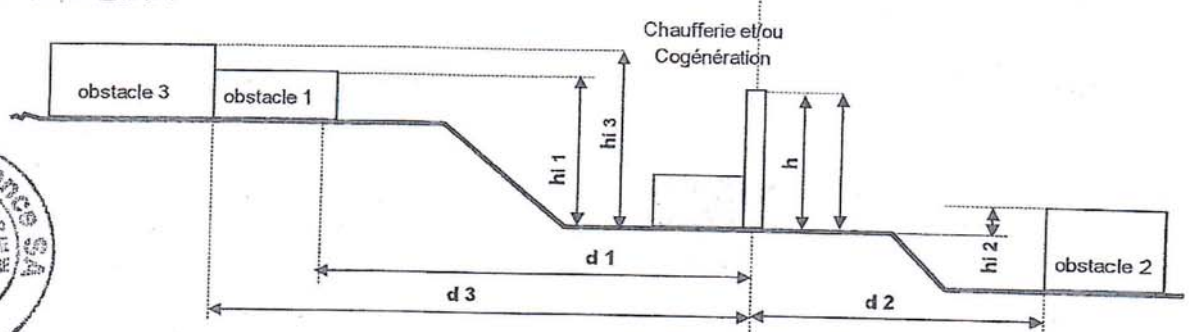


Centrale d'énergie thermique de puissance totale installée : $2MW < P < 20 MW$

1. SCHEMA



Hauteur minimum de la cheminée 15,00 m
C'est la plus grande des valeurs de H_p et de H_i

2. HYPOTHESES D'ETUDE

2.1 - TYPE D'AGGLOMERATION

Commune : **CHELLES** 45495 habitants
Département : **77 - SEINE et MARNE** Zone de Protection Spéciale - **ZPS 2**

2.2 - COGENERATION

Désignations	Bases unitaires de calcul		Totaux
	N° 1	N° 2	
Type de machine	M.A.G.	M.A.G.	
Puissances installées M.A.G. P_{cm}	9 972	9 972	19 944 kW PCI
Puissances installées T.A.G. P_{ct}			kW PCI
Puissance élec. sortie alternateur P_{el}	3 989	3 989	7 978 kW élec.
Puissances installées (combustible) P_c	9 972	9 972	19 944 kW PCI
Combustibles	Gaz	Gaz	
Températures des fumées T_c	115	115	115 °C
Débits Massiques des fumées Q_{mc}	31 392	31 392	62 784 Kg/h
	8,720	8,720	17,440 kg/s
Débits volumiques des fumées Q_c	34 856	34 856	69 712 m³/h
Vitesse d'éjection minimale des gaz de combustion en marche continue maximale (Mini réglementaire 25 m/s) V_c	25	25	25 m/s
Conduits séparés (\varnothing maximum) \varnothing_c	702	702	mm int.
Conduit unique (\varnothing maximum) \varnothing_c	-	-	993 mm int.

2.3 - CHAUFFERIE

Désignations	Bases unitaires de calcul		Totaux
Type de générateur			
Puissances installées P_g			kW PCI
Combustibles			
Pouvoir calorifique inférieur PCI			kW/kg
Rendement des générateurs η_g			
Températures des fumées T_g			°C moy.
Masse volumique des fumées m_{vg}			kg/m³
Débits Massiques des fumées Q_{mg}			Kg/h
			kg/s
Débits volumiques des fumées Q_g			m³/h.T°
Vitesse d'éjection minimale des gaz de combustion en marche continue maximale			
Vitesse d'éjection minimale $V_g >$			m/s
Conduits séparés (\varnothing maximum) \varnothing_g			mm int.
Conduit unique (\varnothing maximum) \varnothing_g			mm int.

2.4 - PUISSANCE ENERGETIQUE TOTALE INSTALLEE

La puissance totale installée en kW PCI sur le site (cogénération et chaufferie) est de : **19,944 MW**

2.5 - OBSTACLES

Désignations	Obstacles pris en compte, vus sous un angle supérieur à 15° dans le plan horizontal (voir plan joint)						Bât. de l'install.
	Obstacles pris en compte	<input checked="" type="checkbox"/> N° 1	<input checked="" type="checkbox"/> N° 2	<input checked="" type="checkbox"/> N° 3	<input checked="" type="checkbox"/> N° 4	<input checked="" type="checkbox"/> N° 5	
Hauteur de l'obstacle h_i		4,00 m	10,00 m	6,00 m	5,00 m	5,00 m	13,43 m
Distance de l'obstacle d		12,00 m	32,00 m	33,00 m	74,00 m	44,00 m	27,00 m

