●INTERNAL

Air Liquide ENGINEERING & CONSTRUCTION

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

Rev.	Status	Description	Sheet	Date	Prepared by	Checked by	Approved by
2	AFI	Approved for Inquiry	All	2026-06-05	M. JACQUEMIN	F. PÈRE	L. GRANADOS
1	AFI	Approved for Inquiry	All	2025-10-01	M. JACQUEMIN	L.GRANADOS	L.GRANADOS
0	AFI	Approved for Inquiry	All	2025-05-13	Z.BONDOUX	M.HEINRCH	L.GRANADOS

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●CONFIDENTIAL

01	Item Number	C12	Unit No. N/A	Unit Name
02				
03	Designation	WET FLUE GAS COMPRESSOR		
04	Number required	1	Supplier/Type	
05	Driver	Electrical Motor		

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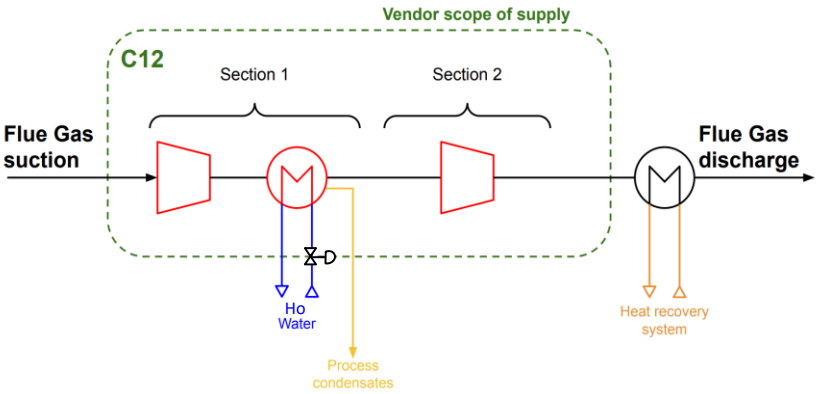
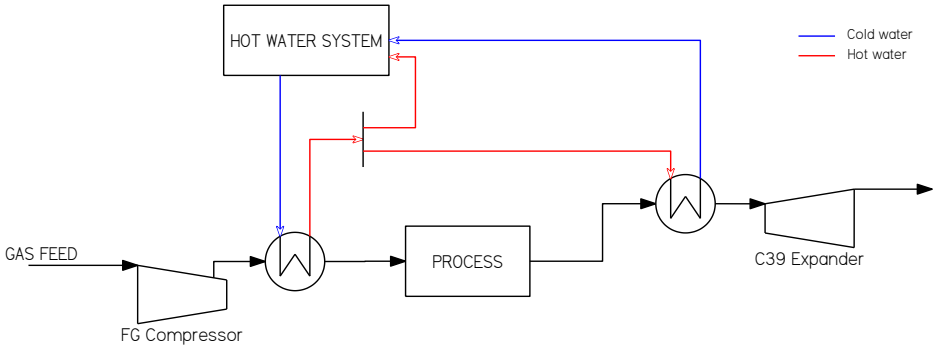
PROCESS DESCRIPTION AND VENDOR SCOPE OF SUPPLY

PROCESS SCHEME



PROCESS DESCIPTIOI

The WET FLUE GAS COMPRESSOR (C12) compresses wet flue gas from low to medium pressure and is divided into two sections.
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.
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**.
This datasheet contains the process specifications for DESIGN, NOMINAL, TURNDOWN and START-UP cases.
Vendor to optimize the compressor operation and TCO considering all cases and power evaluation.
Heat integration is performed on the first stage intercooler, pressure ratio to be chosen to reach specified temperature at the inlet of intercooler.
Vendor to advise the number of compression stages and intercoolers in both sections.
Vendor to advise the sealing gas configuration.



Line revised under Rev. No.

