

6 Anexos

Anexo 1: Pliego de condiciones

REQUISITION D'ACHAT N° RTH 01

OBJET: Groupes diesel de production d'électricité

2x3 MW- 5500 V- 50 Hz

2x0,5 MW- 220 V- 50 Hz

Généralités:

La présente réquisition concerne la fourniture, l'installation et la mise en service, clé en main, d'une centrale électrique basée sur des groupes diesel de production d'électricité:

- Groupes électrogènes de production continue :

Cette installation est d'une puissance totale de 6 MW, service continu, et se composera de deux groupes de 3 MW chacun, et aura les caractéristiques spécifiées dans la partie A/ ci-après.

- Groupes électrogènes de secours :

Cette installation sera d'une puissance totale de 1 MW, composée de deux groupes électrogènes de secours, dont les caractéristiques sont spécifiées dans la partie B/ ci-après.

A/ GROUPES ELECTROGENES 2x3 MW- 5500V- 50 Hz- 3Φ

Les groupes diesel seront conçus pour assurer une production continue et de secours. Ils doivent être équipés pour fonctionner en parallèle avec le réseau électrique publique, avec d'autres groupes de production d'électricité, et également en flot.

La mise en marche des groupes électrogènes diesel s'opérera en premier lieu dans la salle de commande. Le mode de fonctionnement est manuel avec synchronisation automatique, basée sur la commande par touches d'opérateur. Les équipements auxiliaires sont commandés à partir de panneaux de commande locaux, installés à coté des équipements respectifs.

L'installation sera conçue pour fonctionner uniquement au GAS OIL.

1) Conditions du site :

Température ambiante maximale extérieur	: 45°C
Température maximale ambiante, salle des moteurs	: 50°C
Altitude maximale au-dessus du niveau de la mer	: 3 mètres
Humidité relative maximale	: 90%
Pouvoir calorifique	: 42.700 kJ/kg

2) Disposition :

Les groupes électrogènes diesel seront installés sur des fondations en béton dans un bâtiment dis salle des moteurs. Les filtres à air de combustion, les silencieux des gaz d'échappement et les réservoirs du GAS OIL, seront installés à l'extérieur du bâtiment principal.

Les groupes électrogènes seront fournis avec des pompes de pré lubrification et une unité de préchauffage à commande électrique, permettant la mise en ligne de ses unités avec préavis court.

3) Caractéristiques principales :

La puissance électrique dans sa totalité est produite par deux groupes électrogènes équipés de moteurs diesel fonctionnant au GAS OIL, avec les caractéristiques électriques ci-après :

Puissance nominale installée de la centrale	: 2x3000	kWe
Puissance nette de sortie de la centrale	: 2x3750	kVA
Tension générateur et secteur	: 5500	V, ajust ! 5%
Fréquence	: 50	Hz
Tension auxiliaire	: 400	V CA
	110/48/24	V CC

4) Moteur diesel :

Le moteur diesel équipant le groupe électrogène doit être un Turbo Diesel à 4 temps suralimenté.

Les soumissionnaires doivent joindre à leur offre les caractéristiques détaillées du moteur proposé.

La consommation spécifique, selon les conditions du site et suivant les conditions de référence de la norme ISO 3046/1 doivent être fournies, à différents régimes (100%, 75% et 50% de la charge).

5) Alternateur :

L'alternateur est un générateur synchronique autorégulateur sans balais dont les caractéristiques principales sont :

Puissance admissible en service continu	: 3750	kVA
Facteur de puissance minimal	: 0,8	
Tension nominale	: 5,5	kV
Classe d'échauffement	: F	
Classe d'isolation	: F	
Classe de protection	: IP 23, minimal	
Montage moteur	: IM 1101	
Réglage de tension	: Unité RT à distance, ! 5%	
Norme	: CEI-34	

L'alternateur comportera un circuit d'amortissement pour fonctionner en parallèle avec d'autres alternateurs ou le secteur.

L'alternateur sera menu d'un système d'excitation à diodes tournantes. La puissance de commande de l'excitation est assurée par un régulateur automatique de tension.

Les soumissionnaires joindront à leurs offres les caractéristiques détaillées de l'alternateur, système d'excitation, régulateur de tension et de toute autre composante no accessoire.

6) Systèmes auxiliaires :

Les soumissionnaires joindront à leurs offres le descriptif technique détaillé des systèmes auxiliaires tel que :

- Système du combustible
- Système de lubrification
- Système d'air comprimé
- Système de refroidissement
- Système d'air de suralimentation ou de combustion
- Système de gaz d'échappement

7) Equipement haute tension :

Le soumissionnaire joindra à son offre les caractéristiques techniques des équipements haute tension et de l'appareillage à utiliser :

- Cellule 5,5 kV, arrivée alternateur
- Cellule point neutre
- Système de mise à la terre
- Système de verrouillage
- Protections
- Et tout autre équipement nécessaire à prévoir.

8) Equipement basse tension :

Le tableau général basse tension sera installé dans un local à la salle des moteurs. Ce tableau alimentera tous les auxiliaires (380 V CA- 110 V CC- 48 V CC- 24 V CC ...)

Les panneaux de commande locale des groupes seront prévus dans le même local et comporteront les équipements de commande, synchronisation, régulation, etc....

La commande à distance, la synchronisation, la mise en charge, les afficheurs, les enregistreurs et tout équipement similaire à prévoir seront dupliqués sur pupitre à la salle de contrôle.

9) Etendue des travaux :

Le présent marché consistant à fournir, installer et mettre en service une centrale à groupes électrogènes, clé en main. La société adjudicatrice aura à sa charge toutes fournitures et tous travaux nécessaires.

10) Visite du site :

Les sociétés soumissionnaires peuvent à effectuer une visite sur site afin de prendre connaissance des travaux à exécuter et des fournitures à prévoir, pour bien estimer leurs offres.

11) Documents à joindre à l'offre :

- Documentation technique détaillée des équipements proposés
- Plans et schémas de principe
- Planning détaillé de réalisation
- Bordereaux des prix.

B/ GROUPES DE SECOURS 2x0,5 MW- 220 V- 50 Hz- 3Φ

L'installation sera composée de deux groupes électrogènes d'une puissance totale de 1 MW.

Les conditions de site sont les mêmes. L'emplacement des 2 groupes est, à priori, dans le même bâtiment (salle des moteurs).

Les groupes électrogènes serviront de secours pour alimenter un tableau principal de distribution 220 V.

Les 2 groupes seront de type à temps de démarrage zéro, et seront à démarrage automatique ou manuel.

Les caractéristiques techniques principales sont :

Puissance nominale	: 525	kVA
Tension nominale	: 220	V triphasée
Fréquence	: 50	Hz
Classe d'échauffement	: F	
Classe d'isolement	: F	
Cos Φ	: 0,8	
Excitation	: Statique à diodes tournantes	
Réglage de tension	: Automatique	
Classe de protection	: IP 44	
Démarrage	: Batterie 24 V CC	
Combustible	: Gazoil	

Les groupes électrogènes seront dotés d'une armoire chacun, dans laquelle il y aura le disjoncteur général sortie groupe avec les protections, l'alimentation des auxiliaires, les appareils de mesure...

Les sociétés soumissionnaires peuvent à effectuer une visite sur site afin de prendre connaissance des travaux à exécuter et des fournitures à prévoir, pour bien estimer leurs offres.

Les soumissionnaires doivent joindre à leurs offres :

- Documentation technique détaillée des équipements proposés
- Plans et schémas de principe
- Planning détaillé de réalisation
- Bordereaux des prix.

Anexo 2: Aplicación configuración grupo (CISA)

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Caterpillar S.A.R.L. | 11/13/2007 02:09

Quotation | 17

3612 DIESEL EPG | Total price: EUR 751,508.59 / 1 EA

01MANDATORY | 02PCD/MNT | 03FLV/MNT/PTO/CNT | 04COO/JWH | 05LUB/FUL | 06AIR/EXH/ST | 07PRO/WIR/TVA | 08SHR/PCK/TST/TLS/PNT | 09LIT

Instances	No.	Item	5
3612 EPG	0	0	
7E7012	1.0	0001	
2W4556	1.0	0010	
7W1543	1.0	0030	
000000000001859353	1.0	0040	
1W0797	1.0	0090	
1W0806	3.0	0100	
1W0887	1.0	0130	
1W0891	1.0	0140	
1W9874	2.0	0150	
2W3329	1.0	0180	
2W2681	2.0	0190	
2W2682	2.0	0200	
2W7889	2.0	0210	
4P2375	1.0	0240	
5P2506	2.0	0280	
7C1903	12.0	0290	

FUEL TYPE | Reset | Display options | Details...

FULSTL_I DISTILLATE FUEL (Surcharge: 29,522.00)

HERTZ | Reset | Display options | Details...

50HERTZ_I 50 HERTZ (Surcharge: 0.00)

DUTY TYPE | Reset | Display options | Details...

PBCNTNU_I CONTINUOUS POWER APPLICATION (Surcharge: 0.00)

RATING | Reset | Display options | Details...

KWR3520_I 3520 KW (Surcharge: 0.00)

ENGINE SPEED | Display options | Details...

1000RPM_I 1000 RPM

TURBO CONFIGURATION | Display options | Details...

TURBO05_I TURBOCHARGER GP-BASIC 254 01

CONFIGURATION | Display options | Details...

612DE02_I 3612 DIESEL GEN SET

SERVICE SIDE | Reset | Display options | Details...

SRVRHSV_I RIGHT HAND SERVICE SIDE (Surcharge: 1,644.00)

ON SITE POWER | Display options | Details...

ELTAIR1_I START AIR PRESSURE (Surcharge: 0.00)

ELT0524_I 24VOLT DC POWER (Surcharge: 0.00)

ELT0120_I 120 VOLT DC POWER (Surcharge: 0.00)

ELT0230_I 230 VAC 50 HZ SINGLE PH POWER (Surcharge: 0.00)

THREE PHASE ON SITE POWER | Display options | Details...

MARKET SEGMENT | Display options | Details...

démarrer | Miguel Angel PEREZ... | 2 Internet Explorer | TAM3595 | Imágenes | Proyecto - Microsoft... | FR | 100% | 09:19

Caterpillar Internet Sales Application - Microsoft Internet Explorer fourni par JADELMAS EXPORT

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Find

Extended Search...

EPG

TRUCK

INDUSTRIAL

PETROLEUM

MARINE

LOCOMOTIVE

Miscellaneous

Overview		Product		Price
Quantity	Product Number	Description		
<input type="checkbox"/>	3306 PKGG	3306 EPG PKG GEN SET		
<input type="checkbox"/>	3306 PKGI	3306 EPG PKG GEN SET		
<input type="checkbox"/>	3406 GSEM	3406 EPG GEN SET ENGINE		
<input type="checkbox"/>	3406 PGAG	3406 EPG CD PKG GEN SET		
<input type="checkbox"/>	3406 PGBI	3406 EPG CD PKG GEN SET		
<input type="checkbox"/>	3406 PGAT	3406 EPG CD PKG GEN SET		
<input type="checkbox"/>	3412 GSEG	3412 EPG GEN SET ENGINE		
<input type="checkbox"/>	3412 PGAI	3412 EPG PKG GEN SET		
<input type="checkbox"/>	3412 PKGG	3412 EPG PKG GEN SET		
<input type="checkbox"/>	3412 PKGT	3412 EPG PKG GEN SET		
<input type="checkbox"/>	3508 GSEL	3508 EPG ENGINE ONLY		
<input type="checkbox"/>	3508 PKGG	3508 EPG PKG GEN SET		
<input type="checkbox"/>	3508 PGAG	3508 EPG PKG GEN SET		
<input type="checkbox"/>	3512 GSEL	3512 EPG ENGINE ONLY		
<input type="checkbox"/>	3512 PKGG	3512 EPG PKG GEN SET		
<input type="checkbox"/>	3512 PKGI	3512 EPG PKG GEN SET		
<input type="checkbox"/>	3512 PGAG	3512 EPG PKG GEN SET		
<input type="checkbox"/>	3516 GSEL	3516 EPG ENGINE ONLY		
<input type="checkbox"/>	3516 PKGI	3516 EPG PKG GEN SET		

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Miguel Angel PEREZ...

2 Internet Explorer

TAM3595

Proyecto

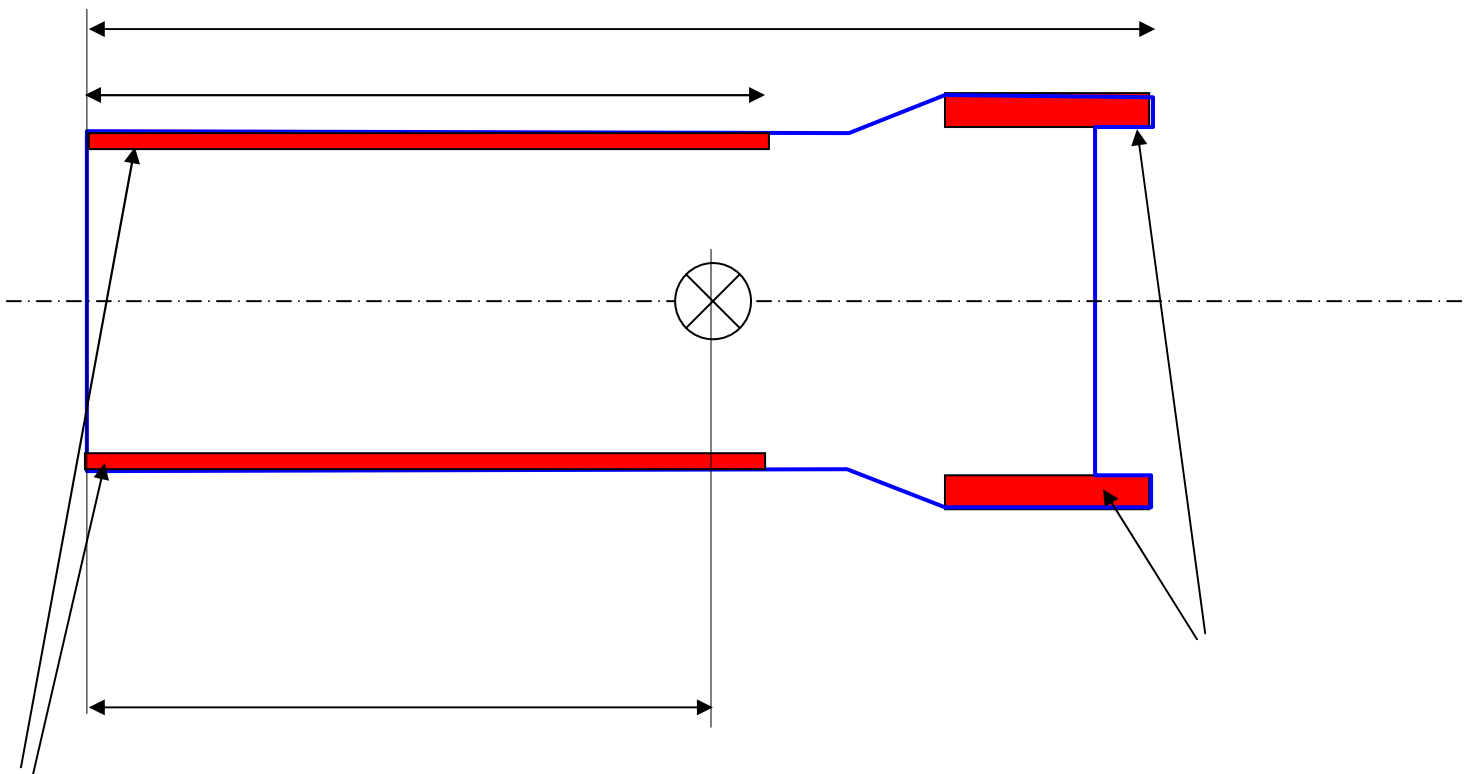
Proyecto - Microsoft...

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Anexo 3: Amortiguación de vibraciones

SCHEMA DE PRINCIPE DE REPARTITION DE CHARGE



Fréquence excitatrice :	25 Hz
Fréquence propre de l'ensemble suspendu :	9,5Hz
Déflexion sous charge :	3 à 4mm
Atténuation vibratoire (en solidien) :	83,50%

Anexo 4: Incotérminos

INTRODUCTION

1. PURPOSE AND SCOPE OF INCOTERMS

The purpose of Incoterms is to provide a set of international rules for the interpretation of the most commonly used trade terms

in foreign trade. Thus, the uncertainties of different interpretations of such terms in different countries can be avoided or at least reduced to a considerable degree.