h_i : par rapport au sol naturel de la production

**Performances garanties pour 2x 18V28SG
Producteur PUR (auxiliaires alimentés par un contrat EDF)**

Conditions				
Altitude site	500,0	Mètre	+	0 m
Température extérieure maximale	20,0	°C	maxi	
Température Air Comburant	25,0	°C	maxi	
Indice de méthane	72		mini	
PEI du gaz	36 200	kJ/Nm3	mini	
Température mini-maxi du gaz	5 à 50	°C		
Pression minimale du gaz	3,7	Bars relatifs		
Pourcentage volumique de C ₂ H ₆ du gaz	< 5,0	%		
Pourcentage volumique de condensat dans le gaz	< 0.005	%		
Quantité d'huile admissible contenue dans le gaz	< 5	mg/Nm3		
Température Production Eau Chaude (côté cogénération)	95,0	°C		
Température maximale de retour Eau Chaude (côté cogénération)	70,0	°C	@1	
Facteur de puissance (cos phi)	0,928			
Performances garanties				
Puissance électrique fournie aux bornes alternateur	8 090	kWe	+/-	0%
Puissance électrique nette vendue HTA (hors alimentation auxiliaires)	8 010	kWe	valeur garantie	
Puissance thermique fournie Eau Chaude : 70-95°C (régime réseau 65-90°C)	8 280	kWth	+/-	5%
Emissions de NOx (sortie cheminée) à 5% O ₂ - Gaz sec	350,0	mg/Nm3	valeur maxi	
Emissions de CO (sortie cheminée) à 5% O ₂ - Gaz sec	650,0	mg/Nm3	valeur maxi	
Emissions de C _n H _m (sortie cheminée) à 5% O ₂ - Gaz sec	150,0	mg/Nm3	valeur maxi	
Consommation Gaz	20 000	kW pci	valeur garantie	
Consommation électrique de la centrale (hors compresseur gaz)	160	kWe	valeur maxi	
Consommation d'huile	0,61	g/kWhe	valeur maxi	
Rendement Electrique Net HTA	40,1%			
Rendement Thermique	39,4%			
Rendement Total	79,5%			

Zwolle

Pour information:

Consommation électrique du compresseur gaz par moteur

71 kWe

Remarque.:

@1 : si la température de retour de l'eau chaude réseau dépasse 70°C, alors la cogénération est bypassée (aucune production de chaleur tant que cette température reste supérieure à 70°C), car le circuit de compensation est dimensionné uniquement pour assu

MARCHE N° CC 002 HL PB

ANNEXE 1

C - PERFORMANCES GARANTIES

IM = 72	2 x 18V28SG	Unité	Tolérance
Production électrique nette vendue à EDF	7850	kWe	$\pm 0\%$
Production thermique T°C de sortie maxi : 95°C côté cogénération T°C d'entrée maxi : 55°C côté cogénération ⁽¹⁾	8550	kWth	$\pm 5\%$
Consommation de gaz	20 000	kWPCI	$\pm 0\%$
Rendement électrique (bornes alternateur)	40,4	%	$\pm 0\%$
Rendement thermique (brut)	42,7	%	$\pm 5\%$

Pression de gaz à l'entrée de la rampe d'alimentation : mini = 3.7 bar
maxi = 8 bar

Les valeurs ci-dessus sont données pour Tg $\varphi = 0,4$ au niveau 20 kV
Le fonctionnement réel attendu sur site est = Tg $\varphi = 0,4$ au niveau 20 kV

AUTRES CARACTERISTIQUES

Temps de fonctionnement annuel : 3.624 heures
Disponibilité : 95%
PCI minimum gaz : annexe 4

(1) Si la température de retour eau chaude dépasse 80°C, la cogénération est bypassée.



SGS Technische Inspecties B.V.
 An Affiliate of SGS Nederland B.V.

INSPECTION REPORT NO : 28021.01

SUBJECT : **FACTORY TEST GASENGINE GENERATOR SET**

DATE OF REPORT : 31-08-2001

PLACE OF INSPECTION : **WÄRTILÄ NL, ZWOLLE**

DATE OF INSPECTIONS : 30-08 and 31-08-2001

PROJECT : **Chellas, France**

CONTRACTOR : **WARTSILÄ FL**

INTERNAL ORDER : 2099.05

SGS INSPECTION ORDER : 320.800/28021 Chellas

ATTENDANTS:

Mr A. Hamberg
 Mr H.Karsten
 Mr.Jean-Claude Lageat
 Mr. Philippe Bouan
 Mr R.Hoogendonk

WNL, Test department, Zwolle
 WNL, Test department, Zwolle
 Wärtsilä France SA
 Cofathec -France
 SGS Technische Inspekties, NL

1.0 PREAMBLE

Wärtsilä NL requested SGS, to attend to the factory acceptance test of one gas engine generator set. The factory test was carried out at works Wärtsilä NL, Zwolle in test box no: 7.2 on 30-08-2001. The calibration of the box found valid till 12-2001.