•INTERNAL

Air Liquide ENGINEERING & CONSTRUCTION

Process
Process Data Sheet

Compressor

Cryogenics & Lurgi technologies

01	Item Number	621001C12						
02								
03	Designation	PROCESS DATA - WET FEED GAS COMPRESSOR						
04								
05	Number required	1		Supplier/Type				
06	Driver	Electrical Motor						
07	**CASE**			**RATED DESIGN**	**NOMINAL WINTER**	**NOMINAL SUMMER**	**START UP**	
08								
09	Fluid **(see page 5 for detailed composition and properties)**			**Flue gas**	**Flue gas**	**Flue gas**	**Air**	
10	**SUCTION**							
11	Molar Flowrate (wet basis)		Nm^3/h	601 413	552 936	545 230		2
12	Mass Flowrate (wet basis)		kg/h	835 595	767 768	761 551		2
13	Volume Flowrate		m^3/h	693 721	637 797	615 487		2
14	Inlet Pressure **(1)**		bar(a)	0.990	0.990	0.990	1.013	2
15	Temperature **(1)**		°C	35.0	35.0	28.4	23.8	2
16	Duct diameter		DN	146"				2
17	Design pressure	min. / max.	mbarg	-0.09 / +0.09				2
18	Design temperature	min. / max.	°C	-20 / +80				2
19								
20	**Section 1 DISCHARGE (before intercooler) (6)**							
21	Section 1 discharge pressure		bar(a)	v.t.a	v.t.a	v.t.a		
22	Section 1 discharge temperature **(2)**		°C	v.t.a	v.t.a	v.t.a		2
23	**Section 2 DISCHARGE**							
24	Molar Flowrate (wet basis) **(3)**		Nm^3/h	v.t.g	v.t.g	v.t.g		
25	Mass Flowrate (wet basis)		kg/h	v.t.a	v.t.a	v.t.a		
26	Section 2 discharge pressure		bar(a)	8.60	8.27	8.27		2
27	Temperature **(4)**		°C	v.t.g	v.t.g	v.t.a		2
28	Water content		kg/h					
29	Pipe diameter		DN	84"				2
30	Design pressure		bar(g)	9				2
31	Design temperature	min. / max.	°C	-20 / 250				2
32								
33	**HOT WATER**							
34	Minimum available hot water temperature		°C	26.1	26.1	26.1	26.1	2
35								
36	**ENERGY**							
37	Polytropic efficiency		%					
38	Thermodynamic power		kW					
39	Mechanical losses (including main oil pump)		kW					
40	Power at motor coupling (including losses)		kW					
41	Total power at motor terminals		kW					
42	Motor rating		kW					
43	Surge limit in % of flow (p=constant)		%					
44	Driver rotating speed		RPM					

45 Notes: $Nm^3 = m^3$ reduced to 0°C and 1.013 bar abs.

46 **(1) Before inlet flange (inlet silencer if required), no inlet filter is required.**

47 **(2) Vendor to advise temperature, according to design philosophy page 5.** 2

48 **(3) Vendor to advise on the condensed fluid in the intercooler and %H2O content in compressed gas.**

49 **(4) Vendor to guarantee temperature, according to design philosophy page 5.** 2

50 **(5) Vendor to advise minimum load of the compressor.** 2

(6) Possibility to have acid condensates in intercooler during transitory phases. 2

: values to be advised by vendor.

: values to be guaranteed by vendor with the following tolerances : Pressure (- 0 %) ; Power construction tolerances (+ 0 %) ; Power measurement tolerances (< 1.5 %, advise if different) ; Discharged flow (- 0 %) ; Temperature (+ 1°C) ; Water flow (+ 5 %) ; Leakage flowrate of process gas (+ 0 %)

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Case-Name: N/A

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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		m^3/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		$m^2h°C/kcal$			0.0001		2
14	Water inlet pressure		bar(a)			19.5		2
15	Allowable water pressure drop (skid)		mbar			2 500		2
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	2
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)		Nm^3/h					
31	Seal gas leakage into process section (overall)		Nm^3/h					
32	Seal gas leakage to atmosphere (overall)		Nm^3/h					
33	Minimum seal gas pressure		bara					
34	Instrument air flowrate		Nm^3/h					
35	Frequency		Hz			50.0		
36								
37								
38	Notes: $Nm^3 = m^3$ 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.**							2
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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DESIGN PHILOSOPHY