Frequently, parties to a contract are unaware of the different trading practices in their respective countries. This can give rise to misunderstandings, disputes and litigation with all the waste of time and money that this entails. In order to remedy these

problems the International Chamber of Commerce first published in 1936 a set of international rules for the interpretation of trade terms. These rules were known as «Incoterms 1936». Amendments and additions were later made in 1953, 1967, 1976,

1980, 1990 and presently in 2000 in order to bring the rules in line with current international trade practices. It should be stressed that the scope of Incoterms is limited to matters relating to the rights and obligations of the parties to the

contract of sale with respect to the delivery of goods sold (in the sense of «tangibles », not including «intangibles» such as computer software).

It appears that two particular misconceptions about Incoterms are very common. First, Incoterms are frequently misunderstood as applying to the contract of carriage rather than to the contract of sale. Second, they are sometimes wrongly assumed to

provide for all the duties which parties may wish to include in a contract of sale. As has always been underlined by ICC, Incoterms deal only with the relation between sellers and buyers under the contract of

sale, and, moreover, only do so in some very distinct respects. While it is essential for exporters and importers to consider the very practical relationship between the various contracts needed to perform an international sales transaction - where not only the contract of sale is required, but also contracts of

carriage, insurance and financing - Incoterms relate to only one of these contracts, namely the contract of sale. Nevertheless, the parties' agreement to use a particular Incoterm would necessarily have implications for the other contracts.

To mention a few examples, a seller having agreed to a CFR - or CIF -contract cannot perform such a contract by any other mode of transport than carriage by sea, since under these terms he must present a bill of lading or other maritime document to

the buyer which is simply not possible if other modes of transport are used. Furthermore, the document required under a documentary credit would necessarily depend upon the means of transport intended to be used.

Second, Incoterms deal with a number of identified obligations imposed on the parties - such as the seller's obligation to place the goods at the disposal of the buyer or hand them over for carriage or deliver them at destination - and with the distribution of risk between the parties in these cases.

Further, they deal with the obligations to clear the goods for export and import, the packing of the goods, the buyer's obligation to take delivery as well as the obligation to provide proof that the respective obligations have been duly fulfilled. Although Incoterms are extremely important for the implementation of the contract of sale, a great number of problems which may occur in such a contract are not dealt with at all, like transfer of ownership and other property rights, breaches of contract and the consequences following from such breaches as well as exemptions from liability in certain situations. It should be stressed that

Incoterms are not intended to replace such contract terms that are needed for a complete contract of sale either by the incorporation of standard terms or by individually negotiated terms.

Generally, Incoterms do not deal with the consequences of breach of contract and any exemptions from liability owing to various impediments. These questions must be resolved by other stipulations in the contract of sale and the applicable law.

Incoterms have always been primarily intended for use where goods are sold for delivery across national boundaries: hence, international commercial terms. However, Incoterms are in practice at times also incorporated into contracts for the sale of goods within purely domestic markets. Where Incoterms are so used, the A2 and B2 clauses and any other stipulation of other articles dealing with export and import do, of course, become redundant.

2. WHY REVISIONS OF INCOTERMS?

The main reason for successive revisions of Incoterms has been the need to adapt them to contemporary commercial practice. Thus, in the 1980 revision the term Free Carrier (now FCA) was introduced in order to deal with the frequent case

where the reception point in maritime trade was no longer the traditional FOB-point (passing of the ship's rail) but rather a point

on land, prior to loading on board a vessel, where the goods were stowed into a container for subsequent transport by sea or

by different means of transport in combination (so-called combined or multimodal transport).

Further, in the 1990 revision of Incoterms, the clauses dealing with the seller's obligation to provide proof of delivery permitted

a replacement of paper documentation by EDI-messages provided the parties had agreed to communicate electronically.

Needless to say, efforts are constantly made to improve upon the at the seller's own premises (the «E»-term Ex works); followed by the drafting and presentation of Incoterms in order to facilitate their practical implementation.

3. INCOTERMS 2000

During the process of revision, which has taken about two years, ICC has done its best to invite views and responses to successive drafts from a wide ranging spectrum of world traders, represented as these various sectors are on the national

committees through which ICC operates. Indeed, it has been gratifying to see that this revision process has attracted far more

reaction from users around the world than any of the previous revisions of Incoterms. The result of this dialogue is Incoterms

2000, a version which when compared with Incoterms 1990 may appear to have effected few changes. It is clear, however,

that Incoterms now enjoy world wide recognition and ICC has therefore decided to consolidate upon that recognition and avoid

change for its own sake. On the other hand, serious efforts have been made to ensure that the wording used in Incoterms

2000 clearly and accurately reflects trade practice. Moreover, substantive changes have been made in two areas:

- the customs clearance and payment of duty obligations under FAS and DEQ; and
- the loading and unloading obligations under FCA.

All changes, whether substantive or formal have been made on the basis of thorough research among users of Incoterms and

particular regard has been given to queries received since 1990 by the Panel of Incoterms Experts, set up as an additional

EXW FAS FCA FOB CFR

CIF CPT CIP DAF DES

DEQ DDU DDP Home

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service to the users of Incoterms.

4. INCORPORATION OF INCOTERMS INTO THE CONTRACT OF SALE

In view of the changes made to Incoterms from time to time, it is important to ensure that where the parties intend to incorporate Incoterms into their contract of sale, an express reference is always made to the current version of Incoterms. This

may easily be overlooked when, for example, a reference has been made to an earlier version in standard contract forms or in

order forms used by merchants. A failure to refer to the current version may then result in disputes as to whether the parties

intended to incorporate that version or an earlier version as a part of their contract. Merchants wishing to use Incoterms 2000

should therefore clearly specify that their contract is governed by «Incoterms 2000».

5. THE STRUCTURE OF INCOTERMS

In 1990, for ease of understanding, the terms were grouped in four basically different categories; namely starting with the term

whereby the seller only makes the goods available to the buyer at the seller's own premises (the «E»-term Ex works); followed

by the second group whereby the seller is called upon to deliver the goods to a carrier appointed by the buyer (the «F»-terms

FCA, FAS and FOB); continuing with the «C»-terms where the seller has to contract for carriage, but without assuming the risk

of loss of or damage to the goods or additional costs due to events occurring after shipment and dispatch (CFR, CIF, CPT and

CIP); and, finally, the «D»-terms whereby the seller has to bear all costs and risks needed to bring the goods to the place of

destination (DAF, DES, DEQ, DDU and DDP). The following chart sets out this classification of the trade terms.

Further, under all terms, as in Incoterms 1990, the respective obligations of the parties have been grouped under 10 headings

where each heading on the seller's side «mirrors» the position of the buyer with respect to the same subject matter.

6. TERMINOLOGY

While drafting Incoterms 2000, considerable efforts have been made to achieve as much consistency as possible and desirable with respect to the various expressions used throughout the thirteen terms. Thus, the use of different expressions intended to convey the same meaning has been avoided. Also, whenever possible, the same expressions as appear in the 1980 UN Convention on Contracts for the International Sale of Goods (CISG) have been used.

"shipper"

In some cases it has been necessary to use the same term to express two different meanings simply because there has been

no suitable alternative. Traders will be familiar with this difficulty both in the context of contracts of sale and also of contracts of

INCOTERMS 2000

Group E

Departure

EXW Ex Works

Group F

Main carriage unpaid

FCA Free Carrier (... named place)

FAS Free Alongside Ship (...named port of shipment)

FOB Free On Board (... named port of shipment)

Group C

Main carriage paid

CFR Cost and Freight (... named port of destination)

CIF Cost, Insurance and Freight (... named port of destination)

CPT Carriage Paid To (... named place of destination)

CIP Carriage and Insurance Paid To (... named place of destination)

Group D

Arrival

DAF Delivered At Frontier (... named place)

DES Delivered Ex Ship (... named port of destination)

DEQ Delivered Ex Quay (... named port of destination)

DDU Delivered Duty Unpaid (... named place of destination)

DDP Delivered Duty Paid (... named place of destination)

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carriage. Thus, for example, the term «shipper» signifies both the person handing over the goods for carriage and the person

who makes the contract with the carrier: however, these two «shippers» may be different persons, for example under a FOB

contract where the seller would hand over the goods for carriage and the buyer would make the contract with the carrier.

"delivery"

It is particularly important to note that the term «delivery» is used in two different senses in Incoterms. First, it is used to determine when the seller has fulfilled his delivery obligation which is specified in the A4 clauses throughout Incoterms. Second, the term «delivery» is also used in the context of the buyer's obligation to take or accept delivery of the goods, an

obligation which appears in the B4 clauses throughout Incoterms. Used in this second context, the word "delivery" means first

that the buyer "accepts" the very nature of the "C"-terms, namely that the seller fulfils his obligations upon the shipment of the

goods and, second that the buyer is obliged to receive the goods. This latter obligation is important so as to avoid unnecessary

charges for storage of the goods until they have been collected by the buyer. Thus, for example under CFR and CIF contracts,

the buyer is bound to accept delivery of the goods and to receive them from the carrier and if the buyer fails to do so, he may

become liable to pay damages to the seller who has made the contract of carriage with the carrier or, alternatively, the buyer

might have to pay demurrage charges resting upon the goods in order to obtain the carrier's release of the goods to him.

When it is said in this context that the buyer must "accept delivery", this does not mean that the buyer has accepted the goods

as conforming with the contract of sale, but only that he has accepted that the seller has performed his obligation to hand the

goods over for carriage in accordance with the contract of carriage which he has to make under the A3 a) clauses of the "C"-

terms. So, if the buyer upon receipt of the goods at destination were to find that the goods did not conform to the stipulations in

the contract of sale, he would be able to use any remedies which the contract of sale and the applicable law gave him against

the seller, matters which, as has already been mentioned, lie entirely outside the scope of Incoterms.

Where appropriate, Incoterms 2000, have used the expression «placing the goods at the disposal of» the buyer when the goods are made available to the buyer at a particular place. This expression is intended to bear the same meaning as that of the phrase "handing over the goods" used in the 1980 United Nations Convention on Contracts for the International Sale of Goods.

"usual"

The word "usual" appears in several terms, for example in EXW with respect to the time of delivery (A4) and in the "C"-terms with respect to the documents which the seller is obliged to provide and the contract of carriage which the seller must procure (A8, A3). It can, of course, be difficult to tell precisely what the word "usual" means, however, in many cases, it is possible to identify what persons in the trade usually do and this practice will then be the guiding light. In this sense, the word "usual" is rather more helpful than the word "reasonable", which requires an assessment not against the world of practice but against the more difficult principle of good faith and fair dealing. In some circumstances it may well be necessary to decide what is "reasonable". However, for the reasons given, in Incoterms the word "usual" has been generally preferred to the word "reasonable".

"charges"

With respect to the obligation to clear the goods for import it is important to determine what is meant by «charges» which must be paid upon import of the goods. In Incoterms 1990 the expression «official charges payable upon exportation and importation of the goods» was used in DDP A6. In Incoterms 2000 DDP A6 the word «official» has been deleted, the reason being that this word gave rise to some uncertainty when determining whether the charge was «official» or not. No change of substantive meaning was intended through this deletion. The «charges» which must be paid only concern such charges as are a necessary consequence of the import as such and which thus have to be paid according to the applicable import regulations.

Any additional charges levied by private parties in connection with the import are not to be included in these charges, such as charges for storage unrelated to the clearance obligation. However, the performance of that obligation may well result in some costs to customs brokers or freight forwarders if the party bearing the obligation does not do the work himself.

"ports", "places", "points" and "premises"

So far as concerns the place at which the goods are to be delivered, different expressions are used in Incoterms. In the terms intended to be used exclusively for carriage of goods by sea -such as FAS, FOB, CFR, CIF, DES and DEQ - the expressions «port of shipment» and «port of destination» have been used. In all other cases the word «place» has been used. In some cases, it has been deemed necessary also to indicate a «point» within the port or place as it may be important for the seller to know not only that the goods should be delivered in a particular area like a city but also where within that area the goods should be placed at the disposal of the buyer. Contracts of sale would frequently lack information in this respect and Incoterms therefore stipulate that if no specific point has been agreed within the named place, and if there are several points available, the seller may select the point which best suits his purpose (as an example see FCA A4). Where the delivery point is the seller's "place" the expression «the seller's premises» (FCA A4) has been used.

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"ship" and "vessel"

In the terms intended to be used for carriage of goods by sea, the expressions «ship» and «vessel» are used as synonyms.

Needless to say, the term «ship» would have to be used when it is an ingredient in the trade term itself such as in «free alongside ship» (FAS) and «delivery ex ship» (DES). Also, in view of the traditional use of the expression «passed the ship's

rail» in FOB, the word «ship» has had to be used in that connection.

"checking" and "inspection"

In the A9 and B9 clauses of Incoterms the headings «checking -packaging and marking» and «inspection of the goods» respectively have been used. Although the words «checking» and «inspection» are synonyms, it has been deemed appropriate to use the former word with respect to the seller's delivery obligation under A4 and to reserve the latter for the particular case when a «pre -shipment inspection» is performed, since such inspection normally is only required when the

buyer or the authorities of the export or import country want to ensure that the goods conform with contractual or official stipulations before they are shipped.

7. THE SELLER'S DELIVERY OBLIGATIONS

Incoterms focus on the seller's delivery obligation. The precise distribution of functions and costs in connection with the seller's delivery of the goods would normally not cause problems where the parties have a continuing commercial relationship. They would then establish a practice between themselves («course of dealing») which they would follow in subsequent dealings in the same manner as they have done earlier. However, if a new commercial relationship is established or if a contract is made through the medium of brokers - as is common in the sale of commodities -, one would have to apply the stipulations of the contract of sale and, whenever Incoterms 2000 have been incorporated into that contract, apply the division of functions, costs and risks following therefrom. It would, of course, have been desirable if Incoterms could specify in as detailed a manner as possible the duties of the parties

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in connection with the delivery of the goods. Compared with Incoterms 1990, further efforts have been made in this respect in some specified instances (see for example FCA A4). But it has not been possible to avoid reference to customs of the trade in FAS and FOB A4 («in the manner customary at the port »), the reason being that particularly in commodity trade the exact manner in which the goods are delivered for carriage in FAS and FOB contracts vary in the different sea ports.

8. PASSING OF RISKS AND COSTS RELATING TO THE GOODS

The risk of loss of or damage to the goods, as well as the obligation to bear the costs relating to the goods, passes from the seller to the buyer when the seller has fulfilled his obligation to deliver the goods. Since the buyer should not be given the possibility to delay the passing of the risk and costs, all terms stipulate that the passing of risk and costs may occur even before delivery, if the buyer does not take delivery as agreed or fails to give such instructions (with respect to time for shipment and/or place for delivery) as the seller may require in order to fulfil his obligation to deliver the goods. It is a requirement for such premature passing of risk and costs that the goods have been identified as intended for the buyer or, as is stipulated in the terms, set aside for him (appropriation). This requirement is particularly important under EXW, since under all other terms the goods would normally have been identified as intended for the buyer when measures have been taken for their shipment or dispatch («F» - and «C»-terms) or their delivery at destination («D»-terms). In exceptional cases, however, the goods may have been sent from the seller in bulk without identification of the quantity for each buyer and, if so, passing of risk and cost does not occur before the goods have been appropriated as aforesaid (cf. also article 69.3 of the 1980 United Nations Convention on Contracts for the International Sale of Goods).

9. THE TERMS

9.1 The "E"- term is the term in which the seller's obligation is at its minimum: the seller has to do no more than place the goods at the disposal of the buyer at the agreed place - usually at the seller's own premises. On the other hand, as a matter of practical reality, the seller would frequently assist the buyer in loading the goods on the latter's collecting vehicle. Although EXW would better reflect this if the seller's obligations were to be extended so as to include loading, it was thought desirable to retain the traditional principle of the seller's minimum obligation under EXW so that it could be used for cases where the seller does not wish to assume any obligation whatsoever with respect to the loading of the goods. If the buyer wants the seller to do more, this should be made clear in the contract of sale.