ENGINE PARTICULARS

Make	Wärtsilä NL, Zwolle
Type	W 18 V 28 SG
Serial no	28021
Output 100%, air 25°C / water 32°C	4193 KWm
Rpm	1000

GENERATOR PARTICULARS NAMEPLATE

Make	Leroy Somer, France
Type	LSA56 BUL 9-6P, synchronous generator
Serial number	167987/1
IP	23
KW	4500
Cos φ	0,9
Kva	5000
Volts	6300
Amps	458,2
Rpm	1000
Class	F
Hz	50
AVR	R630-3F
Service duty	S1, Excitation R-B-S, A 2,0
Temperature rise	105K, Ambient temperature 40° C
Kg	13800
Date	06-2001
IEC 34	A.C.Generator



SGS Technische Inspecties B.V.
An Affiliate of SGS Nederland B.V.

2.0 PERFORMANCE TESTS

2.1 STANDARD PROCEDURES

The gas engine generator set factory test was carried out to the Standard Wärtsilä program Doc. BZW28SG-GEN Rev.01/00-05-24 and Doc. FAT-W28SG-GEN, Rev.01/99-11-29, order number 565726

The engine was tested, while coupled to the generator built together on a common bedplate resting on springs, which are reportedly included in the delivery, the generator was tested at makers in France and the relevant test records were available for review. The engine was running on local available natural gas, with an assumed calorific value of 32,42 MJ/m³ and a methane number of 81.154 at local box conditions with an outside temperature of 19 to 22C. A gas sample was taken for analysing by and at a certified party and the values of the consumption during the various steps will be corrected accordingly.

Previous to the acceptance test, the engine was subject to the standard test running in program, which covers an adequate number of running hours, during which the engine was tested and inspected at various loads (100/75/50/25%). The generator efficiency at 100% 4105 Kwe (4193 Kwm x 0,979) at the terminals with a power factor of 1,00 is 97, 90%. While the engine was running under these loads during testing, temperatures, pressures, gas consumption etc. are entered in a test record and are compared with the allowed values. The safety devices as per acceptance test program were demonstrated, with good results.

Vibration measurements were carried out at 100% load and a gas sample was taken for analysis. For outstanding and recommendations see par 3.0.

2.2 ENGINE PARTS INSPECTED AFTER TESTING 30-08-2001

Visual inspection without dismantling:

The visual inspection of crankcase, cams and rollers showed no deficiencies

Visual inspection after dismantling of crankpin bearing A4:

Crankpin bearing A4 was found in good condition and all remaining parts as visible found normally ran in. The visual inspection was carried out with mr Karsten test engineer Wärtsilä, Zwolle.

3.0 OUTSTANDINGS BEFORE ACCEPTANCE

ENGINE

- 3.01 Results of gas analysis to be for correction of the gas consumption at the various steps.
- 3.02 Principal engine certificates to be submitted to SGS.
- 3.03 Manufacturers nameplate to be completed with the relevant particulars.
- 3.04 Factory acceptance test report to be verified and signed.

4.0 CONCLUSIONS

SGS attended to the factory testing and visual inspection of S/N 28021 on 30-08-2001 and 31-08-2001 respectively. The factory acceptance was carried out with good results, subject the outstanding in par 3.0 are dealt with. The engine was provided with a die stamped mark "SGS 04", located beside the engine die stamped serial number 28021 in the crankcase at the A-bank turbo blower side.

SGS TECHNISCHE INSPECTIES B.V.
R. Hooogendonk R. C. J. Hooogendonk
Sr. Manager Technical Surveys
Copies to:

WÄRTSILÄ NEDERLAND B.V.
WÄRTSILÄ NSD NEDERLAND B.V.
A. Hamberg / H. Karsten Handelslaan 95
WNL Test Department 8000F Zwolle
the Netherlands

Attendants, Wärtsilä NL QA/QC 3443, Test department, Power Plants Project Manager 3947,
Th. Wassing 3984, W. Jonker 3949.

1/2 + AISU23

1



SGS Technische Inspecties B.V.
An Affiliate of SGS Nederland B.V.