Step 1 → Compander - 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) :

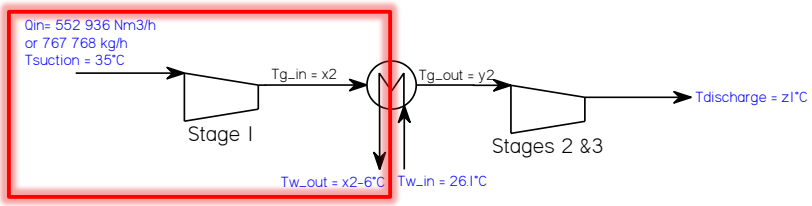
z1 = a1 + 45°C and minimum z1 value should be ~~181°C~~ 212°C

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 Tw_out = Tg_in - 6°C :

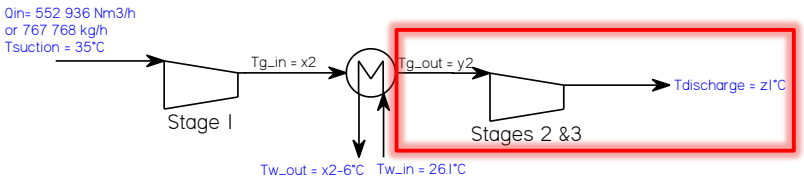
STEP 2		
Variables	Fixed values	Calculated values
Intermediate P	Tg_in	Tw_out



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	-

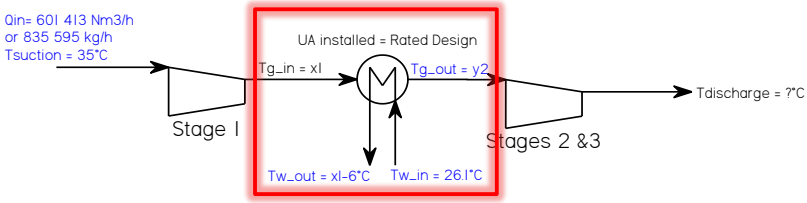


Step 4 → Flue Gas Compressor - Rated Case

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 ; Tw_in	x1 ; intercooler UA ; Tw_out ; Tdischarge



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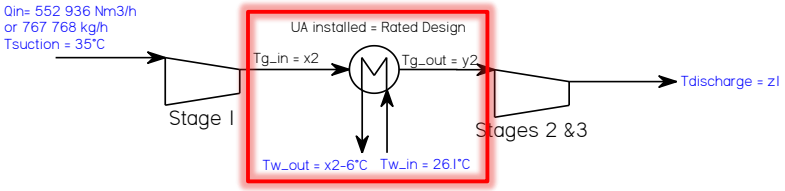
DESIGN PHILOSOPHY - CONTINUATION

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 :

STEP 5		
Variables	Fixed values	Calculated values
Hot water flow	y2 ; x2 ; Tw_in ; intercooler surface	Tw_out



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Compressor

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04								
05	Number required	1	Supplier/Type					
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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_2O)	%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 (SO2)	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 (NH3)	ppmm		< 2		-		
25	Formaldehyde	ppmm		< 1		-		
26	Acetaldehyde	ppmm		< 1		-		
27	**Others**							
28	Total Mercury (Hg)	µg/Nm3		< 10 dry @10%O2		-		
29	PCDD / PCDF	ng/Nm3		0.05 dry @10%O2		-		
30	HAP - EPA	µg/Nm3		5.0 dry @10%O2		-		
31	BTEX	mg/Nm3		1.0 dry @10%O2		-		
32	Mass density **(10)**	kg/m3	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/Nm3/°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

Notes : $Nm^3 = m^3$ reduced to 0°C and 1.013 bar abs.
(10) Physical properties at suction

Dust content

Dust content	µg/Nm³	10

Acid Process Condensates

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

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