9.2 The "F" - terms require the seller to deliver the goods for carriage as instructed by the buyer. The point at which the parties intend delivery to occur in the FCA term has caused difficulty because of the wide variety of circumstances which may surround contracts covered by this term. Thus, the goods may be loaded on a collecting vehicle sent by the buyer to pick them up at the seller's premises; alternatively, the goods may need to be unloaded from a vehicle sent by the seller to deliver the goods at a terminal named by the buyer. Incoterms 2000 take account of these alternatives by stipulating that, when the place

named in the contract as the place of delivery is the seller's premises, delivery is complete when the goods are loaded on the buyer's collecting vehicle and, in other cases, delivery is complete when the goods are placed at the disposal of the buyer not unloaded from the seller's vehicle. The variations mentioned for different modes of transport in FCA A4 of Incoterms 1990 are not repeated in Incoterms 2000.

The delivery point under FOB, which is the same under CFR and CIF, has been left unchanged in Incoterms 2000 in spite of a considerable debate. Although the notion under FOB to deliver the goods «across the ship's rail» nowadays may seem inappropriate in many cases, it is nevertheless understood by merchants and applied in a manner which takes account of the

goods and the available loading facilities. It was felt that a change of the FOB-point would create unnecessary confusion,

particularly with respect to sale of commodities carried by sea typically under charter parties.

Unfortunately, the word «FOB» is used by some merchants merely to indicate any point of delivery-such as «FOB factory»,

«FOB plant», «FOB Ex seller's works» or other inland points -thereby neglecting what the abbreviation means: Free On Board.

It remains the case that such use of «FOB» tends to create confusion and should be avoided.

There is an important change of FAS relating to the obligation to clear the goods for export, since it appears to be the most

common practice to put this duty on the seller rather than on the buyer. In order to ensure that this change is duly noted it has

been marked with capital letters in the preamble of FAS.

9.3 The «C»-terms require the seller to contract for carriage on usual terms at his own expense. Therefore, a point up to which

he would have to pay transport costs must necessarily be indicated after the respective «C»-term. Under the CIF and CIP

terms the seller also has to take out insurance and bear the insurance cost. Since the point for the division of costs is fixed at a

point in the country of destination, the «C»-terms are frequently mistakenly believed to be arrival contracts, in which the seller

would bear all risks and costs until the goods have actually arrived at the agreed point. However, it must be stressed that the

«C»-terms are of the same nature as the «F»-terms in that the seller fulfils the contract in the country of shipment or dispatch.

Thus, the contracts of sale under the «C»-terms, like the contracts under the «F»-terms, fall within the category of shipment contracts.

It is in the nature of shipment contracts that, while the seller is bound to pay the normal transport cost for the carriage of the

goods by a usual route and in a customary manner to the agreed place, the risk of loss of or damage to the goods, as well as

additional costs resulting from events occurring after the goods having been appropriately delivered for carriage, fall upon the

buyer. Hence, the «C»-terms are distinguishable from all other terms in that they contain two «critical» points, one indicating

the point to which the seller is bound to arrange and bear the costs of a contract of carriage and another one for the allocation

of risk. For this reason, the greatest caution must be observed when adding obligations of the seller to the «C»-terms which

seek to extend the seller's responsibility beyond the aforementioned «critical» point for the allocation of risk. It is of the very

essence of the «C»-terms that the seller is relieved of any further risk and cost after he has duly fulfilled his contract by contracting for carriage and handing over the goods to the carrier and by providing for insurance under the CIF- and CIPterms.

The essential nature of the «C»-terms as shipment contracts is also illustrated by the common use of documentary credits as

the preferred mode of payment used in such terms. Where it is agreed by the parties to the sale contract that the seller will be

paid by presenting the agreed shipping documents to a bank under a documentary credit, it would be quite contrary to the

central purpose of the documentary credit for the seller to bear further risks and costs after the moment when payment had

been made under documentary credits or otherwise upon shipment and dispatch of the goods. Of course, the seller would

have to bear the cost of the contract of carriage irrespective of whether freight is pre-paid upon shipment or is payable at destination (freight collect); however, additional costs which may result from events occurring subsequent to shipment and

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dispatch are necessarily for the account of the buyer.

If the seller has to provide a contract of carriage which involves payment of duties, taxes and other charges, such costs will, of

course, fall upon the seller to the extent that they are for his account under that contract. This is now explicitly set forth in the

A6 clause of all "C"-terms.

If it is customary to procure several contracts of carriage involving transshipment of the goods at intermediate places in order to

reach the agreed destination, the seller would have to pay all these costs, including any costs incurred when the goods are

transhipped from one means of conveyance to the other. If, however, the carrier exercised his rights under a transshipment -or

similar clause - in order to avoid unexpected hindrances (such as ice, congestion, labour disturbances, government orders,

war or warlike operations) then any additional cost resulting therefrom would be for the account of the buyer, since the seller's

obligation is limited to procuring the usual contract of carriage.

It happens quite often that the parties to the contract of sale wish to clarify the extent to which the seller should procure a contract of carriage including the costs of discharge. Since such costs are normally covered by the freight when the goods are

carried by regular shipping lines, the contract of sale will frequently stipulate that the goods are to be so carried or at least that

they are to be carried under «liner terms». In other cases, the word «landed» is added after CFR or CIF. However, it is advisable not to use abbreviations added to the «C»-terms unless, in the relevant trade, the meaning of the

abbreviations is

clearly understood and accepted by the contracting parties or under any applicable law or custom of the trade.

In particular, the seller should not - and indeed could not, without changing the very nature of the «C»-terms - undertake any

obligation with respect to the arrival of the goods at destination, since the risk of any delay during the carriage is borne by the

buyer. Thus, any obligation with respect to time must necessarily refer to the place of shipment or dispatch, for example, «shipment (dispatch) not later than...». An agreement for example, «CFR Hamburg not later than...» is really a misnomer and

thus open to different possible interpretations. The parties could be taken to have meant either that the goods must actually

arrive at Hamburg at the specified date, in which case the contract is not a shipment contract but an arrival contract or, alternatively, that the seller must ship the goods at such a time that they would normally arrive at Hamburg before the specified

date unless the carriage would have been delayed because of unforeseen events.

It happens in commodity trades that goods are bought while they are at sea and that, in such cases, the word «afloat» is added after the trade term. Since the risk of loss of or damage to the goods would then, under the CFR- and CIF-terms, have

passed from the seller to the buyer, difficulties of interpretation might arise. One possibility would be to maintain the ordinary

meaning of the CFR- and CIF-terms with respect to the allocation of risk between seller and buyer, namely that risk passes on

shipment: this would mean that the buyer might have to assume the consequences of events having already occurred at the

time when the contract of sale enters into force. The other possibility would be to let the passing of the risk coincide with the

time when the contract of sale is concluded. The former possibility might well be practical, since it is usually impossible to

ascertain the condition of the goods while they are being carried. For this reason the 1980 United Nations Convention on Contracts for the International Sale of Goods article 68 stipulates that «if the circumstances so indicate, the risk is assumed by

the buyer from the time the goods were handed over to the carrier who issued the documents embodying the contract of carriage». There is, however, an exception to this rule when «the seller knew or ought to have known that the goods had been

lost or damaged and did not disclose this to the buyer». Thus, the interpretation of a CFR- or CIF-term with the addition of the

word «afloat» will depend upon the law applicable to the contract of sale. The parties are advised to ascertain the applicable

law and any solution which might follow therefrom. In case of doubt, the parties are advised to clarify the matter in their contract.

In practice, the parties frequently continue to use the traditional expression C&F (or Ñ and F, C+F). Nevertheless, in most

cases it would appear that they regard these expressions as equivalent to CFR. In order to avoid difficulties of interpreting their

contract the parties should use the correct Incoterm which is CFR, the only world-wide-accepted standard abbreviation for the

term «Cost and Freight (... named port of destination)».

CFR and CIF in A8 of Incoterms 1990 obliged the seller to provide a copy of the charterparty whenever his transport document

(usually the bill of lading) contained a reference to the charterparty, for example, by the frequent notation «all other terms and conditions as per charterparty». Although, of course, a contracting party should always be able to ascertain all terms of his

contract - preferably at the time of the conclusion of the contract - it appears that the practice to provide the charterparty as

aforesaid has created problems particularly in connection with documentary credit transactions. The obligation of the seller

under CFR and CIF to provide a copy of the charterparty together with other transport documents has been deleted in Incoterms 2000.

Although the A8 clauses of Incoterms seek to ensure that the seller provides the buyer with «proof of delivery», it should be

stressed that the seller fulfils that requirement when he provides the «usual» proof. Under CPT and CIP it would be the «usual

transport document» and under CFR and CIF a bill of lading or a sea waybill. The transport documents must be «clean», meaning that they must not contain clauses or notations expressly declaring a defective condition of the goods and/or the

packaging. If such clauses or notations appear in the document, it is regarded as «unclean» and would then not be accepted

by banks in documentary credit transactions. However, it should be noted that a transport document even without such clauses or notations would usually not provide the buyer with incontrovertible proof as against the carrier that the goods were

shipped in conformity with the stipulations of the contract of sale. Usually, the carrier would, in standardized text on the front

page of the transport document, refuse to accept responsibility for information with respect to the goods by indicating that the

particulars inserted in the transport document constitute the shipper's declarations and therefore that the information is only

«said to be» as inserted in the document. Under most applicable laws and principles, the carrier must at least use reasonable

means of checking the correctness of the information and his failure to do so may make him liable to the consignee. However,

in container trade, the carrier's means of checking the contents in the container would not exist unless he himself was responsible for stowing the container.

There are only two terms which deal with insurance, namely CIF and CIP. Under these terms the seller is obliged to procure

insurance for the benefit of the buyer. In other cases it is for the parties themselves to decide whether and to what extent they

want to cover themselves by insurance. Since the seller takes out insurance for the benefit of the buyer, he would not know

the buyer's precise requirements. Under the Institute Cargo Clauses drafted by the Institute of London Underwriters, insurance

is available in «minimum cover» under Clause C, «medium cover» under Clause A and «most extended cover» under Clause

A. Since in the sale of commodities under the CIF term the buyer may wish to sell the goods in transit to a subsequent buyer

who in turn may wish to resell the goods again, it is impossible to know the insurance cover suitable to such subsequent buyers and, therefore, the minimum cover under CIF has traditionally been chosen with the possibility for the buyer to require

the seller to take out additional insurance. Minimum cover is however unsuitable for sale of manufactured goods where the risk

of theft, pilferage or improper handling or custody of the goods would require more than the cover available under Clause C.

Since CIP, as distinguished from CIF, would normally not be used for the sale of commodities, it would have been feasible to

adopt the most extended cover under CIP rather than the minimum cover under CIF. But to vary the seller's insurance obligation under CIF and CIP would lead to confusion and both terms therefore limit the seller's insurance obligation to the

minimum cover. It is particularly important for the CIP-buyer to observe this: should additional cover be required, he should

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agree with the seller that the latter could take out additional insurance or, alternatively, arrange for extended insurance cover

himself. There are also particular instances where the buyer may wish to obtain even more protection than is available under

Institute Clause A, for example insurance against war, riots, civil commotion, strikes or other labour disturbances. If he wishes the seller to arrange such insurance he must instruct him accordingly in which case the seller would have to provide such insurance if procurable.

9.4 The «D»-terms are different in nature from the «C»-terms, since the seller according to the «D»-terms is responsible for the arrival of the goods at the agreed place or point of destination at the border or within the country of import. The seller must bear all risks and costs in bringing the goods thereto. Hence, the «D»-terms signify arrival contracts, while the «C»-terms evidence departure (shipment) contracts. Under the «D»-terms except DDP the seller does not have to deliver the goods cleared for import in the country of destination.

Traditionally, the seller had the obligation to clear the goods for import under DEQ, since the goods had to be landed on the quay and thus were brought into the country of import. But owing to changes in customs clearance procedures in most countries, it is now more appropriate that the party domiciled in the country concerned undertakes the clearance and pays the duties and other charges. Thus, a change in DEQ has been made for the same reason as the change in FAS previously mentioned. As in FAS, in DEQ the change has been marked with capital letters in the preamble.

It appears that in many countries trade terms not included in Incoterms are used particularly in railway traffic («franco border»,

«franco-frontiere», «Frei Grenze»). However, undersuch terms it is normally not intended that the seller should assume the risk of loss of or damage to goods during the transport up to the border. It would be preferable in these circumstances to use CPT indicating the border. If, on the other hand, the parties intend that the seller should bear the risk during the transport DAF

indicating the border would be appropriate.

The DDU term was added in the 1990 version of Incoterms. The term fulfils an important function whenever the seller is prepared to deliver the goods in the country of destination without clearing the goods for import and paying the duty. In countries where import clearance may be difficult and time consuming, it may be risky for the seller to undertake an obligation

to deliver the goods beyond the customs clearance point. Although, according to DDU B5 and B6, the buyer would have to bear the additional risks and costs which might follow from his failure to fulfil his obligations to clear the goods for import, the seller is advised not to use the DDU term in countries where difficulties might be expected in clearing the goods for import.

10. THE EXPRESSION «NO OBLIGATION»

As appears from the expressions «the seller must» and «the buyer must» Incoterms are only concerned with the obligations

which the parties owe to each other. The words «no obligation» have therefore been inserted whenever one party does not

owe an obligation to the other party. Thus, if for instance according to A3 of the respective term the seller has to arrange and

pay for the contract of carriage we find the words «no obligation» under the heading «contract of carriage» in B3 a) setting

forth the buyer's position. Again, where neither party owes the other an obligation, the words «no obligation» will appear with

respect to both parties, for example, with respect to insurance.

In either case, it is important to point out that even though one party may be under "no obligation" towards the other to perform

a certain task, this does not mean that it is not in his interest to perform that task. Thus, for example, just because a CFR buyer owes his seller no duty to make a contract of insurance under B4, it is clearly in his interest to make such a contract, the

seller being under no such obligation to procure insurance cover under A4.

11. VARIANTS OF INCOTERMS

In practice, it frequently happens that the parties themselves by adding words to an Incoterm seek further precision than the

term could offer. It should be underlined that Incoterms give no guidance whatsoever for such additions. Thus, if the parties

cannot rely on a well-established custom of the trade for the interpretation of such additions they may encounter serious problems when no consistent understanding of the additions could be proven.

If for instance the common expressions «FOB stowed» or «EXW loaded» are used, it is impossible to establish a world-wide

understanding to the effect that the seller's obligations are extended not only with respect to the cost of actually loading the

goods in the ship or on the vehicle respectively but also include the risk of fortuitous loss of or damage to the goods in the

process of stowage and loading. For these reasons, the parties are strongly advised to clarify whether they only mean that the function or the cost of the stowage and loading operations should fall upon the seller or whether he should also bear the risk until the stowage and loading has actually been completed. These are questions to which Incoterms do not provide an answer:

consequently, if the contract too fails expressly to describe the parties' intentions, the parties may be put to much unnecessary trouble and cost.

Although Incoterms 2000 do not provide for many of these commonly used variants, the preambles to certain trade terms do

alert the parties to the need for special contractual terms if the parties wish to go beyond the stipulations of Incoterms.

In some cases sellers and buyers refer to commercial practice in liner and charter party trade. In these circumstances, it is

necessary to clearly distinguish between the obligations of the parties under the contract of carriage and their obligations to

each other under the contract of sale. Unfortunately, there are no authoritative definitions of expressions such as «liner terms»

and «terminal handling charges» (THC). Distribution of costs under such terms may differ in different places and change from

time to time. The parties are recommended to clarify in the contract of sale how such costs should be distributed between themselves.

Expressions frequently used in charterparties, such as «FOB stowed», «FOB stowed and trimmed», are sometimes used in

contracts of sale in order to clarify to what extent the seller under FOB has to perform stowage and trimming of the goods

onboard the ship. Where such words are added, it is necessary to clarify in the contract of sale whether the added obligations

only relate to costs or to both costs and risks.

As has been said, every effort has been made to ensure that Incoterms reflect the most common commercial practice.

EXW the added obligation for the seller to load the goods on the buyer's collecting vehicle;

CIF/CIP the buyer's need for additional insurance;

DEQ the added obligation for the seller to pay for costs after discharge.

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However in some cases - particularly where Incoterms 2000 differ from Incoterms 1990 - the parties may wish the trade terms

to operate differently. They are reminded of such options in the preamble of the terms signalled by the word «However».

