	10				
42							
43							
44	Acid Process Condensates						
45	Please note that acidic process condensates (pH around 2-3) are generated during condensation of wet flue gas at intercooler, vendor to advise on material selection.						2
46							
47							
48							
49							
50							
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