INSPECTION REPORT NO

: 28022.01

SUBJECT: **FACTORY TEST GASENGINE GENERATOR SET****DATE OF REPORT**

: 12-09-2001

PLACE OF INSPECTION: **WÄRTSILÄ NL, ZWOLLE****DATE OF INSPECTIONS**

: 11-09 and 12-09-2001

PROJECT: **Chellas, France****CONTRACTOR**: **WÄRTSILÄ FL****INTERNAL ORDER**

: 2099.05

SGS INSPECTION ORDER

: 320.800/28022 Chellas

ATTENDANTS:

Mr. A. Hamberg
Mr. A. Poetsma
Mr. H. Karsten
Mrs. M. Broekhuizen
Mr R. Hoogendonk

WNL, Test department, Zwolle
WNL, Test department, Zwolle
WNL, Test department, Zwolle
WNL, Test department, Zwolle
SGS Technische Inspekties, NL

1.0 PREAMBLE

Wärtsilä NL requested SGS, to attend to the factory acceptance test of one gas engine generator set. The factory test was carried out at works Wärtsilä NL, Zwolle in test box no: 7.2 on 11-09-2001. The calibration of the box found valid till 12-2001.

ENGINE PARTICULARS

Make	Wärtsilä NL, Zwolle
Type	W 18 V 28 SG
Serial no	28022
Output 100%, air 25°C / water 32°C	4193 KWm
Rpm	1000

GENERATOR PARTICULARS NAMEPLATE

Make	Leroy Somer, France
Type	LSA56 BUL 9-6P, synchronous generator
Serial number	167987/2
IP	23
KW	4500
Cos φ	0,9
Kva	5000
Volts	6300
Amps	458,2
Rpm	1000
Class	F
Hz	50
AVR	R630-3F
Service duty	S1, Excitation R-B-S, A 2,0
Temperature rise	105K, Ambient temperature 40° C
Kg	13800
Date	06-2001
IEC 34	A.C. Generator

2 1/2 + AISU23

2



SGS Technische Inspecties B.V.
An Affiliante of SGS Nederland B.V.

2.0 PERFORMANCE TESTS

2.1 STANDARD PROCEDURES

The gas engine generator set factory test was carried out to the Standard Wärtsilä program Doc. BZW28SG-GEN Rev.01/00-05-24 and Doc. FAT-W28SG-GEN, Rev.01/99-11-29, order number 565727

The engine was tested, while coupled to the generator built together on a common bedplate resting on springs, which are reportedly included in the delivery, the generator was tested at makers in France and the relevant test records were available for review. The engine was running on local available natural gas, with an assumed calorific value of 32,38 MJ/m³ and a methane number of 80.427 at local box conditions with an outside temperature of 18 to 19C. A gas sample was taken for analysing by and at a certified party and the values of the consumption during the various steps will be corrected accordingly.

Previous to the acceptance test, the engine was subject to the standard test running in program, which covers an adequate number of running hours, during which the engine was tested and inspected at various loads (100/75/50/25%). The generator efficiency at 100% 4101 Kwe (4193 Kwm x 0,978) at the terminals with a power factor of 1,00 is 97, 80%. While the engine was running under these loads during testing, temperatures, pressures, gas consumption etc. are entered in a test record and are compared with the allowed values. The safety devices as per acceptance test program were demonstrated, with good results.

Vibration measurements were carried out at 100% load and a gas sample was taken for analysis.

For outstanding and recommendations see par 3.0.

2.2 ENGINE PARTS INSPECTED AFTER TESTING 30-08-2001

Visual inspection without dismantling:

The visual inspection of crankcase, cams and rollers showed no deficiencies

Visual inspection after dismantling of crankpin bearing :B7

Crankpin bearing B7 was found in good condition and all remaining parts as visible found normally ran in.

The visual inspection was carried out with mrs. Broekhuizen test engineer Wärtsilä, Zwolle.

3.0 OUTSTANDINGS BEFORE ACCEPTANCE

ENGINE

3.01 Results of gas analysis to be for correction of the gas consumption at the various steps.

3.02 Principal engine certificates to be submitted to SGS.

3.03 Manufacturers nameplate to be completed with the relevant particulars.

3.04 Factory acceptance test report to be verified and signed.

4.0 CONCLUSIONS

SGS attended to the factory testing and visual inspection of S/N 28022 on 11-09-2001 and 12-09-2001 respectively. The factory acceptance was carried out with good results, subject the outstanding in par 3.0 are dealt with. The engine was provided with a die stamped mark "SGS 04", located beside the engine die stamped serial number 28022 in the crankcase at the A-bank turbo blower side.

SGS TECHNISCHE INSPECTIES B.V.

R. Hoogenboezem R. C. Hoogenboezem

Sr. Manager Technical Surveyor

Copies to:

Attendants, Wärtsilä NL QA/QC 3443, Test department, Power Plants Project Manager 3947
Th. Wassing 3984, W. Jonker 3949.

WÄRTSILÄ NEDERLAND B.V.

A. Hamberg / H. Karsten

WNL Test Department

6017 JE Zwolle