12. CUSTOMS OF THE PORT OR OF A PARTICULAR TRADE

Since Incoterms provide a set of terms for use in different trades and regions it is impossible always to set forth the obligations

of the parties with precision. To some extent it is therefore necessary to refer to the custom of the port or of the particular trade

or to the practices which the parties themselves may have established in their previous dealings (cf. article 9 of the 1980 United Nations Convention on Contracts for the International Sale of Goods). It is of course desirable that sellers and buyers

keep themselves duly informed of such customs when they negotiate their contract and that, whenever uncertainty arises, they

clarify their legal position by appropriate clauses in their contract of sale. Such special provisions in the individual contract

would supersede or vary anything that is set forth as a rule of interpretation in the various Incoterms.

13. THE BUYER'S OPTIONS AS TO THE PLACE OF SHIPMENT

In some situations, it may not be possible at the time when the contract of sale is entered into to decide precisely on the exact

point or even the place where the goods should be delivered by the seller for carriage. For instance reference might have been

made at this stage merely to a «range» or to a rather large place, for example, seaport, and it is then usually stipulated that the

buyer has the right or duty to name later on the more precise point within the range or the place. If the buyer has a duty to

name the precise point as aforesaid his failure to do so might result in liability to bear the risks and additional costs resulting

from such failure (B5/B7 of all terms). In addition, the buyer's failure to use his right to indicate the point may give the seller the

right to select the point which best suits his purpose (FCA A4).

14. CUSTOMS CLEARANCE

The term «customs clearance» has given rise to misunderstandings. Thus, whenever reference is made to an obligation of the

seller or the buyer to undertake obligations in connection with passing the goods through customs of the country of export or import it is now made clear that this obligation does not only include the payment of duty and other charges but also the performance and payment of whatever administrative matters are connected with the passing of the goods through customs and the information to the authorities in this connection. Further, it has - although quite wrongfully - been considered in some quarters inappropriate to use terms dealing with the obligation to clear the goods through customs when, as in intra-European Union trade or other free trade areas, there is no longer any obligation to pay duty and no restrictions relating to import or export. In order to clarify the situation, the words «where applicable» have been added in the A2 and B2, A6 and B6 clauses of the relevant Incoterms in order for them to be used without any ambiguity where no customs procedures are required. It is normally desirable that customs clearance is arranged by the party domiciled in the country where such clearance should take place or at least by somebody acting there on his behalf. Thus, the exporter should normally clear the goods for export, while the importer should clear the goods for import. Incoterms 1990 departed from this under the trade terms EXW and FAS (export clearance duty on the buyer) and DEQ (import clearance duty on the seller) but in Incoterms 2000 FAS and DEQ place the duty of clearing the goods for export on the seller and to clear them for import on the buyer respectively, while EXW -representing the seller's minimum obligation - has been left unamended (export clearance duty on the buyer). Under DDP the seller specifically agrees to do what follows from the very name of the term - Delivered Duty Paid - namely to clear the goods for import and pay any duty as a consequence thereof.

15. PACKAGING

In most cases, the parties would know beforehand which packaging is required for the safe carriage of the goods to destination. However, since the seller's obligation to pack the goods may well vary according to the type and duration of the transport envisaged, it has been felt necessary to stipulate that the seller is obliged to pack the goods in such a manner as is required for the transport, but only to the extent that the circumstances relating to the transport are made known to him before the contract of sale is concluded (cf. articles 35.1. and 35.2.b. of the 1980 United Nations Convention on Contracts for the International Sale of Goods where the goods, including packaging, must be «fit for any particular purpose expressly or impliedly made known to the seller at the time of the conclusion of the contract, except where the circumstances show that the buyer did not rely, or that it was unreasonable for him to rely, on the seller's skill and judgement»).

16. INSPECTION OF GOODS

In many cases, the buyer may be well advised to arrange for inspection of the goods before or at the time they are handed over by the seller for carriage (so-called pre-shipment inspection or PSI). Unless the contract stipulates otherwise, the buyer would himself have to pay the cost for such inspection that is arranged in his own interest. However, if the inspection has been made in order to enable the seller to comply with any mandatory rules applicable to the export of the goods in his own country, the seller would have to pay for that inspection, unless the EXW term is used, in which case the costs of such inspection are for the account of the buyer.

17. MODE OF TRANSPORT AND THE APPROPRIATE INCOTERM 2000

Any mode of transport

Group E **EXW** Ex Works (... named place)

Group F **FCA** Free Carrier (... named place)

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<http://users.raketnet.nl/incoterms/incoterms/2000/incoterms.htm> 9/11/2003

18. THE RECOMMENDED USE

In some cases the preamble recommends the use or non-use of a particular term. This is particularly important with respect to the choice between FCA and FOB. Regrettably, merchants continue to use FOB when it is totally out of place thereby causing the seller to incur risks subsequent to the handing over of the goods to the carrier named by the buyer. FOB is only appropriate to use where the goods are intended to be delivered «across the ship's rail» or, in any event, to the ship and not

where the goods are handed over to the carrier for subsequent entry into the ship, for example stowed in containers or loaded

on lorries or wagons in so-called roll on - roll off traffic. Thus, a strong warning has been made in the preamble of FOB that the

term should not be used when the parties do not intend delivery across the ship's rail.

It happens that the parties by mistake use terms intended for carriage of goods by sea also when another mode of transport is

contemplated. This may put the seller in the unfortunate position that he cannot fulfil his obligation to tender the proper document to the buyer (for example a bill of lading, sea waybill or the electronic equivalent). The chart printed at paragraph 17

above makes clear which trade term in Incoterms 2000 it is appropriate to use for which mode of transport. Also, it is indicated

in the preamble of each term whether it can be used for all modes of transport or only for carriage of goods by sea.

19. THE BILL OF LADING AND ELECTRONIC COMMERCE

Traditionally, the on board bill of lading has been the only acceptable document to be presented by the seller under the CFR

and CIF terms. The bill of lading fulfils three important functions, namely:

- proof of delivery of the goods on board the vessel;
- evidence of the contract of carriage; and
- a means of transferring rights to the goods in transit to another party by the transfer of the paper document to him.

Transport documents other than the bill of lading would fulfil the two first-mentioned functions, but would not control the delivery of the goods at destination or enable a buyer to sell the goods in transit by surrendering the paper document to his

buyer. Instead, other transport documents would name the party entitled to receive the goods at destination. The fact that the

possession of the bill of lading is required in order to obtain the goods from the carrier at destination makes it particularly difficult to replace by electronic means of communication.

Further, it is customary to issue bills of lading in several originals but it is, of course, of vital importance for a buyer or a bank

acting upon his instructions in paying the seller to ensure that all originals are surrendered by the seller (so-called «full set»).

This is also a requirement under the ICC Rules for Documentary Credits (the so-called ICC Uniform Customs and Practice,

«UCP»; current version at date of publication of Incoterms 2000: ICC publication 500).

The transport document must evidence not only delivery of the goods to the carrier but also that the goods, as far as could be

ascertained by the carrier, were received in good order and condition. Any notation on the transport document which would

indicate that the goods had not been in such condition would make the document «unclean» and would thus make it unacceptable under the UCP.

In spite of the particular legal nature of the bill of lading it is expected that it will be replaced by electronic means in the near

future. The 1990 version of Incoterms had already taken this expected development into proper account. According to the A8

clauses, paper documents may be replaced by electronic messages provided the parties have agreed to communicate electronically. Such messages could be transmitted directly to the party concerned or through a third party providing added value

services. One such service that can be usefully provided by a third party is registration of successive holders of a bill of lading. Systems providing such services, such as the so-called BOLERO service, may require further support by appropriate

legal norms and principles as evidenced by the CMI 1990 Rules for Electronic Bills of Lading and articles 16-17 of the 1996

UNCITRAL Model Law on Electronic Commerce.

20. NON-NEGOTIABLE TRANSPORT DOCUMENTS INSTEAD OF BILLS OF LADING

In recent years, a considerable simplification of documentary practices has been achieved. Bills of lading are frequently Group C **CPT** Carriage Paid To (... named place of destination)

CIP Carriage and Insurance Paid To (... named place of destination)

Group D **DAF** Delivered At Frontier (... named place)

DDU Delivered Duty Unpaid (... named place of destination)

DDP Delivered Duty Paid (... named place of destination)

Maritime and inland waterway transport only

Group F **FAS** Free Alongside Ship (... named port of shipment)

FOB Free On Board (... named port of shipment)

Group C **CFR** Cost and Freight (... named port of destination)

CIF Cost, Insurance and Freight (... named port of destination)

Group D **DES** DES Delivered Ex Ship (... named port of destination)

DEQ Delivered Ex Quay (... named port of destination)

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replaced by non-negotiable documents similar to those which are used for other modes of transport than carriage by sea.

These documents are called «sea waybills», «liner waybills», «freight receipts», or variants of such expressions.

Nonnegotiable

documents are quite satisfactory to use except where the buyer wishes to sell the goods in transit by surrendering a paper document to the new buyer. In order to make this possible, the obligation of the seller to provide a bill of lading under

CFR and CIF must necessarily be retained. However, when the contracting parties know that the buyer does not contemplate

selling the goods in transit, they may specifically agree to relieve the seller from the obligation to provide a bill of lading, or,

alternatively, they may use CPT and CIP where there is no requirement to provide a bill of lading.

21. THE RIGHT TO GIVE INSTRUCTIONS TO THE CARRIER

A buyer paying for the goods under a «C»-term should ensure that the seller upon payment is prevented from disposing of the

goods by giving new instructions to the carrier. Some transport documents used for particular modes of transport (air, road or

rail) offer the contracting parties a possibility to bar the seller from giving such new instructions to the carrier by providing the

buyer with a particular original or duplicate of the waybill. However, the documents used instead of bills of lading for maritime

carriage do not normally contain such a barring function. The Comité Maritime International has remedied this shortcoming of

the above-mentioned documents by introducing the 1990 «Uniform Rules for Sea Waybills» enabling the parties to insert a

«no-disposal» clause whereby the seller surrenders the right to dispose of the goods by instructions to the carrier to deliver the

goods to somebody else or at another place than stipulated in the waybill.

22. ICC ARBITRATION

Contracting parties who wish to have the possibility of resorting to ICC Arbitration in the event of a dispute with their contracting partner should specifically and clearly agree upon ICC Arbitration in their contract or, in the event that no single

contractual document exists, in the exchange of correspondence which constitutes the agreement between them. The fact of

incorporating one or more Incoterms in a contract or the related correspondence does NOT by itself constitute an agreement

to have resort to ICC Arbitration.

The following standard arbitration clause is recommended by ICC: «All disputes arising out of or in connection with the present

contract shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce by one or more arbitrators appointed in accordance with the said Rules.»

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Anexo 5: Cálculo circuito combustible

Microsoft Excel - Master calcul

Calcul des pertes de charge dans un circuit fuel

Caractéristiques du circuit fuel
(Rentrer les données représentées en bleu)

Distance entre deux groupes = 5 m
Longueur de tube aller principal cure -> premier groupe = 20 m
Longueur de tube retour principal cure -> premier groupe = 20 m

Masse volumique du fuel = 860 kg/m3
Viscosité cinématique en cSt = 10 cSt Visc. Dyn. = 0,0086

Consommation d'un groupe = 1000 l/h
Débit retour = 3000 l/h
Débit total par groupe sur l'aller = 4000 l/h

ETAT DES GROUPES

Etat groupe (1=marche / 0=arrêt ou inexistant)	Groupe 1	Groupe 2	Groupe 3	Groupe 4	Groupe 5	Groupe 6	Groupe 7	Groupe 8	Groupe
	1	1	0	0	0	0	0	0	0

CARACTERISTIQUES DE LA TUYAUTERIE

Circuit aller principal

Diamètre tuyauterie aller principal en pouces = 2,5 pouces
Nombre de coudes à 90° sur aller principal = 5
Equivalent tube droit pour un coude à 90° (voir table ci-contre) = 2
Nombre de vannes sur aller principal = 2
Equivalent tube droit pour une vanne (voir table ci-contre) = 0,5

Circuit retour principal

Diamètre tuyauterie retour principal = 2,5 pouces
Nombre de coudes à 90° sur retour principal = 5
Equivalent tube droit pour un coude à 90° (voir table ci-contre) = 2
Nombre de vannes sur retour principal = 1
Equivalent tube droit pour une vanne (voir table ci-contre) = 0,5

Circuit aller secondaire

Diamètre tuyauterie aller secondaire = 1,5 pouces
Longueur aller secondaire = 6 m
Nombre de coudes à 90° sur aller secondaire = 2
Equivalent tube droit pour un coude à 90° (voir table ci-contre) = 0,792
Nombre de vannes sur aller secondaire = 1
Equivalent tube droit pour une vanne (voir table ci-contre) = 0,171

Circuit retour secondaire

Diamètre tuyauterie retour secondaire = 1,5 pouces
Longueur retour secondaire = 6 m

	Coude 90°	Vanne
Diam.		
3/8" (0,375)	0,427	0,085
1/2" (0,5)	0,518	0,107
3/4" (0,75)	0,64	0,134
1" (1)	0,792	0,171
1 1/4" (1,25)	1,07	0,226
1 1/2" (1,5)	1,25	0,262
2" (2)	1,58	0,335

Tiré de l'ABT Guide - Fuel System

Microsoft Excel - Master calcul

Calcul des pertes de charge dans un circuit fuel

Résultats

Rappel diamètre tube aller principal = 2,5 inches
Rappel diamètre tube aller secondaire = 1,5 inches
Rappel diamètre tube retour principal = 2,5 inches
Rappel diamètre tube retour secondaire = 1,5 inches

CIRCUIT ALLER

	Groupe 1	Groupe 2	Groupe 3	Groupe 4	Groupe 5	Groupe 6	Groupe 7	Groupe 8	Groupe 9	Groupe 10
Pertes de charge dans le circuit aller principal	1,48	1,60	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Pertes de charge dans le circuit aller secondaire	1,43	1,43	1,43	1,43	1,43	1,43	1,43	1,43	1,43	1,43
PdC TOTALE CIRCUIT ALLER (en kPa) =	2,9	3,0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

CIRCUIT RETOUR

	Groupe 1	Groupe 2	Groupe 3	Groupe 4	Groupe 5	Groupe 6	Groupe 7	Groupe 8	Groupe 9	Groupe 10
Pertes de charge dans le circuit retour principal	1,10	1,19	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Pertes de charge dans le circuit retour secondaire	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07
PdC TOTALE CIRCUIT RETOUR (en kPa) =	2,2	2,3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Microsoft Excel - Master calcul

Calcul des pertes de charge dans un circuit fuel

Caractéristiques du circuit fuel
(Rentrer les données représentées en bleu)

Distance entre deux groupes = 5 m
Longueur de tube aller principal cuve -> premier groupe = 100 m
Longueur de tube retour principal cuve -> premier groupe = 100 m

Masse volumique du fuel = 860 kg/m³
Viscosité cinématique en cSt = 10
Visc. Dyn. = 0,0086

Consommation d'un groupe = 1000 l/h
Débit retour = 3000 l/h
Débit total par groupe sur l'aller = 4000 l/h

ETAT DES GROUPES

Etat groupe (1=marche / 0=arrêt ou inexistant)	Groupe 1	Groupe 2	Groupe 3	Groupe 4	Groupe 5	Groupe 6	Groupe 7	Groupe 8	Groupe
	1	1	0	0	0	0	0	0	0

CARACTERISTIQUES DE LA TUYAUTERIE

Circuit aller principal

Diamètre tuyauterie aller principal en pouces = 2,5
Nombre de coudes à 90° sur aller principal = 5
Equivalent tube droit pour un coude à 90° (voir table ci-contre) = 2
Nombre de vannes sur aller principal = 2
Equivalent tube droit pour une vanne (voir table ci-contre) = 0,5

Circuit retour principal

Diamètre tuyauterie retour principal = 2,5
Nombre de coudes à 90° sur retour principal = 5
Equivalent tube droit pour un coude à 90° (voir table ci-contre) = 2
Nombre de vannes sur retour principal = 1
Equivalent tube droit pour une vanne (voir table ci-contre) = 0,5

Circuit aller secondaire

Diamètre tuyauterie aller secondaire = 1,5
Longueur aller secondaire = 6 m
Nombre de coudes à 90° sur aller secondaire = 2
Equivalent tube droit pour un coude à 90° (voir table ci-contre) = 0,792
Nombre de vannes sur aller secondaire = 1
Equivalent tube droit pour une vanne (voir table ci-contre) = 0,171

Circuit retour secondaire

Diamètre tuyauterie retour secondaire = 1,5
Longueur retour secondaire = 6 m

	Coude 90°	Vanne
	Diam.	Equiv. en m
3/8" (0,375)	0,427	0,085
1/2" (0,5)	0,518	0,107
3/4" (0,75)	0,64	0,134
1" (1)	0,792	0,171
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1 1/2" (1,5)	1,25	0,262
2" (2)	1,58	0,335

Tiré de l'ABT Guide - Fuel System

Microsoft Excel - Master calcul

Calcul des pertes de charge dans un circuit fuel

Résultats

	Groupe 1	Groupe 2	Groupe 3	Groupe 4	Groupe 5	Groupe 6	Groupe 7	Groupe 8	Groupe 9	Groupe 10
Pertes de charge dans le circuit aller principal	5,32	5,44	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Pertes de charge dans le circuit aller secondaire	1,43	1,43	1,43	1,43	1,43	1,43	1,43	1,43	1,43	1,43
PdC TOTALE CIRCUIT ALLER (en kPa)	6,7	6,9	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Pertes de charge dans le circuit retour principal	3,97	4,06	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Pertes de charge dans le circuit retour secondaire	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07	1,07
PdC TOTALE CIRCUIT RETOUR (en kPa)	5,0	5,1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Anexo 6: Cálculo instalación eléctrica potencia

Microsoft Excel - Choix câbles

Données générales

- En couleur bleu, dates modifiables par l'utilisateur -

Puissance: ### ☐ CV ☒ kW

Type de courant: ☐ Monophasé ☒ Triphasé

Tension: ### volt

cos φ: 0,80 (Valeur conseillée: 0,80)

Chute de tension: 3,0 %

Longueur: 30 m

N° lignes parallèles: 3

Rendement: 1,00 (Valeur conseillée: 0,90)

Temp. conducteurs: ☐ 60 °C ☐ 70 °C ☒ 90 °C

N° de conducteurs: ☒ Unipolaire ☐ Multipolaire

Type d'installation: ☐ Air ☒ Souterrain

Choix d'idiome: < > Calculer par: < > Données d'installation: Résultat

Microsoft Excel - Choix câbles

Données d'installation souterraine

- En couleur bleu, dates modifiables par l'utilisateur -

Temp. du terre: 20 °C

Type de terrain: ☐ Très humide ☐ Humide ☒ Légèrement ☐ Sec ☐ Très sec

N° de lignes dans la même fosse: 3

Disposition: ☐ En contact ☒ Séparés un Ø

Données générales: < > Résultat: < >

Microsoft Excel - Choix câbles

Fichier Edition Affichage Insertion Format Outils Données Fenêtre ? Accueil
 75% Helv 18 G / S

ampers

Top Cable **Resultat**

Calcule par courant

Courant: A Par ligne (total: 459 A)

Section: 95 mm²

Calcule par chute de tension

Chute de tension: 2,1 volt
 % sûr 5500 volts: 0,0 % ==> correct

Section optimale: 95 mm² (considérant 3 lignes en parallèle)

Chute de tension: 2,1 volts
 % sûr 5500 volts: 0,0 %

Données générales Données d'installat Imprimer resultat

Dessin Fgmes automatiques Prêt

démarrer Miguel Angel P... PORTAIL - Mic... 3 Explorateur... Borrador mem... Choix câbles Clipboard02 - I... FR 16:14

Anexo 7: Diseño soportes silenciadores

Africa Power Systems

Africa Power Systems S.A.S

17 rue Vauban
33075 Bordeaux Cedex France
Tél. : +33 (0)5.56.00.53.12
Fax : +33 (0)5.56.00.53.15

CUSTOMER / CLIENT	SAMIR
PROJECT Name - N°	Samir refinery Mohamedia - Morocco
DOCUMENT N°	98DA 3& 4 – chem/echpt
TITLE / TITRE	ETUDE DE CHARPENTE SILENCIEUX
DATE	13/08/03

ETUDE DE CHARPENTE / SUPPORT

ECHAPPEMENT

SOMMAIRE

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Portique : FILE A FILE B	Page 7
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HYPOTHESE DE CALCULS

1/ Charger paramètres

Poids propre : Silencieux
 + Déflecteur
 + Tuyauterie
 1200 kg / par ligne d'échappement

2/ Neige : négligeable

3/ Vent : similaire à celui de bordeaux _ site exposé _ $K=13$
78 / 137 km/hr

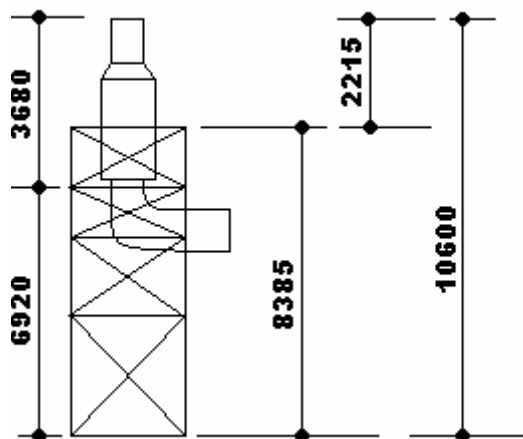
4/ Séisme (suivant PS 69)

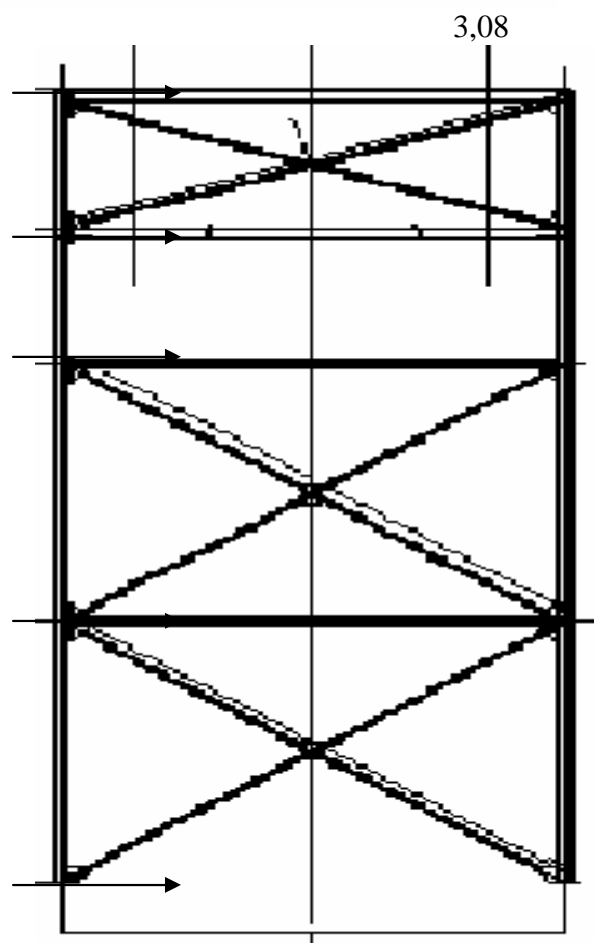
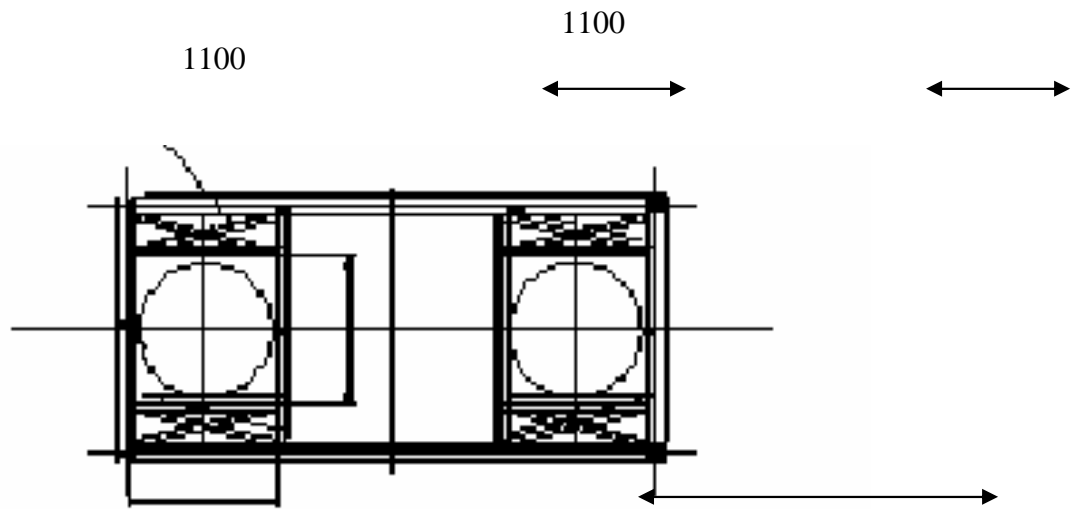
Zone 3 – Forte séismicité $\alpha=1,5$

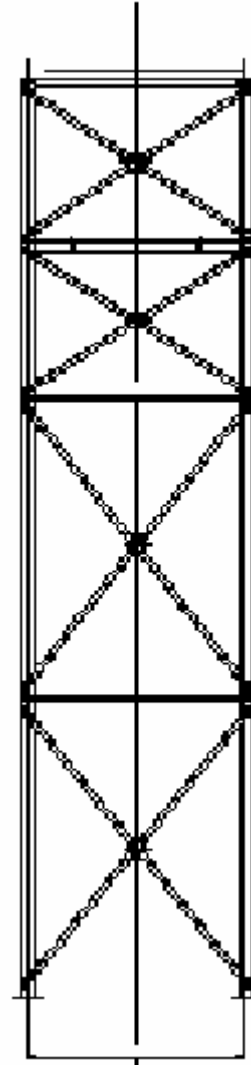
DIMENTION

(Pour élévation de l'effort seulement)

suivre la côte







ACTION DU VENT

1/ Sur la partie d'échappement au dessus de la structure

$d\sqrt{q} = 1,10\sqrt{78} = 9,7 > 1,5$ $C_t=0,55$
Hauteur au dessus de la structure est d'environ 2215 mm
 $F = 78 \times 2,215 \times 1,10 \times 0,55 = 104 \text{ kg / silencieux}$

2/ Sur la structure et la partie d'échappement à l'intérieur de la structure

Hypothèse : le pylône est supposé plein à 50%

2.1/ Vent perpendiculaire à grande façade

$F_{2,85} = 78 \times 1,30 \times 0,85 \times 2,85 \times 2,16 \times 0,5 = 264 \text{ kg}$
 $F_{5,70} = 78 \times 1,30 \times 0,85 \times 2,035 \times 2,16 \times 0,5 = 189 \text{ kg}$
 $F_{6,22} = 78 \times 1,30 \times 0,85 \times 1,34 \times 2,16 \times 0,5 = 124 \text{ kg}$
 $F_{8,385} = 78 \times 1,30 \times 0,85 \times 0,73 \times 2,16 \times 0,5 = 68 \text{ kg}$

2.2/ Vent perpendiculaire à petite façade

$F_{2,85} = 78 \times 1,30 \times 0,85 \times 2,85 \times 1 \times 0,5 = 123 \text{ kg}$
 $F_{5,70} = 78 \times 1,30 \times 0,85 \times 2,035 \times 1 \times 0,5 = 88 \text{ kg}$
 $F_{6,22} = 78 \times 1,30 \times 0,85 \times 1,34 \times 1 \times 0,5 = 68 \text{ kg}$
 $F_{8,385} = 78 \times 1,30 \times 0,85 \times 0,73 \times 1 \times 0,5 = 31 \text{ kg}$

SEISME

Intensité de la force horizontale

$$T_h = I \times R \times \gamma \times C$$

Coefficient d'intensité I $I = 1,5$
(forte séismicité)

Coefficient de réponse R $R_{MAX} = 0,2$
(Max Amortissement faible)

Coefficient de distribution γ $\gamma = 1$ 1 étage

Coefficient de fondation C $\max C = 1,30$
(limon et vase gorgé d'eau)

$$T_h = 1,5 \times 0,2 \times 1 \times 1,30 = 0,39$$

Action horizontale par file S_x / S_y

$$F_x = F_y = 1200 \times 0,39 = 468 \text{ kg}$$

Action verticale $T_{v2} \pm (1/\sqrt{1,5}) \times 0,39 = 0,32$

$$F/\text{poteau} = 600 \times 0,32 = \pm 192 \text{ kg}$$

PORTIQUE FILE A / FILE B

Cas de charges

1/ Charge permanentes

Silencieux par nœud

$F = 600 \text{ kg}$

Poids propre ossature $8,40 \times 16,7 \times 1,10 =$
154

$4,30/2 \times 4 \times 10,4 \times 1,10 =$

98

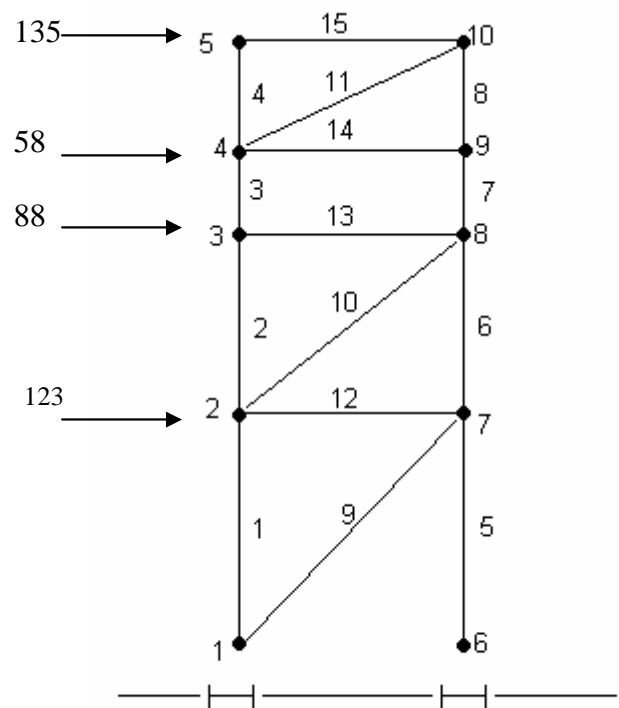
$1,75 \times 8 \times 7,60 \times 1,25 + 2,50 \times 6 \times 7,60 \times 1,25 =$
272

attaches et divers

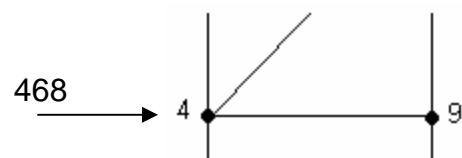
56

580 kg

2/ Vent



3 /Séisme



Géomètre	1	0,00	0,00
	2	0,00	2,85
	3	0,00	5,70
	4	0,00	6,82
	5	0,00	8,385
	6	4,30	0,00
	7	4,30	2,85
	8	4,30	5,70
	9	4,30	6,82
	10	4,30	8,385

PORTIQUE FILE 1 / FILE 2

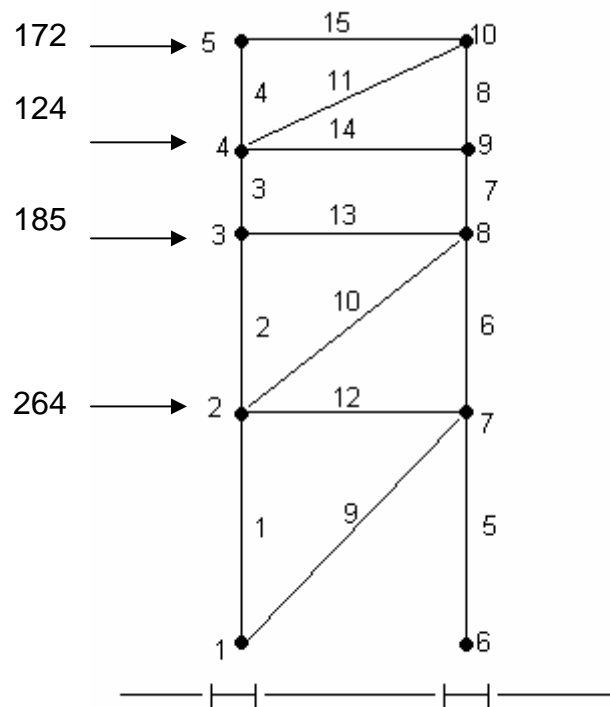
Cas de charge

1/ Charge permanente *idem précédemment*

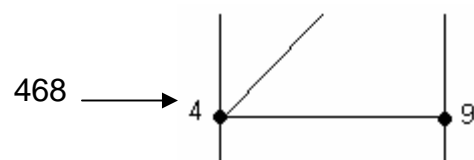
F par poteaux = 580 kg

Géomètre *idem ci-dessous car yx devient 200*

2/ Vent



3/ Séisme





VERIFICATION DES SECTIONS

1/ Poteaux

$$F_{cp} = 580 \text{ kg}$$

Vent transversale

$$V_t \quad F = 2065 \times 1,75 = 3614 \text{ kg}$$

$$\text{Séisme} < V_t$$

Vent longitudinal

$$V_l \quad F = 555 \times 1,75 = 971 \text{ kg}$$

$$\text{Séisme} \quad F = 763 \text{ kg}$$

$$\Rightarrow F = 580 + 971 = 1551$$

$$\Rightarrow M = 217 \text{ kg m}$$

HEA 120

$$T_J = 217/106 = 2,06 \text{ kg / m}^2$$

$$T_c = 1551/25 = 0.61 \text{ kg / m}^2$$

$$\textcircled{2} = 285 / 3,02 = 94$$

$$h = 1,743$$

Par construction
kg / m²

HEA 120

$$\Rightarrow T < 24$$

2/ Diagonale

Sens T



$$V_t = 1306 \text{ kg (t)}$$

$$S = 818 \text{ kg (t)}$$

Sens L



$$V_t = 474 \text{ kg (t)}$$

$$S = 690 \text{ kg (t)}$$

Par construction
m²)

60 x 50 x 5

(S_{net} = 800

3/ Montant Horizontaux Transversaux

Barre 13 – 14 – 15 – 16

$$F_c = 748 \times 1,75 = 1309 \text{ kg}$$

$$y = 2,00 \text{ micron}$$

$$\textcircled{2} = 200 / 1,51 = 132$$

$$h = 2,936$$

$$T = 1309 \times (2,936/960) = 4,00 < 24 \text{ kg / m}^2$$

Par construction

60 x 50 x5

4/ Montant horizontal Longitudinaux (sauf support de silencieux)

Barre 12 – 13 – 14 – 15

$$F_c = 421 \times 1,75 = 737 \text{ kg}$$

$$\textcircled{2} = 430 / 3,13 = 137 \quad h = 2,554$$

$$T = 737 \times (2,554 / 971) < 24 \text{ kg} / \text{m}^2$$

Par construction 80 x 80 x3

5/ Montant Intérieur support de silencieux à plus de 6,920

$$f_g = 2,00 \text{ n} \quad F_{cp} = 1000 \text{ kg} \quad (\text{cl}/2 \text{ par axe})$$

$$M = 600 \times (3/2) \times (2,00/4) = 450 \text{ kg.m}$$

$$T = 450/41,2 = 5,16 \text{ kg} / \text{m}^2 < 24$$

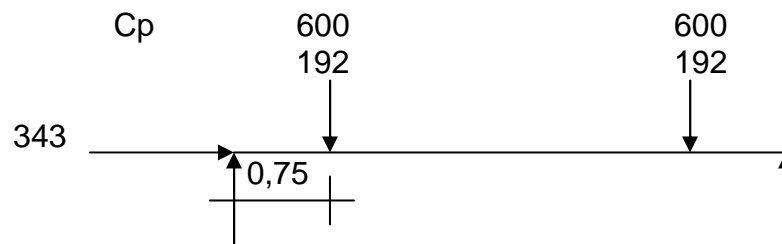
Par construction PN 100

6/ Montant longitudinal support de silencieux

$$F_c \swarrow \quad V_t = 142 \text{ kg} \times 1,75 = 249 \text{ kg}$$

$$S = 343$$

Action verticale due au séisme +/- 192 kg



$$M_f \text{ Max} \swarrow \quad \text{Sans séisme} = 600 \times 0,75 = 450 \rightarrow x$$

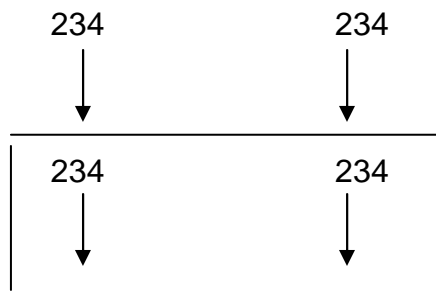
$$3/2 = 675 \text{ kg.m}$$

$$\text{Avec séisme} = (600 + 192) \times 0,75 =$$

$$594 \text{ kg.m}$$

Action horizontale due au séisme

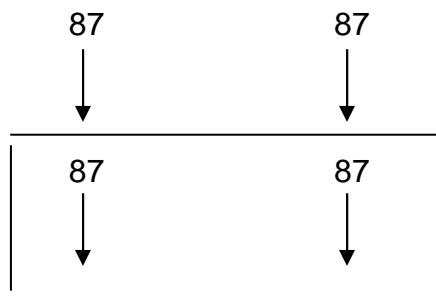
$$F_h = 600 \times 0,39 = 234 \text{ kg par fer}$$



$$M = 234 \times 0,75 = 176 \text{ kg.m}$$

Action horizontale due au vent transversal

$$F/\text{Silencieux} = 78 \times 0,55 \times 1,10 \times 3,68 = 174 \text{ kg}$$



$$M = 87 \times 0,75 = 65 \text{ kg.m}$$

CP + Séisme
 $M_v = 450 \text{ kg.m}$
 $M_h = 176 \text{ kg.m}$
 (Fc Séisme dans l'autre sens)

$$T_{fx} = 450 / 106 = 4,24 \text{ kg/m}^2$$

$$T_{fy} = 176 / 38 = 4,43 \text{ kg/m}^2$$

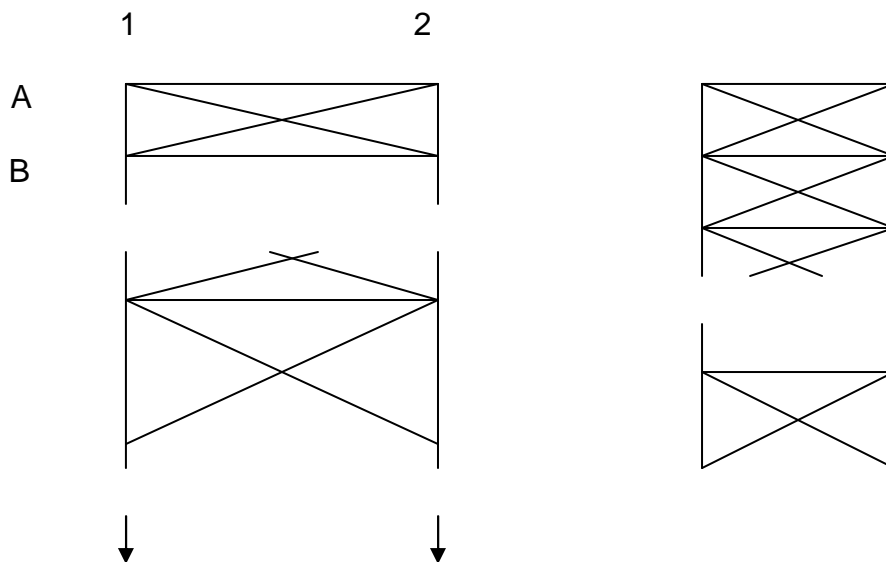
 T < 24 HEA 120
HEA 120

7/ Fer supérieur de ceinturage niveau + 8,385

idem HEA 120 Par construction

DESCENTES DE CHARGES

Action non pondérée de la charpente sur les massifs



	A1	A2	B1	B2	
Fz	+ 700	+7 00	+ 700	+ 700	CP
Fz	+ 600	+ 600	+ 600	+ 600	Silencieux
Fz Fx	- 700 + 500	+ 700	- 700 + 500	+ 700	Vent X+
Fz Fx	+ 700 - 500	- 700 - 500	+ 700	- 700 - 500	Vent X-
Fz Fy	+ 2300	+ 2300	- 2300 + 900	- 2300 + 900	Vent Y +
Fz Fy	- 2300 - 900	- 2300	+ 2300	+ 2300	Vent Y -
Fz Fx	- 900 + 600	+ 900	- 900 + 600	+ 900	Séisme X +
Fz Fx	+ 900 - 600	- 900 - 600	+ 900	- 900 - 600	Séisme X -
Fz Fy	+ 1800	+ 1800	- 1800 + 600	- 1800 + 600	Séisme Y +
Fz Fy	- 1800 - 600	- 1800 - 600	+ 1800	+ 1800	Séisme Y -

PIEDS DE POTEAUX

1/ Charges descendantes – Pression sur le béton

CP	= 700 kg	}	5325 kg
Silencieux	= 600 kg		
Vt	= 2300 x 1,75 = 4025 kg		

$$T_b = 53260/140^2 = 2,72 \text{ Mpa} < 8,50$$

Ciment classe 45
 Dosé à 350 kg/m³
 Conditions courantes
 Sans auto contrôle surveillé

Ep de la platine

$$\begin{aligned} a &= 104 \\ b &= 72 & b/a &= 0,69 & h &= 0,108 \\ c &= 10 & c/b &= 0,14 \end{aligned}$$

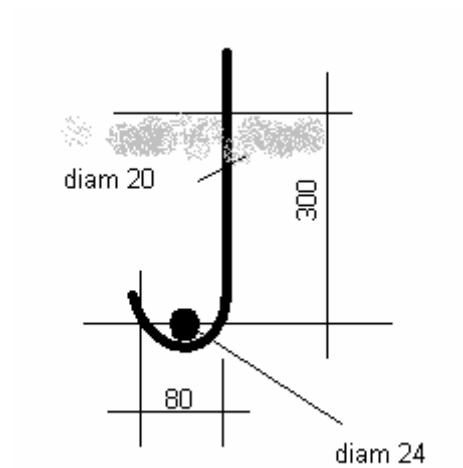
$$M_{\text{moy}} = 0,108 \times 0,272 \times 104^2 = 318 \text{ kg.m}$$

$$T_{\text{min}} = \sqrt{\frac{6 \times 318 \times 0,8}{1,185 \times 24}} = 7,33 \text{ mn} \longrightarrow 10 \text{ mn}$$

Ep Platine 10 mn

2/ Charges ascendantes

CP	= 700 kg	}	2725 kg
Silencieux	= 600 kg		
Vt	= - 2300 x 1,75		
tige			1363 kg /
2 & 20 E 24 2			ld = 30 cm



3/ Effort horizontal

$$F = 900 \times 1,75 = 1575 \text{ kg}$$

Bêche HEA 100 lg 130 cm

Anexo 8: Especificaciones fabricante

PERFORMANCE DATA

3600 Family

1845-7670 hp

1375-5720 kW

Generator Sets

CATERPILLAR® ENGINE SPECIFICATIONS

Bore — mm (in)	280 (11.0)
Stroke — mm (in)	300 (11.8)
Displacement — L (cu in)	18.5 (1127)
Aspiration	Turbocharged-Aftercooled
Compression ratio	13:1
Rotation	ccw or cw
Low Idle Speed — rpm	300-400
Rated Speed — rpm	720-1000
Avg. Piston Speed—m/s (ft/s)	7.2-10.0 (23.6-32.8)
BMEP — bar (psi)	
Continuous	20.0-21.7 (290-314)
Prime.	22.0-23.9 (319-347)
Standby	24.2-26.3 (351-382)
BSFC (with pumps) — g/kW-h (lb/hp-h)	
Continuous	187-199 (.307-.327)
Prime.	186-199 (.306-.327)
Standby	186-199 (.306-.327)

RATING CONDITIONS

All Industry Voltages are Available

Ratings — Generator Set ratings are in electrical kilowatts, operating on distillate fuel.

Continuous — Power and speed capabilities of the engine which can be used without interruption of load — capable of 10% overload.

Prime — For electrical service with variable loads — capable of 10% overload.

Standby — for electrical service during interruption of normal power.

Power — ±5% power tolerance applicable for overload/fuel stop power.

Fuel consumption — is based on ISO3046/1 with +5% tolerance for distillate fuel having an LHV of 42 780 kJ/kg (18,390 BTU/lb) and density of 838.9 g/liter (7.001 lbs/U.S. gal.). Including all associated pumps.

Heavy Fuel continuous ratings are 9% less than distillate fuel. Prime and standby ratings are not available. Fuel viscosity and contaminant capability is CIMAC Class K55 (700 cSt at 50°C) at 720-1000 rpm.

Description — Caterpillar® 3600 Generator Sets are designed to provide reliable and durable service with a

wide variety of blended and bunker fuels up to 700 cSt at 50°C.

Generator Set **Displacement** kW at 720 rpm/60Hz kW at 750 rpm/50 Hz kW at 900 rpm/60 Hz kW at 1000 rpm/50Hz

Engine Model Liters

(cu. in.) Cont. Prime Stdbby Cont. Prime Stdbby Cont. Prime Stdbby Cont. Prime Stdbby

3606 110.8 1375 1525 1680 1420 1570 1730 1650 1820 2000 1760 1940 2150

6 In-line **6,764**

3608 147.8 1830 2020 2220 1890 2080 2290 2200 2420 2660 2350 2600 2860

8 In-line **9,018**

3612 221.7 2750 3050 3360 2840 3140 3460 3300 3640 4000 3520 3880 4300

12 Vee **13,527**

3616 295.6 3660 4040 4440 3780 4160 4580 4400 4840 5320 4700 5200 5720

16 Vee 18,036

DIMENSIONAL DATA

STANDARD EQUIPMENT

Engine

Accessory module with coolant expansion tank
Base mounting
Base, with lifting provisions and vibration isolators
Breather, crankcase
Circuit cooling system, combined or separate
Cooler, lubricating oil
Duplex filters, right/left hand
fuel, full flow
lubricating oil, full flow
Engine running relay signal
Governor, Electronic 2301A
Instrument panel, includes:
differential pressure gauges – oil filter, fuel filter, and inlet air restriction
digital tachometer
pressure gauges – oil, fuel
temperature gauges – engine coolant, lubricating oil, exhaust stack, and air manifold
Manifold, exhaust, dry shielded
Oil filters, centrifugal
Pumps, gear driven
aftercooler & oil cooler
fuel transfer
jacket water
lubricating oil
Shutoff, electrical 24 VDC, for:
crankcase pressure
high oil temperature
high water temperature
low oil pressure (high & low idle)
overspeed
Single or separate circuit cooling system
Starting, air

Generator

Electrical

3 phase, six leads, WYE
Class “F” insulation
Maximum voltage harmonic – not to exceed 5% total with no single voltage harmonic above 3%
NEMA MG1-22, IEC 34-1
Overload capability 110% for two hours on prime . and continuous ratings
Short circuit capability: 300% overcurrent for 10 seconds
Voltage waveform – less than 5% deviation

Mechanical

Bearing, two sleeve, self-lubricating
Enclosure – open drip-proof – guarded (IP23)
Mechanical balance, NEMA
Overspeed: 125% per IEC 34-1 and NEMA MG-1

Package

Performance test to ISO8528

Standard Accessories

Bearing temperature detectors

Space heaters, single phase
 Stator temperature detectors
 Terminal box for connections
Voltage Regulation: $\pm 1/2\%$ no load to full load
 Paralleling capability
 Power isolation transformers and/or permanent
 magnet excitation
 Static regulator, 1 or 3 phase sensing

3600 FAMILY GENERATOR SETS

Materials and specifications are subject to change without notice. The International System of Units (SI) is used in this publication.
 LEHX5459 (9-95) © 1995 Caterpillar Inc. Printed in U.S.A.
 Supersedes LEHX5051

Gen Set

3606

3608

3612

3616

All data is for reference only. Data is subject to change without
 notice. Check TMI or contact factory for confirmation.

No radiator is included in table below.

W T L H W

kg lb mm in mm in mm in

34,070 74,970 7950 313 3330 131 2425 96

41,390 91,050 9240 364 3330 131 2425 96

51,230 112,690 8970 353 3710 146 2515 99

64,470 141,840 10,260 404 3790 149 2515 99

Anexo 9: Configuración del grupo

TRACTAFRIC MAROC

Casablanca, le 29 juillet 2006

TO : M. B. VERON
P. CHOUREAU

Vous passons la commande des deux 3612 « SIEMENS »

COMMANDE N° -03 & -03

MODELE : G.E. **TYPE** : 3612 EPG **QUANTITE** : 02

SPECIFICATIONS :

2 X FULDSTL	DISTILLATE FUEL
2 X 50HERTZ	50 HERTZ
2 X PBCNTNU	CONTINUOUS POWER APPLICATION
2 X KWR3520	3520 EKW
2 X 1000RPM	1000 RPM
2 X TURBO05	TURBOCHARGER GP-BASIC 254
2 X 612DE01	3612 EPG
2 X SRVRHSV	RIGHT HAND SERVICE SIDE
2 X ELTAIR1	START AIR PRESSURE
2 X ELT0024	24 VOLT DC POWER
2 X ENGACC1	ENGINE AND ACCESSORIES
2 X TWOBGR4	TWO BEARING PCKGNG-NON FACTORY
2 X REQNONE	NO SPECIAL REQUIREMENTS
2 X NOBASE1	NO BASE
2 X ACCMOD1	ACCESSORY MODULE
2 X FLY0021	FLYWHEEL-STANDARD
2 X TORCPL2	TORSIONAL COUPLING-TWO BRG GEN
2 X VLTOTHR	OTHER VOLTAGE
2 X CODE000	GENERATOR CODE UNKNOWN
2 X FLYGD05	CUST. PROVIDED FLY/CPLG GUARD
2 X DAMPGD4	DAMPER GUARD - STANDARD
2 X WELDPL2	WELD PLATES-MTG FOOT TO BASE
2 X PCGTBL2	TERMINAL BOX LOCATION - RIGHT
2 X LFTEYE1	ENGINE LIFTING EYES
2 X BARDEV2	MANUAL BARRING DEVICE - 1:1
2 X GOVEL09	GOV GP-2301A LOAD SHARE
2 X GVISOCH	GOVERNOR ISOCHRONOUS SETTING

2 X ACTEGB1 ACTUATOR-EGB HYDRA-ELECTRIC
 2 X ACTSHT1 SHUTDOWN-FWD ACT ENRGD TO RUN

Suite commande 2 X 3612 "SIEMENS"

2 X SNGLCK1 SINGLE/COMBINED CIRCUIT
 2 X EXPTK08 EXP TANK-HI VOL-ACC MOD MOUNT
 2 X TSTAT01 THERMOSTAT-50 DEG C
 2 X JWHCN01 JACKET WATER HEATER CONN ONLY
 2 X WTRCNLH WATER CONNECTIONS- LEFT HAND
 2 X LHBUILD BUILD FOR LH WATER CONNECTIONS
 2 X NOWTPMP NO ENGINE MTD AUX WATER PUMP
 2 X OPADRN5 OIL PAN DRAIN VALVE-FRONT MTD
 2 X DOFLT01 DUPLEX OIL FILTER
 2 X INTRPRE INTERMITTENT PRELUBE PUMP
 2 X PUMPA02 PRELUBE-AIR DRIVEN
 2 X MANFPP1 MANUAL FUEL PRIMING PUMP
 2 X DPLXFU1 DPLX FUEL STRAINER-ACC MOD MNT
 2 X FUFLX01 FLEXIBLE FUEL CONNECTION
 2 X AIA0005 AIR INLET ADAPTER (90 DEG)
 2 X ACLRD07 ACL-STANDARD DUTY-NOR. VOL-HOR
 2 X EXSHD01 EXHAUST SOFT MANIFOLD SHIELDS
 4 X EXCFF19 FLEXIBLE EXH FITTING-18 INCH
 16 X EXCFL12 FLANGE-EXH 18 INCH (457MM)
 2 X REDVLV1 PRESSURE REDUCING VLV-3100 KPA
 2 X ECPSYS5 ECP RELAY SYS-MAX PRO-ACM MNT
 2 X INSPN04 MECH GAGE INST PANEL-ACM MNT
 2 X GAGE002 STANDARD THERMOCOUPLES
 2 X NOWH001 NO WIRING HARNESS
 2 X CYLPRE2 MECH CYLINDER PRESS GA VALVE
 2 X TRKSHIP PREP FOR TRUCK SHIPMENT IN USA
 2 X SET0353 3700 BKW @ 1000 RPM (4962 BHP)
 2 X MSEPGGN GENERAL EPG
 2 X TVA0001 TORSIONAL ANALYSIS-GENSET
 2 X SHOTRAN OCEANIC TRANSPORT
 2 X SWPT001 SHRINK WRAP + TARP-ENGINE ONLY
 2 X TST0010 OVERLOAD TEST
 2 X TST0006 CERTIFIED DYNAMOMETER TEST
 2 X TST0007 FUEL CONSUMPTION TEST-FUEL ST
 2 X TOOL012 3600 SPECIALIZED TOOLING
 2 X TOOL004 TURBOCHARGER TOOL GROUP

2 X TOOL005	CYLINDER HEAD REPAIR TOOL GP
2 X DCLFREN	FRENCH DECALS
2 X LIT0006	INSTALLATION DRAWINGS
2 X LIT0002	ADDITIONAL SET OF LITERATURE
2 X LIT0003	ADDTL SER # SPECIFIC PARTS BK

Suite commande 2 X 3612 "SIEMENS".

2 X LIT0004	ADDITIONAL SERVICE MANUAL
2 X LIT0005	ADDITIONAL TECHNICAL MANUAL
2 X LITPAPR	PAPER PARTS BOOK-IN ENGLISH
2 X SPLPNT1	SPECIAL PAINT - ENGINE ONLY

EXHAUST MUFFLER FOR EACH WITH FITTING GP 7E6282 AND FLANGE GP 7E 6228.

AIR CLEANER GP 7E-5493 FOR EACH WITH ADAPTER 7E6921, AIR INLET 7E-5060 a &b, Gage 7E-7046 AND AIR FILTER SUPPORT (Drawing A 1660-01).

MOUNTING GP GENERATOR BASE, 7E-5491- 6 ISOLATORS FOR EACH GEN SET.

2 X ALTERNATORS LEROY-SOMER, TYPE LSA 5627/6P.

4400 KVA-3,520 KW ELECTRIQUE- 1000 RPM, 5500V/50HZ, AUTOMATIC VOLTAGE REGULATOR R 610 EXCITATION AREP -**OTHER SPECIFICATION, SEE FRERK OFFER N° DCQ011-0.**

2 X AIR COOLED TABLE RADIATOR GEA.

HT & LT WATER COOLER SET FOR CAT 3612 HORIZONTAL DESIGN, CU/AL WITH EPOXY COATING.

THE SCOPE INCLUDES : COOLER MODULE WITH LEGS & 6 ELECTRIC FANS INSTALLED
ELECTRIC POWER 15 KW FOR EACH.

AIR START SYSTEM FOR BOTH UNIT COMPRISING :

1 X DIESEL COMPRESSOR 30 BARS / 16m3/H.
1 X ELECTRIC COMPRESSOR 30 BARS / 16m3 /H.
2 X AIR RECEIVERS 30 BARS/710L.

2 X CUVES A HUILE USEE ET NEUVE, CAPACITE 1500 LITRES, EN ACIER E 24-2 EPAISSEUR 40/10, AVEC BAC DE RETENTION, ELECTROPOMPE JEV71- 380 TRIPHASE, CONTACT DE NIVEAU CF4, POMPE MANUELLE DE SECOURS, FILTRE A TAMIS, TRAPPE DE VISITE DIAM. 400.

EQUIPEMENT DE REMPLISSAGE ET VIDANGE SUIVANT PLAN N° 400 BAZHH.

EQUIPEMENTS MECANIQUES :

SUIVANT OFFRE GEA/APS 3595 3612 ET PV DE REUNION APS/TAM/SIEMENS

Suite commande 2 X 3612 "SIEMENS".

EQUIPEMENTS ELECTRIQUES : COMPRENANT LES ARMOIRES DE CONTROLE COMMANDE ET DE SYNCHRONISATION SUIVANT OFFRE GEA/APS/3595-3612, PV DE REUNION APS/TAM/SIEMENS DES 17/18& 19/3 2003 ET REUNION SAMIR/SIEMENS/TAM/GEA (AVEC ALPHONSE KERIS)

M. DAFFA

TAM

Anexo 10: Lista de componentes de las instalaciones

LISTE DES COMPOSANTS

Rev 03 du 16 Feb 2007

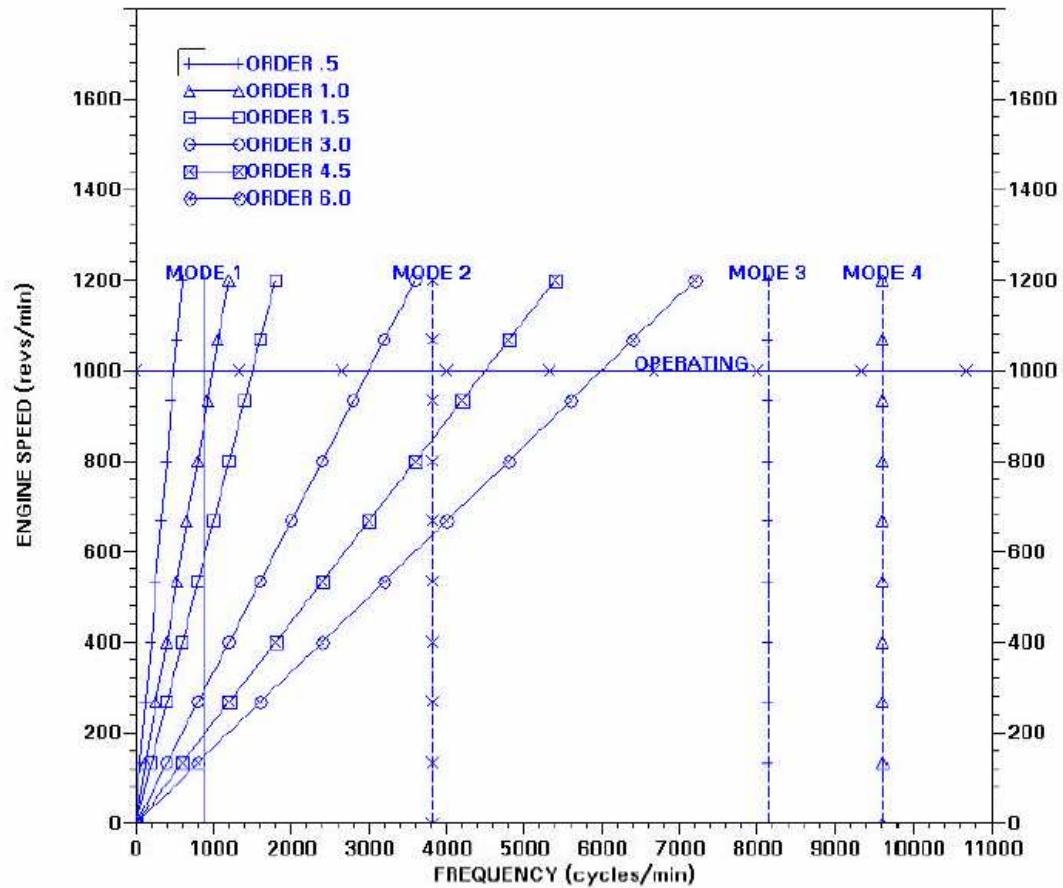
Circuits communs

Description	Manufacturer	Référence	Remarque
Circuit air comprimé			
Compresseur diesel	Neuenhauser	18.2.2.02.01.33.00	
Electrovanne	Neuenhauser		monté sur 98DA 3&4 - AN002
Electrovanne	Neuenhauser		monté sur 98DA 3&4 - AN002
Soupape de décharge	Neuenhauser		monté sur 98DA 3&4 - AN002
Soupape de décharge	Neuenhauser		monté sur 98DA 3&4 - AN002
Clapet de non retour	Neuenhauser		monté sur 98DA 3&4 - AN002
Vanne d'isolation DN20 (3/4 ") - PN64	APS / KDI	EF1025BW/SW	boisseau sphérique
Filtre à air	Neuenhauser		monté sur 98DA 3&4 - AN002
Séparateur d'eau	Neuenhauser		monté sur 98DA 3&4 - AN002
Compresseur électrique	Neuenhauser	35.2.01.01.10.21	
Electrovanne	Neuenhauser		monté sur 98DA 3&4 - AN001
Electrovanne	Neuenhauser		monté sur 98DA 3&4 - AN001
Soupape de décharge	Neuenhauser		monté sur 98DA 3&4 - AN001
Soupape de décharge	Neuenhauser		monté sur 98DA 3&4 - AN001
Clapet de non retour	Neuenhauser		monté sur 98DA 3&4 - AN001
Vanne d'isolation DN20 (3/4 ") - PN64	APS / KDI	EF1025BW/SW	boisseau sphérique
Filtre à air	Neuenhauser		monté sur 98DA 3&4 - AN001
Séparateur d'eau	Neuenhauser		monté sur 98DA 3&4 - AN001
Bouteille air comprimé n°1	Neuenhauser	71N03356	
Vanne d'isolation	Neuenhauser		monté sur 98DA 3&4 - BB001
Vanne d'isolation	Neuenhauser		monté sur 98DA 3&4 - BB001
Soupape de décharge	Neuenhauser		monté sur 98DA 3&4 - BB001
Indicateur de pression	Neuenhauser		monté sur 98DA 3&4 - BB001
Bouteille air comprimé n°2	Neuenhauser	71N03356	
Vanne d'isolation	Neuenhauser		monté sur 98DA 3&4 - BB002
Vanne d'isolation	Neuenhauser		monté sur 98DA 3&4 - BB002
Soupape de décharge	Neuenhauser		monté sur 98DA 3&4 - BB002
Indicateur de pression	Neuenhauser		monté sur 98DA 3&4 - BB002
Vanne d'isolation de 98DA3	APS / KDI	EF1025BW/SW	DN32 PN64 boisseau sphérique
Vanne d'isolation de 98DA4	APS / KDI	EF1025BW/SW	DN32 PN64 boisseau sphérique
Circuit Fuel			
Cuves principales 30,000 L			fourniture Samir
Vanne d'isolation DN65 - PN64	APS / Aquiro	304556	corps acier - sphere inox
Vanne de vidange 2"	APS / Aquiro	576 - 50/60	PN40 -boisseau sphérique laiton

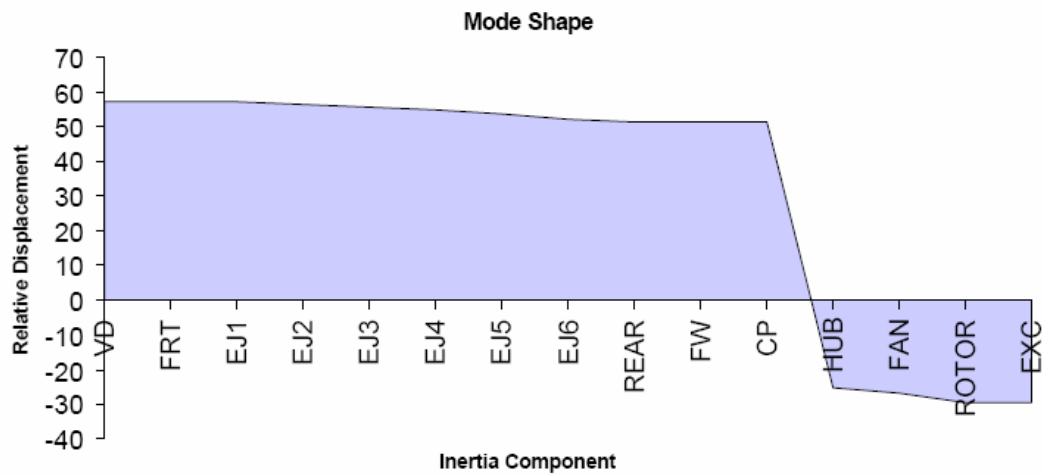
Vanne d'isolation DN ??			fourniture Samir
Vanne d'isolation DN65 - PN64	APS/KDI	304556	corps acier - sphere inox
Vanne de vidange 2"	APS / Aquiro	576 - 50/60	PN40 -boisseau sphérique laiton
Vanne d'isolation DN??			fourniture Samir
Vanne d'isolation DN65	APS/KDI	304556	corps acier - sphere inox
Vanne d'isolation DN65	APS/KDI	304556	corps acier - sphere inox
Circuit huile			
Réservoir huile neuve et usée	Rotatron	400 BA2/HH	
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Pompe de vidange manuelle	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Pompe de vidange électrique	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne de vidange	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne de dépotage	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Indicateur niveau huile usée	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Contact de niveau huile usée	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne d'isolation	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Pompe de vidange manuelle	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Pompe de vidange électrique	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne de vidange	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Vanne de dépotage	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Indicateur niveau huile usée	Rotatron		montée sur 98DA 3&4 - 400BA2HH
Contact de niveau huile usée	Rotatron		montée sur 98DA 3&4 - 400BA2HH

Anexo 11: Resultados simulación Análisis Vibraciones Torsionales

Resonant Speed Diagram

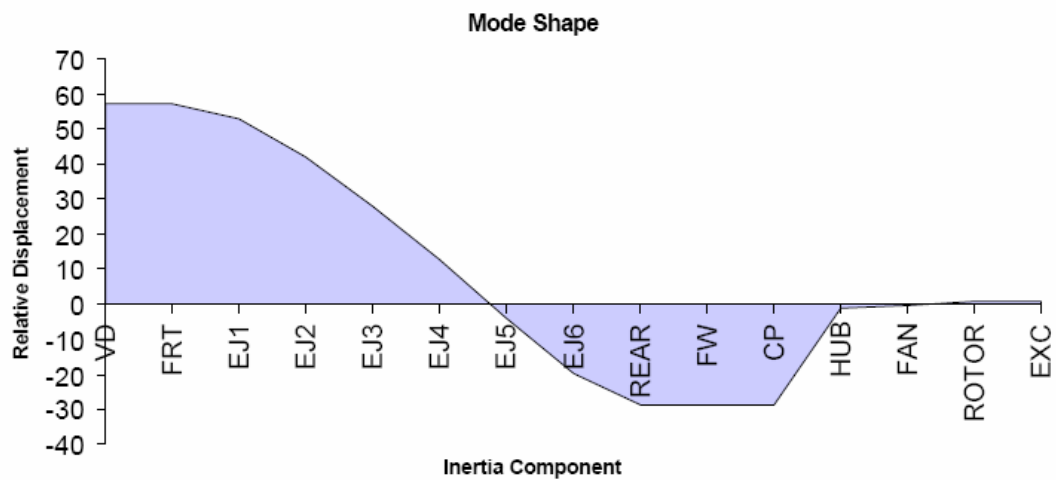


First Natural Frequency Occurs at 877 CPM



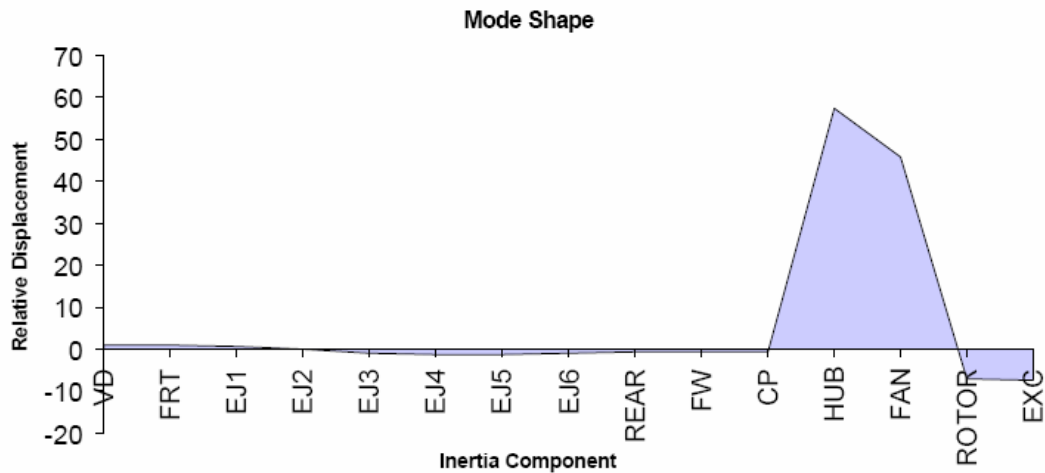
MASS ID	MASS NAME	INERTIA (N*m*sec ²)	DISPLACE (degrees)	SPRING ID	STIFFNESS (MN*m/rad)	CUM TORQUE (N*m)	DIAMETER (mm)	STRESS (MPa)
VD		2.686E+01	5.730E+01		0.000E+00	2.265E+05	0.000E+00	0.000E+00
FRT		5.645E+00	5.730E+01	EK1	6.780E+01	2.741E+05	2.160E+02	2.417E+00
EJ1		1.700E+01	5.706E+01	EK2	4.011E+01	4.168E+05	2.160E+02	3.677E+00
EJ2		1.632E+01	5.647E+01	EK3	4.011E+01	5.525E+05	2.160E+02	4.873E+00
EJ3		1.632E+01	5.568E+01	EK4	4.011E+01	6.862E+05	2.160E+02	6.052E+00
EJ4		1.632E+01	5.470E+01	EK5	4.011E+01	8.175E+05	2.160E+02	7.211E+00
EJ5		1.632E+01	5.353E+01	EK6	4.011E+01	9.461E+05	2.160E+02	8.345E+00
EJ6		1.700E+01	5.218E+01	EK7	6.780E+01	1.077E+06	2.160E+02	9.496E+00
REAR		5.826E+00	5.127E+01		0.000E+00	1.121E+06	0.000E+00	0.000E+00
FW		7.490E+01	5.127E+01		0.000E+00	1.686E+06	0.000E+00	0.000E+00
CP		5.900E+01	5.127E+01	CPK	1.600E+00	2.131E+06	0.000E+00	0.000E+00
HUB		2.030E+01	-2.504E+01	GK1	6.580E+01	2.056E+06	2.000E+02	2.285E+01
FAN		4.600E+01	-2.683E+01	GK2	4.309E+01	1.874E+06	2.100E+02	1.799E+01
ROTOR		4.287E+02	-2.932E+01	GK3	9.390E+01	2.482E+04	2.600E+02	1.255E-01
EXC		5.750E+00	-2.933E+01		0.000E+00	-2.070E-01	0.000E+00	0.000E+00

Second Natural Frequency Occurs at 3815 CPM



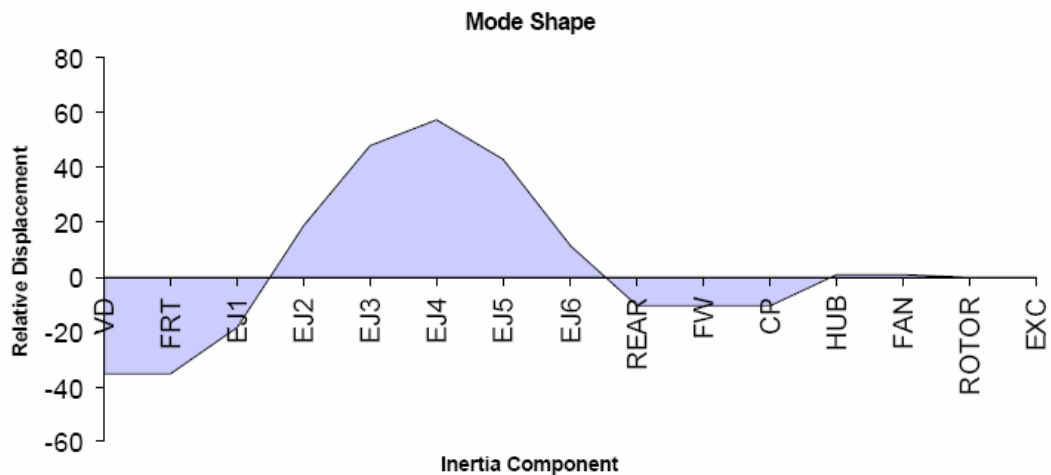
MASS ID	MASS NAME	INERTIA (N*m*sec ²)	DISPLACE (degrees)	SPRING ID	STIFFNESS (MN*m/rad)	CUM TORQUE (N*m)	DIAMETER (mm)	STRESS (MPa)
VD		2.686E+01	5.730E+01		0.000E+00	4.286E+06	0.000E+00	0.000E+00
FRT		5.645E+00	5.730E+01	EK1	6.780E+01	5.187E+06	2.160E+02	4.575E+01
EJ1		1.700E+01	5.291E+01	EK2	4.011E+01	7.692E+06	2.160E+02	6.785E+01
EJ2		1.632E+01	4.192E+01	EK3	4.011E+01	9.598E+06	2.160E+02	8.465E+01
EJ3		1.632E+01	2.821E+01	EK4	4.011E+01	1.088E+07	2.160E+02	9.597E+01
EJ4		1.632E+01	1.267E+01	EK5	4.011E+01	1.146E+07	2.160E+02	1.010E+02
EJ5		1.632E+01	-3.691E+00	EK6	4.011E+01	1.129E+07	2.160E+02	9.957E+01
EJ6		1.700E+01	-1.982E+01	EK7	6.780E+01	1.035E+07	2.160E+02	9.129E+01
REAR		5.826E+00	-2.856E+01		0.000E+00	9.887E+06	0.000E+00	0.000E+00
FW		7.490E+01	-2.856E+01		0.000E+00	3.928E+06	0.000E+00	0.000E+00
CP		5.900E+01	-2.856E+01	CPK	1.600E+00	-7.649E+05	0.000E+00	0.000E+00
HUB		2.030E+01	-1.171E+00	GK1	6.580E+01	-8.311E+05	2.000E+02	9.235E+00
FAN		4.600E+01	-4.471E-01	GK2	4.309E+01	-8.884E+05	2.100E+02	8.527E+00
ROTOR		4.287E+02	7.341E-01	GK3	9.390E+01	-1.187E+04	2.600E+02	6.005E-02
EXC		5.750E+00	7.414E-01		0.000E+00	-4.482E-01	0.000E+00	0.000E+00

Third Natural Frequency Occurs at 8144 CPM



MASS ID	MASS NAME	INERTIA (N*m*sec^2)	DISPLACE (degrees)	SPRING ID	STIFFNESS (MN*m/rad)	CUM TORQUE (N*m)	DIAMETER (mm)	STRESS (MPa)
VD		2.686E+01	9.434E-01		0.000E+00	3.217E+05	0.000E+00	0.000E+00
FRT		5.645E+00	9.434E-01	EK1	6.780E+01	3.893E+05	2.160E+02	3.434E+00
EJ1		1.700E+01	6.144E-01	EK2	4.011E+01	5.219E+05	2.160E+02	4.603E+00
EJ2		1.632E+01	-1.311E-01	EK3	4.011E+01	4.947E+05	2.160E+02	4.364E+00
EJ3		1.632E+01	-8.378E-01	EK4	4.011E+01	3.211E+05	2.160E+02	2.833E+00
EJ4		1.632E+01	-1.297E+00	EK5	4.011E+01	5.252E+04	2.160E+02	4.633E-01
EJ5		1.632E+01	-1.372E+00	EK6	4.011E+01	-2.316E+05	2.160E+02	2.043E+00
EJ6		1.700E+01	-1.041E+00	EK7	6.780E+01	-4.562E+05	2.160E+02	4.024E+00
REAR		5.826E+00	-6.551E-01		0.000E+00	-5.047E+05	0.000E+00	0.000E+00
FW		7.490E+01	-6.551E-01		0.000E+00	-1.128E+06	0.000E+00	0.000E+00
CP		5.900E+01	-6.551E-01	CPK	1.600E+00	-1.618E+06	0.000E+00	0.000E+00
HUB		2.030E+01	5.730E+01	GK1	6.580E+01	1.315E+07	2.000E+02	1.461E+02
FAN		4.600E+01	4.585E+01	GK2	4.309E+01	3.992E+07	2.100E+02	3.832E+02
ROTOR		4.287E+02	-7.234E+00	GK3	9.390E+01	5.526E+05	2.600E+02	2.795E+00
EXC		5.750E+00	-7.571E+00		0.000E+00	1.260E+00	0.000E+00	0.000E+00

Fourth Natural Frequency Occurs at 9611 CPM



MASS ID	MASS NAME	INERTIA (N*m*sec ²)	DISPLACE (degrees)	SPRING ID	STIFFNESS (MN*m/rad)	CUM TORQUE (N*m)	DIAMETER (mm)	STRESS (MPa)
VD		2.686E+01	-3.539E+01		0.000E+00	-1.681E+07	0.000E+00	0.000E+00
FRT		5.645E+00	-3.539E+01	EK1	6.780E+01	-2.034E+07	2.160E+02	1.794E+02
EJ1		1.700E+01	-1.820E+01	EK2	4.011E+01	-2.581E+07	2.160E+02	2.276E+02
EJ2		1.632E+01	1.867E+01	EK3	4.011E+01	-2.042E+07	2.160E+02	1.801E+02
EJ3		1.632E+01	4.784E+01	EK4	4.011E+01	-6.620E+06	2.160E+02	5.839E+01
EJ4		1.632E+01	5.730E+01	EK5	4.011E+01	9.913E+06	2.160E+02	8.743E+01
EJ5		1.632E+01	4.314E+01	EK6	4.011E+01	2.236E+07	2.160E+02	1.972E+02
EJ6		1.700E+01	1.120E+01	EK7	6.780E+01	2.572E+07	2.160E+02	2.269E+02
REAR		5.826E+00	-1.054E+01		0.000E+00	2.464E+07	0.000E+00	0.000E+00
FW		7.490E+01	-1.054E+01		0.000E+00	1.068E+07	0.000E+00	0.000E+00
CP		5.900E+01	-1.054E+01	CPK	1.600E+00	-3.208E+05	0.000E+00	0.000E+00
HUB		2.030E+01	9.466E-01	GK1	6.580E+01	1.891E+04	2.000E+02	2.101E-01
FAN		4.600E+01	9.302E-01	GK2	4.309E+01	7.754E+05	2.100E+02	7.443E+00
ROTOR		4.287E+02	-1.009E-01	GK3	9.390E+01	1.093E+04	2.600E+02	5.528E-02
EXC		5.750E+00	-1.075E-01		0.000E+00	-1.430E+00	0.000E+00	0.000E+00



Single Order Results		Order	Predicted	Permissible Limit
FRT	Absolute Amplitude (deg)	0.5	0.016	1.00
	Absolute Amplitude (deg)	1.0	0.033	1.00
	Absolute Amplitude (deg)	1.5	0.095	0.25
	Absolute Amplitude (deg)	3.0	0.009	0.15
	Absolute Amplitude (deg)	4.5	0.107	0.15
	Absolute Amplitude (deg)	6.0	0.043	0.15
EK5	Vibratory Stress (MPa)	0.5	1.62	21.0
	Vibratory Stress (MPa)	1.0	12.99	21.0
	Vibratory Stress (MPa)	1.5	12.97	21.0
	Vibratory Stress (MPa)	3.0	2.07	21.0
	Vibratory Stress (MPa)	4.5	10.94	21.0
	Vibratory Stress (MPa)	6.0	3.21	21.0
GK1	Vibratory Stress (MPa)	0.5	0.06	34.5
	Vibratory Stress (MPa)	1.0	0.75	34.5
	Vibratory Stress (MPa)	1.5	1.52	34.5
	Vibratory Stress (MPa)	3.0	0.59	34.5
	Vibratory Stress (MPa)	4.5	1.00	34.5
	Vibratory Stress (MPa)	6.0	0.17	34.5
	Vibratory Stress (MPa)	7.5	0.30	34.5
	Vibratory Stress (MPa)	8.0	0.45	34.5

Combined Order Results		Predicted	Permissible Limit
VD	Power Absorbed (kW/m ²)	4.0	5.7
CPK	Maximum Torque (Nm)	41522	134000
	Vibratory Torque (Nm)	5471	25200
	Nominal Torque (Nm)	35332	63000
	Power Loss (kW)	0.15	1.06

Single Order Misfire Results		Order	Predicted	Permissible Limit
FRT	Absolute Amplitude (deg)	0.5	0.081	1.00
	Absolute Amplitude (deg)	1.0	0.510	1.00
EK5	Vibratory Stress (MPa)	0.5	4.21	21.0
	Vibratory Stress (MPa)	1.0	16.50	21.0
GK1	Vibratory Stress (MPa)	0.5	3.79	34.5
	Vibratory Stress (MPa)	1.0	11.72	34.5

Combined Order Misfire Results		Predicted	Permissible Limit
VD	Power Absorbed (kW/m ²)	4.0	5.7
CPK	Maximum Torque (Nm)	61179	134000
	Vibratory Torque (Nm)	24186	25200
	Nominal Torque (Nm)	35332	63000
	Power Loss (kW)	2.02	1.06
Engine misfire may cause significant torsional vibration in the coupling, as indicated by high vibratory torque and power loss levels. This vibration would cause the coupling rubber elements to warm, changing their elastic properties. See warm coupling results beginning on page 25 for a more accurate representation of engine misfire behavior.			

